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2021 Spectrum Policy Initiative Conference | Frontiers in Spectrum Sharing

Day One Keynote

Thursday, September 9, 2021, 1:05 p.m. – 1:30 p.m. MDT

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Keynote Remarks Prepared After Delivery

Congratulations, Dr. Gremban! It's great to see that Silicon Flatirons is continuing to have such great leadership. I'm sure they are really excited to have you, and it will be great to see you leading our discussions in the future. Thank very much for the kind intro.

I'm really glad to be here with you all today on the 42nd day of May 2020. Like most of you I'm pretty sure, I've lost track of time and reality during this time, and it's just been a hard slog just trying to keep moving forward, but I'm glad to see that you're still moving forward. You're still bringing together discussions, thoughtful perspectives, fresh ideas, getting a debate going and new lines of research. I really do miss this real face-to-face dialogue during this period of social distancing. And I even miss more the after-session beer that you get to have with the panelists.

But we're all moving forward. We're all trying to move forward. It is not actually May 2020. We're already in the fourth quarter of 2021, and looking around, I'd talk less specifically about spectrum sharing and less about what Nokia is doing on the moon – although I'm happy to answer questions about that later. I thought I'd talk a bit about macro changes in the past few years – how views on globalization have changed and the rise of populism and activism. And ultimately how that's further accelerated by the pandemic. And then I was going to talk a little bit about how it impacts the world that we inhabit – on spectrum, innovation, and technology. What this all means for spectrum sharing. It seemed better suited to my wheelhouse. I'm not really an engineer, and I don't even play one on TV.

So let's say that we go through cycles of populism every so often. My friend Bruce Mehlman estimates that every sixty-odd years a wave of populism and then subsequent reforms recurs throughout American history. You see it in the civil unrest of the 1960s. It happened during the end of the Gilded Age with the calls to end the gold standard in the late 1890s, into the early 20th century. You might even argue that

the American Revolution could be considered the first American populist movement.

These past few years have definitely borne witness to some of the most shockingly clear articulations of populism – the election and departure of President Trump, the pro-Brexit vote, the Yellow Vest demonstrations in France or just think of any country in South America in 2017 or 2019.

Much of this populist sentiment appears to be due to globalization shocks. In short, it feels like the world is experiencing a giant collective hangover from the policies that have supported globalization.

Globalization – the notion of the free movement of goods, labor, and tech across borders under liberal agreements – really took off in the 1990s, when we saw the end of the Cold War, the economic liberalization of India and China as well as former Soviet satellites. We saw the creation of big multilateral institutions like the World Trade Organization ("WTO") and the European Union ("EU").

And don't forget that this is when the Internet was born and our ability to communicate across borders accelerated and expanded exponentially.

Globalization has had a lot of positive effects. Generally speaking, we saw, at first, what we expected to see -- a massive increase in the global middle class and fewer people living below the poverty line.

And just so you know, folks at the White House used to call me "Globalist Grace," and not in a friendly way. I'm not trying to defend or criticize these trends. I'm just trying to give you my interpretation of events.

The upshot was, though, that we came to realize that globalization didn't make everyone a winner.

For example, during this time, the 1980s and 1990s on, the gap between the rich and the poor really started to increase. Experts argue whether globalization really contributed to income inequality, but the fact remains that the gap increased during the heyday of globalist policies.
The Congressional Budget Office ("CBO") estimates that from 1979 to 2018, income per household grew 33 percent for the lower 80 percent of Americans. For the top quintile, however, income grew 99 percent. For the top 1percent of the income distribution, it was 218 percent.

Other trends probably feud fueled the perception of being left behind: rising trade pressure resulting from increased free trade; the financial crises – like the one that the U.S. and most of the world experienced in 2008-2009 or the fiscal austerity related to foreign debt exposure in multiple countries; labor competition from increased immigration (perceived or otherwise).

These all contributed to a sense of economic insecurity that perhaps has fed populism and activism not just here but across the globe.

Let's also remember that the work that we do as technologists, engineers, and scientists has also contributed to this period of anxiety.

Faster real-time communications, increased automation, greater computing power have contributed to efficiency gains that have also increased the pressure on the middle-class livelihood. The gig economy and part-time work accelerated with the advent of the app economy, which was enabled by 4G deployment. De-unionization and the scarcity of the traditional pension-backed, benefits-laden, full-time job came with those developments.

These are all again factors contributing to a sense of economic insecurity that fed a populist and a protectionist backlash that has now become mainstream.

If globalization shocks and technological advancement were already pushing us toward a more protectionist, populist agenda, I'd argue that the pandemic sealed the deal.

The shutdown of borders gave the world a flash cut to a disconnected international economy that exposed vulnerable supply chains in all areas. People have realized that the globalized world, built for highly leveraged efficiency, was ill-prepared to take on a crisis of this kind.

After all, resiliency and preparedness are ultimately at odds with efficiency. A back-up communications band is spectrum lying fallow. As one general explained: "I don't ever want to have to use it but I sure as hell don't want to be without it in case shit goes south."

I haven't mentioned China explicitly yet, and that's primarily because, in one way, the anti-China sentiment is just shorthand for the anti-globalist view.

China's rise coincides with the world's push toward globalization. China's accession to the WTO during the heyday of globalization had many experts claiming that China would become a liberal economy by 2015 and perhaps even a democracy.

I think we know better now. American businesses and liberal governments have faced a reality of continued trade deficits, state-owned enterprises, forced technology transfers, and the steadfast refusal to open the market for foreign enterprise. We saw a stronger and more aggressive China that took advantage of enforcement-free agreements to expand and grow.

It's true that it's important to realize that China has emerged as a major rival to the United States, but I also still think it's also useful to remember that this is about the reality of globalization.

After all, globalization was fine when it *really* meant "Americanization," as many people outside of the United States have pointed out. We have a harder time with the concept of globalization, if it actually means "Sinification."

It's been interesting to see that policymakers at this point are not interested in *changing* China but *coexisting with China*. The end game appears to be defensive and more containment-oriented (to pull a Cold War term). When I ask experts what our goals should be vis á vis China, one person who works with New America, said, "America has to get used to living with a powerful China." Another person – a U.S. Senator – said that we needed to "prevent China from winning." That's a very different sentiment from saying that the U.S. needs to win or that we will ultimately persuade China to become a liberal democracy and market economy.

If this is all true – that countries need to turn inward and focus on resilience and preparedness in order to be able to continue to fight off perceived threats from climate, from exposed supply chains, from pandemics, from adversarial countries, what actions should policymakers take?

We're seeing in the United States that both parties are realigning around the populist agenda. Leaders on both sides of the aisle are preaching that we need to regulate Big Tech, Big Banks, Big Companies; that we need to Buy American; that we need to control our borders; and that we need to invest in domestic industry and domestic technology.

Policymakers are looking toward is the role of technology in global leadership. And government wants in. Government wants a bigger role in technology and innovation.

And by the way, I fully realize the incongruity of saying this even though we still haven't seen the nominations for an FCC Chair or an NTIA Administrator.

Government wants a role in tech, but not just the tech and innovation that's used typically by the government for the military or for scientific research, but in the technology that's used in the commercial world. I think what we're worried about, to some degree, is "tech imperialism," the notion that a country can spread its influence through its dominance in commercial technology.

Maybe in the way that America has been able to be a significant leader in that respect for the past several years.

And in spectrum, "tech imperialism" particularly matters. No matter how hard any country turns inward, spectrum floats across borders. International cooperation will be necessary. Without cross-country dialogue, we risk interference at the borders, and we risk losing economic opportunity – how many F16s or wireless routers can we sell

if the rest of the world doesn't agree with our frequency allocations? This is just another example of how commercial tech is being co-opted into the realm of national security.

You've probably seen a number of efforts by the government to take a bigger role in tech in the news. Think about the oversight and monitoring of the influence that big tech has; the calls for increased antitrust scrutiny; the efforts to look deeper into supply chains; the efforts to collaborate more closely between private and public sectors, like the new mechanisms for monitoring progress like the cybersecurity safety board established in the recent Executive Order. Or greater review of research facilities and who's actually staffing them; or explicit guidance on permissible or impermissible components in equipment and just plain greater information sharing or spying.

On the plus side, there's the government checkbook. The U.S. Innovation and Competition Act, still in draft at the House after its passage by the Senate, captures our desire to secure technology leadership and industry here. It runs to the tune of $200 billion. The bill focuses on so-called strategic sectors: semiconductors, drones, wireless broadband, and artificial intelligence. It seeks to do everything from educating a tech-forward workforce to creating funds to counter Chinese investment in other countries.

(By the way, I did want to point out that the word "spectrum" appears twice in the nearly 1450-page bill. One of those times is just to talk about a "full spectrum of issues," so that one doesn't count. It's a little troubling.)

And while the United States has never conducted explicit industrial policy, it's no longer completely unthinkable. After all, this is the time for big changes. After the 50s and 60s came the Civil Rights Act. After the end of the Gilded Age came the Progressive era and the glory days of the labor unions and active antitrust enforcement. And if the U.S. goes into industrial policy, we'll see the rest of the world do even more of it.

But then, you all work in spectrum, and, very possibly, spectrum policy has been one area where the U.S. has come closest to ever having an industrial policy, despite the absence of the word in the Senate draft.

We all know the mantra: Spectrum is a scarce public resource, and the government has a compelling interest in ensuring its highest and best use.

Well, here's a secret that I think you all know. There is no highest and best use.

Not at the level that you all work at. GPS is just as important as weather forecasting is just as important as missile radars is just as important as mobile communications is just as important as research into the Big Bang. New and innovative services are absolutely necessary for

growth, but incumbent services are also absolutely necessary for stability.

Each of these priorities are important to a functioning society. Sure, sometimes we shift them, but there is never going to be a point where the choices will be easy or that we'll be able to easily choose a winner or loser.

Today, it seems that policymakers will likely seek efforts that will move the U.S. to self-sufficiency and preparedness. There is very little margin. Against that policy backdrop, it becomes much harder to repurpose federal spectrum for commercial use. Plus, we've made all of the "easy" decisions on spectrum already. (Although I think David Redl and Larry Strickling would not say that AWS-3 was "easy.")

This is why, essentially, the spectrum memorandum of 2018 requires the NTIA to develop a sustainable strategy for spectrum usage with a particular emphasis on advancing spectrum efficiency, i.e., sharing.

At least, that was the goal when I first started working on it in 2017.

The point of the memorandum was to take the focus off repurposing spectrum from the federal bands and move the ball on advancing sharing technologies. It was a recognition that more spectrum was not likely to come.

Instead, I really wanted us to think differently – about solving the problem. What was our desired end state? Ultimately, we should be able to take any device – phone, radar, automobile, tiny little moisture sensor by the soybean plant – and have it connect to whatever spectrum is available and work flawlessly.

Okay, so that's a pipe dream, but this is the time for big ideas. It's just as important now, as it was in 2018, to set us on the path toward determining how to make spectrum as abundant as possible. The memo was intended to turn us toward pulsing up our research into new spectrum sharing technologies. We wanted to know how coordination could be improved and information could be better exchanged – perhaps with less melodrama, among other things. We wanted to examine how older technologies used by government or the commercial sector could be phased out and the spectrum reformed.

Of course, by "us," that meant NTIA. Sorry to all of you from NTIA, who are here. You did have a ton of work. I would have tried to get you longer than nine months to write up a National Spectrum Strategy, but then I left government.

It would have been ideal to have NTIA lead a process to develop a strategy to increase the efficiency of spectrum usage and allocation for all of American society, not just government.

Ideally, I would have liked to see a strategy outlining several work streams, including a review of governmental uses (unclassified and

classified) with an understanding of services that might be prime candidates for upgrades to different technologies; a cooperative review with the FCC of underutilized bands, even in the commercial area, and possibilities for phaseout and reframing of spectrum; review of redundancy in government services (though, I suspect that this will be even less palatable now, given our current stance on emergency preparedness); possible technologies and candidate bands for sharing in both federal and commercial bands – and which spectrum sharing technologies might be good protocols to implement; and policy and technology measures to improve coordination of spectrum allocations.

Listing all of that, I'm sure NTIA is glad that someone else finished the memo instead.

I would have hoped to see a review of engineering efforts to make transmission more efficient – or perhaps a plan to review engineering efforts – with the cooperation of folks like you, here at Silicon Flatirons or at academic for or standards groups. I would have hoped to see a section on cognitive radio may actually help satellite systems use spectrum more efficiently. I would have liked to see a reprisal of the receiver standards question in the document. I know that the industry appeared to heave this giant collective shudder when the question was asked the last time back in 2012, but I am glad to see Commissioner Simington bringing the issue to the surface in such a thoughtful and deliberative way. It's a question worth exploring, particularly as the margins get tighter. And, like I've been saying, it is the time for big ideas.

Speaking about big ideas, maybe it is time to revisit harm thresholds. What do our product cycles look like now? With NGSOs and shorter lifecycles for satellite hardware, do we think we can implement evolving harm thresholds to get more use out of spectrum?

I would also have imagined that the memo would have included a review of possible improvements to spectrum access systems ("SAS") for tiered access bands, like the CBRS band.

I'm going to have to toot Nokia's horn a little; I think it's obligatory. Nokia has done a great deal of work in developing the radios and sharing architecture for shared use of the 3.5 GHz band. Using this architecture, you're seeing some budding success with the deployment of networks in multiple environments – like airports, oilfields, and congestion zones.

We can probably think of ways to improve SAS with different modes of integrating shared information. The new Incumbent Informing Capability system expected for 3.45-3.55 GHz allows for submitted information – not just sensed information which might eliminate a layer of work and minimize transmission delay. But coordination always introduces a kludge factor. I would have loved to have seen NTIA talk about how to minimize the kludginess of coordination to automate the

processes. Maybe, they could have talked about how to use artificial intelligence ("AI") in determining and possibly predicting patterns of use.

Everyone likes to bring up AI, I suppose. I did mention AI in spectrum sharing to the House of Representatives staff on the Science Committee as they were drafting their upcoming National Institute of Standards and Technology ("NIST") reauthorization. Just so you know who to blame if that does come up again.

I would have also liked to have seen suggestions for increased collaboration between the developers of different services. This is something that Mike Marcus and I have talked about in looking at spectrum above 95 GHz. I have to mention 6G, though I know some of you are throwing up a little bit in your mouths. As researchers are beginning to work on the next generation of commercial mobile communications, it seems to be the perfect time to understand the characteristics of services that coexist within the same radiofrequency and actually try to design for coexistence.

That's one of the good things coming out of this current discussion on radio altimeters in the C-band, at least in my opinion. The Radio Technical Commission for Aeronautics ("RTCA") is seeking to better understand the characteristics of 5G transmissions, so they can take those into consideration as they plan the next standards for the next generation of Radio altimeters. Certainly, the government's convening power could certainly help to produce that dialogue.

I'm not sure what the National Spectrum Strategy will actually hold. But with the amount of attention paid to the last rather spectacular spectrum battles, I suspect that sharing methods will be top of mind. And I hope there are big ideas in the strategy to shake this world up a bit and meet the challenges posed by times of crisis.

In the end, though, I think the single most important thing to bring back to the spectrum allocation process is trust. Without information exchanged between the potential coexisting services, sharing becomes impossible. Without sharing spectrum, it will be impossible to meet the challenges of the day.

During my debrief after WRC-19, policymakers talked to me about improving the spectrum allocation process – making it less uncertain and less chaotic. Staffers and others have floated the idea of turning spectrum over to a single regulator to make final decisions. That's a very understandable desire for finality and certainty; I'm sure there are ways to make it logistically and administratively feasible if legislated. And, as I've said before, this is the time for big ideas.

In the end, however, it's hard for one agency to make a call and determine what's going to happen for all of these incredibly important equities. What really does need to happen is for people to convene, without drama and fanfare, and have the conversation. They need to

talk about what is actually needed and what might be accomplished together, and that chaos of conversation could yield good spectrum usage improvements in sharing

That is ultimately one of the things that hopefully the government will turn its attention to: trying to figure out how to produce that kind of environment. I would highly recommend that they do this, maybe over a beer.

Thanks for listening to me, thanks for listening to my survey of thoughts over the developments of the times in the past few years, and how that I think that it might impact the work that you all do. I appreciate your time.