

22 October 2012

The Honorable Julius Genachowski  
Chairman  
Federal Communications Commission  
445 12<sup>th</sup> Street, SW  
Washington DC 20554

Dear Chairman Genachowski:

As President of the Institute of Electrical and Electronics Engineers-United States of America (IEEE-USA), I believe you would like to note our recent position statement, "*Developing the U.S. Broadband Network*," (attached/available at <http://www.ieeeusa.org/policy/positions/Broadband0912.pdf>).

The position recognizes the great advances made in the last few years, but calls out the following issues as needing early and urgent action:

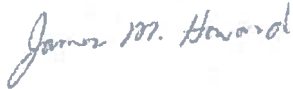
- **Further development of the broadband network, mainly by encouraging the competitive forces of industry to accomplish it—to adequately serve the needs of the entire nation and to reach parity with the principal U.S. global competitors.**
- **Additional broadband spectrum with improved efficiency of use—to support wireless applications for mobile commerce, rural access, and public safety.**
- **Legislation that strengthens the security of the network—to fight incursion into critical public- and private-sector infrastructure networks, costly industrial espionage, and loss of trust in commercial network transactions.**
- **Early completion of Universal Service Fund reform and transition to the Connect America Fund—to give underserved populations economic and social opportunity equal to that of fully served areas.**

These four imperatives are not exhaustive. Rather, they deserve particular attention as critical to the rapid, comprehensive, and equitable development of a key national resource. Other issues, such as protection of privacy and protection of intellectual property, remain for similar attention. We thank all parties for their past and future concern for our broadband infrastructure.

IEEE-USA advances the public good and promotes the careers and public policy interests of the more than 200,000 engineering, computing and technology professionals who are U.S. members of IEEE. <http://www.ieeeusa.org>. If we can be of further assistance, please contact Deborah Rudolph in our Washington office at (202) 530-8332 or email at [d.rudolph@ieee.org](mailto:d.rudolph@ieee.org).

IEEE-USA stands ready to meet with interested groups to discuss this paper further.

Sincerely,



James M. Howard  
IEEE-USA President

Distribution List - The same letter was sent to the following:

- The Honorable Lawrence Strickling, Asst. Secretary of Commerce,  
National Telecommunications & Information Administration
- All Members of the U.S. House Energy & Commerce Committee
- All Members of U.S. Senate Commerce, Science & Transportation Committee

JMH/dr:bc



## POSITION STATEMENT

# Developing the U.S. Broadband Network

*Adopted by the IEEE-USA  
Board of Directors, 19 September 2012*

IEEE-USA continues to recommend that government and industry take further action to improve the functioning of the U.S. broadband network. Such action should be focused on development and policy issues that enable the network to fully satisfy the communication needs of the United States.

Important technological and social trends since IEEE-USA's earlier policy position on this subject<sup>1</sup> have driven a dramatic increase in traffic as measured by the number of users and the volume of traffic per user. This growth raises imperatives for the broadband network taken as a whole, including the wireless portion. The National Broadband Plan<sup>2</sup> comprehensively addresses these issues. The four most urgently needed policy responses, in the view of IEEE-USA, follow:

- **The Federal Communications Commission (FCC) should point the way toward a broadband network that serves the needs of the entire nation and reaches parity with the principal U.S. global competitors, empowering the competitive forces of industry to achieve it. The result will stimulate economic activity, social services, and innovative applications.**

The wide-ranging dependency on broadband services gives sound evidence of the value of the comprehensive network to society. At the same time, both its reach and performance lie below values for many other countries. Plainly, its future development must take its place among the nation's priorities, tracked by uniform measures.

In particular, the FCC should establish consistent measures of the national wireline and wireless broadband network performance and set future milestones for ample network capability.

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<sup>1</sup> *Nationwide High-Speed Broadband Data Services*, Adopted by the IEEE-USA Board of Directors, 15 January 2009 - <http://www.ieeeusa.org/policy/positions/broadband.pdf>

<sup>2</sup> *The National Broadband Plan Connecting America*, <http://www.broadband.gov/download-plan/>

Such measures, or metrics, should consider such factors as market and subscriber penetration, network speeds, and service prices, all suited to U.S. demographics and terrain. FCC should set time-sensitive milestones for measurable improvement, rather than final goals, aware that technical and financial objectives are subject to continuous change. The metrics should distinguish between wireless and wireline services, because each has distinct advantages and limitations depending on the applications. With such metrics each kind of provider can compare their relative usage side-by-side and encourage use of the more suitable technology for given purposes.

- **The FCC, the Department of Commerce, and industry, in cooperation, should intensify efforts to increase available broadband spectrum as an essential part of the broadband network and to improve its efficient use. The results will support wireless applications for mobile commerce, rural access, and public safety.**

Doing so will provide anywhere-anytime communication, commercial transactions, and entertainment. Such action will also continue to drive down the cost of deploying and delivering wireless broadband service.

Specific actions should identify underused licensed bands beyond those already earmarked, facilitate spectrum sharing in underused bands, expand unlicensed ones, speed up auctions of licensed bands where exclusive use is essential, and expedite regulatory review of proposed innovative spectrum technologies. Steps should also support research on efficient spectrum use, establish procedures for the treatment of harmful interference in spectrum allocations, assure a comprehensive backhaul network for wireless traffic, and require open standards.

- **The Congress should promptly enact legislation that strengthens the security of the broadband network. Such provisions will limit harmful incursion into critical public- and private-sector infrastructure networks, costly industrial espionage, and loss of trust in commercial network transactions.**

Without cybersecurity, the usefulness of the network vanishes. Cyberattacks on the United States increased 44 percent in 2011, according to the Director of the National Security Agency, Keith B. Alexander. Domestic and international threats are well documented by almost daily reports. Wireless networking is especially vulnerable because the radio signal itself can be intercepted with little or no physical intrusion into secure areas. Internetworking is also at risk with the service and subscriber Internet addresses exposed to faraway actors on the Internet.

New legislation should provide both incentives for and regulation of enhanced security. Organizations at risk should share information on threats and defenses among themselves and the government. Authorities should certify critical

infrastructure providers that use best practices to harden their systems against attack. Policy should support development of platform security standards, widespread security education, and protection of privacy and civil liberties. However, even these measures can only improve security rather than guarantee it because of the dynamic nature of the Internet and the ingenuity of its assailants.

- **The FCC should bring Universal Service Fund (USF) reform and the transition to the Connect America Fund to early completion. This initiative will give underserved populations equal economic and social opportunity with fully served areas, fully integrating their resources and output into the national economy.**

Rural broadband penetration still lags that of urban areas. FCC reports that approximately 19 million Americans, mostly rural, lack access to fixed broadband and, indirectly, the jobs and opportunities made possible by it<sup>3</sup>. Investment in wireless capabilities in sparsely populated areas comes at less cost than in wireline, so that full use should be made of this technology.

As examples of particular moves, USF reform should relax the requirements for “Eligible Telecommunications Carrier,” to allow new competitive entrants, bringing new services and innovations. Policy should expedite competitive deployment of new Wireless Internet Service Providers who deliver robust rural broadband capability at a cost that is often substantially less than traditional wireline and mobile wireless.

These four imperatives are not exhaustive. Rather, they deserve particular attention as critical to the rapid, comprehensive, and equitable development of a key national resource. Other issues, such as protection of privacy and protection of intellectual property, remain for similar attention.

Intensified effort remains necessary—first, to achieve objectives as yet unmet; next, to attain and sustain U.S. technological and competitive advantage globally; and, finally, to open a new era of innovation for knowledge-based goods and services in the domestic economy.

This statement was developed by the IEEE-USA Committee on Communications Policy and represents the considered judgment of a group of U.S. IEEE members with expertise in the subject field. IEEE-USA advances the public good and promotes the careers and public policy interests of more than 200,000 engineers, scientists, and allied professionals who are U.S. members of IEEE. The positions taken by IEEE-USA do not necessarily reflect the views of IEEE or its other organizational units.

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<sup>3</sup> *Annual Report and Analysis of Competitive Market Conditions With Respect to Mobile Wireless, Including Commercial Mobile Services*. FCC 11-103. June 27, 2011, [http://hraunfoss.fcc.gov/edocs\\_public/attachmatch/FCC-11-103A1.pdf](http://hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-11-103A1.pdf)

## **BACKGROUND**

The growth of high-data-rate traffic is predicted at a compound annual rate of about 22 percent (**See Reference 1 - Cisco, 2012**). Improving and developing all aspects of broadband communications to accommodate such traffic is the only way to continue to enjoy the socio-economic benefits derived already from national, regional, and local broadband technologies, networks, and applications. (Broadband, in the context here, refers, typically to wired data rates greater than 3 megabits per second, and somewhat less for wireless.)

### **Broadband Has Enjoyed Great Advances**

Broadband has made notable progress in the last four years through the leadership of the Administration, Congress, the Federal Communications Commission (FCC), the National Telecommunications, and Information Administration (NTIA), and industry.

In particular, in 2009 the American Recovery and Reinvestment Act (Stimulus Bill) provided \$7.2 billion for broadband, including some funds for digital literacy, administered in part by the NTIA and in part by the Rural Utilities Service (RUS).

The FCC issued its National Broadband Plan (NBP). The NBP has set in motion many plans, workshops, studies, reports, and proposed rulemakings to implement its many specific and ambitious goals to be reached by 2020. Among these are affordable fixed service at leading-edge speeds, a world-leading wireless service that will require newly available spectrum, assured cybersecurity, and universal access with special concern for rural areas. This paper focuses on those four goals.

The “no blocking” provision of the FCC’s Report and Order, Preserving the Open Internet, took a welcome step toward network neutrality and competitive content (**See Reference 2 - FCC, 2010b**).

The FCC announced reform of the Universal Service Fund (USF) and creation of the Connect America Fund (CAF). Both are important to communications in underserved and rural areas (**See Reference 3 - FCC, 2011b**).

The FCC’s Measuring Broadband America program provides useful ongoing data about speeds offered and actually delivered by Internet Service Providers (ISP) (**See Reference 4 – FCC, 2012a**). The average delivered speed increased to 14.6 megabits per second.

The NTIA maintains a searchable, public database of information on broadband Internet availability in the United States—the National Broadband Map (**See Reference 5 - NTIA, no date**).

President Obama ordered government agencies to facilitate broadband infrastructure deployment within their operations (**See Reference 6 - White House, 2012**).

Industry invested a total of \$195 billion in 2009 through 2011 in additional backbone and subscriber bandwidth to accommodate convergence of information by Internet delivery (**See Reference 7 - Brogan, 2012**). As a result, 96 percent of Americans now have access to fixed broadband. Nevertheless, *penetration* (the fraction of households that subscribe), as well as usage, lags for economic and cultural reasons. Further, industry developed immensely popular 3G and 4G mobile networks, bringing the estimated total mobile subscribership to 332 million (**See Reference 8 - CTIA, 2012**). Wireless broadband applications (for example, video) as well as adjunct technologies (for example, Wi-Fi) have expanded at extremely high rates. In particular, the United States ranks third, behind the United Kingdom and South Korea, with 114,000 free and pay Wi-Fi hot spots (**See Reference 9 - JiWire Global, 2012**). Even so, WiMAX and fiber-to-the home have slowed.

### **New Trends Emerged**

Nonetheless, during the same period significant trends appeared that raised new issues for resolution and intensified the need to achieve still unmet objectives.

Internet delivery of video, social networking, and cloud computing produced more traffic. Sensing and remote control of objects (the so-called “Internet of Things”), such as home surveillance systems, as well as critical systems like the electric grid, created demand for greater wireline and wireless bandwidth. In spite of all the progress, network congestion resulted from concurrent transmission of data, audio, and video under limited bandwidth. Fortunately, steps to counter such congestion emerged through nondiscriminatory network management with respect to type of content, sources, and users.

Yet, penetration, speed, and price in the United States still lagged those measures in other developed countries despite increase in traffic. According to the Organization for Economic Cooperation and Development (OECD), among its 34 countries, the United States was 15<sup>th</sup> in subscriptions per 100 inhabitants, 19<sup>th</sup> in advertised speeds, and 29<sup>th</sup> in the lowest price per megabit per second (**See Reference 10 - OECD, 2012**). Although many country-specific factors are responsible for these differences, U.S. policy holds that competition is the best force to drive investment and innovation, which in turn should improve the U.S. rankings. .

Mobile applications and commerce became enormously popular. For example, in 2009, the mobile wireless system comprised 21.8 percent of the total revenues of the U.S. information and communications technology industry, up from 19.9 percent in 2008. Data revenue increased 28 percent from \$32 billion to \$42 billion. The spectrum deficit to support such growth will approach 300 megahertz by 2016. (**See Reference 11 - FCC, 2011a**).

Network security emerged as an overriding priority. Intrusions into computers that run essential infrastructure increased 17-fold from 2009-11, according to the director of the National Security Agency, Keith B. Alexander (**See Reference 12 - New York Times**,

**2012**). For example, a software system called Niagara Framework controls 11 million devices in 52 countries. These devices include supervisory control and data acquisition systems responsible for critical infrastructure management, which were vulnerable to cyberattack (See Reference 13 - O'Harrow, 2012) until security patches were issued in August, 2012. Beyond the national security threat, cyberattacks result in illicit appropriation of proprietary technology and business information. Estimates of these losses are imprecise and vary widely, but they are in the range of tens of billions of dollars per year. Further, lack of network and storage security invites computer fraud and identity theft, injuring ordinary consumers.

Rural or low population density areas remained a paradox for providing broadband services. Such areas are often hardest to serve, yet often see the greatest economic benefit from getting broadband capability. They suffer from the one-two punch of initial higher build-out cost and lower on-going revenue. Both factors contribute to the very real challenge of rural business model sustainability.

### **New Issues Require Action**

The issues raised by these trends go beyond simple considerations of availability, speed, and price. Therefore, the further development of broadband network services should broadly support all the NBP initiatives, in anticipation of their benefits, with emphasis on the following:

- ***Network capability.*** Set milestones and encourage competition to reach penetration, speed, and price levels that accommodate demand from existing and new applications—to meet all domestic needs and to assure a fully competitive position with main U.S. global partners.

Achieve average broadband penetration approaching telephone penetration (94 percent), recognizing unique demographic and geographic characteristics. In contrast, the adoption rate for 3-megabit-per-second fixed service (fraction of subscriptions in households that have access) was only 40.4 percent in June, 2011 (See Reference 14 - FCC, 2012b).

Set wireline and wireless speed milestones at or above even the foreseeable high-end applications. Headroom allows for inevitable growth in demand. Additionally, speed milestones are useful in that they tell innovative developers what execution speeds they can design toward.

Propose price milestones to achieve or exceed parity with major global economies—typically \$0.50 per month per megabit per second at present. Lower prices will increase penetration of broadband by those who cannot presently afford its capabilities.

The above three parameters should equal or exceed comparable values for China, Japan, South Korea, and major European countries, for example. However they need not necessarily lead small economies such as Finland or



Sweden. FCC's Measuring Broadband America program should serve as a useful tool for tracking progress toward the milestones.

The challenge of meeting these three performance objectives is compounded by growth in applications—those existing and those yet to be innovated. For example, apart from voice and data, Internet delivery of entertainment streams constituted 60 percent of North American fixed peak download traffic in 2011 **(See Reference 15 - Sandvine, 2011)**. Cloud computing and social networking also make up increasing components of traffic. New applications continually require increased capacity, both in the backbone and in the connection to the user. Examples include full telecommuting, virtual meetings, live video meetings, and virtual presence. These applications, moreover, contribute to reducing carbon emissions by decreasing energy-consuming travel. Wireless sensing and remote control of individual objects as well as entire critical systems, such as the Smart Grid, need to be accommodated. As an especially forward-looking example, the US Ignite Partnership seeks to catalyze approximately 60 advanced, next-generation applications in six areas of national priority: education and workforce development, advanced manufacturing, health, transportation, public safety, and clean energy using symmetric 100-mebabit-per-second speeds **(See Reference 16 - US Ignite, 2012)**.

Effective competition within the industry in services, applications, and content—and to a lesser extent in facilities since facilities can be shared by many service providers—should provide the main approach to achieve the above network goals. Competition will compel a combination of efficient resource allocation and expansion of facilities.

Competition should also provide incentives for expansion, experimentation, and innovation. Multimodal competition in facilities is already provided primarily by the cable and digital-subscriber-line plants and, to a more limited extent, by terrestrial wireless, satellite, and fiber-optic systems. As technology extends wireless coverage and capacity, the competitive mix of transport modes will be enlarged. Developing applications, such as migration of TV to the Internet, telemedicine, and even the management of unmanned aerial vehicles, will demand such an expanded blend of wireless and landline facilities. Innovative pricing models, such as tiered pricing for different service levels, can promote efficient network utilization and pay for needed expansion.

Strategically, fiber gives the infrastructure more immediate capacity than other modes. Deploying as much fiber as possible to homes and businesses allows capacity to be easily expanded on future demand. It can be used in some applications to free up spectrum that would be better used for mobile communications and for sparsely populated areas where fiber is prohibitively expensive. There is ample opportunity to deploy more fiber, by both incumbents and fiber-oriented Competitive Access Providers. According to RVA, LLC, a market research and consulting firm, as of March 2012, the number of North American homes passed by optical fiber was 22,600,000, a small fraction of all

homes. The number of homes actually connected was only 8,000,000 (**See Reference 17 - Broadband Communities, 2012**).

In addition to competition, adaptive network management can produce more efficient use of network resources, although it poses a difficult regulatory problem to monitor and prevent abuses. Also, negotiation between service providers and facilities providers for access to the physical network, can realize content-related benefits of diversity, innovation, and end-user choice.

- ***Spectrum. Expand available spectrum and enable its efficient use—to support mobile commerce, rural access, and public safety.***

Spectrum is a critical component of the network as a whole. The following steps will ameliorate the spectrum issue.

Move quickly to make the NBP's proposed additional spectrum available for economically productive applications such as broadband, medical monitoring; first responders; law enforcement; and electric metering, monitoring, control, and optimization of distributed energy resources. Moreover, an additional user of spectrum, mobile entertainment, is the largest component (31 percent) of aggregate North American mobile traffic (**See Reference 15 - Sandvine, 2011**).

In particular, conduct a complete spectrum inventory to determine underused bands (for example the 3.7-4.2 gigahertz common carrier bands). Dynamically share underutilized and inefficient government allocations with both Federal and commercial users, as advocated in the report of the President's Council of Advisors on Science and Technology (**See Reference 18 - PCAST, 2012**). Emphasize availability of unlicensed spectrum. However, where exclusive licenses are unavoidable, expedite auctions so that market forces determine the highest economic use. Require prompt build-out schedules after a spectrum award. Reuse spectrum with many small cells (microcells and picocells). Use independent, competitive Wi-Fi hotspots for consumer price reduction. Use these and even smaller cells (femtocells) to offload cellular carrier traffic to the wired network at corresponding economic savings on new cellular telephony sites.

Eliminate excessive regulatory delay by strictly observing the time limit of one year for determining whether an new technology or service is in the public interest, as set by 47 USC 157(b) (Section 7 of the Communications Act of 1934, as amended).

Support research to alleviate spectrum scarcity, using integrated government, industry, and academic resources. Conduct basic and applied research where the technology is too forward-looking to be undertaken by commercial firms alone, such as data compression, modulation techniques, encryption-key management for large scale networks, and higher frequencies (for example, 60 gigahertz, able to support one gigabit per second). Also, support research-related activities, such as the clarification of harmful interference, that inform spectrum

regulators and policymakers, but may have no direct commercial reward for those who undertake them (**See Reference 19 - IEEE-USA, 2012**).

The use of databases to help aid spectrum sharing and reuse is also good. Ensuring adequate validation of other new approaches to spectrum sharing and use beyond databases, such as cognitive radio and frequency-agile (software-defined) radio are also important to our nation's spectrum policy innovation. Make nationally accredited test-bed facilities widely available at reasonable cost to both government and non-government users.

- **Security. Expedite legislation that provides both incentives and regulation for the security of broadband networks—to protect from cyberattack and industrial espionage and to establish trust in proprietary and personal network transactions.**

Allow the government to share information on threats and defenses with operators of critical networks. Legislate requirements for critical industries to share threat and attack information without compromising privacy and to adopt best practices as they evolve. In return for sharing, provide security-certified critical industries with reasonable liability protection for breaches. Allow the national security establishment to participate in defending critical industries against sophisticated threats, just as it would against physical attack.

For non-critical industries, legislate incentives rather than mandates. Develop, through standards organizations, platform security standards for end-user devices and systems.

Mount campaigns for public education on security awareness and proper end-user practices, as the most effective means of protecting widespread consumer networks. As the NBP recommends, such campaigns should point consumers to government agencies that combat fraud and identity theft.

A secure network will also help safeguard individual privacy, although personal data is widely disclosed and accumulated where no security breach occurs. Privacy policy, however, lies outside the scope of this paper.

- **Universal Access. Pursue Universal Service Fund reform and the Connect America Fund—to fill out connectivity to underserved populations, bringing them equality of opportunity with their fully served counterparts.**

The historical purpose of the USF was to provide universal telephone access to low-income subscribers and high-facility-cost (especially rural) areas. In rural areas USF meant subsidies for the copper-wire plant. However, technology has overtaken this narrow function. The convergence of services such as voice, video, and data delivered by one Internet "pipe" presents an opportunity for better economies of scale and sustainability in rural markets. The "pipe" can now consist of municipally funded optical fiber or reasonably priced broadband

wireless, either fixed or mobile. Accordingly, reform of USF and transition to CAF is in order.

In addition to the actions recommended at the beginning of this paper, there are useful specific steps that can be associated with such reform. Congress should expand the Community Connect program administered by RUS. Administrative action should remove anticompetitive barriers to self-financed rural deployment. Successful ventures of this nature now exist in many localities, for example, ECFiber, which serves 22 towns and one city in Vermont. Facilitate all fixed and mobile wireless to enable cost-effective rural availability. Launch programs to increase computer literacy to motivate actual subscriptions to available broadband.

**IEEE-USA concludes that to assure continued economic and social benefits that broadband networks have brought to the nation and to the world, their further development requires diligent attention by policymakers and the industry to issues, both new and unresolved, raised by the very success of such networks.**

The most urgent needs revolve mainly around network capability that is fully adequate for a competitive economy, available spectrum for that network, security of operation, and universal access for the population. To meet these needs, government should facilitate private sector action wherever possible and regulate with restraint. Competitive providers help to assure user choice, to compel efficient pricing, and to stimulate innovation.

Although the above position focuses mainly on U.S. networks, IEEE-USA supports efforts to expand broadband penetration in all countries, free of any national restraint on human rights, as a way to global economic growth and social equity.

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