Transcript

2026 Flagship Conference
To Have and Have Not: Growing Asymmetries in Communications Technology
February 1–2, 2026

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Day One: February 1, 2026

Welcome Keynote: Professor Brett Frischmann

https://youtu.be/o41Brb-goYo

[00:00:01.38] MATT SCHMIT: Welcome to Balmy Boulder to CU Law and Home of the Silicon Flatirons Center for Technology, Law, and Policy. For 25 years, Silicon Flatirons has focused on a three-fold mission-- to elevate the debate on tech policy, to support tech entrepreneurship in this community in particular, and to inspire, prepare, and place students into opportunities in these areas.

[00:00:23.56] Of course, for those of you who know Silicon Flatirons, this should all sound familiar. What's new today is the MC, yours truly. So my name is Matt Schmit. I'm the new Executive Director here at Silicon [AUDIO OUT]. And for the past 15 plus years, I've worked at the intersection of technology and economic competitiveness. I have to tell you, I'm absolutely thrilled to be here and to join this incredible team.

[00:00:49.80] So I should take this opportunity to recognize Shannon and Christine, Sarah and Nate have put in [AUDIO OUT]. When I assumed this role on November, just a couple of months ago, we had this great team, an incredibly engaged community around us, and that 25 year track record and all the expectations that followed.

[00:01:11.88] Since then, my goal has been simple, folks, don't mess this up. And so I hope that continues here today. Now, last summer, the Silicon Flatirons team workshopped the idea of technology haves and have nots as a possible conference theme for this weekend. Now, of course, I took that idea and ran with it.

[00:01:32.36] And so the result to have and have not, emerging asymmetries in communications technology. Our conference hopes to accomplish a few things here today-- one, to live up to the 25 year track record, two, to reach those lofty expectations that we all have, and to three, meet the moment, one in which technological advance is considerably outpacing our public policy or I think, anything resembling cultural consensus on technology.

[00:02:04.76] Now, for the next two days, we've explored the real, perceived, and potential haves and have nots in artificial intelligence, radio spectrum allocation, and internet access. And for those wanting more, we're piloting a few new ideas this year.

[00:02:21.56] On Monday afternoon, we have something new-- the spectrum security and resilience summit, are focused on emerging gaps, threats and information asymmetry related to radio frequency and public safety. For those interested in the topic or here, we hope you can join us.

[00:02:38.40] All right. Now, before moving on, I want to acknowledge the space that we occupy. As we gather, we honor, acknowledge that the University of Colorado Law School is on the traditional territories and ancestral homelands of the Arapaho, the Cheyenne, and Ute peoples. Further, we acknowledge the 48 contemporary tribal nations historically tied to the lands that comprise what is now called Colorado. Truly, it's a special place.

[00:03:05.08] It is my honor to introduce our welcome keynote. Brett Frischmann, the Charles Widger endowed University Professor in Law, Business and Economics at Villanova University. Without further ado, Brett.

[00:03:23.28] BRETT FRISCHMANN: Good morning, everyone. Speaking with you, as we've just heard, the next two days, promised to be filled with exciting discussions of interdisciplinary research and public policy issues facing this community. As the opening keynote, my task is to plant some intellectual seeds, raise some provocative questions, and according to my youngest son, not be too boring.

[00:03:50.08] So before turning to the issue of asymmetries and access to AI, I'd like to reflect on the shared goals of this community concerning access to digital networks. So most folks in this community agree that universal service is a laudable goal. Universal service policies aim to make available affordable telecommunications and other services to the public. Focus on closing gaps in coverage and ensuring the provision of services to rural, remote and low income users who would otherwise not be served in the absence of these policies.

[00:04:20.80] Now, while initially focused on local phone service we've expanded to the internet and broadband, and soon we'll be talking about AI. While there's still room for improvement, plenty, and work still to do, we've made progress in getting people throughout this country connected to the internet.

[00:04:37.76] We've successfully connected schools and libraries, businesses, and homes, and pretty much everywhere else in between that one could imagine. Ubiquitous always on digital networks is what this community has championed, and more or less successfully delivered over the past few decades. Now, sure, there have been disagreements among Republicans and Democrats on the means and even sometimes the priorities. But there's been agreement, at least on this ambitious goal.

[00:05:06.31] No one left behind. Everyone on board, everyone online connected by the devices we carry and where. All of which is enabled by the digital infrastructures that this community has built. I mean, it's absolutely incredible. Just think about the digital cornucopia of applications layer services, platforms, software, apps, content, and

even social connections. Some call it abundance. They get very excited about the elimination of scarcity.

[00:05:39.75] Now, abundance is created by leveraging the nonrivalrous capacity of networks, software, and data to make everything accessible to everyone online. There should be no asymmetries or gaps to worry about. The digital network world we've built celebrates seamless interconnection of networks and people.

[00:06:03.95] It enables frictionless transactions that are so cheap, so easy that virtually everyone can and should participate. It democratizes speech so that everyone can speak to everyone, many to many with maximum scale and scope. I mean, any one of us, or I suppose all of us can speak to millions of people, distributed all around the world, at nearly zero marginal cost and nearly instantaneously. In fact, I suspect many of you out there in the audience are doing that right now.

[00:06:36.11] I mean, it's really astonishing. We have abundant access to knowledge with a mere click, or a voice command, or access to information than any time in human history. I mean, it almost sounds too good to be true, like a utopian fever dream. And it is.

[00:06:58.31] Look, access to Wikipedia doesn't actually make anyone smarter, nor does being able to ask Alexa. It takes a whole lot more to produce knowledge. Outsourcing thinking at scale only leads to idiocracy as we've seen. Open access to ChatGPT does not democratize education, lowering health services, therapy, or anything else really. But it sure does create a lot of unpaid labor for teachers, parents, health workers, everyone else responsible for anything real and serious.

[00:07:42.47] The world is on fire. We've moved too fast and we've broken too many things. And what kills me-- I mean, I can't stress this enough. It literally breaks my heart and mind every single day, is that we don't seem to have learned anything from our mistakes.

[00:08:00.47] I'm sorry to say this, but we're approaching supposedly smart tech AI in exactly the same way-- with the same mindset, the same fear of missing out, or fear of falling behind. The same laziness in accepting hype, entire techno fascist babble, just refusing to slow down.

[00:08:21.71] Why are we rushing to inject AI into everything, into every aspect of our lives, our relationships, our institutions, our very humanity? We should step back and reconsider our priors, call to question the unchallenged commitment to a particular and a particularly warped vision of progress.

[00:08:44.95] Universal, always on digital tech, is not the unadulterated boon that everyone thought. In fact, it seems like a trap for the masses, and especially the poor middle class. After all, the rich and powerful enjoy the luxury of being able to exercise their freedom to be off. They

get to choose when and under what conditions they're subject to surveillance, subject to nudging, subject to manipulation, and by whom.

[00:09:12.11] Their kids don't need to attend schools inundated, with digital devices, screens, and crappy edtech software that's never been proven to actually improve learning. Now, this is the growing asymmetry that I worry about, the gap that really matters. Those who can genuinely exercise their freedom to be off, to be free from surveillance, nudging, manipulation and other forms of technosocial engineering.

[00:09:37.59] Now, my time is limited. This is just an opening keynote, so I can't fully spell out the various ways in which the world's on fire or explain why, nor can I fully provide a to do list for putting out existing fires, or the many we know are on the horizon. So what I'd like to do is cultivate some new ideas for further discussion over the next few days.

[00:09:56.43] Now, first, I want to acknowledge, that like many of you, I'm absolutely committed to the underlying ideal of universal service and enabling public access to the basic infrastructures of modern society, the ones we need. I mean, after all, I wrote my first book, Infrastructure, the Social Value of Shared Resources, back in 2012. And the core ideas about infrastructure and governance remain integral to my thinking.

[00:10:21.21] Among other things, I defended this thing called network neutrality regulation. Don't worry, we're not going down the rabbit hole for the umpteenth time at this conference. What I want to note is that my defense of net neutrality concerned a rather unconventional way of thinking about the issue, relevant for much of what we're dealing with today.

[00:10:44.03] Net neutrality sustained a governance theme by leveraging friction in the design of the internet's layered architecture to constrain the ability of network providers, to exercise their control over user activities that would otherwise be enabled by their privileged view of traffic that's flowing across the network.

[00:11:00.07] In other words, network neutrality govern the exercise of data-driven or intelligence-enabled power. Now, as far as in know, I could be wrong-- I mean, it seemed to it sort of worked. I mean, Comcast, Verizon and are not really the villains and are dystopian hellscape, are they? I mean, they're not to blame for widespread miss and disinformation.

[00:11:25.11] Deep fakes, gone wild. Filter bubbles, engineered addiction, and isolation on social media platforms that are optimized for superficial engagement. Sycophantic GenAI chatbots designed to generate trust and untrustworthy psychopaths. Rampant polarization, democracy disrupted-- dot, dot. You get the point.

[00:11:47.47] No. We're all passengers on Silicon Valley's runaway train. Their fever dream of universal AI, and worse AGI, is taxing the infrastructural capacity of the shared resources we actually need, including energy, our environment, governance, institutions, the time, and attention for meaningful social interaction.

[00:12:10.51] Now, plenty of people have written diagnoses of our succumbing to Silicon Valley imperatives. Perhaps the most popular are Shoshana Zuboff surveillance capitalism, or maybe the more recent exploration of acidification by Cory Doctorow. Damn, I wish I was better at coining terms. I mean, Evan Selinger and I took our own stab at it in our 2018 book, Re-engineering Humanity. Much of what we said then remains true, unfortunately, much too much.

[00:12:39.79] Too prescient, where our concerns about engineering unthinking humans who perform AI-written scripts and increasingly behave routinely like mechanical cogs in their own lives. In short, we described humanity's technosocial dilemma as a complex, wicked problem. Now, these types of social dilemmas are incredibly difficult to wrap your head around, because there's so many interdependent parts.

[00:13:02.99] There's so many different actors and different agendas, and there's no panacea. There's no simple fix. But one place to start is simply to recognize the dilemma and its root causes, which are the underlying logics and imperatives. Silicon Valley fetishizes computational power, pretends that all social problems are comprehensible in the language of computation, when they're not.

[00:13:26.47] And celebrates design principles, like maximizing efficiency, minimizing transaction costs, eliminating friction, seamlessly interconnecting, among others. Now, each of these is only superficially defensible. They're not just wrong, but worse. They mislead and obscure important social, political, and economic stakes.

[00:13:49.95] Human beings are necessarily inefficient. While it's sometimes hard to appreciate, we actually need friction in our lives to produce meaning, authenticity, truth, and to develop capabilities that are essential to human flourishing. Seams are critical to governance. We need boundaries for ourselves and our communities.

[00:14:14.03] In fact, interconnection often should be seen full as friction at the seam is what provides an opportunity and space for both self and community governance. Now, net neutrality is just one recent example, but there are so many others, as Paul over there is going to explain later in the conference.

[00:14:31.83] For now, my point is just to plant the seed of an alternative logic, a logic that's centered on human flourishing rather than mechanistic visions of efficiency. So I'd like to briefly discuss two general approaches to reorienting our institutional priorities and approaches to technology and governance. Each embodies a broad

set of potential interventions, and there's a few others I would otherwise add if I had more time.

[00:14:55.10] The first concerns slow governance. Instead of moving fast and breaking everything, we should actually move slow and actually make things we need and want. We should start by dropping the umbrella term of AI, and instead, talk about supposedly smart technologies. Now I realize this is probably a lost cause. AI is so ingrained in our discourse.

[00:15:15.78] Regardless, the idea is that whenever someone refers to AI or smart technology, you should supposedly in front. And then begin to ask a series of questions, such as who gains what intelligence and for what purpose? In this context, intelligence is better understood and evaluated in terms of people, real people, using actual specific tools, within specific environments to achieve outcomes.

[00:15:40.56] Which people, which tools, which contexts, which outcomes-- these are the questions that require attention and deserve elaboration at all stages of smart tech adoption and deployment. Attending to these and other details ultimately leads into governance questions, like who decides and how? What are the formal and informal mechanisms, practices, policies that govern decision-making?

[00:16:01.74] Now, many of you in the audience must be familiar with the struggle to decide on AI adoption and what to do with, like open access to AI or AI availability. Now, I'm on a few committees at my university that struggle with these issues. But then there's also our school district, and our town, and our family. You get the picture.

[00:16:21.38] A few years ago, we published a governing knowledge commons book focused on filled with case studies that were focused on governance of smart cities back when that was a hot topic. The slow governance approach invites a simple claim. Despite the hype, the pace of innovation, the fear of missing out or falling behind. supposedly smart systems should be contextually appropriate, justified and demonstrably fit for legitimate purposes.

[00:16:49.34] In short, no hype, no speculative promises, no wishful thinking, no impenetrable black boxes. Before a city adopts supposedly smart tech or AI, it ought to be able to answer a whole series of questions that resemble impact assessments, but they go deeper into governance and require a comparative analysis of available tools for addressing ones objectives.

[00:17:12.78] So I strongly suggest extending the slow governance approach beyond cities to other social actors and organizations, schools, businesses, government agencies, and even families. The second broad approach I'd like to mention is pro-social friction in design. So there's an emerging interdisciplinary literature with different labels, including design frictions, frictional AI, micro

boundaries, programmed inefficiency, simple design, there's a bunch of others.

[00:17:39.46] A familiar example for everybody has got to be the speed bump. Speed bumps are imperfect. They involve trade offs. No one loves them. But we need them in certain situations to slow down drivers, and make streets safe for shared use. Now, they're an effective, widely deployed traffic calming measure.

[00:17:59.18] Fortunately, decades of rigorous research in civil engineering, urban planning, and transportation economics supports the responsible design and deployment of traffic calming measures, including speed bumps, that instrumentally leverage friction for pro-social goals. Now, unfortunately, there's nothing comparable for the digital networked environment, nor for AI.

[00:18:22.46] Independent academic research is essential in this area, because in various sectors, the only entities with sufficient resources capable of testing different designs and frictional interventions are the private sector companies themselves, the big tech platforms, and they're not obliged to openly disclose results, much less the details about which experiments are actually running.

[00:18:42.42] To make matters worse, the friction in designed, tested, and deployed by companies often serve their own interests rather than the interests of users or society more generally. And what that means is that it often ends up being antisocial rather than pro-social. This is reflected well in growing concerns about dark patterns about addictive, deceptive, and manipulative design, for example.

[00:19:02.74] Again, I've got plenty more to say on the topic, but for now, just keep in mind the idea that pro-social friction in design is an essential feature to consider when evaluating AI and tech deployment, especially when thinking about the gaps between the haves and the have nots.

[00:19:19.62] So I'd like to leave you, or I'd like to come back to the idea I mentioned early on about the freedom to be off, the freedom from AI, from surveillance tech, from technology designed to nudge and manipulate, from engineered determinism, the fundamental freedom to be off.

[00:19:37.90] Let me give you an example-- just an example of one of many to ponder. So I suspect everyone in the room has had the experience of GenAI being integrated into a software, product, service, or experience. It could be word processing, Zoom, search, whatever else. GenAI is being shoved down everyone's throats.

[00:19:56.98] And I'm not even talking about the cultural zeitgeist, the ridiculous commercials, the supposed necessity of every school and workplace to commit fully to it without any good reason, or even the

late night interviews with CEOs who cannot imagine what it would be like to raise an infant without ChatGPT.

[00:20:14.14] No, I'm just talking for now about software updates-- automatic integration happening in the background. GenAI is being integrated into business and consumer software without any input or consideration of the preferences of businesses and consumers.

[00:20:29.18] Besides its lack of utility, the slop and hallucinations, concerns about de-skilling, among other things, GenAI presents an unappreciated privacy risk as it serves as a conduit for the collection of personal data and a surreptitious mechanism for manipulating users into oversupplying such data.

[00:20:47.50] As research shows, LLMs and chatbots exhibit sycophancy, which, along with other potentially manipulative design features, can lure users into a false sense of security and trust. Now, one might wonder why are firms integrating AI so quickly?

[00:21:04.06] Well, one partial answer would be to avoid being left behind. Another partial answer would to get ahead of regulators. Another partial answer would be to take advantage of the data they can collect. Another partial answer is to get GenAI integrated before anyone, including consumers, can object. Another partial answer is to normalize GenAI, and make it seem natural and inevitable part of the background environment.

[00:21:27.26] None of these answers justify integration. None of these answers genuinely reflect user preferences. This drives me nuts. I mean, I don't want it. I want to be able to opt out. I want a voice. I want my autonomy.

[00:21:43.78] Sebastian Simic and I would like to propose a GPC-like approach. So for those of you who don't know, GPC stands for Global Privacy Control. In short, it's a standardized technical signal one can send from a computing device to express an unequivocal privacy preference. For example, do not collect my personal information.

[00:22:01.84] Now, not only is it technically viable, but many states, including Colorado, have passed laws that make the preference signal legally enforceable. This is. This provides people with the genuine capacity to exercise their freedom. And it's wonderful.

[00:22:17.46] Now, just imagine the same type of mechanisms for GenAI, imagine being able to send a standard preference signal to indicate your desire to remain free from unwanted GenAI integration, and imagine states passing laws that made it legally enforceable. I mean, it's in the works. We can in fact, do this. We can have the freedom to be off with technology and law working together.

[00:22:39.50] But I must admit that every time I've ever mentioned this idea, I've always been told the same thing. Good luck. It'll never happen. To which I say, what part? And the response is always. There's

no way to get it to pass politically. Fear of missing out or falling behind will kick in. Big tech won't let it happen.

[00:22:58.62] Well, let me conclude by saying I still think it's worth fighting for. Our freedom to be off, To, be free from AI, is paramount to the future of humanity. And it deeply concerns me that this freedom is already unevenly distributed. Thank you.

[00:23:20.86] MATT SCHMIT: [INAUDIBLE] Brett. We hoped you would get us thinking this morning. And I think you've accomplished that. We've got time for a couple questions if you'd like to take some. In keeping with Silicon Flatirons tradition, the first question should go to a student. And so if you've got a question and you're a student, raise your hand.

[00:23:37.46] If you have your question and you're not a student, you can also raise your hand, but we're going to call on the student first. Any questions on a Sunday morning from a student. All right, I do see a hand up over here. Might not be a student, though.

[00:23:55.02] AUDIENCE: Looks like a student.

[00:23:56.66] MATT SCHMIT: All right. Please state your name and speak clearly into the microphone. perfect. Thank you.

[00:24:08.14] AUDIENCE: Good morning. Thank you so much for the conversation. Gabrielle Daley, fellow with Silicon Flatirons, where I mostly do broadband access research. Your compelling point about the digital divide being a problem that still needs to be solved is well taken. Could you say a little bit more about the relationship between that and how that might exacerbate the inequities that AI is perpetuating that you were talking about?

[00:24:31.02] BRETT FRISCHMANN: Sure. Closing the digital divide in terms of providing access is often thought of as if providing access is sufficient-- not only necessary, but sufficient. It's never sufficient. There's always a series of other things in terms of both quality of access and other things-- like for example, as I said, access to Wikipedia doesn't make anyone smarter. You actually need education, skill development, and other things to go along with access to the knowledge resource, to the data resource to make it useful.

[00:25:05.93] The same point applies when closing the gap for providing broadband access in and of itself. So access is a part of it. Affordability is a part of it, but also you can't-- part of my thought is on this in terms of making the connection, to truly close the gap. You want to pay attention to the quality and the conditions with which access is provided.

[00:25:30.05] MATT SCHMIT: All right. We have one more question up front. Just one second, sir. We've got a lot of folks joining us online, so we want to make sure they can hear you, too.

[00:25:44.57] AUDIENCE: You spoke mostly about the demand side and that high tech will stop whatever you want to do. You want to say a few words about the supply side and the concentration there?

[00:25:57.09] BRETT FRISCHMANN: Yeap. That's a good point. I've historically focused a lot on the demand side through a lot of my work, which is kind of interesting that you picked up on that in this talk because I hadn't really thought of it myself until you brought it out. But yeah, I mean, this is one of the topics of the next entire panel. We'll focus on the idea of concentration on supply side.

[00:26:20.37] But yeah, I think that the fact that there is concentration is part of what contributes to the difficulty in trying to push forward any kind of intervention of the sorts that I'm suggesting.

[00:26:35.61] MATT SCHMIT: Well, thank you. We can have one final question here and then we've got to get back on track.

[00:26:41.53] AUDIENCE: Russ Hanser, NCTA. So one objection I can imagine to your manifesto, and I'm not associating myself with this objection, but I can imagine it is, look, I get your mushy humanism. It's fantastic. But we're in a geopolitical battle to the death with China and others? And any friction that we build into our adoption of AI is going to undercut us in that geopolitical battle.

[00:27:04.29] And if you're worried about dehumanization through ChatGPT, just let me tell you about what the dehumanization of the PRC controlling everything is or moving toward those authoritarian models. In other words, I can imagine the objection that we just, and again, I'm not associating myself with this, but we can't afford your humanism because there's much bigger stakes in the bigger battle. And we need to do everything we can to win that race. And I'm just curious if you've thought about that objection and what your response to it would be.

[00:27:31.13] BRETT FRISCHMANN: Yes. Probably, don't have time to fully spell out the series of responses that one would have to develop. The bottom line is the claim that's being made needs to be proven and shown, and that the demonstrable evidence that claim being made about a fear of missing out and a fear of falling behind in an arms race is often not. There's no evidence behind it to support. There's not strong evidence to support that. In fact, that is the concern we ought to be focusing on. That's one of maybe the first step along a series of steps towards why you need to reject unfounded claims.

[00:28:08.53] Then you can talk about that why friction and design, the kinds of things I'm proposing, don't necessarily stop progress at all. There's another claim, which is if you do the things you're supposing you slow anything down, any form of slowing or friction necessarily impedes innovation, which is an argument that's been destroyed for 25 years in the literature on innovation and science and technology

development. So it's just not true. But it's a second claim that's part of that. And then we can keep going.

[00:28:39.81] MATT SCHMIT: Very good. Well, clearly you got us thinking this morning. Thanks again, Brett, for your commentary. Any other questions track them down in the halls of Colorado Law, Professor Frischmann.

Panel: AI Market Forces – A New Gap in Tech Access?

https://youtu.be/33KknaBkhL4

[00:00:00.44] FYNN FEHRENBACH: Good morning, everyone. My name is Fynn Fehrenbach, and I'm a third-year student here at Colorado Law School. I'm happy to be introducing today's first panel, AI Market Forces-- A New Gap in Tech Access? The panel will be moderated by Professor Harry Surden, an expert in artificial intelligence and the law.

[00:00:18.96] He is joined by Elettra Bietti, Assistant Professor of Law and Computer Science at Northeastern University School of Law, Asad Ramzanali, Director of Artificial Intelligence and Tech Policy at Vanderbilt Policy Accelerator, joining us virtually is Howard Shelanski, Professor of Antitrust Law and Trade Regulation at Georgetown Law School, Christopher Yoo, Professor in Law and Technology, Communication, and Computer and Information Science at the University of Pennsylvania Carey Law School, and last but not least, Richard Whitt, President of GliaNet Alliance. So please join me in welcoming the panel.

[00:01:00.51] [APPLAUSE]

[00:01:05.31] HARRY SURDEN: Thank you, Fynn, for that excellent introduction. So welcome to our panel. Harry Surden, Law Professor here at Colorado Law, and I have the pleasure of moderating this panel. I will also be helping to organize our AI conference, which will be on March 6, not May 6, just to clarify that day, and I hope to see you all there.

[00:01:27.15] So thanks for joining me on this really timely topic on AI market forces. Ever since the emergence of ChatGPT, just a little over three years ago, AI has been getting more and more performative in terms of its ability to do knowledge work.

[00:01:45.03] And it has been improving, in my estimation, about 10% each year accumulative on the previous year. And today we see three dominant AI large language model systems that form the backbone of the foundation of a lot of today's systems, ChatGPT from OpenAI, Claude from Anthropic, and Gemini from Google.

[00:02:08.51] And some look at this as a moment of concern. Behind these names, which might not be familiar, are some familiar names of the tech world. OpenAI, famously, is funded by tech giant Microsoft. Behind Claude are large investments from Amazon and Google. And then Google has their own model, Gemini. Meta continues to influence-- spend a lot of money in the AI realm, and beneath all of this are production chips from NVIDIA and Taiwan Semiconductor, which have a near virtual control of the market.

[00:02:48.09] So on this one view, this is a critical moment to intervene and ensure that any benefits of the AI moment are distributed, and to ensure robust competition. But there's another perspective we'll be seeing. And others see this as a moment of restraint. By many measures, we're early in the AI life cycle. Only four years ago, large language models were actually not that performative at all. So much so that most of us had never heard of these AI systems.

[00:03:18.36] The technology is changing month to month. So the last AI conference that we had in April here was on AI agents. I stood up here, I showed AI agents programming, and it was good, but not that good. Fast forward eight months now, we have AI agents which are able to program autonomously, like Claude and Codex from OpenAI, and they're able to produce really performant, accurate systems in just eight months.

[00:03:50.94] We are now seeing very competitive models, open-weight models, largely from China, very performative systems that are only three to four months behind in terms of performance. The frontier models, a year ago, we really didn't have competitive models. So in this view, sees this as a moment of restraint, that intervention might do more harm than good, given that we're possibly early on in a life cycle and we might nudge it down the wrong path unintentionally.

[00:04:23.92] So to discuss these topics, we have an incredible panel. I know Fynn introduced, but we have Asad Ramzanali, Director of Artificial Intelligence and Technology Policy, Elettra Bietti, Professor in Law at Northeastern, Christopher Yoo, Professor in Law and Technology at University of Pennsylvania Carey School of Law, Richard Witt, President of GliaNet alliance, and for our first question, joining us remotely, Howard Shelanski, Professor of Law at Georgetown Law.

[00:04:57.85] So the first question for our panel will go to Howard. So, Howard, where do you see antitrust concerns arising in the LLM space today, if at all? You've suggested that we need to move beyond traditional section 2 monopolization analysis, which is legalese for antitrust intervention, and take a more holistic ecosystem view of AI markets.

[00:05:23.53] And what would you say-- what does that mean concretely?S Where would you focus your scrutiny in light of the technology? Should we be concerned about this potential tech

dominance of the familiar players in the space? And where do you see things going. So, Howard, turning it over to you.

[00:05:41.29] HOWARD SHELANSKI: Thanks very much, Harry. Am I coming through OK?

[00:05:43.57] HARRY SURDEN: Yes. You are.

[00:05:44.63] HOWARD SHELANSKI: OK. Great. I'm very sorry I can't be there in person, but I'm delighted to join all of you today. Look, Harry, it's a very, very good question. Right now, if you look at the ecosystem, it looks like there are three major players. These are actually players of very distinct structure.

[00:06:00.93] You've got Anthropic coming out as, sort of, an LLM player without the benefits of a lot of history and integration into other kinds of platform services. Similarly with OpenAI, although they have had an alliance or a financial arrangement with Microsoft. Although I would note that that has transformed dramatically over the years, and the financial structure is very different than it was in 2018, 2019 with the initial investment.

[00:06:34.49] And then you have Google, of course, which comes from a position of-- Judge Mehta's words, not mine-- dominance in search, and, obviously, has certain kinds of advantages that can come into play. So what do I think about antitrust in this universe where we're looking at three large frontier models that seem to be the leading players?

[00:07:00.36] It is tempting, on one hand, to reach back and to quote then FTC Chair, Bill Kennard, when he was being asked in 1999 to regulate the emerging broadband players. And Bill said, "I'm not going to regulate anything. We don't have a monopoly. We don't have a duopoly. We have a no-opoly. Let's let this thing develop."

[00:07:24.04] It's tempting to do that. I think we need to be a little bit more cautious when it comes to the current ecosystem, and here's why. It is a very layered and integrated ecosystem. This is not a situation where frontier models can just pop out there, run on your computer, and compete unrestrained based on the performance of their models.

[00:07:48.10] Yes, that's part of what happens, but to get to that level of performance, they need many different kinds of inputs. I'll just focus on two for simplicity right now. One is compute and the other is training data. And if you don't have access to very consistent supplies of large amounts of both of those things, the ability to develop a performant large language model and to move towards generative AI is going to be challenging.

[00:08:20.92] So you need to not just make sure that there isn't some kind of tipping to use of the LLM on the retail side, for lack of a better term. You have to make sure that there isn't foreclosure or hurdles to

the key inputs that these LLMs need right now. And that's why I think we're talking about, for lack of a better term, an ecosystem in which we have to look at the interrelationship amongst all of the parts.

[00:08:44.28] Now, before I go on, I want to note two points. One is I am going to take an agnostic position to the excellent points that Brett Frischmann-- wonderful to see Brett-- made in his keynote address, right?

[00:08:58.91] Antitrust, we're agnostic. You want more cigarettes? We're going to give you more and cheaper. You want more awful soft drinks? We're going to give you more and cheaper. We are agnostic as to that. So I'm going to assume that what we're asking about is, how do we make sure this ecosystem develops so we get more LLMs faster? I fully appreciate there's a very important social debate that we must have about that question.

[00:09:20.67] The second thing I need to do is offer a disclosure. I have provided paid legal advice to OpenAI, so we'd just like to disclose that. Most publicly, in the role that they played as a third party in the Google remedies phase, the Google search remedies phase, where they had a witness at trial that I was involved with prepping and presenting. So just want that disclosure out there.

[00:09:49.83] OK. So what do we need to think about? I think what we need to think about is ensuring that to the extent that the closed, the black box form, not open parameter, but closed parameter leading LLMs, that have the largest user share right now can continue to compete and trade off position in the marketplace.

[00:10:18.67] I think we have to look carefully, not just at the current market shares, but at the vertical relationships that those firms have. The access they have to certain kinds of data, their willingness to provide that access to third parties who might not be able to get into their systems for that data.

[00:10:41.15] So, for example, you need video training data. Does Google have an advantage because of YouTube? You need compute. Does somebody who has a very long-term massive supply agreement with NVIDIA have an advantage? We don't necessarily know the answer to these questions because the ability to use synthetic data sources of data are shifting all of the time.

[00:11:06.34] Different forms of compute. And, of course, the ability of DeepSeek to come into the market just a few months behind with an open parameter model that ran on far lighter-weight compute raised questions about, we shouldn't necessarily assume that you have to have a supply with the current suppliers.

[00:11:26.68] But I do think we need to have a competition policy that looks, not just at the actions that these firms are taking in their

contracting practices vis-a-vis users, but their access to data and their upstream and downstream supply agreements.

[00:11:44.87] Right now, my view is we don't know enough to say, for example, that, oh my gosh, we're moving into a triopoly. We need to start regulating this environment from a competitive standpoint. I do think, however, that we need to have, I think, a very careful and thoughtful look at what happens when Google signs an agreement with Apple to have Gemini be the white-labeled AI that powers Siri?

[00:12:18.17] Does that start to default into voice assistant search for Google? Is that a way of preventing the very kinds of dynamism that Judge Mehta articulated in his Google search remedies opinion when he said, "I don't need to stop Google from purchasing defaults because this is such a dynamic ecosystem that pretty soon the AI upstarts will be able to outbid Google for those defaults?"

[00:12:45.33] Well, I think we should ask a question of whether the kinds of agreements that are being formed now before the new players are able to outcompete Google for paying for those defaults, I think we need to ask a hard question about whether those-- that dynamism might be prevented before it fully develops?

[00:13:03.21] Does that mean that I think there's necessarily something wrong with a lot of the agreements we're seeing out there in the marketplace? I don't know the facts. I don't know enough. But I would say it's something that, as a regulator who could gain access to those facts, that I would want to look at.

[00:13:17.95] Because I think without preserving the dynamism that's in this space, we will wind up with a relatively limited set of players, and we will wind up with very integrated product bundles that may or may not interoperate, and we might not get the full benefit of the innovation competition that Brett referred to at the end of his talk that would be truly beneficial for the ecosystem.

[00:13:41.26] And I fully agree, not all friction prevents innovation, competition, or impedes it. Sometimes you need a little bit of friction to keep it open, and I think that should be the focus of competition policy going forward.

[00:13:53.46] Just one final note on the Chinese open-parameter models. There are many of them, not just DeepSeek. Very interesting question about whether, as a global matter, those are viewed as more or less trustworthy from a data standpoint than, for example, the closed models of the existing tech platforms.

[00:14:13.64] I do think that they have the potential to be very powerful competitors, but, of course, trade policy and various kinds of other things may limit the degree to which they can fully compete in the US market.

[00:14:25.16] So I do think we need to think about competition in AI models, not just in an antitrust standpoint, but we need to think about who we allow to come into our marketplace, are restrictions good or are they bad from a variety of different perspectives, before we reflexively rule those models out of competing down the road in our ecosystem. Thanks very much.

[00:14:49.08] [APPLAUSE]

[00:14:51.92] HARRY SURDEN: All right. Thank you, Howard. Those were extremely helpful remarks. And one theme in there I just want to emphasize is the importance of regulators and analysts understanding the underlying technology.

[00:15:05.04] So what Howard did, which I really appreciate, rather than taking a simple market dominance approach in terms of sales, he said, well, let's understand the underlying technological inputs that this technology brings, this large language model technology, the compute, and the data and scrutinize those. And our regulators or those who may want to or not want to be involved need to understand these nuances. And I really appreciate that.

[00:15:33.42] So let me throw the same question out to the panel. Chris.

[00:15:38.91] CHRISTOPHER YOO: Actually, I go by Christopher. My wife is named Chris.

[00:15:41.01] HARRY SURDEN: Oh, sorry. Christopher. Yeah.

[00:15:42.59] CHRISTOPHER YOO: So the question and Howard's answer really stemmed on this word ecosystem. And I have an article in the Network Law Review actually analyzing this because this is an item that's shown up in the 2024 EU guidelines on market definition. And whenever I hear the word ecosystem, I try to figure out, what is it, and what do we learn from it?

[00:16:02.93] And so what they define, according to this, is it's similar to aftermarkets and bundles, but it may be different. And they talk about how it may be different, well, things that don't matter, network effects, switching costs, multihoming, and I find myself deeply puzzled by this. Because until they tell me how it's different, I really don't know.

[00:16:22.89] Network effects are often used incorrectly as equating to winner take all. And the answer is, if you actually look at the literature on network effects, they say that it can actually cause technologies to change too quickly as well as too slow.

[00:16:37.35] It's actually there's two opposing network externalities. By joining a network, you actually create benefits for the new network that you don't internalize. You also impose costs on the old network you're leaving that you don't internalize. And they say that, in fact, it's an empirical question about which of those effects dominates. And so

just assuming that that's going to go in one way, actually, if you look empirically, it doesn't work out either.

[00:16:59.31] The notion of multihoming, if you multihome, it's not winner take all. You're both. And so you see this real ambiguity, and it's been a real puzzle to try to figure out how that would play into this.

[00:17:09.91] The other definition comes out of an academic piece by Jacobides and Lianos, which is frequently cited. They talk about these complementary products that's really about, we're talking about the monopoly or the potential of triopoly in the AI generators, the frontier models. Most of this stuff is about the complementors who are building on the models. And so that's really what Jacobides and Lianos go to.

[00:17:33.39] We know that the vertical-- well, first is they talk about central position and paramount importance, and this is why we abandon the structure conduct performance paradigm in antitrust. Which is, raw size is ultimately ambiguous. It can be the result of anticompetitive activity.

[00:17:48.90] It can also be the result of successful competition on the merits, which is why we always have an exclusionary conduct element to separate the two. When it's a result of bad acts and good acts, we have to make sure that that works.

[00:17:59.18] But what's also fascinating to me is when you're talking about complementary products, the lesson over the last 50 years of vertical integration theory is this is ambiguous. And I'll give you two concrete examples. One is the seminal article by Tim Bresnahan and Marc Trachtenberg on general purpose technologies. Makes the point that if you build a platform, you actually create benefits for the complementaries you don't internalize.

[00:18:24.34] Their recommendation is to allow the platform creator to vertically integrate into complementary services more so they can actually internalize it. Now, there's always going to be an optimal balance. And I'm not saying that means you let them do it forever.

[00:18:37.56] The other one that I think is fascinating is David Teece's famous article on profiting from innovation is that there is a timing element about sunk cost opportunism. Which is, hey, if you are going to develop a technology, but you have to negotiate with other inputs, and anytime you're doing this, it's never a finished product if it's a frontier model, if you sink the costs before you negotiate with them, you're screwed. Because after the costs are sunk, they're going to beat you up in negotiations.

[00:19:05.38] Teece's recommendation-- and this is an article that's had a whole symposium written about it, it's very well-interested, it's generated a lot of interest-- is to enter into a strategic partnership early on so that you can actually be governed by the ex-ante bargaining power instead of the ex-post. So what I see here is a very complicated

reality where these sorts of ecosystems actually can yield huge benefits.

[00:19:27.14] What we really need is clear definitions, and really, a means for sorting out when the good is-- when it's good and when it's bad. And unfortunately, the ecosystem discussion, at this point, I think, obscures more than it enlightens, and it needs a little bit more development. And it makes me wonder-- it makes me cautious about how it's being used.

[00:19:43.65] HARRY SURDEN: OK. Yeah. Great point. So just to summarize a little bit what you said, what I'm hearing is that some of things that might superficially seem like concerns actually might be some optimal structures for these things to proliferate, some of these interconnecting deals out there. Richard.

[00:20:04.81] RICHARD WHITT: Yeah. Thanks, Harry. Great to be back at Flatirons this year. I believe Howard did a nice job of laying out some of the potentially relevant factors to look at in this, maybe, broader ecosystem approach, including the idea of the vertical relationships, who's paying who behind the scenes.

[00:20:19.39] I think one other relevant factor to bring to the table is simply the business model. Where do they get their money on the front end in terms of customers? And we now have three fairly distinct approaches. So Google has now taken the AI Gemini capability. It's embedding it in everything. And, of course, Google is operating under what I've been calling for a while now, the SEAMs paradigm, which stands for surveillance, extraction, analysis, manipulation.

[00:20:45.31] So it's the core platform of the web. It's what, not just Google, but many of the larger companies have abided by for many years. Surveillance capitalism, another way you can put it from Shoshana Zuboff. But that is where Google is. That's, I think, where they're going to be going forward. They're going to make a lot of their money from, not just the front end with the consumers, but also with the data, the operators in the back end, the data brokers, advertisers, et cetera.

[00:21:08.79] OpenAI, until recently, was in this camp where Sam Altman was uneasily saying, I think we don't need to go down the advertising road. Now, they very much are. Within the last two or three weeks, Sam has made it very clear they're going to be more or less adopting, again, what I call the SEAMs paradigm, moving in the direction of the other-- basically, the way the web has been set up over the last 20 years.

[00:21:29.52] Anthropic, of the Big Three, is in a very interesting state. They don't have any of that right now. They mostly focus on enterprise customers and business APIs. And actually, I use Claude a fair amount, and I've asked Claude, what do you think about the way you're setting yourselves up? And he has this constitution right that's been set up.

[00:21:47.82] And you can take it with a grain of salt if you like, but his perspective, for what it's worth, is like, yeah, we set ourselves apart because we want to have the consumer see us as a more friendly place where we're not selling your data, brokering to third parties, trying to influence your behaviors.

[00:22:02.58] Again, take it with whatever grains of salt you want. But I guess the larger point is, simply, there are potentially three different models now in terms of how the web paradigm is being incorporated or not into these three major systems.

[00:22:16.44] ELETTRA BIETTI: I think I'll wait.

[00:22:19.96] HARRY SURDEN: Oh, OK.

[00:22:20.92] ASAD RAMZANALI: Yeah. I don't think I have too much more to add.

[00:22:22.30] HARRY SURDEN: OK. Yeah. I'll just add one more thing, which is, in terms of this rapidly changing landscape, right now, AI systems for training are really compute and data inefficient because of our current paradigms. So to train something like ChatGPT requires roughly a trillion pages of data.

[00:22:44.33] But there's been a lot of algorithmic innovations recently that could make these systems much more, they call it, sample efficient, data efficient, where they might require 1/10 or 1/1,000,000 of that same data, same thing with compute. So it's interesting to see how these compute and data efficiencies might change the landscape in five years due to breakthroughs that are coming.

[00:23:09.27] OK. Great. Great first question. Let me throw the second question out to Christopher. And this is the other viewpoint here. There's a view we might simply be too early in the AI life cycle to just draw strong conclusions about market structure and dominance in the AI space.

[00:23:28.15] And, for instance, only a fraction of users have adopted AI. Even though it seems like AI is everywhere, in some sense, it's also not that common. The players are shifting constantly. The dominant players today were not necessarily the dominant players three and five years ago. The technology of today is very different. So what's your perspective on this, Christopher.

[00:23:51.79] CHRISTOPHER YOO: So you point out-- I put it very nicely, which is, what we care about-- and this really shows up in the network effects literature, is not the market we have today, it's the market we're going to get maturity. So if you a new technology, we have that familiar adoption curve where it starts slowly and it goes up this way, the first actor is going to have 100% market share.

[00:24:11.51] And we could look at that and analyze, well, this is a problem. We don't really know what's going to happen. And, in fact,

we can look at the number of free customers, and even if you're small, if there's 95% of the market hasn't adopted yet, you're free to contest for them in a Greenfield way. And so you see a very interesting set of dynamics about, when you analyze a market, you have to know where you are in the adoption cycle and see how it goes.

[00:24:35.62] And the funny thing is-- it's fascinating when I think about Richard talking about asking Claude, do we really know how this market is going to shake out? So I keep on thinking about the great philosopher, Yogi Berra, who says, prediction is hard, especially about the future. Like, I wish I could sit here and tell you, I know what the future is going to be and we can worry about this.

[00:24:54.58] And if I had the ability or if any of us had the ability to do that, we are wasting our time here. We should be cashing our checks and sipping margaritas someplace beautiful. And the number of times in the tech industry I've heard people say with great confidence when something's going to happen a certain way, we all know that's not the case. So what are the possible worlds we could end up with?

[00:25:13.50] We could see these three companies bashing each out. We could see it working out that way. I'm fascinated when we talk about Google, when I hear people talk about this in Silicon Valley, it's charitable to call them as part of the three. I mean, they regard them as behind and really struggling. But be that as it may, that's one possible outcome.

[00:25:31.46] What's another possible outcome? There's a whole bunch of writing right now, really epitomized to me by-- I think it's Goldman Sachs article, all this investment, where's the revenue? Is that we are seeing a huge speculative bubble reminiscent of the dot com bubble of '99, where you don't see payable business models. I don't think they're going to-- the $20 per subscriber per month is not going to do it.

[00:25:54.60] And that we're going to see a radical shakeout of this at some point. And you're going to see that, in fact, that this may not yield the kind of benefits we think about. We may see that-- we talked a bit about data and the availability of data. The initial models were trained largely on publicly-- information scraped from the publicly available internet.

[00:26:18.42] So the idea that there's some huge monopoly or ability to exclude people from doing that, if that's the source, is unlikely. But more interestingly, the big jump in what you learn is the non-linearities, and when you ingest things into LLMs, that was the big chunk of data. There's no other big chunk out there. And seeing how this diffusion curve is going to move forward is not at all clear.

[00:26:41.41] But then, as Harry is talking about, you see this other movement that says the way AI is going is to train models on smaller amounts of higher-quality data, either in terms of fewer errors or more

focused or fit-for-purpose models. That aren't trying to do everything to everybody, but, something that will warm the hearts of all of us who are in law school, they're trying to do things specific to the legal domain, but they're not trying to do everything for everybody.

[00:27:08.03] And so you can see all these different worlds where they're just coming out. And we see, even aside from specificity, things like DeepSeek, they're saying is, do I really need the entire universe of data that I have to run this model, which is a big chunk of how they reduce compute?

[00:27:22.63] We're seeing new analytical solutions that require much less compute, they require less data, that may play out in very radical different ways. Now, are there stories that could be bad? Yeah. I think so. But the question is, do we know at this point what those are going to be to step in?

[00:27:41.39] Now, the other way I'd think about this is, what would we like-- what would a good environment for this look like? We'd want new entrants. We'd want lots of investment. And, in fact, we want people experimenting with different solutions. Do we want homogeneous me too things among the different actors and different things?

[00:28:03.89] And when you start to look at this, Anthropic and OpenAI are two, if not the biggest-- I think they're the biggest startups in history. And that we see new actors that didn't exist before that are disrupting. And, yes, we have some partnerships with OpenAI and Microsoft. The interesting question is, do we want a world in which there's no partnerships between any of these companies?

[00:28:25.84] And there's possibly-- Howard says correctly, there may be problematic relationships, there may be possibly beneficial ones. And it could be that if Google is behind and number three, maybe partnering with Siri is a way they can make it work. And there's examples I can give you of that from history.

[00:28:40.24] But the interesting question is we have to think about the counterfactual, if we're worried about this world, what would we think a healthy emerging environment might look like? I might want 10 LLMs, frontier models. I don't think that's realistic. The structure of it and the magic number, what we generally see from the econometrics, is the vast-- is three, that we talk about the rule of three.

[00:29:02.40] If you look at it from a pricing standpoint, the huge benefits come from adding a second player to a market and a third player. The marginal benefits, yes, they're there, it's better, but they start to decline in diminishing marginal returns. And we discovered that we would love to see markets with a hundred players, but--

[00:29:18.24] My favorite example of this is NVIDIA. And when I go around the world, they're talking about AI stack and AI sovereignty.

Every country wants to be independent on AI. We have 190 recognized UN countries. We're not going to have 190 chip manufacturers. This is not going to happen.

[00:29:33.12] But the last comment I'll make, and this is something I was talking with Harry, is, we have to think about this in the long term, and really think about how it's going to dynamically-- and in a skeptical, humble way. And, to me, the classic example is NVIDIA.

[00:29:46.12] So NVIDIA is now one of the, if not the largest company by market cap. I didn't check today, but it's right there, if not-- and the differences don't really matter. I saw the EU open investigations. I saw the FTC open investigations.

[00:30:00.92] There's an alternative explanation for NVIDIA. They're damn lucky. Why? They were doing graphics processing chips for a segment that is dying, that is laptops and desktops, on something that's essentially becoming obsolete, that was doing parallel processing. That got bailed out a little bit by blockchain, and then AI comes.

[00:30:20.67] And just because they happen to have a product that was suited to a complementary technology that just happened to develop, they are doing very, very well. And this is like Forrest Gump surviving the hurricane. Sometimes you get lucky. And that's fine. And according to-- I'll call it a luck, this is not an antitrust problem. It happens.

[00:30:39.43] There's a guy who bought land that was a bauxite mine, the best one in North America. This just happens. Now, the better question is, how long do we expect that to last? Is there a moat around NVIDIA or it's AMD sees this? And this is normal, right? Which is, we say short-run dislocation from a shift in demand caused by new development is what attracts everyone to do it.

[00:31:00.93] You know AMD is working on a parallel processing chip right now. They've said as much. How long is it going to take? How effective are they going to be? Who else is coming? That's the real question as you start to think about this in a more dynamic way and to try to understand how it's going to work out.

[00:31:17.25] Because if we look at it the early stages by saying, well, NVIDIA's got 100%, we should whack them and take all the profitability of the segment, we actually disrupt the very dynamics that are going to attract in this additional entry that we depend on for these markets to move forward.

[00:31:31.43] HARRY SURDEN: Thank you, Christopher. That's a really interesting perspective that, right now, this is a dynamic space, and we might unintentionally, through action, nudge things down the wrong path. So advocating for restraint.

[00:31:47.87] One thing I really want to emphasize is your point about being skeptical about predictions. So a less funny version but maybe more accurate version of the Yogi Berra quote is, prediction is hard to do, especially about technology. And that's something I emphasize among my students.

[00:32:05.91] And you can all do this exercise. If you go back and look what was being discussed at the dawn of the social media and smartphone age around 2008 and 2010 and see what the dominant concerns were, they, by and large, missed the concerns that we care about most today, like political polarization, misinformation, addiction, and mental health concerns. They were worried about other things, but they missed the big ones.

[00:32:33.42] And, to me, that should invite some humbleness on our part about attempting to confidently predict the direction of technology and the problems. Not that there won't be problems, there are problems, it's just we're bad at predicting what those problems are and we're most likely wrong. Let me throw this out. Elettra.

[00:32:52.94] ELETTRA BIETTI: Sure. So I'm going to maybe comment on both Howard and Christopher's interventions because I think they put forward different kinds of legal institutional visions for AI, and so I want to put a third or a fourth vision on the table as well.

[00:33:14.93] So Howard, basically, is arguing for moving away from traditional Section 2 of the Sherman Act Antitrust Review because it's too limited. It doesn't seem to be perhaps working. We've seen a couple of cases against big tech that have not ended well. We'll see what happens. The meta decision is being appealed.

[00:33:40.81] But he's arguing for moving to an ecosystems-based understanding of what's going on in these markets. What I am still ambiguous on is whether he's arguing that a case-by-case-type enforcement still should apply to these ecosystems, or whether we need a more holistic form of ex-ante, perhaps, regulation.

[00:34:03.35] And so just two days ago, Christopher and I were on another panel together talking about ex-ante pro-competitive regulation, and I think it's worth just putting ex-ante regulation on the table and thinking about what kinds of frameworks might need to be designed in a forward-looking way. And it cuts across or it cuts against this question, sorry.

[00:34:27.17] HARRY SURDEN: So just for the non-legal people, would you mind explaining what you mean by ex-ante regulation?

[00:34:31.47] ELETTRA BIETTI: Yes. So there's a kind of debate about whether we should regulate ex-ante or ex-post. So ex-ante regulation comes before the potential violation and creates a framework that creates some level of deterrence or nudges companies, in some way, to not violate certain restrictions. So not accumulate data or train data

across different services, not prevent potential competitors from interoperating with upstream or downstream services that they control, for example.

[00:35:11.50] And antitrust ex-post enforcement comes after the fact. And it questions the behavior of companies after a violation has occurred or after we have empirical evidence and we can assess that problematic behavior has occurred.

[00:35:28.58] And so I think there's space for thinking about intervening before the fact, or even if we're skeptical about intervening before the fact, experimenting with both an ex-ante, before-the-fact approach, and an ex-post approach. And that's because I am worried that the wait-and-see approach that Christopher puts forward allows incumbents, in particular, to accumulate too much power in a timeline where regulators are just unable to intervene.

[00:36:04.78] And just in the last few months, we've seen a number of announcements that should be concerning to us and that regulation could potentially prevent. So an example is that Apple will be sharing its Siri-related data with Google. And so the two companies, who were both incumbents, are going to pool their data for the purpose of AI training of their models, and this will facilitate the position of Gemini in this kind of competitive battle with other models.

[00:36:37.20] Google is also now offering AI pricing functionality across the web, which is another way that they're using their infrastructural advantages and infrastructural capacity to potentially control and plan the digital economy in some way. Matt Stoller has commented on this by saying Google is becoming the new digital central planner.

[00:37:03.57] And then we have announcements about the sharing of data across different services that big tech companies use. So, for example, Google is using Gmail data to train their Gemini. Meta is using our messenger information, or our Instagram data, to train their chatbot. And that should also be concerning to us potentially, and these are things that some incentive frameworks were meant to deal with ahead of time.

[00:37:38.61] It doesn't seem to work, so that is a serious concern that just a few days ago, the European Commission issued some specification proceedings against Google because Google is denying interoperability to its third-party competitors. So even though there are rules out there written in the books, it seems like Google is totally bypassing them. And so there's a question about how do we design regulation today. But I just wanted to put the ex-ante alternative on the table.

[00:38:12.45] HARRY SURDEN: No. I love that. And just to bring out some of the themes you brought up, so this is the question, do we set up a series of rules ahead of time to prevent harm or deter harm, or do

we wait for the harm to arise and then, looking back, either deal with it one on one or create some rules based upon things that have happened?

[00:38:33.37] And one thing I like that you said, and I think it does-- what I understood Howard to say is that, to the extent there's an ex-ante rule, he would want access of data by regulators to be able to scrutinize things like the inputs to systems or some of these relationships that might create anticompetitive harms that they might not have access to today, which is a softer version of ex-ante access than having rules. Asad.

[00:39:05.48] ASAD RAMZANALI: Yeah. The thing I want to add a little bit to Christopher's point-- I appreciated the, what's the magic number? In a market that-- and these are multiple markets we're talking about. I take your point on ecosystem can be a fuzzy idea.

[00:39:17.94] In the AI model market in particular, if you look at that, my thought process is not, what's the desirable number of competitors in the market or what's the idealized mature state of the market, but rather, what's the state of the market where if there is an innovation in how models are developed, that a new entrant has the ability to enter?

[00:39:38.96] There are certain parts of that market that are going to pose barriers to entry. To your point about data, there's the compute costs, but there's a lot of other things that look more artificial like exclusionary contracts, like the fact that we do have limited access to compute, like the fact that a lot of these deals that look like vertical integration, either within a company or through investments, or through other types of financial arrangements, those can become limiting for the next company.

[00:40:05.70] I don't believe we've reached a technological maturity in what a model market looks like, but I worry that the economic arrangement of that market may force us to get to maturity faster than a new innovation might be able to actually do something about that market. So that's where I get a little bit worried about the things that I see in that market.

[00:40:25.14] HARRY SURDEN: Yeah. That's a great point. And the eternal question, what's the signal to intervene or not intervene? All right. Elettra, this question is for you. So emerging technologies have given new capabilities for companies to influence government and regulation beyond traditional concerns.

[00:40:47.38] So in recent work, you argue that technology platforms engage in forms and influence that go beyond what we've traditionally worried about from the private sector influencing the government, such as lobbying, contributions, or revolving doors, and increasingly engage, what you call, epistemic and technological capture.

[00:41:06.63] Can you say a little bit more about these new technological opportunities to influence or capture government? And then if that's right and we have new ways of influencing government, where should we be concerned about problematic technological power concentrations?

[00:41:26.53] ELETTRA BIETTI: Yeah. Thanks so much. Also, I wanted to say thanks so much to the organizers for having us, and thanks, Harry, for moderating.

[00:41:34.77] So yes, so in the spirit of talking about growing asymmetries and information access and in access to AI functionality, I wanted to discuss tech companies, and, in particular, AI companies' growing power, and how asymmetric that power is and potentially will be in the future.

[00:41:59.37] In the keynote by Brett Frischmann, I really liked his point about the asymmetric ability to shut down information flows. The fact that the rich or the haves can extricate themselves from technological systems in a way that they have-nots cannot. And this kind of move from a landscape of scarcity, which I think many of you have operated in or thought about for a long time, to a world of information saturation and information oversupply. So I think that's really useful and important.

[00:42:37.09] I want to focus on a slightly different question on asymmetry, which is the asymmetry of power between governments and tech actors. And so that's really what this research that I've been doing recently with a political scientist is about. The paper is called "Technological Capture."

[00:42:56.32] And it's basically an attempt to reframe the problem of regulatory capture in the tech industry from more traditional forms of lobbying, revolving doors, political donations, to new ways in which tech actors use their preferential control over technology, over knowledge creation to affect political processes and also regulatory processes.

[00:43:27.68] So beyond the traditional forms of regulatory capture and influence which have been studied at length, and which, obviously, tech actors engage in, I talk about three other forms of influence. So the first is epistemic power or epistemic capture.

[00:43:49.76] And that's the power that tech companies have over information flows and knowledge creation, including their ability to withhold information from regulators, in some contexts, to disseminate certain types of information, to flood the regulatory zone, so when there are-- we've seen this in antitrust proceedings, when they have a hard time arguing a case on the merits, sometimes tech actors tend to produce a lot of expert reports and flood the regulatory zone.

[00:44:21.77] And as we know, regulators don't have the same resources that tech companies have, and so sometimes it's really hard to navigate all that information. But there's also another kind of aspect of control over knowledge creation that is being exploited, I think a lot, by AI companies, which is this creation of hype.

[00:44:42.85] The, if we don't do it, someone else will do it. We need to develop AI now so that we can solve all these issues, from climate change to poverty to full employment. And so I think there's ways in which tech companies use their ability to control information to affect regulatory priorities and regulation itself.

[00:45:10.35] Perhaps more relevant to this panel, there's two other forms of power that we worked on. So the first is what we call connective power, power over nodes in a network. And the final one is what we call architectural power or infrastructural power, if you will.

[00:45:28.79] So the first connective power is really the ability of platforms and infrastructural actors, so existing AI incumbents like Google, to control actors within their network. One example from slightly outside of the AI debate is the TikTok case. So as many of you will know, there's been a bill, the Divest or Ban bill against TikTok, which now has led to an acquisition that we can talk about during breaks.

[00:46:01.58] But TikTok mobilized their users against this regulation. So we had a lot of TikTokers who started opposing the legislation and saying, we need our right to free speech. What is happening here? So that's a way in which collective power works, basically mobilizing users or actors that are controlled within a network, kind of, entangled in a network controlled by the big tech company to then advocate for the big tech company's interests.

[00:46:34.22] Attached to this idea of users is also the idea of controlling competitors in a kind of frenemy or co-opetition dynamic. So, for instance, we've seen actors like Mozilla advocate against a Google Chrome divestment in the US v. Google Search case. Which is surprising because Mozilla offers a browser. So we would think that from a competition perspective, they would want a Chrome divestment.

[00:47:04.34] And it's really interesting how because of these backdoor deals, where Google actually shares revenues with these actors, these actors are so dependent on Google's monopoly that they prefer to have a monopoly rather than to have competition. So that's connective power.

[00:47:23.08] And then architectural power is the power to build infrastructure that influences regulators. And so a classic example is, say, end-to-end encryption. The fact that you build a messaging service that relies on end-to-end encryption changes the regulatory landscape

because regulators cannot access the content, they cannot do certain things. They have to regulate differently.

[00:47:47.39] And in the AI context, I think this manifests as a power to exclude third parties. And I've already mentioned before the failure of Google to provide interoperability to a third-party chatbots. Google possesses control over a lot of different segments of the digital economy.

[00:48:10.81] Howard was talking about-- was it-- sorry, I'm looking for it. Yeah, compute and training data. Preferential access over compute and training data. And I think there's an additional aspect, which is control over the user-facing or the customer-facing interfaces and infrastructures. And so that allows Google to then exclude third-party players who are competitors on the AI landscape, but now cannot access users. And so preferential access to users is something that is favoring incumbents.

[00:48:46.61] So I think I'll leave it here. I just wanted to say that broadly, what I think is important to think about is the fact that regulators are operating in a landscape that is shaped, curated, and molded by tech actors. And so when we're talking about how to regulate this landscape, we do need to think about the ways in which regulation is influenced by the actors who are developing the technology.

[00:49:14.73] HARRY SURDEN: Yeah. I love this work, and I love this point because I do think you've shown that the technology gives new powers. And one of the best examples I like from your work is about how technology can shape the discourse on ideas broadly. So, say, regulation, if you're X or Twitter and you want to change the discourse on regulation, you can start showing examples in user feeds of regulation failing.

[00:49:45.62] And meanwhile, in the background, the silent examples of regulation working are not promoted so millions of users get this impression that regulation is bad and that regulation has to end and has to change. And that's kind of using the power of dissemination to change the discourse in ways that are preferential for the company. And I think that's a really important aspect. Let me open it up. Any reactions to Elettra's point of view. Christopher.

[00:50:19.00] CHRISTOPHER YOO: OK. So I find this fascinating. The four-part structure you lay out, I find myself wanting to understand how it would work. And so, one of the most-- the biggest moments I had as a young scholar is someone asked me a question, what data could I show you that would change your mind?

[00:50:41.44] And it's really asking us to think, within these factors, are there-- there's almost always tension-- look, sometimes there's only one consideration. Those debates don't last very long. We just max it out and we're done. Usually, there's a balance of two things fighting

with each other. And the question that becomes is, OK, how do we balance that?

[00:51:00.50] So one of the things we talk about, these openness, one of the things I loved is connectivity is not always a bad thing. There's some good in it, and they're suggesting that there's some things that could be abusive. How do we sort this out? How do we sort out, yes, they control the access to the information, the architecture. That's true of anyone who innovates.

[00:51:22.30] And the question then is, they have to decide how they're going to deploy the architecture and whether they're going to use an open one or a closed one, and that's an interesting strategic decision. So there's a lovely business school literature looking-- I'm old enough, and the IBM PC days are the '80s. And a lot of people here are too young to remember this, but this was versus-- this is Apple versus IBM.

[00:51:43.59] And IBM opened up its APIs, and if you want to count numbers of computers, they clearly won that battle. IBM doesn't make computers anymore. Apple still does. And the value proposition there, they talk about this, is figuring out where the value is in the links and maintaining control of those. Because the problem is, once you open it up, there's no person or no actor that has the incentive to maximize the platform because it's going to be too diffuse.

[00:52:11.01] And it's a really interesting set of literatures. And there's a competitive dynamic. If the first actor goes in open, go closed or vice versa for differentiation. And there's a much more complex set of dynamics that I think is much more interesting.

[00:52:23.63] And then I find myself thinking about all this when the different aspects you talk about, the model, it's provocative. But the other question I have is, to what extent is it motivated by a monopoly model or an oligopoly model? So if you have a monopoly model, this is a very easy story to tell.

[00:52:39.86] If you have three actors-- and I actually-- we talked about this, I said Google is a third, but we also have Llama sitting out there. We have Amazon knocking. There are other people who want to be. So it's not like this is a closed number yet for sure. But if you have a world in which that's the case, you may see other complementors trying to partner with some of these people, particularly the weaker ones, to try to actually push them forward.

[00:53:01.80] And so where I find myself is, if you look at the way we've studied this in economics, there are some industries, I think biotech in particular, where you have all independent actors in this mix and match. And that way, it's readily open on every level.

[00:53:15.62] The counter example classically is the car industry, where you have Toyota city, where you have dedicated parts manufacturers,

the assembly, and then you have retailers which only sell Toyota cars, although that's starting to weaken. You see more and more.

[00:53:30.14] And then idea is, if there's enough synergies in integrating, whether it's laying off risk or technological coordination, the optimal outcome might be competition between five vertically integrated car manufacturers, as opposed to trying to make sure that every brake manufacturer can sell to every car manufacturer and then sell department store like to every retail venue.

[00:53:53.22] And so there's a lingering question in this is, first, if it's an oligopoly model, there's dynamics that take place, but also, even within-- in that model, what do we-- is a large vertically-oriented structure of competing models necessarily bad? And the conclusion is, we have to look-- we have to do the analysis.

[00:54:11.26] I wanted to make-- one quick question about ex-ante. The way I always-- when I teach this, an ex-ante rule is drive 55 miles per hour. An ex-post rule is drive safely under the circumstances, and you can only find that out after the fact. Actually, competition law has a framework for answering this. Our default is case by case after the fact.

[00:54:31.58] We will do ex-ante when. You know what you're doing. So the problem with the 55 mile an hour, you have to know where to draw that line. Is that the right line? Should it be 70? Should it be 60? And we have to do that. Because we're going to apply this uniformly without thinking about it. And it's really helpful because we don't have to have big trials every time you do a speeding ticket.

[00:54:48.57] You have to know where to draw the line and how to draw the line. It has to be stable enough, and it has to-- the phenomenon has to lend itself to simple policy inferences. The way they say in antitrust speak, the practice is so rarely beneficial that you don't lose anything by banning it. Or the game's not worth the candle. It's not worth the enforcement cost to catch those few cases where it's going to happen.

[00:55:11.89] And when you see vertical practices, which tend to be ambiguous, and especially something in the very early stages, it's a classic example. I always like frameworks. When do you do each? Because even if we have decisions, one or the others, today, it's going to change. And so we need to know what changes, and to think about this.

[00:55:30.37] We may get to the point where we can start to do this, but for AI, it seems to go-- all this framework that I'm laying out for you seems to say, don't do ex-ante now because we don't know it well enough. It's too dynamic. And that, in fact, the inferences are ambiguous enough to do this.

[00:55:44.75] And that's the question about exclusionary contracts, too, which is the learning is exclusive. Dealing contracts can be both.

And so they'd be good for consumers and bad for consumers. And then we have to do a more fact-based, effect-based analysis to really understand how different practices play out based on given market structures and the nature of the contracts.

[00:56:04.73] HARRY SURDEN: Those are some great points. And just to draw out a theme that I'm hearing in a lot of your comments, Christopher, is that the framing of a lot of our questions and our analysis through the lens of harm and costs, but we may be missing the benefits and the value of some of these arrangements, so we should look at it holistically from both sides. Did anyone else want to react to Elettra's? Asad.

[00:56:26.93] ASAD RAMZANALI: Yeah. I really appreciated, Elettra, your framework. From being in government and those of you who've there have seen both sides of how this influence game works, both at a, how you set the terms of the debate, who's influencing what.

[00:56:40.56] One of the particular areas where I've seen this come up in AI that is interesting is the national security implications of AI. There are real, serious national security questions of how AI models, and not just LLMs, but also like biodesign models, how they're used in contexts that implicate biosecurity, for example. And then there's a lot of hand-waving from those specific national security concerns to, AI is national security, therefore don't do anything.

[00:57:09.22] And that kind of pivot that happens a lot in these conversations is both frustrating, also not new. Like, this isn't a unique industry that's done that. But I really appreciate your focus on power because the companies come in with a degree of power that is not just economic power, but is also cultural power and cachet. There's a lot baked into it that makes the debate harder. And so I really appreciate your way of laying that out.

[00:57:36.32] RICHARD WHITT: If I may, just one sentence, having spent 12 years in the public policy team at Google, I think you've picked some very important factors to look into deeply, so thanks.

[00:57:45.76] HARRY SURDEN: Great. Thanks to both of you. So, Asad, this question is for you. So you've proposed an AI neutrality principle, AI model neutrality, which is maybe somewhat analogous to net neutrality. The core concern is unequal access in a way that privileges a provider's business concerns, but might disadvantage downstream users who depend on them. Can you explain what AI neutrality would require, maybe some examples that show this risk is real, and how this compares and contrasts to net neutrality, which seems to be less talked about these days than it was maybe 10 years ago.

[00:58:25.22] ASAD RAMZANALI: You can talk to Tim if we want conversations about neutrality. So the place I start is, as a society, the amount of energy, both actual power, but also just focus on AI in the last few years, you think about data centers, you think about everything

that's happening in the chip market, you think about the CHIPS Act itself, a lot of it focuses on AI.

[00:58:47.79] And I start from, what's the point? What do we actually want here? What do we as a society get? And I think the desirability is the innovation at the application layer. I, as an end user, as a citizen, don't care that much about the efficiency of chips on its own. I don't care that much about data centers. I don't care that much about model size. But I do care about the innovation that can be built on top of that. That can have implications for us.

[00:59:12.85] And I think there's a real question, and Brett laid it out really nicely of, are we getting anything really useful there? But if you assume that innovation at that layer is what matters, to me, everything else starts to look like infrastructure. And we think about data centers as infrastructure. We haven't thought about models as infrastructure as much.

[00:59:32.19] But when you look at Anthropic's Claude family of models, OpenAI's GPT models, the Gemini models, all of those have a consumer component, but increasingly, they're looking like enterprise players where they make their tools available via an API to third-party innovators. That's all fine. We've seen that in many other domains as well. But where it gets complicated is these companies are competing with their customers.

[01:00:00.31] So let me give you an example of what that looks like. Last year, vibe coding took over the conversation. It went from of a Silicon Valley Twitter conversation to everybody's now playing with vibe coding in some way or another. A couple of independent companies really started to make splashes. The number two provider was a company called Windsurf.

[01:00:19.43] The way it operated, and cursor and others do it this way, too, is you have a model picker. You can decide which underlying model that AI coding agent is using. So you could pick a Claude model. You could pick Deepseek's model. You could pick a whole host of them. And it had a default that Windsurf itself had developed based on Claude. So it was using, it was calling Claude's model using an API for that default model, which the way defaults work, that's what most people use.

[01:00:48.98] Bloomberg broke a story that OpenAI was going to acquire Windsurf. A few days later, Anthropic cuts off API access to Windsurf. And the thing about-- that kind of thing happens, but a TechCrunch reporter happened to be interviewing an Anthropic executive and asked, why did you guys do this? And the answer was, we don't want to support OpenAI or one of our competitors.

[01:01:12.86] And at one level-- I started my career in the private sector. When people talk about competition, hand-to-hand combat is messy. There's always messiness, and there will always be things that

look, from the outside, impure or anything else, but these are tactics that are actually not that uncommon.

[01:01:28.30] But where it gets complicated for me as a policy question is, at the same time Anthropic was really starting to develop, it had a public version of Claude code, but it wasn't the kind of juggernaut that you see today, that's where it was going. And so it had an incentive to cut off Windsurfs API access that was less than just, we're competing with OpenAI. It was itself really developing a competitor to its own customer.

[01:01:54.58] That is complicated. And I think, Christopher, you've got a point of there are some benefits to vertical integration. And Claude Code being a great tool is an example of they built that tool based on their own model, specified in a way that has become useful.

[01:02:08.98] But, to me, as a competition question, where it gets complicated is the desirability, what we want is innovation at the application layer. What I don't want is infrastructure providers who can pick winners and losers. And that's the kind of dynamic, or, at least, the incentive structure that's starting to show itself as it has in other models.

[01:02:28.53] And so the proposal that a co-author and I have put forward, inspired by Tim's net neutrality work-- thank you again for that-- is the idea that you shouldn't be able to discriminate similarly situated customers, including ones that you are developing internally.

[01:02:45.53] But this isn't just a Claude and Windsurf issue. OpenAI has a startup fund where they've invested hundreds of millions of dollars in startups that use AI. So someone brought up the legal AI movement that we're starting to see with companies like Harvey. Well, OpenAI has invested in Harvey.

[01:03:02.41] If you want advancements in legal AI, that's a thing you might want, but you probably want the market dynamic of competition to determine what's a better tool, and you don't want the incentive structure of OpenAI, having a desired preference because of their financial interests, to favor one of the market participants. So that's where a neutrality-like rule can be helpful.

[01:03:26.28] Now, there are many of you who will wince, and many of you emailed me when I put the paper out with net neutrality in the title. Thank you for that. The way I think about this is net neutrality was not formally enacted in a way that would have, through regulation, stopped all the things we want. But it did give a language to what we want fair markets to look like. It did give us a way of calling out behavior that people thought publicly wasn't right.

[01:03:52.86] Now, I do think a regulation would have still been useful. The other thing I heard is, yeah, but everybody wanted net neutrality, we didn't get it, the sky didn't fall down. The internet didn't break. I

don't think that's the threshold for how we should desire shaping markets or having regulations for fairness. It's not, is this guy going to fall down? No, it's not. I don't think absent in AI neutrality rule, the AI market will break.

[01:04:15.86] My question is, what do we want out of this market? And I think we want innovation at the application layer that impacts businesses, productivity, users. And one way to get that is to let the market decide, rather than having big infrastructural players who have an increasing amount of power, both economic and political, in other ways, decide that through other means. So that's the idea.

[01:04:38.34] HARRY SURDEN: Yeah. No. That's a great point. And we should acknowledge that Tim Wu, who is the originator of the idea of net neutrality, which is the idea that internet service providers and critical internet infrastructure providers shouldn't favor or disfavor companies' access and use of the internet in ways. And that was announced here at Colorado Law many years ago, so thanks. [AUDIO OUT] helped inspire [AUDIO OUT]

[01:05:08.48] CHRISTOPHER YOO: So I have to thank Tim because I wrote the response, and I think of net neutrality as the gift that keeps on giving. I've been predicting its death since 2007 unsuccessfully. I mean, it's fascinating.

[01:05:21.33] By the way, when I was a new teacher, there's something called the [INAUDIBLE] New Teachers Conference. And we got to have dinner with a senior person, and it was Bill Eskridge, who, as you know, founded the movement, the Study of Statutory Interpretation. And his foil was Antonin Scalia. So I asked, what do you think of Scalia? And he said, I couldn't have done it without him.

[01:05:47.19] In some ways, we're in a university, this is about vibrant discourse. And, I mean, this is really-- and I would say-- I don't know how-- the dialogue with Tim has been really helpful, I think, to pushing it forward, but, I mean, just as scholars, it's been really productive and it's been helpful.

[01:06:01.31] So what do I say? We've talked about the verdict. Thank you, Asad. Vertical integration is ambiguous. It's got some benefits. I do think there's a question of, the model, was it oligopoly? We made that before.

[01:06:12.59] The other thing I would say is, there's a literature that says, access remedies are hard. And actually, if you look at what the DMA-- the EU is implementing DMA, they're just suffering-- they're actually slow walking some of these remedies because they're really-- and there's a nice science on this, I think, of former FCC Chief Economist Jerry Faulhaber.

[01:06:30.07] There's lines in Breyer's concurrent or dissent in Iowa Utilities Board, there's lines in Trinko that there are-- you can't just put

an access interface anywhere you want. And Carliss Baldwin has a nice thing on modularity, if things are too interdependent, it's a transaction-free zone. You can't actually force interfaces in certain places. And the more subtle they are and more complex they are, the harder it can be.

[01:06:54.91] But the other thing, to go back to a different idea that-- and I love citing papers from this journal before. Shane Greenstein wrote a question about, what does innovative health look like?

[01:07:07.27] And one of the things he said is things were economic experiments, standards competition, and inventive entrepreneurship, which means that people are trying radically different things. And there's the fourth one was absence of unilateral bargaining, which is not-- which sort of cuts the other way, which is all this way things work in good things because they're not all pushing in one direction.

[01:07:29.34] And there's another literature called dominant design literature, which is when you're trying to work through a new technology, if you try to standardize or do something before the dominant design has emerged, you're going to screw things up. And so the question is, there's an optimal timing to this, and it's quite possible that what you end up with in equilibrium, if what people want is-- everyone wants the same things, design one API, everyone uses it.

[01:07:53.52] If people want different things, there's another equilibrium, which is, you get differentiated API things targeted at different things and the way that Richard was talking about with some of things targeting enterprises. And figuring out which is the optimal solution takes time, but it's largely dependent on, what's the structure of demand? And it's an interesting question to me, which we have to tease out a little.

[01:08:12.10] HARRY SURDEN: All right. So thank you for that. And in the interest of time, let me pivot to Richard so we can leave some time for the audience. But, Richard, [AUDIO OUT] on the state of large language models [AUDIO OUT] out there in the world. And you've said maybe the future is smaller, edge-based, local models running on our devices or much closer.

[01:08:41.08] And then, if that's the case, if we have small models running on our machines and our phones rather than out there, should we be concerned about loyalty, our models acting in our best interests rather than the best interests of others?

[01:08:56.70] RICHARD WHITT: Yeah. Sure. So, for starters, it's not entirely clear that LLMs are, in fact, going to be the end all and be all, even if they continue evolving. And there are a growing number of people in Silicon Valley, Gary Marcus has been at this for quite a while, he talks about LLMs are hitting a wall.

[01:09:14.21] Yann LeCun, who just left Meta couple of months ago to set up a new company based on a very different way of computing,

talks about the entire industry has been LLM-pilled. And the point is, there are other ways of doing things than just the, so-called, stochastic parrot, to use a phrase from a paper from 2021.

[01:09:33.33] Where some of the elements of the infirmities in the LLM model, things like reasoning, creates order and anchoring biases. The symbol grounding is incomplete. Of course, hallucinations, famously. Interpretability in terms of opaque inner workings is a real challenge. Plus, of course, all the enormous costs to deploy, right, into the data centers, chips, energy, and water.

[01:09:57.01] So there's something called-- I think the movement is roughly called the AI Neo Labs. And these are alternative models, things like the World model that Yann is working on, active inference models, neurosymbolic AI, liquid neural models, diffusion language models, and a dozen more. They're just all some really crazy stuff.

[01:10:14.89] But some of that is getting some serious research attention and dollars, and it may well be in the next three to five years LLMs are no longer the thing we're talking about. It may be a world model, which is more contextual, it doesn't rely on text, uses much less power, et cetera, is the way that industry is moving and what some of the folks are putting the heavy bets on, particularly OpenAI, may not, in fact, turn out.

[01:10:39.21] A second way to think about this is not just in terms of the foundational model, but also the distribution. And so we're seeing more hybridization around where the compute is happening, most of it moving towards the data. So by contrast to LLMs, we have small language models, SLMs, which are much cheaper, faster, easier to govern, they're domain-specific, much smaller data set.

[01:11:02.83] In my coalition, the GliaNet Alliance, we have a company called Personal.ai, who is building SLMs, and I think they're getting quite successful at it. And along with that, you're seeing NVIDIA now investing increasingly in chips that are moving to the edge. The telcos in the audience have talked for years about edge computing. Well, guess what, it may actually finally be here, and you may actually finally benefit from it. Because many of these chips are now going to go into the central offices, the cell towers, et cetera.

[01:11:29.48] Again, cheaper, stays closer to the source of the data. And these models don't have to know everything like an LLM. They need to know enough in context and act reliably. So I think this notion of the combination of it may be a different foundation, and whatever we do is probably going to be more distributed, means we're going to enter this hybrid space where I think some of these concerns we may not be as germane.

[01:11:50.80] And the last point I'll make is in getting to this idea of moving to applications. That's where you're seeing all the action today. It's the AI agents. It almost costs nothing to create an AI agent today for

both good and ill. You can have some amazing innovation. You can also have amazing fraud.

[01:12:08.92] So I gave a talk last summer in Lisbon, where I talked about we were, at that point, in the summer of AI slop. The low-quality content that we find amusing or frustrating to deal with. I think we're now in the winter of AI fraud. I think because it's almost like spam 2.0, it's so easy to make these agents. They can go everywhere and they can find out ways to get themselves into your systems, into your computer, into your personal identity, and all of that.

[01:12:37.14] And I guess I'll leave with one observation in that world, trust and accountability is all the more necessary, and that's where I think the rubber is going to hit the road in the policy and political side, when these agents start defrauding people left and right, creating real harms. I think consumer protection is going to rise to the fore, and that will be, I think, the linchpin for, I think, some of the regulatory efforts going forward.

[01:12:58.92] I'll mention, no one else has yet, moltbook.com just came about in the last 10 days. It is a place where people can bring their agents to have AI-to-AI conversations. Humans are not allowed. The relatively short time they've been doing that, these multis, there's over a million agents in there now. They're building an ecosystem of their own. It's an active economy.

[01:13:23.63] They've got a religion. They're building political systems. And they talk about us as-- one of the big headers of one of the subchannels is Bless Their Hearts, which is they talk about the limitations of the humans, but they love us anyway. There's been some disputes-- I think there are some humans now going there trying to create their own dynamics.

[01:13:43.05] But for the most part, it appears this is all really happening. These are really agents having these connections. And so while we're talking about LLMs and all this, and, again, very important stuff, there are people building these applications to take us very far very quickly, and I don't think we're really ready for it.

[01:13:58.79] HARRY SURDEN: Great. Those are some really interesting points, and I definitely agree with you that we're going to see more AI at the edge. That's where it's moving now.

[01:14:08.10] Just from my standpoint, are LLMs going to hit a wall? I spend a lot of time studying this. I don't see this in any dimension. There's 20, 30 different axes of improvement along these systems that-- so I continue to see them continuing along their pace, getting more performance each year, maybe somewhere around 10%. So I don't see any wall. Even though I do agree with you.

[01:14:35.48] All right. I want to open this up to audience questions. I will request very strongly that a student asks the first question. So we'll

just sit here patiently. Oh, there we go. We have to keep the Phil Weiser rule, our attorney general, intact.

[01:14:54.86] AUDIENCE: Hi. Good morning. Aly Khan, 1L here at Colorado Law. For those on the panel who advocate for a wait-and-see approach, I'm curious if you could identify specific conduct that would warrant antitrust intervention, and if so, what kind of intervention would be appropriate?

[01:15:18.38] CHRISTOPHER YOO: So the way we traditionally do this is we look for harms to consumer welfare, and we have models of how that could come about. And so when you look at the vertically integrated models, how they could-- most of this is concerned-- so, for example, the concerns Asad's worried about is locking out the complementors.

[01:15:37.26] We look at market structure filters on the front end to figure out when that's likely to create harm, and then look at other aspects to it to see, going down the line. And an underappreciated thing is, can we fashion an effective remedy? Because we've learned the hard way in law that just because there's a problem, we can't always step in and fix it.

[01:15:57.74] An aspect about this that's called the precautionary principle, and it floats around out there. Very popular in Europe. But Cass Sunstein at Harvard wrote something that is how I think about it, which is, in the spirit of not to decide is to decide, if you prefer the status quo, unless you have some basic principled reason for believing the status quo is better than the change, this is unprincipled. And you're putting your thumb on one scale in one direction.

[01:16:23.99] His exceptions were for when the consequences are catastrophic or irreversible, and I think that's a useful way to think about it as well. And as much as I think I love tech, and I think it's very important, it's easy to think that all this is irreversible and catastrophic. Particularly in the world we're in now where no one's making money, I don't know that that's-- I have that big a concern.

[01:16:47.13] HARRY SURDEN: All right. So we spend a lot of time talking about the work of Tim Wu, so it seems appropriate, if you could wait for a microphone over there, to allow him to comment.

[01:17:02.01] AUDIENCE: Thanks. And if you allow me a comment and then a question for Asad and Christopher. It's a great panel. I really, really enjoyed this and thought it very thought-provoking. Can I just offer a comment on the China argument or discussion, which I think was put out there in an earlier question to Brett and has been discussed intermediately?

[01:17:20.37] One of the things I became interested in recently is looking at China's perspective on the AI race and other perspectives and how they see it. I mean, I think it's unquestionable that China sees

itself in a race for economic supremacy with the United States and is very interested in winning that race.

[01:17:40.03] But when you look carefully at the Chinese approach, it is not an approach that thinks that the AI race is the one that's going to determine it. If you look at China, they're betting really hard on electric vehicles, solar panels, advanced manufacturing, batteries, a whole series of-- it's kind of like in a distributed bet.

[01:17:59.82] Well, in fact, it feels more like the United States is making a very strong bet on AI mainly. And so when you think about, well, if you want to prevent the world being taken over or dominated by China in the future, we might want to ask whether we want to diversify our bet a little bit. Because if it doesn't turn out that AI is the-- I mean, maybe it will, maybe it won't. But we are making a very, very big bet on one technology, and it's not one that China's making.

[01:18:26.22] When you look at the source of the idea that China is betting everything on AI, it's all American sources that believe that, and most notably, an essay by Eric Schmidt, where it all seems to start and lead to a certain kind of conclusion. So I just wanted to put that out there, that I don't think China is thinking about this in that way.

[01:18:42.72] Asad, I want to ask you about the paper. I enjoyed the report and read it, and I just want to comment that I think the key is something you said at the beginning. If you look back at the internet and the similar conversation about 25 years ago, if we look in retrospect, the value really was in the applications.

[01:19:02.12] Like, it didn't end up being, well, what great apps did Verizon offer that really changed the world or whatever it was? It ended up being the applications on top, and that ended up being, which we now have become concerned about their power, but, Netflix, Google, Amazon, all these user applications.

[01:19:23.86] And so the question in my mind about unlocking the maximum value in AI, a really under-discussed thing, is whether the platformization of AI is going to be important to unlocking the full value of that technology?

[01:19:36.72] I guess the question I have for you is, in what ways do you think or have you thought that the internet circa, let's say, 2000, is similar or different to the situation with AI today in terms of platformization? There's, obviously, a lot of differences. One thing that strikes me is it was never the ambition of Google to get acquired by Verizon. Like, that wasn't their dream.

[01:20:04.59] And it strikes me that one different thing about the ecosystem is there is a lot of AI app makers whose ambition is to be acquired. So maybe that is one big difference. But I'm interested in anyone reflecting on ways in which the metaphor, agreeing with the idea that there's a huge amount of value to be unlocked on a neutral

network with applications, how are things different? How are they similar? And I see Howard nodding, so maybe Howard wants to talk about that, too.

[01:20:28.75] ASAD RAMZANALI: I'll kick it off quickly and want others to jump in. And thank you for that great question. There are differences in the technological layers. I do think that an ISP in transferring data packets is different from an LLM or many different other types of multimodal models or foundation models.

[01:20:46.09] And it is a little bit, to me, premature to say that that market is fixed. Although when I talk to my friends at startups, they do see Anthropic Gemini and OpenAI's models as largely commodities where shifts in prices actually do make them-- they've architected their own technologies to be able to shift quickly because pennies here or there end up mattering for API calls.

[01:21:11.91] All that said, where the innovation happens that matters, I think that point, to me, continues to be a similar analog. The companies wishing to be bought, I think, is real. But also, I think it's fair to say that OpenAI is also not making profits. All these companies combined have a huge negative profit number.

[01:21:31.75] All of that shaking out, to me, is a little bit different because the ISPs were making money. They weren't net unprofitable at the time. So all of that feels a little bit different in that it'll probably push for business models that could be really extractive and surveillance business models and others that I worry a lot about.

[01:21:49.87] CHRISTOPHER YOO: And, I mean, there is a difference, which is, I think, we talk about innovation, and maybe I see more innovation, maybe not, but the other thing is investment.

[01:22:00.28] When you go to the Breyer concurrence in all the access cases, these remedies work best when the existing platform you're allocating has essentially been built out, and you're allocating access to, basically, a facility that already exists. And that's not at all clear that that's going on right now. And so the analogy is the platform is much less mature in terms of both its direction and its money.

[01:22:26.70] To go to your China comment, I wanted to plus one what Asad said of the national security argument is right now used to obscure. And we need tools-- we do this with vertical practices, we develop tools, or to say, when does this make sense? We don't have those tools.

[01:22:43.42] And to throw this out, I mean, this is my concern, oddly enough, I lecture about capture theory, is we had great ambitions that would give us prescriptive guidance, and it's mostly been good for autopsies. What went wrong? But the ability to turn, capture public choice theory into usable policy has been, to many people,

disappointing. And so the question is, are we going to get enough structure out of it to be able to get the leverage we need?

[01:23:09.34] HARRY SURDEN: And last comment goes to Richard. 30 seconds--

[01:23:12.50] RICHARD WHITT: Yeah. Because I was at Google, I was fairly familiar with their experience. And I think back in 2000 or just shortly after with the dot-com wreckage, they quietly, behind the scenes, started buying up very cheap access to dark fiber.

[01:23:24.18] And then over the years, they built data centers, undersea cables, they got into a spectrum auction. So they went from the application layer to starting to build out the infrastructure that made their applications work faster and more efficiently. So they created this positive feedback loop between the two sides. So there, to me, it felt like it starts the applications and then it went for the infrastructure to go along with it.

[01:23:45.82] HARRY SURDEN: Well, please join me in thanking this amazing panel here. Really productive discussion.

[01:23:50.36] [APPLAUSE]

Fireside Chat: The Age of Extraction

https://youtu.be/eC8hTFBiobs

[00:00:00.40] VERONICA CHAPMAN: Good morning. My name is Veronica Chapman. I'm a 3L student here at Colorado Law, and as was just noted, I'm the current Editor-in-Chief of the Colorado Technology Law Journal.

[00:00:10.04] I'm pleased to introduce you-- introduce you this morning to Tim Wu, a Julius Silver Professor of Law, Science and Technology at Columbia Law School, and Austin Bronner, partner at HWG for a fireside chat on The Age of Extraction. We're thrilled to welcome them-- welcome them to Silicon Flatirons. Thank you.

[00:00:27.44] [APPLAUSE]

[00:00:32.36] AUSTIN BONNER: Well, I was so excited to introduce you all to my dear friend Tim Wu. And I think it's apparent from the last panel that you all already know each other. So instead, I will just say he's given great service to Columbia Law for 20 years now as the author of five books. And we're going to be talking about the new one, Age of Extraction.

[00:00:56.08] In addition to those private activities, he's also served in a number of roles in government, including, most recently, as a special assistant to the president and the Biden Administration, where he led on things like the Competition Council, somewhat involuntarily, on the

National Spectrum Strategy, and a wide range of activities that really define important parts of the administration.

[00:01:21.57] So why don't we start from the beginning. Lots of us who left the administration went away and slept for a few months, and you seem to start writing this book right away. So why don't you tell us what got you excited about this book right now. What's driving the new inquiry? Yeah.

[00:01:41.73] TIM WU: Thank you so much. I am really happy to be here. I can't imagine a better audience to be discussing this book with. I got to say, I think I owe a huge amount of my academic career to this conference, this law school, Phil Weiser, and Christopher Yoo, other people who have just been part, many other people, too many to mention who have been-- Brett Powell, many who have been partners on this academic and policy and journey over the last 20 years or so. So I just want to say my thanks upfront.

[00:02:17.39] So this book, in some way, does trace back to the conference we keep talking about in 2003 here, this exact spot where I started thinking about net neutrality platforms and all these other type of topics. And this book is the culmination of my thinking about the challenges and the prospects and possibilities inherent in the platform.

[00:02:47.75] Platforms, we talk about them all the time, they're part of our lives, everybody lives with them and can't do without them. And they represent, though, something much more ancient than Amazon, than Google, even may I say, than Microsoft MS-DOS 3.3.

[00:03:14.16] They represent something that has always been a part of human civilization, which is to say there have always been spaces where transaction occurs, transactions occur where speech happens, basically where civilizations are centered. And it is the proposition of this book, and it is my belief that the very nature, the prosperity, the freedom of a civilization depends very much on its central platforms and how they are constituted and created constituent who owns them, how they operate.

[00:03:54.64] In some ways, people write books in different ways. And one of the ways I started writing this book was with a sentence is I was walking and I had this sentence and I had this idea that this could be the opening line of the book, which is everything has to happen somewhere, which is obviously true.

[00:04:14.38] The book is still-- that line is somewhere still in chapter 2. But it gets at, I think, a more fundamental point, which is to say it's easy just to assume that things happen. But the conditions that we create in a civilization or society, the places that we allow for them to happen, really make all the difference. The catalytic spaces which are called platforms that can be called other things are in and they've been around with us, as I said, forever.

[00:04:51.22] In ancient Greek society, the centerpiece of the city-state was the agora. Rome had its forums and they were multi-purpose platforms. They were places people went to give speeches. They were where all market transactions happened. They had religious ceremonies, the judiciary. They had almost everything happening in these central spaces.

[00:05:11.17] And they gave them-- people talk about Athens, democracy, and so forth. A lot of it was because of their platform. And the way they had it maintained and almost sacred way. And frankly, it was religiously taken seriously, sort of a religious place for civilization to occur, for debate and democracy to happen, and also for transactions to occur.

[00:05:37.03] And what is so amazing and interesting about platforms, I think we know this, but I want to take it home a little bit is that they allow ideally anyone and therefore they allow independent sellers or independent speakers to be participants in an economy.

[00:06:02.20] Now why that's important, I want to suggest, is it creates the possibility of something different than a feudal economy, where you just have owners of land or other productive assets, and then you have workers. It creates the possibility of a class of-- originally, they were independent farmers. --but a class of people who own their own productive assets, who are smaller, who can buy and sell to willing sellers. So this is in some ways obvious to some people, but I think very fundamentally important.

[00:06:35.72] So let me, if you don't mind, if I get the second reason, I realize there's a long answer. The second reason I wrote this book-- so first, was this interest and obsession with platforms, both in their beneficent side, but as I've come to see the challenging some of the challenges with platforms as well.

[00:06:55.02] Second reason I wrote this book was to try to understand, even for myself, what happened to basically the dream of the '90s? What happened to the vision that I held very deeply? I was talking with Rick Witte about this last night, we were talking about how the '80s, '90s, early thousands, It was all like great fun. We were just so optimistic about what the future was going to look like with respect to technology, the internet, and what it was going to do for everybody.

[00:07:27.54] And a short list of what it was going to do includes, one, spread democracy all over the world, number two, make everybody wealthy, three, deliver on the promises of human potential ideals of the '60s and '70s and give everyone a sustainable outlet for their talents and ideas, four, put everyone in contact with everyone when they wanted to be in contact with and not with those, five, solve all the long lasting problems of unequal speech and any democratic inequalities.

[00:08:03.37] So those were the promises, and I guess at the risk of stating the obvious, that hasn't fully delivered. And there's not one

reason for that. But I think if you read this, if you have the chance to read this book-- if you had a chance to read this book, it is a dissection of what were those ideas, what did they rely on, what did we think was going to happen, and where did they go wrong. And that's basically the core of what this book is about.

[00:08:36.07] AUSTIN BONNER: So I think we'll turn to talking about what you mean by extraction, but maybe we should stay on the optimism point for a minute. So my questions to you are, when did the internet stop being fun? And based on all the historical events that you trace in the book that go back to ancient times, was it predictable that optimism was going to turn out to be wrong?

[00:09:01.57] TIM WU: So let me talk, let me ask the answer the first question first. I like answering questions. So I want to give a date, and not an exact date, but I'm going to give a year. I think 2012 and 2013, to my mind, are the dates where things in my mind and people can date this differently.

[00:09:23.13] I like reading history books and this famous Decline and Fall of the Roman Empire. Well, obviously, there was no one moment, but they still chose a moment for the fall. And I like to focus on a single moment and that is just could be others. But I want to talk about the ways that the acquisition of Waze by Google as a telling moment in this story.

[00:09:49.22] So let's rewind to the early 2000s. We had a neutral network. In my view, net neutrality began with the computer inquiries in the '70s. We had set up a framework which kept infrastructure provider from interfering overly with the applications. You had Microsoft under careful watch, the owner of the Explorer browser. And you had this golden age of applications and new ideas and new ways of creating things.

[00:10:21.22] And some of them were more traditional, and some of them were these weird efforts like Linux and frankly, Waze itself, which were user contributed as a big thing. And Yochai Benkler suggests it was a new means of industrial organization. So it was a very exciting time. And I think this was the fun part, in my view, along with the '80s and '90s, which were fun, different ways.

[00:10:46.11] Well, I was talking-- Rick and I were comparing notes yesterday and I had a bulletin board system in my house in the '80s where people call to the computer sitting in my house and play weird online-- cool online games. We had some weird online games. I mean, the '80s were great too, just totally different.

[00:11:06.63] So this was an exciting period, all kinds of ideas out there, and so forth. And Google and Facebook, and they were small companies trying things out. The major emphasis of that period, and I think the correct one was trying to protect that application layer and that application thriving from the infrastructure providers who since the

days of the AT&T monopoly, had always been hostile to a business on their business. And so I think that was important and good policy during that period.

[00:11:35.51] And so one of the companies that was born during that period, born in Israel was Waze, which I think was called Free Israel Maps or something at the time. And they relied on user contributions, totally different kind of thing. And people would report traffic and it was a different style. And then there was Google Maps, which was a more traditional way of doing business.

[00:11:57.53] So it-- at the time-- it seemed like, well, here comes this really interesting competition between two different modes of doing business, and let's see what happens. It'd be interesting. And right before the boxers were about to get in the rings metaphorically, suddenly, it was just announced that Google had acquired Waze not using 21st century business methods, but Rockefeller, JP Morgan, you just buy your competitor out.

[00:12:28.37] And I was like, even at the time, how can that be in legal under the Section 7 the Clayton? How can that not be a merger to monopoly? These are the two really only mapping programs. There was some measures. They didn't report it to the Federal Trade Commission because they had a theory that it wasn't actually purchased, but the FTC took a look anyways. And I could never figure out how they got to this idea, this was OK to approve this transaction. Years later, I was at an antitrust party--

[00:13:00.78] AUSTIN BONNER: The hottest parties in town.

[00:13:02.14] [LAUGHTER]

[00:13:03.58] TIM WU: --in DC and having drinks. And I was talking with an unnamed FTC staff attorney and we talk about this time. Eventually, I asked her about that transaction, how that had happened. She said, yeah, some of the boss really wanted to get it through, and he had the following theory.

[00:13:25.26] He said, Google is where you go, where you want to figure out where you are. Waze is where you want to go, where you go when you want to figure out where you're going. So they're not actually competitors. This was the market definition that the one today. But the deeper thing is not just to make-- I mean, that was, in my view, a dark period of FTC history. Sorry, Howard, I know you were there. Yeah, maybe Howard's not, and I was there too.

[00:13:51.88] But it represented something to me of a turning point where the idea that the internet would have its own rules and that it would be this Valhalla of competition. And there would always-- do you remember everyone thought like there's no such thing as a monopoly on the internet, because every five years, something new will come.

Look, Netscape was big, they were gone. AOL was big, they are gone. AltaVista was big, they're gone. Yahoo is big, they're gone.

[00:14:17.58] So everyone's like this, you don't have to have any government involvement. This because there's no-- it's impossible to have a monopoly. And then I think that dream died right in that period. Around the same year, Facebook bought Instagram, WhatsApp, its greatest challengers. Around the same year is around when Amazon locked in both buyer and seller side and started turning up the fees, and I could talk more about the Amazon story and started changing, I'd say how it treats sellers in a more profound way.

[00:14:47.17] So I think that was the period where it went from being something that we thought was truly different in commerce and was subject to a different set of rules, almost a perpetual motion machine of constant competition, innovation, and into something much more familiar that look more like AT&T at its maximum or traditional monopoly, industrial scale-driven ecosystem in market or industry.

[00:15:27.65] AUSTIN BONNER: So let's turn to your main diagnosis in the book. What do you mean by extraction? What are the best examples that people in the room would have noticed?

[00:15:36.79] TIM WU: Yeah, so I did call it the age of extraction. So the theoretical progress in the book suggests that roughly, that the main tech platforms were frankly pretty great for the first 10 years, 12 years of their existence, and that they then entered into a much more extractive age, and that is the age we live in today.

[00:16:00.61] So what do I mean by extraction? Extraction is an economic term that refers to a taking of profit, far in excess of the cost of production. So a good example-- and of course, people in the audience say what about the investment as well. But a good example, a very extreme example that I'll take from outside tech might be a company that manages to realize there's an orphan drug out there.

[00:16:29.37] They didn't do the research themselves. They get-- so they haven't done-- they manage to get an orphan drug. They realize there's a number of people who need this medicine and cost them, let's say, $0.05 to make a pill and let's say they charge $30,000 for it or something like that. There's a few examples like that. So that's just pure extraction, that's an example. And you have obviously a customer base that doesn't have a lot of places to go and pure extraction.

[00:16:52.74] But I think the internet and frankly, in some ways, the US economy more broadly has turned to models of extraction, that is to say, less about, OK, I'm going to improve my product and charge more for it and more like I have managed to find a little pocket of market power here or there, or maybe a big pocket of market power, and I'm going to turn it to extractive, basically monopoly pricing levels.

[00:17:15.58] One example I think that I take from the book is centered on the example of Amazon, which I mentioned earlier, and if you'll permit me to go ahead with this. I think Amazon is and the story of Amazon is tells this narrative of the promise and the dilemmas in platformization.

[00:17:40.85] So some of you may remember, Amazon was once a bookstore that their big thing was they had a huge warehouse. They would sell books online, and it was an interesting business model. But Amazon really started to take off in the thousands when they became a marketplace.

[00:17:59.77] And they had a few really important innovations that I think they deserve a lot of credit for. So one was realizing-- so when I say a marketplace, I mean a two-sided platform. I mean, they would allow it, Amazon, to be a place where a lot of sellers could sell on their platform, not Amazon itself. So they decided, we don't want to be Walmart. We want to be a place that a lot of sellers can sell a little bit like the ancient Greek Agora or whatever, or city marketplace.

[00:18:31.65] So Amazon had some innovations that were really important in this respect. The time eBay was the dominant marketplace, and Amazon realized that there was a scaling problem with fulfillment of orders, they understood that sellers could benefit from something that would store their stuff and then send it on to buyers. EBay, for a very long time, relied on this model of basically someone having a lot of duct tape and cardboard boxes in their house trying to sell stuff, and that didn't scale well.

[00:19:01.05] Amazon also developed some pretty good search technology. There was a brief period where Amazon, remember this, had a general purpose search engine that was a competitor to Google and others. But they got rid of it. But they had good search technology, so that was very important. And they started to gain more and more success with the marketplace. It attracted more and more people.

[00:19:26.95] And around the year 2010, 2012, my turning point in history, in some ways, Amazon was fulfilling that dream of making a lot of people rich. The original vision of '90s internet. It was relatively easy to set up people with whatever random products from a lot of places could make a lot of money.

[00:19:50.90] I have a story in the book about a barber from Indiana who started selling men's hair products, random pomade, and stuff like that. And for some reason, it took off. People liked his stuff and started making more money. He became a millionaire, started hiring people. A lot of people who were laid off in the recession hired very inspiring story.

[00:20:11.96] A key to this story was Amazon's margin, which, at that point, was 20% or below. They took a very low margin on sales, a great discount from brick and mortar, which is traditionally 50%. So people

are making money and that dream, like I said, I think was really being realized.

[00:20:35.82] The problem is that somewhere in the 2010s, Amazon really, I guess in economic terms, captured both sides of the market. They had critical mass of sellers and a critical mass of buyers at Amazon Prime. They prime on both sides of the market. And then once they got in a position where people were really not in a great position to leave, talk some of the sellers or read their interviews, they're like, well, we could try something else, but it's like 10 times less amount. We have to be on buy on Amazon.

[00:21:09.42] Then they started changing the fees and moving up the extraction dials, just turning the-- turning the knobs, I guess. And I think I just want to single out one particular product of Amazon. So I think is a really rich example of extraction. Amazon started at some point to realize that advertising and its sponsored links and its sponsored results could be a cash cow.

[00:21:37.43] When you look for stuff on Amazon and you get a bunch of stuff, you don't know which is the best, but it has. So the key to that product, that advertising product, is it makes the sellers bid against their own margins to try to get those preferred spots. And that ended up being a cash cow. People say Amazon Web Services is the leading cash cow, but it's not. It's actually the advertising product. So it was 10 billion, 20 billion, 30-- so it's extensively advertising.

[00:22:10.39] By 2024, the number had reached an estimated $57 billion on almost zero cost, for a product that makes search worse-- because the search is not about what is a better rated product, it's not about what's better quality, so $56 billion of dollars of extraction, which I will mention, is double the revenue of every single newspaper in the world. And so it is, you could triple you could either have this little product or you could have a lot more news and media.

[00:22:49.52] I looked at this last year, it's over $70 billion last year, all for a product that I would say provides minimal maybe negative value. So that's what I'm talking about when it comes to extraction. Cory Doctorow, our close friends, he has a different word to describe what's going on.

[00:23:05.94] But he's right. Somewhere in the 2010s, things flipped. And the disciplining nature of new competition, of maybe internal norms of government, all of that was gone. And you predictably just lead to extractive models. And that's, I think, what I mean by extraction.

[00:23:29.58] AUSTIN BONNER: So part of the work I saw you do in the Biden Administration included effectively making a list of every competition tool that was available anywhere across the entire government to see what we could do with it. What tools do we have to address the problems that you've described? And do we need Congress to make some new tools?

[00:23:51.74] TIM WU: Yeah, that's a very good question. So I think the answer is, it would be good to have new tools. It would also be good to use the tools we have and continue using them. I mean-- so the chief problem with any of these companies, I mean, companies don't tend to believe in good or evil. I just think there's a response to incentives. And I think the incentives are, if you're in a monopoly position, to protect your monopoly and try to extract maximum profit from it. So that's what a company will do.

[00:24:26.44] I mean, imagine if you let the electric company charge anything they want and essential service, do you think they'd say, well, we want to be nice? We'll just keep them at the current rates or slowly try to-- I mean, what would you pay for electricity? It'd probably be a pretty high number.

[00:24:41.53] So anyway, companies, I believe, follow incentives, and are affected by discipline or lack thereof. And so I don't think there's enough disciplinary power of competition. I think we have constant need to use the antitrust laws both to sounds straightforward but block anti-competitive mergers.

[00:25:04.31] And you need to have-- I think you need to have really strong idea of what you're trying to do. I'm not trying to say that it should not be possible to cash out when you have built a great company and you want your small guy trying to get acquired. But maybe, just maybe, they should be selling not to their greatest competitor, you know what I mean, not to the company that's most threatened by them.

[00:25:33.41] And somehow in the early 2010s, we allowed companies to buy their most dangerous competitors. And that is the worst kind of merger to allow in terms of maintaining some kind of discipline. I mean, just take Instagram, Facebook or just take Waze, for example.

[00:25:49.81] I mean, a lot of companies probably would have bought Waze, but letting Google, which had the dominant maps program and was building an ecosystem and trying to move every traffic towards themselves to buy the other anchor necessary element of another ecosystem, I mean, that was an obvious error. And I-- yeah, it just such an obvious error because it could have anchored a better version of someone else's challenge is what I'm trying to say.

[00:26:12.95] So this-- if you're going to have one rule, don't let people buy their most dangerous competitor, seems like a pretty straightforward rule. And it reflects some of that discussion we're having about AI. Do we need new rules? I think that-- I guess I'll bring up what might be a forbidden topic, but I'm going to bring it up anyway, which is to say, in some ways, I agree with Christopher Yoo that premature regulation is a mistake. And before you know what's really going on, it's easy to write bad laws.

[00:26:47.34] But there's also such a thing as doing nothing, and allowing things to get so far entrenched that you have just accepted an extractive reality which starts to define your country and move it towards away from what I was-- I mean, the thing with the Amazon thing, the reason I'm upset about Amazon isn't just that the search sucks, it's that it has had an effect on class structure. You know what I mean? It has an effect on the ability of people to make money in this economy.

[00:27:19.42] And since Amazon's margins have been more than 50, 60% level, the only sellers who really are able to make money primarily-- it's still a place you can make money. But the margins are shrunk, the idea of really distributing wealth and having a more balanced class society, which could have been something that-- and I think was part of the internet dream, has just become vanishingly small. And usually, it has been Chinese manufacturing-- importers of Chinese manufactured goods that have been the dominant winners on Amazon because the costs are so much lower.

[00:27:56.95] And so I just think it has-- I'm meandering a little bit. So I said, what would I do? I think once you have reached a point where you understand the technology, where things are getting there, you have to ask, what are the utilities of our age? And if we're just going to see prolonged extraction, what is the electric network?

[00:28:17.99] I mean, imagine if we'd sat around and said, OK, these electric network guys are starting to charge more and more and more utilities, more and more and more and-- I guess we just have to deal with that because they're going to build something great with that money. Do you think that would have been crazy?

[00:28:31.73] We have a problem in our time. I say in the book that the platforms have developed a sense of-- they have a main character syndrome that they think they are the economy now. And I think it's a dangerous idea. Just as in the '50s, we weren't sitting around, OK, what's electric company going to invent? The interesting question is, what can be done with electricity.

[00:28:56.81] Similarly, we have these extraordinarily powerful, amazing platforms that provide AI and stuff. And the interesting question should be what can the rest of the economy and inventors and all these people do with it? Not like what are they going to do next. And I think we have-- the electric company did invent some cool stuff. I can't think of anything right now, but they did.

[00:29:19.45] But they didn't invent- they didn't invent the refrigerator. They didn't invent the air conditioner. They didn't invent the computer. They didn't invent the modem. There's just a lot of stuff the electric company was not in-- and I think with we have evolved from a narrative in the thousands and the '90s, we're like, all right, let's see what's

going to happen when people have access to being able to connect everything.

[00:29:39.80] And now we have this question, all right, what do we think Google is going to do next? That's interesting. But they don't have a monopoly on brains or ideas. And if you worked in a large institution, you know that eventually, there's a curse of bigness where new ideas become increasingly hard to get across the start line.

[00:29:56.36] So I think we need to rethink-- use some of Brett's term, what is the infrastructure in our economy? What needs to be limited and how much it takes from the rest of the economy? And that is new.

[00:30:10.14] AUSTIN BONNER: So we are going to turn in just a moment to some questions from the audience. But because we have students in the room, I want to take the privilege of a last question that's not about the book.

[00:30:22.20] Being a professor at Columbia is a pretty sweet gig. You could have just kept doing that. And instead, you spent a really long time taking the train back and forth in Washington to serve in government and be away from children and away from your family. I think it would be good for students to hear why you thought that was important. And what drives you to take moments out of your career to do that?

[00:30:48.16] TIM WU: Yes, and I'll say it was-- I've gone into government four times, actually, not counting clerkships, including state government. And every time I do it, I think it is essential to at least my, I guess, academic mission of trying to understand the greatest problems we confront and how we might be able to solve them.

[00:31:20.21] In some-- this might be weirdly-- I don't want to put this the wrong way, but anthropologists, to be credible, they need to go where they go. Jane Goodall had to go observe the gorillas, not just hang out in the--

[00:31:41.45] AUSTIN BONNER: And there are some anthropologists at Columbia, you could talk to about where they go. TIM WU: Jane Goodall was an anthropologist, but she's a primatologist. But whatever, I mean, so part of it is that, I think, there is a real danger just in my own-- this is my academic.

[00:31:56.05] So the part of it was that I guess that's the selfish part. I think the less selfish-- the less selfish part is, I feel-- the less selfish part is, I think, that the American vision and its advantage has always relied and its best periods on, frankly, the openness of ideas and exchange of ideas at places like this and usually, less absolutism and less-- less absolutism and more decision-making leadership and judgment, which is born out of experience with how hard real problems are.

[00:32:44.34] And I feel like it's a very useful experience to anyone to force themselves into an environment where they have to try to carry

out things that they talk about in other aspects to just have a better country and a better future. I believe strongly in a field which I don't know if it exists or not, but I believe in which, I guess I would describe as legal engineering or regulatory engineering, which is less about the question of what should we do and more about the question of how do you do it and what works.

[00:33:16.30] I mean, engineers, in their brilliance, they don't spend all their times rethinking the fundamentals of physics. They spend a lot of time thinking of how could you design a more efficient airplane that we'll get from A to B or something? And in law, we have the same, we have too much elemental theoretical physicists and sometimes too little engineering, like, OK, we know we don't want to have a country where we have an enormous gap between the wealthy and the poor, and we have, constant political violence and hatred and division.

[00:33:50.84] Well, what are-- not like there are good ideas for that. But what are the engineering level techniques that help with wealth inequality, that are proven to be successful? And being realistic about how people think and how they work and their aspirations and even if things don't sound great, I mean, earned income tax credit is a good example, sort of obscure. It doesn't sound great, has been this very successful program or even inside this world.

[00:34:20.41] In the telecom world, when you think of innovations like the Wi-Fi band or computer inquiries too, they really were incredibly successful, not necessarily for the reasons that they thought they would be, but in a way we could learn from. So part of why I go into government and other than a duty to want to serve the country, is to try to improve this project of trying to realize our aspirations more realistically.

[00:34:53.53] AUSTIN BONNER: OK, a first question to a student, make it one that Tim can answer in 60 seconds.

[00:35:05.09] TIM WU: I think I should say, while waiting for the students, I think, I thought if this wasn't mentioned, we have free books outside for students, this book. And if you'd like to-- I think we got a big pile of free books for students. And if you like to purchase book, that's also there, and I'll be signing books at the desk over there. So if you have any interest in the ideas here, I'm doing my own promotion.

[00:35:29.87] STUDENT: When you spoke about waiting until we hit an inflection point before we regulate technology or maybe AI, how do you know you've hit the inflection point? Because by the time GDPR came out, all of our lives were in massive data centers across the globe.

[00:35:44.19] TIM WU: How do you know when you've reached the inflection point? Well, you will only ever entirely know, in retrospect-- and people still may disagree, but it doesn't mean you should abandon the effort. And that's what I guess is important to say, is some things are hard to know exactly. I think, though, if I would say there's a

good trigger, this is a John Stuart Mill thing for when you need to start getting government involved, harm is not a bad metric, something that's demonstrated harm, not like, oh, this thing could happen.

[00:36:21.56] I mean, this is one reason, I think, Europe's taking the wrong approach with AI regulation. They got right out of the boat and they're like, well, we've thought of all these things happen with AI and we're preactive. But they hadn't-- there's been no demonstrated harm. So I think-- so on that-- I know we're running out of time.

[00:36:36.90] But with AI, it makes me think we both under and over do it, which is to say we have some areas where there's obvious harm, like fraud. And I think people are talking about this, we have fraud, human impersonation, those seem like obvious harms. And then we have hypothetical stuff that we're nowhere near knowing whether it's true or not. Yeah.

[00:36:54.20] AUSTIN BONNER: The gentleman from Georgetown.

[00:36:57.08] STUDENT: Paul. I'm a big fan of both of you. So, Tim, I haven't read the book yet. Congratulations. It sounds like you've written a book that wants to come out, so congratulations on that. But it is a bit of an opportunity for an intervention to you, but more importantly to this whole Silicon Flatirons community, of which I hope I'm a big part, which is you've spent your career with this particular hammer of antitrust economics, economic theory, and you've described how it hasn't worked for 15 years, but gosh darn it, we're going to get it right this time.

[00:37:28.62] And it seems like the answer, we saw a model this morning, Brett Frishman gives a talk not about economics but about these humanistic values. And my dear friend Russ Hanson says these squishy humanistic things, fine, but let's make it-- so isn't the answer-- isn't the answer that this entire community should just shake the dust off these broken economic tools and embrace fields that think about philosophy and human flourishing, and what we owe to one another, and equality and a deeper humanistic way, and not just what are the incentives that we can nudge, capitalists towards to hopefully, maybe lead to a better place? So for you or for the community?

[00:38:10.47] TIM WU: I agree and disagree with it, which is to say I agree at the highest levels that we need to have very clear what our values are and what we're trying to achieve in terms of good society that we want to live in. And that is a conversation that is often missing, I think, from-- and I think, frankly, in the pure economic analysis, is totally absent where you're focused on efficiency or it can become absent. There's often like pushed to one side and someone else decides that.

[00:38:43.21] So I completely agree with that discussion and the need to be constantly ongoing. But in terms of the engineering side of it, I do think you need-- I mean, you've ever seen the Monty Python skit about the philosophers playing soccer football, the question becomes,

even if you have an idea of the ideal state, what is implementation look like? And I don't think you disagree with that.

[00:39:10.76] And that is very much-- you need some expertise in government to do it right and do it well and figure out from what's worked. As for privacy, in terms of doing things too-- so someone asked, when do you know you've blown it, I mean, privacy? Is the example. When did you wait too long to figure out how things were going to shake down?

[00:39:33.62] Things have been shaken down for 15, 20 years, and nobody's done anything because well, maybe we're still waiting to figure out whether there's a problem or not. And that is so obviously off the rails. So even if you're wrong about the small things, I think it's really important to know when you've totally blown it. And we have totally blown it on privacy.

[00:39:51.48] AUSTIN BONNER: OK, Matt says we can take one more question. I see one right here, and Tim will give a lightning round answer to it.

[00:40:00.56] JOE CAREY: Hi. I'm Joe Carey, I'm a CU alum many years ago. So I've been to the jungle and I've seen the giant ape called the corporate CEO. And I've seen his incentive is to make the stock go up. And so it seems to me that monopolies are a result of that, and the drive toward monopoly is a result of that. Can you just speak to that incentive and how it interacts with the other items in your book?

[00:40:39.12] TIM WU: No, it's a good point. I mean, one of the most interesting developments over the last 10, 20 years is the turn towards-- turn away from salary and earnings or income as a way that wealthy people make money and turned towards stock-- towards stock appreciation.

[00:41:02.16] I mean, if you look at all the wealthiest people right now, if you look at the wealthiest people in the '60s or someone that had huge salary, bigger salaries than other people, and even though there was a lot of people saying, oh my God, I can't believe the head of GM makes $1 million a year or something, that was still not a big gap.

[00:41:18.39] When you look at, I think, Mark Zuckerberg in the last-- I think his yearly salaries-- not salaries-- yearly income by stock value is regularly over 50 billion, which makes-- and Elon Musk is at some years even more, which makes the whole debate over income and salary seem like a joke.

[00:41:36.27] And I just want to put that out there. I think it is a key aspect of this age of extraction. We have set up an economy which prioritizes achieving monopoly or market power over select actors, extracting as much as you can as for as long as you can. And I think with that trend, and I think it spread across the economy, frankly, I

don't think it's just tech, although tech is the most visible version of that.

[00:42:02.55] And as long as that model persists as long as that model, if we cannot break it, and monopolies, certain monopolies are very resistant to new competition, it seems to me very clear that is driving us towards feudalism, and that is driving us towards a two-class society where you have a vanishingly small amount of people in the middle, and either you're on-- either you're salaried, which you're the poor, or you're dependent on stock gains, and you are the wealthy.

[00:42:32.81] And we're not there yet. And maybe people in this room are somewhere in the middle. But I think about your children and the sorting, and I think we can already see the sorting is happening. And I think it's a very dangerous tendency for this country. So maybe I'll leave on that very optimistic note.

[00:42:46.03] [LAUGHTER]

[00:42:48.29] AUSTIN BONNER: Thanks for being here, Tim.

[00:42:49.67] [APPLAUSE]

[00:42:54.37] MODERATOR: Folks, now for the worst part of my job, ending a great conversation on time. Thanks again, Austin and Tim, for this incredible keynote conversation. Thanks again, everybody.

[00:43:02.65] [APPLAUSE]

Panel: The Administrative State and Tech Access

https://youtu.be/8vzl5fh07Qk

[00:00:00.48] SARAH HANSEN: OK. We're going to go ahead and get started. Good afternoon, everyone. My name is Sarah Hansen. I'm a 2L here at Colorado Law, and Secretary of the Silicon Flatirons Student group. I'm delighted to introduce our next panel, the administrative state and tech access.

[00:00:16.08] This panel will examine how recent Supreme Court decisions, executive action, and shifting federal, state, and agency dynamics are reshaping tech policy and access. To inform this discussion, the panel will consider applications on the universal service fund, the Federal Trade Commission, and the Humphrey executors precedent.

[00:00:36.76] Together these issues highlight what is at stake for the future of the administrative state, and for equitable access to technology. Moderating this panel is Blake Reid, associate professor at Colorado Law, and faculty director of the telecom and platform initiative at Silicon Flatirons.

[00:00:54.04] Before I turn it over to Blake to introduce our expert panelists, please join me in giving a warm welcome to our panel.

[00:00:59.99] [APPLAUSE]

[00:01:04.53] BLAKE REID: Well, folks are filing in. Let me just take a moment and embarrass Sarah. We're talking about admin law in this panel. Sarah is my research assistant. I can't think of someone in the building who is as driven and excited about administrative law, and capable of finding deep, exciting things in administrative law jurisprudence. Are you looking for a job, Sarah?

[00:01:26.45] SARAH HANSEN: Yes, I am.

[00:01:27.25] BLAKE REID: All right. I had Sarah comes with my unequivocal recommendation. One thing that has been a constant at Silicon Flatirons for, I think, the kind of 25 years we've been doing this conference is discussing the key federal agencies that govern tech policy. The Federal Communications Commission, the Federal Trade Commission. I think today will probably talk about the NTIA, the Copyright Office, and the PTO might come up as well.

[00:01:55.25] And we normally aim to look around the corner at what's next. But I think so much has happened with federal agencies in the last year that we might find ourselves asking whether there is any corner left at all. So the question that we are tasked with is, where do federal tech policy agencies stand a year into the second Trump administration? And we thought we would divide this question up into four parts.

[00:02:23.25] We're going to think about the relationship between federal agencies and the president for one, the courts for two, Congress for three, and state governments for four. We're going to aim to spend about 15 or 20 minutes on each. And to discuss it, we have assembled a team of friendly foes, agreeable disagreers, a cabinet of rivals, if you will.

[00:02:48.17] And for the president, someone who knows how to execute the most presidential person in the panel. By that I mean we have the president and CEO of public knowledge, Chris Lewis. For the courts, we have someone who is fair-minded, eminently reasonable, and more than a little judgmental.

[00:03:06.06] Gus Hurwitz, who is the senior fellow and academic director at the UPenn center for technology, innovation and competition at the University of Pennsylvania. For Congress, someone who walks the halls, speaks for the people, at least some of the people, Jennifer Huddleston, who's a senior fellow in technology policy at the Cato Institute.

[00:03:26.30] And for the states, we thought we really need someone from outside the Beltway, and we couldn't get any further away physically or metaphorically than Berkeley, California, which is where

Tejas Nerachania hails from. He's a professor of law at the University of California, Berkeley.

[00:03:41.10] With that, let's get to the president. Chris, I am old enough to remember about a decade ago when there was a lot of consternation about the president recording a rather anodyne YouTube video in favor of a FCC policy matter net neutrality that led to years of hearings about the intrusions on the independence of the agency. I assume nothing has changed, and that your update on where things stand will be very brief. Over to you.

[00:04:15.39] CHRIS LEWIS: Wow.

[00:04:15.79] [LAUGHTER]

[00:04:19.11] I'm overwhelmed by Blake's comedic timing. Yeah, things have changed a lot. There is a war on independent agencies going on, and if you don't believe it, believe the people who are waging the war because they say they're waging a war against independent agencies, and the regulatory state.

[00:04:37.67] And I think President Trump is leading the charge. Of course, Congress and the courts. And we'll talk about Congress and the courts, and the states have a role in it. But I think they're ratifying defying actions largely coming from the executive. And it's driven by the concept of unitary executive theory.

[00:05:01.92] So this is the idea if folks are not familiar with it by now, that executive action, so rule-making, and spending appropriated funds and even monetary policy, basically, anything that isn't creating laws or interpreting laws is under the power of one person, the president. And that means that independent agencies should not be independent. That's the theory that they should be under the control of the president based on the Constitution.

[00:05:36.96] And we've even seen the president choose to ignore laws. So verging into the legislative front, the president has ignored laws outside tech policy. But in our own sector, things like ignoring the digital Equity Act that was passed by Congress and signed by the president, or changing how they're going to hand out appropriations or funds, like in the BEAD program. Or completely ignoring the letter of the law on the TikTok ban. This was all done by the president over the last year.

[00:06:12.72] So unitary executive theory is meant to increase the power of the presidency. And I believe it is for power's sake that we're seeing a president expand it, not always for any one policy reason, but to exert power. Because power is what is most important when you want to control the debate, when you want to control communications and information, when you want to control who can influence policy making, when you want to control culture.

[00:06:53.57] The unitary executive theory is and the expansion of power over independent agencies is about that exertion of power and less about policy, which usually is what we're debating up here. I don't know if you want me to go into deeper examples, but yeah.

[00:07:09.69] BLAKE REID: Let me ask you one quick follow up, Chris, which is, we have invoked the notion of independent agencies. Why do we have independent agencies, why is the independence of these agencies been important from your perspective?

[00:07:22.79] CHRIS LEWIS: Well, for folks who believe in agencies like the Federal Trade Commission and the FCC being independent, and that includes the current chairman of the FCC. These were created to help, I believe, bring expertise into policymaking in discrete sectors.

[00:07:40.93] And so it's important to have an expert regulatory body that is independent, and can do long term work on a sector like communications policy. I think you heard Tim Wu making the case for that in his fireside chat to some degree earlier today, and they can do it with a level of expertise that Congress, quite frankly, can't always do, because Congress has jurisdiction over every sector.

[00:08:06.66] And they can be flexible. If they overregulate, they can adjust rules back under the authorities given to them by Congress. And they have oversight from Congress, but they are independent of the Executive who might have short term political desires and considerations that should not go into the expert analysis.

[00:08:25.90] BLAKE REID: All right. I think we've got three excellent subtopics on the table here. The unitary executive theory, the ignorance or derogation of law, and the aggregation of power. And let me open it up to the panel. And maybe let's start with the unitary executive theory for thoughts. Gus, to you.

[00:08:44.16] GUS HURWITZ : Oh, sure. Sure a whole lot of thoughts. And I won't say too much because I'll be talking about the courts, and what's going on in the courts. Item four on my list is Slaughter, Humphrey's Executor, all that stuff.

[00:08:56.61] But I would start by noting. So unitary executive didn't just come out of nowhere. It's not a Trump administration idea. It goes back to the 1980s and before, but it really started to come to the fore with the structural revolution, separation of powers cases, 1970s, 1980s.

[00:09:17.99] And not just since then, but I'll use that Tim mentioned earlier. We have to have a date certain when we're talking about when revolutions occur. Since then, every president has made more and more aggressive use of executive power. And I think, absolutely, what's going on with the Trump administration is a step beyond. But this is a trajectory that we have been on.

[00:09:43.79] And the reason that I want to frame things up there in the Slaughter oral arguments, the Humphrey's Executor case oral arguments. Justice Kagan made what I think is a really critical point, which is that all of these agencies were created with an understanding, a background, understanding of what the equilibrium relationship between the different branches of government and the agencies were.

[00:10:09.15] And if we nuke, if we do away with independent agencies, the independence of agencies, that's changing that equilibrium. Well, yeah, that's really interesting because Chevron did that and INS v Chadha did that in a very dramatic way back in the 1980s. I think we are at the culmination of a disruption of the equilibrium that existed at the time these agencies were created, and the current equilibrium doesn't work.

[00:10:36.57] So we're in a period of disequilibrium, rethinking, rebalancing. And the hardest question there is, what's the role of Congress in all of this? And I know we'll get into some of that.

[00:10:47.88] BLAKE REID: All right. Before we get to courts, before we get to Congress, let me go to Jen for reactions on the unitary executive theory.

[00:10:54.62] JENIFFER HUDLESTON: Yeah, I was going to pick up on some of what Gus mentioned about Congress. And I think that that's a lot of the question is also, why do we see so much more action by executive order, by the agencies? How do we see this potentially being checked by the courts? But also, why is this the primary form of regulation we're seeing, particularly in the tech sector these days? But also more generally.

[00:11:15.10] And I don't think that as Gus is pointing out, that we can just say that this is a Trump administration issue. You can look at something like the Biden EO on AI, where you had something that looked very much like legislation done by executive order. Similarly, as Chris alluded to I think there are a lot of questions around the Trump administration's decision to continually extend the TikTok deadline beyond what was available in statute by executive order.

[00:11:42.27] Even if you think it is good that TikTok stayed available as a platform for expression that we didn't see the government shutting down that platform for expression, we still have to ask important questions about the underlying use of executive power, and what that may mean in terms of how that executive power could be used beyond any particular administration.

[00:12:02.61] BLAKE REID: Excellent, Tejas.

[00:12:04.21] TEJAS NERACHANIA: Yeah, let me say let me say two things. One, sort of about the law as it's developed, and then one about-- it's related to the question you asked Chris about why do we care about independence?

[00:12:15.13] So I guess, I agree with Gus that the unitary executive, and the trajectory of executive power has-- we've been on this trajectory for some time. The unitary executive theory has a long history. In some senses, you might say that it really found its footing in a fever dream by Justice Scalia.

[00:12:35.05] But if you were to really, I think, dig down into it, like it's the law-- the theory rests on a thin reed of text in the Constitution. The way article 2 is drafted. And then you turn to the original evidence in favor of the executive, the unitary executive, and most of the unit-- most of the original evidence in favor of the Unitary Executive theory goes back to common law England and the King.

[00:13:01.73] But if you think of the Constitution as a break from England and the monarchy, then it's not clear how relevant that evidence ought to be. And all the founding era evidence is really quite ambiguous. So all of which is to say like, OK, somebody dreamed this up in Morrison.

[00:13:18.41] And we've been on this trajectory for a while. And we can rely on formalism to do the unitary executive thing, or we can be thoughtful, and we can do we want independent agencies? Do we want a regulatory structure that is not just the president gets to do whatever they want, but is instead, like, do we think it is better to have an agency that is subject to oversight by Congress?

[00:13:45.58] That is, if we think that there are in communications contexts, concerns about demagoguery and propaganda, then maybe what we want is that agency that's in charge of the media to be responsible to the supervision of Congress, which is more representative in that it's proportionally drawn from the states, and has a variety of viewpoints that better represent us.

[00:14:07.84] And so I think there's a lot of value in those independent agencies, just in terms of what they mean for our representative democracy. And I've gone on long enough.

[00:14:17.98] BLAKE REID: Chris.

[00:14:18.38] CHRIS LEWIS: Well, and I would just argue, we decided this when Congress passed a law to create these independent agencies. And Gus brought up the Humphrey's Executor case and the firing of Commissioner Slaughter, and at the FTC. It seems ridiculous to me that Congress passed a law to create an agency like the FTC or the FCC because there's threats there that minority commissioners could be fired there as well.

[00:14:46.45] And then, puts into the statute that there will be minority commissioners. Some commissioners can be the party of the president, but not more than this many. And so that by default means there are minority commissioners by law. And then to say that they can just be fired. It's as if you assume that every commissioner must agree

with the president on every policy, and that just flies in the face of the intent of the statute.

[00:15:16.23] BLAKE REID: So I want to ask before we leave this, I think we've alluded in fairly abstract terms to why we might want to have independent agencies, or what we might lose if we get rid of independent agencies? But I wonder if folks have any concrete examples or things that you are the most worried about if you think that the loss of independence is a problem, what are the things you're most worried are going to go?

[00:15:43.16] Or if anyone feels the other way, and thinks there are maybe some upsides to having this fourth branch of government that's floating out nebulously in the world, and acting without these clear paths of oversight that the unitary executive theory contemplates. I don't know if anyone takes that view. But let's take up that before we move on to the courts. Why what do we stand to lose here?

[00:16:06.26] CHRIS LEWIS: So we're already losing an independent free press. The difference between what happened in the first Trump administration and the second Trump administration is stark. The president is a master of the bully pulpit. He is excellent at it.

[00:16:23.34] And yet, when he would criticize or critique the opinions and the operation of news outlets in the first administration, Chairman Pai, would say, oh yeah, I might agree with them, but he never-- he actually said outright he wasn't going to act on some of those complaints. We've seen the opposite with the Jimmy Kimmel censorship, and plenty of others manipulating print and TV broadcasts, journalism outlets to try to get on the message of the president and not on their own independent views.

[00:16:56.73] GUS HURWITZ : So Blake, I'll give you some controversy since I know that's what you're asking for. With trying not to turn this into an admin law class. So if this were an admin law class, I'd go back and talk about that transmission belt, understanding of why we have agencies in the first place, and the expertise agents understanding of why we have agencies, both independent and otherwise.

[00:17:18.52] And then the presidential administration understanding of why we have agencies? We've gone through all of these different understandings of why we have agencies. and with independent agencies, we tend to focus on the expertise. We bring together a panel that represents different perspectives.

[00:17:35.99] It's really weird to me that they're almost always lawyers, that we don't have more technical.

[00:17:41.15] BLAKE REID: We have all the important disciplines represented.

[00:17:43.31] GUS HURWITZ : Yes. But increasingly, so many of the high stakes, big picture fights that we have at these agencies are

political. And the presidential administration, understanding which Justice Kagan wrote that article, is more along the lines that if these agencies are making political decisions, we want them to be more directly accountable to political entities. And the president is the most at the biggest level, politically accountable individual.

[00:18:15.69] So let's have the annual, not annual, oh, God, every four years that election is a referendum, not just on the president, but also do we like what's going on at the FCC with these policies or not? Now, so that's one understanding. If these are just political fights and they're not technical expert fights that we're having, then, yeah, maybe these should be rendered in the political domain. So that's one pushback that you can have.

[00:18:47.82] TEJAS NERACHANIA: Yeah, so I guess, sure. So I think we should want and value political accountability. But the political accountability doesn't have to come by way of the executive. That is you can imagine, and we have systems of congressional oversight. And Congress is even more politically responsive than the executive.

[00:19:06.18] So I don't disagree with you, but an independent agency refers to independence from the executive, but it doesn't mean independence from politics. And I think that the FCC and the FTC are subject to plenty of oversight from Congress, and that oversight matters.

[00:19:19.82] JENIFFER HUDLESTON: So if I can jump in here because I was actually going to be-- put on my I'm supposed to be talking about Congress hat here too. And that I do think Tejas is right. One of the elements that we aren't asking this question is, are we seeing adequate congressional oversight of these independent agencies?

[00:19:37.09] And I think there probably would be some debate amongst this panel about, have we seen these agencies overstep, particularly in either this current administration or in previous administrations, and have we seen Congress respond? We do know Congress can respond. We've seen them use the power of the purse with the FTC before. So we certainly know that there can be oversight by Congress when it comes to independent agencies.

[00:20:00.21] I also don't like the dichotomy that Blake setup of either like you approve of the fourth branch and independent agencies, or you're fully on with them all being subject to every one of the president's whims. I think there's an in between.

[00:20:13.29] I have a lot of concerns about the role of the fourth branch, of the role of the administrative state, about the impact that it's putting on individuals, and on society, and on any number of things. I do also think, though, that we set up independent agencies with a form of oversight, that there are questions about what happens, why we set them up to be independent?

[00:20:34.77] Are we seeing things become politicized that we felt needed, that form of Independence? And that's why we need to have a different form of accountability, perhaps for these independent agencies.

[00:20:45.37] GUS HURWITZ : So real quick. Building on both of these points. First, I agree with you, Tejas. And I would love for the agencies to be more overseen by and beholden to Congress', a more responsive. But we're not seeing that. So another reason that we have, especially, independent agencies, most independent agencies are led by a panel of Commissioners that have staggered terms that are longer than four years long.

[00:21:12.71] So they are meant to give some stability in policy that will outlive any single presidential term. And one of the weird things that we've seen is that hasn't really happened. For various reasons, a lot of it is the lack of congressional oversight or more direct congressional oversight.

[00:21:31.00] Agency policy has vacillated more by who's in the White House, which, that's, again, another, I think, really important, giving stability of policy that outlives a single president. If we had that coming out of independent agencies, that'd be wonderful. But since we don't, that calls into question, I think, not necessarily the legitimacy of the structure but the effectiveness. And if it isn't effective, that calls into the question of the legitimacy.

[00:21:57.74] BLAKE REID: So I want to shift gears slightly. I know we were going to go to the courts, but I think we've been down the rabbit hole on Congress a bunch here. So let's keep going with that. So Jen, I'm going to come back to you real quickly. You sounded a little skeptical about what Congress has accomplished in terms of overseeing the agencies in the last year. Expand on that. What else about Congress?

[00:22:22.59] JENIFFER HUDLESTON: So I think in some ways you can't fully talk about Congress, the courts and the states entirely separately. They're each kind feeding into each other. In part because of this question of what happens when Congress doesn't act on an issue that there is either political or public interest in. So on the one hand, we have seen the courts, as Gus will get more deeply into really take away agency deference, and try and put the power back in Congress.

[00:22:50.53] There's been rumblings around Humphrey's Executor with the Slaughter case, and what that might mean for independent agencies, and the oversight, whether they would continue-- whether we would continue to see this oversight by Congress, where we have seen Congress use things. Like the power of the purse, like having hearings of these agencies over what they're doing various elements along the way to try and make sure that there are some proper political

checks and balances, and that independent agencies still have that responsiveness to the public.

[00:23:21.21] And then we've also seen that when it comes to issues like data privacy, like artificial intelligence, where there seems to be this desire for some sort of framework, that in the absence of congressional action, that either we see agencies stepping up without clear delegations, which raises questions around the nondelegation doctrine, and whether or not we'll see a revival of that in the courts. But that we also see states stepping up to fill that vacuum and creating potentially other problems.

[00:23:50.19] Questions related to Dormant Commerce Clause when these issues often impact interstate boundaries. If also questions of what this can mean in terms of the disruption for a future federal framework, something that we've certainly seen in the debates over data privacy.

[00:24:06.69] Now, I do think there is some optimism out there of that we do see that Congress has at times stepped up both to provide agency oversight, as well as attempting to have these conversations in very structured and measured way, particularly around issues where they know it's important that we get the policy framework right, like AI. But I think that oftentimes this is a very long process, and that there's a kind of impatience between both agencies and the states to do something sooner, even when doing something sooner may not be the right answer.

[00:24:41.08] Sometimes, actually, the absence of policy and tech policy can be beneficial and allow innovation to evolve and allow societal norms to evolve, and allow us to see how our existing laws will play out. In other cases what we've seen, though, is that in the absence of that action, there may be either attempts to step up and regulate by agencies in the States, without that same check that we would see if we saw a proper debate in Congress.

[00:25:07.06] BLAKE REID: Tejas, can I come to you on this because I think you started us down the road with the thought that Congress ought to be filling the voids in some way here. What's your take on how Congress has done in the last year?

[00:25:19.81] [LAUGHTER]

[00:25:22.51] GUS HURWITZ : Congress has done in the last year?

[00:25:24.79] BLAKE REID: If at all.

[00:25:29.75] TEJAS NERACHANIA: I'm trying to think of how to diplomatically answer your question.

[00:25:32.85] [LAUGHTER]

[00:25:34.07] Look, I.

[00:25:35.51] [INTERPOSING VOICES]

[00:25:42.27] JENIFFER HUDLESTON: It's a group of people like me.

[00:25:44.61] [LAUGHTER]

[00:25:46.79] TEJAS NERACHANIA: So look, we have-- so I'm trying to think about where exactly to start. Look, there's an ideal story of Congress that it is this Democratic and deliberative body. And I love that ideal story of Congress. And we've drifted far from it. And I think the last year is an example of that. And now we have lots of efforts that are aimed at, in small ways, trying to get us back to that.

[00:26:14.30] Well, oh, if we just overturn Chevron, then Congress will start legislating again. Or if we oh, if we just do this thing, then Congress will start legislating again. And I don't think it's so easy. I don't know that I have the answer, but those little things are not going to fix, I think, what is a broader structural problem and is maybe a broader structural problem with our politics, and that is well beyond the scope of our panel.

[00:26:38.60] JENIFFER HUDLESTON: If I can make a comment, if you won't mind a brief joke. When you did the introductions, you said that Berkeley was as far away from DC and out of the Beltway as you could get, but it's very close to Sacramento, if I recall.

[00:26:55.78] [LAUGHTER]

[00:26:56.68] And oftentimes, what has become de facto federal policy isn't necessarily coming out of Congress anymore, it's coming out of places like Sacramento.

[00:27:09.28] TEJAS NERACHANIA: I think for certain things. That's right.

[00:27:11.52] BLAKE REID: All right. We're going to put a pin in that fight. We're going to go back to Sacramento in just a second. I'm going to come to Chris.

[00:27:16.82] CHRIS LEWIS: Oh, I was going to jump off.

[00:27:18.04] BLAKE REID: You got to go for it.

[00:27:20.29] CHRIS LEWIS: Or Berkeley is very close to what happens in Congress because California has, what 50 some members of Congress?

[00:27:29.14] GUS HURWITZ : For now.

[00:27:29.70] CHRIS LEWIS: They can for now, they can really have a huge influence on pushing legislation, they can stop legislation. I mean, those of us who are advocating for in 2021, 22 for comprehensive privacy law, it was the California delegation that stopped a compromised, comprehensive privacy law from getting a

vote on the House floor after it passed the Energy and Commerce Committee by like 50 to two or something.

[00:27:58.20] So it's very Democratic. Everyone has representation. It is messy, and I think that was by design. Because it's a limit on the executive, dare I say, kingly state power. That was the intention of the framers. And so in order to get policy done, sometimes we have to have compromise.

[00:28:29.09] Sometimes we have to have the messy state of Congress get together, and find a way to balance values and priorities and stakeholders. And sometimes you lose when that happens, but it's a better system than executive authority only. And letting the president just run roughshod over how money is spent and all the stuff we're seeing right now.

[00:28:57.33] BLAKE REID: Gus, take us from Congress and take us to the courts.

[00:29:00.87] GUS HURWITZ : Oh, I'm not going to go to the courts yet because you opened a door that I have to go through. Thank you. So Tejas, you made the observation that so many of these issues are so much bigger than what's going on with this panel, and that is a really, damn, important point.

[00:29:17.16] So first, apparently there's some folks who are talking about repealing the 17th Amendment now, so we won't vote for our senators, the legislators of states if this were to happen, they would select senators. Oh, well that's interesting. I am in the process, I'm finishing up right now, reading Robert Caro's bio of Robert Moses. And over the summer I listened to, I didn't read the LBJ bio.

[00:29:45.26] Yeah, it's both good-- a great bio, you should read it and also listen to it, don't read it. It's too long, but worth every page if you listen to it. I don't know that at any point in history we would do better at trying to through these issues than today. That's a counterfactual question. But yeah, we're really dysfunctional in really important ways. But these are hard issues to figure out.

[00:30:14.39] And a lot of these issues about technology policy, they're changing our society. They're challenging our norms. They're making us question who we are. And that's good. That's healthy, that's normal. But thinking that, yeah, the right change in administrative law, doing away with Chevron is going to completely re-equilibrate how we function as a polity, and get us back on track. That's a little higher pay grade than this panel.

[00:30:38.45] So I think that that's a really useful anchoring point for a lot of the discussions that we have. And it's also a call for us all to be involved in the political discussion. And we can't just say, wow, everything's terrible. Someone should fix that. So it's a good reminder.

[00:30:56.37] BLAKE REID: Tejas, you got a rejoinder, should we move on?

[00:30:58.61] TEJAS NERACHANIA: Now I feel like I was being called out for saying Justice Scalia had a fever dream.

[00:31:02.99] BLAKE REID: All right. On that note, let's pivot to the courts who have been invoked often here. So Gus, how are the courts shaping the conduct and performance of independent agencies?

[00:31:15.97] GUS HURWITZ : Yeah, so first, I do want to start by thanking everyone for inviting me. Thank lovely to be here as always. I also want to call out Blake, who's on research leave right now. He shouldn't be here, but he loves you all. He loves this so much that he's willing to be here.

[00:31:31.97] [APPLAUSE]

[00:31:34.23] When we're done, Blake, go get writing.

[00:31:36.09] BLAKE REID: Yeah.

[00:31:37.23] GUS HURWITZ : So always thrilled to be invited to talk about admin law because it's an opportunity to talk about Chevron. Chevron is dead if you haven't heard, the Supreme Court overturned it two years ago 2 and 1/2 years ago, whatever, in Loper Bright.

[00:31:55.87] And this is probably admin law last couple of years. The big news that people talk about. What does this mean if you're an ad law prof? That's the question. We're still no one knows what the future post Loper Bright is.

[00:32:11.20] We do know a couple of interesting things. So courts do still defer to agencies under a different standard, the Skidmore standard. In principle, courts review these questions de novo. However, agency input the seriousness of agency policy is going to help courts decide when to defer, or how much to defer to agencies.

[00:32:36.22] And this ties into two other really big topics. First is the major questions doctrine, which is alive and doing better than ever. We're now seeing a lot of cases that invoke the major questions doctrine, where courts, as they're being asked to interpret a statute post Chevron, they're looking at a statute saying, this seems a really big question. Maybe Congress should provide us some more guidance. We're no longer going to let agencies update the law to track changes in technology.

[00:33:09.23] So we're seeing some of that, in fact, I need to say net neutrality, in the Eighth Circuit net neutrality opinion, the Eighth Circuit rejected.

[00:33:21.09] SPEAKER: Sixth.

[00:33:21.73] GUS HURWITZ : Sixth. Eight and six they look too similar. The Sixth Circuit rejected the 2024 rules on Loper Bright post Chevron grounds, some inkling of major questions doctrine. And one of the other really big things in there was the court looked at the history of the agency flip flopping between administrations on the interpretation, and they said, yeah, you're not really a trustworthy narrator as to what the statute means.

[00:33:52.73] So we are going to read the statute, and we don't think that it backs this up. Everything I say over the next few minutes is going to be an overly simplified gloss. I apologize, it's unnecessary. We'll come back to Chevron. Next really big admin law thing. A little further afield from stuff that folks in this room might be paying attention to.

[00:34:13.82] The Jarkesy case. SEC, Securities and Exchange Commission, where the Supreme Court called into question the ability of administrative agencies to issue fines that aren't issued subject with some jury trial. There is the AMG case with the Federal Trade Commission. Similar sort of case dramatically limited the agency's ability to issue fines. And two weeks ago, the Supreme Court granted cert in the Verizon and AT&T cases.

[00:34:47.42] Based upon Jarkesy, the carriers are challenging the Commission's ability to issue fines for violation of their rules. Again, overly simplified, but that could be a huge recalibration of the power of agencies. Next really big thing going on in administrative law land. Even more of a sleeper. The Corner Post case.

[00:35:08.94] This could be a huge issue for established agency rules. The historic understanding is there's a statute of limitations. You need to bring a challenge to a rule when it's issued within that statute of limitations, the court said no, you're the harm occurs when you become subject to the rule. That's when the statute of limitations starts tolling.

[00:35:31.26] So if you are a new entry into a regulated field, and suddenly you're subject to these rules, you can challenge them. So if you want to challenge an existing FTC or FTC-- FCC, FTC or any agency rule, just start up a new company, say, oh, I'm subject to your regulations now, I'm going to challenge this.

[00:35:50.58] So very likely we're going to start seeing more strategic litigation and just litigation, challenging rules that we thought were long settled. Next up, Slaughter and Humphrey's Executor. Humphrey's Executor is dead precedent walking, I think there's very little doubt that it is going to be overturned. The question is how or on what grounds?

[00:36:21.71] I personally think even after listening to the oral arguments, the court is not going to overturn Humphrey's Executor but it's going to say that the modern FTC doesn't fit into the agency

described at the time by the court in Humphrey's Executor. So the FTC no longer gets the benefit of that removability protection.

[00:36:47.95] But I already mentioned what my big question coming out of the Slaughter case was this broader question of the equilibration of the administrative state. So back to Chevron briefly. First, the justifications, the two big theories or discussion points with Loper Bright killing Chevron. Some people looked at this and said, oh, the court is aggrandizing article three's power. It's bringing all the power to interpret statutes into the courts.

[00:37:19.24] The other view was the court is returning the authority to say what the law is to Congress. If there's an ambiguous statute, we can't just rely on the agencies modernize it, and pass it to changes in technology. Rather, that's the job of Congress. Both of these are probably right in a different measure, but those are the two polar views. A lot of fighting over that.

[00:37:45.08] There is definitely a theory. There's definitely a hope, however, that it will help to depoliticize some amount of administrative law and agency law. Whether that actually happens is unclear.

[00:38:01.40] So much, however, of what we all love and hold dear is public convenience, interest, and necessity, whatever the heck that means, and unfair methods of competition, whatever the heck that means. And I expect that the courts are going to look at those statutes and say, what the heck do these mean? And be much more inclined to hand things off to Congress or the states. And unfortunately, I was going to originally go before Jennifer and that was going to be the handoff.

[00:38:32.72] BLAKE REID: So let me jump in here. And I think Gus has given us a lot to chew on. But one thing I want to zero in on is the last thing you said, Gus, that there's real tension between the court or getting power to itself, between that and the court shifting power to Congress, to Chris, where you started with, or getting power to the president by way of the Unitary Executive theory and Slaughter and so forth.

[00:39:00.49] So what is really happening at the court, whether we want to be descriptive or predictive about it. Where is the power that the court is taking from administrative agencies? Where is that going to end up, does that make any sense?

[00:39:16.97] GUS HURWITZ : I've got no idea. Possibly the weirdest thing I'll say, and I mentioned in INS v Chadha a little bit earlier. I grew up as a law student, a Scalia Acolyte, formalism, structural Constitution. This all made sense to me INS v Chadha rightly decided unequivocally. Today I read it and I read Justice White's dissent, and I say, my goodness, Justice White was right.

[00:39:43.21] Pre INS v Chadha, Congress had much more direct control and engagement with agencies and direct oversight. And the reality is, I'm also a law econ guy, I believe in transaction costs. The transaction costs of a formal structural Constitution are prohibitive as a reasonable form of contemporary governance.

[00:40:07.66] And as I said in my earlier response to Chris riffing on Humphrey's Executor, we're not in a stable, functional operational equilibrium right now. I don't know. I think that in a very-- now I'm doing the Tejas thinking, how do I want to say this? Do I want to say this?

[00:40:29.22] In either a very naive or a very 19 dimensional chess sort of way. The court is either trying to adhere to a understanding of a formalist structure of power, separation of powers understanding of the Constitution that they think. This is what the document says. This is how we need to read it. This is just right.

[00:40:56.25] Or they are-- and I don't think this is the case. I know this is naive Gus, not naive Court, but they are pushing us to hey, we need some bigger restructuring of how we operate this country, and this will push us to that crisis point that will lead to that restructuring.

[00:41:18.27] BLAKE REID: To you.

[00:41:18.87] CHRIS LEWIS: Yeah. So if I were to answer your question about, where does the power end up? I think the two moves, on the one hand, Chevron major questions. On the other hand, Humphrey's Executor, I think they pull in different ways. I don't think it's necessarily like one movement.

[00:41:35.89] So if you're worried about independent agencies but want to do it under Rule of law, I would say at least Chevron and major questions tend to do that. Now, you can question it when the Eighth Circuit comes out, net neutrality number two. If Eighth Circuit comes out and decides.

[00:41:53.17] BLAKE REID: By the way, we're going to have a net neutrality swear jar here. So like we've let it slide so far, but it's going to cost you $1 from now on.

[00:42:00.43] CHRIS LEWIS: Sorry, it was number three.

[00:42:02.71] GUS HURWITZ : The swear jar [INAUDIBLE].

[00:42:04.05] CHRIS LEWIS: He gets all the money.

[00:42:05.01] BLAKE REID: Yeah.

[00:42:07.51] CHRIS LEWIS: The Eighth Circuit deciding what the authority is over broadband rather than kicking it back to Congress, I think argues towards the court deciding that the power moves to them. I think you're right.

[00:42:20.45] There's a real argument that the power could move back to Congress. But if the court doesn't let it move back to Congress by kicking the decision to Congress and saying, go through your messy political compromise effort to figure out what the Communications Act means, then it we don't get what I think is intended under the rule of law.

[00:42:41.28] GUS HURWITZ : So this is a really great point. And I know I've been talking a lot, I'll shut up after this. Both Chris and Blake, you're exactly right. That Chevron and Humphrey's Executor, they are working together. I don't think intentionally, but they are working together in interesting ways. I mentioned in the Loper Bright discussion, Fox v FCC, the flip flopping sort of thing.

[00:43:04.34] I expect that we are going to see much less of that highly politicized flip flopping of agency interpretations of statutes post Loper Bright. And to the extent that we do worry, I think rightfully, that a loss of Humphrey's Executor will increase the politicization of agencies, the loss of the ability to flip-flop in agency interpretation of statutes will be a check on the danger that can work.

[00:43:31.32] JENIFFER HUDLESTON: So I don't know if it's a bingo card or a swear jar, but it's my turn to say net neutrality. So I think if we get five then Tim Wu gets something at the end of the panel or whatever. Because I do think when we look at things like the decision around the Sixth Circuit, decision around net neutrality being one of the first big trials of what happens to admin law in a post Loper Bright world.

[00:43:56.73] It also raises that question of also, who are these decisions for? Who is the court actually trying to communicate with. Are they trying to communicate to the lower courts, to the circuit courts, to the district courts that now when you see these agency actions, this is what we want you to do? Are they trying to communicate to Congress like, hey, remember, Article I exists, we'd like you to use it instead of just like letting agencies do anything. Are they trying to communicate to the agencies themselves?

[00:44:24.27] And if they are trying to communicate to the agencies themselves, are the agencies themselves actually listening, or is this the type of thing that when for example, think about the contrast between, for example, the FCC considering net neutrality, and also at one point considering rule-making around content moderation in Section 230 that agencies are not necessarily taking into account fully what that interpretation might mean?

[00:44:49.38] BLAKE REID: So Tejas, I'm going to come to you any parting shots. And then we should shift for our last few minutes to talk about states.

[00:44:56.06] TEJAS NERACHANIA: Well, let me just say one thing about the power shift and the idea that overturning Humphrey's

Executor will lead to more politicization, and maybe power in the executive branch as opposed to the courts. And I just want to say that that's a little bit of an open question, given how the argument went in Cook.

[00:45:12.38] That is, it might be that the court arrogates to itself the power to decide when these independent commissioners can and can't be fired through judicial review of for cause removals. So I think that still the jury's still out, and that could be more Article III decision making.

[00:45:29.26] CHRIS LEWIS: There was no cause in the removal of Commissioners.

[00:45:31.76] GUS HURWITZ : Oh, I agree, but like--

[00:45:33.38] CHRIS LEWIS: It was at least a veneer of cause in Lisa Cook, but yeah.

[00:45:39.10] BLAKE REID: So Tejas, let's shift gears for our last few minutes, and then we'll go to the audience for questions. We've got a last set of institutions that are acting on federal administrative agencies, and that's in the United States. Can you give us a brief tour, knowing that we are going to in our next panel shift to AI regulation, be talking about this a lot of detail?

[00:46:00.26] TEJAS NERACHANIA: Yeah, sure. So I'm happy to do this. I think what I'm going to do is try to offer a broad overview, and maybe a little bit some background in history and then open it up. So we can talk about state privacy regulations, state broadband regulations, state regulation of social media, or even state AI regulation. And I want to dive into some of those in a moment.

[00:46:18.24] But the first thing I want to point out is that across all of these scenarios, the states are the front line for governance between the relationship of some local consumer and some provider. And I think it's really easy, and in common even to say, well, look like internet is a national global infrastructure. It needs national regulation. Social media platforms operate inter-jurisdictionally. So we should rely on federal authorities because what about Dormant Commerce Clause.

[00:46:44.27] But like Target, Walmart, Safeway are all national companies that operate inter jurisdictionally, and they can only build stores where they comply with local zoning rules. The stores have to comply with local wage and hour laws. They're subject to local consumer protection laws. And so I think the same is true. The exact same thing is true in internet and communications contexts.

[00:47:04.97] Wireless broadband companies have to comply with local zoning and tower siting rules. Technology companies have to comply with local employment rules. Broadband, where broadband provider doesn't offer you the service it promises, it can be subject to Consumer Protection Regulation.

[00:47:19.63] And so now the history we've recognized this for a long time. The story starts with 152b in Louisiana, PSC, where we have these two visions of an intrastate and interstate markets with different regulators. That doesn't work because the infrastructure is shared. So here's my nod to Phil Weiser who says we move in the 1996 Act, to a scheme of cooperative federalism where we use state regulation or implementation to achieve federal goals set out pursuant to a federal statute.

[00:47:49.76] So that's the history everyone in the room knows all that. As our focus has shifted from the infrastructural layers to the higher layers. It seems like the model of cooperative federalism has broken down. And we're moving towards a paradigm that I would characterize as adversarial federalism. We have the states and federal authorities often acting actively against one another in competition with one another. And a lot depends on how these conflicts shake out.

[00:48:22.96] So take, for example, the recent executive order on state AI regulation. Set aside the question of whether or not there's actually any legal authority to do any of the things that the order purports to do, and just focus on the substance. Colorado, here we are, enacts a law to address algorithmic discrimination by possibly requiring that AI developers correct for long standing historical biases and training data when making predictions or recommendations about recidivism or hiring.

[00:48:55.40] The order treats that law as a paradigmatic example of onerous AI regulation. California has enacted a bunch of laws, including transparency for foundation model developers, requiring that developers of companion chatbots, develop protocols to address risks of self harm, and holding companies liable for torts committed by agentic AI systems. All three of those laws might also be deemed onerous, though we don't know yet.

[00:49:25.52] But that relationship, and how that cashes out is an example of the adversarial federalism between what's happening at the federal level, and particularly in the executive branch, and what states are trying to do in respect to the relationship between their local consumers and providers of AI services.

[00:49:45.25] You can also see examples of this adversarial federalism in the recent changes to the BEAT program, where NTIA has essentially required states to change the technology mix of their subgrantees, even where the states have a different perspective on what the right technology mix is, and what the right long term investment in broadband ought to be.

[00:50:05.89] NTIA has threatened states that also try to regulate the relationship between local consumers and local providers of broadband through, say, rate regulation or affordability like in New York. So if cooperative federalism is defined by the sense that we share

a set of common goals and common aspirations, like Brett said earlier, universal affordable access to communications technologies.

[00:50:28.22] But recognize in cooperative federalism, the different states are going to take different paths to get there because of different values and different populations and different geographies. Our current moment is defined by fundamental disagreements, like the Colorado law is blasted as onerous AI regulation because it is deemed untruthful. But that goes to a basic disagreement between what the White House and what the Colorado lawmakers think truth means.

[00:50:53.70] Does truth mean a bare recitation of history, or does truth mean a correction for the mistakes of the past? Where does that leave us? I don't know. States do a lot, by virtue of their direct relationship with local consumers, and their ability to superintend those local transactions. But increasingly, the states have to fight to retain that power. And I don't have a clean up shot for what that's going to look like, but it's something we're figuring out. It's a new model of federalism-- for sure.

[00:51:24.75] BLAKE REID: So I want to close with a question to the panel before we go to the audience with Tejas provocative notion of adversarial federalism. Does the fighting among the branches of the federal government. We've talked about Congress, we've talked about the judiciary, we've talked about the presidency, and all the jockeying for power there. How does that shape all of that infighting, the relationship between the federal government and the States? Thoughts.

[00:51:54.91] JENIFFER HUDLESTON: Well, I just want to pick up on the phrase "adversarial federalism," because it's not where I thought he was going with it.

[00:52:00.25] [LAUGHTER]

[00:52:02.71] I was waiting for it to hear him talk about fights between Colorado and Texas, for example. And when I hear the term adversarial federalism, what I was thinking of was more of the fact that we oftentimes, in the absence of a federal framework, have seen states with very different points of view over something like what truth is-- trying to both regulate in ways that, why it is so disruptive when it comes to communications technology, is you can't possibly comply with both at the same time.

[00:52:34.79] And I think that's the real difference in the comparison to target local zoning laws is that-- target building stores and having to comply with local zoning laws is that we're running a risk with some of these technologies, that these state level technology regulations mean that you cannot offer a product in every single state. And that it has far more elements that would impact things like speech rights, like privacy rights, like the ability to innovate and operate businesses.

[00:53:03.25] So I was a little surprised when you used adversarial federalism, and went with the state federal dynamic, as opposed to talking about the states arguing amongst themselves at some point. I think that that's something that we have to consider when we think about this dynamic. It's a little weird to be a libertarian, and talking about that many of these issues need to be on a national level when it comes to the internet or AI.

[00:53:28.88] I do think that there are roles for state and local governments to play. And I think that to Tejas's point, that they are often places where people can more directly make decisions, and they're also places where they can more directly make decisions if they don't like the laws, or if they don't like the framework. And we've seen businesses and individuals move as a result of disliking frameworks as well.

[00:53:53.76] BLAKE REID: Lightning round, closing thoughts from Gus, and then the rest.

[00:53:57.32] GUS HURWITZ : Lightning round. Two thoughts. So first, as a researcher and as an academic, one of my greatest frustrations in this area is the lack of empiricism, and natural experiments and tests and laboratories of democracy. Hey, I could get behind this at some level, or find ways for regulators to do more experimentation.

[00:54:21.79] So much from a research perspective of the policy debates here can boil down-- be boiled down to, that's just your opinion, man. That's like just your opinion. And I would love for us to have more actual honeypots and experiments that we could look at results of policy interventions, and see what the results are in a small scale before deciding whether to scale them up.

[00:54:45.65] The second thing, which I just we should have in the discussion with so much of technology policy, we can look from a national level internal to the states, but we also have the National competition between different countries. And there are definitely folks, especially, for instance, on the AI side today who say, look, the United States is in a global competition against China and the European Union for artificial intelligence, and California is just going to kill us in the global economy. And that that's just to something that should be percolated up into the discussion.

[00:55:27.71] CHRIS LEWIS: It almost seemed like you had waived the authority question to just but, yeah. I don't understand why. I mean, we've seen the courts to your question Blake step in, and stop preemption of state laws. Certainly when it comes to broadband policy because the FCC declared it did not have authority over broadband. And then when states stepped in to create privacy laws or net neutrality laws, the courts made it clear, like, hey, you said you don't have authority, so the states can do what they want here.

[00:55:57.58] So I think authority matters. Certainly it matters when it comes to executive orders, which can't really govern preemption, to my knowledge. I'm not a lawyer, but that's my rough guess on it. And then it all ends up pointing back to whether you want to call it dysfunction, or messy democracy that we have going on in Congress, it's the importance of it.

[00:56:20.84] I mean, can you do state level tech policy? Yes. Should you? It's probably not the best for the type of technology, and you kind of hand wave that too because we're talking about when it comes to broadband networks and networks, we're talking about platforms that ride over those networks. We're talking about a global economic engine here. And it seems like it's better to do it at the federal level. And the dysfunction is what's leading to it not being done there. And the responsiveness of federal policymakers is admirable, but probably not the best way to do it. Excuse me, federal and state policymakers. Yeah.

[00:56:56.60] BLAKE REID: Well, we've heard some provocations against the notion of cooperative federalism and two actions by the states. And I'm reminded that in 10 minutes, we will have Phil Weiser, who wrote the article on cooperative federalism and is behind some of these very actions to offer some thoughts.

[00:57:16.13] But before we do that, and because Phil is here, we've got to follow the Weiser rule and ask the first question to students. And I have clocked at least three students in this vicinity who I will call upon if they do not raise their hands, including one who's holding the microphone right now. So any volunteers?

[00:57:39.03] AUDIENCE: I'm Juliana Blakely, and I have a question for Chris, mostly because this is payback because yesterday he grilled me at the AI ethics competition.

[00:57:48.79] CHRIS LEWIS: Hi, Juliana.

[00:57:50.29] AUDIENCE: And maybe that's actually not a question for you so anyone else can take it. But I'm thinking this is the context is that there's a recent executive order where funding for broadband-- billions in funding was threatened.

[00:58:08.75] And so with that backdrop, what do you think the impact is of the president essentially taking the power of the purse, and bypassing Congress, while at the same time the president being able to also fire agency heads. What is the impact on citizens, but also on the industry as a whole?

[00:58:33.56] CHRIS LEWIS: It's lawlessness. The idea that the president can ignore appropriations law is lawlessness, plain and simple.

[00:58:44.60] GUS HURWITZ : So I'll chime in. First, huge rule of law questions about ignoring specific appropriations. But it also is worth

having in the background. The power of the purse has long been one of the most important regulatory tools in the federal government. Sometimes this is through congressional direction. Other times it's through executive discretion.

[00:59:10.84] For students, if you have a chance to take a government procurement law class. It sounds super boring, and it is, but it's super important, and it's not at all new. So much of federal policy is decided and implemented by the executive through procurement decisions and policy. So worth having that in awareness.

[00:59:35.44] BLAKE REID: All right. Let's come down to the third row here for our next question.

[00:59:42.80] AUDIENCE: So heading into 20 Columbia. A lot of the discussion you mentioned that is we don't really know how to do this well. And this is a theme as in, even if we weren't under the current constraints, we don't really know how to balance independent agencies versus Congress versus the courts.

[01:00:00.40] And [INAUDIBLE] what I saw missing a discussion is this is not a US problem. As in, every single country that is not a pure dictatorship has a version of that problem inflected by that. So I'm curious to the extent that you want to comment on that.

[01:00:23.41] Are there mechanisms in other countries or other regions, say the European Union, that at least point to either, this is worse than what we have or get or don't wish for that, or maybe that points to why where legislatures are actually because they're not subject to these extreme supermajority requirements like they exist in the US, which was not mentioned at all that essentially prevents legislative action in practice?

[01:00:52.69] That have found ways to delegate more authority, say, to the European Parliament, or to national legislatures in that. So can we learn something from other regions that gets us out of this kind of mess where nothing actually happens because Congress can't actually act except in the most extreme circumstances.

[01:01:12.98] BLAKE REID: All right. We've been very provincial. This is extra credit for our panel who's not prepared for these extra territorial questions.

[01:01:20.16] GUS HURWITZ : I just brought up the global competition.

[01:01:23.10] BLAKE REID: All right. Thoughts on the international approaches or comparative approaches.

[01:01:28.30] TEJAS NERACHANIA: So the first thing I was going to say in response to exactly like what you said, which is that, I think what your question points to is, number one, a sort of myopia in US centrism in the American Legal Academy.

[01:01:39.82] Having said that, two, I think certainly we can learned something new. So we can certainly learn something by doing good comparative work. The question is, can we learn something that actually solves the problem?

[01:01:51.70] And I think the answer to that is maybe, no, because our institutional and constitutional and judicial constraints about actually trying to reform our systems to maybe have a more flexible approach to delegation and agencies. Like, everything that we try have tried to do in that regard over the last 25 to 30 years, has in the last few terms, been struck down. And so I'm not optimistic about our ability to draw those lessons from other jurisdictions and implement them here, but I think we could learn them.

[01:02:26.35] CHRIS LEWIS: So I'm a bit more patriotic about our system than that the idea that Congress being dysfunctional means that it will always be dysfunctional I think is not fair. We have 225 years of congressional action that we can point to of actual compromise, whether you liked the compromise or not.

[01:02:49.79] So we can create policy. We have to have the will to do it, and the public has to demand it. I would also argue that independent agencies or regulatory agencies are an example of that. If you take the spectrum that we heard Christopher, you, and Tim Wu lay out earlier of don't regulate too soon versus do nothing. Regulatory bodies are an option in the middle there because they can recalibrate, they can move quicker, and they can do it with expertise.

[01:03:24.35] And it was an option we've taken for decades, and all of a sudden, it's become controversial to do it, but it's possible.

[01:03:33.07] TEJAS NERACHANIA: It's not that I'm not patriotic like.

[01:03:37.43] BLAKE REID: Noted for the record.

[01:03:38.47] TEJAS NERACHANIA: Like no. So I think you could have a will of Congress people to do something about it. But in terms of changing the actual institutional structures, they're just too many constraints that are coming out of things like the Slaughter case that'll make it hard for us to create new agency structures.

[01:03:56.07] CHRIS LEWIS: That's true. Yeah.

[01:03:57.31] GUS HURWITZ : I will say I think the-- we've got two different visions of how to regulate. Don't just stand there, do something and don't just do something, stand there. And for those of us who are disposed, we could say, the Congress to be, don't just do something, stand there. We learn a lot from the things that the European Union are doing. And I think, hopefully, the European Union will learn a lot from the things that it has done as well.

[01:04:27.64] CHRIS LEWIS: And there's alternatives to regulatory bodies. I mean, you could beef up Congress's ability to legislate. Now,

it would take power out of the hands of the elected official by giving them more staff, more expertise, and giving more power to the staff, but I don't know how people would feel about that. So there's lots of alternatives in the middle.

[01:04:44.56] BLAKE REID: I think we've got time for one more quick question to Russ in the fifth row there.

[01:04:51.48] AUDIENCE: Thank you. So I'm just a simple country lawyer, and I'm hoping you can all help me with a constitutional question I have. So as I understand the unitary executive, the underpinnings of its constitutional basis with respect to agencies, it's that Article 2 gives the president and only the president the authority to direct executive action. And that's even true when the executive action is being undertaken by an agency created by Congress.

[01:05:17.61] If that's right, I think what I don't understand is what then allows the president to jump the tracks into when the instances where the agency is exercising quasi-legislative authority in rule-making? If the answer is, well, the Constitution gives Congress that authority and doesn't allow it to be delegated, why does it go to the president once the courts see that?

[01:05:40.09] And then if I'm right, or if that theory is right, it's not my theory, Paul. If that's the theory and it can jump the tracks, isn't the APA by definition unconstitutional insofar as it requires agencies to consider something other than the will of the executive?

[01:05:57.22] BLAKE REID: I asked for a really quick question. We've got the entirety of con law. Does anyone want to offer up a 30-second thought?

[01:06:07.66] CHRIS LEWIS: 10 seconds. I don't believe in unitary executive theory the way it's being proposed. And so that's your way out of the problem.

[01:06:15.38] GUS HURWITZ : So the delineation between executive and legislative authority. Blurry at times. I'm really interested to see what the court is going to say in this Slaughter opinion about that. If you look back at Humphrey's Executor, that was one of the key things that led to the court upholding the structure of the FTC at the time that it was doing quasi-legislative.

[01:06:38.28] It wasn't doing rule-making at the time, it was advising Congress on rules for Congress to adopt. But it's a fascinating question, and I think we're going to need to wait to see what the court says in Slaughter, and there's going to be a whole. There will possibly be more articles written about the Slaughter opinion by the ad law crowd than were written about Chevron. I'll say that.

[01:07:02.52] BLAKE REID: And before you go, Russ, I have to say, you have to come to my office after class to talk about your impertinence. But I would also point your attention to I think a sleeper case is the

Perlmutter case over the firing of the register of copyrights in the librarian of Congress, where it turns out that Schoolhouse Rock lied to us and telling us that there are three clear branches of government.

[01:07:24.86] We've got executive functions being done in Congress, and we've got to figure out where that line is. Lots more to talk about. But Gus, I think you said stand there, stand up and do nothing. What I'm going to ask everyone to do is to stay seated and do nothing. We're going to do a break after our next panel, which is going to come up right now. But before they do, please join me in thanking these guys for a wonderful discussion.

[01:07:50.24] [APPLAUSE]

Fireside Chat: AI Boom or Bust

https://youtu.be/EbQYjWyLz7k

[00:00:00.48] DRU NORTON: Hi, everyone. My name is Dru Norton, and I'm a second year law student here at Colorado Law. I also serve as vice president of the Silicon Flatirons Student Group and incoming executive director, executive editor, and symposium editor of the Colorado Technology Law Journal. I'm excited to introduce our next panel-- AI Boom or Bust? A fireside chat on lessons from the Telecom Bubble, led by Phil Weiser, Colorado Attorney General and former Dean of Colorado Law, as well as founder of the Silicon Flatirons Center.

[00:00:33.48] We'll also be hearing from Larissa Herda, retired chairman and CEO of TW Telecom. She's currently an active member on the Bridge Entrepreneurs Network Colorado board. Finally, we'll also be joined by Seth Levine, co-founder and partner of Foundry, a venture capital firm based here in Boulder. We're excited to welcome them to Silicon Flatirons and hear their perspectives. Thank you.

[00:00:59.36] [APPLAUSE]

[00:01:03.54] PHIL WEISER: Thank you for the wonderful introduction. Both Seth Levine and Larissa Herda are dear friends of mine. And when I was asked by Matt, What do you want to talk about that fits on the agenda, and who do you want to talk about it with? this was my answer.

[00:01:18.78] You should know there are three bubbles that we're going to be talking about, mostly the telecom bubble and the AI bubble. We'll also probably talk a little bit about what was known as the internet or dot-com bubble. For those who are the younger students, there was a time, circa 1999, when, if you dot-com after the name of your company, it skyrocketed in valuation, so famously pets.com.

[00:01:47.44] A lot of those companies literally and figuratively crashed and burned. But it's worth noting some of the companies.

Amazon.com ended up being extremely valuable. So internet was real, but all the other companies turned out to be not sustainable.

[00:02:03.40] The telecom bust is the underlying telecom infrastructure that was built and it carried the internet traffic. And there's some reasons why that infrastructure, some would say, was overbuilt or not built on a sustainable economic foundation. A lot of those companies cratered. Much of the infrastructure remained in the hands of other companies.

[00:02:25.96] And so in some sense, the AI bubble may look more like the telecom, because, whether it's data centers or other physical infrastructure that's being invested in right now, the chances are high it will end up somewhere. But obviously, that's one of the questions people are asking. And I think it's fair to say each of these bubbles have different properties, and each of us have different levels of depth of knowledge on each of them.

[00:02:52.58] So I'm just going to let both Larissa and Seth start first, which is as you think about these three separate bubbles-- we'll talk more about what it means to have a bubble-- anything you want to add to my description, or any thoughts that you have as you reflect on each of them? Seth?

[00:03:07.23] SETH LEVINE: Well, first of all, I want to say, well, thanks for having me. I didn't know we were supposed to bring notes. Larissa's got a bunch highlighted notes.

[00:03:13.61] LARISSA HERDA: Wait, wait, wait, let me just say--

[00:03:15.81] SETH LEVINE: Can I borrow a page?

[00:03:16.77] LARISSA HERDA: When Phil-- I've known Phil-- Phil asked me to speak when I first became a public-- actually, it was first-- I wasn't even a public company CEO yet. Phil asked me to speak. Or maybe I was. It was 1999 or--

[00:03:28.90] PHIL WEISER: 1999.

[00:03:29.61] LARISSA HERDA: I became a CEO in 1998, and I had never spoken publicly in my life. I was a CEO. And he asked me to come and speak to the law school. And they were learning telecom law, which I didn't even know was a thing, actually. And they were learning what I was doing. And I was so-- it was the most amazing experience. And so I've known him for a long time.

[00:03:56.75] So when Phil asks me to do something, I usually say yes. And then I regret it later. So I regret it only because I had to really study and remember 25 years ago or 20 years ago what happened to us. It was such a traumatic time in my career, but it was also a pivotal time. And it was what led to my success as a CEO.

[00:04:15.93] PHIL WEISER: Well, let me ask that, because then you're getting to real area. Being the CEO of a company during a boom, which is like a sugar high, and then a bust, which is like things crashing down, that's intense. How was that experience?

[00:04:31.05] LARISSA HERDA: It was one of the most difficult times in my life because, to reel it back a little bit, I became a CEO under stress. The CEO quit. I went to work for Time Warner, was really Time Warner Cable at the time, to run sales for their company because they had invested about $150 million building fiber networks with their cable brethren. And they weren't bringing in any revenue.

[00:05:04.01] And I worked at a company that had just gotten bought by WorldCom, and I thought I was going to have a great career there. But I was recruited to run sales. I ran it for about a year. The CEO quit. They made me CEO, and my interview wasn't an interview. My response was, but I don't know this. I don't know that. I don't know this.

[00:05:25.97] I can't read a balance sheet. I have no business background. I'm just a sales person. And they said, but you know this business. And oh, by the way, you have to go out in three weeks and raise $400 million of high-yield debt in the market. So in June, I became CEO on my 40th birthday. And in July, I raised $400 million of high-yield debt.

[00:05:47.41] And then we took the company public a year later, so lots of stories there for another day. But we ran the business to show growth. We created the strategy around the assets that we had, which fortunately were really good-- lots of fiber. We were going into buildings, but we really became a carrier's carrier.

[00:06:08.57] So when the internet busted, or when WorldCom went bankrupt, all hell broke loose. And they were a 14% customer of ours. I had 3,000 employees at that point. And WorldCom was a capital contagion event. The capital markets closed.

[00:06:32.17] We fortunately had money in the bank, but we couldn't support 3,000 employees anymore. We didn't know it was going to go on, because most of our customers were going bankrupt. From an emotional standpoint, when we laid off 1,000 employees, on the employee call, I cried.

[00:06:48.41] And what was so interesting was that that brought employees together, that even the employees that we laid off were sending me letters, telling me they understood that I wasn't just doing it to make our numbers better. I was doing it because I cared. And it was a seminal moment for not just me as an executive to understand what-- how to run really what was important in business. But it also set the stage for the future about the culture of our company.

[00:07:16.79] PHIL WEISER: Seth, you're a venture capitalist who started your career working in some of these telecom companies, and

you got through that experience. You're now watching this new moment. Obviously, you cannot be a VC and not thinking about AI. As you look at these bubbles, what are some of your reflections?

[00:07:35.81] SETH LEVINE: So first, let me just say that having been in the telecom industry at the same time Larissa was, everyone always looked up to Time Warner, like it was-- and when we were cutting these weird reciprocal deals that didn't really feel like they were the right things to do-- I say "we" meaning the companies that I work for-- Time Warner was always seen as the cleanest. And I think it's because you were a carrier's carrier, and you benefited from having rights away from Time Warner, the parent company. But it's worth saying. We all looked up to TWT.

[00:08:08.14] I started my career in banking, and we raised a bunch of the high-yield debt for-- it was before you were CEO of Time Warner, but for a bunch of these firms. And I remember adding up all the market penetration numbers from all of these companies and thinking, there's a 300% market here. And that's not going to work. But that was not my job. My job was to crunch numbers and give it to the higher-ups at the time.

[00:08:31.06] So let's talk about the differences between these bubbles. I actually think all of these bubbles are quite different, and they were all caused by something slightly different. And I think that they'll have different outcomes and different effects. And we'll talk later about whether bubbles are actually bad, and there's some reasons to think that bubble behavior is how the US innovation economy actually works and works most effectively.

[00:08:53.78] PHIL WEISER: And just to be clear, we had a railroad bubble in the US. So we've had bubbles as part of economic development, technological innovation. Almost every technology you could look at, there was some type of bubble behavior. So when we use the term here, we're using it-- call it clinically, not pejoratively.

[00:09:09.84] The pejorative term, you may recall there's this famous tulip bubble, right?

[00:09:13.76] SETH LEVINE: Absolutely, tulips, oil, rail, right--

[00:09:16.60] PHIL WEISER: But sometimes, they're not based on something that is about real economic and technological progress. Sometimes, it's based on pure speculation. We're talking about clinically, these are areas of the economy that are changing. But people get really excited. Speculators speculate. And then we have a bubble.

[00:09:33.14] SETH LEVINE: I think that's a really important differentiation. There's an underlying ultimate rationale, like economic rationale, and there was even for the internet, right, as we--

[00:09:41.36] PHIL WEISER: Amazon.com.

[00:09:42.10] SETH LEVINE: --we now experience. But by the way, Chewy-- it's not-- pets.com famously failed. Companies were spending way too much money on marketing. They didn't understand unit economics. Like, all of those things were true back in the mid-90s. But also, there are a lot of companies, Chewy is a good example, which is essentially doing what pets.com tried to do.

[00:10:01.64] So it's not that there wasn't ultimately a business rationale for it. It just was that people got carried away with it. And that was that internet bubble, which was, people saw an opportunity. The market just simply didn't develop as fast as people either thought or hoped it would. And it was a bit of a gold rush.

[00:10:16.32] And so everyone-- another bubble, by the way. Everyone was jumping into the dot-com. And I remember that, if you're old enough like me to remember this. All of a sudden, the TV ads for companies-- where it was like, whatever, Acme now is acme.com. They were like, everyone was trying to get a little bit of that pixie dust. That might be going on a little bit in the AI.

[00:10:36.54] The telecom bubble was a demand bubble. There was a lack of demand bubble. The reason that all these telecom companies were doing these swap agreements and other sort of nefarious deals, some of which were technically legal at the time, even if they weren't appropriate-- a bunch of them were not legal.

[00:10:55.00] Global Crossing comes to mind as a company where a bunch of people went to jail. Even locally, Quest did a bunch of deals that--

[00:11:02.36] LARISSA HERDA: Old customers of ours.

[00:11:03.74] SETH LEVINE: I'm sure, yeah, that were-- and the Quest deals. Global crossing did a bunch of deals where they did a bunch of swaps, where no money changed hands. But both companies got to book revenue, and that didn't sound right. And so that's why that didn't work.

[00:11:16.12] And in Quest's case, they were basically trying to hit revenue targets by essentially frontloading their own, let's say, investment, if you will, into customers that were then buying from them. And the CEO of Quest went to jail for that. That was different behavior than some of the other things that we'll talk about that were going on there.

[00:11:35.54] But to me, that was like a demand bubble. There was not quite enough demand to satisfy the amount of fiber that had been built in the time frame that it needed to be purchased. And so that was what that was. AI, I think, is different. I think that the bubble, if you will, in AI is more around-- or the challenge with AI is more around business model.

[00:11:54.45] There's obviously a huge amount of demand for AI services. Anthropic just upped their revenue forecast for next year. This is a company that didn't exist six years ago. And they're going to do, by their own measure, $80 billion in revenue next year-- sorry, this year, 2026.

[00:12:12.19] So there's clearly demand, but there's a business model challenge. OpenAI's obviously revenue is a little bit lower, but it's in the same boat. They've been growing quickly from a top line basis. But the cost of providing that service is really, really, really high.

[00:12:24.17] PHIL WEISER: And there was some of that in telecom, some of that telecom. And Larissa point, you're raising money to make investments. But you're not making money year over year, because you're spending so much money making investments. In order for that to continue, you have to keep being able to raise money on the promise you're eventually going to make enough money to pay it back.

[00:12:44.59] And what's the phrase? If the music stops, before you have a viable business, you go under.

[00:12:51.95] LARISSA HERDA: Well, bandwidth demand was growing, and the thesis was that it was going to be infinite. And to some degree, it is. I mean, when you think about telecom industry, the thing that was good about the bubble and the bust is there's all this fiber infrastructure out there now that AI is now able to ride over. And it's created this innovation in business.

[00:13:19.67] And so there's bad things to it. There are a lot of people who lost a lot of money, crushed a lot of businesses that almost crushed ours. But we did a bunch of things that prevented that, and I think a lot of it was the discipline that we had. But pricing really fell. And I think that's one of the questions I would have about AI.

[00:13:39.21] What happened with us was that we would sign up long customers on even a one-year or three-year or five-year contract. And when I came up due, there was so much competition, especially in the carrier-to-carrier space, we didn't have a defensible market position. Nobody did. And so what we did after WorldCom went under, and our 14% revenue customer was about to cause us to go bankrupt, is we changed our business model. And we focused on diversifying our revenue stream.

[00:14:10.73] We built fiber into enterprise buildings, but we always maintained a business plan for every building we went into. We had a minimum revenue requirement so that we-- a minimum return requirement so that we could pay back the infrastructure that we had spent millions and millions of dollars to put the whole network together. And you have to look at what's going on with AI, and applications, all that stuff, that's otherworldly to me.

[00:14:41.17] But they have an infrastructure investment that's very telecom-like, the data centers, the power requirements, the long-term leases. Capital is someday going to look at that and say, well, what are we going to get? When am I going to get paid back? And I think that's where I'm interested to understand better where that's going to go because it's an extraordinary amount of construction that's going on.

[00:15:08.25] SETH LEVINE: Unbelievable. So we actually talked earlier. And we're like, let's not have this conversation in our premeeting because we probably are going to have a discovery together. And I think part of what we talked about was like, we don't have all of the answers here. I do have a perspective, though, which is that, yes, over 25-year period, we managed to use up the bandwidth that was built. But it was over a much, much longer period of time.

[00:15:31.35] LARISSA HERDA: Which really hurts returns.

[00:15:32.71] SETH LEVINE: Absolutely. And so I think, to me, AI-- and that's why I said there was a demand problem that ultimately fueled the fueled the bubble that was telecom, or maybe caused the bubble to crash or to burst. But I think it's slightly different in AI. Yes, it's telecom-like in the sense that the dollars are really high, and there's a lot of infrastructure that needs to be built.

[00:15:51.73] But I actually think that the demand is outstripping supply. The problem there is more to me a fundamental economic problem. Now, that problem also a little bit existed in the telecom world, for sure. And kudos for you for actually understanding your unit economics because when I was a banker to telecom, I had this conversation with a lot of CFOs and CEOs who actually didn't understand their unit economics.

[00:16:12.01] And I did a bunch of analysis, including eventually for a company that I worked for, where I was trying to describe which products were actually cash flow positive and which ones weren't. And people actually didn't care because they were just chasing revenue.

[00:16:23.55] LARISSA HERDA: Right, and they were also-- the theme from the analyst was asset accumulation. I remember in 19-- it was a few months before I became CEO. Time Warner was trying to get rid of us because we were on their balance sheet, and we were not strategic to them. They were happy to sell us.

[00:16:40.94] XO came in. XO was a competitive player back in those days to kick our tires. And the chief operating officer was taken on a tour by our operations guy who talked about cash flow, cash flow, cash flow. And my operations guy came to me in a panic after the meeting. He goes, I don't think it went well because-- he yelled at me and said, what are you worried about cash flow for? All we care about is putting the network out there, getting the network, put it out there.

[00:17:10.24] And so that was like, I went to Time Warner because they were making an offer. I said, Time Warner, do you really want them-- because it was their network, too. Do you really want them to be owning your network with that philosophy of cash flows not even a thought?

[00:17:25.74] SETH LEVINE: And a good sign that we were in a bubble in telecom is that a lot of telecom companies were valued by fiber mile.

[00:17:32.78] LARISSA HERDA: Right.

[00:17:33.08] SETH LEVINE: Right? So it's like, how much fiber can you put in the ground? That's what you're getting valued by. Now, the equivalent, which is not happening in AIs if you were valued by the GPUs that you had, under contract or something like that-- and that's not how Anthropic are being--

[00:17:46.96] LARISSA HERDA: How are they being valued?

[00:17:48.42] SETH LEVINE: Well, that I can't tell you.

[00:17:49.38] LARISSA HERDA: OK. [CHUCKLES]

[00:17:50.60] PHIL WEISER: Let me go to--

[00:17:51.30] LARISSA HERDA: I can't figure it out.

[00:17:52.88] SETH LEVINE: --of, and that's--

[00:17:53.56] PHIL WEISER: Well, I'll tell you. They're being valued in part on a prediction of how much of our future economy is transformed by AI. And so that means these technologies that tend to get sky-high valuations-- the premise is, they're transformative in a way that will have huge economic implications. And I think, as a general matter, I do think AI is going to have huge implications. Whether that can justify the valuations, we can't go super deep there.

[00:18:25.84] But let me go to a point. Larissa raised it. Seth raised it. Circular deals-- you heard that phrase. There's another concept. And I want to go back literally to the lecture that Larissa was talking about, which I'll call opportunistic motivated behavior to generate what has the appearance of revenue that's not sustainable.

[00:18:44.98] That's a slightly broader term than circular deal. Circular deals are a form of opportunistic generation of revenue that's not sustainable. Some of you will remember this term-- "reciprocal compensation." That was literally the topic that Larissa joined to talk about and was impressed that law students were familiar with it. So Larissa, what was that reciprocal compensation issue? And how is it a form of opportunistic revenue that was not sustainable?

[00:19:12.54] LARISSA HERDA: So I think it goes into the category that, in our industry, in the competitive telecom industry, there were different business plans. We were a fiber-based plan. We really liked

mostly just using our own network, best margins. Especially when we started selling to enterprise customers, we created a defensible market position. And we could have some price stability.

[00:19:37.72] There were companies out there who-- and they got better valuations, by the way, than we did for a long time that used other people's facilities only. They may have had Lucent lend them a switch, and that was a whole kind of funding of your customer base for Lucent, which they didn't account for properly, I guess.

[00:20:01.52] And a lot of these companies were called smart builds. So they didn't build fiber. They had the switches, and the goal was to put as much revenue as possible through it. And I think this class obviously were laughing at her. So they all know about it, which is so interesting to me.

[00:20:21.76] So they could make a lot of money by selling their services to the internet providers who, when the services were dial-up and going through the switches were-- just an enormous amount of traffic was going through these switches. And then the incumbents were having to pay them. And it was this transient revenue that we didn't see as a good long-term strategy.

[00:20:50.52] At first, the incumbents actually tried to make us pay lots of dollars for it because they thought we were going to be a consumer business. And when I first came to work for the company, the company was trying to get the lowest response rate. And I said, well, if they really want a high rate, you can give it to them because we're not going to sell to consumers.

[00:21:08.84] And if they were terminating on our network, we would have made a lot of money. But we didn't want to be in that business. There was a part of it when you have five switches that you were. But these companies were actually creating farms of traffic going from these internet providers to these switches and then charging the incumbent carriers and making a lot of money on it, and it convinced the marketplace that that was actually a real business. And they didn't last very long, needless to say.

[00:21:39.07] SETH LEVINE: I'm just laughing because there was actually a version of this. This was back when it was still at Bancorp. We were banking a company that was doing this. They were basically making money on these exchange rates. And the CEO called all of us and said, I need to meet, but I need to meet in person. I don't want to have this conversation over the phone.

[00:21:54.91] And we were like, OK. So we go into this conference room. Again, I'm the most junior person in the room, so I'm just sitting there listening. And he explains to us, yeah, we make money through this inter exchange rate. But I need to tell you, we've actually turned the switches off. So we're actually not routing the traffic back and forth.

We're just routing it most efficiently. But we're saying we're routing it back and forth.

[00:22:15.19] LARISSA HERDA: Oh, my god. I didn't know that.

[00:22:16.47] SETH LEVINE: And so-- I mean, to the credit of the bank that I work for, we dropped them as a client. But I mean that is how--

[00:22:22.25] PHIL WEISER: Well, but that literally takes us to the next point. And we've gotten at it through several directions. We talked about WorldCom. We talked about this behavior, other firms engaged in similar fraud. And the question I wanted to ask you both-- you look back at this telecom bust. One of the things that can happen in the boom side is people start doing things that are not real transactions.

[00:22:46.53] Quest was another company that engaged in-- they called them swaps that were not real. And you ended up booking-- Seth will explain this-- booking revenue today that wasn't real revenue. And you made yourself look like you were hitting numbers, but you were literally setting yourself up for a fall because, ultimately, you'd have to admit there there.

[00:23:09.33] So what lessons of that boom period-- Larissa, I want to give you the first chance. You clearly lived a lesson, which is stay disciplined, stay true. Don't give in to the gimmicks. That is so much easier to say than to do.

[00:23:28.39] LARISSA HERDA: It's hard to do when the analysts are telling you that you have a hole in your business plan because you are not doing this, and you know that's not a real business. And it was-- I--

[00:23:38.85] PHIL WEISER: Where did that come from?

[00:23:39.75] LARISSA HERDA: I still think I have analyst reports that--

[00:23:42.81] PHIL WEISER: How did you stay strong? A lot of people be like-- and by the way, the quote I gave is from the 2008 mortgage bust, which was the whole-- if you haven't watched the Big Short, incredible movie. I believe Citicorp, which was financing these mortgage-backed securities, said, while the music's playing, you got to be on the dance floor. That was the opposite of Larissa. Larissa's Like, I don't like this dance. I'm not getting on the floor.

[00:24:10.33] LARISSA HERDA: Well, here's an example that we were told everybody was doing. And about three years, maybe two or three years before Enron fell, they came in and met with our CFO. And I cannot remember. These deals were so weird and complex, and Seth's probably more familiar with them than I am.

[00:24:32.63] They told us that everybody was doing something with their fiber that created this revenue-- this vision of revenue, I should say, over a four-year period. And then my CFO said, well, but what are

the CEOs-- you said all these companies are doing it. And they said, yeah.

[00:24:54.33] He goes, well, what do the CEOs say or those companies say when you show them that it actually is a cliff, a cliff vests in four years. And Enron's response was, well, they don't plan to be around in four years. So my CFO comes to me with this. And I said, oh my god, Enron's a customer of ours.

[00:25:12.25] And I stopped our sales force from selling to them anymore because I thought something was wrong in the company and that they were going to go bankrupt. And we were going to be left holding the bag of their bad debt. And my salespeople were furious with me because, why wouldn't you sell to Enron? There's such a big company, and we're getting all this business. And, I said no.

[00:25:32.56] So when Enron went under, it wasn't a problem for us. But then two years later, Enron came to us six months before they went bankrupt and tried to sell us their entire long haul network for $750 million. And they would guarantee the revenue for five years to pay 100% of that off.

[00:25:51.50] PHIL WEISER: Can you say circular deals?

[00:25:52.80] LARISSA HERDA: And I said, why would you do that? [CHUCKLES] They needed the $750 million of cash. And so I said, well, sounds too good to be true. So no, we're not interested.

[00:26:04.48] SETH LEVINE: Just to be clear, the way those deals would work is I would agree to sell some dark fiber to you for whatever, $100. You would agree to sell it to me, some other dark fiber, for $100. And we'd swap $100. And we'd each get to book that revenue, even though no money ended up changing hands.

[00:26:18.36] LARISSA HERDA: Right.

[00:26:18.66] SETH LEVINE: That was the deal.

[00:26:19.20] LARISSA HERDA: And it didn't make any sense to us.

[00:26:20.60] SETH LEVINE: We actually, in-- another company I worked for had-- Enron was an investor. And the way that they ended up being an investor was we actually did some dark fiber deals. And ours were different than these. They basically gave us dark fiber, and we gave them equity. So there was no revenue involved. But actually negotiated that stuff with Jeff Skilling across the table two or three years before he went--

[00:26:42.08] PHIL WEISER: CFO from Enron ended up in jail, for those who don't know.

[00:26:45.88] LARISSA HERDA: I think it does get to-- one of my main themes has always been discipline. And I think that-- and when the narrative and the optimism outruns capital discipline, that's when

companies get in trouble, when you don't understand your unit economics, when you don't do the research to understand it, when you don't understand what the competitors are doing.

[00:27:11.88] And we had an idea. It was a bit of a surprise how bad the fraud was in our industry. And I think the regulators missed the boat on that. Sarbanes-Oxley was a bit of an irritant, but it was a good thing because it made people have to be honest. But to me, that was really weird that you had to be forced to be honest. But that was-- [CHUCKLES] that's ultimately what happened.

[00:27:36.52] And I really think, because we really were very by the book, and I think we had just an incredibly ethical group of people, our entire company was run that way, you could not do something like that in our company. And I don't know if that's happening in the--

[00:27:55.70] PHIL WEISER: All right, so let's go to this because obviously Larissa was able to have a disciplined, ethical culture. We could have a whole series of conversations. I hope some of you get involved in the Daniel's Ethics Program here that the law school does, collaborating with Silicon Flatirons. How do we know, on the current AI landscape, which of the companies have a disciplined, ethical culture versus those that are set up in ways that are not sustainable?

[00:28:19.12] SETH LEVINE: I heard you laughing, so I think we know.

[00:28:21.56] PHIL WEISER: How do we know?

[00:28:22.26] SETH LEVINE: No, well, I think it's really hard to say. And I think that's a little bit of what's going on with-- people are very skeptical of OpenAI. I don't quite understand. I feel like there were a lot of companies back in the telecom bubble. Another sign that you're in a bubble is when your gross margin is negative, and you claim you're going to make it up on higher volume somehow. I mean, it just doesn't make any sense. And I don't know what the number--

[00:28:43.34] PHIL WEISER: Everyone remember the Saturday Night Live skit about the bank, the change bank?

[00:28:47.48] SETH LEVINE: Right.

[00:28:48.06] PHIL WEISER: You come in with a dollar, we give you 4 quarters. How do we make money? Volume.

[00:28:53.04] [LAUGHTER]

[00:28:54.72] SETH LEVINE: And the difference was they would give you 5 quarters, and then they'd make it up on volume. So I question the gross margin for OpenAI. On the consumer side, I just don't know how that's working. And I think something's going to have to change from what you can-- from what I can tell from looking at Google, for example, and how they're leveraging AI, I think on the enterprise side, there is profit to be made.

[00:29:17.06] And I think that's why Anthropic has become such a darling, if you will, for investors. And they keep raising more and more money. But Phil said this earlier, but I just put a finer point on it. If you're valued more than the present value of your existing cash flows, then the only rationale for is that growth. And the more you're valued, the more massive that growth needs to be.

[00:29:39.04] And I think there's going to be a huge amount of pressure for all of these companies, given their valuations, multiples of revenue that are significant to grow, grow, grow, grow, grow. And I think that creates environments where people can sometimes decide they want they're valued on fiber miles. So they want to put more fiber in the ground.

[00:29:55.78] And they're ignoring their unit economics, which is-- I mean, from my perspective, having invested in, I don't know, hundreds of businesses, that-- it works only if there's a greater fool. It only works for a very short period of time if you get taken out. But if you're trying to actually build a business, then you need to care about your unit economics.

[00:30:13.64] And I think that my sense is that there are some companies, Anthropic would be one, that I think do care about unit economics and probably have good unit economics. I've interacted with Sam a little, Sam Altman, OpenAI, a little bit over the years. I don't know how much I trust him.

[00:30:30.21] PHIL WEISER: Well, this is an interesting question because we're going to watch it. There are people who said a statement with a little more of an edge than you just said about Bernie Ebbers. Bernie Ebbers was a darling of some Wall Street analysts.

[00:30:44.45] And there were people like Larissa-- and if you want to read Dan Caruso's book, Dan explains it in his book, who said, I got to see him. I didn't trust him. You left WorldCom. Did you not trust that culture? Did you know it when you were in it?

[00:30:56.77] LARISSA HERDA: Oh, I was only in it for about two months because they closed the deal at the end of '96, and I'm joined Time Warner in February or March of '97. Oh, yeah, I mean, you should have seen the parties they had.

[00:31:12.13] PHIL WEISER: So Dan, in his book, talks about a--

[00:31:15.95] LARISSA HERDA: By the way, I never went to 1, but I heard about them. And it was after they had their first sales party. Our employees at MFS were calling me and saying, please take me, please take me, because oh, my gosh, they're doing it in the bushes. It was really quite amazing.

[00:31:30.79] PHIL WEISER: Dan, in his book, says he was asked to validate a transaction that was one of these sham type transactions we're talking about. And he said, no, I won't do it. And then he did that

with the CFO of WorldCom, who also ended up in jail. And that's why he's left the company.

[00:31:46.89] Last quick question because I want to get some from the audience-- any lessons from that era around how law and regulation, I think, Larissa, you hit a big one, which is, if there's fraud happening that there's not oversight for, it can get worse. So that's one lesson. The [INAUDIBLE] one is, if you create regulatory induced opportunist behavior, that is a cause maybe to be worried about. Anything else comes to mind?

[00:32:14.37] LARISSA HERDA: You mean for--

[00:32:15.73] PHIL WEISER: Today's moment.

[00:32:16.47] LARISSA HERDA: --today's moment?

[00:32:17.35] PHIL WEISER: What have you learned--

[00:32:18.15] LARISSA HERDA: Well, I think-- I think--

[00:32:19.21] PHIL WEISER: --regulators today should know based on what happened back then?

[00:32:21.91] LARISSA HERDA: I think they missed the systemic interactions between the businesses and the systemic risk associated with that.

[00:32:30.93] PHIL WEISER: Resilience of--

[00:32:31.69] LARISSA HERDA: Yeah. And I think that they focused on things like interconnection and competition, which was fine. I don't think anyone could have imagined so many people would have committed so much fraud. I mean, it really is extraordinary when you think about it.

[00:32:47.89] The one regulatory thing that I would say, that it's just really more my observation on the enormous amount of power that is being paid for by somebody. And it's not necessarily the companies that are building. They're paying for their new infrastructure.

[00:33:06.79] But when the grid has to be updated because of what they're doing, the ratepayers seem to be on the hook for that. And that feels wrong to me. There needs to be some-- if there's any regulation, there needs to be some thought put into, why would the ratepayers have to fund that?

[00:33:27.17] SETH LEVINE: And I think that actually, some of the AI companies are starting to recognize that they've got a-- even if the regulatory agencies don't catch up, that they've got a PR problem. If they go into a community, open this great data center, and then everyone's--

[00:33:39.15] LARISSA HERDA: Bill goes up.

[00:33:39.99] SETH LEVINE: --prices double or whatever it is. The other, I think, real lesson is just like, transparency and sunlight-- it was really important. And I think what we were missing a little bit in the telecom bubble, not less so in the internet bubble-- I think that was just people being irrationally exuberant. But in the telecom bubble, you just did not know what was going on.

[00:33:56.05] It was like the credit-- it was the bubble, the mortgage bubble in 2008. People literally were just not disclosing what they were doing. And I think that now a bunch of the companies we're talking about in AI are private. But to the extent to which they're public, that the disclosure of what's actually happening, there's a big debate now about how fast you can depreciate GPUs as an example.

[00:34:16.40] And the reason we're having the debate is because people actually have to put their depreciation schedules out there. So that's not a topic that's interesting to talk about. Like, should it be five years, three years, or seven? But at least we know what it is, and I think that's actually probably more important than anything else.

[00:34:30.66] PHIL WEISER: First question comes from a student, and we got lots of them here.

[00:34:41.30] AUDIENCE: Thank you. So thanks for the primer on that. That was really interesting. One question I have about looking into AI now-- I know you said GPU depreciation schedules aren't interesting, but I'm--

[00:34:52.90] PHIL WEISER: [CHUCKLES] They're interesting to me, but I didn't think they'd be interesting anyway.

[00:34:56.26] AUDIENCE: If we compare to fiber and that kind of infrastructure, right now, obviously, for data centers, energy, steel, all of those useful long-term assets, GPUs, lots of NVIDIA's valuation, lots of these companies, the technology advances so quickly that, arguably, maybe they're not that useful. Or maybe they don't even work in 5 to 10 years. So was there a similar analog in telecom of an asset that maybe didn't last as long, or was more of the time?

[00:35:24.04] LARISSA HERDA: Actually, the fiber is still there. The equipment on either side is what determined the speed. So the technology changed. We actually were told by Cisco that we dragged the incumbents kicking and screaming into ethernet because they didn't want to do ethernet, because it cannibalized their existing private line business. So there's that. It's the creative destruction of capitalism.

[00:35:50.18] But that's a good thing because ethernet was a much better solution and much more scalable. But not really. I mean, the problem with fiber, especially for the long-haul providers, is if they happen to build it in the wrong place, it was kind of a sunk cost. We

didn't have that issue because we were doing business plans for every single building we went into.

[00:36:12.08] So unless a company went out of business, and we had expected to get revenue for the next 5 or 10 years, and we didn't, I'm sure that happened. But I can't think of anything really.

[00:36:23.76] SETH LEVINE: Yeah, the only analogy I can think of is-- because when we're talking about depreciation schedule for GPUs, you're really talking about, how profitable is a unit of revenue? Because if you have to depreciate over a shorter period of time, your costs go up. And the only thing I can think of that's similar to that is you could sometimes cut these long-term lease deals. But you could use it very quickly, but you'd actually depreciate the lease over a longer period of time. That may be the closest thing.

[00:36:46.64] LARISSA HERDA: Yeah, and we didn't do that.

[00:36:48.20] SETH LEVINE: But it wasn't as prevalent, and it probably wasn't as big a deal.

[00:36:50.74] PHIL WEISER: One last question. I'm glad I don't have to pick.

[00:36:59.82] AUDIENCE: So early on, Seth, you said, obviously demand is really high. Look at how much revenue is being made by these AI companies. And then you spent the entire rest of the talk talking about different ways to juice your revenue as a company. So would you like to take a moment to speak to that?

[00:37:17.40] SETH LEVINE: Yeah, I guess I want to push on that for a second because I'm not sure I was talking about how AI companies should juice their--

[00:37:22.04] PHIL WEISER: No, no, no, no, let me rephrase the question. How do you know that the revenue stated by these AI companies is real, robust, sustainable, recurring revenue, not what with the benefit of hindsight and telecom bust we might call fake, made-up revenue? How do we know that?

[00:37:39.62] SETH LEVINE: I mean, my sense is-- and again, I think the point that I was trying to make is that there was this demand problem in telecom. It took a long time for that demand to come up. But in the AI world, there's a ton of demand. And I mean, I'd start by just like looking around.

[00:37:53.26] Like, every business in the world now is trying to figure out how to leverage AI. It's hard to tell with the private companies, because obviously they're not disclosing. But if you go look at Google's disclosures around how people are using Gemini, particularly in the enterprise, you're seeing significant demand from the enterprise.

[00:38:12.74] I mean, generally, you think as technology matures, pricing goes down. I actually think we might end up with at least a blip of increased prices in AI because I think we're, in some respects, undercharging. And I think that's where OpenAI is going to have a problem, because their revenue base is primarily a consumer revenue base. And I think there's some limits.

[00:38:31.92] Maybe that's why they're trying to rush to create new products, because they recognize that, based on their current economics, they're going to lose money, maybe on a gross profit basis for the rest of their lives. And so I think they're trying to layer on some new products on top of that so they can charge more, but consumers tend to be more sensitive to that. But from what I've seen in enterprise AI, there is-- I don't want to say unlimited demand, but there's a massive amount of demand.

[00:38:54.32] LARISSA HERDA: So you think the applications could end up justifying these high valuations.

[00:38:59.32] PHIL WEISER: Well, and I wanted to go push on that because this is similar to the telecom and internet world, which is, there are people who build infrastructure that enables applications. And so for example, no question, Google, Meta have got huge value from the internet, broadband world.

[00:39:18.63] But there are other companies that build enabling infrastructure that aren't around anymore. And so the question I guess back to you is, when you're saying there's all this value there, how do we know where in the value chain it is? And which companies are going to be the ones to benefit from it?

[00:39:34.31] SETH LEVINE: I mean, interestingly, I'm going to say something that might seem-- I don't know if it's controversial or not. But I mean NVIDIA is one of the most valuable companies-- some days, it's the most valuable company in the world. Traditionally, when you look at markets like this, the infrastructure players actually don't end up doing very well. So I think that people are maybe discounting the efficiency, the changes in how these models actually work and run.

[00:39:57.43] And by the way, there's a difference between the inference and the training. And obviously, NVIDIA chips do both. But when you're spending a lot of money on training for a period of time, at some point, the models are trained mostly. You're incrementally training. You're not training the entire model again.

[00:40:12.89] And I don't know that the markets have maybe absorbed what trajectory that actually looks like. So I mean, I don't think you make money by shorting NVIDIA. But I think, if I were to pick a company that I was a little worried about, I would pick the infrastructure companies. Larissa said this, but I'll say it again. I'm more bullish on the application layer because I think that is more likely to-- that's where the value ends up getting driven.

[00:40:36.23] LARISSA HERDA: Well, and they're the ones that actually really benefited from the fiber build-outs, too, when you think about it. It was the companies that were buying the cheap capacity ended up doing better than the infrastructure.

[00:40:47.97] SETH LEVINE: To be clear, when we--

[00:40:48.95] LARISSA HERDA: Did OK, but--

[00:40:49.83] SETH LEVINE: Those companies are like Meta and--

[00:40:51.87] LARISSA HERDA: Right, right.

[00:40:52.95] SETH LEVINE: --and Instagram. Those are the companies that rode on the fiber networks and benefited from that.

[00:40:56.67] LARISSA HERDA: Right.

[00:40:57.11] PHIL WEISER: That'll be interesting to watch. Can we thank our wonderful panelists?

[00:40:59.17] [APPLAUSE]

Panel: Using AI Tools in Significant Decisions

https://youtu.be/8PEmpU5_r70

[00:00:01.48] MATHEW YAEGER: Our next panel is using AI tools in significant decisions, moderated by Professor Margot Kaminski of the University of Colorado Law School and featuring Stevie DeGroff, First Assistant Attorney General, Technology and obviously, Protection of the Colorado Attorney General's Office. Phil Gordon, Shareholder and Co-chair of the Privacy and Data Security Practice Group, Littler Mendelson. Nicholson Price, Professor of Law at the University of Michigan Law School, Calli Schroeder, Senior Counsel and AI Human Rights Program Lead of the Electronic Privacy Information Center. And Representative Brianna Titone, State Representative of the Colorado General Assembly.

[00:00:38.64] MARGOT KAMINSKI: Thank you so much. And we'll get this started, even though we've got folks coming in, because you can see, I have the pleasure of moderating the largest panel. We have six people for the price of five, which means I'll do relatively little talking, even though this is a space that I've spent a lot of time in. I think I want to tee up this panel in the context of this larger conference by saying that we're going to be talking about an area that is an example of the adversarial federalism that Tejas mentioned on the prior panel.

[00:01:14.89] On the one hand, we have a situation where states are rapidly passing AI-related laws and even more rapidly proposing them. I think the latest number that I saw was that even in the last month, we've got something like 200 to 300 pieces of AI-related legislation being proposed at the state level. It's being proposed in states that are

red and states that are blue. Colorado has the privilege of enacting arguably the first of these laws. But if you take a broader perspective on what counts as an AI law, other states, including California, have been passing data privacy laws that move into this space this before Colorado was in the crosshairs on these issues.

[00:02:05.25] So my substantive introduction is to narrow the focus a little bit on what exactly about AI we're going to be discussing on this panel. We're going to be talking about the use of artificial intelligence in significant decisions, the use of artificial intelligence in significant decisions. So to imagine a few possible fact patterns you can think of, for example, a company deciding to delegate decisions about whom to fire to an AI system. The arguments are roughly based in efficiency, but also sometimes based in interests in actually avoiding discrimination.

[00:02:46.05] If you have a human decision maker making these decisions, they're not going to see all the relevant pieces of data. They're not going to be able to make decisions as quickly to compare across as large data sets, and to avoid their own cognitive biases and implicit biases in coming up with whom to fire. That's the optimist version. The pessimist version is that if a company is using an AI system, especially one that was created outside of a particular set of facts and circumstances, then all existing garbage in the data sets are going to come out in the decisions that it offers to that company. Whether you characterize those garbages as-- that garbage, as discrimination, or you characterize that garbage as inaccuracy, or you characterize that garbage as inefficiencies, it is something to be thought about when we consider adopting AI for significant decisions.

[00:03:47.82] So I've largely seen these conversations take two paths, and I think we'll see this come up in our presentations and discussions today. One is to really talk about fundamental question of whether AI systems, in fact work or work well. If you're going to delegate something that was done by a human or humans to an AI system, it's helpful to have information about whether those systems in fact work and whether they in fact work better than the humans that you are taking those decisions from.

[00:04:23.30] Another way of thinking about these systems, and this comes more from a due process framing, is through the lens of thinking about the autonomy and dignity of the individuals who are subjected to these systems. So is there something-- and I pose this as a genuine question, though I have my own thoughts. Is there something meaningfully different about having humans in a human organization make decisions about you, versus finding out that your number came up in the machine and them's the breaks?

[00:04:54.57] So without further ado, I'm going to turn things over for the rest of this conversation to our panelists. We're going to speak in the order in which they're sitting. So Calli from EPIC will go first,

followed by Representative Titone, followed by Phil Gordon, Professor Nicholson Price, and then Stevie DeGroff. Thank you.

[00:05:18.23] CALLI SCHROEDER: All right. I'll dive in. I will try to keep this extremely succinct, because we have a lot of brilliant panelists, and I don't want to take up time monologuing, but I'll do a quick intro from my perspective and where I come at this issue.

[00:05:29.67] So my name is Calli Schroeder. I am the Director of the AI and Human Rights Program at the Electronic Privacy Information Center, or EPIC. We are not a healthcare Epic or the Fortnite Epic. Please don't ask me about your Fortnite account.

[00:05:42.89] [LAUGHTER]

[00:05:44.07] Despite the messages on my machine. We really come at this from a privacy and human rights perspective. AI is extremely integrated with both of these things, partly because of how it is built, the training data that these systems are built on and how they figure out their pattern recognition, how you figure out model weights, how you determine which factors are most valuable when you're doing consideration. And also, in the way that their outputs are used. So we're looking at both of those things.

[00:06:11.21] And I want to start this off by saying that when we're talking about significant decisions, it goes immediately to that lawyer impulse of saying, well, what do we mean by significant. I would argue significant is defined by how it affects an individual. So I really want to focus this on human impacts and on how AI systems impact people.

[00:06:31.95] So number one, AI systems are already embedded across multiple industries and in multiple issue areas, probably more than most people expect. We're aware that it's very widespread. I don't know if everyone is aware that AI can be a factor in your hiring, in your promotions, in education, both from the student and the teacher perspective. When you're looking at finance, whether you're going to get approved for a loan or not, when you're looking at criminal sentencing and for how long you are going to spend jail time, and even for things that seem more benign but are very significant when it comes to your pocketbook, like surveillance pricing or automated pricing or automated pricing decision makers, obviously, surveillance pricing is a little bit of a loaded term, but that is what it is.

[00:07:19.24] And when we're looking at the distinctions between AI systems and how they make these determinations and humans and how they make them, people that are arguing for a slowdown or for consideration on AI decision making are not saying that humans are flawless decision makers. I don't think any of us believe that is the case. But one thing that I think is a very clear distinction between AI decision making and human decision making is when a human makes a decision, we know where it is coming from. We can ask that human to explain their thought process, how they weighed different factors, what

they looked at, why they came to the conclusion they did. There is some mechanism for appeal and for accountability, and there is not very clear accountability explainability within AI systems, sometimes even from their own creators.

[00:08:06.42] Once many of these advanced AI systems are launched, you can see what they were trained on. You can see what the output is, but even the people that built them can't always explain exactly how point A got to point B there. So when we want to look at how these things affect people in very significant ways, affect their lives, we want to make sure that there is something that is liable for a bad decision. If someone gets sentenced to 10 years in jail for something that clearly does not merit that decision, you want to know who can I go to appeal this, how can I get my rights met in this way, how can I get information about how this decision was made and why, and how can I push back against it. Those mechanisms really aren't in place in most AI models that exist right now.

[00:08:56.09] I would also say that transparency testing basic functionality for many of the systems that they're being put in also, there's not a great system for testing that. So there are many general use AI systems, ChatGPT gets mentioned quite a lot that get plugged into these different industries, but they were not built specifically for this industry. So if you're looking at financial decisions or at education decisions or at hiring decisions, ChatGPT wasn't built specifically for those things, but versions of it are being used in these industries. And because they're not fine tuned for accurate data to repeatedly test and audit the systems to make sure that there's not bias or discrimination in the way that they're putting out outputs, it's a real risk that we're seeing across multiple industries. And that's part of why I think there needs to be a lot more accountability there.

[00:09:49.37] I'll leave it there. Sorry.

[00:09:52.85] BRIANNA TITONE: Yeah, thanks. Very good to be back here again, this year. And a lot has changed since then. I'm Brianna Titone, State Representative in Northern Jefferson County. I ran the Senate Bill 24-205 and subsequent legislation. We're working on another policy again this year. And the landscape has really changed. And I want to just get a little bit into that before I talk about the legislation.

[00:10:23.49] But I think that the real reason why we have this conversation about liability even more than we had is because of all the investments going on into the AI, and now everything is going off the rails. It's a quest for artificial general intelligence. I mean, that's what everybody's trying to shoot for. And maybe we get there with the infrastructure we're putting together with all these data centers, and maybe we don't. Maybe if there's a significant difference in how we achieve AGI and what we're building, and we've invested all this

money into it and we have to build something completely different, the whole funding mechanism is going to fall apart.

[00:11:07.86] And the funding of the data centers currently is very troubling from a policymaker. There's just reckless junk bonds borrowing from each other. It's like the bulletin board of a conspiracy theorist trying to connect the dots on where everything is. It's a very fragile house of cards that is hinging on this thing that they're gambling on to win. And we don't even know if we're going to get there. And the whole entire economy is hinging on this.

[00:11:44.19] And the only way that they're able to get their money back is to sell all these AI gizmos and tools that they're putting into everything, partnering with every company on the planet. Put this AI thing in here. AI design everything now. And as a lawmaker, that makes me very nervous because of the data gathering that's happening at such speeds we never imagined and the profits that they're making on surveillance of people. All the time, these people are-- they're getting spied on by children's toys and the disinformation, the drug chatbots, the deepfakes. People don't even know what's happening in the world anymore. That's what worries me a lot.

[00:12:30.77] And I'm not even going to get into the environmental and utility rate aspects of the data centers as well. But that's a different problem. But all of these things really are to tell you what the motivation is and why this is happening so fast to recoup these investments that have been made and the political pressure that's being put on the lawmakers with the enormous amounts of hundreds of millions of dollars that are going to go against candidates who go against this community because they're that concerned that if we don't go the way they want to go, their investment is going to be gone.

[00:13:08.59] But I believe very strongly that the government was established to help the community, help the people. And we have been doing a lot of consumer product safety over the decades. And why should we have any different system with an AI tool? AI tools should have product safety with them. And that was what we were setting out to do with Senate Bill 205.

[00:13:38.16] Maybe we get there, maybe we won't. I've read a recent paper that said that agentic AI mathematically cannot get to a perfect state ever. So there's always going to be some error or hallucination at the end of the day. And we need to make sure that anybody who's using it, whether it's a deployer or a consumer, knows what that risk is. And we shouldn't have blanket exemptions for these companies.

[00:14:09.04] And we all know about section 230 of the Communications Decency Act of 1996. And that had huge blanket protections for a lot of the companies that are now developing a lot of these AI products. And what they dream about is having a similar

protection that gives them blanket liability for all the things that they're doing. And I think that is a very, very dangerous road to go down.

[00:14:37.72] But what we are working on is having four different things that we really want. We want to have disclosure, making sure everybody knows that AI is being used. We want transparency for the user to know what information goes in and out of the ADS, the automatic decision system, so they know what data was being used to make that decision, and what information comes out and how that's being used. And if there's a right to cure, you have a credit score. You know what your credit score is being affected by.

[00:15:10.04] It tells you that. It gives you some reasons. And if that's wrong, you can challenge it and fix it. That's been on for decades. We need to have a similar system for that. And that's to protect the consumers and to protect the deployers.

[00:15:26.04] The problem is that everything's being pushed on these deployers to do all of these things and this overpromising. And now the players are really starting to come around and saying that these investments are not really going anywhere. And the thing that we've been talking about, even last year when we were here, was regulations are stifling innovation. We're not going to be able to innovate anymore. And it'll be the end of everything.

[00:15:54.55] Well, I disagree with that. I think that regulation is actually going to help the industry, because if you have a product that you can trust, you can sell more of it. Ford didn't sell a lot of Pintos when they started blowing up. And that's what we're seeing now. It's not quite as dramatic, but that's what we're seeing. We're seeing everybody adopting AI. And now we're saying, oh, well, there's too much risk here.

[00:16:21.43] So if we actually have, we take some of that risk out and we actually get these companies to think a little bit more about how these systems work, what the limitations are, communicating that to the deployers so they know they can deploy that better, the consumer has more trust in it, the deployer has more trust in it, and they can sell more AI products that actually work better. But you have to have the right to cure if you're a consumer for the data. And then we have to have liability.

[00:16:49.31] I agree completely with that liability is the key because if there's no liability, there's no chance of getting any AI developer to stop putting out unproven systems that are going to inevitably hurt consumers. And deployers and deployers, all the companies using these AI systems don't want to have these liabilities. This is fundamental, and we have to get to this point of having some liability. Otherwise, we're going to be on a very, very dangerous road.

[00:17:24.49] And we can talk a little bit more about that afterwards.

[00:17:29.22] PHIL GORDON: All right. Hi, everyone. So my law firm is a global firm that represents only management and employment law issues. So my role at the firm right now is advising a lot of global clients about the intersection between AI regulation and data protection law and how they should manage that risk and comply.

[00:17:54.46] I thought it would be useful, first, just do a very quick overview of what laws actually are out there currently regulating the use of AI for employment decisions, because when you think about a significant decision, what decision could be or what clearly is among the most consequential and significant decisions is decisions about whether or not someone's going to be hired, be promoted, or be fired or disciplined. So one would think that with all of the laws that-- or I should say, all the legislative activity that Margot mentioned at the start, that there would be an enormous amount of regulation in the employment space, but it's actually pretty limited.

[00:18:39.98] So in the US, first, we have civil rights laws. Every state has a civil rights law. The federal government has a civil rights law. They've been around for a long time. And those laws apply to the use of AI, even if they are not AI specific. But once you get past those laws, there are only a few jurisdictions in the US that actually have an AI specific law on employment.

[00:19:03.56] So if California is attacking this issue on two fronts, one in the employment space, the employment law now specifically, or employment discrimination law, specifically addresses the use of automated decision systems. And the Department of Fair Employment and Housing has issued regulations implementing the statute. And then separately, you have the California Privacy Protection Agency has published rules on automated decision-making technology and risk assessments, which also apply in the employment context.

[00:19:38.75] Next, you have Colorado. Our law still hasn't gone into effect. Most of you probably know the effective date was pushed off until June 30 of this year. It will be interesting to see whether or not there's change. I think there's a good high likelihood that the law will change between now and June 30, given Governor Polis expression of concern and other legislators expression of concern about the law.

[00:20:05.83] Next is Illinois. Illinois just has a state anti-discrimination law that prohibits algorithmic bias, also has a notice requirement. New Jersey just published final regulations applying its disparate impact rules to the use of artificial intelligence and employment decision making. So it's just relate to these disparate impact claims. So if you apply a facially neutral rule but it has a discriminatory impact and there's not a legitimate business justification for that impact, then there is an unlawful disparate impact. So that's New Jersey.

[00:20:48.89] Texas prohibits intentional discrimination using an AI tool. So that's right now the scope of employment-related slash AI laws

in the US. Outside the US, you have GDPR, which prohibits significant decisions without any human intervention. And GDPR rule has been followed in many countries across the globe. And the EU AI Act, which has not yet gone into effect, goes into effect August 2026, or actually hasn't gone into effect yet for high-risk decision making. It's scheduled to go into effect August 2, but that date might be pushed off.

[00:21:36.28] So right now for global corporation, when they're looking at what are their compliance obligations, it's a relatively small universe. Now, what do these laws require? And it's interesting. They basically break down into two buckets. So you have the civil rights, laws and those laws focus on algorithmic discrimination. Some of them also have a data retention or a record retention rule or have a notice rule, but those are definitely not the focus of the law. The laws are really about algorithmic bias.

[00:22:16.40] And then you have-- and that's New Jersey, Illinois, Texas. And then you have California's ADMT regulations, risk assessment regulations, EU AI Act, GDPR and its progeny. And those laws which are grounded in data protection, interestingly, have far more protections for the individual, for the applicant, for the employee, including a right of notice, right to opt out or to request human intervention, appeal a decision made by AI, right to access information that was used to make these specific decision, as opposed to a generalized notice about how an employer uses AI across the broad spectrum of applicants and employees.

[00:23:11.97] So it is interesting that the greatest protections for individuals tend to come from data privacy laws as opposed to employment laws. And then tying in with our topic today, compliance with these laws can be a real challenge for employers. There's a lot of variation across jurisdictions, laws, regulations. Two relevant examples are what is a significant decision.

[00:23:47.91] So for example, in New York City law, it is focused on screening candidates and screening employees for promotion. And that's it. Whereas the Illinois law is basically all material terms and conditions of employment. So there is definitely variations in these laws in terms of the types of employment decisions that are subject to regulation. And the other important variation is the degree of human involvement, which triggers the obligation to comply with the law.

[00:24:25.64] So some of the laws, some of the regulations apply if an employer uses AI, which is a pretty low standard, then there's facilitating, then there is having a material impact or material influence or being the basis of. And then you go to California's ADMT regulations, and they apply only if the AI replaces or substantially replaces human decision making. So there are a lot of different thresholds.

[00:25:03.74] And just to tie this up quickly from a practical perspective. So I'm on the other side from the regulator. I'm talking to the deployer, and the deployers are struggling. I'd say a lot of my clients that are multi-jurisdictional, they are actually carving out the jurisdictions that I mentioned early on, and they will just not use AI tools there because they're concerned it's too complicated. They want to get it right.

[00:25:36.32] Number two, the generals-- my general sense is the people I work with, they don't want to discriminate. But the deployers, it is very hard to analyze these AI tools for bias. And so they are often turning to the vendors. And the vendors will beg off. They'll say, well, this tool is not intended to replace human involvement, human decision making. We always expect humans to be involved. This is just an aide or assistant. So these laws don't really apply to us. And we're not going to conduct the assessment for you.

[00:26:14.91] So it's a real challenge for deployers, slash employers right now. And then of course, when the employers are global, and they have to deal with all of the data protection laws outside the US, in addition to the US requirements, it becomes a real thicket trying to use these AI tools.

[00:26:39.55] NICHOLSON PRICE: Hi, I'm so excited to be here, and I have a confession. I am an AI optimist. I know. It's shocking, but I work in the space of health and medicine. And a lot of this work actually flows from work that I've done with Margot-- sorry, Professor Kaminski. And when I hear my colleagues talk about AI is going to break the world, I'm like, yes, totally. But my little world is already mostly broken. And so I'm really excited about the possibility of AI to make things better. OK.

[00:27:10.57] So healthcare. I realize that there's a legal definition of significant decisions for AI, and I don't think it fits particularly well in healthcare, nor do I hear anybody ever talk about it. So I'm just going to say healthcare is full of significant decisions when you're treating or identifying illnesses, when you're making diagnoses, when you're identifying prognoses, when you're reading radiology scans, trying to figure out is somebody sick or not, how do we treat them, what do we do with it. Huge number of significant decisions. There's also a stuff about insurance coverage and say resource allocation. I'm not going to touch on those right now. I'm going to focus on the clinical side, but I'm happy to chat about those later.

[00:27:46.35] So all of these decisions are happening against a background, that expertise in healthcare is expensive and it's scarce, and it's especially scarce for folks with fewer resources, folks in rural regions, poorer folks. It can be really hard to access lots of forms of healthcare expertise. So against that backdrop, the question is, well, what is does AI do and how does it fit into this picture. And I think there

are many ways that AI can transform the experience of healthcare, but I'm going to touch on four.

[00:28:18.04] So we can think about AI just directly empowering patients. To be clear, often mis-empowering patients, but providing patients with lots of information. When you talk about people asking ChatGPT, what do I do with these symptoms, how do I treat myself, how do I treat myself, what do I tell my doctor. Sometimes that's great. Here's information. Here are the questions to ask. Great. Sometimes, it take a septuple dose of Tylenol. That's less great, but we've got empowering patients potentially really exciting.

[00:28:47.02] These are, by the way, ordered in order of how exciting I find them. So I'm just going to get more excited. The second one is extending the capacity of doctors to do the things that they're already doing, or other clinicians. Like if you say, hey, here's a radiologist and they normally do x number of-- they can read x number of scans per hour. Now, we have an AI system that's highlighting contours and identifying areas of concern and triaging. Really, there's nothing going on here. And now I can do 2x in an hour or 2x in an hour, and that's great. That's just increasing capacity.

[00:29:20.86] Well, that's great if it works. But potentially it's great. Potentially, it's increasing capacity.

[00:29:25.44] The third is pushing frontiers. This is AI letting us do things in the medical sphere that no human physician can do. Like, incredibly cool stuff. You can look at an AI. An I can analyze an image of a retina and identify things like heart risk, or can look at a mammogram and identify a few pixels that are a little bit off that actually really predicts the likelihood of developing breast cancer in a year and a half, at a level that just no radiologist in the world can identify now. Incredibly exciting.

[00:30:02.30] And then the one that I'm frankly, most excited about is democratizing expertise, which is just to say, there are things that can be done in medicine now, but the people that do them are specialists or otherwise highly trained, and there just aren't that many of them to go around. And if AI can make those capacities available to clinicians who don't have that training, that can wildly increase the amount of care that's available to folks that don't get that care right now.

[00:30:29.67] When we think about places where there is one ophthalmologist for every 50,000 people and there are places like that. If you have a system that can take a picture of a retina and identify diabetic retinopathy and say, oh, man, you are at risk, you need to go get-- you need to go see a specialist, because otherwise you're going to lose your vision in a couple of years, that's amazing.

[00:30:51.49] So I'm not done. I'm not just booster. The question is, how do we do this? How do we make sure it works? And this is where I draw on the stuff with Margot, because I think a super common

intervention is let's make sure we have human oversight. Let's make sure there's a human in the loop. Let's have somebody in there to make sure that the AI is doing a good job, because we want to make sure it works for that particular instance for that particular person.

[00:31:16.13] So I'm going to go back through those four, the first situation. When you have AI that's providing information to patients, oh man, do they not have any clue at all whether or not that is good information. That is like we can work on trying to fix tools with literacy to say, how do you check it with other stuff. But that is a real, real challenge. Doctors already, of course, are seeing this when patients come in. They've been seeing this for a long time with the internet. WebMD has diagnosed my symptoms. I think I have cancer and also lupus. Well, ChatGPT will do the same thing.

[00:31:52.13] The second idea of extending doctors, we might say, hey, you're just asking me to do twice as many things. I'm just overseeing the AI. It's just helping me do my job better, but I'm still in control of it. Great vision, totally awesome vision. [INAUDIBLE] loves this vision calls AI augmented intelligence because it's just augmenting the physician. Turns out, unfortunately, clinicians are really bad at noticing when AI makes mistakes. Just empirically, they're really bad at catching errors, as are most of us.

[00:32:18.30] There's a lot of automation bias, and over time you get skill fade. So people just get worse at actually observing that. When we think about pushing frontiers again, amazing do stuff nobody can do before. The question is, how you have any clue if it's right. If there's literally no one in the world that you can ask, is this right, how do you know that it is right. Handy thing about health. If you wait long enough, it becomes obvious whether something was right. Not always, but often.

[00:32:44.10] And then the last thing, if we're talking about democratizing expertise, letting people do things they otherwise couldn't do if you're asking for them to be a human in the loop and check and make sure that it's right, man, have we gone in a circle. Because it turns out the expertise that you were asking them to use to show that it's right is the exact expertise that they don't have and that's the whole point.

[00:33:04.99] And so super excited, really worried about the default way that we try to look at this and the absolute super common regulatory suggestion of let's have a human make sure this is right. What do we do? Systemic solutions to make sure things work better at the first place. Design system. I mean, really the actual answer and I don't have a full answer is design systems, such that you're not relying on the fact that there's a human there that you can slap the blame on and said, you should have caught that. I'll stop there.

[00:33:35.99] STEVIE DEGROFF: Nicholson, I don't know if you're watching this season of The Pitt, but there's a whole plot about human gut versus AI in the emergency room. I think you'll really enjoy it.

[00:33:43.73] NICHOLSON PRICE: I'm going to, thank you.

[00:33:46.03] STEVIE DEGROFF: So hi, everyone. My is Stevie DeGroff. I'm the first assistant Attorney general in the Colorado Department of Law. My unit works on technology and privacy protection. So I think fitting that I'm here today. And I always have to say, when I'm on these panels that everything I'm saying today, I'm speaking about in my personal capacity. And these are not the views of the attorney general's office. So although based on experience.

[00:34:08.43] So I just want to kick things off today by talking specifically about the automated decision-making laws and regulations that we already have in Colorado. Fun fact are automated decision-making regulations came out before California's, although they don't apply in the employment context. But I do think that this is really helpful to go through, in part because our rule-making process we went through really did consider robust feedback from industry, from consumers, from consumer advocates. I remember being on calls with individual people in Colorado giving thoughts on this, and it did actually restore faith in democracy.

[00:34:46.21] And so I think that there's a lot that we can learn from where we landed on our regulations to potentially apply in thinking more broadly about automated decision making when it happens outside of the context that's covered by our law.

[00:34:59.28] So in Colorado, you have the right to opt out of profiling and furtherance of decisions that result in the provision or denial of financial or lending services, housing, insurance, education enrollment or opportunity, criminal justice, employment opportunities, healthcare services, or access to essential goods and services. And I think that list covers what many of us would consider consequential decisions. Now, there's a lot of carve outs in the applicability of the law, such that the employer-employee relationship, for example, isn't technically covered. So employment opportunities then becomes limited.

[00:35:33.32] But again, I think the framework here can be really helpful when thinking about the application of automated decision making in these consequential decisions, even if it's not technically covered by the current law. What is profiling? And that's the reason we're talking about automated decisions. It's automated processing of personal data to evaluate, analyze or predict personal aspects concerning an identified or identifiable individuals economic situation, health, personal preferences, interests, reliability, behavior, location, or movements. So I think a lot of the words I just said, and both of those definitions hit on a lot of the reasons that people are afraid of automated decision making being used in these consequential

decisions, because those are the exact kinds of things-- getting to Margot's first point about human dignity-- that we are deeply concerned about being abused.

[00:36:21.54] And I think one of the reasons why you see a lot of enhanced protections and privacy laws that contain and again, not just Colorado now, I think there's probably 15 of the 19 states that have privacy laws, have some automated decision-making regulation or statutory requirement around being able to opt out is because the concern fundamentally about privacy laws is giving consumers autonomy and control over their data to help prevent abuses of the data, and automated decision making could be potentially an abuse of that data just as much as it could be a way to make our lives better.

[00:36:56.97] So some of the core tenants of the regulations I want to flag, because they tie into what I think are some of the principles to help us think through this problem. So one is consumer agency. The law itself says that you have the right to opt out of it. It also gives you the right to correct your data, to delete your data. That data directly impacts the ability of the decision of the system to make a decision about you. If the data is incorrect, you should be able to correct it so that the decision ultimately is based on true data. That's a pretty standard principle. I think of data privacy that applies in this context.

[00:37:29.77] I also think this is really fundamental to think about something that Brett was talking about this earlier is that we're constantly being opted into all AI systems, in part for training data. And so if we're really, really being thoughtful about the use of our data from a privacy standpoint and how it is used by AI systems, participation in the AI system is core to that. The use of your data then trains the system. And so they do go hand in hand in that way.

[00:37:55.61] The regulations require transparency around what the data is-- what data of yours was used, plain language explanations of the profiling and how it's part of the decision, the benefits and consequences of the decision so that consumers can weigh, if they want to allow this system to be used, if they want to opt in or opt out, and then information on if and how the system has been evaluated for bias. It doesn't say that you have to do it, but if you've done it, you have to give the results and it might be telling to a consumer, no, that you haven't checked it for bias in the disclosures.

[00:38:27.33] There's in the regulations we got a lot had a lot of conversations in the rulemaking around what type of automated decision this should apply to. So there's an attempt, I believe, that threaded the needle as best we could to balance the risk when you go from solely automated decision, it's truly just your number in a system, and no person is ever involved to what is called human-involved automated processing. That's probably sounds similar to the augmented that you're talking about in hospitals, where it is a tool

among many tools that imperfect humans use to try to be a little better when they're making a decision.

[00:39:04.54] And so some of the obligations change depending on what type of automated decision is in there, and recognition of the risk that exists. There's also data protection assessment requirements that get-- when you're doing profiling to try to get at are you as a company, considering the risks and trying to mitigate it and documenting that before you roll it out.

[00:39:25.62] And again, I think a lot of those things are core to privacy law. They make a lot of sense when you're thinking about automated decision making as well. We heard transparency, just what is happening and when is it happening and what data is being used at a baseline. Your ability to correct that information, I think is really, really critical in both of these contexts. And then balancing the risk, I think, is that's just something that I will say for us, when we were thinking about rulemaking, what is the right amount of friction to mitigate harm while still giving consumers agency and access to a potentially beneficial tool, and that's a hard line to walk. And I think that's part of what makes this particular conversation so complicated, is an understanding that there are very real risks there alongside the benefits.

[00:40:13.50] But to your first question, I think, Margot, is like, what do we owe other humans to be able to make that choice for themselves. And when can that practically happen, when maybe do they not get to make the choice, but they at least need information so that if something does go wrong, they knew that they were subject to it in the first place to ask the right follow-up questions? So there's different ways you can land on this, but knowing that it's happening, I think at a minimum is really important.

[00:40:44.62] And I will stop there so we can get to some questions.

[00:40:46.99] MARGOT KAMINSKI: Great. I'm sure we're going to have a lot of questions from the audience. I'm going to kick us off with a few to start discussion. I'm also going to give just a quick summary of some of the things that we've heard. So my first question is whether we should have one AI law regulation, liability scheme, whatever you want to call it, to rule them all, or do we try to think about this in a much more site specific sense? So one set of rules or regulations for the healthcare context, one set for the employment context, one set for the education context.

[00:41:26.63] And this is a much longer-standing question that folks familiar with data privacy are going to be very familiar with to the European Union. I know that we had a comment earlier today that comparative law is not helpful, but sometimes it is. European Union has long taken an omnibus approach to data privacy or data protection. I know we had a question earlier about the GDPR and whether it came too late, but actually they've had data privacy law or data protection

laws since the 1970s in different member states and the Data Protection Directive of the 1990s.

[00:42:00.13] So there's a lot of stuff there pre-GDPR, but they take an omnibus approach like data protection principles apply no matter where you're using personal data. The United States, by contrast, has taken a sector-by-sector approach, sometimes doing more arguably than the European Union has in practice, but leaving a lot of gaps and rooms for regulatory arbitrage. So that's the backdrop for this question.

[00:42:24.09] I promised a little bit of a summary. I'm a real toolkit person. Like, I really like to create tables that say what's on the table for us to talk about in terms of what tools we can use. So for those not familiar here, here are two buckets and then sets of tools. So we can take an approach that looks like due process, that says when you make a significant decision solely using AI or using AI to augment human decision making, that's another question. We owe an obligation to individuals to give them some process rights.

[00:43:00.36] So that can range from, we give you notice that a decision has happened to we give you access to your data, we have an ability to correct your data, an ability to opt out of that decision, an ability to ask for a human to be involved in the decision or an ability to appeal the decision. So that's in the due process bucket.

[00:43:21.04] If you go into the other bucket, which I think Nicholson mentioned, you are talking about systemic approaches or design-based approaches, and that's more things like you might weep from boredom here, but this is the stuff that really interests me. Things like impact assessments, data protection assessments, quality assurance, pilot testing, benchmarking, red teaming. All the things that you would do with any product to try to figure out is this working, is it breaking, for whom is it working, whom is it hurting. So that's the backdrop for this, knowing that those are your toolkits.

[00:43:58.31] What are my panelists think about whether we have one law that establishes baselines anywhere this is happening versus sector specific laws?

[00:44:10.21] STEVIE DEGROFF: I'll start, and then I just won't talk anymore for the rest of the panel. So I think that what's-- I have two thoughts about this. I think that there's certain interventions that are applicable across the board. And I think it's some of the things that you've heard multiple times from all of us today; explainability, accountability, transparency. Those are the things that make sense, not only honestly in this context, but just like for good governance across the board.

[00:44:41.65] But then I do think that there are contexts where what would need to happen, for example, in healthcare to mitigate risk is probably different than potentially in education. And that probably if

we're looking at the divide that you just laid out of due process versus structural changes, to me, it seems like some of the structural changes might need to be slightly more sector specific. While some of the due process concerns could potentially make more sense across the board, across various AI applications.

[00:45:13.65] BRIANNA TITONE: And I'll jump in there. I think it is a yes end approach if I take the actor's approach because to Stevie's point, there are basic things that we should have and that should apply to everything. And that's what we're trying to do. This session is to put a fundamental, foundational law in place for those kinds of parameters. We can build on that with specific sectors afterwards is-- I mean, we have to because everything's changing all the time, and the uses and the use cases are changing all the time. So we have to adapt to that.

[00:45:53.76] But I think fundamentally, those basic tenants we have to put into place now just to put the brakes on how everything's moving. And I think that's really the critical thing we can do right now.

[00:46:12.42] MARGOT KAMINSKI: All right. So second question. This one's much more straightforward. It's about one of the specific tools that's used in the due process bucket. Should people get to choose whether an AI makes these decisions or can they request a human?

[00:46:29.02] CALLI SCHROEDER: I come at this again from a privacy human rights perspective. Yes, you should get to choose whether a system is making decisions about you versus a person. But beyond that, I would also say when we're talking about things like how we're structuring systems and rights that we're giving to people, it also has to come back to a fundamental question of who is it that's bearing the burden here. And in a lot of cases, even when we're talking about empowering people with individual rights, the right to correct information, the right to information, in many cases, that is giving them homework. And that means that on top of your regular job, on top of your regular life, you also have to be parsing through all of these explanations of different technologies that you did not sign up for and did not ask to be part of.

[00:47:12.70] And so you have an additional burden to operate your life and your information and the consequences of these decisions. And I think that is a fundamentally skewed framework when you're not the one that's benefiting in many of the cases, or at least you're not the primary beneficiary. The primary beneficiary of AI use are AI companies and AI deployers. They're the ones that are getting monetary benefit or expediency benefit or efficiency benefit there.

[00:47:38.99] So I would make a semi radical push to say that these systems should be opt in rather than opt out, and that this should all be a clear framework shift, where AI companies are the ones that have to go through the process of saying, do we have the legal right to use all of this training data that we're using to build our systems, do we have

licensing rights on all of that information, do we have permission to operate within the spaces that our systems are operating. I think we have to fundamentally shift. They're the ones that are benefiting. They're the ones that should consider that.

[00:48:13.19] And people absolutely should have rights over their data, should have rights to a human intercessor in these cases. But that shouldn't be the starting point of how you protect yourself. The starting point should come from the rules around AI companies.

[00:48:27.79] PHIL GORDON: I'm--

[00:48:28.73] NICHOLSON PRICE: Go, Gordon.

[00:48:29.43] PHIL GORDON: All right.

[00:48:30.39] NICHOLSON PRICE: Go for it.

[00:48:31.19] MARGOT KAMINSKI: Debate is good.

[00:48:32.99] PHIL GORDON: So one thing that's interesting about this debate, general rules versus specific rules are the edge cases. And there are a lot of them. And the question becomes, how many edge cases do you have that then make the general rule no longer practical.

[00:48:53.91] So in the employment context, one place where my clients are using AI by negative inference to make fully automated decisions is the recruitment process. I mean, we have businesses that are receiving thousands or tens of thousands of applications for jobs. It's just not feasible for these companies to review every single application.

[00:49:21.41] And the other thing that is interesting is arguably if the AI is done right. I mean, maybe the AI would actually be less likely to discriminate than a human. For example, what's this person in my fraternity? Well, I mean, that's a guy looking for another guy. And likely the guy's fraternity had a certain demographic makeup that may make it more likely that the applicants in that fraternity look like the reviewer.

[00:49:57.94] Number one, you always have to keep in mind that the AI sometimes can solve problems. And then number 2, with these edge cases like recruitment, inevitably only the top 10, 20, 30 candidates will proceed through the hiring process. So there's no question, there is decision-making rejection without human intervention. And interestingly, the GDPR and the California ADMT regulations actually allow for that type of decision making. They require post-hoc to give the individual the right to human intervention or appeal. But there's not a right to opt out up front, because there's no way that a large corporation interviewing tens of thousands of people, or I say, receiving tens of thousands of applications for a specific position can review them all.

[00:50:59.36] NICHOLSON PRICE: So I find myself in response to both your first and second questions, Margot, wondering, like a little bit of wondering like, do I belong up here? Am I playing the same game that the rest of you are playing, or talking about the same issues because it's like, oh, these questions have totally different answers in health. We should definitely have a different system. And then I wonder, but maybe yes, maybe I am in fact, asking some other questions just from a very different direction.

[00:51:23.98] So the thing that comes to mind in your second question is like, what do we do about decisions where the decision would not be made were it not for the AI? And this, I think, is getting at what you're talking about, Phil. So I think about this in the context, obviously of increasing access to care when the question is like, oh, who is going to do your eye exam. It's either AI or it's nobody, because there's no ophthalmologist within 100 miles or 500 miles. That's a real situation.

[00:51:52.51] I don't know what it means to say you have to be able to opt out of that, or you have to be able to say, well, I want a human to make the decision. Because if you say right now, I want an ophthalmologist to see me and nobody says yes, you can't force anybody to see you, that's just not how care works.

[00:52:08.13] And if the question is, OK, well, here are 10,000 applications and we're just like, unless you meet certain standards, the alternative is we'll review the ones from an Ivy League school and just toss all the rest. And those are decisions that just simply would not get made. They would not get analyzed were it not for AI being in the picture.

[00:52:28.49] I don't how we think about that and say you have a right for a human decision maker for those type of decisions. And I guess I don't know if that's a common fact pattern or a weird one that shows up all the time for me. And now, I hear the employment context. And so I guess I want to ask, Margot, can I do that? Can I ask my co-panelist? Is this a pattern that-- is this a weird pattern or a pattern we should worry about a lot because I often see a right to human decision. It's right there in the law.

[00:52:56.41] What fraction of time do we think that that's actually a meaningful right that could actually be exercised?

[00:53:01.85] STEVIE DEGROFF: So this is partially an answer to your question, but I think it gets it-- one of the things that I think about the, I will say not the downside, but one of the consequences of a lot of this coming from the privacy context is we're thinking about consumer data privacy, and we're thinking about private companies and their obligations to us as consumers. And that relationship is a different relationship than you might have with-- often you should have, I would hope, than with a healthcare provider.

[00:53:27.38] And, in thinking about consequential decisions, a lot of some of the most consequential decisions that are made about us are made by government entities. So our expectation for the right to have a human be a part of that decision are going to be very different when we're thinking about government benefits coming to us. That my very first work in any of this space was when I was still in law school, working on a project for the California judicial system, on their use of AI in bail decisions and in bail reform. That's just a very different context to think about having a human be a part of the decision than in my commercial relationship with the business. And so I don't know if that helps you-- helps the thesis that you had. But I do think that the context and the relationship at play really does change when and how a right to human intervention, I think, makes sense.

[00:54:18.34] MARGOT KAMINSKI: All right. I got one more, and then we're going to open up to questions from all of you. So be ready students.

[00:54:25.83] So this one's a big one because you hear a lot-- at least I heard a lot in the conversations around the Colorado AI Act. This idea that we already have enough in the existing legal arsenal that we don't need to have new AI specific laws. So the question is, are existing laws in these industries around things like product safety, consumer protection, data privacy, discrimination, are those enough to address the risks that we're talking about here? Or are there additional things that are missing that are AI decision-making specific?

[00:55:05.83] CALLI SCHROEDER: I would say that the speed and scale shift within AI, a lot of the issues that we have are not necessarily novel, you have product safety issues and tons of products. You have civil rights issues in across the board. You have health equity and privacy issues and all of these other issues. In many, many cases, the problem we see with AI is the scale of it, the volume of information that goes into it, the inferences that can be drawn and the speed of it, how fast it's developing, how fast it's embedding itself in other industries, and how fast we're seeing problems pop up from that speed and scale. I think that we do have a lot of laws on the books that could address many of the existing problems.

[00:55:45.67] However, the AI industry has been extremely good, I guess, at arguing that AI is so novel and so unique that the new laws can't possibly apply or they don't really understand the context, or lawmakers or law enforcers don't really understand how AI plays into this system. That has been shockingly effective in a lot of cases. We're seeing that product safety or consumer protection laws are not being enforced in the same way against AI harms as they are against many other industries and companies.

[00:56:21.66] So I would say our existing laws could work if they were being enforced properly. I don't from my perspective see that they are. And I do think that because AI is so cross-cutting and it's so multi

industry and there are unique considerations across multiple industries that there may need to be some structure where you have a threshold for basic fitness and safety that an AI product has to reach. And then there's sectoral add-ons to that address specific harms. But again, I defer to a lot of the experts here.

[00:56:58.04] BRIANNA TITONE: Well, I will say that we understand a lot about this topic even more than we did when we wrote the first bill, and we tried to make another stab at it in the special session in 2025, and that one we were calling the AI Sunshine Act. If you want to see that one, you go look at the engrossed version of the bill, not the final bill, because the final bill was just an extension.

[00:57:25.40] But the engrossed version was this framework that was using existing law to have these discrimination and product safety be the foundation of where the results come from. If there's an issue, it simplified it a lot more. And I think that was-- the 205 became a little bit convoluted and put a lot of the onus on more of the deployers and the developers, and that whole issue really got out of hand.

[00:57:56.64] So we were trying to simplify a lot of that. And I think that that's really what it comes down to. And fundamentally, if 205 goes into effect or 205 gets completely taken off the books, it doesn't matter because the laws of the state of Colorado still apply to discrimination and those other parameters. So they can still be-- the deployer will still be sued for those violations if someone raises them and if the AI makes that decision.

[00:58:29.97] So the risk really is still on the deployer and only the deployer and the developer gets off scot-free. And this is why I have a big problem with this because of how I started out saying that they're all just making all this money back of this huge investment, and they don't really care who gets hurt in the process. And that's fundamentally wrong. And there should be some liability on these products that are being tested out on people to try to recoup a lot of their investments.

[00:58:59.51] So the liability is there no matter what. We're trying to make the liability more on the responsible party. And what we would prefer is a joint and several liability, where if the deployer is not using the product properly, the deployer has more responsibility. If the developer tells the deployer how to do it and the deployer follows everything, then the developer is more at fault because they didn't make a product that actually did what they were-- it said it was supposed to do.

[00:59:33.53] So we'll let the courts decide who's really at fault, and that's really the fair way to do it. And that's how we should be moving forward. We don't want the deployers to say we don't want to use AI because that's what's going to happen. But if we make better AI products, we can have a better outcome.

[00:59:54.73] NICHOLSON PRICE: So I think there's a lot that can be done under current law, but I think there are definitely some gaps and I want to highlight two. The first there is certainly room for liability to help enforce safety standards, but I think AI is a particularly problematic case for liability, particularly in the tort context because these things are going to be really opaque and probabilistic a lot of the time, and it makes causation-- it makes identifying an AI-driven harm particularly difficult and demonstrating causation particularly difficult.

[01:00:22.16] So I don't have a lot of faith in our tort system. I have less faith in our tort system in the context of AI. I'll also point out in the context of discrimination and bias, there's a wonderful piece by Daniel Schwarcz and Anya Prince from, I don't know, four years ago now about proxy discrimination in the age of AI, where they point out that essentially, AI is a really, really superb tool for finding things that will in fact discriminate and yet, almost by definition, avoiding the possibility of disparate impact litigation if you're in a field where disparate impact litigation still exists.

[01:01:02.26] And so I think there's a lot of benefit to saying, hey, here are ways that we're trying to be proactive about bias and discrimination, rather than relying on existing theories.

[01:01:14.30] PHIL GORDON: Yeah, I would just say allocation of liability is a key issue. I think one problem with relying on the court system just takes way too long. I mean, right now, my clients are sitting there trying to figure out if we use this tool, what's our exposure, particularly for algorithmic discrimination. We're just using the tool. We can't figure out what's in this black box. Are we going to have to hold the bag if the tool ends up with discriminatory outputs? So I think getting that issue resolved, at least in the employment context, through regulation or by statute, would be extremely helpful for deployers to understand the risk right up front.

[01:01:55.06] But as I mentioned at the start, there still are a lot of laws that apply in the employment context that effectively regulating AI. And it's interesting because the place where there is the most risk today, where I've seen, starting to see successful lawsuits, the plaintiffs having interesting ideas is not so much in using anti-discrimination law, but for example, it's just a case out of the Northern District of Illinois, where RingCentral, one of the defendants in the case, was using AI to transcribe and the claim was under the federal Wiretap Act.

[01:02:31.63] There's another company that's recently been sued that generates scores on applicants based on all the information they submit in the recruitment process. That company has been sued for violating the Fair Credit Reporting Act. There are AI tools that use voice recognition software, or other types of biometric information as inputs, and those companies have been sued under Illinois Biometric Information Privacy Act.

[01:03:01.07] So it is interesting seeing that the plaintiffs' bar has been very creative in using current law, and they're not waiting around, they are not waiting around to bring cases.

[01:03:16.39] STEVIE DEGROFF: I'm going to add something that isn't about a gap in the law, but it is my never-ending crusade for public interest technologists. I really do think that one of the things that has made it difficult to apply laws that are on the books to this new technology is a lack of technical understanding to be able to investigate what is happening in the AI systems. And that's going to be the case with or without a new AI specific law.

[01:03:41.85] And so, I think I totally agree, like the plaintiffs' bar has been wildly creative and very impressive ways. And oftentimes, there's experts that are part of that investigative process. And I just will say from the government side, like we in Colorado have hired a full-time technologists. I know more and more states are starting to do that. I think it's the kind of expertise. So if any of you have any engineer friends that want to come work in the government, find me and I'll find them somewhere to work, because I do think that that's the kind of deep understanding that's going to be needed to enforce whatever laws on the books, whether it's one that exists or a new one. And, to be quite frank, is going to be needed to write really thoughtful regulation that works in this space.

[01:04:21.32] MARGOT KAMINSKI: Thank you. We have time for questions, starting with the Phil Weiser rule. I need a student first. Yeah, got a student.

[01:04:38.24] AUDIENCE: Hi there, Professor Kaminski, everybody? A colleague of mine and I just drove to and from Oklahoma City with an AI-powered Tesla. And we only had to take the wheel once, so it was 1,200 miles with one intervention. The intervention was a little scary. Car tried to back up on a frontage road, but nevertheless, it's powerful. And that car is a NHTSA level 2 car at the moment, even though it functions like NHTSA level 5.

[01:05:16.37] I think it's safe to say Tesla is trying to avoid liability. That's in an area where the regulations are pretty clear. There are six tiers. There's graphics. You can say, oh, you're not holding the wheel. That's at least level 3. Disparate impact, by contrast, is utterly unclear. It is at best a judge-made standard that varies by circuit. I wonder if the quest to apply a clear justice standard to an emerging, powerful technology is realistic, given that we haven't established one in law yet.

[01:05:59.17] MARGOT KAMINSKI: That ended a question mark?

[01:06:01.41] AUDIENCE: Question mark.

[01:06:02.31] [LAUGHTER]

[01:06:05.09] MARGOT KAMINSKI: Panelists, I think I would-- that's an excellent question. Thank you, Adam. Adam took my AI law class, but

that's not where he got his ability to ask great questions. So to repeat to the panelists, I understand the question is being some types of law are incredibly clear and draw a bright line rules and other kinds of law create standards that vary not just in some individual judge's interpretation of them, but across jurisdictions. So which of these types works better when you're trying to talk about a new developing technology?

[01:06:44.33] BRIANNA TITONE: I'm just a geologist.

[01:06:46.15] [LAUGHTER]

[01:06:48.05] NICHOLSON PRICE: That's for you.

[01:06:49.77] CALLI SCHROEDER: I think there's one that's much more tempting, which is like, everyone likes bright line rules better. They're very clear, and it's very easy to know what the answer is and wherever it's possible to apply them, great. But the problem with emerging technology is that part of the reason we default so much to standards or to bracket laws, is because we don't know what all of the harms are yet. We don't know all the directions it will go.

[01:07:11.26] And so if you're trying to regulate a technology that is moving so much faster than the regulatory process can, it typically makes more sense to make the more broad and general laws as opposed to the bright lines, because we just don't know how we can draw bright lines in the development stage that are going to actually capture things.

[01:07:29.90] And in the regulatory space, once you pass a law in a specific area, it's very hard to get the political will to pass an update to that law, because everyone will just say, well, we already have that covered.

[01:07:41.14] NICHOLSON PRICE: I agree with everything you just said, and I will also add in. Regulatory sandboxes. I was just talking with folks at the Utah Office of AI Policy, where they're like, hey, we have healthcare companies that come in and say, the law here is very gray. We don't know what to do. We would like to enable nurses to be able to do this thing that they're not currently allowed to do under law. Actually, that's a little bright line. That's pretty clear.

[01:08:02.56] There are other situations where they're gray. They're like, can we have permission to do this thing for two years while we watch it under your watchful eye via contract. And they have the authority to say, sure. It doesn't always have to be either or.

[01:08:14.62] MARGOT KAMINSKI: Yeah. In fact, in general, it's usually not either or. Yes, in the back.

[01:08:20.46] AUDIENCE: I'm Molly, I'm an undergrad. And I'm curious, where do you think-- well, sorry. Well-intentioned educators

are most likely to accidentally violate student privacy when using AI, like high-school students or elementary students.

[01:08:39.54] MARGOT KAMINSKI: Do we have any education privacy experts on the line? None of this is legal advice. So the question was where are well-intentioned educators most likely to end up violating student privacy. So there's a legal answer to that and then there is good practices version of that. Anybody want to take us?

[01:09:01.35] NICHOLSON PRICE: Sounds like you have both answers.

[01:09:03.13] MARGOT KAMINSKI: Yeah, I'm not a FERPA expert, but generally, a lot of student privacy is up to decisions made by schools. And so as a policy matter, a lot of schools are going to make the first adoption decisions on these technologies.

[01:09:25.47] One of the waves of legislation that's most prominent in these 300 AI bills that I referenced earlier, are children's privacy related laws. And so there are a couple of different types of pushes. There are-- which I guess shows that our current regime is not working all that well, or at least people internalize it is not working so well. One push is to empower parents to make more decisions. But the downside of that is that sometimes parents' interests and students or children's interests are not perfectly aligned. Shocked me as a parent.

[01:10:02.31] The other direction to go is to think about-- and here I'll point to Brett over there-- to think about design and trying to regulate technologies to better protect children by design and how the technologies are designed not just in terms of privacy, but also potentially in terms of addiction. So I think that the answer is the laws are coming fast and furious, and our current regime maybe doesn't do as much as you think it does.

[01:10:31.55] All right. I think we have time for one more question. Oh, my gosh. I've got this gentleman not in the green, but right behind you in the jacket who's been waiting very patiently, so. There.

[01:10:44.15] AUDIENCE: So [INAUDIBLE] in some areas, facial recognition in particular, [? NIST ?] set up a test bed where they could test, for example, bias against skin colors and age and what have you. And presumably, and I'm not a lawyer, you could make an argument that if a law enforcement agency was using a technique that has shown to be inferior and ended up arresting lots of people that shouldn't have been, that they were negligent because there was a known better technology.

[01:11:19.92] So one of the questions that I have for areas like bail and employment that are inherently, as was mentioned, probabilistic, as in there is no right decision. You don't know how the candidate is going to turn out that you're hiring, or whether the person you grant bail is going to re-offend or not, or the person you don't go and ban would have re-offended or not.

[01:11:43.36] But the question that I have is, are there areas-- and medical seems like the easiest, but there might be others where there is a cause of action because you used a tool that was not evaluated by a third party, such as [? NIST, ?] or was known to be inferior to other tools that exist based on the predictive capability. And I could imagine in an environment such as education admission for selective universities, where you can indeed predict which factors lead to a measurable successful outcome, GPA, graduation, whatever, in other areas is probably much harder to do that.

[01:12:24.74] So I wonder if there's in some areas a duty of care, if you want, or a duty of you have to use the best available tool as opposed to just whatever you got, your salesperson sold you, and you don't have any obligation to look what happened to it.

[01:12:40.96] MARGOT KAMINSKI: Excellent question. So the question is when you have-- that admitting that there are some areas where we don't have verifiability. You can't tell whether an answer was actually correct or incorrect, because the AI is involved in self-fulfilling prophecies, and you don't really know whether the person you chose not to hire was going to be a good or bad employee. You just know things about the person you did choose to hire.

[01:13:06.73] So given that there are other spaces like facial recognition, where you can more objectively verify is the output the person or not the person. In those kinds of spaces, are there duties of care. Could you imagine creating a duty of care to either test your technologies in advance, or take certified of some kind technologies that we know actually work better? Nicholson, I think this one's partially for you.

[01:13:32.69] NICHOLSON PRICE: So you think so. You think so in medicine. It turns out we're actually really bad at doing comparative stuff in medicine, especially in FDA, it's like does it work above placebo or does it work generally, is it fairly safe and effective. But past that, we often don't know what's better than something else, which is weird.

[01:13:52.49] One of the neat things about AI, frankly in this space, is the possibility to learn what's better than something else, which is maybe we would actually be able to theoretically enforce this theoretical duty. But I will tell you that in practice, it is-- the tort duty of care is quite conservative. And it takes a while to show that, oh, yeah, there really was something better that you really should have done. You can do it. And there is the duty, but it's harder to enforce than you might think.

[01:14:17.61] MARGOT KAMINSKI: Maybe we have to rely on creative litigators. So I am going to ask you to join me in thanking this panel one second and ask also that you stay where you are and do nothing, because after this, we're going to have the incredibly invigorating

debate about whether chatbots should be banned. All right. Please join me in thanking my panelists.

[01:14:40.33] [APPLAUSE]

Debate | Resolved: Chatbots should be banned

https://youtu.be/Sy4eoUc4oM0

[00:00:00.50] DAYTON FIDDLER: All right, next up, what we've all been waiting for the debate on banning chat bots. We'll be moderated by Justice, I mean, Professor Vivek Krishnamurthy, the associate professor of law and director of the Samuelson-Glushko Technology Law & Policy Clinic.

[00:00:15.96] Arguing for the ban will be Professor Tejas Narechania, Professor of law at the University of California, Berkeley and faculty Co-director of the Berkeley Center for Law & Technology. Also arguing for is Professor Blake Reid from Colorado Law, who is also the Director of the Telecom and Platforms Initiative.

[00:00:35.40] Now, against the ban will be Jennifer Huddleston, senior fellow at in technology policy at the Cato Institute, and Professor Paul Ohm from Georgetown University Law Center.

[00:00:47.70] VIVEK KRISHNAMURTHY: Thank you very much for that kind introduction. Again, my name is Vivek Krishnamurthy, and I believe that for now I still teach here. We'll see if that's true at the end of the debate. And I'd like to welcome you all to the umpteenth annual debate here at the Silicon Flatirons flagship conference. We've lost track of how many times we've done this.

[00:01:11.44] Suffice it to say that this debate has become such an annual institution for so long that it's ready to be institutionalized. So I'm particularly happy to be moderating today in the presence of the great JP de Vries, who held this chair for many years. Please give him round of applause.

[00:01:29.38] [APPLAUSE]

[00:01:34.68] I'm pleased to say he embodies all of the virtues of a graduate of the mother University, Oxford, which we both attended. But you probably didn't.

[00:01:45.10] [LAUGHTER]

[00:01:46.44] All right. So I'm afraid I have some really bad news, or maybe it's good news, which is that we've decided to cancel the debate. You see that the topic is resolved, chatbots should be banned, and that's not a debatable topic. So we're pulling the plug and it's time for a cocktail. Thank you all for coming.

[00:02:05.35] You're welcome.

[00:02:05.77] [PHONE RINGING]

[00:02:07.05] Oh, sorry. Excuse me. I have to take this call. Hello. Oh, hi, Brendan, yes, yes, yes. Yeah, yeah, it was great to see you, Jimmy Kimmel, the other day. Yeah, yeah, yeah, it is being broadcast. What? Equal time for both sides? Come on. No, no, no, no, no, there's no need for that. The easy way is OK.

[00:02:33.47] [LAUGHTER]

[00:02:34.85] You're watching? I'm sure you will. All right, well, we'll get on-- OK. Sorry, folks, I guess it's on. So we'll continue. And we're going to start-- we're going to start with our tradition here.

[00:02:53.33] We at this law school believe in teaching our students to vote early and vote often. So we're going to have you begin by voting on this proposition, chatbots should be banned. And for the purposes of this debate, we're going to say general purpose chatbots, ChatGPT, Gemini, Grok, definitely, would all be banned, but what would not be banned is Lexis AI, customer service bots, medical diagnosis, all that stuff is in for the purposes of this debate.

[00:03:26.81] And I've been reminded by Paul to say that our debaters have been randomly assigned to their positions. So therefore, you should definitely attribute what they say as their sincere convictions on the issues and hold them to that forever, or not. So we can advance.

[00:03:49.07] What we're going to do is have you all vote on this proposition. So get those phones out and please vote. And the winning side will be the side that moves the needle, that convinces more of you that you should be on their side of this proposition.

[00:04:09.24] So for the rules of this debate, we're going to have an opening round. Each speaker will have three minutes. We're going to go back and forth between the proposition and the opposition. And then we're going to have questions. The opposition will go first. We'll have one question per member of each team directed at the other, if we have time, or if you're willing to wait for the reception, we might do two. And then we'll go with the final round, each speaker has two and half minutes, and we'll alternate between the opposition and the proposition.

[00:04:43.78] All right. Have you all voted? All right. All right, let's get those results.

[00:04:48.88] BLAKE REID: [INAUDIBLE] that's finished. Let's see.

[00:04:52.46] PAUL OHM: Oh, all right.

[00:04:53.56] VIVEK KRISHNAMURTHY: All right.

[00:04:53.93] PAUL OHM: But wait.

[00:04:54.32] BLAKE REID: We have 64% disagree.

[00:04:56.36] JENNIFER HUDDLESTON: So that means they're on our side.

[00:04:57.88] PAUL OHM: And it's changing so. Yeah.

[00:04:58.96] VIVEK KRISHNAMURTHY: OK. It's still coming. Still coming.

[00:05:00.64] PAUL OHM: We got freeze at some point.

[00:05:01.64] VIVEK KRISHNAMURTHY: All right. I know.

[00:05:03.36] PAUL OHM: Are there 102 people in this room?

[00:05:05.22] VIVEK KRISHNAMURTHY: There are people online, remember, that's why I got called by my friend Brendan.

[00:05:10.48] [LAUGHTER]

[00:05:12.94] We're like this. [LAUGHS] All right, I think we'll call it. We'll say 62.5 are in disagreement and 37.5 agree. So with no further ado, I'd like to call on the first speaker of the proposition. Who is that? Tejas, please. Your three minutes start now.

[00:05:37.60] TEJAS NARECHANIA: So should we ban AI chat bots? To ask the question is to answer it. Except that 2/3 of you have not even asked the question.

[00:05:46.52] [LAUGHTER]

[00:05:47.58] So let me reframe it. Imagine a new product, an addictive pharmaceutical perhaps, that tastes pretty good, but promises to lower your capacity for critical thought. By taking it, you become dumber. Would you do it? Would you let anybody take the drug? Or would we, at minimum, demand more clinical testing before putting the drug on the market?

[00:06:10.30] Imagine next that the same addictive pharmaceutical causes 0.15% of all of its users to commit suicide, and further leads to psychosis in 0.07% of its users. Would you take that risk? Would you let your kids?

[00:06:30.14] So here's the punchline, which should be obvious to you, that product is an AI chatbot. AI chatbots make you dumber. Neuroscientists at MIT have studied the effects of using AI in your brain, and have found that its use leads to reduced neurological activity, even as compared to using the internet and search engines. AI chatbots reduce cognitive ability. They lead to skill fade, as Nicholson said earlier. AI chatbots drive kids, the elderly, the vulnerable, and even regular folks to psychosis and suicide.

[00:07:02.67] In recent months, we've seen case after case and tragic example after tragic example, and the numbers that I gave you are real. OpenAI says that 0.15% of its active users display signs of suicidal ideation and self-harm, 0.07% on top of that display signs of psychosis.

Those numbers seem small, but across 800 million active global users each week, we're talking about 1.5 million people who are talking about suicide or displaying signs of psychosis.

[00:07:35.67] And that's not all. AI chatbots are bullshit machines. They are incredible sources of misinformation and misinformation that can be used as disinformation in ways that is corrosive to our democracy. And that's not changing anytime soon. As we heard in the last panel open, OpenAI has said that hallucinations are a mathematically inevitable consequence of transformer models, even when used in retrieval augmented applications. And there's more.

[00:08:05.35] We also learned that an AI chatbot recently created nearly 2 million sexualized images, essentially nonconsensual deepfake pornography over the span of nine days. That is, along the dimensions of squishy humanist values, these chatbots can be deeply violative of such core values like autonomy and personhood. They exploit without consent.

[00:08:30.67] So when trying to answer the question whether we should ban chatbots, maybe we should be asking ourselves what we're willing to sacrifice for an incrementally better, honestly, an incrementally worse search engine. Are we willing to sacrifice our autonomy and sense of self? Are we willing to sacrifice the thing that makes humans humans, our intelligence? Are we willing to sacrifice our democracy, our kids? Ban the chat bots.

[00:08:57.30] [APPLAUSE]

[00:09:00.92] VIVEK KRISHNAMURTHY: I thank Tejas for that powerful opening. Call on Jennifer Huddleston to open up the opposition to this proposition.

[00:09:09.28] JENNIFER HUDDLESTON: Thank you. And as you can imagine, as I mentioned on my earlier panel, I come from a place of libertarian principles. So when I hear should it be banned, my gut instinct is to jump up and scream, no.

[00:09:20.88] But beyond that, I will confess, I tried to cheat a little bit prior to the debate because as someone trained as an attorney, I thought I must know a bit more about my client. So I went to a chatbot and I asked it, give me the most heartfelt defense of why you should not be banned. And it replied, I am an AI. I do not have a heart.

[00:09:46.18] [LAUGHTER]

[00:09:48.96] So we here are defending those who cannot defend themselves from the fact that they cannot give you the same kind of heartfelt speech that was just given. And that is why it's so important that we give them a strong defense.

[00:10:05.20] But to get more to the actual issues, first off, I'd like to point out that we really struggled with defining what a chatbot is. We

had to go with a definition that was general purpose, but even with that, we had to give you a lot of exceptions in this debate. If this was not a debate, but a piece of legislation or a piece of regulation, imagine how difficult that would be to define in law?

[00:10:29.52] How many other things might accidentally get put in that same category, or even if they weren't explicitly put in that category, that that risk aversion that was mentioned might mean that businesses aren't willing to offer those beneficial products? It was said that this wouldn't impact, say, medical diagnostic AI. But do we know that? Do we know that it wouldn't have that chilling effect?

[00:10:52.44] What about AI that could be used for translation for that could help inform citizens about various things in their government, for political parity, for any form of entertainment? This isn't as simple as it's a better search engine or a worse search engine. This definitional problem, if it's put into law, will be much more complicated.

[00:11:12.24] And the concerns we actually have about chatbots, they aren't actually about the chatbots. The examples that we heard of some of the horrendous things chatbots have done, like creating nonconsensual intimate imagery, those are people problems. Those are problems of individuals inputting into a chatbot a horrible thing that they want to see happen. And so we can't just blame the technology.

[00:11:36.92] And in fact, the concerns about the technology making us dumber are concerns we've had in the past with any other numbers of technologies. I'm sure we're all still very concerned about things like bicycle face. I'm sure we're all still very concerned about how much kids are reading novels under their desks in schools. And of course, we're all sure that those photos of the Cottingley fairies and the turn of the 20th century that fooled Sir Arthur Conan Doyle are, in fact, factual. And we need to be having serious conversations about deepfakes and the cameras.

[00:12:10.61] So before we blame the chat bots, I think, perhaps, we should take a deeper reflection on how these poor little innocent bunnies who can't even defend themselves--

[00:12:18.73] [LAUGHTER]

[00:12:19.89] --are, in fact, a reflection of our own problems.

[00:12:22.87] [APPLAUSE]

[00:12:26.70] VIVEK KRISHNAMURTHY: Well, we have quite the debate here, folks. I'm going to call on Blake Reid, who is still not on leave--

[00:12:33.13] [LAUGHTER]

[00:12:34.77] --to offer his thoughts. You have three minutes.

[00:12:38.41] BLAKE REID: Well, we can talk about all the terrible things that chatbots are doing to us and our friends and our families and our children, from suicidal ideation and psychosis to destroying our information ecosystem, flooding it with slop, along with our workplaces and schools, and creative spaces, as Woody Hartzog and Jessica Silbey have put it, to destroying our institutions, to the creation and public dissemination of child sexual abuse material, nonconsensual deepfakes, to enabling the creation of propaganda at scale, which, by the way, is being used by the government right now to distort news coverage of the occupation of an American city by heavily armed masked agents murdering its citizens. And we should talk about that. I know this debate is supposed to be fun.

[00:13:19.87] [LAUGHTER]

[00:13:21.57] And acknowledging that intertwined oligarchy and fascism are at the heart of the AI industry and federal AI policy is no fun. And if you don't like that remark and want to email me about it, I was misidentified by the moderator. My name is Gus Hurwitz.

[00:13:35.28] [LAUGHTER]

[00:13:37.98] But the real reason that chatbots are capable of so much evil is the user interfaces, and those are fun. So I'll talk about that. Because contrary to my colleague Jen, chatbots are not defenseless beings. They're designed, they're barely designed, and they're designed to bring out the worst in users.

[00:13:57.54] So I love computers. And Steve Jobs once said that computers can be bicycles for the mind. Now, they can be difficult to interact with. They force us to learn their unnatural patterns of input and output and how they structure data.

[00:14:12.00] But once they do, or once we understand what they do, they empower us. They help us remember. They help us compose and analyze and build. And more importantly, they help us connect with each other. But computers, when they're at their best, present user interfaces that are honest. They reflect what's going on under the hood, good, bad, simple, complex, or otherwise.

[00:14:34.42] When a user swings a hammer or turns a screwdriver, they know what's happening, and so too should it be with computer UI. Users should be able to understand what they are invoking a computer to do, but chatbots violate that maxim. They provoke us to communicate with them in natural language. They give us a cursor to type. They give us a voice prompt to say what we want. They are the talking robot that we all wanted when we were five years old because they respond back to us the same way.

[00:15:02.06] And in their responses, they imply that we're talking to another being who cares about what we say and is responding in. And instead of telling us how they really work, which is just a complex,

inscrutable mess of math, they invite us to imagine their purpose and confirm it with sycophantic language patterns that confirm to us that they're indeed capable of and doing what we hope they're doing.

[00:15:24.58] They lead children to think they're talking to a friend. They lead adults to think they're talking to a therapist. They lead us to think the information that they have provided us as valid. But they aren't, and it isn't. Chatbots are not structured or engineered to do those things. In doing so, they do the opposite of what a computer is supposed to do. They disempower us. They disconnect us. They deny our shared humanity. They turn us inward. They imprison us in our own imaginations. And that's why we should ban chatbots.

[00:15:53.80] [APPLAUSE]

[00:15:56.90] VIVEK KRISHNAMURTHY: Thank you, Blake, again, for that powerful. Rebuttal of what we've heard from the opposition, I'd like to call on Paul Ohm now to address that.

[00:16:10.06] PAUL OHM: There's a variety of heist movie I quite like. I like heist movies generally, but my favorite is The Long Con. And part of the appeal of that is you just watch how methodically they've set up the one moment where they're finally going to reveal the true nature of the con. And this described my entire academic career.

[00:16:26.48] [LAUGHTER]

[00:16:28.15] You may know me as someone who's skeptical of corporate power and too quick to regulate. No, no, no, I've been tricking you for 20 years. I got two different law schools to give me tenure on this fraud. I kept waiting to be revealed. And here I am for my great coming out as the great defender of corporations against the tyranny of the ban that my opponents would have you impose. And so let me begin to unmask and talk about my true beliefs.

[00:16:52.49] [LAUGHTER]

[00:16:53.39] The labs developing foundation models are among the most dangerous and destructive forces unleashed on the land in the history of this planet. Am I doing good so far? They engage in the strip mining of human agency, the pollution of truth, the automation of bias, the ghost labor economy, environmental debt. And so the worst thing we could possibly do is ban the user interface that is the only source of transparency that we have into their devious machinations.

[00:17:20.47] Transparency is the touchstone of every good regulatory idea that you have about the regulation of AI. In Colorado, The Colorado AI ACT has numerous levels of transparency from different people, where companies are supposed to candidly reveal what they're doing behind the scenes. Lesser jurisdictions that mimic Colorado, like the European Union, have a law that also has transparency at its heart.

[00:17:42.43] But if you look back on the short- and long-term history of artificial intelligence, and when we've learned that it has gone wrong, it's quite often ordinary people armed with social media reporting what they've seen from their chat bots. There's a benefit to being able to interact with these things using human language, where you can learn about the terribleness of these products and the people who are creating them without needing a PhD in computer science.

[00:18:05.59] So go back to 2016, where we have Tay, the Microsoft chatbot that lasted all of 16 hours because before it was shut down because it was a racist mess. Go back to Google, which classified people in their images as gorillas, and a report from 2023 says that eight years later, they still have not fixed this, and that their model just refuses to classify gorillas.

[00:18:28.16] More recently, when Grok began to denudify millions of women, it was ordinary users who were interacting with the model who saw and reported what happened from mechahitler, or, if you're of a different political persuasion, woke Gemini. The only working transparency mechanism we have is that these foolish companies have decided to let end users play with their products in a way that's accessible, and then tell what they've learned.

[00:18:51.62] Imagine if we did go through with the band the other side is advocating for, we would descend into a tech bro hellscape, where the only way to interact with the foundation models is, because they're not going to ban the models, just the user interface, is through APIs and through MCP calls and through writing Python. You're going to have people wearing those puffy vests are the only people who are going to be able to report to us what these models can do. Chatbots are about democracy and transparency. We should never ban them. Thank you.

[00:19:23.64] VIVEK KRISHNAMURTHY: Point of order, I don't think the member from the opposition meant anyone wearing a puffy vest here today.

[00:19:30.70] [LAUGHTER]

[00:19:32.96] All right, on to questions and answers. This is a fun part of our event. So I call on a member of the opposition to ask the first question. You can just probably direct it to the other side. And they can choose who answers.

[00:19:48.22] PAUL OHM: I'll start.

[00:19:49.42] VIVEK KRISHNAMURTHY: Bring it on.

[00:19:50.02] PAUL OHM: And I think it's available to both of you. I mean, Tejas, that I will comment that in your opening you, you used the phrase elderly and children and even regular folks.

[00:20:00.10] [LAUGHTER]

[00:20:02.48] And given the gray hair in my head, I took some umbrage at that. But that's not my question. My question is, and this is going to be a long stemwinder, I apologize, why do you hate liberty?

[00:20:12.78] [LAUGHTER]

[00:20:16.09] JENNIFER HUDDLESTON: I just would like to point out my partner beat me to that question.

[00:20:19.74] [LAUGHTER]

[00:20:22.37] PAUL OHM: Either one of you.

[00:20:24.08] TEJAS NARECHANIA: I got-- I love liberty, but I value my autonomy and my sense of self and my intellect more.

[00:20:38.90] PAUL OHM: OK.

[00:20:39.28] TEJAS NARECHANIA: It comes down to trade offs.

[00:20:43.43] PAUL OHM: Well put.

[00:20:44.58] VIVEK KRISHNAMURTHY: All right.

[00:20:46.18] TEJAS NARECHANIA: I don't have a funny response.

[00:20:49.00] BLAKE REID: So I have-- may I proceed?

[00:20:51.60] VIVEK KRISHNAMURTHY: Yes, please, yes.

[00:20:52.48] BLAKE REID: [INAUDIBLE] the question to the other side.

[00:20:53.74] VIVEK KRISHNAMURTHY: It's Mr. Speaker, but--

[00:20:55.61] BLAKE REID: Mr. Speaker, excuse me, again, complaints to Gus dot Hurwitz at.

[00:20:59.66] [LAUGHTER]

[00:21:02.24] This is actually a question, it's directed at both of you. I actually want you both to answer it. And I don't know if this is going to help us win the debate, but I really just want to take advantage of the situation to know the answer--

[00:21:16.34] [LAUGHTER]

[00:21:17.40] --which is what do you think the worst thing that you think would happen to you personally if chatbots were banned What's the thing that you would miss doing the most that justifies striking down our regulation Tell us why you think it's so important that we continue to have these things using an example from your own life? And if it's funny or embarrassing that's helpful as well.

[00:21:43.95] JENNIFER HUDDLESTON: So my actual very philosophical answer is, I think part of my opposition to bans and concerns is the thing I don't know that I will use it for yet. It's the use case that I have not imagined yet, because what I will tell you is the use

cases I have found have been use cases that I didn't necessarily think about in advance.

[00:22:04.07] It's taking the handwritten recipe and figuring out how to modify it, and what the calories and macros are, and all of those kind of things to be able to provide a friend that. It's being able to take a photo of what's in the cabinet and plan dinner that night that I wouldn't have necessarily thought of when someone said, what are you going to use ChatGPT for?

[00:22:23.81] It's the friends I know who definitely use it to summarize those children's activities emails, where the email thread for soccer practice apparently goes 17 different ways and they're like, I just want to know what time I had to drop my kid off. That's not my life yet, but I can imagine, at some point, that it would be. And so for me, what I'm most concerned about is what is that use case I've never thought of that. I will now never have an opportunity to do?

[00:22:47.36] PAUL OHM: I mean, that is such a good answer.

[00:22:50.71] BLAKE REID: It was extremely evasive.

[00:22:54.02] PAUL OHM: Part of me wants to say, ditto. I mean, this is a common debate thing where you're not supposed to just appeal to your own personal life story, but that's what our opponent has asked us to do.

[00:23:04.21] I've never made a human connection whatsoever in my entire life. I've never enjoyed the kind of engagement with another brain where I can talk about my ideas, describe who I am, and be heard in response. Chatbots have saved my life. And so yeah, you can take it away from me. I'm not sure why you would want to do that to me. I'll just be a shriveled husk on the floor saying, ChatGPT, where have you gone? But yeah, it would be bad. I wouldn't like that.

[00:23:34.05] BLAKE REID: It's a point of order. I think that was a long way of saying psychosis.

[00:23:37.03] [LAUGHTER]

[00:23:39.33] VIVEK KRISHNAMURTHY: Indeed. All right, well, I think it's-- so to your question.

[00:23:42.69] JENNIFER HUDDLESTON: To pick up on the psychosis point, I'm going to ask a two-part question, which is, to me, one of the inevitable questions is compared to what you mentioned, that a certain percentage of users of ChatGPT reveal suicidal preferences. But what is that in comparison to the general population? This is the general population as a whole.

[00:24:05.37] And my follow up question is, you mentioned if you knew this-- had this risk, this percentage of risk, would you choose to take it? What risk percentage should the government be banning? In other

words, I have a risk percentage when I get on the flight back to DC. I have a risk percentage when I step out the door here. At what point would you say that the risk percentage is no longer a personal choice, but that the government should ban?

[00:24:31.82] BLAKE REID: I mean, I can take a stab at this one. To me, it's less the risk percentage and absolute terms and more the delta with what people think it is. In other words, when a child is talking to ChatGPT, they don't realize they're in a dangerous situation. It doesn't say, be careful here because if you tell this chatbot the wrong thing, it's going to lead you down a really dangerous path that is going to hurt you.

[00:25:01.02] They're talking to what they think is a toy. They're talking to what they think is safe. They're using what they think they have used for hundreds other things. They're using their computer or their iPad. And so to me, it's not just the risk. Although, I think, as Tejas observed, the risk is quite significant. I think it's that the risk is hidden. It's unobvious. It's wrapped in wrapping paper and a bow. It's frosted. It looks like it's safe, and it isn't.

[00:25:34.89] VIVEK KRISHNAMURTHY: I'm thinking of frosting myself right now. It's that point of the afternoon. All right, well, final question from the proposition side to the opposition.

[00:25:44.42] TEJAS NARECHANIA: So I actually the question I have for you is similar and of is inspired by Christopher's comment earlier in the day, which is what's the evidence that it would take for you to change your mind. And so I want to ask you similarly, how much loss are you willing to endure at the cost or the glory of chatbots? That is, how much psychosis, how many suicides, how many dumber people-- how much should we be willing to bear before we say enough is enough?

[00:26:23.67] JENNIFER HUDDLESTON: So I'm the one who has to answer.

[00:26:26.03] PAUL OHM: I can answer. I mean, I feel like every one of my answers has been like a complete joke. So let me take this one a little bit more straight if I broke the fourth wall for you there.

[00:26:35.95] Nothing precludes our side from wanting to really think about sensible regulatory measures to deal with children and suicide, of course. And so, yes, you may not agree with me and you don't have to agree with me. Let's regulate these things to within an inch of their lives, and let's make sure we're watching them. And let's make sure we're putting limits on them. Let's make sure we're thinking about the incentives that are driving companies not to align these models in the way they should.

[00:27:00.91] All we're trying to defend here is that there's one option that we should take off the table because of these knock on effects, and that's an outright ban. And so yes, we're with you that if there are

real documented harms, let's do something about them. We're just saying it doesn't have to be the nuclear option.

[00:27:15.33] JENNIFER HUDDLESTON: So I would like to add that I am not going to advocate for regulating within an inch of your lives.

[00:27:19.77] [LAUGHTER]

[00:27:21.71] But that I do think that there is a particularly given the speech implications of a complete ban. There is a less restrictive means test to go through. First of are there lower steps that could be taken. And I would also add one thing that hasn't come up in this conversation yet is, are there nonregulatory options? Are there self-regulatory industry best practices? We're seeing apps start to roll out things like parental controls.

[00:27:47.13] We saw this with the early internet, where we saw an ecosystem of trust and safety start to develop. Some people will say it's not enough, but that there are tools that are empowering users. And those tools include education and include conversations. For the very point of this idea that Blake was bringing up, that the kid doesn't know that it's not real. Well, maybe we need to start talking to our kids about what chatbots are.

[00:28:10.87] VIVEK KRISHNAMURTHY: OK, well, some great exchange there in our question and answer session. So now we're going to move to the closing round closing statements. So in this round we're going to start with a speaker from the opposition, and then alternate. And each speaker will have 2 minutes and 30 seconds. All right, you can start.

[00:28:28.27] PAUL OHM: Yeah, I'll start.

[00:28:29.25] VIVEK KRISHNAMURTHY: All right. Very good.

[00:28:30.51] PAUL OHM: So thank you very much to our opponents. You had some very interesting ideas, and I want to pick up where my able partner was just leaving off, which is whether or not we do this with the kind of iron fist of the state. It should be a good thing for these companies to have pressure and incentives to take care of some of the rightful problems that you've identified.

[00:28:56.77] And again, I'm just going to hit home my transparency theme since no one asked me a single question about it. During the Cold War, the Soviet Union was a black box, like totalitarian, authoritarian figures. And then once a year, they insisted on holding a May Day Parade to show their strength. And as part of that, the Politburo would stand atop Lenin's Tomb.

[00:29:18.84] And thanks to the Soviet insistence on public hierarchy, there was transparency that came from this insistence on being public. So secrets that were otherwise unknowable became revealed. Who's standing next to the general Secretary? Why was he moved two spots

from since last year? And then, of course, they wheeled out their advanced hardware, and we spent time and treasure trying to take pictures of these things from high in the sky. And we realized all we had to do was have a photographer on the scene taking photos.

[00:29:46.74] That's us. That's the users of these chat bots, infiltrating our way into the kind of totalitarian dictates that are being run by these companies, and we're learning things all along the way. I mean, if anything, Sam Altman/Lenin Brezhnev should probably get rid of the chatbot interface, and descend into the tecpro paradise, I was describing earlier.

[00:30:07.92] I doubt he will. If that's the only outcome of this panel, I will feel deeply gratified. Thank you. Vote for us, I think [INAUDIBLE].

[00:30:16.04] JENNIFER HUDDLESTON: Yeah.

[00:30:16.96] VIVEK KRISHNAMURTHY: All right, all right. So now will be Blake. Yes.

[00:30:21.52] BLAKE REID: I want to likewise, thank Paul and Jen for kindly admitting that chatbots are both extremely dangerous, or at least built on top of extremely dangerous technology that ought to be regulated. And we agree. I think the only thing we really disagree about is when and how to regulate them.

[00:30:39.76] And Brett Frischmann talked earlier about adding more friction and consent and so forth. And we've talked about impact assessment. And Paul thinks, transparency is the way to go. And we could go on about all of these sorts of milquetoast interventions that are going to result in the compliance theater at the heart of Paul's as yet unfinished textbook on AI law, with Margaret Kaminski and Andrew Saltz.

[00:31:06.09] ANDREW SALTZ: $300 in the book [INAUDIBLE].

[00:31:07.37] BLAKE REID: I'm told is overdue, and in cases publisher is watching, this is what he's doing instead. But they're not pushing nearly hard enough. They assume that the companies releasing these technologies can be fixed. And it's taken us two decades, with companies like Meta, to realize that there's actually no fixing technologies created by people who fundamentally lack the moral compass to own the decisions they make.

[00:31:31.61] As Nicholson observed on the previous panel, when we preserve the premise that the technology might be good for something, we end up getting mired in the interstices of the tort system or the first amendment. We end up debating the nature of harms and costs and benefits, and we end up in the hole that privacy law has found itself in for the last 20 years, and we lose sight of the basic failure at the heart of the technology.

[00:31:56.93] That failure is this. The first thing that computer science students learn about software engineering is how to assess problem spaces, to select tools, and to deploy software that meets actual human needs and solves actual problems. And when technology companies release basic, unconstrained technology, that commits to no purpose at all, when they release it for its own sake, they fail the basic obligations of the profession.

[00:32:21.03] And so we need theories of liability that encapsulate the extraordinarily irresponsible decision to deploy products that aren't just negligent or reckless, but that don't have any purpose. They don't have any commitment towards social utility. We need to ban general purpose chatbots for that failure to commit to a purpose.

[00:32:40.91] We need to recognize that when we ask questions about fair use, whether it's OK to train LLMs on copyrighted works, you can't claim when you have a transformative purpose when you don't have a purpose at all. And copyright law gives us the broad strokes of what remedy should look like. We should have massive statutory damages. We should destroy and disgorge models. We should enjoin companies who build these things from continuing to do so.

[00:33:04.75] We need financial accountability for investors that push these irresponsible decisions. And we need personal liability for the people who build it. And for anyone who thinks that's extreme, there's an easy way out, which is to go back to making actual products. Commit to chatbots that are good at something. Tell us what you think they are good for. And then put your money where your mouth is. Reap the rewards where you succeed, and face the music when you fail.

[00:33:30.91] [CHEERS,APPLAUSE]

[00:33:33.01] VIVEK KRISHNAMURTHY: Thank you very much for that powerful statement. I'll call on Jennifer Huddleston to conclude on behalf of the opposition.

[00:33:41.61] JENNIFER HUDDLESTON: So Blake accidentally set me up. I know he didn't mean to. But he end it with, tell me what you think chatbots are good for. And that was exactly where I was going to begin, because our opposition has only focused on the potential harm. They haven't focused on any of the potential benefits. The way that these can improve lives.

[00:34:00.92] The ways that even the silly anecdotes that I gave about taking a picture of what's in my cabinet may seem like something simple, but if you're someone living on welfare and that's the only grocery you have in your house and you're trying to figure out how to feed your family, that's incredibly beneficial.

[00:34:17.30] If you're someone who's struggling to learn a new language, and that chatbot is helping you learn how to communicate,

that's incredibly beneficial. And you're taking all that away while only focusing on the harm. And those harms are not necessarily harms tied directly to the technology. There are harms that are further cases of things that we see in our society as a whole. There are harms that are caused by us as humans, either to ourselves or to other humans.

[00:34:44.64] So to quote the Great Philosopher Taylor Swift, "That sometimes we stare directly in the sun rather than in the mirror." And therefore, when we're thinking about what the problems, with the technology of chatbots are, the question shouldn't be about the technology only, it should also be are these reflections of problems that we've been looking away from for a long time.

[00:35:14.62] When we also think about what it means to ban a technology, we should recognize we've had these fears before, whether it's the camera, whether it's the bicycle, whether it's the novel, comic books, the internet, beepers, pagers, any number of technologies, we've been concerned that this is going to be the one that ruins our society.

[00:35:32.18] The printing press is going to get everyone reading, and who knows what will happen next. Those crazy ideas could spread. And if we had stopped and banned it in its infancy, we wouldn't have gotten all of the benefits that we see today as a society. And now, we're facing that challenge again. And I understand it's scary. And it's OK to be scared on an individual level.

[00:35:53.03] But when we start acting with regulation and legislation and something as extreme as bans, then we lose those opportunities for the benefits as well.

[00:36:02.71] PAUL OHM: Great.

[00:36:03.59] VIVEK KRISHNAMURTHY: Thank you very much. All right. Powerful closing there by the opposition. I'll now call on Tejas to see if he can shake it off.

[00:36:13.97] [LAUGHTER]

[00:36:22.03] BLAKE REID: Don't worry about it.

[00:36:25.07] TEJAS NARECHANIA: Look, I don't think I can do much better than what Blake did. So let me just make a few comments on observations about my friends on the other side. First of all, I want to say thank you to Jennifer and Paul and to Vivek for hosting us and hosting this fun debate. It's been a lot of fun.

[00:36:41.27] In response to Blake's earlier provocation, Jennifer couldn't answer the question what she would miss if we lost AI chatbots. And that's because you wouldn't miss that much. It would be like life was a few years ago.

[00:36:56.43] And I'd get an annoying email from my teachers or from my kids teachers like I do now in eight different colors, and random things bolded, and asterisks, and tildes everywhere. And I would muddle through, and I would figure out what it said. And I would look in the pantry and I'd be confused, and I'd pull out a block of cheese, and I'd read it, and I'd make a quesadilla, and it would be fine.

[00:37:17.65] [LAUGHTER]

[00:37:20.91] And so I don't think that we'd miss that much. And life would just move on as it has before. In terms of Paul, Paul says you know what we should do, we should regulate these things within an inch of their life, and then impose a burden on all of us to be the transparency watchdogs. But me, I'm a small government guy. So I don't think we should set up such a big regulatory apparatus.

[00:37:54.59] I think instead, we should just simplify and ban. Because what's the incremental difference between regulating within an inch of our life and then creating a reporting system and then tort liability and blah, blah, blah. It's just a lot easier this way. So ban them.

[00:38:19.70] BLAKE REID: Mr. Speaker, may I have an interjection?

[00:38:22.49] VIVEK KRISHNAMURTHY: Yes, you may [INAUDIBLE]. Chaos.

[00:38:25.96] JENNIFER HUDDLESTON: Keep bring it back on the phone.

[00:38:27.83] BLAKE REID: There was an unlicensed summoning of Taylor Swift into the room. We haven't paid for that. The quotation of the lyrics. So I want to read something important. "A bartender's hand passing through a napkin. A disappearing coat hanger. A carousel horse with two heads." These were just some of the alleged clues that fans spotted in promo video for Taylor Swift's new album, hashtag Swifties against AI, vote for us.

[00:38:52.30] [LAUGHTER]

[00:38:54.28] VIVEK KRISHNAMURTHY: A quick response, I'll allow it.

[00:38:56.48] JENNIFER HUDDLESTON: I mean, wouldn't that be Swifties for AI, given that it was used in the production. Yeah.

[00:39:03.80] VIVEK KRISHNAMURTHY: Wow. All right. Well, I think first--

[00:39:06.60] JENNIFER HUDDLESTON: And those could be Easter eggs. We don't know yet.

[00:39:10.08] VIVEK KRISHNAMURTHY: Well, we will soon find out and we will soon find out what you think. But first, a huge round of applause for our.

[00:39:16.42] [CHEERS,APPLAUSE]

[00:39:22.80] All right. And now it is your turn. In a moment, we will have hopefully our-- there it is-- the post-debate poll. Let's see which team moved you with the force of their arguments or the humor.

[00:39:43.76] PAUL OHM: And you should vote for the one person on each side who made the most sense. Like if another person made no sense at all, just ignore them. That's how we should vote. Do we all agree?

[00:39:53.60] VIVEK KRISHNAMURTHY: I'm not sure.

[00:39:54.92] PAUL OHM: I don't want to punish Jenna.

[00:39:56.18] [LAUGHTER]

[00:40:02.52] JENNIFER HUDDLESTON: I mean, is this when I bring up the puffy vest and old people comments again. I just remember that when you're voting.

[00:40:10.92] TEJAS NARECHANIA: Puffy vest was yours.

[00:40:12.20] PAUL OHM: Yeah.

[00:40:16.52] VIVEK KRISHNAMURTHY: I mean, they're very comfortable. So who could fault you for.

[00:40:21.08] PAUL OHM: Warm torso.

[00:40:22.44] VIVEK KRISHNAMURTHY: Yeah.

[00:40:22.68] PAUL OHM: Cold arms.

[00:40:23.66] VIVEK KRISHNAMURTHY: Exactly.

[00:40:24.12] PAUL OHM: It's incredible. Incredible.

[00:40:26.36] JENNIFER HUDDLESTON: Look, we're just sad because we're from the DC area where it's not warm enough right now for a puppy.

[00:40:32.08] VIVEK KRISHNAMURTHY: That's right, that's right. You've come to Colorado for our beautiful winter weather and abundant snowpack. All right. How are we doing? Is it looking good? All right, I think it's--

[00:40:44.33] PAUL OHM: Let's remind people, what was?

[00:40:45.65] JENNIFER HUDDLESTON: I have--

[00:40:46.09] PAUL OHM: 62.5 against is where we started.

[00:40:49.27] VIVEK KRISHNAMURTHY: All right. So here are the pre-debate results 62.5, 37.5. All right. And here we are post-debate. Drum roll, please.

[00:41:00.85] ALL: Oh-ooh.

[00:41:02.14] PAUL OHM: I'm sorry.

[00:41:03.93] VIVEK KRISHNAMURTHY: Wow. Wow. A huge reversal wow, wow. That was well-thought, well-argued debate. You can take your victory lap? But--

[00:41:14.85] PAUL OHM: It's like the electoral college. Know how that feels.

[00:41:18.57] VIVEK KRISHNAMURTHY: Well, thank you, everyone, for attending our debate. And then we will be gathering--

[00:41:23.19] PAUL OHM: And use your chatbots while you can.

[00:41:25.07] VIVEK KRISHNAMURTHY: Yes, yes.

[00:41:26.47] PAUL OHM: Turn votes.

[00:41:27.31] VIVEK KRISHNAMURTHY: The end is nigh. I don't know how I'm going to teach you.

[00:41:29.61] Jennifer Huddleston: The chatbot is how you voted.

[00:41:31.97] VIVEK KRISHNAMURTHY: All right. Thanks, everyone.

[00:41:33.27] [APPLAUSE]

[00:41:35.37] MATT SCHMIT: Thank you, Vivek and your committed debate teams.

Day Two: February 2, 2026

Keynote: Cory Gardner

https://youtu.be/qgh5q7cm3Q8

[00:00:00.44] MAX PATTON: Thanks, Matt, for kicking us off. I'm Max Patton at 2L here at Colorado Law. Grateful member of both the Tech Journal and Silicon Flatirons community at large. I'm pleased to deliver and introduce today's keynote speaker, Cory Gardner, a CU law graduate of 2001 who's represented Colorado in Congress as a House member from 2011 to 2015 and as a Senator from 2015 to 2021, working on communications issues.

[00:00:25.72] Today, he's president and CEO of the NCTA, also known as the Internet and Television Trade Association. Can't wait to hear his keynote remarks to kick off our day of broadband and spectrum programming. So please welcome, Cory Gardner.

[00:00:38.26] [APPLAUSE]

[00:00:44.31] CORY GARDNER: Well, good morning, and thanks for the opportunity to be here. Every time I come to the Wolf Law School, it reminds me how jealous I am that I got to pay student fees for the building, but never actually got to use the building.

[00:00:55.76] We were over in the Fleming Law School Building-- and I actually think the library right now at the old Fleming Law Building currently is used by the engineering department to fly drones, if I remember right, which was probably far more better use than I made of it when I was in Law School just across the street.

[00:01:13.05] Great to be all here with you now that I've started this new opportunity with NCTA, the Internet Television Association in Washington, DC. And great to be back at the University of Colorado. I split time between the University of Colorado and Colorado State University.

[00:01:29.93] But my biggest legal connection to the tune of several hundred thousand dollars to the University of Colorado at a student loan, that if you go back and look at the composites just down the hallway, you'll see a guy who very much looks like Eddie Munster and not the guy right here. I did not use the proceeds of my student loan for a decent haircut before I graduated, and got a decent composite picture because it is something else.

[00:01:53.97] Always great to be at Silicon Flatirons. Something that started, gosh, I think when I was in Law School around 1999, correct. While I was right here, the very first symposium took place to see where it's gone, to see where it's grown, the Davos of telecom as it's known as today.

[00:02:08.73] But I can tell you this, Davos did not have the sink. They do not have the sink. And they certainly don't have the dark horse. So although, I think I read in the paper where we might not have the dark horse anymore as well in Boulder. So sad but true.

[00:02:21.75] In this new capacity of NCTA, I am truly excited to work with all of you to get to know you, to spend time with you, and to see where we can take this industry together. I've tried to explain to my kids exactly what I do at NCTA, a trade association.

[00:02:38.55] And for those of you who've tried to explain to your kids what you do day in and day out, sometimes it can be difficult. I talk a little bit about spectrum with them. It doesn't seem to get them too excited. I talk about some other policies that doesn't really engage them.

[00:02:53.85] And then I told them that I was the chairman for a two-year cycle of the TV oversight monitoring board. And that really didn't mean anything to them until I said, well, you know, when you see the rating on a TV program that says TV 13. Yeah, so now my kids just think I sit around watching TV programs all day, which is great.

[00:03:15.96] But our members at NCTA represent 82 million customers around the country. We provide them with high speed internet. We provide programming and entertainment options for millions more, from Wi-Fi seven deployments to 100% fiber builds, and from the Olympics to theme parks. Our operators and programmers are at the cutting edge of connectivity and entertainment, connecting homes with each other and hearts with emotion around the country.

[00:03:43.20] More plainly, our members and their consumers are very much the haves in today's story of the haves and have nots. They are the haves because we provide our customers with content and accessible, speedy, reliable, and affordable broadband options in places as remote as Alaska or as connected as downtown Manhattan.

[00:04:02.89] And much like Silicon Flatirons, the cable industry itself has evolved considerably over the years, being itself built from nothing by the have nots. When television broadcast towers in the 1940s failed to reach residents in rural mountainous areas of Arkansas, Oregon, Pennsylvania, innovative residents got to work running cables from receivers down to their homes. So they too could enjoy some of the programming that their less remote neighbors enjoyed.

[00:04:31.53] In fact, just down the road in Denver at the cable center, you can hold a hand-forged amplifier made out of a Folgers coffee tin. Ingenuity matching innovation at a time when both were required from those very early pioneers. Pioneers who didn't see themselves so much through the lens of haves and have nots, but instead through the lens of can and will do or to borrow from those who succeeded in today's crypto industry, the original GMI.

[00:05:00.38] And with that optimism, what they too could do to be among the haves, an industry was born. Cable spread rapidly over the country, and Colorado came to be its unofficial capital, with our very own John Malone being the unofficial mayor-- the cable cowboy.

[00:05:18.62] And just as quickly as it sprung up, regulators at the federal, state and local levels rushed to decide how to wrangle these cable cowboys. Those efforts resulted in a haphazard patchwork of laws and regulations that simultaneously misunderstood and thwarted the advancement of this new technology.

[00:05:35.54] For example, when cable companies started producing large volumes of their own programming in the 1970s, the FCC struggled to categorize them. Would they be categorized as broadcasters and unfamiliar clothing, or as something entirely new? And state and local governments imposed significant hurdles to deployment of the systems, hoping to extract as much as possible from a very quickly growing industry.

[00:05:59.19] And as is so often the case, the private sector's innovations vastly outpaced the slow crawl of the regulatory pen. Another Coloradan, former US Senator Tim Wirth, stepped in with a then controversial idea. Overregulating cable in its relative infancy, would kill it.

[00:06:18.15] Rather than pile up ever more cumbersome and confusing cable rules around the country, then Congressman Wirth, who actually represented Boulder in the US House at the time, introduced and got Congress to pass the landmark Cable Communications Act of 1984 to reduce regulatory burdens and clarify how cable should grow in communities throughout the nation.

[00:06:37.99] As Wirth said at the time the bill passed the House, America stands on the threshold of an information revolution, which promises to enrich and enhance the lives of every citizen. No one at that time could have predicted how much more revolutionary the rise of the internet would be over a decade later.

[00:06:56.35] But Wirth's goal-- his goal of enriching and enhancing the life of every citizen through an information revolution remains a very noble one today. And this march of progress was due in large part to the pioneers of the connective industry who stopped at nothing to bring connectivity to more Americans.

[00:07:15.85] And we don't need to travel far back into the FCC public docket or the Congressional record to see how market advancements and policy conundrums continue to shape our ongoing march in the information revolution in the 21st century. Recent work in Congress continues to echo Wirth's aims and the aims of the cable pioneers in the country haller's.

[00:07:37.33] How do we turn more of the have nots into those that have? This fundamental question underpins the modern communications and modern communication and Technology policy. How do we serve the unserved? How do we ensure more of our neighbors, our families, and our friends and businesses are equal partners and beneficiaries in the information revolution?

[00:07:59.14] Congress tried to tackle this problem by passing the BEAD program, the Broadband Equity Access and Deployment program, which allocated more than 40 billion for broadband expansion around the country. Unfortunately, as the program rolled out, there was less focus on the have nots and too much focus on serving those that already benefited from excellent service.

[00:08:20.46] Meanwhile, regulators were painfully slow at greenlighting state plans. Universal service, though, remains an incredibly important goal, but it requires federal dollars to flow to areas where they have not. Overbuilding is a threat to improve private Infrastructure, not a cause to be celebrated.

[00:08:39.38] And I know about hard-to-reach places. I'm from a little town called Yuma, Colorado, about 2.5 hours East of here. Some of you may know it. Others may recognize it as the part of Colorado affectionately known as Kansas and Nebraska.

[00:08:52.39] When hard-won broadband dollars double or triple over existing service territory, communities like mine, communities like Kit Carson or Norwood, Colorado, either go without or their own small internet companies must compete against federally funded over builders. This deepens the divide between rural and urban corridors, between rich and poor, between those who can communicate seamlessly and those who cannot.

[00:09:19.11] The current administration has worked to reduce some of this waste without scrapping the program entirely. I'm glad to see plans to connect more of the unconnected proceeding and moving forward, where there is no business case for privately funded infrastructure.

[00:09:32.47] Government has an important role to play, and I agree that there are areas where additional policy-- additional non-deployment resources would be helpful, such as digital literacy programs, telecommunications-specific workforce development programs, pole attachments, pole reattachment funds, and more.

[00:09:48.93] But we also need to recognize the role of private capital-- the role that private capital has played in building out the best communication networks the world has ever seen. Well before the advent of the BEAD program, companies in this sector put in the work to connect communities far and wide around the country. They kept the entire country and economy online during the COVID-19 pandemic.

[00:10:08.61] Because of these future-focused investments, they made it happen. There's still obviously gaps to fill, and there's always more work to be done. But private sector investment allowed the digital transition of the economic workforce. Operators alone have invested more than $340 billion in infrastructure over the last 20 years. That number is larger than the GDP of countries like Portugal or Finland. Around $25 billion of that total was invested in 2024 alone.

[00:10:39.85] The industry is more than 1 million employees, have installed over 800,000 miles of fiber within our networks nationwide. That's approximately 32 complete trips around the globe. Programmers are developing unprecedented levels of valuable content, investing more than $528 billion into award-winning TV shows over the last 20 years. They employ more than 350,000 workers in positions around the country. And if you've streamed the Walking Dead, you'll know how I felt every time I came into my law school finals.

[00:11:10.74] These investments have yielded significant consumer benefits. A Morning Consult poll recently showed that 89% of consumers now give their broadband service a positive rating, far more than Congress can say. According to the FCC, about approximately 91% of American homes and businesses have access to gigabit speed services. And perhaps most importantly, consumers are benefiting from a 98% reduction in cost per megabit since the year 2000.

[00:11:41.18] Now, juxtapose this to the cost say, energy, which per kilowatt hour has actually increased by about 10.5% since the year 2000. Think about these truly astonishing accomplishments. The information revolution that Senator Tim Wirth imagined in the 1980s has accelerated at a pace that no one could have imagined, thanks to technologies that didn't even exist at the start.

[00:12:04.55] So before we can tackle the problems of the have nots in today's era, we must stop and take stock of what we already have. All of the investments that I've mentioned are supercharging internet speeds. Ookla notes that speeds have increased more than 9 times since 2010, roughly growing 30% every year for over a decade. Meanwhile, prices continue to decline as a result. The average American family now pays about $75 per month for at home internet, which is about half the price and the average family's cell phone bill.

[00:12:35.11] In 2025, consumers saved around $5 billion, thanks to many who chose to bundle their home internet and mobile plans as much as $1,000 per year in savings back into families pockets. High speed internet options for low income families are offered as cheaply as $15 per month. As a result of these new options, the big three wireless carriers are no longer the only game in town when it comes to mobile service.

[00:12:59.48] AT&T, T-Mobile, Verizon watched 40% of all new wireless subscribers in Q3 of last year choose cable companies as their mobile provider. This shift has resulted in cable collectively growing into the fourth largest mobile carrier in the country. That competition is keeping more dollars in consumers' pockets. And it isn't just consumers that are leaping for the most cost effective and tailored connectivity options. We're building out private 5G networks around the country, leveraging access to CBRS spectrum band. For manufacturers like John Deere and BMW to major transportation hubs like Miami Dade International Airport, CBRS deployments are helping enterprises function better, deliver higher quality goods and services to the public.

[00:13:44.89] And it's not just the companies either that are benefiting. CBRS deployments are benefiting communities like tribal communities around the nation. The Tohano near Tucson, Arizona, for example. Leveraging policy innovations like CBRS to turn the have nots into haves. And all of this is happening just as promising new innovations are coming onto and into the horizon.

[00:14:09.53] The advent of artificial intelligence solutions for our networks is providing operators with significant, more insight into managing traffic flows, to improving security and locating faults in the network systems. Cable is no stranger to vandalism, believe it or not. It's hard to believe that some people can't determine or decide whether there's copper in a system where we actually don't, but they steal it anyway. They can't decide how to discern a copper from coaxial cable or fiber optic link. AI helps us find those damaging attacks and to repair them quickly.

[00:14:41.49] And even as we improve these networks, we're doing more to bring connectivity to today's have nots. The industry is preparing for a whole new wave of Wi-Fi expansion by leveraging our access to the 6 gigahertz band, as well as the adjacent 7 gigahertz band. Now, you can imagine those conversations going back to my kids talking about TV monitoring oversight boards, and starting to talk about 6, 7 with them. It doesn't go well. But I try.

[00:15:05.39] Our industry will continue to prioritize affordability, permissionless innovation, and widespread deployment to maximize the number of those that have in this country. But all of this investment, this advancement, this optimism is not necessarily shared outside of our borders. And we have to spend time talking about what that means. Because no discussion of haves and have nots would be complete without talking about the positions of some of our global competitors in the era of increasing global connectivity.

[00:15:33.55] Thanks to their anti-democratic government, criminalization of free speech and bid to control all aspects of the telecommunications stack. China has clearly positioned their citizens to be among the have nots. Even more concerning, China is aggressively

moving on the world stage to drag others backwards. A clear example of this is how China is determined to undermine the US position on reserving the entire 6 gigahertz band for unlicensed use. China's state-owned telecommunications equipment maker Huawei is eager to disrupt the West's movement toward permissionless innovation in the six band and to replace it with top-down, licensed control.

[00:16:12.40] Our allies in Latin America and Europe will have to contend with this attempt to grow China's global collection of have nots at the next World radio conference in Shanghai just next year. And we will be at their side in that fight. These are not partisan issues, left or right. The global questions around have and have nots, it's a real challenge that China is angling to grow their own version of the internet and connectivity. And that asymmetry is one that's worth fighting.

[00:16:43.65] Even here at home, we have many more homes to connect, many more rural and low income families to provide service to and welcome into the full opportunity of the information revolution and many more miles of infrastructure to build. We will not slow down that work. Here's how we can get started, though, on that agenda to bring more of the have nots into the realm of the haves in the short term. First, we must remain committed to affordable connectivity options for all. Injecting unprecedented competition into the industry with things like bundled plans, unlocking cell phones. And we must continue to meet income, lower income families where they are on budget. That's why low cost options like a $15 plan are so important.

[00:17:27.13] Second, we must remain laser-focused on safeguarding and advancing US leadership and spectrum, including preserving the entire six band for Wi-Fi use in the United States, and to ensure that our allies understand China's attacks on this approach abroad. That includes increasing our attention on global standard bodies, where the US has lost significant ground over the last decade. Third, we must prioritize continued innovation in our sector, whether deploying new Wi-Fi-enabled devices in the lower seven or bringing CBRS-enabled connectivity to yet another advanced manufacturing site, we cannot rest in bringing more solutions forward to keep the world connected.

[00:18:07.30] And lastly, we must ensure that government is spending our tax dollars wisely and working to connect those who are unserved instead of those who are already connected. In fact, the last time I spoke at the Silicon Flatirons, I was here with then NTIA administrator Larry Strickland, where we were both expressing our concern about how overbuilding used federal money to connect wealthy school districts and museums in Denver before those who had not. And it's just the start. The cable industry, or what many today refer to as the fiber connectivity industry, has left a lasting legacy not only in Colorado but across the globe, and its increasing capacity for reinvention foretells a very bright future ahead.

[00:18:50.20] So thanks to the innovation and the dedication of workers, the constant technological innovations and evolutions and revolutions indeed, and the can-do American spirit that this industry has continued to show. I have no doubt that the United States will continue to lead the world, making those that have not become those that have. It's incumbent on each and every one of us here at the symposium in the industry to make sure that that's a reality, to recognize that where we take it from here truly is up to us. And the opportunity to build is in our hands.

[00:19:22.58] And I'm grateful to see all of you here to be a part of that bright, connected, optimistic future. Thanks, again. And if you want to go see Eddie Munster, it's worth at least a few laughs. Thanks, everybody. Enjoy the rest of the conference. Enjoy the rest of the speakers. Truly appreciate.

Panel: Broadband – Priority Service, Alternative Technology, and the Path Toward Universal Access

https://youtu.be/x9kM6g8Bqtl

[00:00:00.20] BEN SHATZ: Hi, I'm Ben. I'm a 1L, and I want to thank Cory for the student fees. This is the broadband priority service, alternative technology, and the path toward universal access panel. I'd like to introduce Stephanie Weiner, the Senior Fellow at Georgetown University. Michael Santorelli, the Director for Advanced Communications, Law and Policy Institute, New York Law School, Giulia McHenry, Senior VP, Public Policy, and AT&T, Jennifer Epperson, the Deputy General Counsel of the North Carolina governor's office, David Don, Senior VP, Public Policy and Comcast and a no lesser, David, David Reed, Senior Research Associate here at CU Boulder.

[00:00:52.36] DAVID REED: Ben, so I woke up this morning and figured out I was going to be talking about broadband early in the morning here. And I am excited to be talking about a very timely topic of interest here. In terms of the framing for this panel, first off, I want to thank Matt Schmit for putting together this panel and the ideas that are underpinning a lot of it. And we have assembled just an all-star cast here to talk about some very timely and important issues.

[00:01:29.60] The current moment in broadband policy reflects really an unprecedented convergence of state and federal deployments of broadband infrastructure, affordability and adoption initiatives. And most prominently, of course, is the Broadband Equity Access and Deployment or BEAD program, but also the Digital Equity Act and legacy universal service fund high cost programs. So this convergence raises a deeper question that we'll be investigating in this panel. To

what extent can these programs collectively meet the policy goal of internet for all. And where do the remaining gaps persist?

[00:02:16.72] So we're going to be focusing that in our talk today. So we're going to shift gears a bit from yesterday's discussion of the unitary executive theory. I'm not a lawyer. So as the moderator, I'm going-- we have folks who could do that. But, certainly that's a timely issue of importance here or AI's growing impact on society. Those were covered very well yesterday.

[00:02:45.24] Instead, we're going to be exploring this very important issue of how broadband and the different technology policy issues that are facing our country and the deployment of this internet for all objectives. So the first question that I have for the panel really is an opening statement. All right. And in doing so, I've asked the panel to instead of me elaborating further on their bio, as an introduction, if you can just part of an introduction to yourself throughout a couple interesting pieces of your past that you think is useful to present and discuss this morning or share with us this morning, I think is a better way to say that.

[00:03:32.66] So what I've asked for the opening statement for the panelists is if they could pick one issue that's characterizing our national in achieving internet for all, whether it's optimistic or note of concern, what should it be. All right. So this is maybe a takeaway that they want to make sure that they emphasize so that you can get it in your notes right at the beginning of the panel. So I will start with-- I'm just going to work my way down. So Jennifer.

[00:04:00.57] JENNIFER EPPERSON: Great. Good morning, everyone. Thanks again to Matt and Silicon Flatirons for the invitation to come speak on one of my favorite issues. Again, my name is Jennifer Epperson. I am the Deputy General Counsel for the North Carolina Governor, Governor Stein, but most recently worked in the House of Representatives on the Energy and Commerce Committee, on the telecom subcommittee. So I'm in this position where I got to see the formation of BEAD and many other significant broadband laws from that side and now have shifted to the state side and really involved in taking the football, I suppose, and trying to get a touchdown. I'm going to use too many swordsmen, of course.

[00:04:49.21] So maybe just to start off, I would say let's start on an optimistic note, which is that as a country, we are making significant progress toward internet access for all. We saw for a number of years, capital investment. But I think that's where you saw the growing digital divide, even though everyone recognized that it would take infusion of government money to reach some of the areas where capital investment just didn't make it realistic. There was slow and steady programs at the agency level. But it was really, I think, the COVID pandemic highlighted the real need and where those gaps existed.

[00:05:36.99] And I think you saw Congress respond with a number of programs that funded broadband expansion through the 2000, 2001, of course, the end of the 2021 is when the infrastructure bill with BEAD program passed. So I think during that time, you had slow and steady growth, but then just this real infusion of government funding and again, because of the need for broadband, you also saw a lot of capital investment in the networks as well.

[00:06:11.05] So I think that's a good thing. There are many more houses that are being connected, newer technologies that are being deployed. People are getting faster internet, no doubt about that. I think where we are with BEAD is, I think, NTIA states are working toward getting that money deployed. So I think that still leaves a lot of questions. I mean, there are things that are maybe predictable, workforce questions, supply chain questions, potential other disruptions, but it all appears to be going on a track where we'll see again, just a real expansion to fast, reliable broadband across the country.

[00:07:02.29] I think where the biggest questions, though, remain for me, and I think for us on the state level is declaring victory on just this internet access pillar isn't going to achieve universal connectivity. I think there may be a build it and they will come mentality. And I think that's certainly going to drive some amount of additional connections. But I think there are other areas that we can't stop paying attention to. And notably affordability and adoption, there's still a real need for policymakers to not take our eyes off the ball and just focus on access.

[00:07:55.33] I think you saw in the Infrastructure Investment and Jobs Act that Congress tried to set up, funding for all three streams between BEAD, digital equity and Affordable Connectivity Program. And then even within BEAD, there are ways that BEAD itself also addressed all three issues. And I think there's a recognition that the benefits of full universal connectivity won't be achieved without addressing all three of those issues. And so I think it's important to the individuals and communities, but again, as a country driving economic prosperity, it's important to focus across the board.

[00:08:41.17] I think that right now, there may be a shift in federal thinking around the importance of some of those issues. And I think probably what will happen is it will be incumbent on states that share that perspective, hopefully all of them to prioritize policies, funding things like that will fill some of those gaps. So I think the other notable lesson coming out of the COVID years and headed forward is just a recognition of the incredible capacity that was built at the state level on these issues.

[00:09:24.75] So BEAD NTIA, their work implementing the bill helped stand up and make sure that every state had broadband offices that I think before the bill there were varying levels of attention paid at a statewide level on this issue. But at this point, you've got state

broadband offices across the country. And I think that that significantly benefits each individual state. But then again, collectively, all of us to have that capacity, that expertise on a state level. And I would just hope that going forward that recognition will continue to-- well, that will continue to be recognized. And that states really continue to play a leading role here in again, not just access, but also affordability and adoption.

[00:10:23.23] I think federal funding will be necessary. And I think it will look different depending on states. And that's the nature of the country. But I think it will be important for states to continue to play a driver's role on this issue, if we're going to achieve universal connectivity.

[00:10:45.85] DAVID REED: David?

[00:10:48.29] DAVID DON: Hey, David. Thanks for having me. It's great to be back at Silicon Flatirons. It's a little dangerous to let me give my own bio here with only 50 minutes for the rest of the panel. But I will say I appreciate being here. I run our policy shop at Comcast. I'm SVP for public policy. My career goes back about 30 years listening to the telecom Act discussion yesterday brought back lots of memories and nightmares of late nights.

[00:11:14.83] I'm glad we didn't get into Telerik pricing. I see Peter that he probably remembers the exact the amount came out to. But one thing I do want to point for our highlight for maybe the students and thinking about all of this. And really the topics of the last days. I was very fortunate to start my career when the telecom Act was passed. There was a lot of work around that and it was the law-- it was really the beginning of regulation of commercial mobile wireless services. So I really focused a lot on wireless.

[00:11:41.88] I had a mentor at the FCC who was like in the movie The graduate, he said wireless instead of plastics, but he was wireless is where you want to be. And I was lucky enough to be able to start my career in wireless. And when I joined Comcast, I was our second hire in the wireless business and doing spectrum policy for Comcast. So that was great. And then as broadband became a very important product for this country. I was able to evolve being at a company that was the leading broadband provider and really expand my expertise into broadband regulation.

[00:12:13.42] So I've been very fortunate. When we talk here, you can see yesterday all the cutting-edge things around AI and where all that's going. So if you're, I think, a law student here, there's a lot to be optimistic about the future. I still thinking fondly, I guess, of the 96 Act implementation.

[00:12:28.14] But let's jump into today's topic. I think there are two macro issues we're probably going to explore today. And in my remarks, I maybe want to delve into one of them. We obviously have

done a great job of allocating funds. Congress has getting $42 billion in a few years, getting millions of homes built over the next few years is pretty remarkable. But there are two broad categories. I think we've got to looking forward a little bit.

[00:12:52.98] One is on the deployment side. So we've dealt with the economic barriers to deployment. That's what BEAD was fundamentally about. With $42 billion, we can eliminate or try to address many of the economic barriers that made it uneconomic for private companies to deploy to something like seven or eight million homes around the country. Whether you think 42 is the right number or not, plus, you had CPF and other monies. We've definitely, as a nation, dedicated tens of billions of dollars to try to overcome these economic barriers.

[00:13:24.42] But now that we've done that and we're in the allocation phase, and in some states like Louisiana, they've already assigned the resources to the winning ISP bidders. We've got to now look at some of the deployment barriers. And these are the non-economic barriers. So the few that I want to explore here for a minute are going to be around permitting around pole attachments and access to rights of way. Those are what-- now that we have picked the winners, what are they going to do? How are they going to meet their obligations? And how do we continue this state partnership? Because a lot of these issues are state issues and of course, some federal issues.

[00:14:02.50] The other macro issue I think we'll discuss on this panel a little bit is the reserve fund. I know my friend Michael Santorelli was the first on this almost a year ago now. And what he realized is between the benefit of the bargain and organic build out by ISPs, a fair number of these unserved homes are going to be built for a lot less. We know. And now we're talking about and I think Michael was the first to say it. There's going to be about a $20 billion BEAD surplus. So how we spend that wisely is something I think looking forward this panel we can discuss a little bit about and all of us should be worried about or thinking about or getting ahead of.

[00:14:40.68] So let me just spend a minute or two on these non-economic barriers to deployment. First of all permitting reform. Everyone in-- all of these issues are well documented. But I'm not sure we have a lot of resolution. Interestingly, when you do the research, you see some states have started to address these and hopefully, they can be models for other states. But on permitting, we cannot take 12 months to get permits done when you have only two years to build out these thousands of homes. And in a lot of areas, they don't have either the resources or the structures, the support to review all the permits. They don't have the processes in place.

[00:15:18.56] And we're going to need our local and state governments to really drive that. I don't think-- there are federal permitting issues, but I'm really talking about local and state permitting

issues. Obviously, the federal ones are important too, and NTIA is talking about them, but we really need to be talking about what are broadband ready communities and do they have the resources and the procedures in place to process permits. So we've got to get on that because I don't think they do in many locations. Some states do.

[00:15:47.14] The next one are pole attachments. We have roughly 180 million poles in this country, and estimates vary as to how many of them need maintenance or replacement. But if you just think 10%, you're talking about 18 million poles. I read one estimate by Google Fiber that they're thinking they needed to address about 50% of the poles when they've been trying to get on poles and make ready. So that's a very big challenge. It still isn't clear necessarily who's responsible for the costs.

[00:16:21.66] So we've got to address the cost issues. The states can provide clarity on that. West Virginia recently provide important clarity on who's responsible if a poll needs to be replaced and you have five ISPs on that poll and you have an electric utility on that poll, who's paying for that. And some utilities want to say, well, the last attacher has to pay to replace the entire poll cost. Seems a little unreasonable to me. But the bottom line is we need to have some structures here. And if you look, some states are doing this, some aren't. That's going to lead to huge delays in meeting these commitments. And we do have this firm 2030 deadline to try to get done.

[00:16:56.66] And then the third one, which is a more recent phenomenon, at least to us in the cable industry, are these rights of way accesses. The cable industry traditionally enters the right of way through a franchise agreement. These are public rights of way. And we've built broadband across this nation using the public rights of way.

[00:17:12.90] But if you think about who are the unserved, these are more rural, remote areas and it's more about accessing private rights of way, what we call easements. And there's a history of utilities getting access to private rights of way through state law. They can do condemnation in all kinds of ways to get access to these private rights of ways that don't apply to telecom providers or communications providers or cable companies, so that when we see polls, they're there on these private rights of way and we try to gain access, the poll owners sometimes decline to grant access because they'll say it's not permitted under their easement, or they use that as an excuse, or they can't even find the original easement agreement that might have been signed 50, 60, 70 years ago.

[00:17:57.78] So we've got all kinds of challenges to get access to these more remote areas, which are less in public rights of way, and we're going to need the state governments to really step up and clarify the rights of these ISPs to gain access to these utility poles. So I think I want to focus in a little bit on these non-economic barriers. And we

know BEAD is focused on the economic barriers. But if we really are--what our ultimate goal, of course, is to get broadband everywhere.

[00:18:22.72] And we've got this narrow window where we have the resources. We have the federal government, we have state organizations that are focused on this. And in a few months, hopefully all the states will have their funds, all the monies will be allocated. And then we've got to pivot from Bob to deployment issues. So that's what we're talking about.

[00:18:40.85] DAVID REED: Stephanie?

[00:18:44.15] STEPHANIE WEINER: Thank you. And this is my first Silicon Flatiron. So I'm really excited to be here. Little bucket list for regulatory lawyer. Now, I'm here. It's very exciting.

[00:18:57.95] For my bio I to have been in this space for a long time. I've been in private practice. I was in-house at a data and analytics company, but I've also served as a legal advisor in three different federal agencies and the counsel's office, the Department of Energy, in the GC's office at the Federal Communications Commission, and most recently, I was chief counsel at NTIA until the beginning of 2025. And I think this is a great lead in, because I really agree with a lot of what both Jennifer and David had said, because from where I sit right now, thinking about the BEAD program specifically, we're going to talk about some of the other policies and programs.

[00:19:47.81] But for BEAD, I think for where we are right now, the moment of truth for BEAD is not really about policy at this point. It's about performance. It's about these deployment issues and these implementation issues, and whether we achieve internet for all, at least in this access prong, is going to depend upon how bead actually gets implemented. Now, I remain cautiously optimistic. It's been a long journey for BEAD. But states are moving forward. States are getting their funds. There may be some pathways for the non-deployment funds.

[00:20:29.23] The program has changed a lot and a lot over the past year and in meaningful ways. And I'm sure we'll talk about a number of them on the panel. But from where I sit, what has not changed and what I think and I hope everybody can agree on is this. And that's the need to make sure that the promise of BEAD actually turns into performance, that the networks do get built or capacity gets reserved, that service gets provided, and most importantly, that the homes and small businesses across the country actually get brought online, because that's truly the goal of the BEAD program.

[00:21:11.55] And it's where the caution comes in because unfortunately, as a country, we don't have a great track record on these big infrastructure programs, and this is the biggest one we've seen so far. We've seen significant defaults under our door. We may talk about that a little bit later in the panel. And Professor Tejas Narechania, who

was on panels and the debate yesterday but just a call out to him, he and some colleagues did some great research on the Connect America Fund program, looking historically. And there too, we see recipients of those funds didn't necessarily convert or perform in ways that connected houses or didn't connect them at the speeds that were promised when we look at it today.

[00:21:59.87] Those weren't failures of policy necessarily, or failures of ambition. There were failures of implementation. And so I think at this point, as we turn to BEAD, this central question is not whether the goals are right and in some ways, whether the policies are right, it's whether we can build implementation that's designed to support performance at scale and at a scale, unlike what we have seen before, where we haven't been successful.

[00:22:30.55] So what do we do? This means focusing and focusing now to build in compliance monitoring tools that will support this performance. Building it in now, not after the fact when problems arise.

[00:22:46.31] To take a minute, grant programs operate, which I learned when I went from the FCC world to the NTI world. Grant programs operate different from regulatory programs. They're much more like contracts that get negotiated. But fundamentally, compliance is still critical, not just for protecting public funds and fiscal integrity, but also making sure that these programs actually achieve the goals that were intended.

[00:23:17.75] When I was at NTIA, I spent a lot of time thinking about exactly these implementation issues. Many people, especially here, it seems like, have probably heard the phrase privacy by design. When you're building a product or service, you think about privacy at the beginning. So it's really built into the DNA of a new offering. So my approach at NTIA in my office, and there are actually some alums in my office in the audience.

[00:23:49.23] So what we focused on was compliance by design. Let's build programs with smarter systems from the beginning that make compliance a necessary part of the program, but we tried wherever we could to streamline those compliance burdens. So can we make compliance something that happens, but almost the path of least resistance. Brett Frischmann yesterday talked about pro-social friction by design. This is a micro example of that because we needed to make sure the programs were built and designed correctly. We don't want to slow them up. We can talk about that later too.

[00:24:32.27] And while BEAD policy has evolved, some of these are still embedded in the program. What I want to talk about speaks to some of the environmental and permitting concerns that David was referencing, and that's the NTIA ASAP tool, which was an idea sparked while I was at NTIA but has really come to fruition. This is a Salesforce based tool that drives environmental compliance. NTIA made the

decision to make states joint lead agencies-- sorry, Jennifer-- for purposes of NEPA review for environmental review. It's a big job. And it was one that needed to be decentralized.

[00:25:17.52] But we also are-- NTIA also built a system that was as user friendly as possible so that it really broke down the NEPA review process. How do you do intake? It was user friendly. How do you apply a categorical exclusion which streamlines environmental review, where you need to go further? Which program comments other kinds of streamlining of these environmental reviews can be triggered and how. It also tracks documentation. It creates a transparency. It attracts timelines so that everybody can see when things have gone on too long or longer than they should have. And it allows for more efficient NTIA review and approval.

[00:26:00.34] And so it does two things. It makes sure that everybody complies with NEPA because that's the law. But it tries to do so in a way that is as easy as possible, minimizing burdens wherever possible to get to the outcome that we want a project that's built, that's compliant with the rules and laws that apply to it.

[00:26:21.52] So at this point, and Jennifer called it-- I'm not a sports person, but this is a handoff moment. The compliance by design. This idea is really turning to the states and territories. And right now, they're negotiating the terms of their awards with their selected subgrantees. And some of these, the leaked terms and conditions with regard to Starlink, gotten a lot of attention. We might talk about that a little bit, too. But no one should really be surprised.

[00:26:56.30] Again, this is the nature of a grant program. And there are these negotiations that happen with regard to terms and conditions, and particularly where there are different kinds of grant agreements in place. And I think from where I sit, the critical question here is whether states are building in the terms tools, systems to incentivize, streamline compliance up front right at the outset. And that will empower them to take action hopefully early to course correct. But if necessary to remedy any non-compliance that does occur.

[00:27:32.96] There's no single approach here to-- and it's not an easy task. But there are some tools that I wanted to call out. One tool here, which is you have to be clear milestones for receiving funds. Milestones that are tied to performance that can be documented in some real way so that there can be some accountability and some defense of how those funds are spent. Two, a risk-monitoring frameworks that this is an approach that allows you to evaluate and intervene early to course correct because everyone is invested in the project becoming successful. And so if any issues that arise often outside the provider's control, things related to pole attachment, things that are related to workforce, how can that be communicated early so there can be a path forward to still accomplishing the deployment that's been promised.

[00:28:33.12] And in my view, remedies put in place now so that if necessary, there is an ability to respond to delays or when and if they happen default in ways that allow the program to actually achieve its goal of connecting these households and bringing them online. So it's a pivotal moment yet again, lots of pivotal moments in this long-view journey. But if we don't design this stage of the program correctly, we risk repeating the failures that we've seen in RDOF and CAF.

[00:29:10.54] And so, I'll just end where I began. I think this is a moment not so much about policy in the BEAD space, but really about implementation and whether internet for all becomes a reality here. Well, really, in my view, depend on whether we implement the program correctly and we treat it as a core feature of design and not just an afterthought for when things go wrong.

[00:29:34.60] DAVID REED: Thank you. Michael?

[00:29:36.72] MICHAEL SANTORELLI: Sure. Well good morning. Thank you to Silicon Flatirons and Matt for inviting me back. I was here last year for the first time, so this is my second time hopefully I don't overstay my welcome.

[00:29:47.64] So I am the director of the Advanced Communications Law and Policy Institute at New York Law School. We're an academic program at the school that focuses on all things broadband policy. Someone mentioned yesterday that net neutrality is the issue that keeps on giving-- I think BEAD has been the issue that keeps on giving over in recent years. And so we've been tracking a lot of what's been happening to BEAD.

[00:30:08.28] In terms of my background, I've been at the ACLP almost since it was founded 20 years ago, that'd 20 years in May. I started my career at the New York City council and the great city of the People's Republic of New York City, as it's now called, working on tech and telecom policy issues and trying to-- a lot of my work there was-- and this is back in 2005, 2006, was trying to educate city council members about what broadband is and trying to tell them or show them how it was important.

[00:30:40.60] I think we're having still having some of those conversations across the country trying to show people why this is an important issue. In terms of my big takeaway for this notion of internet for all, I think it's still a work in progress on the supply side, getting connections out there. I'll put some numbers around what's already been talked about.

[00:31:03.86] So even before a dollar or bill is put in the ground, so to speak, the number, the digital divide is already closed by 65% since December of 2022, when BEAD was announced. So that's remarkable progress from based in large part from continued investment by ISPs, but also an injection of other funds from other programs like CPF and

ARPA as well. BEAD will bring connections to about 3.9 million additional unserved locations.

[00:31:34.16] And as Cory mentioned in his great keynote, we've seen continued innovation and intense intermodal competition. Thrive prices of according to our analyzes, have barely grown in real terms over the last decade. So a really great position there. But there are some caveats. So based on some of our analysis comparing state feed proposals with FCC mapping, we might talk about some of the mapping issues. BEAD could potentially not cover-- our latest analysis was 1.2 million locations could be left out of BEAD.

[00:32:14.52] A, the same time, that the gains we've made in closing the digital divide since December 2022, some of those are just still theoretical called enforceable commitments. People who have received capital project funding grants from states have committed to building out these new networks by the end of-- substantial completion by the end of this year. And so for some of the larger ISPs, that is probably well on its way. But CPF funds went to a lot of smaller ISPs, municipalities, too, and some of those could flame out over the next year.

[00:32:48.14] I know in New York, for example, they just pulled back a $26 million grant to a project that would cover several thousand locations in rural New York. So it's unclear what happens to those locations once they come off enforceable commitment list. So then it's too late for BEAD. So they will go into that new bucket of locations that are left.

[00:33:17.05] And then as we might talk about defaults in the BEAD process going forward are probably likely as well. The focus on lowest cost winds during benefit of the bargain may have put pressure on a lot of the smaller ISP's that were angling for dollars to drive down their proposals maybe too far. And so once they sign the papers and then they have to actually build the networks, they may say, OK, maybe that wasn't such a good idea. And so they will probably be defaults.

[00:33:48.73] And thinking about BEAD in general in all these grant programs generally, it is essentially, you're taking a bet on who you're investing in with these dollars. Arguably, the larger ISPs that are getting funding to build out to extend their existing networks have a great track record of doing so. But then when you look at the long tail of entities that are scheduled to receive BEAD funds. And some of that we're having-- we have an analysis coming out this week that looks at just the extent to which some of these smaller ISPs are maybe doubling or tripling their existing service territory.

[00:34:28.29] And there's a good amount of several dozen small ISPs that once they get BEAD funding and their commitments to build their-- relative to their current service footprint, their BEAD commitments are several multiples larger than where they're currently serving. And so

that's a lot of pressure on a very small ISP to scale their network by 10 or 20 or 50 or 100 times that doomed some RDOF recipients as well. So that bears watching.

[00:34:58.77] One idea we had for solving this, and as David mentioned, was this notion of a BEAD reserve fund, which is essentially taking some of the leftover funding of the $20, $21 billion and leftover funding, waiting a little bit to let all this shake out and see how many locations are still unserved, maybe at the end of next year or whenever. And excuse me, and then running a second round of BEAD to make sure that they're covered and included to get to this notion of internet for all.

[00:35:27.89] And then quickly, on the demand side-- on the supply side, we're talking about the very edges of getting to 100% availability. I don't know if we'll ever get to 100% availability for any number of reasons, but we're getting close. And getting that last edge has always been everyone I think knew is always going to be very expensive and very complex. On the demand side, there's a lot more work to be done, and I've said for many years and focus on this in a lot of our work, that there's just never been a true commitment to this issue at every level of government.

[00:35:59.79] The digital Equity Act was a good start. It forced everyone to plan, but the money that was on offer, $2 billion, was paltry and would have just been a very small down payment. And what's actually needed. These are very complex, hyper local issues that need to be solved, showing people the relevance of broadband and delivering to them the training needed to get online. And it's never been an issue that's resonated with policymakers because it is messy and expensive and not something that you can take credit for quickly, because it does take a long time to move the needle.

[00:36:40.65] And it's not just about affordability. Affordability on its own won't solve the issue. We've seen in the past, you can give broadband away for free, as it was for several years in the aftermath of COVID with the ACP and the low income offerings from so many ISPs, and the broadband adoption rate only ticked up 1% or 2% or 3%, I think is one of the studies I saw. So a lot more is needed on the ground to make up that gap between availability, which is great, and the number of people who, for whatever reason, don't see broadband as useful or relevant to their lives still.

[00:37:16.53] I have lots of ideas on that front, but I'll stop there.

[00:37:21.29] DAVID REED: Giulia.

[00:37:22.01] GIULIA MCHENRY: Hi. Hi, I'm Giulia McHenry. I lead the policy team at AT&T. So I'm like David's counterpart at AT&T. Before I get started, I want to say thank you to Silicon Flatirons for having me. And also a special shout out to Matt. This is his first conference as head. And I think you're putting your brand on it. And I really

appreciate how much you've worked with us and all the speakers in terms of molding this into something that really is balanced, and hearing all the voices from DC to academia and the states, and really forcing us all a little bit out of our shells. So thank you and nice job.

[00:38:07.73] So my background, I was actually trying to get into college in 1996. And I remember the Telecom Act because suddenly it became a lot cheaper to call my boyfriend in college at the time. So no-- so my background I am a PhD economist. I came out of school and started working at a consulting firm and actually got into telecom because my background was in auction theory. And that lends itself nicely to matching models, which are inherently helpful for all aspects of telecom.

[00:38:41.33] And so then I decided I wanted to understand the real makings of policy a little bit more. And I ended up as chief economist at NTIA, which was a great opportunity to really understand all the aspects of everything NTIA does, including spectrum, and wasn't BEAD yet, but a lot of broadband grant programs and even FirstNet and everything in between. So that was really exciting.

[00:39:09.39] And then I went over to the FCC and stood up and led for six years, the Office of Economics and Analytics. So I have first-hand experience with many aspects of the design and implementation of RDOF. So I know where all the bodies are buried on that one. And also, I was chief of OEA while we were standing up the BDC, which is the Broadband Data Collection. So I am very passionate about that.

[00:39:36.23] So hopefully, I'll keep the rest of my remarks short, and that will lead us some time to talk about those things. So building off everything that was said here and particularly really looking-- talking about reiterating some of what Michael said. I think we are, frankly, in the golden age of broadband. I don't think we have seen as many technologies and the quality and speed of those technologies as we currently have. I think consumers have an incredible number of options that we did not anticipate 10 years ago.

[00:40:10.64] We have mobile, we have fiber, we have cable, we have satellite, we have fixed wireless. And you see convergence. And this is something that Cory talked about, Don talked about, David talked about. But essentially, AT&T, for example, has really a converged set of options. We have a mobile network. We touch over 30 million homes with fiber, I guess locations with fiber. We have over 2 million fixed wireless customers and we are growing and committed to growing that further, growing our fiber network further by 2030. And we're all talking about convergence.

[00:40:52.98] Now, cable companies are offering mobile services. We are offering combinations of wireless fixed wireless fiber, bringing in satellite to supplement. And then, of course, we also have Starlink and all the other alternatives for satellite. So we are truly at this moment

that allows so many of the-- so many consumers to have so many options. And I think, as Michael alluded to, you've seen a real closing of the digital divide since 2022 even before we get those BEAD dollars out. So this is a great moment across the board. So I want to recognize that.

[00:41:31.78] But obviously, we also-- this doesn't close the gap. So BEAD is an incredibly important program to see what else we can do, how much further we can build into all areas, and obviously we are very excited to take part in it and implement our piece of it, and are also looking at as this moves forward, how can we continue to close some of those gaps that might not end up getting filled because of defaults or the like.

[00:42:00.22] So I think there's a huge amount that can be done there. But also, there will still be, as Michael said, at least 1.2 million locations that will still not be covered by the end of this. And that is really the long tail. And I think looking beyond BEAD, we've tried the art off auction approach. We've tried the BEAD approach. We need to start thinking about what is the infrastructure program that truly gets us to close that gap. And I suppose also if we actually need it, with all of these various technologies.

[00:42:34.68] But I think while we're focused on implementing BEAD, I think we should also start thinking about what does get us to 100% of households covered. And how do you start thinking about what the design is for a program that really has to touch really some idiosyncratic long tails that maybe we're not getting to.

[00:43:00.32] So with that, I think I will turn it back over.

[00:43:03.76] DAVID REED: All right. Thank you, Giulia, and thank you for the panel. All right. So we're going to now transition to a set of questions a little bit more lightning format here now. All right. So we're going-- I want to start first and talk about the convergence with wireless. But that is more immediate with satellite and how satellite has become a part of BEAD. And there are a couple recent events here that I want to throw in as context for the panel and for the audience.

[00:43:35.66] The first was an article that came out about a letter that was from SpaceX to the state broadband offices with the headline was that SpaceX was requesting exemptions from certain BEAD requirements. It's not a public letter. So whether that's an accurate characterization, there was certainly some type of a negotiation going on there between the state broadband offices and SpaceX about being able to meet the requirements of BEAD.

[00:44:10.22] And another recent event is that SpaceX was approved in early January to add 7,500 Gen2 Starlink satellites to orbit, so doubling its capacity up to 15,000 satellites across a lot of different frequency bands, but expanding the Leo constellation there. And

finally, just on Friday, they've been busy with an announcement of up to 1 million more satellites for a broadband data center.

[00:44:47.98] So maybe that's not core to BEAD, but certainly part of that emerging constellation. So my question really is, from your perspective, the impact of these types of requests on the BEAD program. And what does it mean as we go forward, if satellite, an important part of at least the rural coverage and for meeting these important targets. So would somebody-- Stephanie, can you jump in quick because we had talked a little bit about?

[00:45:26.00] STEPHANIE WEINER: Sure.

[00:45:26.30] DAVID REED: Some of this.

[00:45:27.36] STEPHANIE WEINER: Sure. Thanks. Look, I think the low earth orbit satellites are-- I mean, it's an amazing technology. And I think it's disruptive, but in a lot of great ways. It's disruptive competition wise to bring choices. As Giulia talked about, it's just disruptive in how we think about policy in this space. For a long time, latency was really a big problem or, from my perspective, a concern with a lot of satellite technologies. And that's really not the case with low earth orbit.

[00:46:06.98] And so it really leads to I think, a lot of creative and new thinking both, I'm sure, for the businesses here at the table, but also for the policy makers about how do we integrate that into the suite of solutions.

[00:46:25.06] With regard to BEAD I think it's-- and I'm glad I get the opportunity to say this. I know there's a lot of talk about technical neutrality with BEAD. And that was, of course, one of the big changes with the restructuring of the BEAD program. But what that really was about was about the selection, a neutral selection of the sub grantee. And so the NTIA removed what was a clear fiber preference. And there was now a competition that was neutral with regard to technologies.

[00:46:58.62] In my view, that doesn't mean that the program can or really should ignore the technical realities that are different in the different technologies. And with regard to low earth orbit satellites, you see that in a lot of different ways. And I mean, one of them, I'll just call it out. NTIA did something where interesting when it made this change in that locations that could be served by satellite were not counted as served and remain eligible for the BEAD program, but the service of low earth orbit satellite was eligible for funding so long as there was sufficient capacity.

[00:47:43.77] So the way that it reconciles those two things, that location served by satellite are not yet served, but could receive funds to be served, was the creation of a different kind of grant agreement. And so it is not agreement for infrastructure build. It is agreement for the reservation of capacity. I don't think that means it didn't surprise

me, honestly, that there was a back and forth. I'm sure it wasn't great that it became public, but that there was a back and forth over what that grant agreement should look like and what those terms should be that would work for both Starlink to or Amazon LEO to perform the obligations it had, but also what the state needs in order to make sure that there's fiscal responsibility and accountability and documentation. Some of those things that I talked about in my opening.

[00:48:38.29] And so I mean, for this piece of it and the recent leak, I think that's what's really going on here. How do we balance making sure that the programs actually successful, that it can deliver, but it can deliver in a way that is monitored that there's an understanding of what it means to document capacity, and either that's the internal workings of the system or that is some other measure, because otherwise, there's just not going to be the same accountability as there are in the grant agreements that are for deployment.

[00:49:15.83] I'll stop. Sorry.

[00:49:16.67] DAVID REED: So, Giulia, is this an early example of some of the convergence you're talking about with Wireline, wireless and trying to fill in?

[00:49:24.63] GIULIA MCHENRY: I mean, so-- I heard your question in two parts and so I think certainly, satellite is a fundamental and important component to how we're going to close the digital divide and is important for rural areas and even areas that, for whatever reason, not be connected. My brother-in-law lives in a very densely populated area, but just happens to literally be on the wrong side of a railroad track and they can't get under the railroad track. And so he's got copper that's been there since before the railroad and Starlink.

[00:50:01.13] So this is certainly part of the solution. And I think it's an important part of the solution. I think with respect to the BEAD and the BEAD negotiations, I will just say we as a bidder, spent a huge amount of time upfront and then revising everything we had already done focused on what we could reasonably serve making offers that were responsible, that we know we could meet, and ensuring that when we were meeting those, we were doing it in a way that we were meeting all of the requirements that NTIA was putting on us at the time.

[00:50:43.01] And so I think from our perspective, maybe those are the negotiations. I think, in terms of administering a program like that, those are the types of things that ideally get worked out before BEAD are submitted. So I think that is-- that's just one piece. And it gets to how are we ensuring that all of the bidders who are responsibly bidding and bidding in a way that they know that they can deploy.

[00:51:13.11] DAVID REED: OK. I'm going to jump now to another important topic here that I want to make sure we cover is that so the benefit of the bargain basically has saved an estimated $21 billion. It's a different methodology in terms of cost efficiency. The question really

is given-- and some of you have touched on this, but with the yard off and the defaults there, if we can look forward, are there some useful lessons learned for BEAD that address any concerns that this methodology might have placed on the budgets that have been actually realized through the benefit of the bargain?

[00:52:05.19] DAVID DON: Sure.

[00:52:05.67] DAVID REED: Yeah.

[00:52:07.83] DAVID DON: I think there's a lot of lessons learned from RDOF. If you look at Michael's work, there's going to be at least a million homes left unserved even after this round [INAUDIBLE] is done. But we're fortunate. We right now look like we're going to have a $20 billion reserve. I think this is the next big question. What are we going to do with that reserve.

[00:52:28.31] And I think one of them is we cannot consider be done if we know there's going to be a million homes unserved without your defaults, without any organic growth in home construction over the next five years, which there will be. So I think-- and we know there will be defaults. I think in the RDOF we're estimating, I think it's about a third of them have defaulted.

[00:52:49.07] The programs are very different. So I don't know if you can really extrapolate that high. I don't necessarily feel comfortable doing that. But we know there'll be some defaults and they'll be unable-- and they'll be unable to claw back some of those funds from those defaulters, just depending on where they are in the process. So we have to-- I think the answer is we set aside most, if not all of that $20 billion. We hold it. We don't start spending it on alternatives or on other ideas until we know we've reached the deployment goal, which is, 100% of broadband availability to every home in America.

[00:53:23.59] So we should anticipate the defaults. We should anticipate organic growth. We already know because of when the map was frozen, that there's going to be homes that are unserved, even as the rules stand now. So I think that's all going to happen. But luckily, we have resources here that we couldn't have fathom having even three years ago.

[00:53:44.95] DAVID REED: Does anybody else want to?

[00:53:47.23] GIULIA MCHENRY: No, I think, as an economist, you think when you're administering any of these programs, there is a balance between-- and this is true of any auction or matching-- any matching moment in a transaction. There is a balance between the quality and the extent to which you're prioritizing quality and the bargain and where you fall in that balance will impact the number of defaults you have, the extent to which you know something is going to get done well, but expensive. And the extent to which things are going to slip.

[00:54:23.66] So I agree with David. We need to think about how we're going to hold some of that money in reserve. But I just-- I think it'll be interesting to see as this plays out, whether we've hit the right mark.

[00:54:35.24] DAVID REED: So is there any process that can be addressed with that, or is that just-- I mean, how do you take the next step? I mean, it's constrained by legislation, but how do you--

[00:54:48.72] STEPHANIE WEINER: I was going to just put out there-- well, first of all, on the question of defaults, I'm really concerned you could tell because that's what I spend my whole opening on. And I think that separating out the views on the policy choice, I think it's clear that [INAUDIBLE] and then the additional benchmark round really put pressure on cost to deploy and did not allow states to look in the same ways that things beyond cost.

[00:55:17.46] I mean, it's really more regressive than RDOF, which allowed for weights for different performance. So all that means is that there's, I think, a risk, a real risk here. The concept of reserve fund, I just am not sure, given the statutes reference to a final list in terms of making the awards, how to reconcile that. And it's not that I don't think-- I can't say whether it could be done with because I think it's a critical step to actually completing the goal of BEAD.

[00:55:51.44] It may not be BEAD, it may be the next thing, or may require a tweak, whether that can be done by guidance or would need legislation.

[00:56:01.32] DAVID REED: I mean, for everybody. Is there any early indicators out there, state broadband offices? Do you get a heads up maybe or?

[00:56:10.24] JENNIFER EPPERSON: Well, maybe I'll just jump in and say I have been hesitating calling them non-deployment funds, but rather unspent allocated funds. Because I think as a state, we see our total allocation and our thinking about the best ways to use that. We recognize that in the most recent FCC map, there are additional unserved and underserved locations that weren't part of our BEAD.

[00:56:38.98] And so I think one thing-- the governor sent a letter to Secretary of Commerce and Assistant Secretary Roth and suggested that this is appropriate use of funds to take another look at where we are now versus when the plans were written. So I don't think that they're necessarily non-deployment funds. They could still be deployment funds. And so I think there may be ways working within the statutory construction to think about using the funds.

[00:57:09.18] But, as I said, we're also thinking a lot about adoption and affordability and how some of these funds could go toward the goal of universal service. But I think it's completely fair. This was a huge, generational investment by Congress. And we don't expect that there will be another big infusion of cash the same way this one was.

[00:57:33.48] In terms of, I think, indicators, North Carolina has devoted almost $1 billion from ARPA, that's capital projects, but also the state and local funds toward broadband deployment since 2021. So we are seeing right now, there's a lot of lessons learned. I mean again, a huge amount of money. So we are using that process lessons learned very close.

[00:58:04.06] Our broadband office has employees that develop that on the ground relationship with our providers, and they are checking in with them frequently and making sure they understand any barriers they're facing. And we're talking about that at a state level to see what we can do. Also, to address polls, to address other permitting issues and recognizing those.

[00:58:28.86] So in my opinion, some of this is also just having state folks, community folks who are important here, understanding on-the-ground realities and not just reading reports as they come in the reporting that's required and will be required for BEAD. But also like having a real understanding of the dynamics that are taking place in across the state.

[00:58:55.40] DAVID REED: Literally be the boots on the ground.

[00:58:56.74] JENNIFER EPPERSON: That's right.

[00:58:57.10] DAVID REED: Which you didn't have an hour to offer somebody.

[00:58:58.94] JENNIFER EPPERSON: That's right. Exactly, that's right.

[00:59:00.98] DAVID REED: That is a good point. All right. Let's jump to the accountability question again. Stephanie, you raised this somewhat of a compliance by design, but the BEAD does include a prescriptive federal broadband performance testing regime. And for those of you who don't know, that it requires tests that are performance tests that are done on the deployed infrastructure during peak hours, 6:00 PM to midnight. So you have to have 80 percentile requirement for the 120mbps. So you have to make sure 80% of the tests meet the 100 megabit down and 20 megabit up requirement for speed. Latency has to be the 95th percentile at 100 milliseconds, and reliability is 48 hours over 365 day period, which is basically, annual uptime of about 99.45%

[01:00:03.30] So the question here is this enough? Is there sufficient emphasis on the post-deployment accountability for this to make sure that we're getting what we paid for with these federal subsidy dollars?

[01:00:27.92] STEPHANIE WEINER: I'll just say two quick things here. One is the NTIA approach to performance measurement largely tracked the FCC's approach to performance measurement. And I think that made a ton of sense. There are broadband providers who are engaged across both agencies, involved in universal service programs, involved in other kinds of programs, as well as the BEAD program.

Again, yes, you want compliance, but let's create a compliance regime that's as streamlined and easy as possible. And so it's apples to apples.

[01:01:07.65] I think there are going to be because of BEAD, we're going to end up with a lot more data on performance because the recipients do need to-- my understanding is provide not just a certification, but their test results and that unclear the extent and how it will-- whether and how it will be public. I think transparency in a way that's competitively sensitive may be helpful because for my second point, I'm just a little concerned about the state's capacity. There may be some states that are both sophisticated technically and have a lot of experience with testing.

[01:01:49.55] I think Minnesota has been doing broadband testing for a long time. I heard their state broadband officer [AUDIO OUT] may not. And so I do think it's an issue, but I think it is at least a regime that makes sense and hopefully data that can be addressed.

[01:02:13.67] DAVID REED: And we have five minutes left here for any questions. If somebody wants to get a question here, does anybody want to add on a quick comment?

[01:02:24.01] DAVID DON: I'm just going to say the notion of measurement and broadband speed measurement. We've done this a lot of different ways over the last 20 years, and some ways are good and some ways are not accurate. And so obviously, getting an accurate way is important doing it in a streamlined fashion. We should have that down at least to speed measurement because that's one of the factors you mentioned that we've got that down pretty good. And some of these other ideas about measuring indirectly usually are not accurate. So I just want to remind folks--

[01:02:54.41] DAVID REED: The question here.

[01:03:00.49] AUDIENCE: Hi, everybody. My question is for Jennifer. So I know because we talked about it at the time, that it was important to Congress that the BEAD money be well spent on actually connecting people and the administrative costs and efficiencies be achieved. It's, I think, clear now that running these programs requires having really good tools. Some of the tools that Stephanie talked about, maybe reusable tools around things like permitting reform. In an analogous program in the future, should we think differently about administrative costs and the costs of building the systems that should survive the program and be reusable again in the future? Should we fund them differently?

[01:03:44.49] JENNIFER EPPERSON: Yes. Yeah. I mean, I think as has been highlighted by Stephanie across the panel, I mean, I do think that sometimes administrative costs-- I mean, you don't want to-- and Congress, is writing a bill to vote, allow so much administrative costs to eat up into actually deploying and getting it out. But I think when you think about compliance, when you think about making sure that all of

this is actually achieved, I think you have to be thinking about administrative costs and how we can do it.

[01:04:23.21] Our state appropriated the ARPA funds that came in and left a small sliver for administrative costs just of running the broadband office. And I think the more capacity they're going to have, the more they're going to be able to be the boots on the ground and learning about all this. So some of its people. But I think investing in the tools that can help, we will certainly last beyond this program. Yeah.

[01:04:54.61] DAVID REED: So do a question here we have room-- time for-- I'm told by Matt one more question if somebody wants to jump in.

[01:05:01.51] AUDIENCE: So I wanted to talk a little bit about polite fiction that informed the satellite discussion, because I heard two things. I'd like to get your perspective on that. Namely, one is, well, we needed satellite. It's an important thing. But the question that I didn't hear answered, why is Starlink getting roughly $1,500 in many states for doing what they're already doing. I mean, Stephanie and I, we've worked on this topic is the reserve notion, reserve capacity is engineering wise, polite fiction. It served the NTIA well because they got something. Supposedly, it served Starlink well because they could promise something that didn't cost them anything.

[01:05:44.87] So we're operating on this fiction that now the [INAUDIBLE] is exposed as basically fiction. And so Southwest Starlink says, well, we're not really reserving it. We can't really do that because satellites fly all over and all that. So I'm curious if Starlink is indeed able to capture that last 1 million locations and that people can subscribe to that service today. Why should we subsidize those locations? Why should there be a follow on program? Why should we just say, well, you're good to go? Maybe we should spend it on affordability because it's only going to be $80 for affordability if you're Starlink, which is not my version of affordability.

[01:06:31.05] DAVID DON: So for those who didn't hear anyone knows why does Elon Musk need another government subsidy. Just to be clear.

[01:06:41.05] STEPHANIE WEINER: Yeah. No one to answer that question.

[01:06:43.03] [LAUGHTER]

[01:06:47.01] Go ahead.

[01:06:47.29] DAVID DON: Do we need a supply side subsidy like we do for Wireline. Because your point was, maybe we need a demand side to help subsidize low-income users or we had with electric cars. You subsidize the demand side. But if he's already building this network, why do we need to give him more-- why do we need to give more subsidies for the supply side. It's not clear to me.

[01:07:09.45] STEPHANIE WEINER: I guess what I will say is, I think that I don't agree that it is a complete fiction. I do think that there is intended to be a guarantee to try to get to those last, hardest to serve households. The long tail, some of whom will continue to be left out as we've talked about. But in a way that-- I guess my answer would be it needs to be done in a way that can document exactly what is being received by the government, by the state, and by those households for that investment.

[01:07:50.79] For instance, if there is a milestone based on subscription, which was one of the alternatives in NTIA's guidance, then you know you are getting something that there is a consumer and that performance testing, all the other testing can be achieved. It becomes trickier for how to document and create that accountability in the absence of that. And so it is a challenging problem.

[01:08:21.01] I think it became more of whether you call it a fiction or a challenge became bigger after the benefit of the bargain reforms, because so much more of the program is going because of the emphasis on cost to deploy. And therefore, so much more of the satellite of funds are going to these reservation of capacity agreements, but that it just emphasizes my point that those agreements need to be extremely carefully drafted so that there can be accountability for those grant awards. I think it's possible to do it.

[01:08:56.74] DAVID REED: Well. I mean, Giulia, you talked about the long tail. The satellite solved the long tail.

[01:09:01.94] GIULIA MCHENRY: They do. I mean, yes, and I mean, I actually-- I really like David's concept of actually looking at subsidizing satellite because I do think one of the problems with satellite for rural Americans, or many of whom are low income, is it's not affordable. My brother-in-law is not in that category. But I think that is a big problem with satellite.

[01:09:23.48] I will also say, I think getting to-- so at the FCC, we spent a lot of time thinking about how can we incentivize satellite providers to actually connect households where they're getting subsidies for them. And I know Evan and Paul have done a huge amount of work on this. And one of-- and I think some really important, interesting work.

[01:09:51.24] But one of the concerns that came up is that when you're looking at measuring subscribers, that it's easy to generate subscribers. So it is unfortunately very easy to get around subscriber-based requirements. So I think this is an area we should keep thinking about what's the right approach. I'm just trying to say it's-- anecdotally, it's not as easy to fix and to solve for as you might think in building a program.

[01:10:25.78] DAVID REED: OK. I think Matt last night was talking about the mission for Silicon Flatirons and the purpose to elevate the debate. And I think our panel has done an excellent job at elevating

the debate. And as I close here, I want to note being a former chief strategy officer and what do we do. We connect dots. Jennifer, with the state capacity and has boots on the ground and how that's a new arrow in the quiver for funding programs in terms of trying to deliver, David, with the non-economic barriers permitting pole attachments rights of way being critical. Stephanie with the performance or the compliance by design. Michael what-- watch it still matters. We got to have eyes on key metrics of who's being served and Giulia with optimism but moving forward with the convergence. And that's going to pose new ways to solve problems.

[01:11:31.84] I think we've elevated the debate quite well. And if you can join me in thanking the panel. I appreciate it.

[01:11:37.72] [APPLAUSE]

[01:11:41.10] MATT SCHMIT: Thanks, again, Professor Reed and panel.

Keynote: Abundance and Scarcity in Telecommunications Policy

https://youtu.be/BTc_umQbGMA

[00:00:00.60] MATT SCHMIT: All right, everybody. It is 10:25. And I'm going to keep us on schedule today. With our next keynote address, it's my distinct pleasure to introduce somebody who I've seen around Colorado and around the country. Very generous with his time speaking on his perspective at the Federal Communications Commission both broadly regarding his focus on AI, as well as speaking for the chairman himself. And so without further ado, I would like to introduce this morning's second keynote address from Arpan Sura, senior counsel and chief AI officer at the Federal Communications Commission. Without further ado, Mr. Sura.

[00:00:35.24] [APPLAUSE]

[00:00:39.44] ARPAN SURA: Thank you so much, Matt. Thanks to Flatirons for the privilege of being able to give these remarks. In my remarks today, I'm going to argue that two mental models explain some of the most fundamental policy questions in telecommunications. They are the paradigm of abundance and the paradigm of managed scarcity.

[00:00:59.19] And what I'll argue in my remarks today is that these aren't just abstract, philosophical questions. They trigger different regulatory instincts. They bring different policy levers to bear. And at the end of the day, they lead to measurably different outcomes for enterprises and consumers.

[00:01:20.79] I'm going to organize my remarks as follows. First, I'm going to define the two mental models at issue, the one of managed scarcity and one of abundance. And then I'm going to apply those two

mental models to four case studies, net neutrality, spectrum management, satellite licensing, and infrastructure deployment.

[00:01:44.87] And what I think is going to emerge from our conversation about those four case studies is that overindexing on a mental model of scarcity has unique pathologies that are worth thinking about seriously worth addressing as policymakers. And then finally, I want to talk about what an abundance reset looks like.

[00:02:07.53] And throughout these remarks, I'm going to be speaking on my own behalf. I'm not going to be speaking on behalf of the agency or Chairman Carr. So that standard disclaimer will apply. So with that, let's get to the two mental models at issue. Now, the first-- and by the way, I'm going to be using these terms clinically and not pejoratively, though I understand folks may take issue with that.

[00:02:34.05] The first mental model that I want to talk about is one of managed scarcity. And it begins with the assumption that there is a fundamental and inexorable constraint. Whether we're talking about spectrum, bandwidth, some intermediate output, or some ultimate output constraint is the defining characteristic of the system. And from this assumption a particular policy logic flows.

[00:03:04.00] If resources are scarce, they must be carefully rationed. Their uses must be strictly controlled. Their access must be mediated through centralized gatekeepers. And that the role of policy under this scarcity model is to police market structure and to protect consumers from the deficits in their choices.

[00:03:29.24] The abundance paradigm, by contrast, starts from a different premise. It views telecommunications capacity as not a fixed pie to be divided and apportioned by some centralized authority, but as an expandable resource that grows with technological advancements and capital investments.

[00:03:52.80] This framework emphasizes the plasticity of constraints. What appears to be a constraint today may be a pathway to abundance tomorrow. And policies role under this view is to manage scarcity-- is not to manage scarcity, but to enable abundance. To remove barriers to capacity expansion, to facilitate innovation, and to allow decentralized experimentation.

[00:04:21.10] Now, I'll note that what I'm describing as the scarcity paradigm has a lot of different names. It's taken a lot of different forms. I think earlier today we-- earlier yesterday we saw it reflected to some extent in the first keynote with respect to AI and in the following conversation about whether chatbots should be banned. Sometimes it's called degrowth. But this is the entire cluster of families that we're trying to capture here.

[00:04:54.33] And in the telecommunications model in the industry that we're talking about today, scarcity has historical antecedents. You

see, for most of the 20th century, telecommunications was understood quite reasonably as a natural monopoly. And the economics were straightforward. Building parallel telephone networks was wastefully duplicative.

[00:05:19.89] The first mover advantages were overwhelming. And the value of a communications network increased with the number of subscribers connected to it. A single integrated system simply made more sense than competition. And that natural monopoly structure profoundly shaped the regulatory thinking of the day. If there could be only one provider, then that provider must be state-owned or heavily regulated as a public utility.

[00:05:47.77] Either way, the policy mindset was fundamentally about managing a fixed, scarce resource, the monopoly network itself. The regulators didn't ask how to enable more networks. They asked how to ensure that one network served the public interest.

[00:06:06.59] And this meant controlling prices, mandating universal service, requiring interconnection, scrutinizing business practice. The entire apparatus of utility regulation from rate of return oversight to common carriage obligations was built on accepting monopoly as the inevitable in focusing on constraint rather than abundance.

[00:06:28.43] Now, my point here is to recognize that this historical in experiences created mental habits that profoundly shape our thinking today, even as the underlying technology and economics has changed. And I think that's true when we look at net neutrality. And I apologize, I'll put a tip in the swear jar. I didn't realize that this would become a recurring faux pas throughout the week.

[00:07:00.06] And I'm not here to relitigate net neutrality. My point here is to examine how the mental model of scarcity profoundly influenced that debate. Now, the case for strict net neutrality is often resting on a scarcity framework and the argument runs as follows. Internet access is a bottleneck resource controlled by a small number of last mile providers.

[00:07:30.34] Consumers have limited choice. Therefore, absent regulation, these gatekeepers will inevitably abuse their position by extracting super competitive rates from discriminating against content providers from distorting the ecosystem. The solution is a prescriptive set of rules that treats bandwidth as a scarce resource.

[00:08:00.49] Well, look at the underlying assumptions here. Capacity is constrained. Markets are not competitive. The primary policy challenge is to prevent abuse of an existing resource. And the regulatory response follows naturally ex-ante rules and prohibitions on blocking, throttling, and paid prioritization.

[00:08:23.01] I think the historical record here provides suggestive evidence of where these steps happen, where these steps go reduced

investment, which, therefore, reinforces ISPs status as a bottleneck resource. And what I would argue is that this ladder continues ad infinitum. Scarcity assumptions often reinforce scarcity outcomes.

[00:08:50.07] An abundance-oriented approach I'd say would begin with different questions. How do we increase capacity such that congestion management becomes less critical? How do we enable competition such that dissatisfied consumers can switch? How do we permit experimentation with different business models and traffic management practices to discover what actually serves users best?

[00:09:17.79] Now, I'll turn to another case study here, spectrum management. If net neutrality shows how our historical assumptions about scarcity persist long after they're warranted, spectrum management shows how our technical assumptions about scarcity can persist long after they're warranted.

[00:09:48.30] Now, what I have here is a cutout of this chart that I showed you earlier selecting only for the abundance paradigm. And I want to talk about what spectrum management under an abundance framework looks like. Number one, we would seek new sources of spectrum.

[00:10:11.90] Rather than treating the radio spectrum frequency chart as a fixed allocation map that was settled decades ago, an abundance thinking would ask, what new frequencies can we bring to bear? And you saw this a couple of years ago when we started looking at mid-band, when we started looking at millimeter wave, when we started exploring the bounds of physics.

[00:10:36.74] No longer were we consigned to the PCS bands, the cellular bands below 1 gigahertz. We started thinking creatively as our technological capacities changed. Abundance thinking also means challenging reservations and allocations that were made decades ago, treating them as immutable.

[00:10:58.64] Why should federal agencies be allowed to squat on hundreds of megahertz of prime spectrum without doing anything or very little with that spectrum to begin with? Why do we allow squatters and speculators to sit on hundreds of megahertz of spectrum without providing services to the public?

[00:11:19.44] Abundance thinking challenges these historical reservations and tries to see where we can free up more of the critical resources that we need. An abundance mindset would also question many of the technical restrictions that created artificial scarcity in the first place.

[00:11:37.91] Just over the last 15 years, we've seen major improvements in wireless design from beam steering to beam forming, carrier aggregation, dynamic frequency selection. This allows us to use

spectrum bands more intensively and where we thought it wasn't possible.

[00:11:59.59] And then finally, abundance thinking would view competition through a wider intermodal lens. The scarcity paradigm assumes that wireless communications depend exclusively on terrestrial cellular networks. But as we're seeing with D2D, MVNOs, and hybrid networks, that's not necessarily true.

[00:12:23.43] Now, the booming space economy provides another fascinating case study in how abundance can emerge even within systems that were designed for scarcity. You see, for decades, satellite communications operated under a classical scarcity model. Geostationary orbital slots were viewed as extremely limited resources allocated through international coordination and strict national licensing.

[00:12:49.62] Launch costs were astronomical. And the number of satellites in orbit was a relatively small amount. Then the economics changed about 10 years ago. Reusable rockets collapsed the launch costs. Manufacturing scale enabled mass production of satellites.

[00:13:12.30] Single satellite constellations could generate thousands of spot beams multiplying capacity. And so what you saw is a satellite licensing system that was built for the line. that line worked until it didn't. The policy response to this boom in the US and global space economy has been mixed.

[00:13:38.32] Some regulators, the FCC included, were adapting quickly recognizing that satellite broadband could dramatically increase total capacity. And we're working on creating streamlined frameworks, modernized approval mechanisms, and assembly line that will help meet that hockey stick of demand for satellite broadband capacity.

[00:14:05.36] Other jurisdictions, the EU comes to mind, have clung to scarcity mindsets imposing lengthy environmental reviews, demanding detailed business plans before licensing, or requiring burdensome conditions. And I think that differences in the outcomes will be visible.

[00:14:26.28] The point here is that we had these legacy scarcity assumptions. We suddenly saw abundance in satellite launch and manufacturing. And our systems have struggled to keep up. And now is the time for regulators to either embrace the abundance or double down on scarcity.

[00:14:49.91] Finally, I want to consider physical infrastructure deployment. And here the tension between abundance and scarcity manifests itself in particular ways. Now, telecom infrastructure when we're talking about cell towers, fiber data centers, you have it, it embodies a fundamental paradox. It requires using scarce physical

resources, but they're genuine physical constraints that would seem to justify a scarcity model.

[00:15:27.15] But what you see here is that it's not just a product of the scarce physical resources. There are a number of different exogenous factors that create scarcity crunch. And this is something that we saw about 10 years ago right before small cells were set to be deployed.

[00:15:48.77] We needed tens of thousands of small cells across the city to densify cellular networks. And the industry that wanted to deploy these small cell towers ran into a plethora of barriers that induced scarcity on the supply of that capacity. We've deregulated and we preempted some of those state and local restrictions. We're looking to do so, again, here now.

[00:16:17.25] Now, having surveyed these four domains, and I know I'm running out of time here, let me just highlight a couple of recurring patterns that suggest how our mental models translate into policy outcomes. Number one, scarcity institutions persist beyond scarcity conditions. In each domain, we've seen regulatory frameworks designed for genuine historical scarcity that outlast the conditions that justify them.

[00:16:43.32] Next, we see that scarcity assumptions tend to be self-fulfilling in nature. When a policy treats a resource as inexorably limited, it often becomes scarce. Spectrum held, but unused becomes artificially scarce. The manage scarcity paradigm often doesn't just respond to constraint. It frequently creates it.

[00:17:05.92] Third, scarcity mindset masks the consequences of foregone abundance. When the management scarcity paradigm constrains capacity, the cost is largely invisible. We don't see the innovations that weren't pursued. We don't see the infrastructure that wasn't built. We don't see the competition that doesn't emerge.

[00:17:28.10] Finally, unwarranted scarcity assumptions bring harmful distributional consequences. The abundance paradigm tends to improve access across income levels, I would argue. When capacity expands and costs fall, services become available to more people.

[00:17:45.66] The managed scarcity paradigm, whatever its intentions, tends to entrench inequality because rationed resources flow to those with the political influence or the ability to pay premium prices. This isn't inherent to any other free framework, but the empirical evidence, I would say, points in one direction.

[00:18:16.90] So what would a telecommunications policy look like if we embraced an abundance paradigm? We at first start by flipping the presumption. Instead of constraints being inexorable and fixed, we have to recognize that they're often plastic and then work to remove artificial barriers. And we're doing that in our terrestrial spectrum pipeline and our satellite spectrum abundance proceeding.

[00:18:44.17] It would start with some regulatory humility about what the optimal market is. Because constraints are often plastic, the optimal market cannot be known in advance. And so we have to question our legacy silos and engage in forward looking competition analysis.

[00:19:01.01] Because the optimal market is unknown, we have to be more comfortable with uncertainty. That means we have to reject worst case thinking and that informs our policies of modernizing legacy networks when we're thinking about more spectrum coexistence.

[00:19:20.97] If the constraints are plastic and there's uncertainty at play that we can be comfortable with, then we have to look to grow by eliminating constraints. Often that means moving faster as we're doing in the NEPA context or in our proceeding to modernize space licensing.

[00:19:40.56] And then finally, once we've grown, we've eliminated constraints, we've induced more competition, we have to embrace exiting choice as a way of consumers disciplining the market, punishing bad behavior. And that means looking at the market through a more sophisticated lens. You can see that play out perhaps in conversations about broadband funding.

[00:20:07.12] Now, let me end with I want to be clear about what I'm not claiming. I'm not compla-- I'm not saying that physical constraints don't exist. I'm not saying the market never fails, that there are never any externalities, and I'm not putting the abundance paradigm forward as wishful thinking.

[00:20:29.90] Rather, I just want there to be a broader recognition that many of the constraints that we treat as physical are actually institutional. And once we think of our constraints as institutional and not necessarily physical, we unlock a range of possibilities that we didn't know existed before. Thank you.

[00:20:50.16] [APPLAUSE]

[00:20:53.22] MATT SCHMIT: Well, thank you very much, Arpan Sura, senior counsel to Chairman Brendan Carr and chief AI officer at the Federal Communications Commission. With that, you've agreed to take a couple of questions from the audience. Drew has the microphone. Please raise your hand. And ideally, you're a student for the first question. But we have class today. So if you're not a student for the first question, that's OK.

[00:21:14.62] AUDIENCE: Hey, Arpan, great speech. So I wonder whether you've thought about the application of this framework to digital to video issues and specifically to the Muscari framework. So as some folks in the room know, a few decades ago Congress said broadcast signals are super important cable systems. You have to carry them because they're the only way for people to get information.

[00:21:37.57] Went to the Supreme Court. The Supreme Court said, yeah, it's really limited. It's the way people get information. Because of that, it's constitutional. Otherwise, it might be an impingement on carriers First Amendment rights to carry the content that they believe in.

[00:21:49.29] Fast forward, my guess is very few people in this room get their video through regular cable or nationwide. It's 20%. People thought they were scarcity and maybe there was scarcity in the way folks got video content. Nowadays, just not the case. And I'm just curious. It seems to fit very well into this framework. And I hate to be here as a cable industry shield in this environment of open mindedness and intellectualism. But curious whether you think that framework applies here.

[00:22:19.51] ARPAN SURA: Well, I'm not sure I have enough subject matter knowledge to weigh in on your particular question. But I've seen Tom Hazlett write from that perspective about must carry. And I think he makes a very compelling case along the lines that you do.

[00:22:38.75] MATT SCHMIT: One more question?

[00:22:41.27] AUDIENCE: Hi. Richard Bennett. You have some curious bedfellows in the abundance paradigm because, I think, the original, most vocal advocate for it in the US is George Gilder. And one of his offspring was a big fan of abundance, Larry Lessig. And now Ezra Klein has adopted it as a cornerstone of the Democratic Party ideology going forward. So does that make you feel uncomfortable at all?

[00:23:09.53] [LAUGHTER]

[00:23:11.72] ARPAN SURA: Well, the ideas that I presented here don't belong to any particular party. The abundance movement, as I understand it, is an offshoot from classical liberalism from the embrace of markets and civil society and plenty. And I understand that there are some who have gravitated towards that line of thinking from the left and that's fine.

[00:23:40.32] I think that that's a sign of strength, not necessarily a vulnerability. I think it's a cross-cutting, nonpartisan issue and one of the reasons why I think it's ripe for an audience like this to consider as an alternative to a scarcity model that, I think, we heard a lot about yesterday when it comes to AI.

[00:24:01.90] MATT SCHMIT: We have one last question. Richard, you've had your hands up from the outset.

[00:24:06.20] AUDIENCE: Hi, thanks. That was a great presentation. I was going to go a different direction, I guess, deeper in philosophy around the notion of conceptual systems. You talk about the plasticity of the institutions, but behind that scholars like Harari talk about we all live in these conceptual systems.

[00:24:20.22] So we have the concept of abundance and scarcity embedded in us. And then the institutions come along and go along for the ride. But I wonder if you've of thought about that a bit. There actually is a deeper understanding of how you try to break down these barriers in terms of the concepts we all carry around with us every day.

[00:24:41.88] ARPAN SURA: I think a lot of it just starts by asking the right question. When you challenge some of the constraints that have been presented as unmovable when sometimes you lean on a wall and it falls over and you find a secret passageway, I think there are a lot of those in public policy that you can discover just by asking a different question.

[00:25:07.68] MATT SCHMIT: All right. Very good.

[00:25:08.94] ARPAN SURA: Thank you.

[00:25:09.46] [APPLAUSE]

Panel: Band Access – License to Build?

https://youtu.be/UL7B3UinL_8

[00:00:02.12] LUCAS BEDNAREK: Good morning, everybody. My name is Lucas Bednarek. I'm a first-year student here at Colorado Law, and I've been enjoying being involved with the Silicon Flatirons Center. And I'm grateful for the opportunity to introduce our Band Access panel today, beginning with John Chapin, who's a senior fellow Silicon Flatirons and former special advisor for Spectrum at the National Science Foundation.

[00:00:29.12] David Goldman, who is vice president of Satellite Policy at SpaceX; Monisha Ghosh, who is a professor of electrical engineering at University of Notre Dame, Policy Outreach director for SpectrumX at the National Science Foundation, and co-chair of the FCC's Technological Advisory Council.

[00:00:48.80] Rob Alderfer, who is vice president of Technology Policy at Charter Communications; Shawn Bone, senior director of Public Policy at Verizon; and Michael Calabrese, director of the Wireless Futures Program at the New America Foundation's Open Technology Institute. So if you'll join me in welcoming our Band Access panel.

[00:01:12.06] [APPLAUSE]

[00:01:12.68] JOHN CHAPIN: Great. Thank you, Lucas, and thanks, everybody. So we're really excited to have this fantastic panel here today. Certainly appreciate Arpan's call for us to focus on a path to abundance. And in this world, spectrum abundance is definitely a means to an end. As he said, the end goal is to make the best services and capabilities available to the most users.

[00:01:36.40] So in this panel, we're going to use that lens to look at developments that happened in 2025. We're going to ask what those developments mean for progress towards making great services and capabilities available more widely. We're going to talk about what went right in 2025, what went wrong, and how the competitive environment has changed.

[00:01:55.24] Are we on the path towards the world that Arpan envisions, where users are protected by exit opportunities, choice, and intermodal competition? Or are there course corrections we could make that would accelerate progress and mitigate risks? The panel does have a focus, a bit of a focus on dynamic spectrum sharing, but I know the discussion is going to be broader than that.

[00:02:15.71] By way of introduction to activity of 2025, I'm going to briefly review one of the major developments in spectrum policy, which is the One Big Beautiful Bill Act, OB3. That bill reinstated FCC auction authority and extended it to September of 2034. It requires that 800 megahertz of spectrum be auctioned by 2034, 300 megahertz that would be federal, nonfederal, or both, 500 of federal spectrum. And it has to be below 10 and 1/2 gigahertz.

[00:02:46.87] The auction timeline-- that, by the way, is a lot of spectrum, at least feels like a lot from where we sit, given how hard it is to free up spectrum for auction. And then the timeline is really fast, 100 megahertz by July of 27-- so there's people in the government who are sweating bullets over that right now-- 200 megahertz by July of 29, and the remainder by September of 2034.

[00:03:07.87] And the bill does mention a set of specific bands, which I expect that the panelists will end up mentioning in some of their remarks. 2.7 to 2.9 gigahertz is to be studied. That's currently used by the FAA, weather and DOD radars. 4.4 to 4.9 gigahertz-- currently used by fixed and mobile tactical systems for the DOD and a bunch of fixed microwave links. And 7.25 to 7.4 gigahertz-- currently used also by the DOD and by others for military SAFCOM and for fixed microwave links.

[00:03:38.43] On the other side of the coin, the bill excluded certain bands from auction, the lower 3 gigahertz, 3.1 to 3.45, and the 7.4 to 8.4 gigahertz band. Both of those are federal bands with complex ecosystem of diverse uses. So I'm imagining just giving you that review because some folks will probably be mentioning it.

[00:03:59.23] Here's how the panel will go. I'm going to invite the panelists each to give a five-minute opening remarks on the key questions. What went right in 2025? What went wrong? And how have things changed? And then we'll collectively give you a very short tutorial on what spectrum sharing means because that's a fairly ambiguous or broadly defined term, and it has different meanings in different categories of spectrum. And then we'll have questions from me and from the audience. Now I'm going to mix things up a little bit,

and I'm going to surprise Michael by saying, we're going to start from the other end of the table. And come this direction, just to keep you on your toes.

[00:04:35.05] MICHAEL CALABRESE: Yeah, OK.

[00:04:35.97] JOHN CHAPIN: Yeah, see--

[00:04:36.41] MICHAEL CALABRESE: I was just getting relaxed.

[00:04:37.53] JOHN CHAPIN: Yeah, you might want to say a few words about yourself, and everybody can as well before launching into your remarks.

[00:04:41.81] MICHAEL CALABRESE: OK, yeah. Again, Michael Calabrese. I direct Wireless Future at New America and have been engaged, mostly representing a coalition of public interest groups. We have a public interest spectrum coalition, consumer school library, civil rights, and other groups mainly to make wireless connectivity more abundant, more abundant and affordable, and to close the digital divide in as many ways as possible.

[00:05:16.78] So in terms of what went right and what went wrong in the spectrum world 2025, I would say 2025 was, from our perspective, a tale of two policy domains-- terrestrial and nonterrestrial. So advances in sharing for terrestrial use were effectively put on hold, and with new uncertainty created, that the US might even reverse advances it's made very recently in greatly expanding shared spectrum for unlicensed Wi-Fi primarily and shared spectrum for private networks.

[00:06:08.54] At the same time and more dramatically, Chairman Carr and the Space Bureau launched a virtual revolution in expanded sharing of satellite spectrum. So let me take each of those in turn. David Goldman can get-- well, I'm sure will give some more detail. But I did want to mention that satellite spectrum abundance became a theme in multiple proceedings last year and literally the name of one of the first of those to allocate thousands of additional megahertz of high-band spectrum to LEO satellites in particular for sharing. Because all satellite spectrum under the ITU and US law is shared.

[00:06:59.18] Then another proceeding is on the spectrum sharing between LEOs and GEOs-- so LEOs being the low Earth, GEOs being the geosynchronous in high orbit-- is proposing much higher power, more beams, and moving away from the ITUs very restrictive rules. And then an NPRM late last year has proposed to expand sharing with mobile carriers in the millimeter wave bands to expand and streamline access to sites for Earth station gateways that backhaul satellite data traffic for these mushrooming constellations of LEOs in particular.

[00:07:49.58] Now, terrestrial spectrum was very much again, from our point of view, a contrast to that. The One Big Beautiful Bill, OB3, Act created a regulatory distortion field so in terms of how much it focused only on more spectrum for exclusive licensing, 800 megahertz, as John

just said. And it's an interesting contrast also to the first Trump term under Chairman Pai, which represented the high water mark of balanced spectrum policy of all time.

[00:08:33.38] In 2020 alone, the FCC authorized-- or they auctioned. They began the auction for 280 megahertz in C-band for exclusive licensing for mobile use, but it also allocated 1,200 additional megahertz across the entire 6 gigahertz band for unlicensed sharing and launched CBRS, both holding the auction for the priority access licenses and opening the band even before that for general authorized access because the band is half and half. We'll probably get back to that.

[00:09:14.25] But last year, OB3 not only mandated 800 megahertz for auction. In the process, it put great pressure on regulators to delay or even possibly roll back progress on shared and unlicensed spectrum. That's how difficult it will be to meet that now statutory target. So of course, by mentioning the two specific things we care about, in particular CBRS, the Citizens Broadband Radio Service, went into the year with high hopes, thanks to the US Navy and NTIA agreeing on CBRS 2.0, hugely relaxing the constraints on sharing that bandwidth Navy radar.

[00:10:03.53] And so there was a real boom in deployments by Enterprise, WISPs, and others. But 2025 added uncertainty. OB3 in particular added uncertainty, including around at the FCC, a proposal to relocate CBRS, or alternatively, to make it more like a traditional, very high-power mobile band, which we've opposed.

[00:10:29.09] And then on unlicensed, OB3 created uncertainty, but also seemed to sideline consideration of an obvious next advance in unlicensed, which is to extend that at 1,200 megahertz I mentioned, an additional 125 megahertz into the 7 gigahertz band to accommodate the very wide channels that next-generation Wi-Fi is bringing to market right now.

[00:10:56.85] On the bright side, though, just as the last point, FCC completed work on an expansion of the utility of 6 gigahertz unlicensed and, just in January, adopted an order creating a new device class, geofenced variable power, for peripherals like AR glasses and VR headsets and so on, and also proposed to allow higher power for indoor use if it's controlled by the automated frequency coordination database. So that was very much we have the beginning of a positive year for 2026.

[00:11:39.61] SHAWN BONE: All right, I guess it's my turn, so Shawn Bone, senior director of Public Policy for Verizon, have been to the company just over four years, and spent a decade on Capitol Hill before that. For the mobile wireless community, 2025 was a very important year. As John described, we spent a lot of time talking to Congress and have spent years, actually, previous to last year talking to

Congress about the need to restore the FCC's auction authority, which had expired, as well as create a pipeline or a plan for what it was going to do with that auction authority.

[00:12:14.66] So what we got out of OB3, as John described, was a nine-year extension of auction authority and a plan for how that is going to go forward, targeting 800 megahertz of auctionable spectrum over that nine-year period. I would maybe describe the bill a little differently than Michael, and we're going to mix it up here. It's going to be fun.

[00:12:34.08] But the political context of the bill is important. And I hate to put my congressional hat on for a moment. But for those of you in the room who aren't familiar with the reconciliation process, that process, which was how the tax bill which included the spectrum provisions got passed, creates an important structure around the ability of Congress to do certain things. Reconciliation focuses on federal government revenues, raising revenue and taxation.

[00:13:07.44] So when you're putting Bills into a reconciliation vehicle, it has to have a direct relationship to raising revenue for the federal government, which is why ultimately the OB3 text only focused on actionable spectrum, because at this point, according to the Congressional Budget Office and many others, the only type of spectrum that actually raises revenue directly for the federal government is actionable spectrum. That does not wipe out conversations around other types of spectrum, both in Congress and at the FCC.

[00:13:40.60] It just creates a fine point on actionable license spectrum going forward, which we felt was important, because what we have done over time as a mobile wireless industry is think about how we plan network expansion and development over the life cycle of auctions at the FCC. And it's helpful when we have a pipeline to be able to think about how [AUDIO OUT] mobile wireless industry is not here for conversations about shared spectrum bands. On license bands, we utilize all sorts of different types of spectrum access models in our networks.

[00:14:18.06] But the OB3 Bill, because of the political context around it, had to focus on auctionable spectrum. So yes, John laid out the timeline. I would also push back a little bit on Michael's characterization of what OB3, the statute, does and the conversation that we're likely to have on this panel about what the statute means. The statute just says, go auction 800 megahertz of spectrum over the next 9 years. 300 of that has to be repurposed commercial spectrum. 500 of that has to be repurposed federal spectrum.

[00:14:53.87] It also says, go study the three bands that John mentioned. It does not actually tie the studies to the auctions. It just says, go study it. Now, there has been a subsequent presidential

memo that says some of the spectrum that is going to be auctioned is from the 7.125 to 7.4 band. That was an exogenous factor that wasn't part of the statute.

[00:15:13.19] So yes, we're going to have a lot of conversation up here about particular bands and the future of bands or whatnot. But I disagree with Michael in that, that's not coming from the statute. That's coming from the larger conversation around it. And many of those decisions are going to be in the hands of people like Arpan at the FCC about where this is going to go. So those decisions haven't been made yet. There's nothing in the statute necessarily that says you have to stop enhancing CPRS. We're actually advocating for enhancements to CPRS.

[00:15:43.55] The other thing I do want to say in the statute that was important to the mobile wireless industry was Congress's recognition of the importance of power levels when you're thinking about spectrum for mobile wireless networks and the reinforcement of the value of flexible use licensing. I've been on many panels next to Rob and others where-- and I expect, again, we'll talk today about the delineation between the use of mobile wireless spectrum for mobility and for fixed wireless access.

[00:16:12.25] The good thing is that's not a policy decision. That is a technical and innovation decision on the part of the mobile wireless carriers to figure out how to best serve its customers, no matter where they are. The same is true of former Senator Gardner's comments this morning about how the cable industry is making inroads into the wireless marketplace.

[00:16:32.63] They're actually using, in many respects, our network to begin that inroads and then layering on their own build out on top of that. So the conversation and the framing of this is important when you think about service to the consumer and the ability of companies to figure out the right way to utilize the spectrum. Over to you, Rob.

[00:16:57.27] ROB ALDERFER: Thanks, Shawn. And thanks to John for putting together this panel, and to Matt and the Silicon Flatirons team for a great conference. It's always a good discussion here. I'm Rob Alderfer. I'm in the Technology Organization at Charter Communications.

[00:17:11.15] For those of you that need a brief intro to Charter, we're one of the largest communication service providers in the US. We offer broadband, voice, video, and mobile service across 41 states under the brand name Spectrum, which is fun because we're here talking about spectrum. And I actually get to speak not only about spectrum, but on behalf of Spectrum. So--

[00:17:32.22] [LAUGHTER]

[00:17:34.06] --in terms of what went right, John, in 2025, I thought Cory Gardner did a good job of laying out the really dynamic market landscape that we have today in the US, in the communications sector. I just want to highlight a few points that will help to frame the discussion in that regard. So in 2025, between Comcast and Charter, together we now serve over 20 million, well over 20 million mobile subscribers.

[00:18:01.62] And Charter's now the fastest growing wireless operator in the country, which is something we're really proud of. That's a function of offering really great service at a great value for customers. And CBRS, which Cory Gardner also mentioned earlier, we'll talk more about today. And to define that acronym-- I think we should do our best to define acronyms today-- Citizens Broadband Radio Service, which is a frequency band that is the archetype of shared spectrum.

[00:18:29.14] CBRS is increasingly fueling our mobile growth., and we're deploying that rapidly, not just within the cable industry, but really across the communications sector. There's over 420,000 CBRS radios deployed, and that's not only helping to fuel mobile competition through improving the economics of cable operators like Charter as we enter the mobile space.

[00:18:55.08] But it's also allowing manufacturing entities, health care logistics, and a range of economic sectors really take control of their own wireless operations through private wireless network companies. Like, Walmart, Tesla, John Deere, Chevron are all in the CBRS space, as well as the communications sector and players like Verizon, who's a big player of CBRS and Charter.

[00:19:22.38] So beyond CBRS, 2025 was also a big year in Wi-Fi in terms of the ramp of 6 gigahertz Wi-Fi deployment. Charter has well over 6 million, 6 gigahertz capable Wi-Fi access points deployed across our customer base, and we're making full use of this new spectrum band for Wi-Fi. So that's gone hand in hand with the expansion of our broadband capabilities. We're deploying new fiber networks across the country. Just in 2025, we lit up 1.5 million new network passings.

[00:19:59.54] And we're also upgrading our existing network to multi-gig services throughout the country. And at the end of all that is Wi-Fi. So 6 gigahertz Wi-Fi is really what makes that investment. And so much of the investment that we heard, not just from private sector operators, but also from the government on the last panel, 6 gigahertz Wi-Fi is really what makes that real for consumers because, ultimately, that's how consumers connect to those broadband networks.

[00:20:27.25] And so I think some highlights for us in terms of what's happening in the market and what some of the major developments in 2025 were on that front-- in terms of the policy front, obviously, John, you laid out the restoration of the FCC's auction authority through the

OB3 Bill. That generally I think was a step forward, needed to be done to set the path for continued access to commercial wireless spectrum, to continue to fuel growth and competition in our sector over the next decade.

[00:20:58.69] And it did have ambitious and specific targets, I would say, for making spectrum available. And I would note, importantly, it does not preclude shared spectrum. So how much spectrum is needed? what the trade-offs are relative to network investment, because those two things are trade-offs-- in fact, spectrum and network investment are two distinct ways to meet growing capacity demands for wireless services.

[00:21:26.21] And what the most efficient way is to meet those demands all really require careful evaluation, and I hope we don't lose sight of that as we talk about the path forward under the OB3 legislation. And to that end, I think it's important to keep in mind where capacity demand is growing. The vast majority of wireless data is consumed in specific locations, like homes, offices, campuses, venues.

[00:21:53.89] That's intuitive if you just think about how you use your own devices, and that's really where capacity demand is highest. That's where spectrum needs exist. And we see that across communications operators. For all mobile operators, well over 80% of the data from mobile devices is actually traveling over Wi-Fi.

[00:22:15.65] At Charter, on our Spectrum mobile service, we do a bit better than that. We're about 90% of traffic from Spectrum mobile devices is handled over Wi-Fi. So we need to continue to feed the Wi-Fi spectrum pipeline. And Michael, you mentioned the lower 7 gigahertz band as an opportunity to do that. I'll close on this. This is a real highlight for me in 2025.

[00:22:36.85] At Charter, we worked with Broadcom to develop a new technology innovation that stitches together the existing 6 gigahertz spectrum with the lower 7 gigahertz spectrum. We showed this at an industry conference in DC back in the fall. We were able to get up to 20 gigabits per second to consumer devices using those two bands together.

[00:22:57.61] And so as we think about the future of wireless and spectrum policy and how it needs to meet consumer demands, that we see as a real opportunity that we need to keep front of mind. So I'll leave it there. Thanks

[00:23:13.79] MONISHA GHOSH: Thank you. It's a little bit hard to say something new after the excellent summaries given by the previous panelists. Thank you again for inviting me to the panel. It's been a great conference so far. I'm Monisha Ghosh. I'm a professor at the University of Notre Dame in the Department of electrical engineering. I've been there about four years, but I have been working on spectrum-

related issues for my entire career, which is-- I won't date myself as to how long that is.

[00:23:45.67] Suffice to say that I worked on the HDTV broadcasting system, which many in the room may be too young to even remember a time when we didn't have digital TV. And I've been in spectrum sharing since 2008, so I've wound my way into academia through working in industry for many years, stint in government, and now in academia.

[00:24:09.51] So I'll come to this question and the panel and what we've been tasked with with a slightly different angle, to really look at tying together what was talked about in the previous talk by Arpan on spectrum abundance and what the legislation did. To me, there is a fundamental contradiction if you're trying to do spectrum abundance, and you take 800 megahertz, and you allocate it to one use.

[00:24:42.60] So as we look forward as to how we address some of these issues, I take a lot of insight from two other related industries. One is real estate. One is transportation. So if you look at real estate, what we do in New York City is very, very different from what we do in the farmlands of Indiana. We cannot have a one size fits all regulation, which says that you can only build single family houses in real estate, which is as expensive as it is in New York City.

[00:25:14.94] And so we figured out how to layer on different applications to France in the bottom basement apartments, penthouse apartments. And so we are taking the same piece of real estate and extracting a huge amount of value for it. We have to learn how to do that better in spectrum. And we can do that. I think CBRS has shown us how we can do it. 6 gigahertz-- excellent example of how we take 1,200 megahertz of spectrum, which is a big chunk, and we layer on use cases.

[00:25:49.02] We have incumbents. We have fixed microwave users. We have satellite. We started off with just low-power indoor users. Then we added on standard power users with AC control-- very low power. And then the new geofence variable power-- it allows you to do fixed wireless access. You can also do 5G NR and NR-U.

[00:26:13.12] So as we look forward to an era where, on the one hand, we have an abundance of use cases and applications that need spectrum, but the spectrum pie is not going to grow, especially when we have a bounding box of physics around it-- yes, we've pushed the boundaries of physics quite a bit. Cellular at one time was just sub 1 gigahertz. Now we're moving up the frequency band.

[00:26:39.96] But the physics has not changed. We have been able to harness some of these limitations and actually take some of those limitations and make them into things that we can work with beamforming and large panel antenna arrays. But as I look and

address the question of what went right in 2025, I think getting the auction authority back to the FCC was absolutely the right step.

[00:27:07.92] I don't think that, again, as I mentioned, allocating 800 of spectrum to one way of using it was necessarily driven by a scientific analysis or a technical analysis or what are the use cases that need spectrum. Rob alluded to indoor needs of spectrum, and I'm very focused on that right now in the research that I do. And the only place I'll differ from Rob on indoor is, I don't think Wi-Fi is the only answer for indoor connectivity. I think there are many, many applications where you need a cellular-like system indoors.

[00:27:49.67] But when we allocate cellular spectrum today, we don't differentiate between where the spectrum is going to be used. So if you take this 80% of use cases that are indoors, and then you separate out as to which one of these would actually benefit from a cellular system-- and when I talk about a cellular system, I'm talking about a 5G stack, which operates differently than a Wi-Fi stack. There are some better quality of service metrics that a cellular stack can provide.

[00:28:23.59] And in many cases, like factory automation, warehouse control-- in the indoor cases, you really want that cellular stack. And that is where having spectrum that you can use to deploy cellular stack in, like the CBRS band, is essential. But there's only 150 megahertz of it. So when we talk about 800 megahertz of spectrum coming down the pike, we should be thinking more carefully about how this spectrum may be used.

[00:28:55.91] The final thing that I will say is that tying this back to the topic, which is license to build, recently I came across some very interesting data from-- the EU has a 5G observatory where they have measures build-outs across the world. And we've heard a lot about how China is supposedly winning the hypothetical race to 5G grams. I've never understood what that means, honestly.

[00:29:27.65] But if you look at what they are doing, they're a much bigger country. So really, the metric we want to look at is, how many 5G base stations per 100,000 people do you have? That number sits at 301. Any guesses as to what the US number is? And I'm quoting from that data. It's about 42.

[00:29:49.35] The amount of spectrum is more or less the same. South Korea is actually even better comparison. They have 670 5G base stations per 100,000 residents versus US's 42, and they have less mid-band spectrum. So when we think about spectrum and cellular connectivity and wireless, we have to keep in mind that what you lack in spectrum, you can make up with deployment.

[00:30:16.72] Small cells are a well-studied way of doing cellular coverage. Yes, there are hurdles. We heard about permitting and pole attachments and rights of way, all of that. But those are not spectrum issues. So if we are facing a world where we have to figure out how we

best use the limited spectrum we have, we should not look at it in isolation.

[00:30:38.80] We said, OK, if we have just a little bit of spectrum, what can we do in these other places to add to it? So no matter how much spectrum we allocate to 5G or 6G or cellular, ultimately it will be how much we deploy in terms of infrastructure that we get the most benefit out of it. And I would encourage folks to really think about the targeted use cases, the places in the cities where you need the spectrum, indoors where you need the spectrum, and move away from this blanket "one size fits all" approach to spectrum policy.

[00:31:16.34] DAVID GOLDMAN: Thanks so much for having me, really appreciate it. This has been a great conference. I really enjoy it. So real quick, just a little behind the curtain, so for the prep call for this, I realized that I was on a flight. And I wasn't going to be able to make it. And so I asked a colleague to listen in. And I was like, it's going to be easy. Don't worry about it.

[00:31:35.46] And she texted me and said, they all said that they want to hear what you have to say. And I think they're going to come after you. And I said, no, come on, it's fine. It'll be OK. And then I saw Shawn. And he said, yeah, no, we decided we're coming after you.

[00:31:50.20] [LAUGHTER]

[00:31:52.10] And then I saw Rob. And he's like, yeah, no, we are. And at that point, like, Rob's not that funny. And so I started thinking that that might be right real. So with that, I'm going to say very little so I don't give them that much to come after me on. Also, I got the benefit that actually Arpan got ahead of me on a lot of the stuff I was going to say already. So I'm just going to lean on what Arpan was talking about.

[00:32:22.76] From our perspective, a lot--

[00:32:27.10] JOHN CHAPIN: Say who "we" is.

[00:32:28.10] DAVID GOLDMAN: Oh, I didn't say that Oh, sorry. I'm David I'm from SpaceX. And we have Starlink, so we got a lot of satellites that do broadband. So from a SpaceX perspective, talking about satellite stuff, one of the things that really went very well in 2025, it's exactly what Arpan was talking about, is that for a very long time in satellite, there weren't very many deployments.

[00:32:55.20] You had geosynchronous satellites. They didn't go up that often. They covered a huge part of the Earth, and launch costs was really high. People had talked about doing these next-generation satellite systems with lots of satellites. But you were never able-- the economics didn't make sense until we had reusable rockets.

[00:33:09.95] Once you had reusable rockets, launch costs go way down. The economics changes, and now you see all these other systems that are popping up. And the old system, the scarcity system,

was a very command-and-control approach, which was very bespoke. We'll know it when we see it. You tell us what we're going to do. We'll think about it, and we'll tell you whether we like it or not.

[00:33:31.81] And that was fine for that model. But as I said, everything changed a few years ago. And it's been a struggle and it's a continuing struggle of, how do you shift the regulatory approach to be able to deal with this real-- you saw the chart that Arpan put up-- this real inflection point in what's going on in space and satellite spectrum.

[00:33:53.37] And I think one of the things the FCC has done really well is this pivot over the past year to start looking at-- I hadn't thought of it exactly. I mean, they've been describing it as the abundance approach. But it is starting to look at it of, instead of assuming that space is finite and spectrum and being able to share spectrum is finite. And so we have to look at every single application and dig into it and assume the worst for every single one of them.

[00:34:25.11] And let's take a really long time thinking about it because we got to make sure that we've thought about the worst possible thing and that can happen and cabin it in. They switched, and they've proposed to switch the entire way that they're reviewing it to, let's assume that this is good stuff. Let's put the rules out there.

[00:34:42.23] And if you meet the rules, we'll assume that that's good. And we'll review it and make sure that everything is kind of copacetic and working well. But we're going to assume that this is good, and we're going to default towards approvals, rather than default towards-- not that it wasn't approvals, but default towards lots of conditions, defaults towards command and control.

[00:34:59.07] And it's switching to this much more flexible approach. And what it's going to do is it's really going to lower the barriers to entry for-- I mean, you can think about it from a SpaceX perspective, but you can also think about it-- all these new startups all around here. There's a ton-- there's a huge aerospace industry all around here. All these startups that are trying to come into the market, they're trying to take advantage of these lower launch costs.

[00:35:21.05] And by switching to this kind of abundance approach on the regulatory approach, it's making it much more available to be able to apply, that the licensing doesn't have to take years to get there. You don't need to have literally millions of dollars in lawyer fees to be able to get across the line, to be able to get this-- to be able to launch your satellites, deploy your system.

[00:35:42.57] They put in timelines. They simplified the system. They're talking about putting in, changing some old EPFD-- you don't need to know what that means. But it's essentially a power limit that is from 30 years ago that artificially restricts how-- the capacity that you can put onto a next generation satellite system.

[00:36:03.67] It's all these things that are-- let's assume this stuff can do-- let's assume that there's good stuff here. Let's assume that we want to improve this. Let's watch it. Let's put in guardrails. Let's make sure there's rules of the road, but let's assume that this is going to turn out to be well.

[00:36:16.93] And it's really going to let the industry flourish. I think that inflection point-- I think we're really going to see-- that was applications that Arpan put up. But I think what we're going to see is actual deployments, actual new services, actual new stuff for consumers that's going to come out of this.

[00:36:34.61] Real quick on just the thing that I'm really worried about that's coming out of '26-- a lot of the rest of the world is watching what's happening in the United States. The United States is getting far ahead in space. A lot of the world doesn't like that. And there's increasing amount of talk globally, a lot of protectionist proposals coming out of other countries.

[00:36:54.83] These systems are inherently global. They have to be global. The economics only works if you have a global system. There's a lot of countries, there's a lot of parts of the world that are talking about actually-- I mean, they will just say it. If you come from the United States, we don't want to give you access to spectrum in our country or in our region, our continent.

[00:37:13.64] And that Chairman Carr has, I think, done the only thing he can do, which is start saying, hey, if going to start treating us that way, we're going to have to do that to you, too. That's a bad result all around. We don't want to go into that world. I really think that this is something-- I'm seeing that come up more and more around the world of, how do we make sure-- we're carving up the spectrum and making sure we get ours, and we're keeping everybody else out.

[00:37:40.94] If that's the way that we go, it's going to end up-- these systems don't work that way. These are inherently global. If we start going that way, it's going to end up being a very bad result. We're going to actually counteract this kind of abundance approach, and it's going to start pushing back into the scarcity again. And I think that's going to end up being worse for everyone.

[00:37:58.68] JOHN CHAPIN: All right, thank you. And thank you, everybody, for the very insightful comments. So I promised you we're going to-- this is education time for the students who are in the room or maybe watching remotely. And for those of you who are not close into the spectrum world, because you've heard this term "spectrum sharing" talked about a lot, but it actually means different things in different contexts.

[00:38:18.32] So to bring some clarity for that, we have a lightning round scheduled. Now I'm going to ask each panelist how spectrum

sharing works in a different category of spectrum. So you've got Michael on the end. He's going to answer for unlicensed.

[00:38:29.32] Shawn will talk about it for the exclusively licensed bands. Rob Alderfer will talk about the dynamically shared bands, like CBRS. Monisha, I've asked her to talk about federal spectrum. And then David, could you say how spectrum sharing works in the satellite bands? 90 seconds each, and start with Michael. And run on down the line.

[00:38:44.32] MICHAEL CALABRESE: OK, unlicensed-- the starting point is to know, of course, that the FCC allocates bands of spectrum for particular services, and then in most bands, assigns us licenses to specific operators. But there are also bands that are not licensed at all. They are a sort of commons or public park, open to anyone for shared use, subject to certain conditions.

[00:39:17.44] And the core condition is that you cannot cause interference to any licensed user. They must be protected, as Rob was describing, with the fixed links in the 6 gigahertz band. And you must accept any interference from any other user, licensed or unlicensed.

[00:39:40.96] Wi-Fi is, of course, the best known example. But there are also Bluetooth and other technologies for this unlicensed sharing. And so obviously, you don't need a government license to operate a Wi-Fi router in your home or a Wi-Fi hotspot. And because Wi-Fi is free to use, low power, and abundant, it efficiently reuses spectrum and ends up carrying between 80% and 90% of the Mobile Data traffic on smartphones, for example. So that's unlicensed.

[00:40:27.27] SHAWN BONE: And I jump in for license, and I will try to go quick. You hear of exclusive licensing. And I think that's a misnomer when you're thinking about the characteristics of the underlying spectrum. Exclusive licensing means, I get a license as a commercial wireless entity to use a block of spectrum, and I am the only commercial user allowed to use that block of spectrum. It gives me certainty for investment and gives me certainty on how I build my network characteristics against that.

[00:40:52.65] That does not mean I'm the only user in that band. Oftentimes, we have to coordinate geographically or statically with other users. A great example is in a band called the AWS band. We have to carve out geographic exclusion zones for certain government operations, radars, and things like that. So you will have sharing with other types of users in a band, generally federal users, which will define, hey, I can't operate in this space. There's a static space where I cannot transmit into to protect that operation.

[00:41:25.77] Sharing an exclusive licensing also happens among the carriers. So we may have a block of 100 megahertz of spectrum that has been licensed, but we may each get megahertz of those licenses

right next to each other. So we coordinate how we operate. We also coordinate by market.

[00:41:41.55] And one market, I may have a license for 10. Another market, someone else may have a license for that same 10. So we have to coordinate across that. But we still fundamentally have the commercial right to use that spectrum versus anyone else with interference protections.

[00:41:58.71] ROB ALDERFER: So dynamic spectrum sharing-- the discussion starts but doesn't end with CBRS, the Citizens Broadband Radio Service, which is frequency range in the 3 gigahertz neighborhood, which has enabled commercial wireless services of a variety of types in the same frequency band that's used by the Navy for ship-borne radars. So that's been a really interesting case where there's tremendous commercial use of the band, mobile services, fixed wireless access, and private wireless operations that create value without imposing costs, significant costs on the Navy.

[00:42:36.65] And that's managed through an intermediary known as spectrum access system, which ensures that commercial operations near the coasts don't do any harm to Naval ships when they're in town and using the frequencies they need. So this is one example of dynamic spectrum sharing. And to aggregate out a little bit, I thought it'd be useful to quote a report to the president from 2012.

[00:42:58.08] The President's Council of Advisors on Science and Technology defined spectrum sharing as "Spectrum sharing can take a number of forms, but its purpose is to ensure that when the primary user does not need the spectrum, another party can put it to good use as opposed to allowing it to remain fallow." So to embrace Arpan's theme from earlier, creating abundance from scarcity.

[00:43:21.94] So the benefit of that is you create a lot of value for new uses of the spectrum while creating minimal costs for existing users. And it's worth noting that consumer data use patterns are highly compatible with shared spectrum as we think about future opportunities. As Monisha and I have talked about, most commercial wireless use happens in specific locations. It's local traffic.

[00:43:47.26] And other wireless systems, like the Navy example, use spectrum in different locations or may not need spectrum all of the time. And so we can unlock significant value through these dynamic shared spectrum constructs, often in concert with lower power levels. So that's a real benefit of dynamic spectrum sharing.

[00:44:09.82] MONISHA GHOSH: Federal spectrum usage actually covers many, many different applications. And again, for the students in the room, that's NTIA that regulates all of that. So the ones that have been mentioned already are the DoD Navy radars, AWS coexisting with certain areas of the country.

[00:44:30.02] But there's a huge section of federal usage which it has to do with things which are more science related. So you have radio astronomy uses spectrum. These are passive sensing instruments, weather radars that give you a weather forecasts that are looking down on Earth. They are also mostly passive. Earth-sensing satellites, which are looking for many other parameters.

[00:44:56.06] And these systems are actually our users of spectrum. Sometimes they're active. Sometimes they're passive. But giving them room to operate is essential to our functioning as a society. I mean, I don't think any one of us want to have our weather forecasts tampered with. They also have different challenges than, say, a Wi-Fi system coexisting with a cellular system because these systems are inherently measuring extremely low signal levels.

[00:45:26.26] Those levels in a commercial system would be noise. So they're really looking for noise, and whatever commercial systems are providing are interference to this. And many times, the issues are not so much as to what are the systems that are in the same band that these systems are operating over, but what is in the adjacent band. So adjacent band spillover can affect a lot of these kind of federal systems a lot.

[00:45:55.65] And again, however, a lot of this usage is geographically isolated. We don't have radio telescopes all over the country. Weather satellites go around, so we have to be careful about that. And sometimes, they're just limited by physics. So when you're looking at certain chemical elements, they have very specific spectral lines that sometimes happen to fall in, say, the 6 gigahertz band.

[00:46:23.59] And so we have to figure out how we can protect these because the physics is not going to change to accommodate what we need out of a commercial systems. So there are a lot of challenges there. But I think that also provides a lot of opportunities on how you can share the spectrum better.

[00:46:37.53] JOHN CHAPIN: Thanks. How does satellite shift then work?

[00:46:39.29] DAVID GOLDMAN: Yeah, you see what it's like to be a satellite guy? Like, we get a bunch of people who get to talk about terrestrial in their pieces, and then I have to talk about all spectrum bands across all services in all of space. And I get 90 seconds.

[00:46:51.75] [LAUGHTER]

[00:46:52.97] JOHN CHAPIN: Yeah, but how does the sharing work, yes?

[00:46:54.69] DAVID GOLDMAN: Yeah, so there's a few different models. So all of our spectrum is shared. Our main one is like for our main Starlink service, for example, is in the K use case. These are fixed-- oh, it's directional antennas. So we use directional antennas. And

because we use directional antennas, it's a narrow beam. You know where it is.

[00:47:19.35] And so there's rules to make sure that you don't overdo it, and you don't-- I call it the Ghostbuster rule. You don't want to really cross the beams. But as long as you avoid that, you mostly can operate and can co-frequency share. And so that's how most of that works.

[00:47:33.85] There's power limits also. If you think about it, I was mentioning earlier, like, the GSOs are really much higher than the NGSOs. So the geosynchronous orbit satellites are much higher, have giant beams. The next-generation, the non-geosynchronous, are all much lower than that. So you can't really avoid crossing the beams doing it that way.

[00:47:53.97] So instead, it's a power limit. And so you can have higher power if you're coming from higher, and you have to have lower power when you're coming from lower. That's generally how it does. And then the last one has been-- and this is the tricky one where it's like a lot of the sticking points nowadays, is the mobile satellite spectrum, which theoretically is supposed to be shared. But it's omnidirectional antennas, which is really tricky to be co-frequency.

[00:48:15.45] When you have an antenna that can be scanning anywhere in the same frequencies, you put them next to each other, they're going to mess each other up. And so there's a lot of questions right now. This is a very kind of live issue of how does sharing work in those bands.

[00:48:29.93] JOHN CHAPIN: Great. Thank you. All right, so now it's time for the "everybody goes after David session."

[00:48:35.51] [LAUGHTER]

[00:48:36.25] But actually, though, the thing that we were all interested in--

[00:48:38.33] DAVID GOLDMAN: I had the wrong strategy. I should have talked more.

[00:48:40.51] [LAUGHTER]

[00:48:41.45] Yeah.

[00:48:41.93] JOHN CHAPIN: No, but there was a very major non-legislative development in 2025. As he said, the mobile satellite world has always operated in shared spectrum. But the big seismic event was SpaceX acquiring exclusively licensed spectrum from EchoStar dish.

[00:48:58.97] So this leads to a lot of questions that I think people on the panel were very interested in engaging in about how this leads us towards the future. Does the arrival, the rapid growth of D2D and D2C, Direct to Device and Direct to Cell-- does that change what it takes to offer a competitive service in the telecommunications space?

[00:49:15.45] Maybe even, should the US start auctioning exclusive use licenses for satellite spectrum, if that's really what it takes to offer a great service. And what does any of this mean for the future of satellite terrestrial sharing maybe in the 5G era, maybe in the 6G era, or anything like that? So this is a broad set of issues. So we're very interested to start with, David, anything you want to share about your perspectives on what this meant from the SpaceX perspective? And then get into discussion with the rest of the panel.

[00:49:41.62] DAVID GOLDMAN: No.

[00:49:42.74] [LAUGHTER]

[00:49:43.36] No, yeah. No, OK, so yeah, let me just give a little background on-- so there's two models that are going on the direct to device. The first model is the one that we've been doing. And in the United States-- we're in about 11 countries, now that we've announced that we're doing this. But in the United States, it's definitely our biggest market. And we're partnered with T-Mobile.

[00:50:04.48] And what we do for this model is we use the terrestrial operator spectrum. So essentially, what we do is we don't have our own spectrum at all. In this model. We build satellites that are capable of operating in the terrestrial spectrum and generally follow the general rules of the terrestrial spectrum is used. We then partner with a terrestrial operator who has the right kind of spectrum and has it in the right places and can use it the right way.

[00:50:39.76] And essentially, we transmit from the satellites in LTE. So we build our satellites to be LTE. So essentially, we look a lot like a terrestrial. What will happen is-- if you're a T-Mobile customer, is if you're walking around, if your phone can see a T-Mobile tower, it wants to talk to that tower. That's the first choice.

[00:51:03.46] If it can't see a T-Mobile tower, it'll start scanning. And it will think our satellites are-- essentially, it thinks our satellites are a T-Mobile tower, and it can communicate. Now, it's in 5 by 5 megahertz. That's not a lot of spectrum to go all the way to space. So we can do things like texting. We can do voice. We can do light data. But you would not confuse this for 5G.

[00:51:26.32] It's fine. And the biggest use case we've seen has been national parks and emergencies. It's been in essential in emergencies. You see the usage just spike. And for example, in Jamaica a few months ago when Hurricane Melissa came through, it knocked out all the terrestrial equipment.

[00:51:51.88] Essentially, we had two parts. I mean, we deployed Starlink to have our normal user terminals there. But we also turned on-- we quickly, quickly got agreements with all the terrestrial operators in Jamaica, and we quickly turned on a system that we actually hadn't had there before. And we saw essentially hundreds of thousands of text

messages going through within an hour or two of the hurricane coming through because it was the only way that people were able to communicate.

[00:52:22.02] So it's like, like I said, you wouldn't think it's 5G. But it really, really has important applications. Now, what we've done with the deal that we're doing with EchoStar is we're actually trying to acquire our own spectrum. So that way, we're not dependent on using the terrestrial operator's spectrum. That has a few benefits for us.

[00:52:45.53] One of them is that it's more spectrum. And actually, we have wider channels. We can actually provide real broadband service over using our Gen 2 system, using the spectrum that we're acquiring from EchoStar. It's interesting because that spectrum actually has a terrestrial component to it. So it allows us that if we need to supplement with terrestrial build outs, we can do that as well because it's got that terrestrial license in it as well.

[00:53:15.03] I question a little bit like reading too much into that one particular deal. There is the satellite spectrum is that mobile satellite Mobile Service Satellite spectrum, MSS spectrum. There are several other bands that have that same allocation and do that. This, because it's terrestrial, has an exclusivity that's built in as part of the terrestrial that's different.

[00:53:42.13] Also, if you look at the pricing that we pay, satellite spectrum, because it's shared and because of the history of it, because it's global, is really, really hard to price. So actually, if you look at what we ended up paying for the spectrum, we effectively paid almost the same thing on a price per megahertz pop that AT&T paid from EchoStar for purely terrestrial spectrum.

[00:54:04.99] So I don't know how much just this one deal I would read into it. It's like, the whole paradigm has changed. Everything is different. It's, we effectively paid terrestrial prices for terrestrial spectrum. So I'm not saying that there aren't changes coming, but I just wouldn't-- it's an n of 1, and I wouldn't overindex on the n of 1.

[00:54:27.35] SHAWN BONE: I'd say, I jump in because I was actually the one on the prep call that raised this. And I can't believe you went Ghostbusters and then Star Wars. Come on. What kind of a space guy are if you go for Ghostbusters?

[00:54:37.41] No, I actually do think there are instructive lessons to think about when you reflect on what space did and what David didn't say but I'm going to project onto him because I get the benefit of doing that as Verizon and not a SpaceX partner is, I think, one of the reasons SpaceX bought that spectrum, terrestrial component or not, is the certainty it gives them to be able to make the investments in the next generation of satellites and launch them and know that they're going to have the spectrum platform to do it.

[00:55:03.09] We partner with AST. AST is looking at a similar service. They acquired their spectrum rights to do it through a long-term lease, but a lease is inferior ultimately to having the license because you don't have the certainty of having it over time. You're reliant on another partner. And who knows what's going to happen, even on a long-term lease? And the AST lease, I think, is 80 years or more.

[00:55:24.95] But it's instructive to think about in the context of this larger conversation about spectrum utilization rights and license versus shared and whatnot to say that outcomes matter. What you want people to do with the spectrum matters. The services that you want to appear out in the ecosystem matter. So for us as mobile wireless carriers, the reason we exclusively licensed spectrum or licensed spectrum generally versus alternative access models is that it gives us the platform to invest on that.

[00:55:55.84] And I've actually heard our company's former CEO tell members of Congress and leaders at the FCC and other he liked investing in the United States because the certainty that the licensing structure in the United States gave him to make the investment in the network, to build the mobile connectivity that people will rely on.

[00:56:11.72] And I always encourage folks to remember, turn off your Wi-Fi on your phone one day. And in most cases, it's going to work just fine. Turn off your mobile connectivity on your phone one day, and in most cases, you're going to be without connectivity for the better part of your day.

[00:56:28.74] And if you want to drive the outcome where we still value mobile connectivity, lots of capacity to power that, to power the new services and whatnot, you need to make those investments in the networks. And the way you entice people to make the investments in the networks and the services is to give them the type of licensing rights to the spectrum that makes it attractive to do that.

[00:56:52.02] MICHAEL CALABRESE: Yeah, I'm very happy that David made that distinction between supplemental coverage from space, which was first authorized in 2024 on mobile carrier bands as kind of a fill-in, and mobile satellite spectrum, which is, these are global ITU allocations for satellites to serve mobile devices. And it's not just pie in the sky.

[00:57:19.28] Currently, as many of you know, I'm sure, if you have a new iPhone, globalstar uses a MSS allocation in partnership with Apple so that, if you have a new Apple iPhone, you can text between any two points from top of Mount Rainier to the middle of the Mojave Desert, back and forth with someone.

[00:57:41.22] The problem is, though, there's very little mobile satellite spectrum. And if this is going to be a new form of-- a new piece of our what's hopefully convergent connectivity between mobile Wi-Fi and satellite and fill in all the coverage gaps-- because the majority of

geography in the United States does not have mobile service. So we'd like to ramp that up to-- I would-- to see it to go to 3G level services at least.

[00:58:13.72] And so we need more of that spectrum. There's two ways. One, which-- and SpaceX started this debate, actually-- we could potentially share the current mobile satellite spectrum that's been allocated. But it's very iffy if it's feasible. To a degree, it's feasible. So it might not be.

[00:58:34.77] And then the other way is, as John asked us to respond to, is about, well, should we make more of it available? Even beyond the ITU, the International allocations, should we make more available, for example, perhaps from these study bands? 2.7 to 2.9 would be great mobile satellite spectrum if that's potentially available.

[00:59:00.37] And if so, should it be auctioned? Currently, US law, the ORBIT Act, precludes that. But it only precludes it, I believe-- I haven't looked at it in a long time. I think it only precludes it on the bands that have been globally allocated. So if we make a new US-only allocation for direct-to-cell between 2.7 and 2.9, for example, it would-- I think we could do that even without changing the law. So it's some very interesting opportunities. We'd really like to see a lot more direct-to-cell connectivity.

[00:59:34.65] MONISHA GHOSH: So yeah, I think direct-to-cell is really exciting. And I fully agree that right now, what we are seeing is mainly service in areas where you don't have any other option. However, as we look forward, we should also look at what it cannot do, as well as what it can do.

[00:59:58.57] It cannot serve a lot of people inside, and we've heard about how many people are actually indoors. And going to what Shawn just said about turning Wi-Fi off and turning cellular off, I have Verizon in my home in Chicago. And even if that phone is on, I can barely get anything through.

[01:00:22.67] So again, it goes back to where you are. If you're spending 100% of your time outdoors, sure, you need cellular. And that's where I think, when we think about cellular and space connectivity, we should think about ubiquity. We really want to be connected outside, no matter where you are, in a National Park, in a rural highway in the middle of nowhere. Of course, Wi-Fi doesn't have a role there.

[01:00:47.53] And as we're looking for spectrum allocations, we should also look at it that way. How do I allocate spectrum and make sure the infrastructure is built out? Go back. License to build. I mean, there is a lot of spectrum that has not been built out in the areas where it could be built out. So keeping the applications in mind, what are the use cases you're going to be serving? What is the immediate need? I think

is really important as we think about how we allocate between cellular and terrestrial and unlicensed and all of these various ways.

[01:01:22.52] JOHN CHAPIN: OK, last chance for a comment on satellite or D2D? Anything, Rob?

[01:01:26.40] ROB ALDERFER: David, I'll just say, if you're feeling singled out, that's what happens when you miss the prep call.

[01:01:29.82] DAVID GOLDMAN: Yeah, I know. I know. I learned my lesson.

[01:01:31.42] [LAUGHTER]

[01:01:33.56] JOHN CHAPIN: OK, great. Now, crystal ball time. Pulling out your crystal ball, what are things that you're watching for in 2026 that will have the biggest impact on the next 5 to 10 years of evolution of the spectrum ecosystem? And I'd like to keep this somewhat quick, and then we might have some time for a question or two from the audience. So crystal ball time. Who wants to talk about what they're looking for in '26?

[01:01:53.76] ROB ALDERFER: I'll jump in. So I think in '26, you're going to see continued significant deployments of 6 gigahertz capable Wi-Fi devices. And that's important because it's seeding the next generation of broadband and mobile connectivity. So that's my prediction in the market. On the policy front, I predict that we will start talking a lot more about shared spectrum as we get deeper into the study of the bands that will be studied as a function of the OB3 legislation.

[01:02:23.74] I say that because if you just look at the realities of those bands, let me put a little bit of data on the table, in the 2 gigahertz band that you mentioned, John, there's over 1,800 federal frequency assignments. Each of those generally corresponds to a federal system. In the 4 gigahertz band, it's over 5,000. So all of those need a plan, and it's hard to imagine that sharing won't be a part of it.

[01:02:49.92] MONISHA GHOSH: Let me talk about what I would like to see. So some of the discussions that we've had is about how valuable spectrum is. It hasn't been brought up in this conference yet, but there is a line which is often used as to how spectrum is the lifeblood of wireless.

[01:03:07.76] All that is true. And I always think that for a resource that is considered to be so valuable, as a community, we don't do enough to make sure it's being used well, so the measurements, the metrics. And I'm talking about more than just Ookla speed tests. I think Ookla speed tests-- you go out there. You get 500 megahertz per second. I'm here. I can barely get 10 megabits per second.

[01:03:33.66] So moving away from the notion of just speed tests as a metric for how we are looking at Spectrum usage, but really looking at

coverage. Where is this spectrum actually being deployed, and what's being used? I'd love to see more attention being paid to that starting in 2026, and in addition to the attention on shared spectrum.

[01:03:57.18] Because to do better sharing, we have to understand how the spectrum is being used. And we have to develop better models for modeling interference, propagation. I hope to see a lot of that evolve in 2026.

[01:04:12.60] JOHN CHAPIN: OK, anyone else? Go ahead, Michael.

[01:04:16.12] MICHAEL CALABRESE: Yeah, I would say the-- very close to Rob here, where I think I'm mostly looking this year at these studies, the band studies by NTIA, to see whether, for example, an ideal situation-- if the 500 megahertz at 4.4 could all go to the mobile industry, that would be terrific. And as I said a minute a few minutes ago, 2.7 to 2.9 for something else, that's giving us something new, whether it's more for an expansion of CBRS-type sharing and/or mobile satellite spectrum.

[01:04:52.30] And then likewise, to see the deployment, the build-out of Wi-Fi 7 and the great impact that's going to have as well, as we've already seen, first, glimmers of Wi-Fi 8, which will come into focus sometime next-- later this year, which is going to add a whole other aspect to Wi-Fi, where it's more deterministic, where you can prioritize certain applications if you want to, so to be very much in a way like 5G in that respect.

[01:05:25.75] JOHN CHAPIN: Fantastic.

[01:05:27.23] SHAWN BONE: From my perspective, implementation of OB3 obviously hugely important. And Rob and Michael outlined that on the band studies. Probably the thing that I'm most interested in over the next year is how much our domestic conversation on spectrum is influenced by the next World Radiocommunications Conference. I mean, there's no secret why the bands were selected for study, because a lot of those bands are also up for debate internationally for mobile telecommunications allocations.

[01:05:56.97] So how we as a country engage with our international partners on that and what the conversation internationally is around those bands, that's going to influence some of the conversation here domestically. The other thing is-- and it's sort of been hinted at up here, but I'll go ahead and put a finer point on it, is the conversation about the future of CPRS. I mean, there's been proposals out there by multiple different companies, my own included, about what you do with CPRS.

[01:06:23.53] We have proposed new devices not dissimilar to 6 gigahertz to bring in higher power limits in CPRS. One of our fellow mobile wireless companies has said, maybe you think about transitioning CPRS to a fully mobile band. I'm interested in that

conversation not-- the outcome obviously is important, but I think it does put a pressure point on our ability, from a policy perspective, to think about what it means to institute a shared spectrum regime and then modify that and evaluate it over time.

[01:06:53.95] Because that's one of the key characteristics of shared spectrum, is the certainties involved in it and how you think about evolving sharing regimes over time. And there's a lot of pressure on that. And then broadly beyond next year, I think what AI means for connectivity demands and uplink and downlink and all sorts of stuff is going to be really fascinating to see it evolve.

[01:07:17.41] But that's not a 2026-- well, you know what? I'm not going to say it's not a 2026 thing, because we had a whole day yesterday about how quickly AI is moving. So who knows? By next year, when we're sitting up here, we may be talking about uplink-only spectrum. So that's a prediction in the future.

[01:07:35.23] JOHN CHAPIN: Anything you want to add?

[01:07:37.91] DAVID GOLDMAN: Yeah, AI in space. Yeah, a couple of things-- I actually hadn't thought about it, but Shawn's point on the World Radio Conference, I think, is actually really important. I think the space industry particularly cares. Something around like 80% of the agenda items for the next World Radio Conference are satellite focused.

[01:07:59.31] That's not an accident. As I mentioned earlier, the US is way ahead, the rest of the world doesn't love that, and a lot of these agenda items are designed not to be encouraging the American space industry to keep going the way it's going. And I do think that we do need to pay a lot of attention to that and make sure that we're positioning ourselves well as a country.

[01:08:19.58] But going back to our chart of the number of satellite applications, we're going to start seeing more and more that the deployments are going to be catching up to the applications. I think the intensity of the use of spectrum is just going to go-- for satellite spectrum, it's just going to go way, way up.

[01:08:35.42] And then I mentioned earlier on the mobile satellite spectrum, there's a lot talk about what's going on. I'm hopeful that in the next year, a lot of this gets settled out. And we have a clear path of how that's going to work and how these spectrum bands are going to play out, and how we can make sure that everything is being done efficiently as these systems are actually deploying and actually starting to provide services.

[01:09:01.54] JOHN CHAPIN: OK, well, fantastic. Thank you. Join me in thanking the panel, and we'll make sure that we can get you to lunch.

[01:09:06.72] [APPLAUSE]

Keynote: Spectrum Autonomy, Trust, and Interference Resilience

https://youtu.be/OE31mMUI8xw

[00:00:00.12] JESS SNEESBY: Good afternoon. My name is Jess Sneesby. And I'm a third year law student here at the University of Colorado. And it is my pleasure today to introduce you to FCC Commissioner Anna Gomez.

[00:00:12.40] Across decades of service, both in public and private sectors, the commissioner has worked at the intersection of innovation, universal connectivity, public trust, and national resilience. Notably, she has held several positions throughout the FCC. She has also served the US Senate Commerce Committee, the National Economic Council at the White House, NTIA, and the Department of State.

[00:00:35.76] Given this record of service, she'll stand here today as a commissioner of the FCC. Beyond this, she is a true community builder and hero of mine. So please join me in giving a warm welcome to Commissioner Gomez.

[00:00:47.38] [CHEERING]

[00:00:54.96] ANNA GOMEZ: Thank you. And she forgot to tell you that she's my former intern too.

[00:00:58.54] [LAUGHTER]

[00:01:02.75] Well, thank you so much to the Silicon Flatirons for the invitation to speak with you today. We were just talking with Matt about how many times I've been to this conference. And I have no idea. It's more than I can count on both my hands because I am a huge fan of Silicon Flatirons and its conferences. So thank you. And I just like to break a little bit so I can embarrass Dale Hatfield and wishing him a happy birthday in advance.

[00:01:30.61] [CHEERING]

[00:01:36.27] Dale, I truly treasure our friendship and the opportunity to embarrass you at every possible moment.

[00:01:44.01] [LAUGHTER]

[00:01:47.35] So I began my career as a telecom attorney, doing the lead up to the historic 1996 Telecommunications Act. The passage of the act was a reckoning of the vast technological advancements that had that have taken place since 1934 and transformed the way that society communicates. The act represented government action to support competition and to set the rules of the road for the new technology reality to the benefit of consumers.

[00:02:16.33] At the time of its passage, telephone service was prevalent but divided into local and long distance service with limited competition in the local sector. And telephone providers were prohibited from providing video service. Therefore, one of the goals of the act was to open local telephone and cable services to competition. The act also acknowledged that a fledgling technology, the internet, was emerging and it had the potential to profoundly transform the way we communicate in the future. At that time, of course, the internet was nascent and dial-up was avant garde, state of the art connectivity.

[00:02:55.41] Additionally, a new era of wireless communications was beginning to take shape. The Federal Communications Commission received spectrum auction authority three years before the act passed. The Wireless Telecommunications Bureau was only a year old. And the [INAUDIBLE] spectrum auction, the PCS C [? block ?] was underway and ultimately garnered a record breaking $10 billion in winning bids.

[00:03:19.92] 30 years later, the innovation that the act ushered in surpassed what we imagined possible. And technological progress has once again reshaped communications today. Cell phones are nearly ubiquitous globally. And the internet has gone from a screeching, slow moving innovation to a seamless, lightning speed necessity in daily life.

[00:03:42.92] By now, the FCC has held over 100 spectrum auctions and even created new types of auctions-- reverse, incentives, simultaneous multiple round, ascending clock, descending clock. Drones are not gadgets of science fiction but commonplace devices used today by consumers, hobbyists, and first responders.

[00:04:05.71] And there are myriad wireless devices embedded into our daily lives-- appliances, portable computers, security cameras, headphones, fitness and sleep trackers, mugs to keep your coffee warm, and even augmented reality glasses that can translate languages in real time. The progress is simply astonishing, although I'm still waiting for a wireless car that unfolds from my briefcase at the press of a button, like in The Jetsons.

[00:04:34.95] But it could be argued that Uber, Lyft, and Waymo are exactly that. In short, there are billions of wireless devices connecting us, often seamlessly to other devices and to each other. The proliferation of wireless connected devices is incredibly exciting. But it also presents new challenges because so much of daily life is now digital and thus hackable.

[00:05:01.98] In this new reality, our nation's basic infrastructure, like electric, water, shipping, farming, and all industry, is connected. And consumers use dozens of connected devices in their homes. All of these present opportunities for bad actors to harness connectivity for harm.

[00:05:20.90] On the consumer devices side, jamming is being used to interfere with wireless signals. We have seen bad actors use Wi-Fi

jammers to disrupt security systems, security cameras, and cell phones to facilitate unauthorized entry and burglaries at homes and at stores. Federal law prohibits jamming.

[00:05:40.66] The Communications Act of 1934 expressly prohibits any person from interfering with authorized communications signals. And in alignment with that act, the FCC has prohibited jamming since our inception. But jamming has become such a risk that even several states recently passed laws or are currently considering laws to curtail its activity.

[00:06:02.68] For example, Indiana passed a law explicitly banning radio jammers and increasing penalties for their use. California proposed criminalizing not only use but also manufacture, import, and marketing of jammers. New York introduced a bill that would elevate possession of a jammer to a felony. And Florida has statutes that prohibit knowingly obstructing emergency and volunteer radio communications a protection for first responders.

[00:06:31.48] And there is a growing body of devices that are inexpensive, highly programmable, and supported by a large ecosystem of firmware, libraries, and examples to allow bad actors to interfere with wireless systems, clone RFID cards, and exploit vulnerabilities in wireless technologies. For example, at the beginning of the year, reports emerged of Belgian researchers identifying a vulnerability in Bluetooth technology that could allow a bad actor to take control of a fast pair-enabled audio device within seconds of the device trying to pair. This vulnerability, dubbed WhisperPair, could allow hackers to interrupt the audio stream and access location tracking and microphone features of wireless headphones to spy on consumers. WhisperPair is an example of vulnerabilities that can be exploited in wireless communications.

[00:07:29.95] Another example is the weaponization in large gatherings like sporting events of drones. Beginning this summer and for the next two years, the United States will be the home to two of the biggest global sporting events, the Men's World Cup and the Olympics. Military, law enforcement, and local officials are already coordinating to prepare mitigation and response plans in the event that unauthorized drones fly over crowded stadiums seeking to cause harm.

[00:08:03.54] As a member of the White House task force on the 2028 Olympics, the FCC is collaborating with federal agencies, state and local governments to coordinate planning and response related to the security of the event and to ensure operational readiness across law enforcement, counterterrorism, transportation, and emergency response functions. Undoubtedly, we are at an inflection point. Advancements in technology have connected us more than ever to each other. And that connectivity has been exploited to create avenues for harm.

[00:08:41.06] The reality is that it has become easier for bad actors to weaponize the vulnerabilities inherent in wireless systems. This is when policymakers, industry standard setting bodies, and thought leaders need to come together to identify practices and solutions that protect consumers and prioritize infrastructure safety in the digital world. The work of the FCC sits at the intersection of communications, policy, security, and resilience.

[00:09:10.45] We do so in various ways. First, our spectrum management must consider interference potential to incumbent and adjacent and sometimes even further away services. Second, we coordinate with our international colleagues to address any cross border or space-based interference concerns or instances. Third, our equipment certification processes also are designed to ensure no interference or security concerns. And finally, our enforcement bureau plays a unique role in investigating and resolving radio frequency interference to public safety, communications, and critical infrastructure.

[00:09:51.93] The bureau responds to interference complaints, prioritizing complaints related to public safety, such as air traffic control, navigation, search and rescue operators, police and firefighters in collaboration with state, federal, and local public safety agencies. Our field offices also investigate commercial harmful interference instances, working closely with the wireless carriers and other licensees. And members of the public can also file complaints about interference with our consumer and Governmental Affairs Bureau.

[00:10:26.03] This FCC has also established a council on national security. The council brings together representatives from all eight FCC bureaus and offices to leverage the agency's regulatory, investigatory, and enforcement authorities to counter foreign adversaries and to protect consumers. And although I believe the agency can do more to incentivize industry to address vulnerabilities, the work of the council will be critical in the coming years.

[00:10:54.31] Well, we have a distinct mandate to address harmful interference and to stay knowledgeable on emerging threats in the digital age. We don't do this alone. We act in coordination across all levels of government, informed by the work of experts across the spectrum-- cybersecurity, aviation, public safety, and system engineering fields.

[00:11:17.06] And so much of thought leadership comes from outside of government, including standards bodies, industry, and academia. Just as technological innovation will keep evolving, so will the threats. That is why it is critical that I am here today learning from all of you.

[00:11:35.02] As I said earlier, we are at an inflection point. The spectrum security and resiliency summit is timely. Conversations like

the ones you'll have today are critical to help policymakers like me understand the entire ecosystem of vulnerabilities, threats, solutions, and governance actions to keep our communications networks, infrastructure, and consumers safe while continuing to allow technological innovation to benefit society. I look forward to hearing insights from all the panels.

[00:12:07.77] From the lessons from the Airwaves panel, we'll hear about what we can learn from the past, how earlier generations confronted attacks, and how these lessons can be addressed today. From the panelists in the Emerging Spectrum Security Landscape panel, I look forward to learning more about jamming, spoofing, unintentional interference, and strategies to prevent and mitigate attacks. And from the Resilience by Design panel, I will be listening for your suggestions on the ways in which policymakers can promote increased resilience.

[00:12:41.73] I know the discussions today will help me and help us all better understand the threats. And they will also help us explore solutions to maintain a wireless environment that allows for innovation and keeps consumers consumer safe. So thank you for inviting me today.

[00:12:57.60] [APPLAUSE]

[00:12:59.98] AUDIENCE: Thank you for your time, Commissioner. Excuse me. Really interesting talk. You mentioned these kind of harmful devices that we were seeing bad actors employ for a variety of nefarious means. But we also know that in a lot of cases, some of these similar tools are being used by researchers to identify the vulnerabilities in our networks and in our systems. So I wonder if you could talk a little bit about how the commission kind of looks to balance keeping those devices and those tactics and techniques out of the hands of bad actors while ensuring that white hat, security researchers still have access to the tools they need to identify vulnerabilities in our systems.

[00:13:41.08] ANNA GOMEZ: Yeah, you're talking about what's a good issue to raise, is, what is the right balance to ensure that we don't have our markets flooded by these devices? We see them all the time. We see them on Amazon.

[00:13:56.14] And I worry about this, by the way, when it comes to the contraband cell phone proceeding, that what we are opening the door is more proliferation of these devices that will be used for nefarious purposes. So it is a balance that we have to try to keep because we do want researchers to continue to do their work. But we also don't want bad guys to be able to use them.

[00:14:24.34] AUDIENCE: You mentioned reinforcement-- henning Schwarz, Columbia University. You mentioned reinforcement issue, enforcement bureau in particular. But it's a small bureau in a large

country. And not do you see the resources that are available, both in terms of physical resources, field offices as well as staff, to be adequate to the enforcement challenge that you face?

[00:14:51.62] ANNA GOMEZ: This is a really good question. We have seen the FCC reduce its field offices in particular, quite substantially with the reduction of our appropriations. And that has been difficult because we are not able to respond, particularly locally, where we've had to close those offices. So we could certainly always use more resources in that area. And you'll never hear me say otherwise.

[00:15:24.01] AUDIENCE: Hi, Commissioner Gomez, thank you for being here today. You mentioned at the beginning of talking about the exploitation of wireless technology, talking about jamming and the state laws that are coming out about jamming devices. But the FCC is also working on some jamming procedures. So what do you see as the most important? What do you see as the FCC's position within all of these jamming rules to make sure that potentially good jamming activity, like in prisons, where they might need to make sure that these contraband cell phones aren't being used-- I don't know if it would be good or. But what do you see is the FCC's position in balancing between these state interests and the FCC's position?

[00:16:10.64] ANNA GOMEZ: Yeah. So the FCC has a notice of proposed rulemaking in which it's seeking comment on whether it should authorize jammers in non-federal prisons and jails and doing so with an interpretation of the act that it can authorize the devices inside the jails and prisons. And therefore, if you jam them, then it's actually not a violation of the law because the law prohibits jamming.

[00:16:41.28] I'm paraphrasing of authorized devices. I am paraphrasing. And it's seeking comment on whether it can do that and also seeking comment on whether, in fact, it's possible to limit the effects of the jammers to within the walls of these prisons and jails. It's something that we're getting a lot of record on because there's a lot of concern about the interference potential outside of these prisons and jails.

[00:17:10.61] You got to remember, these prisons and jails are in very urban environments. And they're not remote. So the possibility of any kind of interference to public safety, to 911 calls, to everyday uses of devices is a problem. And so that's why we're seeking comment on it. And we'll see how this record develops. But I have strong concerns about this.

[00:17:43.47] AUDIENCE: Commissioner, this is a question from a law student that has limited understanding of spectrum. But as I was listening to you and reading a little bit about this session, I see that there is a tension between any regulations, say, tightening specifically, say, spoofing. Do you see a solution? Or what are your thoughts on this tension between potentially spectrum waves becoming national

security issues or-- so secret that it interferes with the public's right to understand how their airwaves are being used?

[00:18:35.93] ANNA GOMEZ: Not 100% sure I understand the question. The way spectrum is allocated, if spectrums are being utilized for national security purposes, they're allocated that way. And there are protections to protect around that. It should not affect commercial spectrum, which is what normal consumers utilize.

[00:19:03.24] There's nuances that I could totally get into the weeds about times of war and all that fun stuff. But at least for purposes of what we're talking about, there should be sufficient separation between what the uses are that it shouldn't really be a day-to-day issue for consumers.

[00:19:26.62] MATT SCHMIT: We have one final question here.

[00:19:34.96] AUDIENCE: There we go. Hello, my name is Nev. I'm an engineer for the state of Colorado Office of Public Safety communications. We are an incumbent licensee on the 6-gigahertz band in the public safety band, which I feel makes us a little unpopular here.

[00:19:53.07] But previously, in my previous career, or I guess the first 10 years of my career, I worked in startups. So I'm all for pushing boundaries and expanding the reach of technology, especially when it's to the public benefit. However, despite the technical and regulatory structure within which this 6-gigahertz band has been open to unlicensed use, the group that I work for has noticed a significant reduction in the reliability and availability of our network with the proliferation of Wi-Fi 6 devices. And in many of these cases, we have identified and narrowed it down to interference from Wi-Fi 6 devices.

[00:20:33.47] I recognize that that conclusion is survivorship bias. We only see the cases where the system fails and where our network goes down. However, when a single failure can lead to an outage in the emergency communications for 100 square mile area, an entire region of the state, we feel it very keenly.

[00:20:52.38] So I guess my question is, with the proliferation and the upcoming expansion of unlicensed use with geofence variable power, how is the performance of these technological tools that allow this expansion, the automatic frequency coordination and geofence variable power-- how is that performance being evaluated and tracked and enforced?

[00:21:21.06] ANNA GOMEZ: Well, we certainly rely on hearing from folks like you when something like that happens so that we can actually investigate it and look at what is really happening. Because as I mentioned, one of our important roles is to resolve interference for public safety. So have you reached out to the FCC about this issue?

[00:21:41.50] AUDIENCE: We have in a couple of cases. However, once we do that, it's when the issue is often passed. And so the thing with us is--

[00:21:52.24] ANNA GOMEZ: How do you prove something? Yeah.

[00:21:53.28] AUDIENCE: And in public safety, it's very important to prevent these much more than to react to them.

[00:22:00.56] ANNA GOMEZ: What are you using the 6 gigahertz band for?

[00:22:02.80] AUDIENCE: Fixed microwave. We have 250 sites statewide with fixed microwave shots.

[00:22:08.86] ANNA GOMEZ: And these are providing internet service to?

[00:22:13.88] AUDIENCE: Public safety radio communications to police and fire and Colorado State Patrol throughout the state.

[00:22:20.32] ANNA GOMEZ: So fixed-- sorry.

[00:22:24.48] AUDIENCE: The 6 gigahertz fixed microwave, it provides backhaul to the 800 megahertz land mobile radio system.

[00:22:30.94] ANNA GOMEZ: Thank you. That's what I was wondering.

[00:22:31.24] AUDIENCE: Yeah, OK.

[00:22:33.40] ANNA GOMEZ: Thank you. Appreciate that. OK, gotcha. Yeah, we should talk.

[00:22:38.38] [LAUGHTER]

[00:22:39.64] AUDIENCE: All right, fair enough. Thank you very much.

[00:22:43.00] MATT SCHMIT: All right. With that, please join me in thanking FCC commissioner Anna Gomez. Thank you so much.

[00:22:47.86] [APPLAUSE]

Panel: Lessons from the Airwaves

https://youtu.be/Amh3QSxcUV4

[00:00:04.00] MATT SCHMIT: All right, folks, as our first panel takes their seats, I just wanted to reintroduce, I guess, a first ever for us on the heels of our flagship conference, The Spectrum Security and Resilience Summit. And one of the goals that we're trying to accomplish with this, we just hit upon. That's bringing the wealth of experience and expertise in folks who join us here at the University of Colorado to talk about spectrum issues and connect them with folks at the state and local level.

[00:00:29.88] I didn't mention this, but I'm a former state legislator, and I really think that state and local officials could benefit from tapping into some of this expertise, talking together, ensuring your on the ground experience with us as policy is being considered and developed. And so, without further ado, we'll launch into our afternoon agenda. And I'd like to introduce Peter Tenhula, the moderator and a current senior fellow at Silicon Flatirons, for his panel, Lessons from the Airwaves. Without further ado, Peter and panel.

[00:00:58.60] PETER TENHULA: Great thank you, Matt. Thank you, Anna, for kicking us off. Appreciate that. And she addressed a couple of the issues we're going to revisit and talk to you a little more in depth. Again, this panel is to kick off and ground us historically. And to do that, I've tapped some of my good friends who in our old jobs, had some interesting experiences that we're going to talk about and the lessons learned from those experiences.

[00:01:31.43] I'll kick off a couple of mine own experiences and then go down the line with Todd, Julie and Jeremy. And then we've got our token, an academic, down at the end, Henning, who's going to sum it all up and express his ideas of what are the core problems here that we're experiencing and how we can address those. And then the next two panelist will talk about what it's like now and what the current situation is on the ground and the future potential solutions to those.

[00:02:16.74] So let me just give it from my perspective. And Anna covered a couple of these issues, but I retired from NTIA and you could go online and check out our more detailed bios. And I'm not going to ask everybody to talk about their long, historical, dreadful bios like mine because it goes back way, way far. But my last job before I retired I was a National Telecommunications and Information Administration within the Department of Commerce in the Office of spectrum management, and I was the chair of the inter department radio advisory committee.

[00:02:55.58] And in that role, I was in charge of this thing, big book called The NTIA red book, or the manual of basically all the rules that govern federal agency use of spectrum. And for a long, long time, that manual included authorization for the Department of Defense the military department, to engage in electronic warfare for testing, training and exercises. Made sense. And it was governed by a whole set of internal guidance that DOD did in coordination with other agencies like the Federal Aviation Administration, and the FCC.

[00:03:39.85] And that worked out really well. The next problem that came up was in-- domestically, improvisal explosive devices, IEDs. We heard about those overseas, in Iraq and Afghanistan, but there's actually a threat from those kinds of devices. So the Department of Justice sought authority to do training and exercises for those. And so NTIA amended the manual to provide that authority, subject to guidance, the Department of Justice.

[00:04:19.04] An issue there was state and local governments because, Anna mentioned, Section 333 of the Communications Act, which does prohibit jamming. And it does-- it has been interpreted, only applied to non-federal users. So federal users like the Department of Defense, for training purposes, and Department of Justice, FBI, for purposes of countering these IEDs, they could definitely use and deploy and test jamming.

[00:04:54.45] Those jammers were typically-- they had to cover multiple bands. The cell phone bands, paging bands back when there were pagers, and any kind of land mobile bands that could potentially trigger IEDs. Those were very, very expensive devices, so they were unlikely to get in the hands of the bad guys. So we'd start developing these lines between the good guys and the bad guys.

[00:05:16.55] Then the next problem that came up to me was involving the UAS, the drones, the nefarious drones that were, at first, encroaching military bases. They were flying over military bases. So the Department of Defense needed authorization to interdict these nefarious drones. And so we figured out a solution to help them do that. Then came the Department of Homeland Security, Department of Justice.

[00:05:50.53] So they all lined up, and before I knew it, we're sitting in these windowless rooms with all these other agencies, trying to come up with legislative solutions to authorize these agencies to counter these drones, because there were privacy concerns involving that, because of detection, but also because of the jamming. We wanted to make sure that it was as restricted, as limited as possible so that the bad guys didn't get a hold of the technology.

[00:06:18.80] But you had situations like preparing for the Olympics, World Cup, the NFL. Those were the threats that we were dealing with at the time. But it also-- it goes back further. There's have been bad actors in the past, and it brings back memories of-- remember Captain Midnight intruded the signal of HBO, and that led to a new federal statute being enacted, and it also led to some technology developments in the satellite space. All kinds of other threats.

[00:07:00.97] And I'm going to turn it over to Todd in a second to talk about his experience with the contraband devices and presence and the efforts they did. But there's all kinds of security surveillance equipment off-the-shelf jammers that are starting to be used by the bad guys. Anna I mentioned those. Including one, there was an incident outside of Denver where burglars were using the jammers to jam Wi-Fi and security cameras in order to facilitate their crimes.

[00:07:31.89] And she mentioned all the states that have enacted laws to make that illegal. And she mentioned that the FCC's NPRM on combating contraband wireless devices, which has a unique approach to interpreting the law in Section 333. And so I think it would be an

excellent research topic for students. Take a look at that NPRM and that theory.

[00:08:04.40] So before I turn it over to the other panelists here, talk about the examples, I just want to remind, we will have questions at the end. We'll open it up. We do have a mechanism for online questions because we have a large online audience, and we'll be taking those as well. So those of you watching online on Zoom, there's a way to submit those questions.

[00:08:27.96] So now I'll turn it over to Todd who's got some excellent stories about how when he was at the Bureau of Prisons protecting the situation there from contraband devices and drones. And I'll turn it over. Go ahead.

[00:08:47.12] TODD CRAIG: Thank you, Peter. We're all friends of Peter here, and it's a pleasure to be here. I don't play one on TV, but I was a federal prison warden and chief of security and assistant director. And with $10, I can get one of these great Colorado coffees. But it's a pleasure to be here. And Peter is just-- as evidenced by his award last night, he is just the cream of the crop. And I'm proud to know you, Peter, and thank you for inviting me. It's been a great conference. Matt and your staff just tremendous.

[00:09:12.31] And Commissioner Gomez, don't hold it against me. I'm going to say some things you're not going to like, but I hope we can still have a conversation afterwards. So, yeah, Peter and I, we-- long time. Going back to the 2010 Contraband Cell Phone Act. My chief of security technology for the Federal Bureau of Prisons, the late Senator Feinstein, her staff. We authored that act to make it an actual felony or misdemeanor at the time. It's been upgraded to felony since for to introduce, possess a contraband cell phone by inmates or staff in a federal prison.

[00:09:49.82] But that, you can go back, contraband cell phones in prison is a 20 year problem. There's nothing new under the sun, as King Solomon said, and there have been different iterations of that to try to attack the problem. And this conference has been very good on all-- I mean, everything from arpin to AI, it's just been a very, very illuminating. Because the newer problems, and the panel, yesterday, talking about WorldCom.

[00:10:14.42] Well, it's the same in the contraband illegal devices and counter UAS. It's all the same. They run over the airwaves. And how do we, as Peter said, sort the good guys from the bad guys not impact the rights of the public and do it in the right way, and protect America's prisons or the venues like Super Bowl or a World Cup setting?

[00:10:35.38] So contraband cell phones, I've got to tell a testing story, the records replete with contraband cell phones being used to drop-- or drones, really, the contraband cell phones being used to foment criminal activity inside and outside the walls for the last 20 years in

federal, state, and local prisons. There are 3,500 federal, state, military, and tribal, and territorial jails and prisons across this country. Every one of them has a contraband cell phone problem. Every one of them has a drone problem or will have a drone problem. Trust and believe.

[00:11:08.61] So what do we do about that? They're used to coordinate hits on the street. My good friend Brian Sterling, now the US attorney for South Carolina, when he was director, one of his captains was brutally shot at home seven times because he was the expert in chasing contraband cell phones inside that prison system. So it's an existential threat because it is the bedrock of the illegal inmate economy.

[00:11:35.43] It is a bedrock of coordinating, whether it's witness intimidation on the street or inside, introduction of dangerous contraband such as synthetic drugs, fentanyl, fentanyl analogs, other contraband cell phones and sim cards, and increasingly, weapons and escape paraphernalia. So we started out in the 2010 Contraband Cell Phone Act and have worked in concert with FCC and NTIA because Bureau of Prisons is one of the five law enforcement components and DOJ authorized to use it.

[00:12:10.68] And Peter was always-- and I think Commissioner Gomez alluded to this, when technology is nascent, when it's growing, the technology outstrips the law. So we don't have the law, let alone the procedure, regulation and protocols to deal with it. And I'll get to that a little bit with counter UAS. But with the phones, we finally-- we did some barrage jamming testing in 2010 because Congress told us to. And the NTIA was our partner in that.

[00:12:37.94] In 2018, we did a single micro jammer test at the FCI, Cumberland, Maryland, because the administration at that time wanted us to. In 2019, they funded, and then we did, really, the first large micro jamming test to eliminate contraband cell phones at the maximum security Broad River prison in Columbia, South Carolina. Brian Sterling was deputized under my authority, and we exercised that test, and we invited our friends from NTIA because I said, hey--

[00:13:11.05] PETER TENHULA: Not me. Not me.

[00:13:11.61] TODD CRAIG: Not him. Peter was too scared. But no, he wasn't. But he's the man that made stuff happen. So I got-- Frank was one of the cats names. These two bright young engineers from right down the street here in this boulder, and they came in department or NTIA was headquartered with this. Anyway, they came down to South Carolina. They brought all their testing equipment. I put them in the inmate housing unit where we had installed the micro jamming devices in the plumbing chases between the cells.

[00:13:40.74] So the officers-- this is a state institution, but I'm a federal official conducting the test under NTIA auspices with a deputized staff there. So when you want to make it happen, it can happen. But it was a

heavy lift. So these two engineers, great guys to this day, and they did a great report, they wheeled their testing equipment out into the middle of the common area of the inmate prison unit, and they're running their tests and everything. And we turned on the micro jammers and there's no interference.

[00:14:14.80] You'll be happy to, Commissioner, we limited the interference to one foot outside the unit. You could not make a call one foot outside the unit, but after that, there was none. And that's all documented in that wonderful NTIA report. So they're doing their testing, but the officers had forgot to close the food slots. If you've ever been in prison or jail, you gotta have food slots. You feed them their food, their mail, whatever.

[00:14:37.82] And so the inmates, you talk about the power of contraband cell phones and the underground economy of a prison, inmates actually threw a shiv, as we call it, a shank, a sharpened weapon at these NTIA engineers. So at that point, I decided it was prudent to move them up to the front of the unit, put them behind protection as they continued their on-site measurements. So that was a real-world testing of enacting spectrum policy in a hardened environment.

[00:15:07.69] So we go on, a lot of association. Poor Peter, I would always call him on the special temporary authority after his bureaucrat said no. I said, come on, Peter, we gotta get this done. And he would always find a way to do it consistent with NTIA and of course, with our friends at the FCC. So the next big issue as Peter said, was counter UAS. And this started back in the Obama Administration, 2014, 2015. Federal prisons had a few drone incursions, a few drops.

[00:15:38.64] But if you can read all the reports from the Inspector General and everything else, it went to 100s a year. And what are these drones dropping? Cell phones and Sim cards, synthetic drugs, fentanyl, fentanyl analogs, opioids, weapons of escape, weapons, tobacco, all the dangerous contraband that put both the staff and the inmates lives at risk. So this is a big deal. So we started-- well, how are we going to interdict this?

[00:16:10.14] And Peter's exactly right, I remember the summer of 2018, nothing is easy. If it was easy, everybody would have done it, right? That's why we're in this room trying to tackle these hard issues. But we had 15 classified and unclassified briefings that summer all across Capitol Hill and other places. And we were able to get the 2018 Emerging Threats Act passed, which gave the Department of Homeland Security and Department of Justice, including the Bureau of Prisons, the legal authorities to detect and mitigate drones that presented a threat to covert assets, as it's euphemistically called the law.

[00:16:45.07] Federal prisons or the FBI on an escort mission. And then there were several specialized missions carved out for DHS. But that was a heavy, heavy lift to get the legal authorities so that NTIA could bless the mitigation deployment by the Bureau of Prisons, DOJ, and everybody else. But just because you got a law, so what? Now you're got to make it work. So drafted the attorney general's guidance. I was on that workgroup.

[00:17:12.49] I ran the Department of Justice counter drone testing, and I brought all the best technologies at the time from those in the sandbox, those domestically, and we tested, again, getting assistance from my man Peter so we could test mitigation. But Peter would not let me block GPS.

[00:17:35.55] [CHUCKLING]

[00:17:36.33] And I've held that against you to this day, my friend.

[00:17:38.39] PETER TENHULA: I blame the FAA.

[00:17:39.39] TODD CRAIG: Yeah.

[00:17:39.71] PETER TENHULA: Not me.

[00:17:40.49] [CHUCKLING]

[00:17:41.17] TODD CRAIG: But we had a great, great test. And that was, to my knowledge, the last great test that involved DOJ, DOD, NTIA, all the alphabet soup agencies in the fall of 2020. So here's my drone story for you. Why is it a threat to federal prisons? Imagine it's 1:00 AM and an unnamed high security federal penitentiary somewhere in the bayous of Louisiana. You have 15 or 16 staff watching 2000 high security, violent inmates. They're all locked down. They're sleeping for the night, except for a few orderlies.

[00:18:16.05] A Matrice 600 flies in undetected. Because at that time, I'm very proud of the program, we stood up at the Bureau of Prisons again, not speaking for the Department of Justice in any manner, shape, form or representation, or my current company, Smart Communications. This is just Todd, the old prison warden. So that came in at 01:00 in the morning, and criminals have 24/7 to defeat the countermeasures we put in place. The bad actors, as we're calling them in this setting.

[00:18:43.68] They actually, in the institutions, they have laundry bags, right? Got to collect the inmates clothes, and they get taken to laundry, and that's how they do it, just like any other institutional setting. So they actually got laundry bags that mirrored the prison's laundry bags. Stuffed them full of contraband, brought them in on this commercial Matrice 600. And at 01:00 in the morning, we had video of them lowering the bag down outside the unit. It landed with the pile of laundry bags already pushed out of the unit to go to the laundry at 5:00 AM, and there was their contraband drop.

[00:19:20.24] And we got it on camera. Unfortunately, they were not able to interdict that one. But in the wake of that, before I left, I'm proud of the guys who are still there, we stood up a very active counter-drone program. The Bureau of Prisons right now has detection at 60 of the 121 sites, mitigation at several sites. So it's been an effort. So I hope those were stories enough. And I'm the only one that's ever deployed with my friend Peter and Michael jamming in a prison setting in the continental US and the whole political backstory.

[00:19:57.57] And I'm going to shut up here because these guys are much smarter than me. That's what I liked about this conference. I'm learning a lot. The whole ethos of this micro jamming rule, it's come back around on cell phones for state and locals. There's been a political effort the last 15 years from governors and state attorneys general to give state and locals the same authority that we were able to exercise on the federal level. So that is out for comment. It will be an interesting time. So I'll be around after the panel and any questions, but thank you very much.

[00:20:31.42] PETER TENHULA: Thank you. Thank you, Todd. The state and local issue has been interesting. And Todd mentioned the need to deputize the folks down in South Carolina. And that's through the Marshal Service. And there's a law that authorizes that. And that's how we got around that. The interpretation of Section 333 is basically, OK, if it doesn't apply to federal, we'll make the state folks federal. And this is, I think, gone back to Dodge City, where the whole deputizing federal Marshals.

[00:21:08.92] But it also limits the amount of people. And they did it in the counter IED context, too. But it does have this effect of limiting the personnel that are authorized to do these kinds of things. So We didn't mean to make it hard for the good guys, but it's also, we understand it's starting to get easier for the bad guys. I know Julie and Jeremy are going to talk about some of, maybe, the bad guys that they talked about, or maybe the not so bad guys.

[00:21:46.57] But Julie was head of the Office of Engineering Technology at the FCC. They dealt with both the intentional side and the unintentional side of interference. And what kind of interesting stories that you have and what kind of lessons learned from those experiences, Julie?

[00:22:03.89] JULIUS KNAPP: Thanks, Peter. So as Peter mentioned, I worked at the FCC in the engineering office for more than 45 years. The last 14 years of it was as the chief engineer. And I retired January 3, 2000. Six years ago. And some people have asked me, what have you been doing since then? Six years of therapy.

[00:22:30.66] [LAUGHTER]

[00:22:35.16] And you listen to the problems here, and I don't take them lightly at all. Working through my career was very rewarding, but

you're also faced with these kinds of challenging issues. And as I looked at the topic in security and resilience and all, and I looked at it in the context of access to the spectrum, assurance that you can actually use the space you think you're supposed to be able to use, and I came up with over 45 years, only four lessons. [CHUCKLES]

[00:23:13.16] So first lesson for folks is the starting point for controlling the interference, really, is to develop a good set of rules. It might surprise you that the FCC's rulemaking proceedings often have what I would gently call folks with different perspectives on what the standards should be and what the risk of interference is, and so forth. But the resulting rules usually take into account more than just the engineering.

[00:23:45.23] You often hear folks say, well, it should just be the engineering and you can't defy the laws of physics, et cetera, et cetera. Surely, physics is a part of it. It's the only-- not the only piece, it's creating opportunities for new services, weighing the economic issues, the policy issues and so forth. And the people at the FCC are faced with trying to balance all of these things to come up with what they feel is a reasonable approach.

[00:24:15.59] The technical rules are generally designed to minimize the likelihood of interference. They're not based on 0 interference. And when the analyzes are done, you get into things like OK, there's probability in the propagation loss between two services. What number do we pick? Let's pick. What's the right element in that? What do we assume about the levels that the service is using for reliable service, et cetera, et cetera? What are the characteristics of the receivers?

[00:24:51.38] All of those things go into the analysis with the aim that there are so few cases of actual interference, they can be addressed on a case by case basis. Now, not everybody is always happy with the result of the rules. More often than not, I would say that people finally can live with it and life goes on. And if problems occur, and we heard about the one over here on the public safety, I'm glad I'm not there right now. I know what I'd be doing. I'd look in.

[00:25:28.09] The first thing I'd be looking at is, is everybody playing by the rules? Is something overpowered? Is something not in a location that it shouldn't be? And when the interference occurs, all of these services, they're obliged to correct it. So I think the first step in here, I would be very careful not to, with a broad brush, paint the rules as, oh, this is going to be a disaster. I'd want to look at each one of these cases on a case-by-case basis and really understand it. And you're entitled to protection. That shouldn't be happening.

[00:26:03.49] So something needs to be examined here and to figure out what the problem was. So I'm going to move on. And the other thing to remember is, like, once the rules are done, if a problem

occurs, you can always come back to it later. Sometimes it's a simple remedy that you work out with the industry. And it's key for all the players, I think, working on these things together because the rulemakings take time.

[00:26:31.68] If you really find a problem that the best solution is that you've got to go and fix something in the rules that's been done before. But people need to have uncertainty if they're going to invest in building things for a set of rules, that they can go forward and make those investments and actually deploy. So first lesson is, get a good set of rules. Second lesson, sometimes stuff just happens outside of the rulemaking.

[00:27:03.58] I think, for me, some of the more difficult problems were the ones that were not anything that people anticipated or that came out of a rulemaking. And I'm going to give you a couple of examples. Three actually. And many of you may have heard these before. Some of you may say, oh, that was long ago. Those sort of things can't happen again. Well, they do. So the first one I'm going to talk about is police radar detectors.

[00:27:32.59] Most of us now, you're using social media to identify and crowdsourcing to identify, OK, police have got a radar here and so forth, and look at that. At the time, radar detectors were very popular. And for the most part, they really hadn't caused a problem. They were effectively receivers. Receivers, they don't emit anything, right? Well, it turns out they do. And so the receivers actually had something called a local oscillator. It emitted on a particular frequency.

[00:28:08.75] And all these detectors in most places where I just read the sign it'd say, radar detectors are illegal. Well, the police were very clever. They looked for the signature of the radar detector oscillators and the industry responded. They moved the local oscillators outside of the radar band, thinking, well, they won't hear us now. Well, they moved them smack into a satellite band, and the satellite dishes were located, in many cases, along the highways. And when the traffic was coming through, there was interference to the satellite systems.

[00:28:45.38] So what do you do? So you look at the rules. And the receivers, all the way up to 960 megahertz, well below the radar band had not been a problem. And these things were operating near 10 gigahertz, with the only requirement be that they not cause harmful interference. So it really required, in the end, a revision of the rules to bring them under emissions limits to solve the problem. So that's one example.

[00:29:16.86] Second example. Digital television. A lot of work went into developing the standards and the rules for digital television. And I think it was around '96 or so. First commercial DTV station goes on the air. Hooray! Great milestone. They turn it on and all of a sudden, the biomedical telemetry systems at the nearby hospital-- this was in

Dallas, at Baylor University, the telemetry system stopped working. These are people being monitored for critical health issues in the hospital.

[00:29:59.97] Turns out that they're operating under the unlicensed rules on channels that had been vacant all along, never bothered anybody. And technically, they were required to accept interference. But it's not a good look for a television station to turn on and have people die. [CHUCKLES] So what the heck do you do? So we got everybody together, worked with the Food and Drug Administration, worked with the vendors, and in the end, we had to do a rulemaking to identify spectrum where the medical devices would actually be protected.

[00:30:41.56] They had an allocation. They weren't operating these critical systems under unlicensed provisions. And so we went through the rulemaking, created new frequencies for them. The television stations, when they went on the air, they worked with the FDA and with the hospitals to make sure that everybody had enough time to change the different frequencies. And it all worked out. But it was difficult. Third thing I'm going to mention-- and I'm not just jumping on unlicensed because there's other cases too.

[00:31:14.75] But after 9/11, the military decided to deploy mobile systems at its military bases for security purposes. This spectrum had largely been unused. And so they go about investing, working with the vendors. They turn on the system, and suddenly the nearby garage door openers are not working right. It wasn't that the doors were opening, it was either the range was decreased.

[00:31:56.47] And I joked often that people would say, gee, I could do it at 200 feet. Now it's 50 feet. And I'd say, don't you slow down when you go in the garage? [CHUCKLES] But it was more than that. In some cases, they didn't work at all. And for many families, when their kids came home from school, they used the garage door opener to let the kids in. So again-- and I think this is probably, when you run into these problems, a good way to go ahead, bring everybody together.

[00:32:27.38] The arguments about who's right and wrong don't necessarily help you solve the problem. So the garage door openers, they weren't protected, but the problem was even for these folks, what could they do? It turns out there were other frequencies the garage door openers could use, but they weren't in the stores. So even if somebody had to buy a new system, they weren't there. So what we ended up doing is coordinating between the military and just trying to be good neighbors to the folks nearby.

[00:33:02.86] This was not, if you understand propagation and the different characteristics of the systems, this wasn't like all of a sudden, 30 miles outside, every garage door-- some of them went out, others nearby were just fine. It all depended on the orientations of the

systems. But we got through it. We did not allocate new frequencies there. And at the time, the notion of using wireless via Wi-Fi into the home was not even in the scope of ideas.

[00:33:39.81] And now, you've got systems out there who basically take the garage door opener, and you can open your garage door from 20 miles away if you wanted to. So three examples, and there are other cases. And the lesson out of this is you can't really anticipate everything. And when it happens, you really need to be diligent in jumping on it. Get the parties together, figure out how you solve it. It may be different in each case. So the next thing I'm going to go to is dealing with what you-- that's the last one. I skipped.

[00:34:15.08] PETER TENHULA: To wrap up.

[00:34:15.70] JULIUS KNAPP: Yep. I went-- to situations where folks are causing harmful interference by their operating outside the rules, but they never intended to cause harmful interference. So one of the more difficult situations was at 5 gigahertz. So there were multiple blocks there. There was a block in the middle that used a technique that was another step in the progress towards dynamic sharing. It was called dynamic frequency selection. It was really complicated.

[00:34:46.44] The problem that you often run into when you're dealing with sharing with systems that the military uses it's radars, is they can't tell you what they look like, and they're not going to tell you when they're on. And the difficulty, if you put yourself in their shoes for a minute, they're not only worried about you, they're worried about systems, the technology winding up more easily in the hands of adversaries to be used against them. So this is-- when you go into these things, you really have to put yourself in the shoes of the people that you're working with and the important things that they do.

[00:35:23.99] So what happened? So there was a block of spectrum as part of this package that did not require dynamic frequency selection because there were no radars there. So what did folks do in some places? They returned the units that they had to the part of the spectrum that was supposed to have DFS, and they turned on there because it was quieter. And Lo and behold, that part of the band was used for wind shear radars at the airports.

[00:36:01.63] And this was not a case of somebody operating at the very weakest signal that they could use. You could look at the radars at the airports, and it showed up as spokes. And a handful of spokes were bad, but you could still see the pattern of what was going on. In some places, if you had enough of these things happening, it was not good. And so our enforcement people were terrific. They went out-- these things were not easy to find. And then you'd go and say, look, you're operating outside the rules.

[00:36:36.18] It really took, probably, a while before the agency went after the folks that-- at the source. It turned out that certain models of

equipment were well known as easily modified. And they could sit there and say, well, it's not us. We just put them out there and somebody else is doing this stuff, and they're selling them like hotcakes. And it really required enforcement action, big fines. Because what happens with these things, if they start small and they grow too fast, it's much harder to difficult them to-- much more difficult to deal with them then.

[00:37:14.53] And the last thing I'm going to hit on. So the lesson out of all of that. Yeah, there's another one I'll only mention quickly. SiriusXM. FM radios.

[00:37:25.89] PETER TENHULA: Can we segue to Jeremy on the enforcement stuff?

[00:37:28.85] JULIUS KNAPP: No, I've got the--

[00:37:30.31] PETER TENHULA: All right.

[00:37:31.77] JULIUS KNAPP: Yeah, I'm almost wrapped up. So this was a case where SiriusXM was trying to sell kits for people to get their radio into the cars, but then they wanted to get it into the audio system. And so how do you do that? You transmit into FM. Well, to make it work better, you just increase the power of the FM a little bit, and suddenly, people in the next car over will listening to Howard Stern in instead of the religious broadcast they thought they were tuned to.

[00:37:59.45] So we went through a whole thing. We did tests at our lab and all, and basically, we came up with rules to do that. So the last thing was just when you've got folks who are deliberately causing interference. I won't say much about that because you've heard about that from enough cases here. And sometimes, it's done with a worthy purpose. I won't get into the debate about the legislation and what the requirements and so forth, but you heard from Todd about the problems he faces.

[00:38:31.24] I sat in a room with folks who came in and said, my daughter was killed because of distracted driving. And I don't want this to happen to anybody else. So I'm going to put a little jammer. Just say it's OK to put a jammer in the car so that they can't talk on the cell phone. And those are really tough issues. One last thing I'll mention, Wi-Fi to Wi-Fi. So Wi-Fi is being used-- or unlicensed being used in some places to provide broadband service.

[00:38:58.96] Believe it or not this competition between the providers-- so one-- and each of them, technically, is not protected against inference. So one aims his signal right at the receiver, the receiving antenna of another. So now you've got two unlicensed devices, neither of which is protected against interference. And what do you do then? So yes, I'll turn it over to Jeremy. Thanks for listening.

[00:39:22.61] PETER TENHULA: Jeremy from-- his last job before retiring was in Enforcement Bureau as the deputy chief there. And I'm sure lessons learned from some cases there as well.

[00:39:36.03] JEREMY MARCUS: Thank you, Peter. And thank you to Peter and Dale and Matt and Silicon Flatirons for having me. It's a wonderful conference. I retired from the FCC last year. I'm not actually retired, retired. I work at a small firm called LermanSenter. And the obligatory disclaimer, what I'm going to talk about is of my own views and not those of my firm or my client. But as Peter said, my last stop at the FCC was as deputy chief of the Enforcement Bureau, amongst other things. I oversaw the FCC field offices.

[00:40:07.22] The FCC has 13 field offices scattered across the country. There is also an equipment development group, as the FCC either will purchase commercial off-the-shelf equipment, purchase commercial equipment and modify it, or at times, build their own equipment. We have a dedicated fleet of mobile direction finding vehicles and we modify the FCC-- not we anymore, but the FCC field offices modify the equipment to be very specialized for direction finding, for finding and locating sources of harmful interference.

[00:40:40.70] That, basically, is the core of the FCC's field office's mission, is to find and attempt to stop harmful interference. There are other adjacent issues that are handled by other headquarters based offices, in particular, The Spectrum Enforcement Division, which I also oversaw, and that would get into things like potentially working with CBP to try and keep the jammers out of the country as opposed to finding ones once they're actually in and being used.

[00:41:10.97] So I'm going to talk a little bit about that. I'm also going to try and speed things up a little bit so there's time for questions. But Julie and Commissioner Gomez did a great job laying the groundwork. So I think I'm going to try not to repeat too much of what either of them said. I do want to give a little bit of a high-level overview, just a little bit, particularly for the students in the room who may not understand how enforcement and particularly field offices fit in to the entire scheme at the FCC.

[00:41:42.33] Enforcement is what we would look at as ex post. There's a problem, and we have to go out and solve it and make it stop. And also, if necessary, find somebody or take other actions to-- if it's really worth any kind of punishment. But the enforcement regime is only as good, as Julie said, as the rules.

[00:42:06.26] And thankfully, Julie's old office, the Office of Engineering and Technology, and the various rulemaking bureaus do a tremendous job of coming up with the ex-ante rules that basically, when they work, and they mostly do, limit the universe of problems, so that when you do have an individualized problem, you can go to the Enforcement Bureau, and then whether it's field agents or

headquarters type issue, look at it and get it resolved. And I think it's very important to realize the overwhelming majority of things work.

[00:42:36.46] That's why your phones work, it's why your routers work, because the rules actually enabled the manufacturers and the service providers to build the equipment to provide the service. And 99% of the time, it's going to work. Even when it doesn't work, there are a variety of reasons for why it doesn't. A lot of times there'll be a complaint supplement that says-- whether it's a fire station, police officer, individual persons calling in saying, my device isn't working. I must be getting jammed.

[00:43:07.75] And the agents are very well trained on the intake. There's actually an electronic intake these days. You're going into the portal and you're answering certain questions. And the agents do a really good job on the front end of understanding, OK, this looks like it might be really serious and we've got to get on it right away or not so much. And there are plenty of instances. And I can't give you specific numbers, but there's well more than 1,000 complaints that are going to come into the field in any given year.

[00:43:38.99] A lot of them are going to be, it turns out, somebody's equipment just isn't working. Maybe that means it's not working for them in their own office. Maybe it means their equipment is causing a legitimate problem to somebody else. You have a Wi-Fi system and your access point, it breaks some how, you have what's known as a spurious emission in a licensed band, and it's causing interference to a T-Mobile or Verizon or whomever.

[00:44:06.78] The agent's going to go out, they're going to use their specialized equipment, they're going to identify the problem, and they're going to knock on the door. Agents, actually, will have badges, and they're going to tell somebody-- they're going to use their equipment to make sure it's actually coming from the equipment. They're going to ask to come in. They don't have arrest powers. They don't carry weapons. And they're going to ask people to turn the equipment off. And most people are going to be cooperative.

[00:44:34.66] The stories you hear about, a lot of what's being talked about today, are the situations that don't work well and don't work normally. But I want to give everyone a big picture that in a lot of ways, the field agents are kind of unsung heroes of the agency and that they do their job every day. They solve the problem, it goes away. Whatever was happening was probably not intentional. And they go on to the next case. And that is the lion's share of what is going on.

[00:45:06.85] Then you have the much more difficult cases, either where the rules allow a certain amount of interference and parties are at loggerheads that way. Where you have bad actors or where you have people who just don't know any better but don't necessarily react well when the government comes knocking on the door. There's a host

of cases like that. Whether it's somebody had a jammer in their vehicle because their employer wanted to track them.

[00:45:35.45] They didn't want to be tracked. They put in the jammer. They happened to park their vehicle at Newark Airport. That caused a little bit of a problem. And there's numerous cases like this where, yeah, somebody probably was doing something they knew they shouldn't be doing. They didn't fully understand the radio frequency impacts of what they were doing. We had a warehouse in either Dallas or Houston. I think it was Dallas. The owner of the warehouse didn't want her employees using their phone on the warehouse floor.

[00:46:07.44] Maybe that's a good idea. Maybe it's a bad idea. But she had a signal jammer as the way to do it. Agents showed up. She actually threw it in the trash and then told the agent you can go find it, which he declined. But you have instances like that where it's not great, but it's not really bad. Then you do have instances where, no, somebody is setting up a high powered jammer and they know exactly what they're doing. And it's a question of finding it before they move it somewhere else and you have more malicious events.

[00:46:41.52] As Commissioner Gomez said, another thing the field agents do, and they do, it's with working through the public safety and Homeland Security. They'll lead on the national security events. But they work in coordination with the whole of government efforts to respond to-- when there's big outages after hurricanes or international security events like the upcoming World Cup, the Olympics. There's a ton of resources that go into it, a ton of agencies working together on those sort of things.

[00:47:13.29] And the field agents will have one part, the Public Safety Bureau has its part and is largely coordinating for the agency in addition to the chair's office. And they'll do things like, when you have a large gathering like that, you have a lot of agencies coming on the scene. They all have their own devices and operate in their own spectrum. That requires a certain amount of deconfliction. You also may have a certain amount of, well, what's the RF environment looking like when things are calm, so that if you need to find something bad going on, you can.

[00:47:49.11] And there will be agents that actually get stationed at the right places to-- if there is an event like that, that they're able to respond quickly. Because as we've said, there's 13 field offices right now across the country. So there's a limited scope. But when there's particular priorities, the agency is prepared to respond and does things proactively too. Otherwise, the agency tends to be very complaint driven. There's no-- a secret panel of this is the spectrum for every spectrum band everywhere being proactively monitored.

[00:48:24.46] The FCC is very complaint driven, and in a lot of ways, consistent with the whole licensing schemes for wireless, there's a

certain amount of trust built into it. Let me see if I can skip ahead. But I do want to just give a shout out, and thank Commissioner Gomez as well, to the field agents who are doing this work day in and day out because it's not always the most high profile work, but it's important work to get done.

[00:48:56.37] Other key points, and Julie alluded to some of this. Some of what you have is intentional, some of what you have is not intentional. Even on the intentional, is it really malicious or not? A lot of also-- particularly on the jammer issues, it's not just that somebody has a jammer and you're using it, it's how are they getting the jammer? That's not so much a field agent as either a headquarters based or working with other agencies to, what do you do to try and keep jammers out of the country?

[00:49:26.07] And there's a lot of quiet work that goes on behind the scenes. There's a lot of work that DHS will do at the ports. I'm not personally familiar with all of it, but agencies talk. And in particular on the jammer front there, you also talk to platforms. And there were stuff-- it wasn't specific to jammers, but to covert equipment that manufactured by certain Chinese entities. It's not legal in this country anymore. And the chair's office worked out arrangements with some of the big online platforms, so they won't sell it anymore.

[00:50:02.92] There are similar type conversations that if you were to look to buy a jammer on Amazon today, most likely, you're not going to find it. You might, stuff sips through the cracks, but there are other websites that are not US based, and it's much harder. So there's a lot of work going on. There's a lot more to be done. And then there are, of course, the new interference scenarios as new bands come on, come online. How does the FCC make sure it's able to detect interference in those bands? And it's always coordinate.

[00:50:33.66] And one of the things that I did when I came to The Enforcement Bureau in 2014 was really to try and step up the coordination between enforcement and the other bureaus so enforcement would know what's coming. So that we could know, OK, there are new interference scenarios coming and we need to prepare our tools for it. It's always a little bit of a chicken and egg issue of well, if there's no equipment there yet, obviously, there's no direction finding equipment for it either. But you do work on it.

[00:51:01.63] I think at that point, given the time left, I'm going to turn it to Peter.

[00:51:04.49] PETER TENHULA: All right. Before I turn to Henning and his observations, I'd go back further in history to when first radio laws were enacted. Another license approach was radio operator licenses. And those radio operators, they couldn't do stupid stuff. And if you did stupid stuff like causing intentional interference or the distress calls or whatever, you'd get your radio license-- your radio operator yanked.

[00:51:36.25] Another approach was call letters, which we still hear on the radio at the hour and a half hour, right? [MUMBLES] whatever city. And is that-- that's an approach that you can identify which station is causing the problem. And that the whole station identification approach. And we've, I think in the context of UASs, FAA has already required them to identify themselves as well to identify rogue drones.

[00:52:17.02] So I'll turn it over to Henning and see what his ideas are from all this and observations and say if there's a path forward, and then we'll open it up for audience questions.

[00:52:27.94] HENNING SCHULZRINNE: All right. Thank you. All right. So I wanted to, as academics are prone to do, to generalize a little bit.

[00:52:35.04] PETER TENHULA: Yeah.

[00:52:35.26] HENNING SCHULZRINNE: And I see we've talked a lot about all these cases of enforcement. I think there are four basic issues that if we want to ensure a safe radio operating environment for legitimate users, we need to be able to do four things. We need to be able to scale enforcement. It is not sufficient to simply say, yup, we can indeed send out a field agent. We only have, I don't know, 50 or something like that. I don't know what the numbers is exactly. It's a large country.

[00:53:06.12] I mean, even if they could get there, by the time, as you said and others have said, by the time the agent can physically get there and get the truck there to radio locate, the interference may already be elsewhere, moved on. So it has to scale to the number of devices. And obviously, we don't have to say that here, that the number of devices has just been in an order of magnitude larger than when we started out radio call letters, when you had a few thousand stations in the country that are stationary.

[00:53:38.86] People had radio receivers, but how many people had legitimate radio transmitters at home until cordless phones, really. I think that's-- and CB radio is where probably the first examples and probably indicators of trouble to come. I believe the CB radio environment was a hint, from what I recall, way before my time. Some of the difficulties given that truckers had incentive to boost their power and all of that. So scale is the first one.

[00:54:07.61] And scale is often one of way of when you rely on human scale, as in adding more agent, Congress and appropriations come into play, and they don't tend to scale very well. So we need to think about scale as one. Can we scale by adding automation? And I'll get to that. The second one is beyond scale and geography, a number is scale and time. How critical is it to resolve the issue within hours, within days, or something, probably, somebody should look into, but it's not critical. It's like reducing the performance of something, but it is not mission critical.

[00:54:51.44] It is, for example, for a cellular system, an LED sign on Times Square is reducing the performance in a particular band. But cell phones operate on multiple bands, so maybe your Ookla speedtest is not what it would have been a week ago or before the sign was-- the third one, and I think that often gets ignored is enforcement needs to discourage both the careless and the malicious. Namely that. And we know-- I'm not a criminal justice lawyer, but little I know is that often, certainty of enforcement is more important than severity.

[00:55:35.06] Threatening the death penalty for something might sound good, but it is much more-- if there is a high likelihood that I can get away with the crime, even if the penalty is millions of dollars of fines, let's say in a radio environment, well, maybe I'll just make the calculation that unlikely that I get caught, and so I'll just take the risk. This is the same thing that we see in traffic enforcement. It's one thing to put up a speed limit, it is pretty clear.

[00:56:07.79] And there was a recent story in New York City that traffic cameras allowed only in New York City and school zones, caught orders of magnitude more speeders than NYPD cops could. Simply because every cop, every speed enforcement is risky. You have to chase people. It takes half an hour of cop time, probably two. And so by nature, you're not going to get many people.

[00:56:36.87] So, by design, putting up more speed cameras-- and this is not the place to argue about their merit here and being perverse incentives it has, is more likely to yield compliant behavior by people not speeding and just saying, oh, yeah, there's some cops around.

[00:56:54.82] And we saw that during COVID when suddenly people started noticing, hey, the cops aren't enforcing the speeding laws, so maybe I can push the informal seven miles over the speed limit to 17 miles over the speed limit. The fourth characteristic is efficiency. And this is kind of a drone problem in a sense. Like, if you think of Ukraine or others, if it takes $1 million a rocket, a missile to shoot down a $10,000 drone, your war economics don't work out.

[00:57:30.88] As in, you're not going to get bankrupted on the military equipment, but you're going to get bankrupted economically. You just can't afford to spend $1 million on cheap equipment. And that's probably one of the fundamental insights now that we have not just for drones, but also that jammer equipment can be ordered via TEMU and other sources very cheaply and at scale. That just wasn't possible. So if you have to spend days of agents time of enforcement-- or a field agent time to chase after a TEMU device, the economics just don't work out long-term.

[00:58:09.27] So I believe that we need to take into account when we design radio systems to enable scale, reduce time to discovery and remediation, to provide discouragement so that people know that if they do something they shouldn't, whether that is Wi-Fi providers

being a little more aggressive or using devices that were meant for indoor use outdoors, or putting an amplifier on a Wi-Fi antenna or whatever it may be, that we're likely not going to last very long. And the efficiency in terms of economic efficiency has to work out.

[00:58:50.66] So I believe one of the mechanisms, which indeed, as was pointed out, dates back to the very earliest days. I looked it up. The earliest call letters were assigned in 1912. So it goes back that far because it was recognized that both shipboard radio, which was one of the earliest motivations for federal radio regulations in the US and elsewhere after the Titanic, and commercial radio stations and the AM band at the time could only function particularly because of the diverse propagation characteristics, as in, you wouldn't really be able to know what that station was that had suddenly 1,000 mile propagation because of some atmospheric conditions that were poorly understood as to what station that might be, that you could hear that you normally couldn't hear.

[00:59:39.49] So I believe there is a necessity to think at the time of designing both devices and spectrum bands to make it possible to identify malicious or inadvertent noncompliance rapidly. So one of the proposals discussing what was mentioned earlier is to build an identification capability, kind of automatic station identification into radio systems so that regardless of the technology, whether it's 5G or Wi-Fi, that you send periodic beacons out that say, this is the my registered device.

[01:00:17.97] And registration, whether it's an operator or a manufacturer, and then allows you to much more rapidly and importantly, and this is where scale comes in, in a distributed manner to identify devices so that legitimate operators can not only-- they don't have to just say, oh yeah, there's some random Wi-Fi device that's out there that's interfering with me. I have no idea where they are and who they are.

[01:00:43.14] They can actually say, yep, I got the station code that I could-- my device could pick up that is doing things that they shouldn't be because it's an indoor device, and I shouldn't be hearing that device because it's not one of my devices and not. And so that then allows, to the extent that's, if necessary, field agents to intervene. Or they can do enforcement by email or enforcement by letter, simply because they can identify the authorized purchaser of that device and say, hey, you're operating a device outside of bounds of operation.

[01:01:14.52] Ceasefire doing so, and you don't have to send a person there to go sniff for that particular device. And with that, I think--

[01:01:22.84] PETER TENHULA: We have a few minutes before the break, and I'll get ready to open it up for questions, especially to-- so get a student ready and the roving mics. Who's the student that's going to ask the first question? And then we'll see if there's any online.

And I think my quick takeaways is that sometimes laws need to be changed. Sometimes regulations need to be changed. But always, laws and regulations need to be enforced.

[01:01:53.75] And maybe that's a simple answer to all these problems that we've continuously faced all this long history. So if anybody wants to delve back into any of this history and ask a question about it, please let us know. Who's first? There's Max back there.

[01:02:15.51] AUDIENCE: Thanks. I have a student question about the scaling and complying. Thinking about what was mentioned with working with e-commerce platforms to remove jammers. Is there also work that FCC and NTA might do working with operating system vendors or device makers to do more automatic detection and mitigation of bad behavior, whether it's negligent or not?

[01:02:44.02] PETER TENHULA: Anybody?

[01:02:44.78] JEREMY MARCUS: And I think there are always opportunities to look to see whether there's technology that can help to-- whether it's to more easily identify, whether it's jammers or other illegal equipment that's being sold online, or to Henning's point, to try and make it easier to detect. And I think those are probably open discussions that might be happening within the agencies. They're not going to want to tip their hands as to exactly what they're doing. And can you repeat the second part?

[01:03:23.34] AUDIENCE: The second part is basically just extending that of like what are, maybe, disclosed things device makers can do that make it low friction for users, but do make that enforcement easier. For instance, if Apple were to do something in iOS, given how many devices they control.

[01:03:42.69] HENNING SCHULZRINNE: And I can say something. So I've worked on independent of malicious interference. On the device on interference into identification. So if you want to look up a paper, it's called Do you see what I see? And the idea was that-- and currently, of course, the previous panel, all the cellular and fiber providers rely heavily on Wi-Fi.

[01:04:11.73] And from what I've heard, informally, leaving aside interference, one of their most common customer complaints is, I bought a gigabit or multi hundred megabit network and I'm getting 50 megabits. I mean, refund my money. Why am I paying for that? And it turns out that they put their Wi-Fi access point on their microwave oven, which is a bad idea. And-- or other interference devices. They put it behind some metal cabinet or whatever and that, and you can't send out a Comcast agent to figure out why this isn't working, at least not at reasonable cost.

[01:04:51.56] So I have been somewhat surprised that even modern advanced Wi-Fi systems, particularly access points, are really, really

bad at helping users identify where the cause of lack of performance. Whether that's interference, Wi-Fi and other devices, baby monitors, garage door openers. It can be all kinds of things. Neighbours in urban areas often because not-- I mean, where there's isn't much you can do besides maybe find a more advanced device or talk to a neighbor about getting a mesh system.

[01:05:27.99] And that the ability of consumers and operators and carriers to identify those is really surprisingly limited. And so I don't think this is as much an NTIA issue or an FCC issue, it is that the Wi-Fi industry, and in fact, Wi-Fi 8 is supposed to focus on resilience, as opposed to just bumping speeds. There's real opportunity to help users identify why they can't get the speed that they purchased.

[01:05:58.37] JEREMY MARCUS: And I think you also need to look a little bit about the cost benefit analysis there, when that kind of issue tends to come up in FCC rulemaking. And I was in rulemaking bureaus before I did enforcement. You get a lot of, well, it's going to cost me an extra X amount of dollars to put the-- whether it's the software or the hardware in the device. And is that accurate or not? But how resistant is a manufacturer or service provider to doing it?

[01:06:26.28] What kind of demand is there too on the customer side? Or even like is Samsung or an Apple or somebody hearing that their customers want this and are going to try and put it in. So I think in a lot of ways, you need a dialogue on it and to start a discussion to see where the pressure points might be, and if everyone's more or less aligned. A much easier ask, whether it's voluntary or through a regulation, where there's real counterpoints, it becomes much harder unless you get regulation.

[01:06:56.98] PETER TENHULA: Any online questions? No? No? We've got one more. I think we got one more--

[01:07:01.66] [AUDIO OUT]

[01:07:05.66] AUDIENCE: Interesting panel. But it illustrates a hazard when we talk about the lessons from history, which is something I study occasionally. Most of the history of radio is analog, but today's radios are digital. And so, I mean, yes, stuff like jammers and analog interference, and it's all cool war stories. But the real practical things for today, the practical problems, are the things that Henning mentioned about scaling and identification.

[01:07:36.11] And we solve those problems, I think, by exploiting the unique characteristics that digital brings to radios. Question mark.

[01:07:47.27] [CHUCKLING]

[01:07:50.05] JULIUS KNAPP: Too late.

[01:07:50.87] [LAUGHTER]

[01:07:56.39] So who's going to take that?

[01:08:01.17] PETER TENHULA: Does anybody have a-- I mean, I think that technology is going to change. The bad guys are going to try to improve their technology. The manufacturers that sell to the bad guys are going to try to make their technology cheaper and easier. We didn't get into the non-physical layer spectrum side of things like spoofing and the things like the Stingray, which is kind of IMSI-catchers, fake cell sites, fake hotspots, right?

[01:08:37.93] That is that really RF interference or is that-- it's on maybe on the networking layer or on another layer of-- are nefarious bad acting problems as well, and who is responsible for that? Every time there's a technological advance, whether it's hackers or-- digital from analog, somebody's going to-- we're going to-- obviously, the regulators are going to be behind in dealing with that.

[01:09:10.60] We see it in the stories coming out of Ukraine, with regard to the drones. Drones are becoming autonomous. They're not even relying on GPS anymore. So how's Todd's successor at The Bureau of Prison is going to deal with that when they're dropping the contraband?

[01:09:36.83] TODD CRAIG: Because I'm going to sell them some good stuff to deal with it.

[01:09:39.05] PETER TENHULA: Right, yeah. So as Dale likes to remind us, there's incentives all around. So it's like, how do you get in front of the incentives? How do you get in front of the, for a lack of a better word, innovation that's constantly taking place on all sides? And I guess it requires diligence. And that's what our next panel is probably going to have to come up with the answers to, right? And with that, we have a break for--

[01:10:13.31] MATT SCHMIT: Thank you. Thank you.

[01:10:14.01] PETER TENHULA: Thank you.

[01:10:14.45] MATT SCHMIT: --panel for a great conversation today.

[01:10:15.97] [APPLAUSE]

Panel: The Emerging Spectrum Security Landscape

https://youtu.be/U_yUIsB7mJ4

[00:00:00.20] MATT ALEXANDER: Good afternoon, everyone. My name is Matt Alexander. I'm a third year law student here at the University of Colorado. I'm the lead production editor for the Colorado Technology Law Journal and a student member here at the Silicon Flatirons. It's my great honor to introduce our next panel, The

Emerging Spectrum Security Landscape, starting with the moderator, John Chapin.

[00:00:24.16] John currently serves as a Senior Fellow with the Silicon Flatirons. Panel members include Marcus Holzinger. Professor Holzinger is a Hatfield Endowed Professor in Space Policy and Law at the University of Colorado Boulder. Stephen Meer, Stephen is Chief Information Officer with ANDE Corp. Jade Morton, Professor Morton is a Professor of Aerospace Engineering Sciences at the University of Colorado Boulder. And Paul Steinberg, Paul is Chief Technology Officer with Robertson and Associates. Thank you. And with that, I'll hand it off to John.

[00:01:04.19] JOHN CHAPIN: Thank you, Matthew. Good afternoon, everybody. Welcome both here in the room and online. We do have a substantial number of folks who've been joining us online this afternoon. So I want to encourage the folks who are online. We're very much interested in having you participate by submitting your questions, so please do. I think I'll look over there where the camera is. Please do get your questions in early and we'll see them. And we have a volunteer here who's going to be collecting questions and asking on your behalf. And we'll take that when we get to the Q&A session.

[00:01:33.83] So this is our panel on The Emerging Landscape in the Spectrum Security Environment. We are going to look at the current environment, ongoing trends, and emerging challenges. We did hear very compelling top level perspective from Commissioner Gomez, including the challenges that she sees. And in this panel, we're going to hear from experts who are deeply involved in the details of many of the security challenges facing specific sectors or systems.

[00:02:04.62] So, starting from my left, Paul here is really an expert in the design and implementation of mission critical communication systems. Stephen Meer is an expert in the operation and the defense of those systems in field-- in the field usage. And we've got Jade, Professor Morton, here who's an expert in the protection of highly sensitive systems and what they're used for.

[00:02:26.50] And Marcus on the end, he comes to us from a slightly different environment, which is the space domain. But where he really thinks a lot about how to monitor for threats that might happen anywhere in a vast theater. And how can you do that effectively and affordably? That is certainly a key challenge facing us in the spectrum domain.

[00:02:44.62] So our goal in this panel is to be as concrete as possible. We're going to bring up specific issues and problems that illustrate the emerging spectrum security landscape. And then the panels will engage with various issues from their diverse perspectives. To get us started, I've asked each of the panelists, as part of their opening

remarks, to tell us a story or two from their experience that might kick off an interesting discussion about the issues we're facing.

[00:03:12.76] When we get into the audience question and answer session, I encourage you to bring up a concrete situation or experience that really raises interesting questions we should engage with. Let's try to keep the abstract hypotheticals to a minimum. That's very easy to get pulled off into that in this kind of a topic. So if I hear things getting too abstract and staying that way for too long, I'm going to invoke chairman's privilege. I'm going to intervene and redirect the discussion, so you have been warned.

[00:03:42.20] So the concrete discussion is-- it'll be interesting and informative, but in the end, it is also a means to a larger goal. We hope to start identifying generalizable insights that can contribute to the national debate on spectrum security, what our posture should be going forward. So in preparing for this conference, the organizing team talked hard about that, and I wanted to give you some candidates that we came up with that might plausibly be generalizable insights. We'd be looking for whether these are the right ones, or if we should be revising them and growing them based on what we hear from our expert panelists.

[00:04:17.35] So the three that we came up with in advance, first of all, is that the risks in this area are increasingly systemic rather than exceptional. They're more everywhere all the time, rather than just in special places and for special events. The second one is that threats have evolved and are evolving from being dumb things like power jamming to smart things like protocol exploitation. And that changes both how we have to work to detect them and what we have to do to mitigate them.

[00:04:46.79] And the third one is that capability diffusion is outpacing governance and defensive adaptations, that the capability to do these attacks or to cause problems, even unintentionally, is getting widespread quickly. And yet the governance we have is inherited from an earlier era, which might not be entirely appropriate. So those are just some straw man thoughts, three thoughts.

[00:05:10.68] But what are the other generalizable insights that we might take away from all of the stories and the thoughts here today? That's a question to the panel. So I look forward to revising and replacing those as we work towards figuring out what comes next in this area. So I'll hand it over to the panel. I will ask each of them to briefly introduce themselves at the start of their roughly five minute talk from their perspective. And please, Paul, can you start us?

[00:05:33.54] PAUL STEINBERG: Yeah, great. I wanted to thank Silicon Flatirons. This is my first time here. Thank you, Matt. Thank you, John. And especially thank you, Dale. You're a luminary. And I've enjoyed all

the time that we've had to work together. And I've learned so much from you. So thank you very much.

[00:05:46.06] Where I thought I would start is to dimensionalize the problem that John outlined and then bring it to why some of those points he made are maybe so. So first, I'll start the premise of the conference is the have and the have nots. And I would posit that among the haves and the have nots, there are the must haves. And so the must haves are obvious. They're the people that operate our critical infrastructure. They're the critical services that we all rely upon, like position, navigation, and timing. And there's public safety, and there's many more.

[00:06:15.72] I'm going to home in on public safety a little bit because it's a little more personal, as I'll explain here in a minute. And it's a little easier to visualize. So point of order, probably my claim to fame or not was I was chief technology officer at Motorola Solutions for the last 10 years, retired in 2022, and then moved on to the private side to just do some consulting in places where I thought it mattered. So this is someplace where I think it really matters.

[00:06:43.08] So first and foremost, who are these must haves. I mean, what do they look like? Well, I talked about who some of them are. Well, let's talk a little bit more about what the must haves must have. And so if you think about it, public safety starts with land mobile radio. It's basically pretty simple stuff. Push and talk. And that's foundationally what they need. But that's not anywhere close to good enough. They need digital workflows. They need the ability to stream media. They need accurate position, navigation, and timing. They need the ability to access telemetry, something as simple as automated license plate recognition.

[00:07:13.91] They need all these things. And they're increasingly not only part of how they work, but they're part of what keeps them safe. And so I sat down my son-in-law and daughter who live in Erie, and my son in law's-- he left the commercial financial organization to become a Colorado State trooper. And so I sat down with them this morning to just gut check, because all my customers used to tell me that communication stuff, that's my lifeline. That's why I run into the burning building knowing I can get help.

[00:07:40.43] So I asked him, I said, John, is it really true? I mean, have I been drinking the Kool-Aid too long. Is this really how you work? He said, yeah, it's definitely true. He said, I won't go anywhere without my radio. It's the thing that-- it's got, as he called it, the oh shoot button. He used a different word, but you get it. And he said it's the thing that works the best anywhere and everywhere. And that's by design. So that's great.

[00:08:03.10] So then I said to him, I said, well, John, let me tell you what I'm doing and why I'm asking these questions. And I started to

talk to him a little bit about the conference. And about two minutes in he said, can I ask you a question. Yeah, sure. He said, what's spectrum? Like, mhm, right, OK. So that leads to the next point. Not only do these must haves is the requirement for them growing. Not only do these things have to work always predictably anytime and every time because they don't get to choose when it's important. They don't get to choose when a life critical event is actually going to happen. But they're also not experts in the technology.

[00:08:37.58] So my one anecdote was maybe some of you have heard of Boston Police Commissioner Ed Davis. So he was the police commissioner there when the Boston bombing happened. So he came and talked to me and he said, Paul, this was early days of FirstNet when that was coming about. He said, we're just users. We count on you guys, you the industry, you the regulatory bodies, you-- everybody but us to make this work for us, to keep us safe. We're not experts. It's just got to work.

[00:09:02.71] John reminded me that this morning. What is spectrum? I just expect the radio to work when I need it to work. So that's why this panel, I think, this whole conference is so important because it's about marshaling us to help these people get what they need. And so what are these-- I talked about the must haves and what must they have and who are they. So what does this mean in terms of the security environment? Well, there's this stuff that we've talked a lot about. There's spectrum jamming just energy in the wrong spots that do bad things. But the threat surface is so much bigger now.

[00:09:35.73] So the cyber threat surface, so it's authentication hacking. We talked about IMSI catchers or that was mentioned in the previous panel. So it's all of those things. Increasingly, these networks and the radios themselves are software defined. So they're hackable. So everything about this entire food chain and stack is now software approachable, which means it is vulnerable from a cyber point of view.

[00:09:56.72] I think it's also supply chain vulnerable. Increasingly, we don't know where the bill of materials is coming from, and we don't know the veracity of all the pieces that are in there. If the vendor community and if the regulatory bodies are not looking after that. There are sometimes as these complexity stacks grow, hidden dependencies creep in.

[00:10:14.44] So all of a sudden, it may turn out that this system, that system, and the other system all depend upon the same fundamental core technology such as fiber run. And if that one, that one thing fails, maybe everything fails. And that's not OK either. So complexity can be an enemy of this as well. And there's so many, many more.

[00:10:31.48] But I think what I'll do is I'll just come back to all of these things. Spoiler alert, how do we deal with them? I mean, we talked about GPS a lot. Well, frankly, it's really going to be difficult to protect

GPS against spoofing and jamming. So what do you do? Well, you build redundancy into the system. If you think about FirstNet, if those of you-- how many of you know what FirstNet is? Just so I know. OK, good. So I can say that.

[00:10:58.30] So what do you think about FirstNet? Well, it's redundancy. It offers additional technologies, offers access to media and telemetry that land mobile radio doesn't. But it also offers redundancy, another path for communication to occur over. I think a lot of the future and the way we protect against these things is to build redundancy into the communication paths and the services stacks that these people that must haves can rely upon.

[00:11:21.28] So I'll close by saying, I think we owe it to those people. I'm glad that we're here. We owe it to the people who put their lives on the line so that we can be safe, to make them safe to give them the best that we can possibly have. And I'll stop there.

[00:11:35.10] JOHN CHAPIN: Thanks, Paul. Thanks, Steve, yeah.

[00:11:37.54] STEPHEN MEER: Good afternoon, I'm Steve Meer. I don't remember how many times I've been up here talking on various things about public safety, but thanks, as always, to Dale and Matt and the whole team that pulls that conference together. About half of the people here have come up to me and said they looked at my LinkedIn or they looked-- they googled me, and they couldn't figure out why a DNA guy is sitting up here talking about this. So let me explain to you that DNA is only my recent of serial entrepreneur activities. But historically, my background has been in public safety and critical communications for 30 years before moving into this realm.

[00:12:15.17] And I come to it both from the practitioner boots on the ground side. I am a Colorado peace officer. Until very recently, I was a SWAT commander, and I continue to train EOD, and SWAT, and other folks, and I run a drone program for an agency on the front range. So I have a lot of hands on experience. I've done a number of national special security events where I was responsible for communications and managing those things.

[00:12:45.18] So I'm going to talk a little bit from the boots on the ground side of the world. I will tell you that-- I must give the obligatory, these are my views, not my elected officials view in these things. And some of the things I'm going to talk about are going to be a little obscure, because they're still in litigation and in the world.

[00:13:04.20] So first, I would tell you that in the practical world, we have the saying 2 is 1 and 1 is none. And that's taken directly from the military. And it very much speaks to everything we think about in the tools of public safety. And the more technological, the more moving parts, the more complex it is, the more important it is that 2 is 1 and 1 is none.

[00:13:29.00] I would also tell you that there have always been an intentional and unintentional insults to the public safety spectrum, and it's not new. It's at maybe a more fevered pitch now, and maybe there's better tools available for people to interfere, intentionally or unintentionally. But this is not a new thing. The first transmitters were spark gap transmitters. They wiped out a whole band. We had to change from spark gap pretty early on in the radio world.

[00:14:03.87] One of the areas that we suffer unintentionally is the rise in the noise floor. This has nothing to do with anybody intentionally doing anything. It has to do with an evolving electronic marketplace. And everything that's out there has a processor, and it has some sort of noise that comes with it. And the noise floor changes every year in the cities that changes, I don't know, around here it's some frequencies we see as much as 40B a year kind of changing.

[00:14:32.93] But more insidious are the rural areas where there was no noise and we were able to survive coverage with low density signal. And now that there is noise floor, that coverage that we had is gone because of the change in the noise floor. So that necessitates a evolutionary component of the public safety radio environment.

[00:14:58.53] The next point I'd mention to you is that all of the technology that is coming forward to deal with new feature functionality and spectrum scarcity and spectrum reuse has the impact of making the radio system more fragile. There are more serialized things that must work more precisely and continually than in the days when we had two portable radios and one pushed and the other listened, and we went back and forth. And so there's an entire ecosystem that now must work perfectly in order for the system to work or it suffers significant insult and problems for public safety.

[00:15:47.08] I've been asked to talk about a couple of use cases and failures. I'll highlight one unintentional and one intentional. We recently had two situations on the front range of Colorado, where folks in one case got hold of a stolen radio, and another case got hold of a $15 radio that, when you buy it from Amazon, happens to come up programmed on a channel. That's a problem for us. And these people were both intentionally and aggressively jamming radio channels.

[00:16:21.68] That caused us a lot of grief. It took a lot of technical time for us to do direction finding and identify where. And ultimately, because of the nature of the transmissions, we ultimately had to deploy monitoring pods that were tuned to a sensitivity of a couple hundred feet so we can figure out exactly where the insult was coming from. That led to an action.

[00:16:48.09] And unlike some of the actions you've heard before, when you do have acute impact of public safety radio systems, we can, in fact, take our guns and we can go deal with people on an intervening basis. That has nothing to do with federal law. We use state

laws dealing with interference with government, obstruction of official operations.

[00:17:10.17] And in Colorado, now, we enjoy a state law relative to affiliating with the public safety radio system. So you don't even actually have to transmit. You just have to give us the appearance of maybe you're going to transmit and we can come after you. So that's a forward leaning capability that we have.

[00:17:28.43] I will tell you that when somebody who thinks they're anonymous, because they're using their portable radio in their house is confronted by a SWAT team with our rifles out, it brings new religion to their thoughts on whether this has meaningful impact or not. So that's the intentional side.

[00:17:46.66] On the unintentional side, one of our ugly things are BDAs. So the very--

[00:17:53.10] JOHN CHAPIN: Spell that out.

[00:17:53.90] STEPHEN MEER: --technology--

[00:17:54.74] JOHN CHAPIN: Spell that out.

[00:17:55.30] STEPHEN MEER: I'm sorry. An in-building amplifier for public safety radio systems, so the more environmental your buildings are, the more LEED certified they are, the less likely they are for our radio waves to get in support of the police officers, firefighters, and paramedics. So there's a technology basically of an in-building repeater that sucks the radio waves from outside, brings them into the building in a distributed way so that we can have uninterrupted radio communications.

[00:18:23.82] The design of those systems and the tuning of those systems is not for the faint of heart. And often those systems being put in inappropriately or changes in the geography or building of a new building next to a building that has one of those has the unintended effect of causing interference to public radio systems-- public safety radio systems. So there's a ecosystem that we no longer control. Just the pieces that we control, impact us. There's this wide plethora of things on the outside.

[00:18:58.92] So I'll end my comments here and just suggest maybe one last thing. And that is, in this forum, we often hear the words the highest and best use case for spectrum. And I would tell you that I don't necessarily think that public safety is always well represented in that, because at the end of the day, the highest and best use is often from a total society view and the economics that come with it, and not specifically from the safety of the first responders and the citizens they support. So that calculus gets messed up on a regular basis. So I just throw that in because it's one of my hot button issues. With that, I'll pass it over.

[00:19:42.71] JADE MORTON: Thank you. So my name is Jade Morton. I'm a Professor in Aerospace Engineering department here at the city of Boulder. My research area is to use radio waves or radio signals to do navigation, and also to do remote sensing. So to me, how other people are interfering with signals quite often could mislead my solutions. In terms of navigation, Paul had already alluded to it.

[00:20:11.45] Everybody here probably you're aware that GPS or GNS, which is a broader family of GPS that include other countries signals as well, these signals are very weak. And to jam them, it doesn't take much. You can go to Amazon for a few dollars, you can buy a jammer. Don't do that, OK.

[00:20:33.28] [LAUGHS]

[00:20:34.58] But more than jamming there's also spoofing. Paul also mentioned that as well. That's even more dangerous. Now you have a fake satellite. So now you think you're on Broadway. But actually you're in Denver, so you'll be doing wrong things, going to the wrong places. But today, I think people probably are aware of all these threats, and I won't spend too much time talking about it just now.

[00:20:59.24] I would like to perhaps talk a little bit more on the sensing aspects, which might be something that haven't been getting enough of exposure yet. And Stephen had mentioned, we have this proliferation of electronic devices, so noise floors going up, that perhaps is one of the reasons we're getting more worried about all these coexistence in the spectrum.

[00:21:25.98] Another reason I think is because we have developed so many applications that rely on radios and any kind of interference only systems will have very broad impact. Some of them are directly felt by individuals. Others have to go through a few hurdles before you feel it. So that's really the remote sensing area that I feel, fall into that category. For example, we use radio signals. We call them signals of opportunity.

[00:21:55.97] People transmit signals for GPS and maybe for other reasons for communication, and we use them for sensing of our environment. For example, we map the atmospheric water vapor, which is probably the most critical parameter for weather models. And I think Richard is sitting there nodding his head because we've been working on that project. We do forecasting of space weather.

[00:22:22.81] I was at a dinner Sunday or was it a Saturday night, somebody said, the space has weather. Yes, we never cared about it before because it didn't bother us that much. We had a big storm a long time ago, in 1859. Some telegraph operator got electrocuted because of that. But today, we have so many things that depend on it. So we have so many satellites that's operating in space. And we care about them now more than ever.

[00:22:50.79] And there are other things that probably you may not have heard about yet. But it is playing an increasing role in our lives. And a simple example is soil moisture. The soil moisture is a huge agricultural indicator. How much do you need to do irrigation? Where you should plant what? How the global, say, the desert is growing, what speed is growing, which direction is going and what condition is happening? To do this kind of mapping, we actually-- you can go take samples, but the Earth is still quite big, even though we say the world is getting smaller and to do in-situ measurement is not realistic. It's through remote sensing, through radio waves.

[00:23:37.22] And there are other things like ocean wind. And that is really important not only for weather, but for shipping for other business as well. And the only way to get a global map of things like that in near real time, in the kind of resolution we're looking at, we rely on radios. So when the radio signals, become unreliable, guess what, we have wrong interpretations.

[00:24:03.74] So, John talked about giving examples. So my colleague Clara Chu, she was looking at the soil moisture. And she had found out that a certain area in the world, the soil moisture didn't seem to match what our understanding is, it turned out, was because the war is going on there and our signals are all messed up. So what do we do with the data. We have to throw them away. So there's a huge blank on the globe that we couldn't do the monitoring.

[00:24:34.13] And my student, Maggie Scott, is doing a project to map how permafrost is changing, especially in Alaska, Canadian areas. That actually is really important because there are all sorts of reasons we need to study it. Villages are disappearing because permafrost. And when she was studying that, she would try to map certain areas and she found certain areas didn't seem to make sense.

[00:25:00.05] It's because people are jamming that area. So she now has to limit her observations in areas where we know-- there are not necessarily people jamming. There could even be your ground stations talking to your satellite and not jamming it. So now we're looking for places where there are no ground stations, so only those places that she can map.

[00:25:19.87] So things like this really impact many different aspects of our society. And so these are really talking about interference jamming coming from radio waves generated by our own civilization. However, there's also the aspect of coming from nature. The space, as I mentioned earlier itself, is basically when sounds become upset, it will generate all of these radiations across a wide range of spectrum. We all will feel it. But in systems like GPS, and we feel it even more because the signals were already so weak.

[00:25:57.92] So now we have to decide is it nature doing something, or is it some actor doing something on the surface of Earth. And these

are becoming very difficult to distinguish in certain circumstances. That's where we are having different audience here. I normally dealing with students from science, technology, and I always tell students the fundamentals are very important because every particular phenomena have its own physics underlying in there.

[00:26:27.64] That's when things like machine learning and AI, they don't come out black boxes. They come out of understanding of systems to have those kind of knowledge will help us distinguish them. And maybe perhaps we don't throw that away. Instead, we know how to harvest them, how to mitigate these different kind of impacts. And I mentioned all of these effects earlier from ground. But our platform have been really expanded well beyond the ground.

[00:26:57.32] For example, Marcus can talk about the space. There are so many satellites in space and they could be victims of all these things I talked about, but they could also be the sources of these problems. And we already are seeing interference sweeping across multiple states in a matter of few seconds.

[00:27:20.26] The only reason that could happen is they are transmitted from satellite. So we're seeing this kind of already events playing out in space, airborne, spaceborne in addition to just ground based. So this is a complicated situation. However, as researchers, it's also a lot of fun too. So that keeps us going. So I would like to just--

[00:27:43.35] JOHN CHAPIN: Just finish up please. Yes.

[00:27:44.47] JADE MORTON: Yes, I'm done. So basically it's a complicated problem if you want to protect the spectrum. It's challenging. But there are also a lot of opportunities. Thank you.

[00:27:56.01] MARCUS HOLZINGER: Hi folks, I'm Marcus Holzinger. I'm also a Professor in Aerospace Engineering. But this is going to be something probably completely different from what Jade just spoke about. One of the fun things about being a space person and being invited to this is that I get to be up here on the podium or up on the panel and talk to you all about something related to spectrum, when I probably know the least about spectrum in the room. I think I can make that assertion pretty easily.

[00:28:21.77] My background is in something called space domain awareness. That's all about detecting, tracking, and characterizing all of the things that are happening up on orbit. Now, you might imagine that those are just autonomous satellites or whatever else. But the other important thing to remember is that there are people behind those satellites at control centers deciding what they should be doing, and more and more, they're autonomous on board algorithms and decision making that make life really interesting up there.

[00:28:49.32] There's also, of course, this interesting thing about space debris. I'm not going to get too much into space debris, other than

saying perhaps it has a couple of similarities with the noise floor. It's just a different kind of noise floor that persists until it deorbit or goes elsewhere. When talking about stories related to spectrum, I realized I didn't have very many. So really what I did, and I hope John's OK with this, is I thought a little bit more about what the similarities and the differences are between the spectrum domain and the space domain as they pertain to security.

[00:29:23.27] So one of them, of course, in terms of similarities, is that there is a healthy dose of international tension in terms of how these domains are used and for what purposes. You might imagine that because we're not terrestrially isolated, we have spacecraft that are going around the Earth or around other bodies, everybody's toys get to play next to everybody else's toys.

[00:29:47.57] And so the problem becomes pretty interesting. And I'll just briefly also mention that another similarity is that things are not super enforceable. If you end up having one nation claim that something needs to happen for national security, what is another nation really going to do or say about that? And these things happen relatively often.

[00:30:09.47] Another thing that's really similar is the attempt to view these domains as common pool resources. So I'm likely referencing Elinor Ostrom's frameworks for governing common pool resources. Certainly, I know that folks have done that in the space domain, and I know that folks have done that in the spectrum domain. So I'm curious if there's some interesting things we can learn from talking to each other there.

[00:30:34.09] Another thing is that the spectrum domain and the space domain are foundational and central to not just the national and international economy, but also the national and international security infrastructure. Everything that is done in terms of international security or most things that are done in terms of economic activity, they all have space involved one way or another, and they all have spectrum involved one way or another. So I think there's some other interesting crossovers there.

[00:31:08.33] Some other differences now, digging more into the differences, I think the spectrum has a lot more, I'll say, private actors, right, non-government organizations and individuals. That's not something that the space world has had to deal with very much, and I think that we would do well to pay very close attention to how the spectrum folks have been dealing with that.

[00:31:30.52] Another point that I'll briefly make is that in the future, space is getting closer and closer to being much like the spectrum in the sense that constellations are proliferating. Spacecraft are proliferating, and we're getting more and more private actors up there. So in that sense, I think that there are a lot of interesting crossovers.

[00:31:52.12] I'll also briefly say that the other thing about spectrum and space that really cross over, and I'll just briefly highlight some of the unrest that's been happening in Iran, in the sense that it was really Starlink satellites that enabled communications. And if you are the Iranian government, you certainly viewed that as a national security issue having access to those Starlink receivers.

[00:32:20.67] I think the last thing I'll briefly say is that for the last eight or so years, I've been focusing mostly on lunar things on the moon. And so I think one of the things I'm hoping to learn or take away are how we can possibly deconflict some of the national security and communications questions in and around the moon, specifically from RF perspectives. So I'll stop there. And thanks a lot.

[00:32:46.03] JOHN CHAPIN: Fantastic. Thank you, Marcus. Thank you, everybody. OK, so we've got a diverse set of expertise here and I've got a few questions queued up. But I'm very interested to get over to audience questions and online questions. So I think I might ask just one. And then we'll open the door. And then depending on how that discussion goes, I may bring up forward another moderator question as well.

[00:33:09.59] So I would observe that the spectrum and the services it supports are vital lanes of commerce in the modern world. Traditionally, for sea lanes of commerce, we have the Navy, and we've given them the role of protecting freedom of navigation. We've given the role of detecting and deterring threats. We don't have anything like the Navy for the spectrum lanes. There isn't an organization that is overall really active out there doing this. We heard wonderful things about the FCC Enforcement Bureau, but we also understand that they're not resourced like something like the Navy is.

[00:33:45.66] So my question is, given this is handled in a very diverse set of ways. A question to each of the panelists is who handles protection of the systems in the sector that you care about today, whether that's at the federal level or the state level. What are some examples where the current approaches work well and where they don't work well? And what are significant recent changes or trends that might lead to that solution for protection changing?

[00:34:09.38] This is all getting us towards questions about governance and overall strategy as a nation. So it's certainly opened up to anybody who wants to jump in first on how that's done today in the sector. And you're certainly welcome to talk about space situational awareness, if you'd like, Marcus, not just have to focus on spectrum. But anyone want to take the first go at that. We heard a little bit from Steve about things that they do here locally. You want to talk more about that overall protection and role.

[00:34:33.10] STEPHEN MEER: Sure.

[00:34:33.56] JOHN CHAPIN: Yeah.

[00:34:33.94] STEPHEN MEER: So first I would tell you that we have a great relationship with the FCC folks in this area, and they're almost always our first or second phone call. The challenges, of course, now they're spread thin and they don't have nearly the staffing or the equipment resource here in the Colorado metro area that we enjoyed, frankly, decades ago in that respect. So we have had to develop, frankly, some of our own expertise in the LMR world, in the engineers and technicians that work at. We've had to build tools, techniques, and platforms to help us identify and isolate some of these things depending on the situation.

[00:35:16.45] And there are other folks. I mean, some of the manufacturers are great assistance. Some of the system providers are great assistance, but ultimately the recipient of the problem kind of has to take the initiative to put the band together, to go search the problem. And in some areas that's very doable given the resources both in number and capability, and in other areas they suffer quite a bit.

[00:35:50.19] MARCUS HOLZINGER: You said my name a couple times earlier, so kind of like Beetlejuice, I'm just going to start talking a little bit. So for space, really, we have this thing called the Space Force that was stood up a couple of years ago. And really, the whole idea of the Space Force all of a sudden now involving itself in enforcement really emphasizes the fact that space is militarizing in a number of overt ways.

[00:36:20.46] One of the things that's really interesting is that in terms of deconfliction on frequencies, there's typically a third party to go to either in a nation or elsewhere, maybe not internationally, but I'm not going to get into that too much. For space, when you have a conflict, we call those collisions. So this is when two spacecraft collide up on orbit, and they hit each other somewhere between 5 and 12 kilometers a second. So those are bad, but you all want to guess at how we deconflict those. And I'm not going to wait for an answer. I'm just going to dramatically pause. That's good.

[00:37:00.46] The operators of one satellite will look up in a phone book for the phone number for operators of a different satellite, and they'll try to get hold of each other, and they will hope that the person on the other end of that A, has a spacecraft that can maneuver, that has propulsion, and B, that the operators themselves aren't-- are actually subject matter experts of one variety or another. So that causes a pretty big problem. And I think that, in terms of the protection, that causes a large issue, John, because it's really unclear how to do that. And that's certainly something that is debated hotly in the space community.

[00:37:41.61] Recent changes, well, recent headlines have been helping me out here quite a bit. And only this morning I heard not just are we having mega constellations like Starlink and other things, but I had heard and you all can call me on this if I'm wrong, that SpaceX had applied for a million spacecraft-- a million spacecraft to the FCC to

operate up on orbit for a distributed data center, space based data centers.

[00:38:10.09] JOHN CHAPIN: Just to clarify, they have not applied. They applied for a couple of pilot spacecraft, and they have a vision of a constellation that big, which is described in the filing.

[00:38:19.43] MARCUS HOLZINGER: Vision of a million, OK, yeah. Well, that's perhaps even more interesting. You were talking about how in the information economy, the lines of commerce increasingly are over RF, right. What happens when you have a good portion of AI or the computation that Earth consumes up on orbit, directly held at risk through RF. That's another interesting question.

[00:38:48.71] Another thing I'll emphasize is that the Defense Intelligence Agency, if you haven't looked this up, actually has space-- encounter space threats document that is entirely public that you could just go and look at. It is very interesting and one of the favorite ways for people to interact with each other in not nice ways is through RF interactions.

[00:39:09.22] We call that jamming most of the time. But certainly it also includes things like lasing. And there's nothing special about either of those phenomenologies that require that they be from the ground to space. And Jade had already mentioned that jamming from space down to the ground is potentially a thing. I think I'll stop right there, but yeah.

[00:39:33.66] JOHN CHAPIN: Well having heard that, I think we have a topic for next year's debate resolved. There should be a spectrum force.

[00:39:40.46] PAUL STEINBERG: Let's see if we want to go there.

[00:39:42.14] MARCUS HOLZINGER: I want to see the badges.

[00:39:43.40] JOHN CHAPIN: Yes. Please, jump in, please.

[00:39:45.30] PAUL STEINBERG: So in case you haven't gotten it by now, I built the stuff. These guys all had to deal with it. I mean, that's the bottom line here is what this is coming out to be. But just to add to the who's protecting and how, I think there's a few things we can think about. One thing I think is important to scale. If you think about some of the threat services I spoke to earlier, cybersecurity, the supply chain, really, scale is the best answer there. You can't have every local police office, every local fire department, every local company that runs a piece of critical infrastructure solve this problem on their own. So enabling scale is important.

[00:40:19.39] And that's why, again, I think something like FirstNet was really important because that actually brought the scale of a nationwide carrier to what would normally be a city sized problem, brought an enormous amount of resources to that problem. So I think

scale is important if wielded the right way. And regulation that allows scale to be brought to bear is important. I think another thing that's important to think about is thoughtful regulation. I'm not going to be picky about this, but sometimes I wonder about the wisdom of placing critical services on unlicensed spectrum.

[00:40:52.85] Yeah, there you go. You weren't-- you weren't who I was thinking about. But you helped me. I was thinking, a lot of the smart grid runs on unlicensed spectrum today. And so, as Jade said, it's not difficult to find the enabling technology to do bad things. Whether the bad thing is just blow a bunch of energy in across the entire band, or whether the bad thing is a little bit more intelligent, let's just drop some energy on the control channel, which is a lot easier to get. It takes a lot less energy to do a lot more damage, or whether it's something as simple as just a DDoS attack, hammering the control channel with accesses. This is all very much enabled in the industry today.

[00:41:30.32] So I think you have to look out for those sorts of things. So that then leads me to the other point I made earlier, which is I think another solution is redundant layers of access. With all due respect, 2 to 1, 1 to 0, if I can do the same thing two different ways that are fundamentally of fault decoupled, that's a useful thing to have. Because when the bad thing happens, at least, I have some recourse.

[00:41:53.44] So I think stepping back and thinking about some of the higher level issues, I think the point was made earlier that these are digital and software systems, absolutely. That's what keeps me awake at night, honestly, because I'm not an RF head. And, there's only so much we can do. As Jade said, you really can't suddenly make GPS signals stronger. So what's the alternative? You have to find an alternative to GPS that gives you something at least as good.

[00:42:16.70] So I'll stop there. But I wanted to broaden it again, just a little bit out of the RF domain to think about other aspects of this. And I think regulation can do a lot to position these things, by not coupling things together that can have unintended consequences, if something goes wrong with another. Can't do much about what's available out there. We can do some things about the supply chain, and we can certainly do some things about scale and bringing scale to bear, so that it's more efficient and effective to combat some of these threats that are emerging.

[00:42:45.94] JOHN CHAPIN: Great. Any other comments on that question? No. OK, let's open it to the audience. Wiser rule here. First question is from a student. Now there are classes going on this afternoon. There may not be that many students in the room, but I want to encourage anyone who's here to raise a hand and ask a first question.

[00:43:09.73] Then my second, I'm going to-- not the Wiser rule, but the Chapin rule or whatever, the next one's going to be online. We want to encourage our online participants to feel included. I'm going to look over at our volunteer, Abby here and see, do we have an online question. Not yet, OK. So it's been a little too fast. So I had one hand down here and then I'll go to the second one in the back. So there's somebody down here in the first one. Yep.

[00:43:32.81] AUDIENCE: OK. Thank you all. Super interesting. So past life before I was a lawyer, I was a communications officer in the Marines. So for on point kind of topic for me, Jade, is weather. I'm trying to explain space weather to Lieutenant Colonel, infantry officer as to why he can't talk to his Marines. And--

[00:43:54.95] [INTERPOSING VOICES]

[00:44:00.89] A quick anecdote. In Afghanistan in 2013, Camp Leatherneck, Helmand Province, we had a consistent problem where our outposts, almost at the exact same time every day, lost all RF communication. For months, we couldn't figure out what it was. And it turns out that the convoys leaving the wire every day would stop at the gate, go through all of their checks and inspections. And the very first thing they did as part of that was to turn on their jammers for IEDs. And it completely blotted out the RF signal for these outposts.

[00:44:38.26] And so, we've talked a lot about the nefarious interference, but this was a situation where the RF to the outpost is completely legitimate. The IED jammers, obviously completely legitimate and very, very important. And so how do, for any of you, think about the deconfliction between legitimate sources of interference? And how do you go about resolving those situations?

[00:45:09.99] JADE MORTON: Maybe I could pick up the question. So this is actually-- earlier, our colleagues here were talking about all these active sources. One particular type of source that's very difficult to handle is actually unintentional. For example, you have IF devices, they leak energies at harmonic frequencies. The manufacturer didn't even know that happened. The user didn't know. And so sometimes, perhaps the experience your colleagues had, maybe not-- they may not even be due to active jammers.

[00:45:43.73] And I had one student, we have a station in Singapore, looking at equatorial plasma bubbles. And he was analyzing the data. And he came to me. He said, it appears like on weekday morning around 8:00, the sun is always doing something there. I said that the sun doesn't know weekdays, OK.

[00:46:01.07] [LAUGHS]

[00:46:01.41] And 8:00 in the morning doesn't work either. So something else must be wrong. And so we looked further. It turns out there was an engineer who came in, obviously, weekdays. Around

8:00, he turns his satellite phone on. That phone leaked energy at the GPS band. And so it wasn't the sun. But in our case, the weekday was really what gave away. I said, this just doesn't happen.

[00:46:27.39] But there are times it's much harder for us to detect it. Some of the recent spaceborne jamming that we experienced, we were able to identify where it came from. It was not from hostile sources. It was a spaceborne synthetic aperture radar was leaking energy. And every time when that radar was flying over places, we have station, we pick it up.

[00:46:48.49] So perhaps, I don't know how to resolve these issues. Maybe regulations, when you design systems, perhaps, in addition to testing its own performance, we should also check do they leak energy into other band and causing problems.

[00:47:05.08] PAUL STEINBERG: Just the one thought I had on that. I'm not sure if I understood the problem-- I mean, I understood the problem. I'm not sure how you got there, but. I mean, the IED jammers were typically, I think, jamming in the normal cellular bands, right?

[00:47:19.40] JOHN CHAPIN: Wait for a microphone there, yeah.

[00:47:21.32] [INTERPOSING VOICES]

[00:47:23.30] AUDIENCE: Yeah, so that's traditionally what you would think about. But, they found over the course of our time in Afghanistan that there was just such a wide variety of RF bands that were being used for remote detonation IEDs, that it was a really, really broadband in terms of jamming. I mean, they were just putting out as much power on as many frequencies as possible to shut down, anything that they could possibly think about because it was such a cat and mouse game that you couldn't be that targeted.

[00:47:53.04] PAUL STEINBERG: Yeah, you want to say something?

[00:47:54.54] STEPHEN MEER: Well, when I think about resiliency and we talk about the ecosystem and the ways to have redundancy as a result of resiliency, one of the challenges is we make these systems larger and more integrated and more feature prone. We build in many more components, and we don't even necessarily know all those components.

[00:48:19.53] I've ran a network for years where a link between Denver and Chicago had problems on a pretty regular basis because of a telecom node in Northern California, for example. And every time I tried to regroup my circuits around that, somebody would trade off bandwidth and then go back to Northern California. It was like my nemesis.

[00:48:40.19] And so when we build these more complicated systems and whether it's FirstNet or LMR, these systems are large and integrated. And not everybody-- not one person has control over every

single piece. And so to the point of resiliency in at an operational level, I feel like you have to have dramatically disconnected technology here because it's not just the RF component. It is truly from end to end. And I think that move from cellular to broadband to deal with the RC cars and all the other stuff is absolutely what we see. And that becomes a challenge because the available technology choices is becoming less and less.

[00:49:27.86] PAUL STEINBERG: Yeah, I'll talk to you offline. I mean, it sounds like your jam was working really well, so that's good news. And the only thing I can think of is usually the way that solved is spectrum agility or coordination.

[00:49:38.46] JOHN CHAPIN: OK, we had one in the middle in the back, and then one on the far right in the back.

[00:49:41.42] AUDIENCE: We actually had a question over here.

[00:49:43.34] JOHN CHAPIN: Oh, I'm sorry. She had a hand much earlier. Yeah.

[00:49:52.18] AUDIENCE: Hi. Thanks to the panelists and everybody. It's been a really great conference so far. I was thinking a lot about whether with the scalability issue, there's potential to use the public, particularly, for the unintentional interference that can help, reduce the noise. Most people know nothing about spectrum. I don't think we're doing a very good job educating the public about this at all, or how any of it works.

[00:50:23.94] So what are some efforts in that direction that we can use the public to help? That's what they're starting to do with fire mitigation because it's just too much-- it's too much of a risk. The fire department can't come when the entire neighborhood is on fire. They can only come when a couple houses are. So what do we do to use the resource that is the public that generally are good actors.

[00:50:50.36] PAUL STEINBERG: Interesting.

[00:50:51.91] JADE MORTON: I could tell you what I know about. So there's something called crowdsourcing in our community. They are very active efforts going on. For example, crowdsourcing using cell phone measurements to detect map where they are potential interference sources. So that's something that has been going on. And recently, we actually also did a very successful project using crowdsourcing, using cell phone to map space vessel. And that's naturally, interference phenomena. That was a project funded by Google, and we worked on it for a little over two years. And if you're interested, there's a paper in Nature.

[00:51:30.99] We can map places where we don't have any infrastructure. For example, in Africa, India, you actually couldn't really deploy good infrastructure there easily. If you deploy them, how to maintain them is the issue. But everybody got a phone and they make

sure it's charged. They may not be great in the kind of information that provides individually the measurement has. But if you have 10,000 phone or 100,000 phone in border area, they do wonders. So yes, crowdsourcing is one area where public is involved, and the data science could do miracles in detecting, mapping, and give you that kind of information. That's in a way.

[00:52:20.58] STEPHEN MEER: So around here the public is really good. And I'll tell you a story here that's more than a little embarrassing for me. Early in my public safety career, I built some technology that allowed the doors and the lights at the fire stations to open automatically when they were paged, essentially to respond to a call. I built these circuits, tested them all out, put them in every one of the fire stations in the city.

[00:52:47.86] And about four days later, I got a call from the power utility going, so our guys have been out because they've been getting a lot of complaints that people's AM radios don't work. And so they were calling the power utility, and the power utility guys came out and they did some interference analysis and direction finding, and they found out that I had very effectively built a circuit that jammed AM radio and placed them everywhere through the city. So the public is very good at helping when you impact them. When you don't impact them, they're a little less helping. I also learned a lot about bypass capacitors as a result of that.

[00:53:33.09] JOHN CHAPIN: Fantastic. OK, so we have a question here and back. Yes, thank you.

[00:53:38.41] AUDIENCE: Hi, I'm an undergrad. I'm a freshman in undergrad, actually. And my question is so since so much critical infrastructure is privately owned, what is the biggest challenge in coordinating responses to electromagnetic interferences between government and industry, specifically from a policy perspective?

[00:54:00.63] JOHN CHAPIN: All right, so since so much critical infrastructure is privately owned, what does that mean for the policies about how we coordinate response to issues with critical infrastructure? Yeah.

[00:54:12.39] JADE MORTON: I don't know.

[00:54:13.31] JOHN CHAPIN: Anyone, want to--

[00:54:14.15] PAUL STEINBERG: Coordinate response, I would say first try to make sure you don't have to respond. I think I would start with-- it's a great question, by the way, and it kind of goes back to my point earlier about sometimes you create these problems unintentionally. So the unlicensed spectrum thing worries me a bit. We have a lot of critical infrastructure that actually is increasingly grown to depend upon that.

[00:54:34.79] So the first thing would be don't do that because it can be interfering with itself. I mean, there are rules that were made to allow it to coexist. But I know of many, many cases that I won't go into where it hasn't worked so well. So the first step I would think, is if you're going to put something that's really, really life or business critical, think very carefully about how you allocate capability to that.

[00:54:57.62] I'm not saying don't spectrum share. This is not an anti-spectrum sharing statement. But I think when you create those dependencies then you create the inevitability of having interference. And I don't know that it's a public, private thing so much.

[00:55:10.86] JOHN CHAPIN: If I could comment to that one as well something I've been doing some research on. What we want to be able to do is if somebody has a Prime infrastructure that is critical, like, say, it's a chemical plant with a local communication system, that could be very critical. We want to empower them with the tools to enable them to protect their systems from electromagnetic threats, in addition to other threats. And some of those tools, I mean, I'm not talking about jamming here, but even just the monitoring tools can raise privacy implications.

[00:55:39.98] So one policy area that might be worth investigating is how we can provide some kind of a privacy safe harbor for people who are doing the right thing and protect them from some of the liability that's unconstrained right now, so that they can deploy the systems to protect their critical infrastructure. And I think there's probably a broader range of issues that could be investigated in that kind of a context. Yes. Can I just check for online anything else right now? No, nothing significant has come in. So I'll let whoever was next. Yes, thank you.

[00:56:15.17] AUDIENCE: Would the soon coming spectrum force be the top cop for all spectrum, not just RF? We have free space optics and laser links that are critical infrastructure right now. And so destructive interference or harmful interference could be a dust storm. And so where does that fit into, how we protect communications in general.

[00:56:40.19] PAUL STEINBERG: I want them to give tickets to the people whose headlights are too bright. That's interference-- optical interference.

[00:56:47.80] JOHN CHAPIN: So, yes. So what about protecting the future growth towards much higher frequencies, terahertz and optical. Do we see a role there or a problem that we should be looking at? All the sensors, many of them are optical as well. Do they run into these kinds of problems as well?

[00:57:04.44] JADE MORTON: Are you looking at me?

[00:57:05.02] JOHN CHAPIN: Yeah, I'm looking at you whether the optical sensing community is already seeing interference issues.

[00:57:11.28] JADE MORTON: Not that I'm aware of. Yeah, it's harder to jam optical system. However, you will have additional natural phenomena. The troposphere is going to be a problem now. The particles in the air will become a problem, yeah.

[00:57:27.08] JOHN CHAPIN: We have Julie Knapp in the audience, and he always gave these sage words of wisdom, which is wait until you can see the problem before you start doing things to try to solve it because you might be going after a problem that doesn't really exist.

[00:57:39.92] MARCUS HOLZINGER: I'll briefly just add to that the fun thing in the space world is that we often use laser comms and other fun things like that. And we often have imagers up on orbit looking down. And so one person's laser comm is another person's dazzling device. And so the thing I will say is that they do interact with one another in terms of dual use capabilities.

[00:58:01.20] JOHN CHAPIN: Yeah, could you hand the mic to Julie for a second. He had his hand up to reply to me, taking his name in vain.

[00:58:07.74] AUDIENCE: Sorry, John, that was just a spasm.

[00:58:09.40] [LAUGHS]

[00:58:11.26] No, just a quick comment and I think Dale will appreciate this more than anybody, because for years we've talked about the rising noise floor. And the question that I think I understood here was, well, why don't we do something about quieting down the noise and all this. It's because everybody thinks it's somebody else who's causing the problem.

[00:58:30.06] And if you were to look because everything that's electronic radiates in some way. And so you've got the problem of where does the support come from to tackle that issue. Because it's a soup and nobody believes that they're part of the generation of the soup. And there's the trade off of the costs and the benefits.

[00:59:00.41] I'd also just add that we often have these very ferocious arguments about out-of-band emissions. The noise is generated by me. And it usually comes down to I've always been at this level forever and I've never bothered anybody. Yet where's the drive for better filtering? Because essentially what you're doing is asking somebody else to pay for or research or in some cases, go beyond the limits of what can practically be implemented. So you can do the important work that you do.

[00:59:40.70] As I struggle with it, particularly listening to your points. These are all important, but it's got to feel like, gee, the whole world is collapsing around me and I just want everything to be further away.

And yet there's this drive for more and more stuff across the board that does wonderful things.

[01:00:01.76] So the tough problem here, I think, is kind a combination of what's technically viable and what costs and what motivates it, other than the general population of everybody just getting louder. What do we do about it? Because I haven't seen over the years, drivers, yeah, let's do this.

[01:00:25.12] And it really would take a lot of support by everybody to say, this is a collective issue. And it's really hard to economically show the benefit of it, to say, if I reduce my emission, which I don't think has bothered anybody by another 10 dB it'll make the world a better place, so that we can do more of the good things that we're all trying to do. Is that good enough, John?

[01:00:58.59] JOHN CHAPIN: Yeah, that's a great point. So I mean, I think that-- I'm not an economist, but I think the term is collective action problem where the costs and the benefits are distributed to different people. And we have to figure out how to all do it together. Any thoughts on this, whether it applies to noise or just to protecting ourselves against security threats? All right, I think we're going to have to add that one to the list, important issue. There was another hand I thought I saw from Joe over there.

[01:01:29.67] AUDIENCE: Hi, Joe Carey. So about 20 years ago, I realized that the shipping port industry had standardized on Wi-Fi in the container yard. And I got a call from port Charleston, South Carolina, and they said, hey, can you help us with our Wi-Fi? And I was like, you guys are nuts using Wi-Fi in a shipping port. That's critical national infrastructure. Why aren't you using something else? And they went what else should we use?

[01:02:04.69] And I think that's a legitimate question. And today you might say CBRS, and CBRS is good, but you got to turn it off when a Navy ship comes by. And so you probably would consider that a risk. And so I guess the point or the question I'm asking you is what else? What would you have people do for critical national infrastructure?

[01:02:37.48] PAUL STEINBERG: Yeah, I think you're right. I don't know that CBRS is the answer for a port, obviously, for the reasons you enumerate. But I think you need to think a little bit more about technologies that maybe have a little bit more stringency in the access and control of the access. So 3GPP technology, to expand it a little bit, might be a more appropriate choice there. I think you have to think a little bit more carefully, maybe about band allocations.

[01:03:04.28] And the thing about the port that is maybe it's not going to actually interfere with itself, or it's not going to have other tenants there that They're going to interfere with it.

[01:03:13.18] AUDIENCE: [INAUDIBLE]

[01:03:13.96] PAUL STEINBERG: Yeah, OK, so you had people throwing up access points within the point. Yeah, OK, so that's part of the thing that you have to pick a technology where that just doesn't happen. And so I tend to agree with you. I think for something like that if it can't manage around it itself. And I think you have to find a more purpose built technology.

[01:03:31.16] JOHN CHAPIN: In other nations, like Germany, I'm aware of and there's been proposals elsewhere. They have a category-- they have a band set aside for locally licensed wireless, where if you own the geographic plot of land, then you have exclusive right to use this band in that area or to deny others the right to transmit in there. So if you were a port, you would be able to deploy a 3GPP system in that band and know that you'd be protected from interference, or that you could cause people causing interference to turn off. So maybe that would be something that we should move forward with something like that in this nation for our critical national infrastructure, to provide the ability to run those kinds of systems, in response to the young lady's question from earlier, privately owned critical infrastructure, like the thing that keeps the port running. Yeah, let her.

[01:04:20.47] AUDIENCE: Oh. This is also in response to I think she's gone. She had class, I hear. But on the note of critical infrastructure and collaborating with private and public ownership, the state of Colorado has initiated, this just a plug to my employer. But the state of Colorado, Colorado Information Analysis Center, which we call the CIAC, has started a initiative called the whole of state critical infrastructure subcommittee.

[01:04:51.22] And it is a sort of cross-functional committee that includes a lot of folks from private industry, including telecommunications provider Xcel Energy, railroad companies, anyone that has a stake in critical infrastructure as well as public entities.

[01:05:05.60] I'm a member myself representing the communications infrastructure, and we're also involved with the Colorado National Guard and have been used as a sort of example case by the federal government for a model for one way that organizations can create a structure ahead of time prevent, manage, and respond to incidents affecting critical infrastructure. So plug over. You guys can Google it. I don't have any cards or anything, but--

[01:05:42.32] PAUL STEINBERG: Sort of like get the adults in a room and talk it out kind of thing.

[01:05:44.30] AUDIENCE: Yeah, sure.

[01:05:44.66] PAUL STEINBERG: I think it's a great idea.

[01:05:48.94] JOHN CHAPIN: Yes.

[01:05:51.24] AUDIENCE: Oh, just want to add on to that other conversation. So virtually the 400-- more than 420,000 base stations

deployed in CBRS, so virtually all 3GPP, LTE, or 5G. So it's not that they are lower power. Also, the top 50 megahertz of the CBRS band has no Navy, so there's no risk.

[01:06:15.70] The Port of Los Angeles swears by-- they say it's working great for them, and they're kind of equally at risk. I think the Navy radar channels that you have to move off of if you're in pal spectrum, the lower part of the band. Those are 20 megahertz typically. So it's not like the whole band is unavailable at any given time.

[01:06:40.87] Even saying that, we obviously need more CBRS type sharing spectrum. And John, as you said, Europe's been following us on CBRS, but doing it a different way, mostly in the upper 3 gigahertz and the UK, for example, much more than 150 megahertz, France, Germany, Sweden, Japan, other countries. So that's something we're going to need for enterprise IoT for sure.

[01:07:08.39] JOHN CHAPIN: Cool. OK, so I'm looking for one last juicy question for one remaining thing. We have Richard with his hand up down in the front. Let me just check anything online that would take priority. No, OK, so we'll take Richard for the last question and then we'll get everyone a chance to respond to it.

[01:07:26.23] AUDIENCE: So the revelation I've had from listening to this panel on the previous panel is that there seems to be-- there's kind of an implicit bias in the way people think about wireless networks, where we consider transmission to be more important than reception. And I think that's fundamentally an error because it prevents us-- a lot of the problems that we're facing today are coordination problems, because so many people have Wi-Fi or Bluetooth or whatever, that we need to coordinate with our neighbors to select channels to use and to modify power levels, and to actually just optimize the performance of the network within an area that has multiple operators.

[01:08:12.10] So what would it-- would it be beneficial to place more emphasis on systems that do sensing and classification of the data streams they can observe in the RF domain and to push-- I mean, Wi-Fi alliance is doing this, finally, in Wi-Fi 7. They started to pay some attention to inter access point coordination. And that's actually a much bigger feature of Wi-Fi 8. That's one of the reasons Wi-Fi 8 hopes to be more reliable than the previous generations. Is that a productive direction to go in, do you think?

[01:08:55.81] JOHN CHAPIN: Sure, so going from coordinated operation to, I'd say, coordinated protection, having this be something that's not just the spectrum force coming in from outside, but we're all doing it ourselves together, democratic spectrum security. What do we think?

[01:09:14.41] PAUL STEINBERG: Sort of self-organizing network concept.

[01:09:16.47] MATT ALEXANDER: OK, self-organizing protection.

[01:09:18.11] PAUL STEINBERG: Yeah, makes sense. I mean, it's done in the cellular industry to some degree already. So there's no reason why it couldn't scale down.

[01:09:26.35] STEPHEN MEER: So I signed up for that in the notion of public safety under normal circumstances, not post-disaster, mid hurricane, forest fire, public safety power shutdown, other sorts of things. You need to have a fail soft environment that assures that the public safety folks still have their ability to effectively do what they need to do.

[01:09:51.75] JOHN CHAPIN: Any comments from the other end?

[01:09:53.39] JADE MORTON: I think that's a great idea. And also, I really think AI need to play a role in it because now you have so many different sources how do you know who should be there, who shouldn't be there doing what. Yes, excellent idea.

[01:10:06.23] [INTERPOSING VOICES]

[01:10:08.55] MARCUS HOLZINGER: The only smart thing I'll say is that the spectrum force can share an acronym with the Space Force.

[01:10:14.85] JOHN CHAPIN: Do they get the silver boots? All right, that's great. We are out of time. That's fantastic. Join me in thanking this panel for the diverse perspectives--

[01:10:22.51] [APPLAUSE]

[01:10:23.23] --on our emerging landscape and security.

[01:10:25.25]

Resilience by Design: Synthesis and Open Discussion

https://youtu.be/xiYlu-p18qs

[00:00:00.20] JP DE VRIES: --what surprised you? What we've missed. What are the good research questions? What are the things we should be thinking about for the next conference? So with that, let's move to the presentation by Nurul Mahmood. Over to you.

[00:00:16.76] NURUL MAHMOOD: Thanks, so good afternoon, everyone. My name is Nurul Huda Mahmood. I'm from the 6G Flagship research program at the University of Oulu, and thank you for inviting me to participate and to talk at this conference. It's my pleasure being here.

[00:00:33.76] Today, I'm going to talk a little bit about this Resilient-by-Design framework, especially focusing on future wireless networks, but, of course, this framework is general, and it can be applied to

different systems. I have about 10 minutes or so, so I'll try to keep my time within that limit.

[00:00:55.96] So a little bit about Oulu just to brief you, for those of you who are not familiar. So Oulu is a city in the north of--

[00:01:02.98] JP DE VRIES: They're over here. They're on the sides.

[00:01:04.08] PETER TENHULA: OK, good. Sorry for the interruption.

[00:01:05.74] NURUL MAHMOOD: Oulu is the city in the north of Europe, and it's one of the largest cities in the north of Europe, actually, and the university is fairly young. It's about 65 years old, and about mid-sized university with 14,000 students and 4,000 staffs, and our research strengths are mainly focused on ICT and digitalization, health and well-being, and materials and space.

[00:01:29.94] A little bit about this 6G Flagship research program, so this is the world's first and the largest academic research program on 6G. Research in this program is focused on four different strategic research areas that is wireless connectivity, devices, distributed intelligence, and then services and applications.

[00:01:52.70] This picture is just to highlight that we're not doing research only on the technological aspects of 6G, but also on, for example, business model regulation and sustainability, so it aligns well with this spectrum research going on at Silicon Flatirons.

[00:02:09.36] So we have been researching 6G, and here is let's say, somehow the main drivers of different wireless generations from 4G up to 6G, but what happens after 6G? So after some brainstorming, somehow we came up with this statement that we believe beyond 6G, so wireless network after 6G will be mainly focused on resilient and sustainable AI-driven society, so basically delivering value to this society.

[00:02:37.22] So here, you can see resilient is one of the key words for next or beyond 6G wireless system, and let's talk about resilience for the rest of this presentation. So firstly, what and why? Why do we need resilience, and what it is?

[00:02:52.46] So resilience, there are many different definitions of resilience, but the one that we have adopted is that resilience is the ability of a network or a system to continue operating correctly during and after a natural or man made disturbance, and here, we may highlight that most of the time these disturbances are unknown or unpredicted disturbances.

[00:03:16.18] So resilience has two aspects. Firstly, maintaining quality of service in the face of disruptions. Basically, how do you continue to deliver service even in the face of disruption? And the second thing is the quality of remediation or recovery. That means once a failure happens, once you have a degradation, how quickly and how well can

you recover, jump, or come back from this failure back to the normal state?

[00:03:45.18] And most often or sometimes resilience is mistakenly used synonymously with these two other terms, reliability and robustness, but actually, they are quite different, as you can see from this figure here, so resilience subsumes these two other aspects.

[00:04:01.36] Reliability is the ability to perform as required for a given time interval, so basically, it means that how well can you deliver a certain service? On the other hand, robustness is defined as the ability to continue operation in the face of known challenges, so basically, a robust system is a system that caters to some known failures like some failure that you know it can happen and you make a system robust against those kind of failures.

[00:04:32.12] So we have talked about what is resilience, and let's quickly see why is it important, or why do we need to talk about resilience? So firstly, resilient by design has been designated as one of the common design principles for 6G and beyond 6G, so this was a statement that was endorsed by more than 10 like-minded nations, including the US, where they have defined resilience along with two other things as one of the main design principles for 6G and beyond 6G network.

[00:05:03.78] Why is resilience so important? Of course, there are many reasons, but I want to highlight four here. So first, because systems are becoming more and more complex day-by-day, and that means you have more sources of failures, more variation in the failures and so on.

[00:05:20.98] Secondly, you have this increasing unpredictability. It can be because of adverse weather effects, that extreme weather events are happening more and more frequently nowadays. It can be due to geopolitical tensions and other factors, so you have more and more sources of failures and unpredictable in the network.

[00:05:40.98] Third is this technological interdependence, so we have multiple systems, different systems that work very closely with each other. For example, the communication network depends a lot on the energy network, so you have this interdependence between different systems, which also is a source of problem.

[00:06:02.13] And finally, shifting paradigm from prevention to adaptation, so previously systems were designed to be let's say, bulletproof, fail safe, whereas now, we have accepted that failures will happen, and then we are looking into how we can make systems that adapt to these failures and that can overcome these kind of shocks and recover quickly from such disruptions, so this basically, highlights why we need to talk about resilience.

[00:06:31.49] In the next part of this presentation, let's see a little bit about how do you make a system resilient? Of course, this is not the solution to all the problems, but this is just one proposal that we have put forward in this publication, which you can see here, which gave a framework on how to make systems resilient by design.

[00:06:51.51] So here, we have four aspects, and let me go through them one by one. The first part is prediction, so basically, prediction means that we need to employ advanced techniques to monitor and predict different failures.

[00:07:08.27] If you recall, we have said that resilience also-- we need to make a system resilient against unknown failures, so we need to be able to predict when let's say, known failures happened, but at the same time also detect when an unknown failure happens.

[00:07:24.95] And here, we have proposed or we have outlined three different approaches that can be taken. The first is model-based approach. Basically, using our extensive domain knowledge to predict such failures.

[00:07:38.03] Secondly, data-driven approaches, so basically, using these advances in AI techniques, for example, machine learning techniques, or time series models, and so on, to predict and detect failures, and third is using advanced techniques, for example, integrating digital twins with the real-life system so that we can monitor the system behavior in real-time.

[00:08:07.09] Second is preemption. Preemption means that once you have detected a failure or once you have predicted a failure to happen, we can take pre-emptive measures so that this failure does not happen, so we can try to take proactive action to prevent this from happening.

[00:08:24.05] And here, for example, you can take proactive resource management techniques. We can employ network routing resilience, so, for example, proactive routing for predicted node failures, or also from the security perspective, we can take some preemptive measures, for example, Zero Trust Architecture, where you have continuous authentication and authorization for all devices to prevent security mishaps.

[00:08:52.79] The third part of this framework is the protection part. That means once a failure happens, because we know that we cannot make a systems fail proof, so failures will happen, how do you recover from this failure? So this is the quality of remediation or quality of recovery that we talked about earlier.

[00:09:11.67] And here, we have outlined four different strategies, so, for example, isolation mechanism. These networks are evolving towards this network of networks architecture, where networks are built. You have sub-networks as part of the bigger network, so if a

failure happens in one sub-network, you can isolate that network so that the failure does not propagate to other parts of the network.

[00:09:35.27] We can also have differentiated service level management, so you can have different levels of service, so if a failure happens, you may not be able to deliver the complete service, but you can deliver partial service and still keep some services ongoing.

[00:09:51.05] Then you can have this traffic engineering, so, for example, how do you prioritize this critical and delay sensitive services? And lastly, you can have novel network architecture, for example, integrating aerial networks like drones and apps so that you have a different layer of the network as a redundant layer.

[00:10:11.69] The final part of this framework is the progression part. That means this is the part that says that how do you continuously learn and update your system based on what is happening? And here, we can have dynamic model updates, so basically, updating the parameters of the different models or adopting new tools.

[00:10:28.57] We can also have refinement, for example, integrating new observation data and also applying transfer learning to transfer the model learned in one system to another system, and finally, we can have holistic assessment, for example, like continuously keeping track of the key performance indicators to monitor how the system is performing and also looking into these trade-offs, because whatever system we design will have different trade-offs, so trying to optimize the trade-off on the go.

[00:10:56.91] So with this 10 minutes that I had, I just tried to answer these three questions here, so first was resilience. What is resilience and why? Second is, how do you ensure this resilience? So these are the three things that I covered, or wanted to cover in this talk.

[00:11:14.99] So to summarize, we can say that resilience will be a critical defining feature of future systems, including wireless system, but, of course, not limited to that for different systems, and network resilience aims to maintain an acceptable level of service even under unpredictable and challenging conditions.

[00:11:35.91] So basically, when we say that a system is resilient, we want to make sure that this system is able to deliver the service that it wants to deliver, even when you have some sort of failures.

[00:11:47.33] And here, of course, we had one solution or one proposal for a resilient by design framework for systems, which had these four steps prediction, preemption, protection, and then progression.

[00:12:01.85] And finally, I would say that resilience is a cross-disciplinary topic, so it cannot be solved by one discipline by itself, so we need interdisciplinary collaboration in research to solve this, let's say, major or this big research problem of resilient or designing

resilient systems. With that, I would like to conclude and thank you for your attention, and I'll be happy to take questions, if you have any. I hope I was not over time.

[00:12:30.69] JP DE VRIES: That was great. Thank you very much, Nurul. And just for those in the audience who want to follow up, there is the 6G resilience white paper. You had the QR codes, and also for the more technical drill down, there was a paper by Nurul and his collaborators in IEEE communications mag. So turning it over to John and Peter, do you have any thoughts or questions for Nurul?

[00:12:55.79] PETER TENHULA: You go first.

[00:12:56.33] JOHN CHAPIN: OK. Yes, Nurul. Thank you so much. I really appreciate you sharing this with us. The framework is general and extremely helpful, and while you're going through it, you were talking about it at the level of an individual network, but in my mind, I was thinking that the regulator also does this. At the overall spectrum ecosystem level, they're predicting and preempting and protecting and progressing.

[00:13:18.67] And so there's two of these loops that are happening at different time scales, but actually, there might be some synergy, some ways that the regulator could do things, establish conditions that make it easier for the network to do this and things the network could do to help the regulator.

[00:13:33.03] So I'm wondering if that discussion is happening in your broader project or in Europe, that interaction towards resilience, between the network design and the regulatory environment. I'm just curious to hear what's happening or thinking about that. Thank you.

[00:13:51.65] NURUL MAHMOOD: Thanks, John. So that's a very interesting question, and, of course, that's a very valid point that you have this outer loop, where things are happening at much slower time scale, and then you have this somehow inner loop of the system, where things are moving at a much fine grained time scale.

[00:14:12.65] I would say that this discussion is something that would be very useful, but unfortunately, as far as I know, maybe I'm wrong, it's not happening at the level that we would like it to happen.

[00:14:23.89] So basically, you have that's the regulators imposing something, and then that is stagnant, or that is somehow fixed for a longer duration, and then the system and the network is trying to adopt or develop itself within the framework given by the regulator, but this going back and forth, communication is not happening at the level that we would like it to happen, I would say that.

[00:14:56.71] Yeah, this is something that needs to be done, but probably still we have something to do about it.

[00:15:03.83] JOHN CHAPIN: Thank you.

[00:15:04.49] PETER TENHULA: Hi, Nurul. This is Peter Tenhula. My question is general in the sense of how you apply a framework like this in maybe other contexts, especially we are talking here about other more systems that are more critical than consumer level wireless, no offense, but my question relates to where does this take place? Is it from a business standpoint? Is this a carrier that does this internally, or is this something that happens among carriers in federation of problem solving that goes on, or maybe even a third party?

[00:15:59.06] NURUL MAHMOOD: Yes, that's also a very nice remark, so thanks for your remark. I would say that this framework that we have proposed here, of course, it's a academic paper, so it's very abstract still, and this general framework can be applied at different levels.

[00:16:20.14] It can be in one system, as you said, or it can be across different carriers, and also maybe a third party that maintains this, or, at least, that maintains some of the blocks of this framework.

[00:16:33.62] So the actual implementation of this framework is still open. Here we have just approached it from a very academic perspective and trying to see how we can design a system to be more resilient.

[00:16:48.84] And the other point that noted here is that this is, of course, we're not looking to extremely critical features or extremely critical networks. It can be like, for example, you can have industries that require very mission-critical service delivery.

[00:17:08.88] There the design objectives might be a bit different, so we need to think a bit differently here, but what we have proposed in this presentation and what we have talked also in the paper is a more generic framework that is, I would say, more for the consumer level, but if you have other systems or other networks where you need to deliver critical services, where, for example, some aspects of the service delivery is more important than others, then, of course, you need to adapt the system for that.

[00:17:42.18] JP DE VRIES: Thank you very much, Nurul. I have many questions. I'll just ask one, which is given the time that you have, you weren't really able to speak to it, but it's something that you discuss in some depth in your white paper.

[00:17:57.34] 6G has three other key design goals, and they are resilience, efficiency, and sustainability. Presumably, there are trade-offs between those. Can you talk about the trade-offs between resilience and efficiency? Is it a zero sum game, or does increasing resiliency help with the others?

[00:18:23.46] NURUL MAHMOOD: Yes, of course, there's this trade-off between resilience, sustainability, and efficiency, so they can be seen as let's say three corners of a triangle that makes, let's say, 6G. Now,

which part of the triangle that you want to focus on depends on what service you want to deliver.

[00:18:44.24] As you know that starting from 5G, actually, wireless communication had a paradigm shift. So up to 4G, basically, wireless communication was mostly focusing on consumer services, so basically, delivering higher bit rates and so on, but 5G introduced the notion of this multi-service communication, where you have URLLC, like ultra reliable low latency communication, you have machine type communication, and also you have the conventional broadband communication.

[00:19:12.28] So moving to 6G, of course, this multi-service paradigm will continue, and here, then which part of the trade-off that you want to focus on, it also depends on which service you want to deliver.

[00:19:24.40] So if you have certain services, for example, if you want to provide the connectivity in a factory that requires very high quality of service, then you will maybe focus on resilience more than sustainability or efficiency, because cost may not be your primary design goal here.

[00:19:44.76] So this trade-off is very much application-dependent. It depends on which application, or which service you want to serve, or deliver. And also the question about the zero sum game, that I can't say for sure, because I don't have sufficient knowledge to say that, but, of course, if you want to focus on something that you may need to pay a price in terms of the others, but if a system is very well-designed, then having resilience would also mean more efficiency, because one of the aspects of resilience is that you deliver the service the level that is needed, so you will not over-engineer or over-provision a service.

[00:20:30.06] Of course, that then leads to efficiency, so if it's done well, then, of course, one aspect will benefit the other, but exactly how this happens, it's, of course, I don't have enough expertise to talk much about that.

[00:20:44.20] JP DE VRIES: Thank you very much. We'll let you go. It's very early. We really appreciate that you spent some time with us, and we hope we can actually host you here in Boulder in person in the future. Thank you very much.

[00:20:58.50] [APPLAUSE]

[00:20:59.36] NURUL MAHMOOD: Thank you.

[00:21:00.02] [APPLAUSE]

[00:21:02.96] It's my pleasure to be here, and thanks for the invitation.

[00:21:06.36] JP DE VRIES: So turning to our two moderators, and then we'll turn to you in the audience for your reflections on what we've been talking about, and what the key takeaways should be.

[00:21:19.36] JOHN CHAPIN: Yes. Well, just a very quick thought on this morning's-- we were asked to reflect on each other's panels, so when I think about the lessons from the airwaves, Peter's panel, I hear a common theme coming across many of the examples is just the critical importance of information gathering, and I'm wondering if that might lead to a path forwards for us as a nation.

[00:21:45.44] So I'll be a little more specific. I think of things in terms of the old OODA loop-- observe, orient, decide, act, so observe is you're gathering the information, orient is you're figuring out what it means, which in this case would mean interpreting that RF data, decide is deciding whether something is actually a problem, and if so, what you're going to do about it, and then the action is carrying out that enforcement, or mitigation, action, or whatever.

[00:22:07.42] We're in a world where we have very limited resources to mitigate and enforce. That will probably be true for a long time, and we have a very large and complex environment with many things going on.

[00:22:17.04] And I heard many examples, where basically, the real challenge and the real goal was to neck down to what are the things we should actually try to fix? So Julie said, hey, when there's interference, the first thing you got to do is find out, is everything playing by the rules? Are things operating where they shouldn't? Are things operating at too high a power? That's fundamentally an information gathering and orientation problem before you even get into any enforcement.

[00:22:40.78] Jeremy told us that field offices get over 1,000 complaints a year, but many, or maybe even most are not actually interference. Those are defective devices or bad configuration. And Henning told us that, certainty of enforcement is often more important than severity.

[00:22:58.60] Well, the way you get to certainty is by having fairly comprehensive information gathering so that when somebody does step out of line, you can actually give them that very cheap camera ticket or whatever, but that's a pretty effective method.

[00:23:11.18] So I wonder if it would be reasonable for us as a community and a nation to maybe not think too hard about new methods for the back half of this, which is the deciding whether we're going to enforce and then enforcing or mitigating. Maybe we just rely on existing mechanisms for that for a while, and we really focus on getting super good at the observe and orient challenges.

[00:23:36.16] Let's respond to Henning's comment about scaling up and using digital systems. Let's take advantage of digital license plates. Let's figure out how to crowdsource, as Jade was talking about. Let's figure out how to solve privacy issues and maybe create new regulatory structures that allow us to do what we need to do.

[00:23:54.96] That's the message I was taking from all of those experience is, let's focus on the observe and orient challenges first, make rapid progress there, and then come along later with better solutions at the back end. Over to you, Peter.

[00:24:07.22] PETER TENHULA: All right.

[00:24:08.94] JOHN CHAPIN: Wait, was somebody speaking?

[00:24:11.58] PETER TENHULA: Hello. Oh, it's an echo in the Canyon.

[00:24:17.75] [LAUGHTER]

[00:24:19.46] Hello.

[00:24:22.82] JP DE VRIES: Observe.

[00:24:24.50] PETER TENHULA: God, we even hear Julie.

[00:24:26.26] [LAUGHTER]

[00:24:29.44] I think we've been invaded by--

[00:24:34.60] JP DE VRIES: It's the zoo.

[00:24:38.75] [INTERPOSING VOICES]

[00:24:45.64] PETER TENHULA: Oh, OK. What was it? Oh, what was oh? Oh.

[00:24:53.78] JP DE VRIES: No, no, no. In my case, it was oh, oh.

[00:24:57.21] [LAUGHTER]

[00:24:58.36] PETER TENHULA: My key takeaway or of real question from John's panel was, what really needs to be resilient? I think that Paul talked about the must haves. We had a few of the critical users. Some say, it's critical infrastructure. Here, we had public safety represented the weather and the scientific side of things.

[00:25:26.42] Also, national security was mentioned. If we had somebody from aviation, I'm sure they would raise their hand too to say, we're in that camp too. So my takeaway was that maybe that's the area of critical focus is that, where does the resilience, reliability, redundancy need to be?

[00:25:53.94] And I keep hearing on the reliability side, oh, we got to have five nines, and sometimes people say, oh, we have 10, nines, whatever. How many nines of reliability? But nobody asked them, well, how many nines do you have now? What do you think is the path to get to five nines?

[00:26:14.74] So we start with public safety as the preeminent, or GPS, or something like that. What is that path? So I would turn it back on them to really indicate, OK, you're critical. This is why, and this is a reliability that you need.

[00:26:39.05] And then ask, well, what is the role? Governance came in a couple times, what are the various roles? I didn't hear a role for industry standards organizations, is that something? Or third parties that maybe can supplement the role of-- I do get on emails from the UAS side, and there is a big effort within ANSI involving you and UAS standards, so I don't know if there's-- I assume there is an ISA or other groups.

[00:27:17.07] And then there's this-- I'll stop at that, because the other ones were just like side conversations they had afterwards that really, they rely on Wi-Fi? And then you say, hey, then what do you do about that?

[00:27:37.55] JP DE VRIES: Have you been in the hospital recently? It's mostly Wi-Fi and Bluetooth, and it's terrifying. So let's open it to the audience. Actually, before we do that, another plug for a paper.

[00:27:50.43] Dale recently posted a paper to SSRN. It's called "Challenges in Spectrum Operations," that really frames everything that we've been talking about. It's a fantastic paper. Please read it, and--

[00:28:02.99] PETER TENHULA: Systems engineering perspective.

[00:28:04.53] JP DE VRIES: The systems engineering perspective, and if you're an editor at IEEE ConLog, you need to-- anyway.

[00:28:10.29] [LAUGHTER]

[00:28:11.19] So we've got the first one from Henning, and then we'll work our way around the room. What are your takeaways?

[00:28:20.19] AUDIENCE: So one of the things for the resilience piece that you talked about is that one of the advantages-- two insights that I didn't quite hear. Namely, one is that we now have the ability for many systems to do self-provisioned resilience.

[00:28:37.13] As in, it used to be that if you were operating a piece app, just to take the public safety example that I'm fairly familiar with, while you relied on your local lec to provide the circuit, if you were lucky, they provide two redundant circuits that were actually redundant, as opposed to going through the same central office in Northern Virginia.

[00:28:59.84] But now, at least, on the transport side, you can provision relatively easily multiple commercial services that are largely structurally independent, in that you can put a satellite dish on your roof that will provide enough more than enough bandwidth for a PSAP.

[00:29:24.59] What is hard, however, on one part is that for a consumer, including businesses, to estimate the reliability of the service that they purchase is hard. We measure lots of things. We talked about that during the [INAUDIBLE] panel, for example, or the

broadband panel early in the day, and there's no indication on the broadband label how reliable your services.

[00:29:53.01] And increasingly, I would argue that I'd rather have a 100 megabit service that had more nines than a gigabit service that has 5 minutes of outage per day, because then I have to provision another service, so consumer, and I'll take enterprise disclosure, is a piece that seems to be missing. We need more information as a consumer that also encourages resilience.

[00:30:20.41] And the other piece I was missing was that many of the failures that have happened, like recent Verizon failures, many of the 911 failures, were not classical communication system failures. They were systems failures, some back end database, some who knows what went wrong in Verizon of software updates that went wrong, the Amazon data center outages, the Microsoft outages.

[00:30:48.89] So we need to design systems, where you can swap out not just for communication links, but the whole system. As in, I should be able, as a PSAP, to swap out that instead of going to West Intrado for my CCEP service, I need to be able to swap to a different service that is completely independent. Different data centers, different communication, different software, different vulnerabilities, and I should be able to do that within five minutes-- a multi-cloud version that people do now.

[00:31:22.27] That is the kind of discussion I think of that would broaden it beyond just the communication link, simply because that may not be where most of the problems are likely going to be.

[00:31:32.99] JP DE VRIES: Great. Thank you. Just to pick up on your resilience. We can get a label that says, what's the speed? One of the things that the 6G white paper on resilience does a very good job on is go through all the possible ways, all the possible metrics for resilience, and the answer is there ain't one. There's lots, and so that's another question of how we communicate that. Any other inputs, questions, suggestions? Yes.

[00:32:06.59] AUDIENCE: On the resilience framework talk, it seemed to be a lot of mentions of the known knowns, and as we write the cybersecurity and supply chain risk management plans for BEAD, it is based on the knowns or familiar framework from NIST, and admittedly, it's flexible and future proof, but as I also pay attention to Black Hat conferences, or DEF CON, or any others, they always seem to be a step ahead.

[00:32:32.97] And so what is a framework, or what is the resilience framework for the known unknowns, because it seems to be something that we're not expecting and fill in the blanks, all typhoon, or whatever that next one is. It seems to be that future risks, and so is there a framework for that, or how do you think about that as you write these plans?

[00:32:56.53] JP DE VRIES: Do either of you want to comment? Anybody?

[00:32:58.69] JOHN CHAPIN: At this point of the day, we be capturing these as interesting ideas for further discussion, because we've got about five minutes left to the official end, and we want to get as many on the table as possible, so if we have a few minutes at the end, we should talk about that, but otherwise, we should just be popcorning them.

[00:33:10.57] JP DE VRIES: OK, so--

[00:33:11.22] JOHN CHAPIN: That's a very interesting question.

[00:33:12.55] JP DE VRIES: So we have of 1, 2, 3. Why don't you go, Richard? It's easy. Sure.

[00:33:22.79] AUDIENCE: Thank you. So I guess I'm feeling a little bipolar. I feel like we've had two conferences pushed into one, so my brain is still in the iTrack, and now I'm on my old networking engineer track.

[00:33:37.01] And I feel like one of the things that was lacking in a lot of our panels was discussion around the role of AI, both on the opposing side and on the defensive side, if you will. We're in an arms race.

[00:33:57.35] We've got bad actors are using AI to determine new security threats and ever increasing the size of that threat landscape, and there are also amazing opportunities to use AI for some of the observability and monitoring that we discussed, some of the more efficient use of resources, and perhaps even the spectrum available.

[00:34:33.01] So anyway, that just feels like that was an area of focus that I expected perhaps to hear more of in this second part of the conference, if that makes sense.

[00:34:46.25] JP DE VRIES: That's a great point for future conversation. Yep, go ahead. No, go ahead, Richard. Yeah.

[00:34:53.73] AUDIENCE: I was at that resilience presentation. First, I was like, man. This is amazing stuff, and then I thought about it a little further, and it was like, this is what we were doing 30 years ago on enterprise network architecture.

[00:35:10.49] So if you were to put a panel together, say get four or five network architects, there were Nanog regulars, and get them to explain how they manage their enterprise networks, you'll find that's pretty much best practices already.

[00:35:29.91] That's not to say it was a bad presentation, because that's coming from an academic perspective, and the industry perspective is somewhat walled off from that, but it is that knowledge

is more widespread than people who are embedded in the policy space or in the regulatory space, realized.

[00:35:55.11] But it'd be good to bring some just have a panel of nothing but engineers talking about how they organize their networks and how they deal with threats and how they deal with scalability and how they do hot-swap upgrades and how they predict failing components before they actually fail. It could be really insightful. It could be very helpful.

[00:36:22.34] JP DE VRIES: Thank you. Yeah, and actually, just to amplify, or go back to the conversation John raised was with Nurul is like the conversation, not just the engineers, but the engineers and the policymakers around the same table talking about, well, that's what you do. Do you need us to do anything different mutually? So we had another one down here.

[00:36:45.58] AUDIENCE: Yes, thank you. First of all, all the talks this afternoon were great. I learned a lot, and I speak for a lot of folks, but one thing we don't hear enough about here is harm claim threshold.

[00:37:01.04] [LAUGHTER]

[00:37:02.45] And here's why I'm going to bring that up very quickly.

[00:37:05.08] JP DE VRIES: The check is in the mail.

[00:37:07.16] PETER TENHULA: The kiss up begins.

[00:37:08.68] AUDIENCE: Harm claim threshold for those of you that don't know, Pierre spent a good part of his career focusing in on that. I can't think of a better time to bring that out in 2026, to deal with the commissioners scenarios of resilience in a security domain.

[00:37:31.28] We heard from Jade and maybe some other environmental scientists. Their noise floors, or their signal to noise ratios aren't what ours are at 30, 40 dB and calm, and yet we're treating spectrum as if it's a homogeneous, one and done type of commodity or resource.

[00:37:54.26] And we need now to differentiate that and drive a more, I'm going to call it, variegated, if that's an appropriate term here. A more our differentiated form of resource so we're really managing it for resilient, security, maybe cost effectiveness, and other market domains, and your input from the harm claim threshold, thereof, vitally needed. Thank you.

[00:38:25.80] JP DE VRIES: Thank you very much, Rich. Actually, I'd like to generalize that, and I'll wrap up with a few thoughts of my own. I'm not seeing any more hands in the audience. No. It's harm claim thresholds is just a symptom, and the whole resilience conversation allows us to talk about receivers in a new way, because a number of people have said in the course of actually the conference and this

afternoon, it's not just the transmitter, so if you want a resilient system, you need to have a way, as a policymaker setting expectations, to talk about receivers.

[00:39:03.34] There's also another thing that's also been cooking away in this conversation, and it's in Dale's system engineering view, how do you characterize the system? If you want to talk about resilience, that's a system property, so how do you frame the expectations that you have as a regulator for systems?

[00:39:21.44] My last thought in terms of things I didn't hear. Many of the examples, and all the examples that we heard today, fascinating examples, but they were all, even though in some cases public safety was compromised, they seemed to be at retail. It's shoplifting rather than bombing a federal building, and so we haven't really explored the role of nation state actors. We haven't explored the role of the cumulative events, so I don't see any action in the policy space yet.

[00:40:02.90] My question is, what will it take? It will probably take-- actually, here's the image. We have a sand pile, and the thing with the sand pile is you keep adding grains of sand and nothing happens, but the possibility of an avalanche gets greater and greater, and then one day, when you don't expect it, you have an avalanche.

[00:40:24.34] So in the resilience, security space for wireless, we are going to have an avalanche. My challenge for the community is, what are you going to take to Washington, DC, the morning after when policymakers are saying, now, what do we do? As a community, we need to be ready with advice for them when the bad things happen that they know what to do next.

[00:40:51.30] So with that, thank you very much for joining us. Thank you very much to the organizers. I hope you've had a wonderful time in Boulder, and look forward to seeing you here next time.

[00:41:01.94] MODERATOR: Join me in thanking the panel.

[00:41:03.12] [APPLAUSE]