Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554

In the Matter of	)	
	)	
Reliability and Continuity of Communications Networks, Including Broadband Technologies	)	PS Docket No. 11-60
	)	
Effects on Broadband Communications Networks of Damage or Failure of Network Equipment or Severe Overload	)	PS Docket No. 10-92
	)	
Independent Panel Reviewing the Impact of Hurricane Katrina on Communications Networks	)	EB Docket No. 06-119

To: The Commission

T-MOBILE USA, INC. COMMENTS

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COMMENTS

T-Mobile USA, Inc. ("T-Mobile") responds to the Commission's *Notice of Inquiry* in the above-referenced proceeding.[1] As discussed below, the CMRS industry is effectively addressing network reliability and continuity issues and direct Commission intervention is not needed at this time.

INTRODUCTION AND SUMMARY

T-Mobile recognizes the importance of ensuring the reliability and continuity of its wireless and broadband infrastructure. Today, CMRS carriers compete, in large part, on network reliability, coverage, and capacity. As a result, for example, T-Mobile has invested substantially to ensure the reliability and continuity of its networks. In 2010, capital expenditures totaled $2.8 billion[2] – most of which were related to network buildout and technology upgrades designed to

[1] *Reliability and Continuity of Communications Networks, Including Broadband Technologies*, Notice of Inquiry, 26 FCC Rcd 5614 (2011) ("*NOI*").

[2] *See* T-MOBILE USA, T-MOBILE USA REPORTS FOURTH QUARTER 2010 RESULTS 6 (2011), *available at* http://s.tmocache.com/Cms/Files/Published/

increase speed, capacity, and reliability. T-Mobile is not alone in making these types of investments. As noted in CTIA's Semi-Annual Survey, wireless carriers have committed more than $310 billion in cumulative capital expenditures – excluding the costs of spectrum acquisition – over the past 20 years.[3]

In addition, in order to improve the reliability and continuity of CMRS networks nationwide, T-Mobile and other carriers have assisted in the development of best practices through active involvement in the Alliance for Telecommunications Industry Solutions ("ATIS") Network Reliability Steering Committee ("NRSC"), the Network Reliability and Interoperability Council ("NRIC"), and NRIC's successor, the Communications Security, Reliability, and Interoperability Council ("CSRIC"). These groups have developed hundreds of best practices, many of which T-Mobile has incorporated into its network architecture and day-to-day operations. All of these efforts are voluntary and in response to competitive market conditions, rather than Commission mandates.

While T-Mobile recognizes the Commission's continued interest in the reliability and resiliency of wireless and broadband networks, the company respectfully submits that voluntary efforts and continuing enhancement of best practices remain the best approach to follow. The reality is that carriers compete on coverage and network quality, and have every incentive to ensure networks are resilient – independent of government regulation.

0000BDF20016F5DD010312E2BDE4AE9B/5657114502E70FF3012B5A79D454F2C8/file/ TMUSQ42010PressReleaseFinalv2.pdf.

[3] *See CTIA,® Year-End Top-Line Survey Results* (2011), *available at* http://files.ctia.org/pdf/ CTIA_Survey_Year_End_2010 _Graphics.pdf ("CTIA Semi-Annual Survey"). Total wireless carrier investment for 2010 exceeded $24 billion. *Id.*

I. COMMISSION REGULATIONS REGARDING CONTINUITY, RELIABILITY, AND RESILIENCY ARE UNNECESSARY FOR WIRELESS NETWORKS

The Commission seeks comment on whether regulations regarding continuity, reliability, and resiliency are necessary because networks using broadband technology "may or may not be built to the high carrier grade standards of legacy wireline systems."[4] In particular, the Commission questions whether, absent regulation, networks will utilize "systems, hardware, or software that are extremely reliable, well tested, and proven in their capabilities."[5] As discussed below, Commission regulation at this time is unwarranted to ensure reliable networks are built and maintained.

Based largely on a Congressional mandate to rely on market forces rather than regulation, the Commission has previously concluded that regulation of the CMRS industry is warranted only where there has been a market failure.[6] In this regard, the Commission has determined that competitive forces are sufficient to ensure a proper grade of service to consumers:

> We conclude there is no need to specify requirements or standards pertaining to the adequacy of cellular service. The majority of commenters agree that competition in the marketplace will assure the continued provision of high-quality cellular service.[7]

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[4] *NOI*, 26 FCC Rcd at 5615 (footnote omitted).

[5] *Id.* at 5615 n.4.

[6] *See Orloff v. Vodafone AirTouch Licenses, LLC*, Memorandum Opinion and Order, 17 FCC Rcd. 8987, 8997 n.69 (2002) ("With respect to CMRS, the Commission generally has relied on market forces, rather than regulation, except where there is a market failure"); *Implementation of Competitive Bidding Rules To License Certain Rural Service Areas*, Report and Order, 17 FCC Rcd 1960, 1968 (2002).

[7] *Amendment of Parts 2 and 22 of the Commission's Rules to Permit Liberalization of Technology and Auxiliary Service Offerings in the Domestic Public Cellular Radio Telecommunications Service*, Report and Order, 3 FCC Rcd 7033, 7038 (1988) ("*Part 22 Order*").

Since making that finding, the Commission has released 15 reports analyzing competition in the wireless marketplace.[8] In none of these reports has the Commission concluded that there has been a market failure.[9] Indeed, a mere three months ago, in evaluating the resiliency of communications networks, the President's National Security Telecommunications Advisory Committee ("NSTAC") concluded that "market incentives will remain the fundamental driver of industry practices and standards [and] companies will continue to offer services that are as resilient and secure as customers' preferences dictate."[10]

II. THE CMRS INDUSTRY HAS NUMEROUS STANDARDS AND PRACTICES IN PLACE TO ENSURE THE CONTINUITY, RESILIENCY, AND RELIABILITY OF WIRELESS NETWORKS

In 2007, the Department of Homeland Security ("DHS") released a report evaluating the nation's communications infrastructure.[11] The report stated:

> The communications companies that own, operate, and supply the Nation's communications infrastructure have historically factored natural disasters and accidental disruptions into network resiliency architecture, business continuity plans, and disaster recovery strategies. The interconnected and interdependent nature of these

[8] *See, e.g.*, *Annual Report and Analysis of Competitive Market Conditions With Respect to Mobile Wireless, Including Commercial Mobile Services*, Fifteenth Report, FCC 11-103 (rel. June 27, 2011).

[9] Indeed, adopting standards regarding quality of service, continuity, reliability, and resiliency would be inconsistent with the congressional preference that the CMRS industry be governed by competitive market forces, rather than by regulation. *See Sw. Bell Mobile Sys., Inc.*, Memorandum Opinion and Order, 14 FCC Rcd. 19898, 19902 (1999) .

[10] NSTAC, NSTAC REPORT TO THE PRESIDENT ON COMMUNICATIONS RESILIENCY 14 (2011) ("NSTAC Report") *available at* http://www.ncs.gov/nstac/reports/NSTAC Report to the President on Communications Resiliency (2011-04-19)(Final)(pdf).pdf.

[11] DHS, COMMUNICATIONS: CRITICAL INFRASTRUCTURE AND KEY RESOURCES; SECTOR SPECIFIC PLAN AS INPUT TO THE NATIONAL INFRASTRUCTURE PROTECTION PLAN (2007) ("DHS Report") *available at* http://www.dhs.gov/xlibrary/assets/nipp-ssp-communications.pdf.

> service provider networks has fostered crucial information sharing and cooperative response and recovery relationships for decades.[12]

The report also noted that:

> Communications Sector owners and operators focus on ensuring overall reliability of the networks, maintaining "always on" capabilities for certain critical customers, and quickly restoring capabilities following a disruption. The sector mitigates cascading effects of incidents by designing and building resilient and redundant communications systems and networks to ensure disruptions remain largely localized and do not affect the national communications backbone.[13]

In evaluating the best way to ensure continuity of service and the resiliency and reliability of communications networks, the DHS report *did not* recommend adoption of Federal standards. Instead, the report noted that continued cooperation between industry, government, and standards bodies to develop best practices obviates the need for additional regulation.[14] This cooperative environment, coupled with voluntary best practices, is sufficient "to ensure the Nation's communications networks and systems are secure, resilient, and rapidly restored after an incident."[15] T-Mobile agrees and urges the Commission to promote the collective efforts of the CMRS industry, government, and standards bodies that are well underway.

A. Continuity of Service

T-Mobile agrees with the Commission that it is important for consumers to have access to communications networks during times of major emergencies.[16] It is worth noting that the

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[12] *Id*. at 2.

[13] *Id*. at 7.

[14] *See id*. at 23, 29.

[15] *Id.* at 2.

[16] *See NOI*, 26 FCC Rcd at 5620.

President's NSTAC report recently found that "it would be near impossible to develop and maintain networks that are invulnerable to disruption."[17] Nevertheless, T-Mobile has designed its network to withstand severe conditions based on industry standards and best practices.

As T-Mobile's network has been tested by various natural disasters over the years – such as hurricanes and tornados – the company continuously examines and modifies its practices and procedures as needed based on lessons learned from these events. Additionally as a measure to promote continuity of service, T-Mobile has in place a formal enterprise-wide Business Continuity Program that has been certified as meeting the requirements set forth in an industry-wide Business Continuity/Disaster Recovery program sponsored by CTIA.[18] T-Mobile's Plan involves all sectors of the company to ensure rapid response, service continuity, and recovery during crisis situations. The program is centralized in its design and decentralized in its implementation, promoting active involvement by all lines of business in all locations. Primary components of the program include:

- Enterprise Business Continuity Project Initiation and Oversight;
- Risk Evaluation and Controls;
- Business Impact Assessment and Analysis;
- Business Continuity and Disaster Recovery Strategic Direction;
- Crisis Response, Emergency Response, and Operations;
- Business Continuity Plan Development, Maintenance, and Exercising;
- Awareness and Training Programs;
- Public Relations and Crisis Response and Resumption Coordination; and
- Coordination with External Agencies.

A team of certified Business Continuity professionals is responsible for documenting and developing enterprise standards, processes, and policies for all business continuity and disaster

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[17] NSTAC REPORT at 1.

[18] *See Emergency Preparedness/Business Continuity*, CTIA, http://www.ctia.org/advocacy/policy_topics/topic.cfm/TID/40 (last visited June 27, 2011).

recovery needs throughout T-Mobile. This group supports the line of business continuity planning and defines enterprise tools and methodologies. This level of consistency across the lines of business enhances T-Mobile's overall planning and restoration efforts.

In addition to its Business Continuity Program, T-Mobile has an Emergency Operations Plan and Checklist that provides detailed instructions regarding the steps that should be used to prepare for and respond to emergency situations, such as floods, hurricanes, winter storms, volcanoes, wildfires, tornados, earthquakes, power outages, and terrorist attacks. Among the key steps set forth in the plan are the establishment of an Emergency Operations Center, the creation of safe rooms for employees, the establishment of restoration priority lists for key network elements, mobilization of field/construction crews, testing backup power systems, coordination with FEMA, and staging key equipment and supplies (such as replacement parts, generators, fuel, *etc*.). Further, for many of these scenarios, the checklist sets forth steps to be undertaken at least 72 hours in advance of the anticipated emergency situation.

1. Backup Power Requirements Should Not Be Established

The Commission seeks comment on whether backup power requirements should be adopted.[19] The NSTAC recently evaluated, however, the steps that should be taken to improve communications resiliency and did not recommend backup power requirements for CMRS.[20] In this regard, the report recognizes that a critical issue for ensuring continuity of service is not the availability of backup power, because carriers stockpile *portable generating equipment*, but rather the availability of fuel to power such equipment.[21] Thus, the unavailability of fuel, not

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[19] *NOI*, 26 FCC Rcd at 5621-22.

[20] *See* NSTAC REPORT.

[21] *Id*. at 25.

backup power options, was identified as a key issue by NSTAC. T-Mobile agrees with the NSTAC and urges the Commission to refrain from adopting any backup power requirements for the CMRS industry.

a. Various Factors are Considered in Addressing Service Continuity and Network Reliability

Carriers have the proper incentives and recognize their responsibility to the marketplace. If a carrier's network has a high incidence of failure, customers will quickly become dissatisfied and switch to a different carrier. These competitive factors require carriers to balance the various necessary network related expenditures. Backup power is only one element for addressing network reliability and service continuity.

To optimize network reliability and service continuity, carriers must weigh a variety of options such as:

- installing permanent generators and/or fuel cells at many sites;
- purchasing portable generators;
- establishing fuel stores prior to an emergency;
- purchasing portable assets such as cell sites on wheels ("COWs") or towers on wheels ("TOWs").

Because resources are not unlimited, T-Mobile and other CMRS carriers devise plans that combine all of these options in the optimal manner to ensure reliability and continuity.

For example, carriers may address permanent backup power sites based on geographic factors. The needs of cell sites in the Gulf Coastal region that are frequently impacted by hurricanes likely will require a different approach to backup power than cell sites located in another area of the country. In addition, backup power resource determinations are made based on various other factors, including the type of site, the site's design, and space opportunities.

Carriers also design their networks to have numerous cell sites with overlapping coverage in areas prone to natural disasters. Thus, if a cell site becomes inoperable, coverage can be

obtained in many cases from an adjacent site.[22] In other words, service to a community can be maintained if less than 100% of the sites covering that community are operational.

Rather than have resources fully committed to deploying permanent backup power at all sites, carriers should have the flexibility to purchase portable assets – such as portable generators, COWs, and TOWs – that can be quickly moved into a disaster area. This flexibility is necessary to ensure that, when sites are destroyed by a disaster, carriers will have the resources to deploy portable replacement facilities into the hardest hit areas that are not fully covered by adjacent sites or that need additional capacity. In the wake of a disaster, investments in backup power can be wiped out if sites are destroyed, whereas investments in portable resources such as COWs and portable generators will ensure service is quickly restored and thus will pay huge dividends to the public.

b. Numerous Factors Beyond a Carrier's Control May Prohibit or Limit the Use of Certain Types of Backup Power

There are numerous factors outside the control of carriers that impact the ability to support specific backup power options. Among those factors are:

Space constraints. In many locations, there is insufficient space for the installation of permanent backup power. Adding backup power requires additional space, whether for a battery cabinet or for a generator and fuel tank. Many sites do not have such space available, particularly sites located on utility poles and church steeples.[23]

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[22] *See Amendment of Parts 2 and 22 of the Commission's Rules to Permit Liberalization of Technology and Auxiliary Service Offerings in the Domestic Public Cellular Radio Telecommunications Service,* Report and Order, 3 FCC Rcd 7033, 7038 (1988) ("*Part 22 Order*") (noting that in cases where a cell site can no longer carry traffic, "no or few calls go unserved because other less-loaded cells carry the overflow").

[23] *See, e.g.,* T-Mobile Comments in Support of Petitions for Reconsideration, EB Docket No. 06-199 at 8 (Sept. 4, 2007); Comments of MetroPCS Communications, Inc., PS Docket No. 10-92 at 5 (June 25, 2010).

Moreover, regulatory and other requirements make finding space at a cell site for a backup power source problematic. For example, some local governments limit the area that can be used to house battery cabinets or backup power equipment to 25% or less of the total surface of a rooftop.[24] These requirements would preclude the addition of backup generators or battery cabinets to many rooftops.

Similarly, in the case of liquid propane-fueled generators, OSHA requires a 10-foot-radius clearance between the liquid propane fuel tank and its ignition source.[25] This type of public health and safety restriction can substantially increase the amount of space needed to install a backup power source – space that is unavailable at many sites.

Public Health and Safety Issues. Most backup power sources involve lead (in the case of batteries) or the storage and burning of fuel and, therefore, trigger a myriad of statutes and codes designed to deal with public health and safety issues. These laws would be substantial hurdles that carriers would have to clear before installing additional backup power. For example, local building codes impose detailed requirements for plans and permits related to the construction of fuel-burning equipment or fuel storage. Many state and local governments also have laws that require carriers to obtain permits before installing new diesel generators (or any other source of regulated pollutants) at cell sites.[26] Further, carriers would be forced to comply with various

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[24] *See, e.g.*, MONTGOMERY COUNTY, MD, CODE § 59-A-6.14(a)(5) (2011); FAIRFAX COUNTY, VA, ZONING ORDINANCE § 2-5141.J (2011).

[25] 29 C.F.R. § 1926.151(c)(5) (2010) ("No combustible material shall be stored outdoors within 10 feet of a building or structure.").

[26] *See, e.g.*, CAL. CODE REGS. tit. 17, § 93115.10 (2011); SAN DIEGO COUNTY, CA, AIR POLLUTION CONTROL DISTRICT, RULES & REGS., Rules 10-10.1, 11(a)(5) (2011), *available at* http://www.sdapcd.org/rules/rules/REG2. html; CITY OF ROCKVILLE, EMERGENCY GENERATOR & ABOVE GROUND FUEL TANK INSTALLATIONS (2009), *available at* http://www.rockvillemd.gov/ residents/inspections/generator.htm.

federal environmental statutes such as the Clean Air Act, the Clean Water Act, the Spill Prevention, Control, and Countermeasure Act, and the Emergency Planning and Community Right-to-Know Act.[27] These various requirements would block T-Mobile from being able to comply with a mandatory backup power requirement at various sites and, at the very least, slow the process by which T-Mobile could lawfully modify sites to support the equipment required by any backup power rule.

Regulatory Permits and Approvals and Lease Requirements. In numerous jurisdictions, carriers would have to seek approval from local zoning boards before they could add generators, additional backup batteries, or other backup power sources such as natural gas or fuel cells. The addition of new equipment – including generators and batteries – often is deemed a "material change" to existing, approved cell site plans, which triggers a requirement for new approvals.[28]

Although the Tower Siting Shot Clock has streamlined the siting approval process in many areas,[29] the process remains time consuming and approval is not guaranteed. The installation of backup power would require numerous local permitting applications that must be evaluated on a site-by-site basis. Such applications likely will require the preparation and submission of detailed construction plans (as well as environmental and noise level studies) for review. In addition, for permits and approvals, T-Mobile would be required to negotiate

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[27] *See* Clean Air Act, 42 U.S.C. §§ 7401–7671q (2006); Clean Water Act, 33 U.S.C. §§ 1251–1387 (2006); Spill Prevention, Control, and Countermeasure rule, 40 C.F.R. §§ 112.1–22 (2010); Emergency Planning and Community Right-to-Know Act, 42 U.S.C. §§ 11001–11050 (2006).

[28] *See, e.g.*, Condition 3, *Resolution of the City of Mount Vernon Planning Board Approving the Special Permit Application of T-Mobile dba Omnipoint Communications*, Resolution No. 18-2004 (2004).

[29] *See Petition for Declaratory Ruling to Clarify Provisions of Section 332(c)(7)(B) to Ensure Timely Siting Review and to Preempt Under Section 253 State and Local Ordinances that Classify All Wireless Siting Proposals as Requiring a Variance*, Declaratory Ruling, 24 FCC Rcd 13994 (2009).

numerous both new and existing contractual arrangements for buildings and other locations. All of this would require substantial time and possibly present a serious roadblock to compliance with a backup power requirement.

Weight. Another obstacle carriers would have to overcome at some sites before installing backup power is constraints related to weight. The batteries used to generate backup power can weigh over 100 pounds each. Depending upon the number of batteries required to satisfy a backup power requirement, the addition of backup power could add over 1,000 pounds to a site. In some cases, this may not be possible due to building code requirements that limit the weight of equipment that can be placed on roofs or lease restrictions that preclude modifications that would increase the load at a site. At a minimum, a backup power requirement could require carriers to negotiate approvals from landlords and/or zoning boards to place additional weight at cell sites. These issues would prove even more difficult at multicarrier sites, where compliance could require the addition of several thousand pounds of additional weight.

2. Backhaul Redundancy Requirements are Unnecessary

One paragraph of the *NOI* is devoted to the question of backhaul redundancy and what steps the Commission should take to ensure such redundancy.[30] Again, given the competitive nature of the CMRS industry and the success of voluntary best practices, Commission intervention is unnecessary at this time.

As DHS noted, the communication industry designs and builds "resilient and redundant communications systems."[31] More than 800 industry best practices have been established to date, many of which address redundancy and resiliency issues. For example, CSRIC Working

[30] *NOI*, 26 FCC Rcd at 5622-23.

[31] DHS REPORT at 7.

Group 6 identified Best Practice Number 7-7-5113 – which specifies the use of multiple cable entry points where feasible at critical facilities to avoid single points of failure – as a critical best practice.[32] T-Mobile complies with this best practice.

Moreover, T-Mobile has taken additional steps to ensure the availability of backhaul during emergencies. For example, the company has purchased portable facilities that can be deployed in disaster areas to carry backhaul traffic over satellites. All of these efforts have been undertaken voluntarily without any governmental mandates.

3. The Commission Can Improve Service Continuity by Facilitating the Site Approval Process

Rather than interfere with the efforts undertaken by carriers to ensure the continuity of service, the Commission should focus on areas beyond carrier control that impair continuity of service and restoration efforts. In particular, the Commission should explore measures to further expedite the site approval process.[33] Such action will facilitate service continuity by expediting the approval process associated with the addition of sites that can provide overlapping coverage that can be vital in emergency situations.

T-Mobile applauds adoption of the Tower Siting Shot Clock as a concrete, first step toward expediting the siting approval process. Evaluating whether similar steps can be implemented to eliminate other impediments to site deployment may be an effective follow-up measure. In particular, T-Mobile urges the Commission to consider actions that can be taken to address the following:

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[32] CSRIC WORKING GROUP 6, BEST PRACTICE IMPLEMENTATION: FINAL REPORT (2011) ("CSRIC Report"), *available at* http://transition.fcc.gov/pshs/docs/csric/WG6-Best-Practice-Implementation-Final-Report.pdf.

[33] The Commission should also continue its efforts to ensure that wireless carriers can (i) access their sites during emergencies and (ii) obtain and deliver fuel to power generators during emergency situations.

- Restrictive local zoning ordinances that make finding a site a difficult and time-consuming process;
- The increasing use of municipal "consultants" in the permitting process, which often leads to additional delay and increased costs;
- The delay associated with obtaining approval from various other federal agencies, such as the Bureau of Land Management, National Park Service, and U.S. Fish and Wildlife Service; and
- Insufficient FCC resources to evaluate NEPA and Section 106 issues in a timely manner.[34]

T-Mobile encourages the Commission to assist CMRS carriers on these matters.

B. Network Resiliency and Reliability

The *NOI* notes that "[w]ireline communications networks have traditionally been designed and deployed to achieve carrier grade reliability . . . [with] major components in the network core . . . typically designed to meet downtime objectives not exceeding two minutes per year."[35] The Commission seeks comment on what steps can be taken to ensure that broadband networks possess reliability standards that approach those in legacy wireline networks.[36] The Commission is particularly concerned about network reliability and resiliency as public safety and critical communications platforms transition to an IP-based network.[37]

This debate was previously before the Commission in the context of wireless 911. The Association of Public-Safety Communications Officials ("APCO") and other public safety organizations urged the Commission to adopt a federal grade-of-service standard for 911 calls that would be comparable to wireline grade-of-service standards – one dropped call per one

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[34] Siting issues are currently the subject of another FCC proceeding. *See Acceleration of Broadband Deployment: Expanding the Reach and Reducing the Cost of Broadband Deployment by Improving Policies Regarding Public Rights of Way and Wireless Facilities Siting*, Notice of Inquiry, 26 FCC Rcd 5384 (2011).

[35] *NOI*, 26 FCC Rcd at 5623.

[36] *Id.* at 5623-24.

[37] *Id.*

hundred.[38] The Commission declined to mandate such a requirement, however, finding that "Federal standards regarding grade of service for 911 service are not warranted at this time. The nature of the issue requires a level of expertise and consultation among the parties that can best be achieved through discussions and proceedings of standard-setting bodies. . . ."[39]

The Commission seems to believe that the transition to IP technology decreases overall resiliency.[40] To the contrary, as discussed below, IP networks are generally more robust, reliable, and resilient than legacy circuit-switched networks.[41] IP networks perform error-

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[38] *See Revision of the Commission's Rules To Ensure Compatibility with Enhanced 911 Emergency Calling Systems*, Report and Order and Further Notice of Proposed Rulemaking, 11 FCC Rcd 18676, 18737 (1996).

[39] *Id.*

[40] *See NOI*, 26 FCC Rcd at 5623-24.

[41] Linda K. Moore, U.S. Congressional Research Service, EMERGENCY COMMUNICATIONS: THE FUTURE OF 911, p. 1 (RL34755, March 16, 2010) (describing the general consensus that "IP-enabled emergency communications network that supports 911 will facilitate interoperability and system resilience" and describing Congressional action supporting use of IP-enabled 911 systems); Cisco Systems, Inc., *IP-Based Networks Support Defense Transformation*, at 4-5 (2005) (noting that resilience and survivability are key features of IP networks, which can route around network interruptions using any available physical medium (fiber, wireless, satellite, *etc.*)), *available at* ww.cisco.com/web/strategy/docs/gov/space_IPBasedNetworks_v3.pdf; Cisco Systems, Inc., *Cisco Cable IP Solutions for High-Availability Networks*, at 24 (2003) (performing an analysis of IP-based VoIP on cable systems and concluding that "technological improvements at the component, system, transport, network, and routing level are enabling IP networks to exceed traditional circuit-switched networks in terms of resiliency and availability."), *available at* http://www.cisco.com/en/US/products/hw/cable/ps2209/products_white_paper09186a00801af388.shtml; Anne Smith, *et. al*, "An Overview of Cisco IP Communications," chapter in CISCO CALLMANAGER FUNDAMENTALS (2nd ed. 2005) (describing how packet-based communications provide superior reliability through the use of clustering rather than the traditional analog strategy of supplying redundant network equipment), *available at* http://www.ciscopress.com/articles/article.asp?p=426635.

checking and retransmission functions[42] that simply are not available on legacy circuit-switched networks.

IP networks achieve resiliency and reliability differently than do legacy circuit-based technologies. In a circuit-switched network, a single path between the communicating nodes is established and this path is maintained for the duration of the communication. Thus, to increase the reliability of a circuit-switched communication, every piece of equipment on that path must be made more reliable, since if any link fails, the whole communication fails along with network elements, that in and of themselves may be more reliable than any single element in an IP network.

In contrast, IP networks use multi-path communications, in which pieces of a message may travel many different paths across the network between the communicating nodes. This "connectionless" approach of IP networks[43] is not a flaw; it is part of why IP networks are more resistant to failure than are legacy networks. IP networks can route messages around a failed network node on a different path.

Legacy switched networks cannot achieve such resiliency with near the efficiency of IP networks. Switched networks can "swap in" redundant equipment when a network element fails,

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[42] *NOI* at 5624. The *NOI* indicates that certain protocols do not employ all the error-checking or retransmission capabilities of some IP protocols. However, the Commission should not confuse this conscious choice among protocols as meaning that such streamlined protocols are "less reliable" or "less resilient." For many applications, speed of delivery is more critical to the function of the application than is the need to deliver every single packet. For example, for VoIP it may be more important to get 90% of the data to the destination faster in order to maintain a steady conversation. In other words, the reliability and resiliency of a network depends upon the type of application using the network. IP networks can accommodate a wide range of application types by using different protocols; legacy networks cannot.

[43] *Id.* at 5623. Note that traffic can be sent over IP networks using connectionless "datagrams" or through a connected "virtual circuit." We presume the Commission is referring to the non-circuit-based nature of IP communications when describing such networks as "connectionless."

but in a switched network the redundant circuits must be (i) located in exactly the proper location to route around a failure and (ii) idle when the fault occurs. This requires the installation and upkeep of unused infrastructure throughout the network. Thus, for the same amount of physical network equipment, packet-switched technology such as IP may prove to better adapt to outage situations.

Upgrading IP networks is also easier and less expensive than upgrading a circuit-switched network. IP equipment can be swapped into and out of the network, oftentimes quickly, because the network can route communications around the change until the upgrade is complete. Upgrading an IP network also requires less equipment than would the equivalent upgrade in a circuit-switched network because packet-based networks are more efficient than circuit-switched networks, as discussed above. IP networks are therefore less expensive to maintain and upgrade, which makes it easier to invest in improvements designed to improve reliability and resilience.

To date, the Commission has not adopted regulations establishing network reliability or resiliency standards. Nevertheless, the CMRS industry has forged ahead with numerous best practices and operational procedures designed to ensure the continuity of carrier networks. For example, the NRIC, CSRIC, and NRSC have evaluated network reliability and resiliency issues and developed industry best practices.

- The NRIC alone resulted in more than 800 best practices.[44]
- The NRSC developed 23 modified and new best practices.[45]
- The CSRIC reviewed each of the aforementioned best practices and broke them into three categories: critical, highly important, and important.[46]

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[44] *See* CSRIC Report at 6-7.

[45] *See id.* at 7.

[46] *Id.*

The CSRIC concluded that it would be impractical, if not impossible, to craft best practices that would apply to each participant in the communications industry based on, among other things, the wide variety of network and system designs, technologies, and capabilities characteristic of the industry.[47] This same logic counsels against adoption of uniform standards by the Commission. There is no "one size fits all" approach to network management standards.

T-Mobile, like other CMRS carriers, implements multiple layers of protection to minimize the possibility of a single point of failure in the network. For example:

- Geographic redundancy has been implemented whereby two geographically diverse data centers are utilized;
- Data centers have dual power sources, dual cards, and dual nodes to protect against failure; and
- Data centers are connected by a multi-ring Optical Transport Network so at least two separate paths exist between the redundant data centers.

T-Mobile also has taken steps to identify "silent failures" by pinging the network to verify its operational capacity. As a result, T-Mobile is able to identify such failures in near-real time and resolve the underlying cause of the failure rapidly.

CONCLUSION

As discussed above, network reliability, resiliency, and continuity are important issues that the CMRS industry has expended considerable resources addressing. T-Mobile recognizes the Commission's continued interest in the reliability and resiliency of wireless and broadband

[47] *Id.* at 3, 17.

networks. Voluntary efforts and continuing enhancement of best practices remain the best approach to follow.

Respectfully submitted,

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