Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of	)	
	)	
Protecting and Promoting the Open Internet	)	GN Docket No. 14–28

REPLY COMMENTS OF ERICSSON

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Executive Summary

The mobile Internet is a success story. The U.S. leads the world in deployment and LTE subscriptions. How did we get here so quickly and decisively? Through competition. The record demonstrates that competition is vibrant, has led to an explosion of new service and network investment, and that the fears that led to Net Neutrality regulation in the first place are simply not to be found in wireless broadband networks.

In short, mobile broadband isn't broken. By every measure: consumer prices, investment, number of options to customers. Mobile broadband works.

Ericsson, as the leading global provider of mobile broadband networks and services, has observed some universal truths about mobile broadband. For one: spectrum is limited. As demand explodes faster than the supply of spectrum can keep up, continuous network investment is needed to provide coverage and to keep up with consumers' desire for increased bandwidth. To continue making those investments, operators need to know that they can make a return on those investments to justify capital and operational outlays. Increased regulation of mobile broadband is precisely what is not needed to spur continued investment.

Ericsson also recognizes that network management is the key for optimizing the use of the critical shared resource in all mobile broadband network: spectrum. As described below, the incredibly dynamic demand for spectrum, in terms of both time and space, requires active network management. There will always be varying levels of performance for users and for different service classes and devices. There simply cannot be any strict guarantees of service in the wireless space. Regulation that seeks to impart such guarantees on the industry artificially lowers performance for all users.

The Internet of Things, the difficulties in providing service in a mobile environment, the fact that wireless operators face constraints that wireline operators are largely free from, and that different types of connections and devices demand different data treatment all point to the need for the Commission to stay the course set forth in 2010 and that it tentatively concluded it would continue in 2014. Specifically, the Commission should continue to recognize that wireless is different and should remain under today's successful light-touch regulatory regime.

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Ericsson submits these reply comments in response to the Commission's Notice of Proposed Rulemaking ("*Notice*") seeking comment on the correct public policies to ensure that the Internet remains open.[1] Ericsson supports the ability of consumers to access the content and applications of their choice when using a broadband Internet access service, subject to the right of broadband access providers to manage their networks and the shared spectrum resource to benefit all users.[2] Ericsson focuses these reply comments on the need for mobile networks to be treated differently from fixed networks in the event the Commission determines that new open Internet rules are necessary.

I. Introduction

Although there is widespread disagreement on certain fundamental issues raised in the *Notice*, particularly whether broadband should be reclassified as a common carrier service, there is nonetheless broad consensus that the Internet is a success.[3] As Ericsson has stated in the past,

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[1] *Protecting and Promoting the Open Internet*, Notice of Proposed Rulemaking, 29 FCC Rcd 5561 (2014).

[2] *See* Comments of Ericsson, *Protecting and Promoting the Open Internet*, GN Docket No. 14-28 (filed July 17, 2014) ("Ericsson Comments").

[3] *See* Comments of CTIA – The Wireless Association, *Protecting and Promoting the Open Internet*, GN Docket No. 14-28 (filed July 18, 2014), at 6 ("The United States is the global leader in mobile broadband. Providers compete on the basis of their networks, service quality, plans and services, and rates."); Comments of Free

we seek an environment in which consumers, operators, and content providers are generally free to contract with each other for differentiated user experiences unless there is a demonstrated harm to the public or to competition.[4]

One particular area that again shows vast consensus is the view that mobile broadband occupies an important, and increasingly vital, component of people's lives. While parties to the proceeding may agree on that point, there is, unfortunately, disagreement on whether the Commission should address mobile broadband access separately from fixed technologies. Parties who raise the issue of treating both mobile and fixed access in the same manner offer little support for their position. Their arguments are primarily that wireless is as, or more, important than fixed access, and therefore any wireline rules ought to apply equally to mobile.[5] The arguments fail to address the market and technological differences that Ericsson raised in our comments[6] and that we strengthen here in our reply comments.

It has been the Commission's stated policy since 2010 to give wireless operators much greater leeway with respect to network management than fixed operators. That policy was based on four factors: that the mobile broadband space was rapidly innovating and changing, that most

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Press, *Protecting and Promoting the Open Internet*, GN Docket No. 14-28 (filed July 17, 2014), at 90 ("There is no debating that the open Internet is directly responsible for promoting an unprecedented level of civic engagement and commercial activity, as well as enabling massive innovation and investment by persons and businesses utilizing the Internet as a carrier platform for these activities.); Comments of the National Cable & Telecommunications Association, *Protecting and Promoting the Open Internet*, GN Docket No. 14-28 (filed July 15, 2014), at 88 ("[T]he Internet has flourished in recent years under a consistently light regulatory touch—with unprecedented investment in network expansion and a broad commitment from ISPs to Internet openness.").

[4] *See* Ericsson Comments at 6-8.

[5] *See, e.g.*, Comments of Microsoft, *Protecting and Promoting the Open Internet*, GN Docket No. 14-28, (filed July 18, 2014) at 26 ("[B]ecause the line between fixed and mobile broadband access services is increasingly blurring, the Commission should apply its new open Internet rules equally to mobile and fixed broadband access services, subject to reasonable network management.").

[6] *See* Ericsson Comments at 8-10.

consumers had more mobile broadband options than fixed options, that "operational" challenges create a greater need for network management in the mobile sphere than in the fixed sphere, and that wireless operators were trending toward more openness in their networks anyway as evidenced by the introduction of third-party devices and applications.[7]

That is sound policy, and the record generated in the comments—which supports this policy—should continue to guide the Commission's direction. Competition, and specifically the response from operators to competition and the demonstrable benefits to consumers alone should be reason enough not to burden the mobile broadband industry with new regulation. The technical aspects of delivering a mobile broadband service further support a continued light touch approach for mobile networks. Below, Ericsson responds to comments in the record and further develops the argument that wireless is different.

II. High Levels of Competition and Investment in Wireless Broadband Point to the Need to Keep Regulation to a Minimum.

As numerous comments have illustrated, the competition in the mobile marketplace was one of the justifications in 2010 for treating mobile broadband differently from fixed broadband. At AT&T describes, this completion has only expanded in the years since 2010: "82.0 percent of the U.S. population had access to four or more mobile broadband Internet access providers, whereas this figure was only 67.8 percent in 2011. . . . Competition is so fierce that some mobile providers have recently deployed promotional plans that pay customers for switching to their services."[8]

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[7] *See Preserving the Open Internet and Broadband Industry Practices*, Report and Order, 25 FCC Rcd 17905 (2010), at ¶¶ 94-95.

[8] Comments of AT&T, *Protecting and Promoting the Open Internet*, GN Docket No. 14-28 (filed July 17, 2014), at 22 (citations omitted).

Verizon notes that mobile broadband services are rapidly developing and that the wireless industry has witnessed a staggering increase in data consumption driven by widespread deployment of 4G service. Network investments by U.S. operators have propelled the U.S. to the position of the world's leader in wireless innovation, placing it at the epicenter of the app economy and the global device marketplace. By 2020, the number of connected devices is expected to grow nearly 30-fold to 26 billion units globally, a figure more than three times the number of smartphones, tablets, and PCs in use today.[9]

T-Mobile draws the link between competition in the mobile broadband marketplace and the behaviors this competition has engendered among network operators and end users.[10] Specifically, competition in the mobile broadband marketplace has prompted providers to ensure that customers are able to move from one carrier to another.[11] Providers also compete on network openness: customers demand access to the services, applications, and content of their choice, and a provider that fails to fulfill such expectations risks losing its customers. To remain competitive, mobile broadband providers have every incentive to attract and work with application developers and content providers to ensure their customers have access to the content they demand. Efforts to block or degrade user access to these applications would be contrary to broadband providers' business interests.

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[9] *See* Comments of Verizon and Verizon Wireless, *Protecting and Promoting the Open Internet*, GN Docket No. 14-28 (filed July 15, 2014), at 38-41.

[10] *See* Comments of T-Mobile, *Protecting and Promoting the Open Internet*, GN Docket No. 14-28 (filed July 18, 2014) , at 3-5.

[11] *Compare id.* at 3-4 ("In 2013, for example, T-Mobile – along with AT&T, Verizon Wireless, Sprint, and U.S. Cellular – agreed to new phone unlocking principles, which allow postpaid customers to unlock mobile wireless devices at the end of their service or equipment financing contracts . . . . T-Mobile followed up by offering to pay the early termination fees new customers incur when switching. . . . ") *with* Comments of Microsoft at 24 ("[T]hese mobile broadband access providers retain the ability to act in a manner that undermines the competitive neutrality of the online marketplace.").

With this backdrop of success, Ericsson questions what problem it is the Commission is trying to solve with potentially extending open Internet regulation to mobile broadband? In addition to competitive pressures, technical and engineering justifications for treating wireless differently are just as relevant today as they were in 2010.

III. Mobile Networks Continue to Face Operational Challenges that are Either not Present or Differ by a Great Degree in Fixed Networks.

a) Not all Network Connections are Created Equal – In The Internet Of Things, Some Devices Simply do not Require the Same Access that Others do.

In the Networked Society, everything that can benefit from a network connection will have a network connection. Historically, mobile networks have been used for telephony and personal messaging. While the past 15 years have shown a surge in personal mobile Internet use, still the vast majority of traffic has been aimed at individuals. We are only now starting to see the emergence of machine-to-machine communication. At the end of 2013, there were approximately 200 million cellular M2M devices in use worldwide, which equates to about 2 percent of data subscriptions among the networks that Ericsson can measure.[12] This is expected to grow by three to four times in the next five years.[13]

Operators have voluntarily embraced the concepts openness and fairness in network access in an environment in which connections are primarily aimed at *individuals*' use. Requirements for communications among *machines*, however, are characterized by their diversity. That is, notions of fairness of access and unhampered freedom of expression that are present in the Net Neutrality debate when one speaks about *people*, simply have no place when

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[12] *See* Ericsson Mobility Report, June 2014, at 29, available at http://www.ericsson.com/res/docs/2014/ericsson-mobility-report-june-2014.pdf.

[13] *See id.*

dealing with an Internet of Things and machine communications. Rather, it is the vastly different needs of sensors and machines, and for networks and applications to support those needs, that characterize machine communication. Communications among vehicles for crash avoidance or navigation are more urgent than a 30-minute update on residential electricity usage. The notion that every data bit sent between connected cars should be treated with the same degree of priority as those transmitted from a smart electric meter back to the electricity supply company ignores the difference in requirements of the machines that will increasingly connect to the wireless Internet.

The tremendous range of requirements can be summarized in a number of ways. Ericsson sees at least two major divisions among machine communications scenarios: those that will have massive numbers of "users" (devices, sensors, actuators, etc.) that can tolerate high latency rates and those whose requirements are more critical in nature, and therefore demand low latency.

For those with massive numbers of "users," as sensors, actuators, and other machines proliferate, the aggregate amount of data they will generate will grow rapidly. Sensors and actuators located in relatively simple environments such as home and building automation, logistics and tracking, agriculture, etc., may generate massive amounts of data. Some characteristics of the "massive machine type communications" are that devices tend to be:

- Delay-tolerant;
- Low cost; and
- Low energy consumers.

The data that these devices send also tends to differ from that required for individual mobile broadband use. It can be ultra-long range (in the case of, for example, tracking packages overseas), messages tend to be short, and they may require scalable access. While the data that any individual sensor might transmit and receive could be small, Ericsson expects massive numbers of these devices.

Critical machine communications, by contrast, have far different requirements. Examples of more critical machine communications include industry process control, autonomous vehicle driving, and distribution and fault protection in the electrical smart grid. The critical nature of these systems demands that their communications be ultra reliable, very low latency, and have a very high degree of availability.

Standards bodies, particularly 3GPP, have been analyzing various machine communications and what types of connections make the most sense. Limiting data rates can support extended coverage for devices. For example, a utility meter located in a basement might *benefit* from lower data rates if it means that its signal can be reliably received by a base station. 3GPP TR 36.888 aims to address such situations. In terms of minimizing power usage in battery-operated sensors, for example, delayed downlink transmissions in combination with a power save mode can prolong battery lifetime by two orders of magnitude.[14] These are just two examples of where differentiated treatment of devices can be beneficial even though it means that data transmission performance is *reduced.* Similarly, in critical machine communications, communications for intelligent transportation systems might demand priority over other communication in order to improve road safety on the nation's highways.

Both of the examples illustrate the futility of attempting to apply a regime in which prioritization, or even de-prioritization, of data is prohibited, and we know that future services will only become more complex over time. Rules treating all data equally would either over-provision resources for devices that do not require real-time communications, or could endanger critical uses—like self-driving automobiles—by failing to prioritize their communications over

[14] *See* 3GPP TR 36.888 V12.0.0 (2013-06) - 3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Study on provision of low-cost Machine-Type Communications (MTC) User Equipments (UEs) based on LTE (Release 12), *available at* http://www.3gpp.org/ftp/specs/archive/36_series/36.888/ (2013).

others. Rather than carve out an exception for machine communication, a far better policy is to hew to the *Notice*'s proposal not to apply a no-blocking rule which includes a minimum-level-of-service guarantee to mobile broadband (outside of the website and competing voice/video telephony applications).[15] Instead of muddying the waters with exceptions, with more to come in the future, and the potential of having to define the universe of machine communications to fit under those exceptions, a simpler and more certain approach is not to apply the no-blocking rule to mobile broadband and let market forces continue to drive innovation and investment.

b) Wireless Operators Must Contend with Mobility, Including Dynamic Demand in Terms of Time and Space.

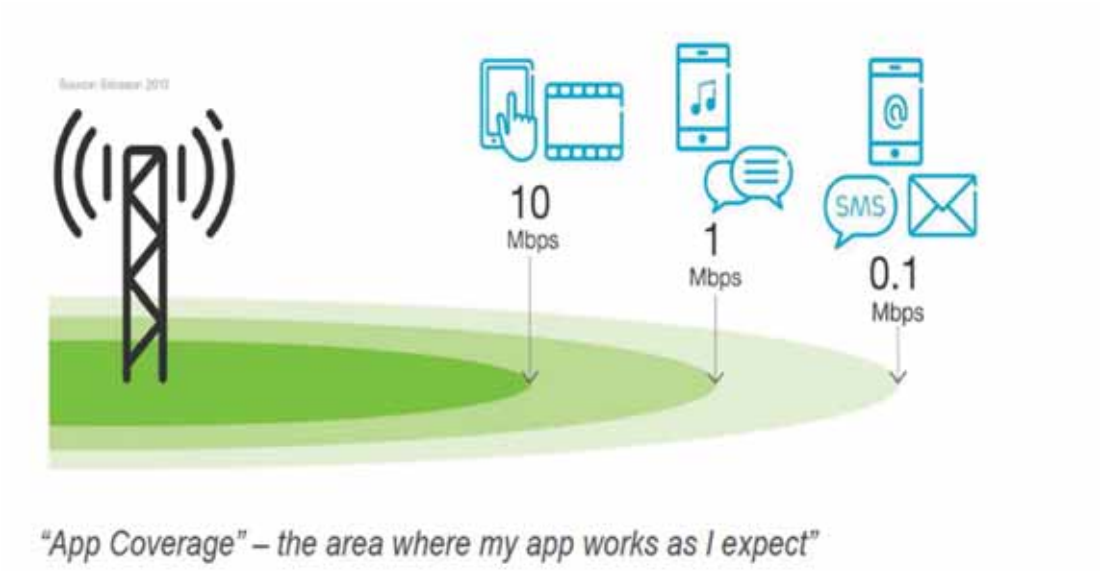
Another major differentiator that wireless operators have to contend with is mobility. In a fixed environment, such as a house or an office, while data use is certainly not a constant, it is hardly subject to the same variability of the wireless environment. True, one might download a file or stream a television show, or even have a few such sessions simultaneously, and reach the limits of one's agreement with the wireline ISP in terms of bandwidth. However, in the wireless space, a crowd could assemble in a park at lunchtime, with hundreds of users competing for the bandwidth delivered by a single base station, and then settle to minimal traffic as the crowd moves on. Fixed broadband simply does not face that eventuality.

Another aspect of mobility is differences in signal strength based on end users' locations. As users move further away from the base station and near the cell edge, they may experience as much as a 60 dB (1,000,000 times) difference in signal strength. This vast difference in signal strength makes the achievable speeds very different for different users. Despite this engineering reality, it seems that some of the most vocal supporters of applying a Net Neutrality regime to mobile broadband might actually support the absurd concept that modern wireless networks—

[15] *See Notice* at ¶105.

which currently hew to the basic principle of delivering all bits as fast as the radio channel conditions allow—should instead dictate that *every* user's experience be equal to those who are far away from the cell center.

This concept is extremely important to understanding the network management decisions an operator faces every day across its entire network. The following graphic illustrates the example that proximity to the cell center can have on applications, showing the bandwidths that deliver high quality video, music, and text/email experiences:



One could "remedy" the problem of the streaming-video user near the cell center receiving a high quality video experience while her friend near the cell edge might have difficulty sending text messages by degrading the mobile experience for everyone. The Scheduler feature in mobile networks could apply what is known as an "equal weight" scheduling algorithm, in which the network strives to give *all* users the exact same throughput irrespective of the device or application. Thus, those at the cell edge would receive the same throughput as those near the center. In effect, this means that the location of a few users will impact the experience for all users served by a given site.

Rather than end up with the rather absurd situation of equality for equality's sake even if it means degrading the experience of those who, as a matter of physics, can benefit from the increased throughput of being near the center of a cell, Ericsson offers wireless operators a number of scheduling strategies. Many are based on proportionality of data rates. Variations on the theme of proportionality attempt to balance the user experience depending on where the user is located. Thus, while the user at the cell edge should not be completely deprioritized based on his or her location, so too should the user nearer the center not take too much of a bandwidth hit just to ensure that someone near the cell edge receives the bulk of the network resources available in the area.

As Microsoft recognizes in its comments, "there are important differences in the technical architecture and capabilities of fixed and mobile broadband networks."[16] However, Ericsson posits that rather than addressing this through exceptions to rules, and the need for mobile broadband providers potentially to have to justify management techniques as economic vs. technical in order to fall under the "reasonable network management" exception, the simpler and more certain approach is simply not to apply an unreasonable discrimination rule to mobile broadband in the first place. Ultimately, engineering decisions must take economics into account. Would effectively slowing down access for those near the node in the name of equality be economic or would it fall under reasonable network management? At some point engineering decisions – "reasonable network management" – *are* economic. Rather than attempt to determine what motivates a particular mobile broadband provider, the Commission ought to recognize, as it has in its tentative conclusion, that the same approach that guided the Commission in 2010,

[16] *See* Comment of Microsoft at 27.

namely that "mobile Internet access service was excluded from the unreasonable discrimination rule"[17] should apply to any new Open Internet regulation.

c) Fixed and Mobile Face Different Demands with Different Resources.

In a fixed network architecture, G-PON fiber can deliver speeds of 10 Gigabits per second.[18] The fiber provides a connection to a specific, unmoving and unchanging, household or business. From there, the user is in charge and connects devices to a router that may or may not be supplied by the ISP. The network operator can fulfill its service obligations without concern about the devices at the other end of the proverbial "last mile."

By contrast, a mobile provider relies on a resource whose theoretical throughput— even if it is from the one of the larger allocations available today in the world, 2 x 20 MHz—pales in comparison. The current state of the art for LTE Release 10 – specifies, *in a perfect environment*, speeds of 140 Mbps downlink and 45 Mbps uplink for a 2 x 20 MHz FDD allocation. In the more common 2 x 5 MHz allocation, 30 Mbps downlink and 9 Mbps are possible. Wireless operators must share that bandwidth among many devices over a given area, with the strength of the signal varying by the user's location.

Adding to the complications, every year Ericsson's statistics show dramatic increases the amount of mobile data traversing operators' networks. Our most recent Mobility Report shows a 60% increase in mobile data traffic, globally, between the second quarter of 2013 vs. the second quarter of 2014.[19]

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[17] *Notice* at ¶ 62.

[18] *See* ITU-T, G.987, 10-Gigabit-capable passive optical network (XG-PON) systems: Definitions, abbreviations and acronyms *available at* http://www.itu.int/rec/T-REC-G.987-201206-I/en.

[19] *See* Interim Ericsson Mobility Report, August 2014, at 4, available at http://www.ericsson.com/res/docs/2014/ericsson-mobility-report-august-2014-interim.pdf .

All of these demands, from the limitations of spectrum resources, to managing a multitude of end user devices with widely disparate capabilities to the explosion of mobile data all require active network management. Ericsson urges the Commission to continue with its general hands-off approach to regulating mobility and allow operators the freedom to address these challenges in a manner consistent with their customers' demands and their own resources.

d) Delivery of Certain Applications, Such As Video, Demands Differentiated Treatment of Data, as do Various Devices.

As Ericsson described in our Comments in 2010, and as stated in the recently filed CTIA study, "voice call[s], email, and streaming video, all require different quality of service levels, and wireless network operators should be allowed the flexibility to prioritize these diverse services in a manner that ensures that an end user experiences the quality of service necessary for these services to function."[20] Video conferencing is an excellent example of how modern networks can deliver an enhanced QoS in order to help ensure a high quality customer experience.

To set up a quality experience for the end user, LTE can offer bit rate guarantees which are useful in the context of a video conference call. As described in the *CTIA Study*, an end user device would first secure an Evolved Packet System ("EPS") bearer of QCI ("QoS Class Identifier")=5 for signaling. Then, when the user seeks to initiate a video conference call, signaling messages exchanged between the end user's device and the IMS network checks with the Policy and Charging Rules Function ("PCRF") in the network to determine if the requisite QoS can be accepted. For video conferencing, this would be a guaranteed bit rate ("GBR")

[20] *See* Letter from Scott K. Bergmann, CTIA, to Marlene H. Dortch, FCC, *attaching* Net Neutrality and Technical Challenges of Mobile Broadband Networks, GN Docket 14-28, at 31 (filed Sept. 4, 2014) ("*CTIA Study*"); *See also* Comments of Ericsson Inc, *Preserving the Open Internet and Broadband Industry Practices*, GN Docket No. 09-191, WC Docket No. 07-52 (filed Jan. 14, 2010).

QCI=2. Ultimately, if it is available, the network works with the eNodeB and serving gateway in order to deliver an EPS bearer that can best support a video conferencing session.

Management tools, such as QoS in the Evolved Packet Core ("EPC") system, enable mobile providers to utilize their finite spectrum resources to deliver multi-service offerings, like video conferencing, that have different required bit rates, acceptable packet delay levels, and sensitivity to variations in network performance than do other traffic types. Thus, as both the number of mobile broadband subscribers contending for network resources and the traffic volume per subscriber intensifies—which is the case today—management tools, like QoS, enable providers to allocate network resources in a more systematic, fair, and efficient manner that improves the overall performance of the network and availability of enhanced services for all users.[21]

Applying a rule such as the Commission's proposed minimum-level-of-service rule to wireless networks would be challenging, at best, as it is difficult to define what a minimum level of service would be, especially over a range of device types. LTE, for example, has no defined minimum level of service for best-efforts access.[22] Rather, it is through management technologies such as those inherent in IMS that allow of any kinds of "guarantees" of service in a mobile world.

IV. Conclusion

Ericsson supports the conclusions the Commission reached in 2010 regarding the proper treatment of wireless broadband in a net Neutrality regime. The tentative conclusions in the

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[21] *See* Comments of Ericsson Inc, *Preserving the Open Internet and Broadband Industry Practices*, GN Docket No. 09-191, WC Docket No. 07-52, at 20-21 (filed Jan. 14, 2010).

[22] *See CTIA Study* at 26.

Notice largely support the Commission's stance in 2010 and would protect the vibrant, growing, and ever-changing wireless ecosystem.

Respectfully submitted,

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