Before the
Federal Communications Commission
Washington, D.C. 20554

In the Matter of	)	
	)	
Preserving the Open Internet	)	GN Docket No. 09-191
	)	
Broadband Industry Practices	)	WC Docket No. 07-52

To: The Commission

COMMENTS OF ALCATEL−LUCENT

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TABLE OF CONTENTS

SUMMARY i

I. INTRODUCTION AND BACKGROUND 2

II. BROADBAND DEMAND IS GROWING EXPONENTIALLY AND CANNOT BE REASONABLY ADDRESSED BY GROWTH IN CAPACITY ALONE 5

III. NETWORK MANAGEMENT PRACTICES ARE CRITICAL FOR ADVANCING HIGH-SPEED INTERNET ACCESS SERVICE AND OTHER IP-ENABLED SERVICES 8

IV. TO MEET BROADBAND DEMAND, NETWORK PROVIDERS MUST BE PERMITTED TO DEVELOP AND OFFER MANAGED SERVICES 10

A. The Commission Should Embrace Managed Services 11

1. Service Sensitive to Packet Loss 14

2. Service Sensitive to Packet Delay 16

3. Service Requiring Secure Private Connectivity 17

4. Service Requiring Bandwidth Guarantees 18

5. Customer–Requested Enhanced Treatment 19

B. Managed Services and Internet Access Service Offerings Will Co-Exist and Flourish 20

V. THE FCC SHOULD ENABLE FLEXIBLE MANAGEMENT AND BUSINESS MODELS AND SHOULD TREAD CAUTIOUSLY IN THE DYNAMIC BROADBAND MARKET 22

VI. THE FOUR CURRENT PRINCIPLES WHEN COUPLED WITH OTHER LEGAL TOOLS ARE SUFFICIENT TO PROTECT CONSUMERS. 24

VII. THE COMMISSION'S PROPOSED RULE ON NONDISCRIMINATION IS A SIGNIFICANT DEPARTURE FROM POLICIES OF THE UNITED STATES AND IS FAR MORE RESTRICTIVE THAN OTHER ADVANCED NATIONS. 25

VIII. THE COMMISSION SHOULD CONSIDER PLATFORM DISTINCTIONS WHEN IMPLEMENTING ITS RULES 27

IX. CONCLUSION 29

SUMMARY

Alcatel-Lucent ("ALU") submits the following comments in the Federal Communications Commission's ("Commission") Open Internet Docket. ALU agrees with the Commission that the openness of the Internet is its greatest asset and most profound strength. An open Internet fosters innovation and investment in both the core and at the edge, driving broadband adoption and increasing use. Alcatel-Lucent has been involved in the net neutrality debate since 2003, when it worked with the high tech community to craft the connectivity principles that eventually became the cornerstone of the Commission's Internet Policy Statement, and later in the 2007 Federal Trade Commission forum and the Commission's Broadband Notice of Inquiry.

Alcatel-Lucent's comments include the attached White Paper, which clearly demonstrates that the Internet traffic demand growth acknowledged by the Commission in its National Broadband Plan proceedings and industry is a reality. We are entering an unprecedented period of capacity demand due to ubiquitous broadband availability, the rapid uptake in devices connected to the Internet, and a change in consumer behavior with users spending more time online, demanding more bandwidth-intensive applications and services, and maintaining more data online. This "perfect storm" of users and uses is straining wireline and wireless broadband networks throughout the world. The White Paper includes the following data:

- Annual network traffic growth, for both wireline and wireless networks, will be between 100% and 114%, with other studies from other parties showing even more intensive growth.
- 100s of millions of new fixed and mobile Internet-connected devices will enter the marketplace.
- Consumer usage behavior is changing rapidly, with fewer passive users and more power users, who typically will consume exponentially larger amounts of bandwidth.

The solution to this unprecedented level of capacity demand is for the Commission to create an environment that provides incentives to invest in continually increased bandwidth networks with reasonable network management and managed services so that tomorrow's Internet maximizes consumer value. All networks need to be managed, including POTS and "best effort" broadband. The Commission should encourage, not discourage, reasonable network management practices and innovative managed services that ensure quality, mitigate congestion, and provide proven benefits to consumers.

The Commission should recognize that managed services are an asset to consumers and an incentive to drive broadband deployment, and the final regulatory proposal should exclude managed services from any rules developed for "best effort" Internet service. New, dynamic services are being made available to enhance the consumer experience on the Internet. These managed services not only include the traditional operator-provided service (e.g. IPTV or managed VoIP) but new consumer-demanded services that will empower users to demand enhanced quality and reliability for applications and services offered online. These services complement and benefit "best effort" Internet service, and service providers should be free to optimally manage their networks to meet varying consumer demand.

At this point, the Commission should continue to rely on its existing principles to protect consumers. There is no compelling evidence that the current principles are inadequate and need to be expanded or enhanced. Furthermore, the proposed rules, particularly the unqualified "nondiscrimination" rule, are overly restrictive, would inhibit innovation, and may be a barrier to effective network management techniques. Such rules would also distinguish the United States and be a departure from the views recently expressed by other nations that have examined the

issue of broadband discrimination. Such a distinction could have an international competitiveness impact.

Finally, in the event the Commission moves forward with the adoption of rules, ALU urges the Commission to recognize the distinct characteristics of wireless services. The physical limitations of radio spectrum bandwidth particularly require the Commission to implement these rules in a cautious manner. The Commission should examine the data submitted in this proceeding and possibly consider a further notice to thoroughly understand how the application of these rules could impact the wireless broadband market.

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COMMENTS OF ALCATEL−LUCENT

Alcatel−Lucent ("ALU") welcomes this opportunity to submit the following comments in response to the Federal Communications Commission's ("Commission") *Preserving the Open Internet* Notice of Proposed Rulemaking, the proceeding to consider net neutrality rules.[1] In these comments, ALU provides the Commission with extensive and compelling data on the current and expected capacity demands posed by increasing Internet usage, high-bandwidth applications, and the number of Internet connected devices. Given this unprecedented level of demand, the FCC should encourage effective network management practices and innovative managed services while continuing to rely on the four principles employed in the 2005 Internet Policy Statement.[2] The proposed rules in the Commission's *Notice* could inhibit the very tools that broadband Internet access service providers need to meet this unprecedented level of demand while providing quality of service and offering new, innovative applications and services.

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[1] *Preserving the Open Internet; Broadband Industry Practices,* GN Dkt No. 09-191 & WC Dkt No. 07-52, *Notice of Proposed Rulemaking,* 24 FCC Rcd 13064 (2009) ("*Notice"*).

[2] *Appropriate Framework for Broadband Access to the Internet Over Wireline Facilities*, CC Dkt Nos. 02-33, 01-337, 95-20, 98-10; GN Dkt No. 00-185; CS Dkt No. 02-52; WC Dkt No. 07-52, Policy Statement, 20 FCC Rcd 14986 (2005)("*Internet Policy Statement*").

I. INTRODUCTION AND BACKGROUND

Alcatel-Lucent is the leading provider of broadband access solutions worldwide, and the company's market leadership and experience provides unique insight into policy prescriptions for the broadband era. With a presence in 130 countries, Alcatel-Lucent has significant experience in deploying current and next generation wired and wireless broadband under a variety of geographical, regulatory, and economic conditions, for private and public entities alike. Specifically, Alcatel-Lucent is the world leader in—

- Current Generation Broadband Access:
    - (3G) mobile wireless broadband solutions, including CDMA (EVDO Rev. A) and UMTS (HSPA+); and
    - Digital Subscriber Line (DSL) wireline technology.
- Next Generation Broadband:
    - (4G) mobile wireless solutions utilizing Long Term Evolution (LTE) technology;
    - WiMAX fixed wireless technology;
    - Gigabit Passive Optical Networking (GPON) solutions utilized in Fiber-to-the-Premises (FTTP) deployments; and
    - Innovative DSL solutions utilized in Fiber-to-the-Node (FTTN) deployments, including VDSL, VDSL2 and ADSL2+.

As demonstrated below, the nation's continually expanding demand for broadband connectivity is outpacing available bandwidth. The virtuous cycle of innovation and deployment has created a scenario whereby demand cannot be met exclusively through additional bandwidth. As bandwidth is added, it is rapidly consumed by ever more consumers and increasingly sophisticated devices and applications, creating even more demand for bandwidth. The solution is to combine continually ***increased bandwidth networks*** with ***reasonable network management***

and ***managed services*** so that tomorrow's broadband will produce ***maximum consumer innovation and value***.

As more Americans subscribe to broadband Internet access at faster and faster speeds, the market and technology are evolving to improve upon "best effort" Internet service. At Alcatel-Lucent, we see an evolutionary trend in which today's binary relationship between networks and applications is being bridged through "applications enablement" – a set of capabilities that enable a more personal web experience, with guaranteed quality of experience, for any user-selected application that chooses to use the network capabilities exposed to the application provider. Applications enablement empowers the end user to enjoy the best of both worlds: the rich diversity of numerous applications and content available through the Internet, along with a higher level of quality of service ("QoS"), privacy and/or security typically reserved for network operator controlled services. By bridging this gap between applications and networks, the applications enablement technology permits the service provider to offer a new class of managed services where the consumer can have a choice beyond subscription service tiers and demand enhanced quality and control for a specific application at his/her discretion.

Network management and the provision of managed services enable more intensive and efficient use of broadband, optimizing the network for a broad array of users, and improving individual user's broadband usage experience. The Commission should strive to preserve the flexibility and dynamism that pervades the broadband ecosystem today, which is driving technological innovation and investment along with competing business models – all to the benefit of consumers.

Alcatel-Lucent respectfully submits these comments to the Commission not only as a network vendor with a broad understanding of the world's communications networks, but as a

longstanding active participant in the network neutrality and open Internet debate. Beginning with the Wireline Broadband Proceeding,[3] Alcatel-Lucent, through its leadership in the High Tech Broadband Coalition, helped formulate and submit the Connectivity Principles to the Commission in 2003.[4] These principles became the cornerstone of the Commission's Policy Statement that has governed broadband Internet access since 2005. Since the adoption of the Policy Statement in 2005, Alcatel-Lucent has consistently stated that the existing four principles, along with preexisting competition and antitrust laws, are sufficient to protect consumer interests.[5] In this proceeding, Alcatel-Lucent maintains that the Commission's record does not provide any compelling evidence that the existing four principles are inadequate, and any enhancement to the existing principles, particularly an unqualified "nondiscrimination" standard, is not only unjustified but could have significant, negative consequences on the very innovation and investment the Commission seeks to protect.[6]

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[3] *See Appropriate Framework for Broadband Access to the Internet over Wireline Facilities*, CC Dkt Nos. 95-20, 98-10, Notice of Proposed Rulemaking, 17 FCC Rcd 3019 (2002).

[4] Letter from High Tech Broadband Coalition to Michael K. Powell, Chairman, Federal Communications Commission, CC Dkt No. 02-33 *et al.* (Sept. 25, 2003).

[5] *See How Internet Protocol-Enabled Services are Changing the Face of Communications: A View from Technology Companies Before the Subcomm. on Telecomm. and the Internet of the H. Comm. on Energy and Commerce*, 109th Cong. (2005) (statements of Patricia Russo, Chairman and CEO, Lucent Technologies and Michael Quigley, CEO, Alcatel North America); Comments of Alcatel-Lucent, Broadband Connectivity Policy Workshop Project No. V07000 (filed Feb. 12, 2007); Reply Comments of Alcatel-Lucent, RM-11361 (filed May 15, 2007); Reply Comments of Alcatel-Lucent, WC Dkt No. 07-52 (filed July 16, 2007).

[6] "The Commission seeks to promote investment and innovation with respect to the Internet." *Notice* at ¶ 51.

II. BROADBAND DEMAND IS GROWING EXPONENTIALLY AND CANNOT BE REASONABLY ADDRESSED BY GROWTH IN CAPACITY ALONE

Alcatel-Lucent agrees with the Commission that the "exaflood" of demand on Internet capacity is real.[7] The demand for bandwidth has been growing dramatically in recent years and, as Alcatel-Lucent demonstrates below and in the attached White Paper, growth is expected to continue exponentially for some time. Broadband capacity growth, however, has been more linear than exponential, since the investment in network capacity required to support this traffic growth simply cannot be sustained based on a linear (or sub-linear) increase in revenue. Looking ahead, merely increasing bandwidth will be insufficient to provide users with an improved Internet experience, since the anticipated concurrent increase in diverse, high-bandwidth application usage will result in peak network traffic loads that will result in service degradation.

In recent years, the broadband marketplace has evolved from low-bandwidth ASCII text files to richly formatted text; from simple graphics to high-resolution photos; from brief, low-quality sound effects to CD-quality (and better) audio; and from small still pictures and crude animations to higher-and-higher-resolution and quality video. High quality network television shows can now even be streamed on-line from Hulu and similar sites. HD-quality videos are readily available for streaming or download from sources such as YouTube and Apple's iTunes Music Store. 3D TV is already commercially available, and 3D content will undoubtedly be streamed and downloaded over the web in the next few years. Applications and upgrades that once were distributed on CDs or DVDs are now provided online — and some programs (such as antivirus applications) may be updated multiple times a day, not just monthly or annually as in

[7] *Id*. at ¶ 8 ("[T]he volume of Internet traffic is increasing rapidly, leading broadband providers to try new ways of managing congestion on their networks."); ¶ 57 ("With the rapid growth of broadband applications and content, especially video, access providers may face capacity constraints.").

the past. Operating system updates of hundreds or thousands of megabytes are downloaded — frequently with no involvement by the user — monthly or even more often, by nearly every networked computer. Indeed, anecdotally, a number of mobile operators have indicated that automatic software upgrades and "patches" consume a significant percentage of the available bandwidth at certain times and limit the bandwidth available for end-user requested services.

The impact on capacity demand has been dramatic. Network capacity is and will continue to be constrained as consumers use voice, data and increasingly video applications, often simultaneously, that are more and more bandwidth-intensive. Likewise, as high downstream (to the end user) *and* upstream (from the end user) broadband connections become more prevalent, more video communications, monitoring and streaming applications will be developed and more content will be maintained in the network, rather than on the end user's device, which will further compound usage and demand of network resources.

This bandwidth demand growth is the result of both ***usage behavior*** (with video becoming incorporated into the vast majority of services) and growth in the ***quantity*** of devices as well. Each household, for example, has an increasing number of connected devices — not only a computer, but multiple computers, smartphones, cameras, Internet radios, High Definition televisions, networked digital picture frames, intelligent appliances, utility meters, *etc.* — resulting in a massive multiplication of the household's need for bandwidth. Moreover, as households find more uses for broadband connectivity, usage is likely to be spread across more hours than is the case when it is just used for web browsing and email, so that all hours become "busy hours." Thus, the traditional statistical multiplexing effect of bandwidth usage that is based on (human) users naturally spreading their service usage across different specific times in a given period, will no longer be appropriate, further straining network capacity.

Alcatel-Lucent has prepared the attached White Paper that provides an assessment of future broadband demand growth trends, as well as the expected shortfall in capacity:

- An Exponential Growth in Bandwidth Demand

  Analysis demonstrates annual traffic growth rates of between 100% and 114% through 2014 for both wireless and wireline networks, with some studies showing even more aggressive growth. Moreover, these growth curves accelerate in the out years of the analysis, indicating continuous growth beyond 2014.

- An Unprecedented Increase in the Number of Devices Connected to the Internet

  100s of millions of new devices will be connected to the Internet – effectively, two new devices per person by 2014.

- Usage Behavior Change That Further Compounds Bandwidth Demand

  With ubiquitous broadband connections, increasingly innovative services and more devices connected to the Internet, consumer behavior is dynamically changing with more users migrating from Passive Users (low demand) to Social Users (medium demand) to Power Users (high demand). By 2014, growth in Power Users, with an average bandwidth consumption eight times that of Passive Users, will increase 67%.

For broadband providers to successfully navigate the "perfect storm" of expanding broadband demand, increased connections and more intensive consumer behavior, they must combine increases in bandwidth with (1) continued and better network management, which will resolve harms and ensure that bandwidth is consumed intelligently and efficiently, thereby lowering the occupancy of bandwidth; and (2) growth in managed services, which will optimize the user experience for QoS-enabled offerings, and will in turn relieve some congestion for "best effort" high-speed Internet access services.

III. NETWORK MANAGEMENT PRACTICES ARE CRITICAL FOR ADVANCING HIGH-SPEED INTERNET ACCESS SERVICE AND OTHER IP-ENABLED SERVICES

To the extent the Commission adopts any regulations in this proceeding, Alcatel-Lucent urges the Commission to apply a very expansive view of permitted network management practices. Service providers offering broadband Internet access must be able to engage in reasonable network management practices, particularly given the current and expected dramatic increases in capacity demand articulated in the attached White Paper. Without the ability to employ a wide range of network management tools, networks would not be able to innovate, capacity shortages would be exacerbated, and the consumer experience would be diminished.

Network management is not new. It exists in legacy circuit-switched voice networks, for example, in managing subscriber lines and allocating individual voice circuits to higher-order bearers (e.g., T1, T3) for switching across the inter-office TDM transport network. Today, broadband network operators and other partners in the broadband ecosystem engage in a variety of additional network management practices. These practices involve enforcing per-subscriber service-level agreements; managing the aggregate traffic as it is multiplexed across the IP edge and IP/MPLS and optical core networks; preventing harms to the network by malicious activities such as Denial of Service attacks; ensuring the requisite security of VPNs and administration and adherence to Digital Rights Management agreements. All of these activities are necessary to ensure that the expected level of services are delivered to subscribers, in accordance with the subscriber contract with respect to bandwidth, availability, security, and reliability.

One clear example of network management used as part of a "best effort" Internet access service today allows all subscribers to share the high speed Internet ("HSI") service bandwidth fairly. This management practice prevents any one subscriber from using all the available service bandwidth in a portion of the network to the exclusion of other subscribers at any point in

time. In addition, different service tiers are typically offered and enforced using similar network management schema.

Another example of a reasonable network management practice, as recognized in the *Notice*,[8] is Spam mitigation. It is estimated that between 45 and 73 percent of all email in the United States is Spam,[9] which is not only a nuisance but the false advertising and phishing scams included in some of these emails are a threat to the end user. Spam protection is best effectuated inside the service provider domain, where the ISP can filter email to delete unsolicited, bulk emails that meet an industry or individual ISP standard. Furthermore, innovative, network-based management of email spam or malicious email attachments using packet inspection in the network path can provide today's "best effort" broadband Internet end user with an extra level of service protection and therefore a superior Internet experience. If such network management practices were impermissible or not available, then more Spam would be delivered to the end user. This would have two immediate, negative effects: first, email traffic would increase by 100 percent or more, which would exhaust more broadband access capacity; and, second, with email remaining one of the primary broadband applications, the user experience would be significantly diminished, possibly impacting broadband usage.

Initially Internet access service on wireline networks addressed the non-guaranteed service quality of "best effort" Internet by over provisioning bandwidth — that is, by building the network with bandwidth capacity to adequately address anticipated peak usage times. This network design paradigm is a thing of the past, however; with rapidly increasing bandwidth demands, network capacities can no longer be over provisioned with reasonable economics for

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[8] *Id*. at ¶ 138.

[9] Spam Laws, Spam Statistics and Facts, http://www.spamlaws.com/spam-stats.html (last visited Jan. 11, 2010).

the network provider. Therefore, active network management has become imperative for both wired and wireless networks in order to ensure an optimal experience for the vast majority of users of the "best effort" Internet service. As outlined above, this may mean limiting the peak information rate ("PIR") for an HSI subscriber to ensure fair usage of the bandwidth among subscribers, or in some cases even rate-limiting particular types of traffic that have a disproportionate impact on other users. For example, TCP-based applications try to use all available bandwidth until congestion of the network is detected (at which point so-called "backoff" occurs) and modifying the TCP parameters can help ensure a better user experience on average. Notably, for wireless networks, some applications tie up a radio bearer with "keep alive" control messages, but do not actually transmit any data over this bearer, effectively wasting this precious resource (spectrum). In such cases, it is beneficial to all users to be able to modify the network parameters associated with these "chatty" applications using network management techniques, so as to optimize the availability of spectrum for actual data transport by other applications, services and users.

Thus, network management is an essential component of the future of broadband and is critical for advancing HSI and other IP-enabled services in an atmosphere of unprecedented demand.

IV. TO MEET BROADBAND DEMAND, NETWORK PROVIDERS MUST BE PERMITTED TO DEVELOP AND OFFER MANAGED SERVICES

Increasingly, consumers will be better served by QoS management practices that result in "managed services" designed to optimize users' broadband experiences, as described below. Currently, "managed services" is a term typically associated with operator or service provider defined and packaged services created to serve a clear need for guaranteed QoS. Plain Old

Telephone Service (POTS) was the first such service and was offered over a dedicated network that initially supported no other services, but then evolved to support fax and dial-up modem services. Subsequently, with the advent of genuine broadband access using advanced Digital Subscriber Line (DSL) technologies (as well as DOCSIS-based Hybrid-Fiber Coax networks), additional IP services could be provided over the same basic physical infrastructure in the last mile. Indeed, sufficient bandwidth could be provided in fiber to the node (FTTN) architectures so that high bandwidth IP video services could be delivered over this infrastructure. However, in order to prevent generic TCP-based Internet "web services" such as web browsing from consuming the available bandwidth and degrading the video service, a separate bandwidth partition was created as a managed service video offering. Similarly, due to the stringent delay requirements associated with voice services, another forwarding class was created to provide a Voice-over-IP (VoIP) managed services offering. Now, looking ahead, the universe of managed services continues to develop as manifold new applications are developed on the Internet and increasingly adopted by consumers and with the desire for similarly stringent QoS requirements. Thus there is a mounting interest in user-requested managed services that can be offered in addition to the conventional operator-provided managed services. These services complement the "best effort" Internet access services that do not have strict QoS requirements, and the additional value created by such service offerings will justify the sustainable private sector investment that is the backbone of broadband investment in the United States.

A. The Commission Should Embrace Managed Services

The Commission recognized in the *Notice* that there can be much more to broadband service than high-speed Internet access — there is also an important role for "'managed' or

'specialized' services."[10] The *Notice* did not provide a definition for this category of services, but instead described certain examples: "Internet-Protocol-based offerings (including voice and subscription video services, and certain business services provided to enterprise customers), often provided over the same networks used for broadband Internet access service."[11] The Commission also cited examples given by the Rural Utilities Service and National Telecommunications and Information Administration: "managed services, such as telemedicine, public safety communications, and distance learning, which use private network connections for enhanced quality of service, rather than traversing the public Internet."[12] Alcatel-Lucent urges the Commission to embrace managed or specialized services to ensure that this regulatory initiative does not constrain the growth of these services, e.g., to allow the diverse array of user-requested managed services offerings described above. The managed services demanded by consumers in 2011 may not exist in 2010, and the Commission's rules, which are amended by rulemaking proceedings measured in years, will constrain the development of these services if a limited, exhaustive list of permissible managed services is adopted.

The Commission should defer to service providers and consumers, who should be free to define the performance parameters of a class of service. From an engineering viewpoint, "managed services" are those services that have some level of guaranteed quality of service, thereby differentiating them from services or applications that run on "best effort" high-speed Internet access, for which no specific guarantees are provided. Managed services include one or several of the following characteristics: (1) guaranteed (low) packet loss, (2) guaranteed (low)

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[10] *Notice* at ¶ 148.

[11] *Id.*

[12] *Id.* at ¶ 148 n.266, quoting from the *Notice of Funding Availability* for the Broadband Technology Opportunities Program/Broadband Improvement Plan, issued jointly by RUS and NTIA, 74 Fed. Reg. 33104, 33111 (July 9, 2009).

packet delay, (3) secure connectivity, or (4) guaranteed bandwidth. This characterization of a managed service does not depend on whether the service is carried over a private network, a virtual private network, the public Internet, or even whether the service is IP-based.[13] Notably, the Commission recognized this reality as well, as the *Notice* itself asks whether services with assured quality of service "should be more properly understood as managed or specialized services rather than broadband Internet access services?"[14] The answer is yes.

In the event the Commission moves forward with a definition of managed service, it should consider the following:

> ***Managed service.*** **A managed service is a service provided in whole or in part over facilities also used to provide "best effort" high-speed Internet access, for which enhanced service treatment is employed due to the fact that the service is:**
>
> **(a) a service sensitive to packet loss;**
>
> **(b) a service sensitive to packet delay;**
>
> **(c) a service requiring secure, private connectivity;**
>
> **(d) a service requiring bandwidth guarantees; or**
>
> **(e) a service for which the user has requested enhanced service treatment.**

These criteria should be interpreted broadly and disjunctively – that is satisfaction of any one of these elements classifies the service as a managed service. These criteria are discussed in the following sections.

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[13] Internet Protocol ("IP") based services include some services carried over the public Internet, as well as services carried over private networks; moreover, IP is only one of many protocols used on the Internet. Thus, there is not necessarily any connection between use or non-use of IP in carrying a service and use of the Internet.

[14] *Notice* at ¶ 113.

1. Service Sensitive to Packet Loss

Any Commission definition of managed services should include applications or services that contain enhanced service treatment because they are sensitive to packet loss. Studies show that users have a very low tolerance for packet loss for video-rich services or applications. As shown in Figure 1, the Broadband Forum has defined recommended packet loss rates for standard definition ("SD") and high definition ("HD") video, based on studies that showed that users were willing to tolerate one noticeable visual distortion every 30 minutes for SD and only one every 4 hours for a "premium" service such as HD.

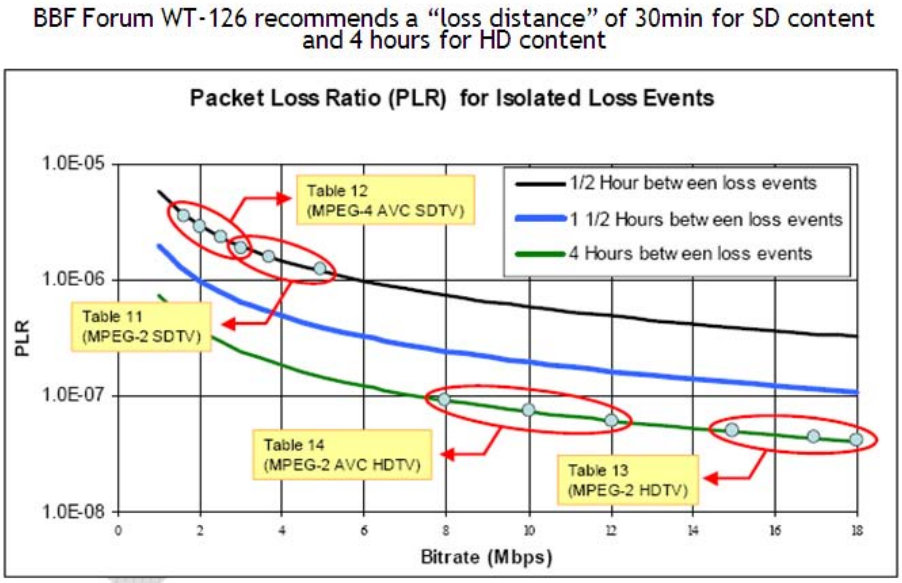

Figure 1. Recommended (standard) metrics for video packet loss, based on user perception

This translates to a packet loss rate approaching one in a million for SD video (PLR = 1 x 10^{-6}) and one in 15 million for HD video (PLR = 7 x 10^{-8}). These numbers are in stark contrast to the behavior observed for a standard high-speed Internet access service offering over DSL, for which approximately 50% of lines will show a visible artifact more frequently than every 4 hours, and 25% show a visible artifact every 30 minutes (Figure 2).

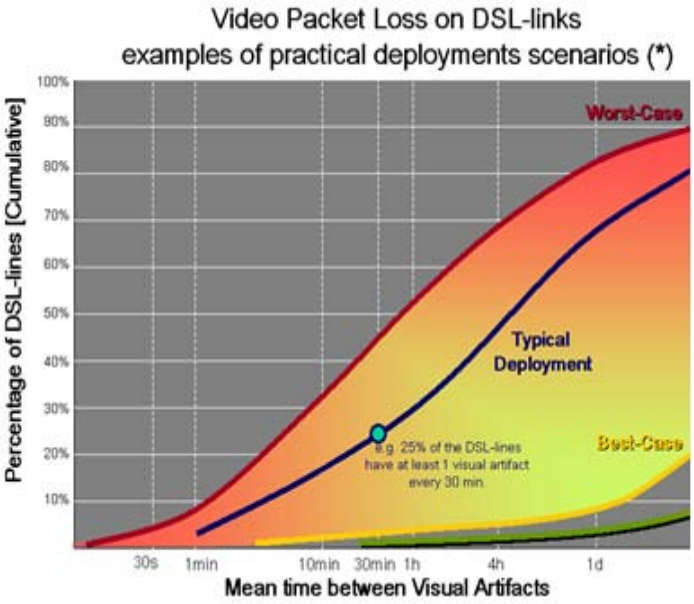

Figure 2. Evaluation of the number of DSL lines (high-speed Internet access subscribers) that could deliver (receive) desired video service, as documented in BBF WT-126

One solution is to provide a managed service consisting of a combination of marking the video packets as high priority, expedited forwarding of video packets within a higher quality of service class, and error correction techniques or fast retransmission of missing packets. This solution can be used for the transmission of video programming similar to cable TV by the same company that provides the broadband Internet access, using a bandwidth segment or partition that is separate from that used for high-speed Internet access. A managed service with these attributes can also be used to provide enhanced quality to video streamed over the high-speed Internet access connection. This type of service would provide QoS guarantees to so-called "over the top" video services of premium interest to the end user, allowing these services to be delivered with similar resolution and quality as conventional managed service video offerings. This service is expected to be increasingly attractive as users consume streaming web video that

is long-form HD, for which the tolerance for packet loss will be low but the probability of loss will be high due to the significant load that such services put on the network.[15]

2. Service Sensitive to Packet Delay

Any definition of managed services must also recognize those applications or services that contain enhanced service treatment because they are sensitive to packet delay. There is a set of applications for which users have shown a tolerance for packet loss, but very limited tolerance for packet delay. Two such applications or services are: i) voice or communications services; and ii) interactive gaming.

For voice communications services, the "round trip time" ("RTT") — the time between the speaker finishing speaking and the response to arrive — must be less than 300 - 400ms for there not to be a perceptible delay in the communication. Therefore, voice services delivered as a managed service would consist of marking the voice packets as "highest priority" and expediting the forwarding of these packets using the highest priority class (which is served before *any* other traffic).[16] Looking forward, the same managed service treatment will clearly be beneficial for any inter-person communications service, such as video calling, video conferencing, interactive videocasting (sharing live audio video with friends and family), as well as for e-health and e-learning, and remote monitoring/security services, all of which depend on such interactive communications services.

For gaming, an RTT (known to gamers as "ping") of below 60ms is optimal for on-line interactive gaming to be acceptable to users. As shown in Figure 3, user rating of satisfaction

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[15] When the BBC put its programming online for viewing in the UK using an application called iPlayer, network traffic increased dramatically. *See* Plusnet, *iPlayer Usage Effect: A Bandwidth Explosion* (Feb. 8, 2008), http://community.plus.net/blog/2008/02/08/iplayer-usage-effect-a-bandwidth-explosion/.

[16] In addition, this treatment can also minimize any echo effect due to the fact that the packet arrives outside the echo cancellation window of analysis.

decreases for delays of 60ms or more, with 100ms and beyond regarded as unacceptable delay. For this reason, on-line games typically assess the RTT to each potential opponent and rank the opponents in order of connection (low RTT) quality, so that the user can have a higher chance of a satisfactory gaming experience.[17]

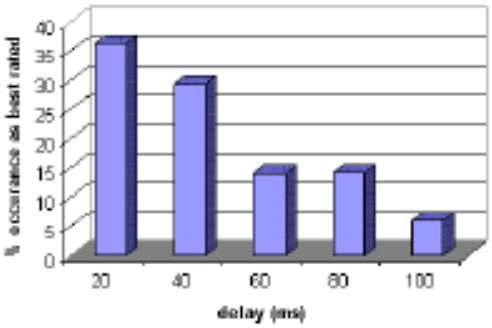

Figure 3. User perception of quality of gaming experience versus delay

In order to optimize their Internet-based gaming experience, avid gamers may choose to upgrade their high-speed Internet access service to a higher tier (more bandwidth), because this diminishes the data transfer time even though it does not directly impact the RTT. The preferred alternative would, however, be to use a managed service for the particular gaming application, with expedited forwarding (low delay) characteristics, if such a service were available on a subscription or on-demand basis.[18]

3. Service Requiring Secure Private Connectivity

Any definition of managed services must also incorporate those applications or services that contain enhanced service treatment because they require secure, private connectivity. There is a set of services that do not have particular delay or packet loss requirements, but do require

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[17] *See generally* N. Degrande, D. De Vleeschauwer, R.E. Kooij, M.R.H. Mandjes, *Modeling Ping Times in First Person Shooter Games,* Proceedings of the 2006 ACM CoNEXT conference, *available at* http://www.kennisportal.com/main.asp?ChapterID=4745.

[18] *See id.*

security of connectivity with freedom to choose the packet addressing schema and with guaranteed immunity from impingement by any other traffic whether malicious or not. Layer 2 and Layer 3 Virtual Private Network ("VPN") services are two such managed services, with the former creating the VPN using Ethernet header information, and the latter using IP header information, to map the traffic to Multi-Protocol Label Switching ("MPLS") tunnels across the IP/MPLS core to the destination(s). Such VPN schema also prevent any unauthorized traffic from unknown Ethernet or IP sources from traversing these connections. The requirement for secure communication alone does not mandate the need for a managed service, as techniques such as IPSec can be used to secure connections over the Internet, but a combination of: i) secure communication, ii) prevention of other traffic traversing the same connection, and iii) the support for the subscriber-selected addressing scheme, does mandate the use of a managed service.

4. Service Requiring Bandwidth Guarantees

Any definition of managed services must also recognize those applications or services that contain enhanced service treatment because they require bandwidth guarantees. In many cases the service requirement may not be for a specified packet loss, or packet delay, or secure private communication, but instead for a guaranteed bandwidth associated with a specific service so as to provide a well-defined data throughput. An example of such a service is a file transfer for back-up to a web-based store, or download of specific content to an end user device within a specified period of time. A basic form of such a service could be provided as an upgrade to the subscriber's Internet service tier and implemented using network management techniques, but the advanced concept described here is for an application-specific temporary bandwidth boost that is more appropriately defined as a managed service offering.

5. Customer–Requested Enhanced Treatment

The preceding subsections described applications that are recognized widely as benefiting from delivery as managed services in order to guarantee the consumer-desired level of packet loss, packet delay, security and/or bandwidth. But, in addition to these operator-driven services, there are myriad other applications that have emerged − and will continue to emerge − and are of sufficient value to the consumer that individual users will desire to see them enhanced in order to receive a guaranteed quality of service. In the majority of cases, the managed service requirements will be those outlined above, but the important distinction here is that the user has the freedom to define any service as one that is delivered as a managed service, rather than this service being created as a packaged, operator-defined managed service with broad appeal. Such user-requested managed services could include:

- Temporary boost or guaranteed level of bandwidth for a fast file download, e.g., for a large movie/video file requested by the end user;
- Temporary boost or guaranteed level of bandwidth for a fast file upload, e.g., for on-line storage or backup, or for remote access to specific content stored in the home requested by the end user;
- Guaranteed low level of delay for a communications application selected by the end user;
- Guaranteed low level of packet loss for a video application selected by the end user; or
- A temporarily higher level of security for sensitive information defined by the end user.

Alcatel-Lucent refers to this ability to empower consumers as "Applications Enablement." In each case, the user may desire the enhanced service to only be applied to a specific end point or application, as a more efficient (and economical) alternative to boosting their entire service tier. For example, the end user may be satisfied with a particular service tier for "best effort" Internet access, but he/she may desire managed service level of quality and reliability for online gaming,

for a specific gaming service not offered as a pre-packaged operator managed service. The service provider can therefore provide the consumer with two choices: i) the choice of a higher tier subscription service that would provide more bandwidth in general; or ii) a specific applications enablement option where the managed service level of quality and reliability is provided for the online gaming application while maintaining the current "best effort" Internet access subscription. This increase in consumer choice with regard to service quality will lead to greater adoption of Internet applications both as "best effort" services and managed services, which in turn will lead to greater stimulus for innovation and investment in next generation Internet services and networks.

B. Managed Services and Internet Access Service Offerings Will Co-Exist and Flourish

Alcatel-Lucent does not see managed service offerings as a threat to "best effort" broadband Internet access but rather as a full complement to this form of access and one that will financially justify the widespread broadband availability the Commission seeks to achieve.[19] The broadband networks deployed by today's service providers are capital-intensive with a cost recovery horizon measured in years or even decades. For example, providing video or television as a managed service (whether as IPTV or otherwise) alongside high-speed Internet access and other services justifies the investment in fiber for broadband (either to the home, or to the node), whereas the revenue from high-speed Internet access alone is not sufficient to make this investment. Given competition in the broadband marketplace, as well as the diversity of broadband user needs and wants, network operators will need to offer high-speed Internet access

[19] Telecommunications Act of 1996, Pub. L. No. 104-104, § 706(a), 110 Stat. 56, 153 (1996), *codified at* 47 U.S.C. § 1302(a) ("The Commission… shall encourage the deployment on a reasonable and timely basis of advances telecommunications capability to all Americans…").

as a valuable and compelling product and will have every incentive to continue developing and improving it for the foreseeable future.

In fact, a case can be made that the offering of managed services, whether operator-provided or consumer-demanded, maintains and strengthens the open Internet environment the Commission is seeking to protect in this proceeding.[20] If managed services were severely limited by the Commission's rules, then many of these services would have to be offered on the "best effort" Internet access service, creating increased network congestion between services in the same service class, which invariably results in service degradation across the board, with no accounting for specific application requirements and characteristics. For example, when a file download using the UDP protocol starts up, it can consume all the available bandwidth and will not back-off like TCP-based transfers. The result will be the degradation of all other services such as streaming video in an indiscriminate fashion, i.e., such that all video sessions will be compromised and suffer packet loss.[21]

Service differentiation is commonly used to deliver a wide range of services in the marketplace (e.g., overnight mail delivery vs. standard delivery) that maximize consumer utility by producing a range of products at variable prices. Managed services offer a differentiated, user-empowered class of services to the broadband Internet user. Unless the Commission's record provides compelling evidence that today's broadband business models, which provide these differentiated services and base investment on revenue derived from both managed services

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[20] The White Paper includes capacity growth estimates demonstrating increased overall capacity and capacity available for "best effort" Internet access when both "best effort" and managed services are offered. A dynamic environment that permits both services to be offered will provide the necessary capital for service providers to invest more aggressively in bandwidth.

[21] The White Paper discusses the quality benefits enjoyed by all users when traffic that is sensitive to delay or jitter is segregated from "best effort" onto a managed service. Jitter is reduced for all users, including those on the "best effort" Internet service.

and "best effort" Internet access service, are anticompetitive or otherwise flawed, then the Commission's rules should not interfere with this model by limiting or restricting managed services.

V. THE FCC SHOULD ENABLE FLEXIBLE MANAGEMENT AND BUSINESS MODELS AND SHOULD TREAD CAUTIOUSLY IN THE DYNAMIC BROADBAND MARKET

As the *Notice* recognizes, the broadband market is dynamic and robust.[22] Innovation abounds, and demand is growing exponentially as described above and in the attached White Paper. New network management practices are developing to address both capacity issues and the growing interest in QoS-enabled offerings, and business models are evolving as the broadband ecosystem develops multiple models that address the varying needs of different user populations. ***Consumers are best served by a regulatory structure that embraces such experimentation***. Absent evidence of clear consumer harm, the Commission should refrain from imposing a regulatory structure that will hinder experimentation or engender significant uncertainty and unintended consequences.

The needs of broadband users are as diverse as the Internet itself. For many Internet users, "best effort" high-speed Internet access may serve their needs quite well, while others may seek enhanced video streaming or communications or telemedicine applications but have little need for enhanced gaming performance, and still others have a wholly different mix of needs. In a competitive environment, network operators can use the capabilities of their network offerings as important selling points. For example, network providers might seek competitive advantage by providing a better customer experience with respect to gaming or other applications by

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[22] *See, e.g., Notice* at ¶¶ 12, 20-22, 56-59.

delivering them as managed services. Rigid rules regarding what may be offered as managed services or overly restrictive network management policies will introduce uncertainty and could impede the delivery of services in a manner that is both technically and economically optimal.

While consumers will undoubtedly have continuing demands for more bandwidth, today's services will continue to evolve, new services will be developed, and some services will fall out of favor. Today there is no uniform approach to the provision of service through speed tiers, monthly usage tiers, hard and soft usage caps, or other billing arrangements. The deployment of next-generation networks will cause a further evolution in the architecture and business models for the provision of voice, video, Internet, and other services. Network operators thus will need the flexibility to change the "dividing lines" between high-speed Internet access and managed services as they respond to consumer preferences and competition. Ultimately, consumer demand will drive network operators' decisions regarding network intelligence, differentiated services, and appropriate management techniques.

With a market as dynamic and evolutionary as broadband, policymakers should not discourage the ability of network operators' to meet this consumer demand. Regulatory proposals that limit the ability of network operators to meet this demand will inevitably result in uncertainty and a chilling of network operators' willingness to invest in both ubiquitous geographic coverage and bandwidth.

VI. THE FOUR CURRENT PRINCIPLES WHEN COUPLED WITH OTHER LEGAL TOOLS ARE SUFFICIENT TO PROTECT CONSUMERS.

The four existing "net neutrality" principles,[23] along with other statutory protections that provide consumer protection and restrict anticompetitive behavior,[24] currently provide consumer protection and guidance to network operators, as does the resolution of the *two* concrete cases that have reached the FCC — the *Madison River* case, which was promptly settled through a consent decree, and the *Comcast* case, in which Comcast agreed to modify its network management practices.[25] In both instances, the combination of high-profile FCC action, widespread Internet coverage, and media attention persuaded the network operators to change their practices, in one case through a consent decree and in the other during the course of an investigation. In the future, the likelihood that the spotlight will quickly be focused on any network operator perceived to be violating the *Internet Policy Statement* makes the adoption of regulations unnecessary.

In particular, the Commission's consideration of an unqualified "nondiscrimination" standard is not only unsupported by any clear showing that the current rules are inadequate, but this strict regulation, which has been limited typically to monopoly utility markets, will harm the very innovation and investment the Commission is seeking to protect. Moreover, "nondiscrimination" presupposes that all applications and content on the "best effort" Internet

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[23] *See Internet Policy Statement*.

[24] Because network providers are not "common carriers" insofar as they are engaged in the provision of broadband Internet access, this service is subject to the terms of the Federal Trade Commission Act. *See* 15 U.S.C. § 45(a). Among other things, that Act gives the Federal Trade Commission authority to take action against "unfair or deceptive acts or practices in or affecting commerce." *See id.* In addition, the provision of these services may also be governed by state laws of general applicability prohibiting unfair or deceptive trade practices.

[25] *See Madison River Communications*, File No. EB-05-IH-0110, 20 FCC Rcd 4295 (EB 2005); *Free Press and Public Knowledge v. Comcast Corporation,* WC Docket No. 07-52, *Memorandum Opinion and Order,* 23 FCC Rcd 13028 (2008) (subsequent history omitted).

are on equal footing, but this is not accurate as, for example, some content delivery networks currently enable higher levels of QoS to proprietary or paying customers. The ability of service providers to innovate and offer differentiated services will benefit consumers through increased competition among services and applications. In any case, the Communications Act expressly prohibits the Commission from imposing common-carriage obligations (such as nondiscrimination requirements) on entities with respect to their provision of an offering that is not a "telecommunications service."[26]

VII. THE COMMISSION'S PROPOSED RULE ON NONDISCRIMINATION IS A SIGNIFICANT DEPARTURE FROM POLICIES OF THE UNITED STATES AND IS FAR MORE RESTRICTIVE THAN OTHER ADVANCED NATIONS.

The Commission's proposal in this proceeding, particularly the "nondiscrimination" standard, is a significant departure from the longstanding policies of the United States to refrain from undue regulation of the Internet. In 1997, the Clinton Administration adopted "A Framework for Global Electronic Commerce," which encouraged "governments [to] adopt a non-regulatory, market-oriented approach to electronic commerce."[27] This policy was maintained through the Clinton and Bush administrations, not only in domestic law but as advocated in international fora as well. The Commission's current proposal is a departure from this deregulatory standard, and it is a move that in some instances may affect the nation's international competitiveness, and in other instances may signal to other countries to move

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[26] *See* 47 U.S.C. § 153(44) ("A telecommunications carrier shall be treated as a common carrier under this chapter only to the extent that it is engaged in providing telecommunications services….").

[27] A Framework for Global Electronic Commerce (White House, 1997).

forward with Internet regulations that may be a pretext to limit broadband deployment or curb free speech.

As an international company, Alcatel-Lucent has a unique viewpoint on the various broadband Internet access policies adopted in other nations. Recently, two nations and the European Union engaged in extensive consideration of network management practices of ISPs, and in each case the regulating entity specifically allowed for reasonable network management practices, including transparent discrimination, in order to manage demand and network congestion. In the end, these nations did not regulate Internet access to the point that the Commission is proposing. If the proposed rules are adopted in their current form, particularly the unqualified nondiscrimination principle, then the United States will be an outlier and innovation and investment could be driven to countries that have a more liberalized regulatory structure.

In Canada, the Canadian Radio-television and Telecommunications Commission ("CRTC") published its review of Internet traffic management practices of Internet service providers and concluded that reasonable traffic management practices, so long as such practices are transparent and not unduly preferential, are permitted.[28] The CRTC recognized that the current and near-future remarkable increase for capacity demand will be addressed by a combination of network investment and reasonable network management practices. The CRTC appears to share the FCC's concern over anticompetitive activity, but the CRTC is relying on competition, investment, and reasonable network management practices to preclude such harmful activity.

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[28] CRTC. Telecom Regulatory Policy 2009-657

Similarly in the EU, the European Commission's recently enacted Telecoms Package examined the issue of traffic discrimination and concluded that traffic shaping to avoid network congestion and meet quality of service requirements is permissible. The EU directed the national regulatory authorities charged with executing the Telecoms Package to ensure such practices do not restrict competition and are properly disclosed to consumers.

Finally in Japan in 2008, the Ministry of Internal Affairs and Communications ("MIC") proposed guidelines for achieving reasonable network management. The MIC recognized that bandwidth-intensive applications are becoming more popular and, even with Japan's widespread FTTH deployment, packet shaping would be permissible in order to alleviate network congestion. As with the EU, the MIC relied on a passive regulatory model where traffic shaping or discrimination was permissible so long as the regulator polices the marketplace and guards against anticompetitive activity.

In sum, such rules would distinguish the United States and be a departure from the views recently expressed by other nations that have examined the issue of broadband discrimination. Such a distinction could have an international competitiveness impact.

VIII. THE COMMISSION SHOULD CONSIDER PLATFORM DISTINCTIONS WHEN IMPLEMENTING ITS RULES.

In the *Notice*, the Commission seeks comment on the application of the principles to different access platforms, particularly to what extent the principles should apply to non-wireline forms of Internet access.[29] Wireless broadband services are constrained by limited and dynamically changing radio resources shared among multiple users, and service providers need

[29] *Notice* at ¶ 154.

to be free to manage their networks in order to meet the current and expected consumer demand and service quality obligations. Alcatel-Lucent and numerous other parties have advocated the Commission seek new spectral resources to dedicate to licensed, wireless broadband in order to help meet the current and expected demand for these services. Even with new spectral resources, the basic physics of wireless networks will limit the available bandwidth when compared to high capacity wireline networks, and the wireless operators must be free to manage network capacity.

The Commission should recognize the technological, market structure, consumer usage, and historical regulatory differences between different Internet access platforms. In so doing, the Commission should recognize these differences when implementing rules on non-wireline forms of Internet access. In addition, it is important to realize that much of the backhaul, IP edge, network core, and application infrastructure used for wireless access may be shared with wireline access as well as with unlicensed wireless access. As such, any rules associated with wireline access may potentially affect the service providers' ability to economically and effectively provide network management for wireless services.

Given the distinct characteristics of mobile broadband, the Commission should carefully examine the record built in this comment cycle and consider, among other options, a further notice or proceeding to gather more information. If the Commission pursues rules here, this approach will provide the Commission with the ability to ask more granular questions and offer specific proposals on whether and how to potentially implement these rules in the mobile broadband market.

IX. CONCLUSION

Alcatel-Lucent respectfully submits these comments and looks forward to working with the Commission in this proceeding. While supportive of the Commission's goals to preserve and protect an open Internet and the original principles adopted in the Wireline Broadband Order, ALU is not supportive of the rules as proposed. Particularly given the anticipated demands on capacity and the national goal of ubiquitous broadband deployment, now is not the time to initiate rules that may hinder the ability of service providers to manage their networks, innovate, and deploy new services.

Respectfully submitted,

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