Before the
Federal Communications Commission
Washington, DC 20554

In the Matter of	)	
	)	
A National Broadband Plan for Our Future	)	GN Docket No. 09-51
	)	
Providing Eligible Entities Access to Aggregate Form 477 Data as Required by the Broadband Data Improvement Act	)	GN Docket No. 09-47
	)	
Inquiry Concerning the Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion, and Possible Steps to Accelerate Such Deployment Pursuant to Section 706 of the Telecommunications Act of 1996	)	GN Docket No. 09-137
	)	
Comment Sought on Telework – NBP Public Notice #3	)	
	)	

To: The Commission

COMMENTS OF CTIA – THE WIRELESS ASSOCIATION®
NBP PUBLIC NOTICE #3

Michael F. Altschul
Senior Vice President, General Counsel

Christopher Guttman-McCabe
Vice President, Regulatory Affairs

David J. Redl
Director, Regulatory Affairs

CTIA – The Wireless Association®
1400 16th Street, NW, Suite 600
Washington, DC 20036
(202) 785-0081
www.ctia.org

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SUMMARY

Mobile wireless broadband networks are bringing U.S. consumers wireless broadband to the person, bringing access to the Internet wherever and whenever consumers want it. Mobile wireless broadband allows employees to work more efficiently wherever their jobs take them.

Constant investment and innovation in core wireless networks has driven a virtuous cycle of innovation that inures its benefits to U.S. consumers. Telework has advanced as a result of these network, device and application innovations that provide consumers with new ways to work away from the desk. From smartphone applications tailored to meet the needs of travelling employees to wireless hotspots bringing nomadic Wi-Fi connectivity on the road, the mobile wireless broadband industry continues to invest and build out to meet the needs of U.S. consumers.

Critical to the ability of any broadband network – particularly during times of emergency – is the ability to deploy service and adapt to changes in traffic. Wireless broadband networks, through both network traffic management techniques as well as dynamic changes to network elements, are robust and flexible tools for meeting U.S. telework needs now and in the event of a national emergency or pandemic.

If wireless broadband service is to continue to be a driver of efficiency for the American worker, however, the FCC needs to act on a wide range of issues – including tower siting, interference, and access to spectrum – that CTIA has raised previously in multiple filings in this docket. The simple fact remains clear that wireless broadband networks are fundamentally different than other broadband networks for many reasons. The Commission should not attempt to shoehorn wireless broadband into definitions and rules crafted and applied for use on wireline technologies. We urge the Commission to affirmatively recognize the different circumstances that militate against attempting to apply wireline rules to a wireless world and to foster the continued growth, investment, innovation and evolution of this industry.

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COMMENTS OF CTIA – THE WIRELESS ASSOCIATION®
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I. INTRODUCTION.

CTIA – The Wireless Association® ("CTIA")[1] submits the following comments in response to the Public Notice seeking comment on the impact of broadband on

[1] CTIA – The Wireless Association® is the international organization of the wireless communications industry for both wireless carriers and manufacturers. Membership in the organization covers Commercial Mobile Radio Service ("CMRS") providers and manufacturers, including cellular, Advanced Wireless Service, 700 MHz, broadband PCS, and ESMR, as well as providers and manufacturers of wireless data services and products.

telework.[2] Mobile wireless broadband networks are bringing U.S. consumers wireless broadband to the person, bringing access to the Internet wherever and whenever consumers want it. Mobile wireless broadband's impact on telework is transformative – bringing the ability to work more efficiently to U.S. employees wherever their jobs take them. To continue to be a driver of efficiency for the American worker, the industry needs help from the FCC on a wide range of issues – including tower siting, interference, and access to spectrum – that CTIA has raised previously in multiple filings in this docket. Critical to the ability of any broadband network is the ability to deploy service and adapt to changes in traffic. Wireless broadband networks, through both network traffic management techniques as well as dynamic changes to network elements, are robust and flexible tools for meeting the needs of U.S. workers.

II. MOBILE WIRELESS BROADBAND ENABLES AMERICANS TO WORK MORE EFFICIENTLY AND PRODUCTIVELY WHEREVER THEIR JOBS TAKE THEM.

As CTIA has stressed to the Commission, wireless is not a third broadband pipe into the *home*, but rather broadband to the *person*, wherever they are, whenever they want access to information. Where wireless broadband has revolutionized the way Americans think about access to the Internet and their data, the field of telework is no exception. With incredible investment in third and fourth generation wireless networks and technologies and innovative wireless devices created to take advantage of high-speed networks, mobile wireless broadband is enabling the U.S. workforce to work wherever their jobs take them.

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[2] *Comment Sought on Telework – NBP Public Notice #3*, GN Docket Nos. 09-47, 09-51, 09-137, Public Notice, DA 09-2018 (rel. Sept. 4, 2009) (the "Public Notice").

Growth of Mobile Wireless Broadband. Mobile broadband additions are driving the growth of high-speed lines overall, and mobile broadband utilization rates are accelerating at breakneck speed. As wireless networks continue to evolve, this trend will only continue. The Commission's data shows that, since 2005, mobile wireless providers have been the fastest-growing providers of both high-speed lines (over 200 kbps in at least one direction) and advanced service lines (over 200 kbps in both directions), with subscriber counts for high-speed lines more than *doubling* and advanced service lines more than *tripling* from just one year earlier.[3] The report further demonstrates that wireless broadband additions from December 2006 to December 2007 (the most recent data available) outpaced, by nearly three to one, the additions for cable companies and wireline telephone companies combined.[4] As of December 2007, mobile wireless providers served more than 15 million customers with advanced service lines – nearly 20 percent of all advanced services.[5]

Mobile Wireless Broadband Network Investment. Mobile wireless broadband providers invest billions annually to extend the coverage and capacity of their networks. According to CTIA's Semi-Annual Survey, wireless network providers invested an average of more than $22.8 billion per year to upgrade their commercially operational

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[3] Report of the Wireline Competition Bureau, Industry Analysis and Technology Division, *High-Speed Services for Internet Access: Status as of December 31, 2007*, at tbls.1-2 (rel. Jan. 2009), *available at* http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-287962A1.pdf.

[4] *Id.*

[5] *Id.*at tbl. 2.

networks from 2001 through 2008. That figure doesn't include the more than $33 billion spent to acquire spectrum licenses at auction.

The result of this investment is that according to FCC data, more than 90% of Americans live in areas with more than four 3G wireless service providers. And, Commission data shows that more consumers have adopted wireless broadband between 2005 and 2007 (the last year the FCC has released data for high-speed subscribers) than DSL and cable, combined. New facilities-based wireless broadband providers are entering the market as a result of the additional spectrum made available through the AWS-1 and 700 MHz auctions. For example, regional provider Leap Wireless has entered several new markets offering wireless broadband service in the last year.[6]

Innovative Wireless Devices and Technologies Enable Telework. From smartphones with applications tailored to meet the needs of employees in disparate industries to wireless PC cards, netbooks and CMRS-enabled Wi-Fi hotspots, the U.S. mobile broadband industry provides many ways for U.S. employees to reach their data and more efficiently conduct business.

For example, mobile broadband telework can occur through dedicated equipment designed to enhance productivity. A well known example of unique wireless broadband devices for telework is the tablet used by United Parcel Service ("UPS") employees. UPS has long used the tablets to increase employee productivity, speed the delivery of

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[6] *See e.g.* "Cricket's Flat-rate, Unlimited Wireless Service Now Available in Washington, D.C.", Press Release *available at* http://www.mycricket.com/aboutcricket/pressroom/details?id=421 (June 23, 2009).

packages, and provide customers with real-time tracking data. This is accomplished through mobile wireless broadband.[7]

Similarly, wireless productivity applications are making telework a part of consumer and business wireless devices. Smartphones like the Blackberry, iPhone, Palm Pre, Windows Mobile devices and others support Microsoft Exchange – the most common corporate email client. Applications specifically written to take advantage of evolving wireless device capabilities are also bringing the work desktop to U.S. employees' hands. For example, MyAccountsToGo, an application written for sales, marketing and financial employees, enables remote access to account information on the SAP BusinessOne financial management system from their wireless devices.[8]

Finally, advances in mobile wireless broadband access technologies are making mobile broadband accessible by more devices. Wireless data cards are bringing direct access to mobile broadband to laptop computers,[9] computer manufacturers and wireless

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[7] *See* Elena Malykhina, *UPS Seeks Reliability, End-to-End Visibility*, Information Week *available at* http://www.informationweek.com/news/global-cio/showArticle.jhtml?articleID=60405849 (March 7, 2005).

[8] *See e.g.* MyAccountsToGo *available at* http://itunes.apple.com/WebObjects/MZStore.woa/wa/viewSoftware?id=284995969&mt=8.

[9] *See e.g.* Cell Phones and Devices, AT&T *available at* http://www.wireless.att.com/cell-phone-service/cell-phones/cell-phones.jsp?feacondition=allphones&feapaytype=standard&startFilter=false&typcat1002=cat1002&allFeatures=on&allManus=on; Mobile Broadband, Verizon Wireless *available at* http://www.verizonwireless.com/b2c/mobilebroadband/?page=products_device&lid=//global//phones+and+accessories//mobile+broadband+devices//data+cards+and+modems; Sprint *available at* http://nextelonline.nextel.com/NASApp/onlinestore/en/Action/DisplayPhones?filterString=Mobile_Broadband_Devices_Phone_Char&id12=UHP_PhonesTab_Link_MobileBroadbandCards; T-Mobile webConnect USB Laptop Stick *available at* http://www.t-

(continued on next page)

providers are offering computers with embedded mobile broadband capabilities,[10] and mobile wireless hotspots provide connectivity to Wi-Fi enabled equipment over mobile broadband networks.[11] The end result of this innovation is better access to data over mobile broadband networks, whether for telework or in our everyday lives.

Economic Impact of Mobile Wireless Broadband. In addition to making access to work easier and more convenient for U.S. employees, mobile wireless broadband is also having a positive impact on the U.S. economy. According to a 2008 study by Ovum, productivity gains from wireless broadband technologies will total nearly $860 billion between 2005 to 2016. In these tough economic times, the value that wireless broadband adds also cannot be underestimated. In 2007 alone, U.S. wireless services added nearly $100 billion in "value added" contributions to the U.S. GDP.[12]

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mobile.com/shop/phones/Cell-Phone-Detail.aspx?cell-phone=T-Mobile-webConnect-USB-Laptop-Stick.

[10] *See e.g.* Cell Phones and Devices, AT&T *available at* http://www.wireless.att.com/cell-phone-service/cell-phones/cell-phones.jsp?feacondition=allphones&feapaytype=standard&startFilter=false&typcat1890038=cat1890038&allFeatures=on&allManus=on; HP Mini 1151NR Netbook, Verizon Wireless *available at* http://www.verizonwireless.com/b2c/hpnetbook/overview.jsp?lid=//global//phones+and+accessories//netbooks.

[11] *See e.g.* MyFi 2200 by Novatel Wireless, Sprint Nextel *available at* http://nextelonline.nextel.com/NASApp/onlinestore/en/Action/DisplayPhones?filterString=Mobile_Broadband_Devices_Phone_Char&id12=UHP_PhonesTab_Link_MobileBroadbandCards; Mobile Broadband, Verizon Wireless *available at* http://www.verizonwireless.com/b2c/mobilebroadband/?page=products_mifi.

[12] "The Wireless Services Sector: A Key to Economic Growth in America," Harold Furchtgott-Roth, at 4-5 (Jan. 2009).

III. MOBILE WIRELESS NETWORK RESILIENCY AND FLEXIBILITY PROVIDE ROBUST, AGILE BROADBAND INFRASTUCTURE SOLUTIONS.

Wireless broadband networks have consistently demonstrated the ability to adapt rapidly to accommodate public demands during the times of crisis. For example, following Hurricane Katrina, wireless networks were instrumental in delivering core communications capabilities to both citizens and first responders. Over 25,000 phones were delivered to the area to provide wireless service. Despite near-term difficulties involving loss of power and backhaul,[13] within one week after Katrina, approximately 80 percent of wireless base station sites in the affected area were up and running at full capabilities.[14] Moreover, the Katrina Panel noted that more than 100 cellular base stations on wheels ("COWs") were used to successfully restore service throughout the affected region.[15] Text messaging provided by wireless providers was highlighted as a service that offered communications even when voice networks became overloaded with traffic.[16] The resiliency of the wireless infrastructure allowed public safety responders, as well as the public, to have access to communications during the aftermath of the storm. In contrast, many of the other communications capabilities that relied upon wired

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13 *See* Independent Panel Reviewing the Impact of Hurricane Katrina on Communications Networks, *Report and Recommendations to the Federal Communications Commission*, rel. June 12, 2006 ("Katrina Report") at 9.

14 *Id.*

15 *Id.*

16 *Id.*

infrastructure were unable to be used reliably for significant periods of time following Hurricane Katrina.[17]

The results of studying national disaster communications response, such as what followed Hurricane Katrina, should not be surprising. Wireless systems are capable of network efficiencies that can be shaped and adapted to the communications needs of the public. During times of peak capacity usage, such as following a natural disaster or during a period of time of dense communications (such as the Presidential inauguration), wireless providers have a variety of tools available to manage and add to the near-term communications system to respond to high volumes of traffic.

Cellular Base Stations on Wheels ("COWs") and Cellular on Light Trucks ("COLTs"). One of the significant methods wireless broadband providers are able to deploy during peak demand cycles are COWs and COLTs. COWs and COLTs are portable cellular base stations that are fully functional without the need for access to commercial power. Within these portable base stations is a full assortment of equipment to sustain base station operations: (1) a diesel generator to ensure that the system is capable of operating even without commercial power; (2) RF equipment such as antenna mounting equipment, antennas, base station controllers and switching gear; (3) air conditioning capabilities to ensure equipment does not overheat; (4) AC power

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[17] *See e.g.*, Katrina Report at 8-9 (noting the difficulties in resurrecting wireline communications in the impacted area).

connectivity, should there be the ability to connect to AC power; and (5) lighting and other needs to enable communications.[18]

COWs and COLTs are used both in response to unexpected peak demands on networks[19] and for pre-planning when extraordinary usage is expected for the wireless system in a particular area.[20] For example, wireless providers in the Washington, DC area used COWs and COLTs to accommodate the increase in demand for wireless services during the inauguration of President Obama earlier this year. COWs and COLTs are able to be deployed and integrated into existing wireless networks by utilizing spectrum efficiency mechanisms such as cell splitting, and antenna sectorization to manage capacity gains for the network.

Cell Splitting. Cell splitting allows for the subdividing of a congested service area covered by a single wireless base station into smaller service areas, each covered with its own base station.[21] To manage network self-interference, the new wireless base stations (in this instance the COWs and COLTs) must reduce their antenna height and transmitter

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[18] *See e.g.*, http://www.mer-group.com/SiteFiles/1/172/528.asp (last visited Sept. 19, 2009).

[19] *See e.g.*, Katrina Report at 9; *see also* http://images.businessweek.com/ss/08/07/0704_ceo_guide/10.htm (noting that Cingular Wireless deployed over 85 COWs and COLTs to prepare for Hurricane Ivan in 2004) (last visited Sept. 19, 2009).

[20] *See e.g.*, http://www.wirelessweek.com/News/2008/12/Inauguration-Bringing-Coverage-Upgrades-to-D-C-/ (noting the preparations wireless providers were making prior to the inauguration, including deployment of COWs and COLTs) (last visited Sept. 19, 2009); *see also* http://www.webwire.com/ViewPressRel.asp?aId=103311 (noting Verizon Wireless use of a COW at Penn State stadium to support increased capacity during football season) (last visited Sept. 19, 2009).

[21] *See e.g.*, *Wireless Communications Principles and Practice*, Theodore S. Rappaport, ISBN 0-13-375536-3 (1996) at 54-55 ("Rappaport").

power as compared to the values used by the single base station. Cell splitting of this nature increases the capacity of a cellular system by increasing the number of times that voice and data channels are re-used – thereby increasing capacity and the additional number of voice and data channels per unit area.[22] It is important to note, however, that the ability to split wireless cells is dependent on access to additional sites for wireless towers. As CTIA has noted earlier in this docket, Commission action on CTIA's long-standing tower siting "shot clock" Petition will help ensure that cell spitting remains a viable option for wireless providers to accommodate consumer demand for services.

Antenna Sectorization. While cell splitting improves capacity by rescaling the overall system, another way to increase capacity is to increase the directionality of the transmitting antenna without reducing the transmitter power.[23] This mechanism is referred to as sectorization. It is implemented through the replacement of a single omni-directional antenna at the wireless base station by several directional antennas, each radiating within a specific sector. When sectorization is used by a wireless base station, the voice and data channels used in the service area are focused into sectored groups (so instead of all channels being used in a 360 degree area around the base station, the channels are able to be used in smaller sectors (such as 120 degree areas)), increasing the overall capacity to the wireless network with the same spectrum usage.[24]

Power Control for Advanced Wireless Systems. While cell splitting and antenna sectorization are techniques that have been deployed even in analog wireless systems,

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22 *Id.*

23 Rappaport at 57-58.

24 *Id.*

more advanced third generation systems (such as CDMA-based technologies as EV-DO and W-CDMA)[25] rely heavily on maintaining power control throughout the network to drive capacity gains. Power control is critical in CDMA-based technologies because each user in a particular service area is using the exact same frequency as other users. Through use of pseudorandom codewords, CDMA receivers detect only the specific desired codeword – the other operations without the codeword appear as noise.[26] Power control is provided by each base station in the broadband wireless system and assures that each mobile within the base station coverage area provides the same signal level to the base station receiver. This dynamic power control resolves the problem of a nearby subscriber overpowering the base station receiver and drowning out the signals of far away subscribers. The great benefit to the use of CDMA and power control is that this allows for a soft capacity limit. Increasing the number of users in a CDMA system raises the noise floor in a linear manner – meaning that there is no absolute limit on the number of users. However, system performance gradually degrades for all users as the number of users is increased, and improves as the number of users is decreased.[27]

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[25] CDMA stands for Code Division Multiple Access, an air interface technology that takes the narrowband voice or data message and multiplies by a very large bandwidth signal called the spreading signal. The spreading signal is a pseudo-noise code sequence that has a chip rate which is orders of magnitude greater than the data rate of the message. This spreading of the signal allows all users in a CDMA system to use the same carrier frequency and transmit simultaneously. EV-DO stands for Evolution-Data Only and is a standard developed for data communications based on the CDMA air interface. W-CDMA stands for wideband CDMA, a third generation wireless standard based on CDMA technology.

[26] *See e.g.,* Rappaport at 405.

[27] *See e.g.,* Rappaport at 406-407.

The ability of wireless networks to use techniques to increase capacity are extremely dynamic. As noted, COWs and COLTs can be deployed as needed, so long as the effects of introducing new coverage and capacity are carefully managed by the engineers of the wireless provider. Cell splitting, sectorization and power control, as examples of the types of mechanisms that are used to provide capacity gains, can be rapidly applied in many instances due to the automation and computerization present in today's wireless infrastructure. Wireless broadband providers obtain constant information from the network, including congestion and other network impairments, and in many cases are able to remotely shape and deploy network enhancements to respond to capacity requirements within the system.[28] In sum, wireless broadband networks have the ability to respond to the demands of the public, assuming carriers will continue to be able to actively manage their networks.

IV. AS EMPLOYERS AND EMPLOYEES BEGIN TO FOCUS ON PERFORMING THEIR JOB FUNCTIONS FROM LOCATIONS OTHER THAN THE OFFICE, NETWORK MANAGEMENT IS CRITICAL TO WIRELESS BROADBAND PROVIDERS' ABILITY TO ADAPT TO CHANGES IN NETWORK TRAFFIC.

While tools to change network topology allow wireless providers to adapt the network itself to changes in traffic patterns, such significant measures are often unnecessary for incremental changes in traffic, such as those that occur when a few employees telecommute. For these incremental changes, wireless broadband providers' network management tools provide operators with the ability to support both higher-bandwidth telework users and everyday wireless users.

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[28] *See e.g.*, http://www.commscope.com/andrew/eng/product/insite/ (describing the remote monitoring capabilities of a wireless base station) (last visited Sept. 19, 2009).

Wireless broadband providers have a number of tools at their disposal to classify packet data and ensure a quality broadband experience. These tools, broadly applicable throughout the history of the Internet Protocol,[29] enable wireless broadband providers to not only adapt to the ever-changing demand on wireless broadband networks and provide every user with a quality broadband experience, but also to meet the telework needs of U.S. employees. Tools such as congestion avoidance,[30] compression,[31] differentiated service handling, buffering, queuing,[32] and security screening[33] are all methods broadband providers can use to assure their customers a quality broadband experience.

Wireless broadband providers response to increased use from telework will similarly rely on network management techniques as the growth in use will not

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[29] *See e.g.* Comments of AT&T, Inc., WT Docket No. 07-52 at 37-40 (filed June 15, 2007).

[30] *Id.* at 40.

[31] *Id.* at 40-41.

[32] *Id.* (citing Chuck Semeria, *Supporting Differentiated Service Classes: Active Queue Memory Management*, at 5, Juniper Networks (2002) http://www.juniper.net/solutions/literature/white_papers/200021.pdf); OpenBSD, *PF: Packet Queuing and Prioritization* (2007) (http://www.openbsd.org/faq/pf/queueing.html). Network engineers have developed a variety of different queuing methodologies. Each is designed to maximize use of the network while minimizing packet loss, and each has its own strengths and weaknesses. Some queuing methodologies—such as "first-in-first-out" (FIFO) and "fair queuing" (FQ)—assign little or no priority to the packets associated with particular types of applications. Because these methodologies subject all applications to latency and jitter during periods of congestion, they are best suited for networks that do not handle real-time applications. In contrast, other techniques, such as "weighted round robin" (WRR) and "class-based queuing" (CBQ), establish different queues for packets associated with different types of applications. Each queue is then assigned sufficient bandwidth to manage latency and jitter, and each may "borrow" momentarily unused bandwidth allocated to other queues. Such dynamic bandwidth allocation facilitates the efficient use of finite network capacity.).

[33] *Id.* at 43-44.

necessarily take place in the same patterns that carriers have designed their networks to accommodate. As a consequence, wireless telecommunications providers need the flexibility not only to accommodate the overall increase in demand, but also to manage the shift in location of its consumers.

This week, Chairman Genachowski announced his intention to propose an NPRM that would extend the Broadband Policy Statement to wireless. The simple fact remains that wireless broadband networks are fundamentally different than other broadband networks for many reasons. The Commission should not attempt to shoehorn the modern, innovative wireless broadband industry into a definition crafted and applied for use on wireline technologies. We urge the Commission to affirmatively recognize the different circumstances that militate against attempting to apply wireline rules to a wireless world.

The underlying infrastructure of wireless networks, including spectrum, as well as the tight and coordinated integration of customer equipment with the network, make wireless significantly different from wired broadband networks:

- **The capacity of a wireless cell site is shared between all users in that cell.** The wireless user must share the available bandwidth with other users in their vicinity.[34]
- **The capacity of a cell is shared between all services running over the network.** Wireless voice and data use share the finite capacity of the cell.

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[34] *See* Opposition of CTIA, RM-11361 (filed Apr. 30, 2007), Attachment C (Jackson Paper) at 3.1.1; *see also* Marius Schwartz and Federico Mini, "Hanging up on *Carterfone*: The Economic Case Against Access Regulation," Mobile Wireless, May 2, 2007, at 19.

- **Wireless providers cannot "build their way out" of spectrum constraints.** Unlike wired services that can add capacity through greater buildout, constraints on expansion of network capacity are a reality for spectrum-based services. In the absence of significant additional spectrum allocations, wireless networks must be managed to maximize the consumer benefit from their network provider.

Affirmative recognition of the differences between wired and wireless networks, as CTIA has advocated, and as echoed by several other parties in their comments in this docket,[35] necessitate recognition that the Commission's Broadband Policy Statement is ill-suited for application to wireless networks. Wireless carriers' network management tools currently strike a content-neutral balance between the need to manage high-bandwidth applications when spectrum-constrained networks become congested, with access to the capacity and capabilities that have brought innovation to wireless consumers. However, as handset offerings and data speeds increase, consumption, and in particular bandwidth use, will continue to grow at a staggering pace. While U.S. wireless providers are among the most efficient worldwide, at some point, consumer demand will simply outstrip spectrum supply – there is a finite limit to how much capacity carriers can squeeze out of their networks.

These network management tools are even more critical to wireless broadband operations during times of crisis. High demand for telework, such as could occur during

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[35] *See, e.g.,* Comments of CTIA at 27-30; *see also* Comments of Google Inc. at 28-29; *see also* Comments of Mobile Future at 14-15; *see also* Comments of Motorola, Inc. at 21; *see also* Comments of Verizon and Verizon Wireless at 103-107, GN Docket No. 09-51 (filed June 8, 2009).

a pandemic, will likely produce a similar spike in demand, especially because many Americans may choose to use telecommunications while they care for a loved-one or recover from the flu and wish to avoid infecting others through face-to-face contact. It should also be noted that this demand will not be limited to one particular day. Experts predict that a pandemic would present in several waves, potentially lasting six to eight weeks each. Carriers' ability to adapt to these changes through network management tools is a necessary part of an appropriate and robust response.

V. CONSTANT INVESTMENT AND INNOVATION AT EVERY LEVEL OF THE WIRELESS BROADBAND ECOSYSTEM HAS PRODUCED ENORMOUS CONSUMER BENEFIT.

As discussed above, U.S. wireless providers invest more than $22 billion annually to expand network coverage and capacity – bringing a choice of at least four wireless broadband providers to more than 90% of Americans. But this investment in the network has not only improved the wireless networks themselves, but as a result of increased capacity and capabilities, carrier investment in faster innovative wireless networks has spurred a virtuous cycle of innovation, leading to new, cutting-edge devices that take advantage of increased network capacity and services, and driving the growth in wireless data use and applications for wireless data.

It is important to recognize that this level of application and device innovation is made possible by the investment and innovation at the network core. Every stage of the wireless broadband ecosystem participates in this virtuous cycle, beginning with wireless providers and equipment vendors. Without significant investment in networks and innovative research and development of next generation wireless technologies, consumers would not now be reaping the benefits of innovation at the network edge.

As wireless networks have evolved to third generation wireless technologies, and more spectrum has been made available and deployed by wireless providers to provide additional capacity, new and innovative devices have emerged to take advantage of those networks. From smartphones to PC cards, netbooks to CMRS-enabled Wi-Fi hotspots,[36] innovation in the wireless device sector is bringing American workers who wish to telework new and innovative ways to use third and fourth generation mobile wireless broadband wherever and whenever they want it.

As both next generation networks and innovative new devices and applications reach the consumer, the innovation at the edge – applications and services – brings new options to consumers. Consumer demand for these applications and services, in turn, drive carriers to reinvest in wireless networks to fuel the next generation of wireless innovation. This virtuous cycle of innovation in both the network and the edge has brought faster speeds, more robust networks, innovative devices, and innovative applications to U.S. consumers, including many of the capabilities that have made mobile telework a reality.

VI. CONCLUSION.

CTIA urges the Commission to recognize the value and innovation that wireless broadband networks continue to bring to U.S. employees as the workplace evolves beyond the office. Commission action to lower barriers to the provision of mobile wireless broadband service will foster continued growth, investment, innovation and evolution of wireless broadband in these tough economic times.

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[36] *See supra* Sec. II.

Respectfully submitted,

By: */s/ David J. Redl*

David J. Redl
Director, Regulatory Affairs

Michael F. Altschul
Senior Vice President, General Counsel

Christopher Guttman-McCabe
Vice President, Regulatory Affairs

CTIA–The Wireless Association®
1400 16th Street, NW, Suite 600
Washington, DC 20036
(202) 785-0081
www.ctia.org

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