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

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## 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.

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

## I. Background

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 <u>choice</u> of a particular architecture for a public network also has implications that stretch far beyond its internal technical and economic performance.

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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).

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 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

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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).

obtained from, a remote centralized location. A major distinction between a decentralized and centralized network computing function is that, in the latter case, 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

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).

System (ONOS), OpenSwitch, and Central Office Reimaged as a Data Center (CORD), etc.

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



[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).

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.

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.



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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.

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 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

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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.

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 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

[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).

systems or that are attempting to influence them, they may not be able to participate 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

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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).

civil society group does not get adequate and timely notice and appropriate 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,

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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.

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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Much of the PSCR's efforts are focused upon FirstNet. FirstNet is an independent authority within 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

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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

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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.*