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Roundtable Report on the Emerging Governance Challenges Related to 5G

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On June 6, 2017, the Silicon Flatirons Center at the University of Colorado Boulder convened a roundtable discussion entitled "5G Wireless and the Challenges of Governance" in Washington, D.C. at the offices of Kelley Drye & Warren. The invitation-only roundtable brought together leading industry experts and public interest organization representatives[1] to explore: 1) the way 5G standards are currently developed, 2) the importance of public values being included in the 5G standards setting process, and 3) how public input and engagement with 5G standards setting bodies might be improved.

This roundtable report describes the discussion that took place, compiles questions raised for further research, and identifies potential limitations and solutions for improving public input in the 5G standards setting process. It is not a consensus document. The roundtable discussion followed a modified Chatham House Rule and no participant is quoted in this report without his or her permission.[2] This roundtable report aims to reflect the diverse views of the roundtable participants. Any opinions or recommendations expressed in this summary are those of the author and participants, as cited, and do not necessarily reflect the views of all participants or their institutions.

Introduction

Mobile networks are rapidly becoming the backbone of today's connected society. 4G mobile networks are bringing mobile broadband to millions of new users and devices. Watches, cars, tablets, and even unmanned aerial vehicles are now connected to the Internet via mobile networks. The advanced capabilities of networks based upon the 4G LTE wireless standard are facilitating ballooning demand for mobile broadband. Cisco estimates that almost half a billion new mobile devices and connections came online in 2016.[3] As demand for mobile data continues to explode, however, legacy 4G networks are becoming more and more saturated; with some suggesting that average data rates may be beginning to slow.[4]

By employing new spectrum bands, advanced air interfaces, and promoting spectrum reuse, network operators are planning for the next generation of mobile wireless.[5] Alongside improved performance for existing mobile customers, network operators hope that the combination of reduced latency, improved coverage, and increased bandwidth provided by 5G and

[1] See Appendix A for a list of roundtable participants and their titles and affiliations.
[2] Under the Chatham House Rule, participants are free to use the information received, but neither the identity nor the affiliation of the speaker may be revealed. This rule has been modified to allow participants to be quoted with their permission.
[3] *Cisco Visual Networking Index: Global Mobile Data Traffic Forecast Update, 2016-2021 White Paper*, Mar. 28, 2017, https://www.cisco.com/c/en/us/solutions/collateral/service-provider/visual-networking-index-vni/mobile-white-paper-c11-520862.html (last visited Jan. 8, 2018).
[4] Rani Molla, *Verizon and AT&T Customers are getting slower speeds because of unlimited data plans*, RECODE (Aug. 2, 2017), https://www.recode.net/2017/8/2/16069642/verizon-att-tmobile-sprint-mobile-customers-slow-speeds-unlimited-data-plan.
[5] Balazs Bertenyi, *3GPP system standards heading into the 5G era*, 3GPP.ORG, http://www.3gpp.org/news-events/3gpp-news/1614-sa_5g (last visited Nov. 11, 2017).

advanced 4G networks will allow mobile services to replace wireline networks as the primary broadband service for most consumers.[6]

Before 5G networks are deployed, however, international organizations will need to complete the standards that will ensure compatibility among the billions of 5G devices that will be deployed. The growing importance of mobile networks and the vastly complicated process of standardizing network technologies poses a key question: What public policy role should governments and public interest organizations play in the development of such critical technology?

The roundtable participants explored precisely this question. To provide a platform to begin discussion, Silicon Flatirons distributed Dale Hatfield's paper, entitled "Addressing Public Policy Goals in the Standards Setting Process: The Case of 5G Wireless Standards," plus a list of background material to all participants.[7] Professor Phil Weiser opened and moderated the three-hour, free-ranging discussion as participants explored how public policy goals might be addressed in the 5G standards setting process. This roundtable report summarizes the roundtable proceedings in the following three sections: I) What is 5G and Who is Developing 5G Standards?, II) Public Values in 5G Standards, and III) Public Input and Engagement In 5G Standards Bodies. The report concludes with a discussion of questions identified for further research and a summary of recommended steps going forward.

I. What is 5G and Who Is Developing 5G Standards?

Tom Sawanobori began the first roundtable session with a description of the technical characteristics of the emerging 5G standards and the process by which 5G standards are being developed. He reported that 5G wireless will build upon the current success of the 4G LTE standard. For the first time in the history of wireless technology, almost all national and regional operators in the U.S. are using the same 4G LTE technology platform. In fact, 4G coverage reaches 99.6% of Americans, and there are more than 250 million LTE subscribers in the U.S. The density of the 4G deployment and the economies of scale it provides enables a very robust ecosystem of devices to be developed, such as smartphones, tablets, and connected vehicles. 5G is evolving from this success. While LTE gives a wide broadband pipe to provide high-speed access, 5G will provide the higher speeds and lower latencies that could enable new devices, such as smart home and smart city sensors, fitness devices, and applications like enhanced virtual and augmented reality, digitally integrated infrastructure and transportation, and smarter manufacturing.

According to Mr. Sawanobori, 5G will provide the following three main consumer benefits:

1. 5G will be very fast, up to a gigabit per second;

[6] 4G networks are already blazing a path toward this reality as almost 13 percent of users employ a mobile device as their only connection to the internet. Monica Anderson & John B. Horrigan, *Smartphones help those without broadband get online, but don't necessarily bridge the digital divide*, PEW RESEARCH CENTER FACTTANK (Oct. 3, 2016), http://www.pewresearch.org/fact-tank/2016/10/03/smartphones-help-those-without-broadband-get-online-but-dont-necessarily-bridge-the-digital-divide/.

[7] See Appendix B for the roundtable's reading list and Appendix C for Professor Hatfield's paper.

2. 5G will improve network density, providing smaller cells with better spectrum reuse and improved network capacity; and
3. 5G will improve latency for real-time responsiveness, in activities such as gaming, vehicle-to-vehicle communications, vehicle safety, and robotics.

Like 4G LTE, 5G is being developed in the Third-Generation Partnership Project (3GPP), a global standards development organization. 3GPP develops standards "Releases." Release 8 launched LTE in 2010 and subsequent releases have brought new capabilities.[8] Release 13 brought in LTE-Unlicensed and better support for machine-to-machine applications.[9] Release 15 will be the first major release of "5G."[10]

Mr. Sawanobori noted that although 5G wireless has not yet launched, the International Telecommunications Union (ITU) has set out the following criteria for a 5G wireless standard:

- over a gigabit per second bandwidth;
- very low latency;
- very high density of Internet of Things (IoT) devices;
- reliability; and
- improved energy usage and battery life.

3GPP is seeking to build and release a set of standards that can fulfill these criteria by 2019.

According to Mr. Sawanobori, three key characteristics will enable 5G wireless:

1. standardization, to create economies of scale for equipment;
2. spectrum, to enable high bandwidth uses; and
3. multi-user-MIMO (multiple input, multiple output) technology that enables high-frequency spectrum to be used at longer distances.

II. Public Values and 5G Standards

Following Mr. Sawanobori's presentation, Professor Weiser asked Professor Hatfield to introduce his paper and discuss concerns regarding the incorporation of public policy values into the setting of wireless standards.

Professor Hatfield asserted that policymaking is an inherent part of standard setting whether domestic or international. For example, next-generation 911 and enhanced capabilities for spectrum enforcement, among other public-interest-driven functions, can be built into the standard at the early stages of its development. If, on the other hand, such capabilities are tacked on at the end, Professor Hatfield explained that the resulting network architecture may not adequately support those functions, and as a result, they may not be broadly adopted. A network architecture,

[8] Alastair Brydon, *Summary of 3GPP Standards Releases for LTE*, Wireless Blog, UNWIRED INSIGHT (Oct. 5, 2012), http://www.unwiredinsight.com/2012/3gpp-lte-releases.
[9] Dino Flore, *Evolution of LTE in Release 13*, 3GPP.ORG (Feb. 13, 2015), http://www.3gpp.org/news-events/3gpp-news/1628-rel13 (last visited Nov. 11, 2017).
[10] 3GPP.org, *Release* 15, http://www.3gpp.org/release-15 (last visited Nov. 11, 2017).

Professor Hatfield claimed, is thus an intentional or unintentional expression of policy. Mr. Sawanobori's presentation and Professor Hatfield's brief remarks led to a discussion about U.S. influence on the standardization and development of wireless technologies. Participants noted that despite the growing international market for wireless communications, U.S. wireless carriers continue to play an important role in the international standardization process and are intimately aware of the regulatory requirements of the U.S. market. Participants claimed that even if the standardization process is not happening on U.S. soil, U.S. wireless carriers help inform the functionality and capability requirements for the 3GPP standard-setting process, suggesting that the capabilities required by U.S. public policy are being adequately adopted at the front end of the design and standards setting process.

Participants also pushed back on the perception that implementing policy choices at the nation-state level is not technologically feasible. For example, U.S. wireless carriers have developed and deployed U.S.-only public safety features like wireless emergency alerts that were incorporated into revised 3GPP standards after the fact.[11] Similarly, the U.S. public safety communications network, FirstNet, will implement 3GPP standards to create an interoperable public safety network, reducing costs through international economies of scale while meeting the requirements of first responders.[12] Participants also noted that allowing too much customization could create a "jungle of different sub-standards" that would impede end-to-end interoperability. One participant expressed hope that the U.S. could continue to lead efforts to preserve a global notion of end-to-end 5G service with few country-specific modifications.

Other participants, however, pushed back on this rosy assessment of public safety in U.S. wireless communications, with one participant noting that the prescriptive nature of international standards can severely limit available options for public safety communications. Public safety officials may want peer-to-peer communications that enable devices to talk directly to each other for "shoot-don't-shoot" decision making. If network architecture standards established at the international level do not allow for flexible implementation, public policy choices made by U.S. officials may well be precluded or undermined.

The discussion next turned to whether civil society organizations have adequate access to international standard setting organizations. One participant noted that lack of specific notice about when and where 3GPP discusses a policy proposal impedes access by those civil society organizations with the resources to participate. Further, even if notice were available, a second participant noted the lack of funding and the extraordinary expense required to participate in frequent international technical working groups preclude many civil society organizations from contributing to standards setting. Participants also noted that lack of technical expertise within civil society organizations further restricts their participation. At many organizations a single technical expert may have telecom as one of their many assigned areas of responsibility. With

[11] 4G Americas, *4G Mobile Broadband Evolution: Release 10, Release 11 and Beyond – HSPA+, SAE/LTE and LTE-Advanced (Oct. 2012)* 159-163, available at http://www.5gamericas.org/files/8714/0759/2427/4G_Mobile_Broadband_Evolution-Rel_10_Rel_11_and_Beyond_October_2012.pdf.

[12] FirstNet, *Project Overview*, https://www.firstnet.gov/content/project-overview (last visited Nov. 11, 2017).

multiple standards setting organizations holding simultaneous technical discussions on related topics, the likelihood that that representative can participate, let alone track standards setting, is very low.[13] Similarly, many civil society organizations lack an understanding about the procedures and agenda-setting mechanisms of international standard setting organizations. At least one participant concluded that even the civil society organizations with appropriate technical expertise, funding, and knowledge of how to participate find it hard to make their voices heard.

In response, participants raised concerns that any attempt to make it easier for civil society organizations to participate would slow down the international standard setting process. At least one participant insisted that standards setting bodies already move too slowly and raising additional policy issues within these organization will create controversy that will further slow the standard setting process.

On the other hand, some participants noted that widely accepted and non-controversial policy proposals are already incorporated into the standards setting process. Companies participating in the standardization process are familiar with the policy concerns of their national markets and bring those policy concerns to the international standardization process.

Some participants pointed out that standards setting bodies are not the right place to try to resolve policy controversies because doing so runs the risk of encouraging companies to abandon the standard setting process and adopt instead custom solutions that can be brought to market more quickly. A participant noted that the industry is already getting around delays in the 5G process by simply accelerating deployment. Japanese and South Korean companies are using their first-mover advantage to drive standards toward their favored technological solutions.[14]

Alissa Cooper commented that when regulatory requirements are "brought in . . . by knowledgeable people who can articulate the relationship between what the public value is or what the requirement is and how that translates into the [technical] problem being worked on, that can be very powerful" and move the standards setting process along more quickly.

Finally, participants noted that the standards setting process, even if successful today, is becoming less relevant in an era where "so much architecture is being built by applications." The drive toward software-defined networks, participants claimed, reduces the need for network-level standardization and enables architectural changes to be made more easily after the specification is finalized.

III. Public Input and Engagement In 5G Standards Bodies

[13] *See* 3GPP Calendar, 3GPP.org, http://www.3gpp.org/3gpp-calendar (last visited Nov. 11, 2017).
[14] Monica Alleven, *Nokia, Ericsson mark separate 5G trial milestones in Japan, South Korea*, FIERCEWIRELESS (May 12, 2017), http://www.fiercewireless.com/wireless/nokia-ericsson-mark-5g-trial-milestones-japan-south-korea.

Alissa Cooper began the third and final session of the roundtable. She outlined a framework for assessing the accessibility by civil society organizations to standards setting organizations. Public input should be assessed along three important dimensions, she suggested:

1. participation, who can contribute;
2. transparency, who can find out what is going on; and
3. decision making, who has the final say.

Regarding participation, Ms. Cooper noted that organizations have adopted a spectrum of models. Some, like the ITU's Telecommunication Standardization Sector (ITU-T), require membership for participation, while others, like the Internet Engineering Task Force (IETF), allow anyone to participate just by being present at meetings or contributing on an electronic mail list. The 3GPP, Cooper noted, largely requires a membership to participate, but makes it easier for some non-profit organizations to join via discounted pricing.

Transparency, Ms. Cooper claimed, offers an important route to influence for players that are not members of standards organizations. With transparent processes, non-members know what is happening as standards setting decisions are made, which allows them the opportunity to try to influence members by applying pressure at the right time when an important item is being discussed. If agendas and meeting minutes are not public, however, non-members are effectively barred from participating and distrust whether a standard setting organization is considering public policy goals in secret. Today, the standards organizations' behavior ranges from extremely opaque to fully transparent. For example, the ITU-T restricts standards under development and meeting proceedings to members only, whereas the IEEE restricts draft standards to members only, but allows public access to electronic mail lists, teleconferences, and meeting minutes.

Finally, Ms. Cooper explored the variety of different decision-making models used by standard setting organizations. In many organizations, a vote of the members is the chief decision-making model. The ITU-T, IEEE, and the World Wide Web Consortium (W3C) all use voting to determine the status of individual specifications, projects, and general technical direction, although in some instances the vote may be more of a formality than anything else. Cooper contrasted this voting model with the IETF's model that seeks rough consensus before moving forward with a technical proposal.

Ms. Cooper's presentation led to a brief but lively discussion about how the international standards setting process *should* fit within this analytical framework. Participants reflected on how transparency is a key part of the legitimacy of the process. One participant noted, however, that transparency is often in the eye of the beholder: governments are comfortable with the ITU-T process and find the IETF and IEEE processes completely opaque, while other organizations have the opposite experience. Participants noted that transparency often has a steep learning curve for new organizations. Going to a 3GPP meeting and effectively contributing, for example, requires knowing how the 3GPP organizes its work and who is actually in charge of the process.

Participants also noted that some standards setting organizations are better than others at adapting to new processes. For example, some government players are often uncomfortable participating in multi-stakeholder organizations like the IETF that require them to participate

alongside non-governmental organizations. Mark Buell noted that the vast majority of device users will soon be non-American, while most multi-stakeholder organizations are predominantly U.S.-focused. Buell expressed his fear that we will soon see a shift from standard setting bodies like the multi-stakeholder IETF model to ones where nation-states are more comfortable.

The roundtable concluded with a discussion of the role that public values play in the standards setting process and whether public policy choices can be separated from technical decision-making. A participant made three points regarding this.

First, the participant noted that "the original sin was probably the introduction of any values into the standards setting processes. In the early days engineers seemed to work together with common cause and common purpose and without the kind of external pressures that are brought to bear today. If it weren't for, for example, business model considerations or second order concerns like [Digital Rights Management (DRM)] to support something not the core point of the protocol, then civil society [organizations] might not feel as left out."

Second, he noted that seeking to improve the process by which public input is incorporated into international standards setting organizations may be a red herring. The participant noted "we have a multi-stakeholder process for that; we call it democracy." Incorporating additional input into standards setting organizations, rather than relying upon democratic governing processes, the participant stressed, may simply be reinventing the wheel.

Finally, the participant noted that Professor Hatfield's list of values[15] that one might want to inject into the standard setting process could be divided into subcategories, some of which are appropriate for consideration by standard setting organizations. Some types of values, like disability and emergency response, the participant claimed, are usually opposed, if at all, primarily on grounds of efficiency. Others, like DRM versus openness or lawful access versus privacy, are high-level policy issues ill-suited for full exploration in a multi-stakeholder organization.

Another participant responded that values should not be reflected in architecture stating, "The fewer problem solutions embedded in architecture, the better – or to put it a more positive way, the more problem solutions that the architecture supports, the better." A good architecture that will support multiple policy problem solutions will, he insisted, "allow everyone the opportunity to implement solutions at law." The participant noted that "the job of civil society is to say, 'Wait a minute, I've got a solution for that and your architecture is preventing me from doing that solution.'"

With this in mind, participants suggested that a triage of which kind of policy issues a standards setting organization should consider could be developed. For example, one participant noted that "we ought to identify the pressure points where policy and values will really come into conflict and leave decisions unmade." Another participant noted that standard setting organizations do not operate in a vacuum, saying "They are aware of policies, they are aware of existing values within the marketplace, they are aware of the interests of civil society. … But at the end of the day, they

[15] Professor Hatfield's paper lists ten U.S. public policy goals: Next Generation 911, Disability Access, Next Generation Enforcement, Lawful Intercept, Network Security, Public Safety/Mission Critical Services, Outage/Performance Reporting, Intellectual Property Protection (DRM), Privacy, and Transparency & Openness.

are also going to be implementing standards that are in their commercial interests." As a result, the participant concluded that conflict between standards setting organizations and governments representing public interest concerns may be a natural state of affairs. Another participant argued that one way to resolve the conflict is for standards setting organizations to explicitly identify controversial policy issues and decide whether to address the conflict within the standards setting process or defer to another body.

Hany Fahmy went on to explain that the issue of having international standards setting organizations take on public policy issues may not be as big as it seems. Operators are aggressively pursuing the concept of open source and software-defined networks to maximize the ability of developers to add value to existing network platforms. Next generation standards, he insisted, will require the architecture itself to be open to reconfiguration via software-defined networks. Opening the network will allow innovations to come on top of the network such that many public policy uses will not be precluded by architectural choices made at the international level.

Other participants, however, noted that the 3GPP is under significant pressure to deliver 5G very quickly, and as a result, software-defined capabilities will likely not be fully enabled until the second or third release of a 5G standard. One participant commented that even absent software-defined capabilities and the ability to develop applications on top of the network, the initial release of 5G will be a huge technical leap forward with speeds of a gigabit to each phone or device.

Mr. Fahmy rounded out the discussion with a defense of the 3GPP standardization process. The process, he noted, brings together "the brightest and the best from the entire world, from corporations and organizations from across the country, even governments from across the globe and puts them in one place to follow a democratic process where attendees vote and pick the best solution." Even if some solutions to policy problems come after the fact, he insisted, it is an excellent process. U.S. policies and regulations are quite different from those in other parts of the world, Fahmy noted, and if all policies and regulations needed to be considered by the 3GPP, the architecture "simply will not come together in an interoperable, timely way. The [global] marketplace will dissipate and parties will go their own way, resulting in disparate standards."

Future Research

Several promising questions for future research emerged during the roundtable:

- How can standards setting organizations be encouraged to consider strategies that ensure both technical performance and economic growth while also addressing core social policy goals? What, if any, steps should be taken to encourage broader participation, increased transparency, and decision making?
- Can a comparative analysis be done of standards setting organizations that are able to efficiently create interoperable standards while also addressing and responding to public policy goals?

- Are the software defined networking and network visualization tools being built into the 5G architecture by 3GPP and other standards setting organizations adequate to support current and future public-interest-driven functionality?

Summary

The roundtable on "5G Wireless and the Challenges of Governance" underscored the concern of many that because adopting international standards is voluntary, addressing public policy concerns could slow the standard setting process and risk losing the voluntary compliance that allows for the advantages of interoperable standards. The roundtable, nonetheless identified: 1) technical advances in 5G that may allow for individualized tailored software solutions to some policy issues, 2) a way to improve civil society participation by increasing the transparency and notice procedures of standards setting bodies without delaying the standard setting process, and 3) the possibility of adopting a triage process for public policy issues considered by standards setting organizations so that only those issues that are established and widely accepted, and therefore can be resolved in a timely matter, are addressed within the standards setting process.

Acknowledgement

In preparing this report, the author benefited from the substantive editing and guidance of Professor Dale Hatfield, Executive Fellow at Silicon Flatirons.

Appendix A: Participant List

Rob Alderfer, Vice President of Technology Policy, CableLabs

Rebecca Arbogast, Senior Vice President, Global Public Policy, Comcast Corporation

Mark Buell, Regional Bureau Director for North America, Internet Society

Michael Calabrese, Senior Research Fellow and Director of the Wireless Future Project, New America Foundation

Len Cali, Senior Vice President, Global Public Policy, AT&T

Alissa Cooper, Fellow, Cisco; Chair, Internet Engineering Task Force

Mark Cooper, Research Director, Consumer Federation of America

Pierre de Vries, Executive Fellow, Silicon Flatirons

Jameson Dempsey, Associate, Kelley Drye & Warren LLP

Hany Fahmy, Assistant Vice President, Global Public Policy, AT&T

Michele Farquhar, Partner, Hogan Lovells US LLP

Danielle Frappier, Partner, Davis Wright Tremaine LLP

Sophie Galleher, Student, University of Colorado Law School

Kathleen Ham, Senior Vice President, Government Affairs, T-Mobile

Dale Hatfield, Executive Fellow, Silicon Flatirons

John Heitmann, Partner, Kelley Drye & Warren LLP

Russ Housley, Principal, Vigil Security, LLC

Hank Kelly, Partner, Kelley Drye & Warren LLP

Robert Kelly, Partner, Squire Patton Boggs

Paul Margie, Partner, Harris, Wiltshire & Grannis

Jon Nuechterlein, Partner, Sidley Austin

Paul Ohm, Professor of Law, Georgetown University Law Center

Danielle Piñeres, Associate General Counsel, NCTA — The Internet & Television Association

Galen Pospisil, Research Assistant, Silicon Flatirons; Student, University of Colorado Law School

Blake Reid, Assistant Clinical Professor, University of Colorado Law School

Tom Sawanobori, Senior Vice President and CTO, CTIA

Sara Schnittgrund, Director of Student Programs, Silicon Flatirons

Roger Sherman, Principal, Waneta Strategies

Ross Slutsky, Associate, Kelley Drye & Warren LLP

Jeff Tantsura, Member, Internet Architecture Board

Peter Tenhula, Deputy Associate Administrator for Spectrum Management, NTIA

Bryan Tramont, Managing Partner, Wilkinson Barker Knauer, LLP

Sanjay Udani, Executive Director, Internet & Technology Policy, Verizon

Phil Verveer, Former Senior Counselor to Chairman Wheeler, Federal Communications Commission

Phil Weiser, Executive Director, Silicon Flatirons; Hatfield Professor of Law, University of Colorado Law School

Chip Yorkgitis, Partner, Kelley Drye & Warren LLP

Appendix B: Reading List

Must Read:

- Dale N. Hatfield, Draft, *Addressing Public Policy Goals in the Standards-setting Process: The Case of 5G Wireless Standards* app. c (2017).

Worth Reading:

- NTIA: Commerce Spectrum Management Advisory Committee (CSMAC), 5G Subcommittee Final Report, https://www.ntia.doc.gov/files/ntia/publications/5g_sc_report_august_1.pdf (2016).
- Braum Naudts et al., *Deploying SDN and NFV at the Speed of Innovation: Toward A New Bond Between Standards Development Organizations, Industry Fora, and Open-Source Software Projects*, 54 IEEE Comm. Mag., no. 3, Mar. 2016, *available at*http://ieeexplore.ieee.org/document/7432171/.
- Haris Tsilikas, *Collaborative Standardization and Disruptive Innovation – The Case of Wireless Telecommunications Standards*, Max Planck Inst. for Innovation and Competition Research Paper No. 16-06 (2016), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2783372.
- Olia Kanevskaia, *Technology Standard-Setting Under the Lens of Global Administrative Law: Accountability, Participation and Transparency of Standards-Setting Organizations*, Tilburg Law and Economics Center (TILEC) Discussion Paper No. 2016-016, (2016), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2812464.
- Phil Weiser, *Entrepreneurial Administration*, U. of. Colo. L. Legal Stud. Research Paper No. 16-11 (2017), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2893139.
- Craig N. Murphy & Joanna Yates, *Afterword: The Globalizing Governance of International Communications: Market Creation and Voluntary Consensus Standard Setting*, 27 J. Pol'yHist., No. 3 (2015) at 550, https://muse.jhu.edu/article/584380/pdf.

Worth Skimming:

- InterDigital, 5G Standardization: Mobile World Congress 2015, http://www.interdigital.com/presentations/5g-standardization (2015) (click on "Download Now").
- Joe Waz & Phil Weiser, *Internet Governance: The Role of Multistakeholder Organizations*, 10 J. on Telecomm. & High Tech. L. 331, 343-344 (2012), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2195167.
- Christopher Achatz, *Open Standards, Open Innovation, and The Rollout of IMS*, Silicon Flatirons Ctr., Rep. No. 7 (2009), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2285108.

Can Quickly Scan:

- 5G Americas, Global Organizations Forge New Frontier of 5G: 5G Americas 5G Global Update July 2016,

http://www.5gamericas.org/files/8914/6774/6748/Global_Organizations_Forge_New_Frontier_of_5G_Final.pdf (2016).

- Int'l Telecomm. Union [ITU], *Recommendation ITU-R M.2083-0, IMT Vision – Framework and Overall Objectives of the Future Development of IMT for 2020 and Beyond, available at*https://www.itu.int/dms_pubrec/itu-r/rec/m/R-REC-M.2083-0-201509-I!!PDF-E.pdf (2015).

Appendix C: Addressing Public Policy Goals in the Standards Setting Process: The Case of 5G Wireless Standards

Dale N. Hatfield
Executive Fellow, Silicon Flatirons Center for Law, Technology and Entrepreneurship
and
Adjunct Professor, Interdisciplinary Telecommunications Program
University of Colorado at Boulder

Introduction

The wireless industry is undergoing a massive transformation in which today's 4G systems and emerging 5G systems[1] are evolving to meet both the exploding demand for ubiquitous broadband data in general and more specialized demands spread across numerous vertical markets. These specialized demands include Fixed Wireless Access Services, Commercial Wireless Mobile Voice and Data/Internet Access Services, Internet of Things (IoT) Services, and Broadband Public Safety (e.g., FirstNet) and Other Mission Critical Services. This massive transformation is accompanied by an equally significant movement by telecommunications operators to adopt virtualized and programmable networks based upon Software-Defined Networking (SDN), Network Function Virtualization (NFV) and Cloud Technologies.

These transformations include changes in network architectures. The choice of a particular architecture for a public network has implications that stretch far beyond its internal technical and economic performance. Such engineering design choices, for example, open versus closed architecture, and centralized versus decentralized computer networks, could facilitate or impede legislatively mandated or widely agreed upon public policy goals. In this paper, we will consider whether and how public policy goals are addressed in the international standards setting process. We will also examine whether and how the views of all interested stakeholders—industry, government, academia, and civil society—are represented at each stage of the standards development process.

I. Background

[1] For brevity, evolving 4G systems and emerging 5G systems will be collectively referred to as 4G+/5G systems.

The emerging 4G+/5G systems are described in many fora, including in reports from Technological Advisory Council (TAC) Working Groups of the Federal Communications Commission (FCC), Commerce Spectrum Management Advisory Committee (CSMAC) Subcommittees of the National Telecommunications and Administration (NTIA) of the U.S. Department of Commerce, and in the many reports and other materials cited therein. Those descriptions will not be repeated or summarized here but, rather, it should be noted that they involve dramatic changes in the network architectures involved. That is, they involve changes in how the network is decomposed into hardware and software modules, the functions performed by each of these components, the interfaces among these components, and the associated protocols that allow the modules to communicate with one another using the interfaces.[2] These massive developments will guide the evolution of both fixed and mobile broadband networks for decades to come.

As described in the Introduction and immediately above, the technology transformation to 4G+/5G networks will have a dramatic impact on network architectures. It has long been recognized that choices of network architectures have important implications for public policy. Just as legal codes or regulations, market forces and social norms control or guide human behavior, so do network architectures. Hence, network architectures are an important component of both national and international policy. As philosopher Bruno Latour expressed it, shaping network architecture is "politics by another means" and, as Larry Lessig said so succinctly, "code is law."[3]

While systems engineers are well aware of the importance of network architectures in determining the technical and economic performance of a given network, the choice of a particular architecture for a public network also has implications that stretch far beyond its internal technical and economic performance. For example, not only does the selection of an architecture have an impact on the overall cost/performance delivered to the public, it can also influence the ability of

[2] *See, e.g.*, Federico Boccardi, Robert W. Heath, Angel Loranzo, Thomas L. Marzetta & Petar Popovski, *Five Disruptive Technology Directions for 5G*, 52 IEEE Comm. Mag., no. 2, Feb. 2014 at 74-80, *available at* http://ieeexplore.ieee.org/document/6736746/.
[3] Lawrence Lessig, *Code: Version 2.0*, at 1 (2nd ed. 2006).

different firms to compete using the network and thereby significantly increase or decrease the pace of innovation. A case-in-point would be an architectural choice that might facilitate or impede the ability of a Mobile Virtual Network Operator (MVNO) to offer retail wireless communications using the wireless network infrastructure of a mobile network operator on a wholesale basis.

Thus, one of the most critical choices is picking how open or closed the architecture should be. Network designs based upon appropriate hardware- and software-based network elements (i.e., appropriate modularity), and upon open architecture principles and standardized (as opposed to proprietary) interfaces between and among network elements, can facilitate competition.[4] But they can also raise issues of, *inter alia*, diminished investment incentives, network security, and privacy.

Another critical design choice involves the computing functions that are carried out using the network.[5] Network computing functions can be carried out or, said another way, applications can be executed, on a decentralized or centralized basis. Decentralized functions use "peer-to-peer" connections.[6] Peer-to-peer computation employs distributed resources such as computer processing power, data storage and content, and network capacity (bandwidth) to perform the network computing function in a decentralized manner. In contrast, centralized network computing exists when the majority of the necessary functions are carried out at, or obtained from, a remote centralized location. A major distinction between a decentralized and centralized network computing function is that, in the latter case,

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[4] The advantages and disadvantages of open versus closed architectures have been explored in numerous policy and regulatory proceedings and in academic and other scholarly papers. Those advantages and disadvantages are widely understood and will not be explored in detail here. *See, e.g.*, Ashish Shah, Douglas C. Sicker, Dale N. Hatfield, *Thinking About Openness in the Telecommunications Policy Context*, Paper Presented at The Thirty-First Telecommunications Policy Research Conference 13 (Sept. 20, 2003), *available at* https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2060641.

[5] The generic term for this type of design is network computing. Network computing is defined as the use of computers and other devices in a linked network (e.g., the Internet), rather than as unconnected, stand-alone devices. Network Computing, TECHNOPEDIA.COM, https://www.techopedia.com/definition/23619/network-computing.

[6] Peer-to-peer computation is "a communications model in which each party has the same capabilities and either party can initiate a communications session." Peer-to-peer systems distribute computational tasks over multiple clients. *Peer-to-Peer Technology*, NEWTON'S TELECOM DICTIONARY (25th ed. 2009).

there is a mandatory centralized point or node through which all the data on the network must access or pass.

A simple example of a decentralized network computing function is a basic push-to-talk connection between two end user devices.[7] In this simple case, the end users' devices could establish the connection on a peer-to-peer basis using their respective addresses. No centralized coordination would be required. A simple example of a centralized network computing function is the retrieval of content such as music from a centrally located data storage device in the classic client – server model. In this case, the mandatory centralized point which distinguishes the centralized computing function is the server because all data on the network must access it. As in the case of picking how open or closed the architecture should be, the advantages and disadvantages of a centralized versus decentralized network and computer architectures will not be explored in detail here. For present purposes, however, it merits emphasis that such peer-to-peer connections are critical for public safety wireless communications, which rely on such connections in emergency response scenarios.

II. Reasons for the Proposition to Be Addressed

A. *Standards Setting Organizations*

In the case of 4G+/5G systems, the design choices elaborated upon above are being made or influenced by a vast range of technical standards setting organizations (SSOs) broadly defined. For our purposes here, this vast array of entities can be organized into three categories:

- Traditional telco-oriented Standards Development Organizations (SDOs) like ITU-R, BBF, and ETSI etc.
- Traditional Internet-oriented SDOs like the IETF and W3C, etc.
- Less traditional Open Source Projects/Consortia like Open Compute Project (OCP), OpenStack, OpenDaylight, Open Network Operating System (ONOS), OpenSwitch, and Central Office Reimaged as a Data Center (CORD), etc.

[7] Push-to-talk communications systems require the user to "press a button to talk and stop pushing the button to listen. . . . Push to talk is used in two-way radio dispatch systems . . . ," including those used by first responders. *Push-to-Talk*, NEWTON'S TELECOM DICTIONARY (25th ed. 2009).

4G+/5G standards are being defined by the 3rd Generation Partnership Project (3GPP) which unites seven telecommunications standards development organizations (ARIB, ATIS, CCSA, ETSI, TSDSI, TTA, TTC) and produces reports and specifications that define 3GPP technologies.[8] It is anticipated that the final specifications developed by 3GPP will be submitted to the ITU's International Mobile Telecommunication (IMT) system process for standardization in the 2020 time frame.[9]

It may be useful to distinguish between SSOs that are organized by governments themselves, like the traditional telco-oriented standards setting organizations (e.g., the European Telecommunications Standards Institute (ETSI)), versus entities in which governments play no special role, like the traditional Internet SSOs (e.g., the Internet Engineering Task Force (IETF)) and Open Source Projects/Consortia (e.g., Apache Software Foundation). Each type of organization has different origins, focus, procedures, governance structures, traditions, and cultures. Stakeholders desiring an architectural change to support a particular capability may need to choose from among the three categories of technical standards organizations described. For certain stakeholders, going through the traditional SDOs may provide more certainty, wider acceptability, and a better cultural fit. However, pursuing this route may result in a longer time-to-market and greater rigidity as stakeholders may struggle to tailor the results of the standards development process to a product rollout in a particular national market.

In competitive markets, time-to-market and agility in terms of changing offerings are often critical to success. Stakeholders with greater knowledge and resources may hedge their bets by participating in both formal SDOs and private voluntary SSOs. In this case, private, voluntary SSOs act as gap fillers between the time of a market need and when the formal standard is actually adopted.

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[8] *See* 3GPP: THE MOBILE BROADBAND STANDARD, http://www.3gpp.org (last visited Apr. 5, 2017) (the seven standards development organizations are: Association of Radio Industries and Businesses (ARIB), the Alliance for Telecommunications Industry Solutions (ATIS), China Communications Standards Association (CCSA), European Telecommunications Standards Institute (ETSI), Telecommunications Standards Development Society, India (TSDSI), Telecommunications Technology Association (TTA), Telecommunication Technology Committee (TTC)).

[9] *See generally* ITU TOWARDS "IMT FOR 2020 AND BEYOND", http://www.itu.int/en/ITU-R/study-groups/rsg5/rwp5d/imt-2020/Pages/default.aspx (last visited Apr. 7, 2017).

Another complicating factor, produced by the convergence of network architectures and service offerings, is already occurring and will doubtlessly accelerate with the evolution of 4G and the emergence of 5G. Convergence increases the number of stakeholders seeking to influence the critical design choices to their benefit and thereby significantly increases the complexity of the relationships between and among them. For example, a service provider offering less advanced telemetry and SCADA services on other platforms and in different frequency ranges or an end user consuming such services today may desire to influence 4G+/5G critical design choices associated with the provision of IoT services.[10] That desire would be prompted by the existing provider or end user being interested in utilizing the 4G+/5G platform rather than less advanced, existing platforms and services.

Not only is there a vast range of technical SSOs, each with their own origins, focus, procedures, governance structures, traditions, and cultures, making critical engineering design choices regarding future network architectures, the associated stakeholder groups -- industry, government, academia and civil society -- have different and often conflicting incentives guiding their participation in those fora as well as varying abilities to influence the choices being made. One result of these differences is that stakeholders are often put in the position of having to choose between what is best for them and what is best for the system as a whole. For example, while corporations may want to be viewed as good corporate citizens, as an end in itself or to court favorable treatment in later regulatory or policymaking proceedings, their directors and officers owe fiduciary duties to their stockholders. These duties create incentives for the directors and officers to support SSO decisions that may give their corporation a market advantage (perhaps by increasing the value of their own intellectual property), and further, to oppose choices that may increase their costs without offsetting compensation.

Consequently, there can be no assurance that the resulting choices are optimum in terms of technical and economic performance or the achievement of important public interest goals. David Burstein, a respected editor of an industry

[10] Supervisory Control and Data Acquisition (SCADA) systems are "used extensively by power, water, gas, and other utility companies to monitor and manage distribution facilities." *SCADA Protocol*, NEWTON'S TELECOM DICTIONARY (25th ed. 2009). SCADA systems often allow for the collection of telemetry information or "status information on a remote process, function or device." *Telemetry*, NEWTON'S TELECOM DICTIONARY (25th ed. 2009). Internet of Things (IoT) is a "computing concept that describes the idea of everyday physical objects being connected to the internet and being able to identify themselves to other devices." *Internet of Things (IoT)*, TECHNOPEDIA.COM, https://www.techopedia.com/definition/23619/network-computing.

newsletter named DSL Prime, recently asserted that even though SSOs, like 3GPP, attract brilliant engineers to define their standards, these groups "have to deliver what the most powerful companies want," while "Africa, Latin America, and the *public interest* are largely ignored."[11] (*Emphasis Added).*

B. Public Policy Goals

In its deliberations leading up to its recommendations to the FCC in 2015, the TAC, via its Future Game Changing Technologies (FGCT) Working Group, identified the following ten examples of legislatively mandated or widely agreed upon public policy goals in the U.S. context:

1. Next Generation 9-1-1
2. Disability Access
3. Next Generation Enforcement
4. Lawful Intercept
5. Network Security
6. Public Safety/Mission Critical Services
7. Outage/Performance Reporting
8. Intellectual Property Protection (DRM)
9. Privacy
10. Transparency and Openness

In identifying these public policy goals, the FGCT Working Group noted that many of them would be affected by programmable networks and what they referred to as 4G+/5G internationally established architectures, standards and specifications.[12] These public policy goals mostly result from the observation that, in economic terms, their production exhibit positive externalities. A positive externality is said to exist if the production and consumption of a good or service benefits a third party not directly involved in the market transaction. With a positive externality, private returns are less than the social returns from the transaction. So, for example, producers of IoT devices or services may make them less secure to lower their own

[11] Dave Burstein, *CTO Blanco: LTE Can Replace Much "5G." Time to Slow Down*, 5G WIRELESS NEWS, May 6, 2017, http://fastnet.news/index.php/88-sp/306-latest-issue.
[12] Presentation Slides for September 20, 2016 Meeting of the Federal Communications Commission Technology Advisory Committee at 89, https://transition.fcc.gov/bureaus/oet/tac/tacdocs/meeting92016/TAC-Presentations9-20-16.pdf.

costs and thereby inadvertently impose economic risks on society as a whole by making the overall network less robust from a cyber security standpoint. Or, said the other way, a producer of IoT products or services will offer less robustness than is socially desirable because some of the benefits of a more secure product or service may largely accrue to others. Similarly, a service provider may be reluctant to facilitate lawful intercept ("wiretapping") by absorbing additional costs when the assumed benefits would accrue to others.

C. Civil Society Groups

Civil society groups (e.g., public interest groups) that (a) operate outside the government and for-profit sectors of the economy and (b) pursue goals that, if achieved, provide benefits to the public at large, might normally be counted on to advocate for architectures, standards, or specifications that would facilitate the achievement of public policy goals through regulatory or other forms of intervention such as public-private partnerships. However, civil society groups may be limited or precluded from doing so by a host of factors:

First, because of the sheer number of government and private sector organizations that are involved in developing architectures, standards, and specifications for 4G+/5G systems, or at least attempting to influence them (e.g., 5G Americas[13]) or other closely associated policy/regulatory issues (e.g., spectrum availability), it is effectively impossible for a civil society group to determine where, in an organizational sense, all the design choices are being made that could facilitate or impede the achievement of important public policy goals.

Second, even if a civil society group is able to identify which organizations are involved in developing architectures, standards, and specifications for 4G+/5G systems or that are attempting to influence them, they may not be able to participate

[13] According to its website, 5G Americas is an industry trade organization composed of leading telecommunications service providers and manufacturers. The organization's mission is to advocate for and foster the advancement and full capabilities of LTE wireless technologies and their evolution to 5G, throughout the ecosystem's networks, services, applications and connected devices in the Americas. *See* 5G AMERICAS, http://www.5gamericas.org (last visited Apr. 6, 2017).

in their deliberations because of governance issues. That is, a civil society group may not be eligible for membership in, say, an industry-led trade or private SSO.[14]

Third, in the case that the civil society group is able to identify key organizations and is eligible for at least some form of membership in them, the cost of participating in terms of membership fees and/or the cost of participating in long, in-person meetings in foreign locations may make participation impractical from a financial standpoint.[15] Although growing broadband accessibility has facilitated more interactive remote participation options, the inherent technical complexity of the subject matter and associated deliberations may still present a challenge to civil society groups who do not have the financial resources to properly staff multiple in-person meetings with qualified technical experts. Civil society groups may also face constraints in terms of developing very specialized talent (whether engineers, lawyers, economists or otherwise) who have expertise in, for example, spectrum policy and disability access and have the connections to and trust of the organization (authenticity).

Fourth, participation by civil society groups in organizations that are involved in developing architectures, standards, and specifications for 4G+/5G systems may be constrained by the lack of transparency at each of three stages of the standards development process; namely, proposal for the standardization activity, technical work on the standard's design, and approval of the draft standard.[16] Obviously, if a civil society group does not get adequate and timely notice and appropriate

[14] *See infra* Appendix A.

[15] See Adrian Scrase, Draft Summary Minutes, Decisions and Actions from 3GPP PCG Meeting#36, 3GPP (Apr. 28, 2016), http://www.3gpp.org/DynaReport/TDocExMtg--PCG-37--32036.htm (follow the second hyperlink labeled PCG37_02 and see sections 3GPP Support and 3GPP Working Hours on pages 3-5). Additionally, a sample of 2017 3GPP meetings and their locations highlights the extensive resources required for in-person representation: June—3GPPSA2#122 in San Jose Del Cabo, Mexico; May—3GPPCT1#104 in Zhangjiajie, China; 3GPPSA6#17 in Prague, Czech Republic; 3GPPSA1#78 in Porto, Portugal; April—3GPPPCG#38 in West Palm Beach, United States; 3GPPSA4#93 in Busan, South Korea; 3GPPRAN5-TTCN Workshop#37 in Sophia Antipolis, France; 3GPPCT4#77 in Spokane, United States; March—3GPPSA#75 in Dubrovnik, Croatia. ETSI Calendar of Meetings, 3GPP (last visited Apr. 7, 2017), https://portal.etsi.org/webapp/meetingcalendar/.

[16] *See* Olia Kanevskaia, *Technology Standard-Setting Under the Lens of Global Administrative Law: Accountability, Participation and Transparency of Standard-Setting Organizations*, Tilburg Law and Economics Center (TILEC) Discussion Paper No. 2016-016, at 13-19 (2016) (describing the three stages of standards development as proposal for standardization, technical work on the standard's design, and approval of the draft standard).

supporting information at each of these three stages, the effectiveness of their participation will be significantly reduced.[17]

One may argue that, in the case of 3GPP, any concerns of civil society groups or the general public could be considered when public input is sought at the final stage of the process, namely, when the 3GPP draft recommendations move to the formal approval stage at the ITU. But, as a practical matter, the possibility of negotiating a change to the recommended standard to accommodate civil society group concerns after years of deliberation is problematic at best. Moreover, the openness and transparency of the ITU's final standards adoption process has sometimes been called into question because it may limit participation by individuals and civil society groups including public interest groups.[18]

As discussed above, civil society groups face significant financial and technical challenges in trying to advocate architectures, standards, and specifications that would facilitate the achievement of public policy goals like the ten identified by the FGCT Working Group of the FCC's TAC. It is instructive to note that one of those public policy goals, ensuring that the architectures, standards, and specifications for 4G+/5G are responsive to the specialized needs of Public Safety/Mission Critical Service providers, is being supported in the U.S. by the Public Safety Communications Research Program (PSCR).[19] The PSCR, notably,

[17] Transparency in terms of (a) the pros and cons of the design choices being made and (b) the processes leading up to those choices (e.g., in terms of the pros and cons of alternative design choices considered), builds trust in the outcomes among stakeholders and is likely to lead to wider acceptance of the choices when they are adopted. It also increases the legitimacy of the standards setting organization involved. Joe Waz & Phil Weiser, *Internet Governance: The Role of Multistakeholder Organizations*, 10 J. ON TELECOMM. & HIGH TECH. L. 331, 343-344 (2012); *see also* Phil Weiser, *Entrepreneurial Administration*, U. OF. COLO. L. LEGAL STUD. Research Paper No. 16-11 (2017).

[18] *See* Grant Gross, *Groups Say ITU's Transparency Efforts Aren't Enough*, PCWorld from IDG (Jul. 16, 2016, 1:47 PM PT), http://www.pcworld.com/article/259337/groups_say_itus_transparency_efforts_arent_enough.html; *see also* Olia Kanevskaia, *Technology Standard-Setting Under the Lens of Global Administrative Law: Accountability, Participation and Transparency of Standards-Setting Organizations*, Tilburg Law and Economics Center (TILEC) Discussion Paper No. 2016-016, (2016).

[19] The Public Safety Communications Research Program (PSCR) is a joint effort between the National Institute of Science and Technology (NIST) and the National Telecommunication and Information Administration (NTIA) both of which are units of the U.S. Department of Commerce. Much of the PSCR's efforts are focused upon FirstNet. FirstNet is an independent authority within

has the financial and technical resources to focus on a particular public policy goal whereas, with respect to other public policy goals (say, accessible for people with disabilities), no such group may exist.[20] Consider, for example, that the public safety community is fortunate and appreciative to have PSRC representing their interests before standards bodies, with one leader noting that the PSRC staff "…has traveled the world over going to 3GPP meetings and going from a point where we thought public safety was going to be and we'd never get anything done. Three or four years later, we're right at the top."[21]

Civil society and even governmental groups (e.g., from smaller countries) that desire to advocate architectures, standards, and specifications that would facilitate the achievement of other public policy goals in the list, say disability access or privacy, may also fear being "buried under a whole bunch of commercial concerns."[22] Unlike PSRC though, they may lack the financial wherewithal, technical resources and the necessary status to participate not only in 3GPP and subsequent ITU proceedings, but also in the myriad of other related Internet-oriented and Open Source SSO activities. Without their participation, the gap between the

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the NTIA that holds the spectrum licenses for a "much-needed nationwide interoperable broadband network that will help police, firefighters, . . . and other public safety officials stay safe and do their jobs. . . . [FirstNet] is charged with taking all actions necessary to build, deploy and operate the network." PUBLIC SAFETY, https://www.ntia.doc.gov/category/public-safety (last visited April 9, 2017).

[20] In addition to having the necessary financial and technical resources to participate in SSO activities, PSCR, as a component of a recognized national standards organization (NIST), does not face potential membership issues like those faced by public interest groups and individuals.

[21] Note that Tetra and Critical Communications Association (TCCA) of the UK is a Market Representation Partner (rather than a Member Organization) of 3GGP. Like the PSCR, TCCA is also concerned with ensuring that 3GPP meets the unique needs of public safety/mission critical service providers. *See The TCCA*, TCCA, https://tandcca.com/tetra/the-tcca/ (last visited April 9, 2017); *Partners*, 3GPP, http://www.3gpp.org/about-3gpp/partners (last visited April 9, 2017); Kevin McGinnis, *Remarks at FirstNet Technology Committee Meeting* (Jun. 2, 2014), *available at* http://www.firstnet.gov/content/board-meeting-june-2014 (follow "Technology Committee - June 2014 (MP4, 86 MB)" hyperlink; *see also* NIST, PUBLIC SAFETY BROADBAND REQUIREMENTS AND STANDARDS PROJECT DESCRIPTION, https://www.nist.gov/programs-projects/public-safety-broadband-requirements-and-standards-project-description.

[22] Kevin McGinnis, *Remarks at FirstNet Technology Committee Meeting* (Jun. 2, 2014), available *at* http://www.firstnet.gov/content/board-meeting-june-2014 (follow "Technology Committee - June 2014 (MP4, 86 MB)" hyperlink; *see also* NIST, PUBLIC SAFETY BROADBAND REQUIREMENTS AND STANDARDS PROJECT DESCRIPTION, https://www.nist.gov/programs-projects/public-safety-broadband-requirements-and-standards-project-description.

social returns and private returns associated with other legally mandated or widely accepted public policy goals may not be closed.

Lastly, it should be realized that there are often important tradeoffs that must be made between the public policy goals in the list. An example would be the ease and scope of lawful intercept versus privacy considerations. Civil society and governmental groups may well disagree among themselves on what is the best tradeoff. But domestic U.S. proponents and opponents of a particular tradeoff both face the same problem – how can they influence the outcome of standards-making processes that are increasingly diverse and internationally driven?

D. Ability of Domestic Entities to Act Unilaterally

Finally, and even more important from a U.S. domestic perspective, technological and marketplace changes both within the Information Communications Technology (ICT) market itself and within the broader international business market for goods and services, have arguably reduced the ability of domestic entities to act unilaterally in the development of ICT standards and increased the technical and economic penalties for doing so. In the early days of cellular communications, the U.S. market for wireless communications was large enough and isolated from the international marketplace well enough to permit the U.S. (and North America) to go its own way to an extent that is not feasible today. This can be illustrated through four examples:

First, early generation cellular telephones were heavy, bulky and consumed lots of battery power. They were permanently mounted in vehicles or carried about in heavy bags ("bag phones"). There was little chance that an end user would take the wireless telephone itself outside the U.S. or North America and hence there was little need to create end user devices and supporting infrastructure that would allow international roaming. This is in sharp contrast to the situation today where end users expect to take their phone, tablet, or laptop computer to another country or region and have it perform as well as at home.

Second, while even in the early days it was important to be able to communicate across international borders, the interfaces and associated protocols were relatively simple because only voice, text and rudimentary data needed to be conveyed. As transnational and global companies with sophisticated voice, data,

image, video and multimedia communications requirements grew, the need for seamless broadband interoperability grew with them. Using one standard in one country or region and a different one in another can increase costs (e.g., for interface adapters that are used to compensate for different physical and software standards) and penalize performance.

Third, in the early days of cellular communications, the North American market was large compared to the total, worldwide market. Today, this is no longer true. For example, in terms of Internet usage, while Internet penetration is still high in the North American market compared to Asia (88.1% versus 44.7% respectively), the absolute number of Internet users is vastly different (320M versus 1.9B respectively). Moreover, the lower penetration rate suggests that the potential for growth is greater in Asia than in the U.S./North American market.[23] While the U.S. market is obviously still desirable, it is not as important as it once was and, hence, again arguably, U.S. market requirements are comparatively less important internationally than they once were. This means that choosing a unique standard that would facilitate the achievement of U.S. legislatively mandated or widely agreed upon public policy goals may result in the loss of cost benefits associated with worldwide economies of scale and potentially exacerbate interoperability issues among countries or regions.

Fourth, in the early days of cellular communications, U.S. firms, Motorola and AT&T (including, at the time, AT&T's equipment designed by Bell Labs and manufactured by Western Electric), played a substantial role in the manufacturing of equipment but, over time, that business shifted to the Nordic firms Ericsson and Nokia. More recently, actual manufacturing has shifted again—this time away from Ericsson and Nokia/Alcatel-Lucent, and towards Chinese firms such as Huawei and ZTE.[24] Dave Burstein, cited earlier, recently said, "When I started DSL Prime, the U.S. was the dynamic world leader in telecom. We are now mostly an also-ran."[25] It could certainly be argued that the Nation's declining role in telecommunications

[23] INTERNET WORLD STATS, http://www.internetworldstats.com/stats.htm (*last visited* Apr. 7, 2017).

[24] Justin Fox, *Huawei Conquers the World, Except the U.S.*, BLOOMBERG VIEW, July 26, 2016, https://www.bloomberg.com/view/articles/2016-07-26/huawei-conquers-the-world-except-the-u-s.

[25] Dave Burstein, Editorial, FASTNET NEWS, February 18, 2017, http://fastnet.news/index.php/88-sp/306-latest-issue.

manufacturing further diminishes the ability of civil society groups to advocate through them in favor of architectures, standards, and specifications that would facilitate the achievement of public policy goals like those itemized above.[26]

III. Proposition to be Addressed

For the reasons expressed in Section II., the FCC, and other government agencies as appropriate, should, with the support of the new Administration and relevant Congressional Committees, reassess how they relate to SSOs.[27] Specifically, the appropriate agencies should take steps to ensure that domestic legislatively mandated or widely agreed upon public policy goals are addressed in the international standards setting process and that the views of all interested stakeholders—industry, government, academia, and civil society—are represented at each stage of the standards development process.[28]

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[26] For example, ATIS represents a wide coalition of telecommunications and high tech companies. Most ATIS companies do not manufacture telecommunications equipment and merely purchase such equipment from international vendors outside the United States. ATIS Members, ATIS (last visited Apr. 13, 2017), https://www.atis.org/01_membership/members/. ATIS members have reduced incentives to push international standards organizations to incorporate nation-specific public interest features that raise the costs of deploying and maintaining telecommunications networks. Equipment manufacturers, faced with implementing international standards in actual products, are unlikely to adopt nation-specific tweaks unless the feature is a product requirement for deployment in certain markets.

[27] OMB Circular A-119 explicitly provides for federal agency participation in SSOs including voluntary consensus bodies and notes that such participation "can be an important contribution to ensuring balance is achieved." *See* OMB Circular A-119, Federal Participation in the Development and Use of Voluntary Consensus Standards and in Conformity Assessment Activities, 27 (Jan. 27, 2017), https://www.nist.gov/sites/default/files/revised_circular_a-119_as_of_01-22-2016.pdf; *see also* Revision of OMB Circular No. A-119, Federal Participation in the Development and Use of Voluntary Consensus Standards and in Conformity Assessment Activities, 81 Fed. Reg. 4673 (Jan. 27, 2017), https://www.gpo.gov/fdsys/pkg/FR-2016-01-27/pdf/2016-01606.pdf.

[28] *See* Presentation Slides for September 20, 2016 Meeting of the Federal Communications Commission Technology Advisory Committee at 91-94, https://transition.fcc.gov/bureaus/oet/tac/tacdocs/meeting92016/TAC-Presentations9-20-16.pdf (recommending that the Commission "establish[] an 'excellence' program around future end-end networks & systems," "undertake an updated assessment of fundamental US societal needs, priorities for economic growth and organizational structure, informed by in-depth insight into industry impact of systemic SDN/NFV/Cloud technology-driven changes" and "establish and maintain a living '5G watch list' of priorities and essential needs for the US market,").

IV. Acknowledgements

In preparing this paper and arriving at the proposition to be addressed, the author benefited greatly from communications with many colleagues, especially those that also served as members of the FCC's Technological Advisory Council and those that are affiliated with the Silicon Flatirons Center for Law, Technology and Entrepreneurship at the University of Colorado at Boulder. For both editing and substantive help, the author is particularly indebted to two Research Assistants, Galen Marston Pospisil and Alexander Joseph Vetras, both students in the University of Colorado School of Law.

Appendix A: Membership Requirements for Standards Setting Organizations

The membership requirements for three categories of SSOs (traditional telco-led, internet related, and open source) shed light on the concern that civil society groups may not be able to participate in SSO deliberations because of governance requirements. First, representative of traditional telco-led SSOs, The Alliance for Telecommunications Industry Solutions (ATIS) requires their full-time members to pay a minimum of $5,000 in annual dues regardless of the member's revenue.[29] Once a member's combination of North American revenue and Non-North American revenue meets a certain threshold, these dues incrementally increase.[30] While only organizations with Full, or ATIS membership, must pay dues, not all organizations are eligible for Full Membership status.[31] ATIS lists several examples of organizations that only qualify for Affiliate Membership: "associations, educational institutions, and PSAPs [(public-safety answering points)]."[32] Although both Full Members and Affiliate Members can hold voting rights, the memberships come with major differences in eligibility for leadership positions. ATIS states: "Affiliate ATIS Member Company representatives…shall not serve as leaders of Forums" and additionally, they "shall not serve as leaders of Subtending Committees or Subcommittees."[33]

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[29] *See* ATIS Dues Calculator, ATIS (last visited Apr. 7, 2017), http://www.atis.org/DuesCalculator/CalcDues.aspx/.
[30] *Id.*
[31] Join ATIS, ATIS (last visited Apr. 7, 2017), http://www.atis.org/01_membership/becomemem.asp/.
[32] *Id.*
[33] Operating Procedures for ATIS Forums and Committees, ATIS, 2-3 (2015), http://www.atis.org/legal/Docs/OP/atisop.pdf.

In contrast, the IETF, an internet related SSO, explains that it has "no formal membership, no membership fee, and nothing to sign."[34] To participate, a newcomer just needs to join a mailing list. Because there is no formal membership for IETF, decisions are not made by voting, but rather by a "general consensus" from those people on a particular mailing list.[35] That being said, the IETF concedes that "[i]f you really want to get results, you probably need to attend some meetings. . . ."[36] And they add that "[t]his isn't free; apart from travel and hotel costs, there is a meeting fee."[37] Thus, while the IETF may be more accessible up front than ATIS, real influence again seems to come with a price tag. Further, the IETF must operate based on the vague idea of "general consensus," while ATIS's memberships allow for a definitive ballot system, albeit at the expense of a more organic, or at least more open, leadership selection process.

Third, the OpenDaylight Project (ODP), which serves as a representative of an open source SSO, sets forth a mix of the guidelines found in the structures of ATIS and the IETF. ODP has six classes of membership: "Platinum Members, Strategic End-User Members, Gold Members, Silver Members, Individual Committer Members, and Associate Members."[38] While there are no fee requirements to join ODP, its voting process is greatly influenced by paying members. For example, Platinum Members who have met all of their fee and membership obligations are given the power to appoint a director on ODP's board, and if they choose, they can also nominate their chosen director to be an officer of ODP.[39] Additionally, Platinum Members can appoint and maintain a representative on the Technical Steering Committee (TSC).[40] Without paying a fee, however, the only membership options available are the Individual Committer and the Associate Member. And of these two, only the Individual Committers can vote among themselves to elect a maximum of two directors to join the board.[41] ODP promises that "[t]he Board and the TSC will use common voting methodologies and ensure

[34] Getting Started in the IETF, The Internet Engineering Task Force (last visited Apr. 9, 2017), https://www.ietf.org/newcomers.html.
[35] *Id.*
[36] *Id.*
[37] *Id.*
[38] Open Daylight Bylaws, OpenDaylight (Jul. 23, 2014), https://www.opendaylight.org/bylaws.
[39] *Id.*
[40] *Id.*
[41] *Id.*

no single vendor or group establishes a controlling number of votes on the Board."[42] Nonetheless, it seems clear that the automatic appointments of a Platinum member, as well as other privileges given to paying members, create barriers to any non-paying member who wishes to influence the ODP's ultimate design choices.

[42] *Id.*