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Network Reliability Steering Committee 2015-2016 Operational Report

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Network Reliability Steering Committee 2015-2016 Operational Report

February 2018

DATE: February 2018

TO: Stakeholders of the Nation's Public Communications Networks

Service disruptions, although infrequent, remind us how dependent we are on the communications networks. During these events, communication providers demonstrated how seriously they take their responsibility to provide reliable services for consumers and businesses, expending significant efforts to mitigate outages and quickly restore service. Once service is restored, equal efforts are expended to analyze the disruption, identify areas for improvement, and implement those improvements. The owners and operators of these networks, along with the equipment vendors they partner with, are firmly committed to building and maintaining reliable and resilient networks. This commitment has been demonstrated again and again – on a day-to-day basis, and in the face of natural and manmade disasters.

The Network Reliability Steering Committee (NRSC) remains committed to this effort by analyzing outage and reliability trends and recommending actions that can help prevent outages or reduce their impact. Its members work together to ensure that communication systems continue to remain secure and reliable. These efforts ultimately benefit consumers, business, the industry, and the nation as a whole.

This report provides a snapshot of the issues addressed by the NRSC over the last two years. As you will see, the efforts of the NRSC, guided by input from member company subject matter experts as well as the FCC, are primarily directed toward ensuring that meaningful data is being collected and analyzed to better understand the cause and mitigation of outages. Ultimately, the NRSC utilizes this information to develop industry guidance that directly impacts and improves the nation's networks. These efforts build upon previous NRSC work and form a strong foundation for ensuring that communication networks continue to be reliable and resilient. This foundation is especially useful in light of ongoing momentous changes to the communications network, including the significant growth of wireless networks and the evolution to an All-IP network. The nation depends on these networks to provide emergency communications, enable commerce, and support individual communications. As these changes to the network occur, the NRSC remains committed to, and will continue working toward, maintaining network reliability and resiliency.

ANDY GORMLEY
T-Mobile
NRSC CO-CHAIR

ANDIS KALNINS
Verizon
NRSC CO-CHAIR

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Executive Summary

About the NRSC

The Alliance for Telecommunications Industry Solutions (ATIS) NRSC addresses network reliability improvement opportunities of service providers and vendors, in a noncompetitive environment, and allows participants to develop standards, technical requirements, technical reports, Bulletins, Best Practices, and reports on the health of the nation's communications networks. The NRSC also coordinates industry improvements in network reliability through outage analysis. The mission statement of the NRSC is:

> ***The NRSC strives to improve network reliability by providing timely consensus-based technical and operational expert guidance to all segments of the public communications industry.*[1]**

The NRSC is deeply committed to intra-industry collaboration, which is essential in ensuring that the industry's expertise is available to monitor and address critical trends in the reliability of our nation's public communications networks. The NRSC addresses these critical trends by:

- Identifying potential network reliability issues through an opportunity evaluation process;
- Establishing teams to work specific reliability issues;
- Conducting special studies to develop industry recommendations and/or Best Practices;
- Providing industry feedback to the Federal Communications Commission (FCC) Public Safety and Homeland Security Bureau (PSHSB) on network reliability and on the FCC's Network Outage Reporting System (NORS) and Disaster Information Reporting System (DIRS); and
- Serving as a public educational resource on network outage trends and the industry's ongoing efforts to resolve network reliability concerns.

This Operational Report covers the period of 2015 through 2016. A brief history of the NRSC is provided in the *Introduction* of this report (page 1).

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[1] NRSC's Mission Statement is available on the ATIS NRSC site < http://www.atis.org/nrsc/index.asp >.

Changing Regulatory Environment & Changing Industry

The 2013-2014 NRSC Operational Report cited an increased focus on issues related to network reliability and resiliency and to the obligation of industry to report communications outages. This focused attention has, if anything, increased over the last two years, with numerous regulatory measures being enacted and industry responding to various high-profile service interruptions. Continuity of emergency services, cybersecurity, and the move to an all-IP network have received the bulk of attention, although reliability of legacy networks remains a critical piece of the equation.

Extension of Outage Reporting to Voice over IP (VoIP)

In 2012, the FCC extended its outage reporting rules to interconnected VoIP service providers, noting that consumers are increasingly using interconnected VoIP services in lieu of traditional telephone service. The interconnected VoIP rules are based on the existing legacy network reporting rules, and in 2014, the FCC indicated they are planning on revising those rules, possibly in 2015, to more accurately reflect the realities of an All-IP network.[2]

Network Reliability and Resiliency

In 2013, the FCC proposed improving the resiliency of mobile wireless networks by requiring public disclosure, on a daily basis, of the percentage of cell sites operational during a disaster for each carrier, and perhaps extending this requirement to all network types.

911

In 2013, the FCC released a Report and Order aimed at maintaining 911 service during a disaster. The report suggests that network operators undertake activity in four primary areas: maintain adequate central office backup power; have reliable network monitoring systems; conduct periodic audits of 911 circuits; and notify 911 call centers of problems. The Report and Order requires operators to report on these areas, certifying either implementation of specific Best Practices or implementation of alternative measures.

Cybersecurity

With the transition to an all-IP network, cybersecurity has taken on added significance and the FCC has increased its attention to this topic. During the FCC's Communications Security, Reliability, and Interoperability Council (CSRIC-IV) and its Technological Advisory Council (TAC), the FCC chartered a CSRIC Working Group (WG-4) to determine how best to ensure implementation of cybersecurity measures. That Working Group delivered a 300+ page Final Report, and the FCC immediately issued a Public Notice about this report, seeking comments on how well the Final Report met the goal and what other measures could be taken to ensure cybersecurity.

While the industry and the underlying network technologies may be evolving, the role of the NRSC remains constant. The NRSC provides expert industry guidance regarding communications reliability issues to ensure that US communications networks remain highly reliable and robust, even during their constant evolution.

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[2] The FCC adopted the *Amendments to Part 4 of the Commission's Rules Concerning Disruptions to Communications NPRM*, (DA No. 15-710) (Dkt No 15-80), on March 30, 2015.

Highlights

During the 2015 to 2016 timeframe, the NRSC convened four Task Forces and reviewed and provided comments for high profile regulatory filings. Along with its Task Forces, the NRSC also had four standing Subcommittees. The covered topics included:

Special Studies/Task Forces

- Non-Affiliated Entity Task Force
- NORS Cause Code Consistency Task Force
- NRSC DS3 Non-Simplex Task Force
- Silent Failures Task Force

Subcommittees

- Best Practices Subcommittee
- IP Reliability Subcommittee
- Outage Reporting Advisory Subcommittee
- Regulatory Subcommittee

NRSC Initiatives, Studies, and Filings

- Completed and Ongoing Initiatives:
  - Best Practices Tutorial and Guidance for CSRIC V
  - Best Practices Website Review and Updates
  - Launch of IP Reliability Task Force to Address VoIP Outage Reporting
  - Reopening of Outage Reporting Advisory Subcommittee to Address Updates to NORS 3.0 User Manual and Other Documentation Related to NORS and DIRS
  - Launch of Hurricane Checklist Task Force (Later renamed to Emergency Preparedness and Response Checklist Task Force)

- Filings
  - Improving 911 Reliability Notice of Proposed Rulemaking, PS Docket No. 13-75 (Comments March 2015; Reply Comments April 2015)
  - New Part 4 of the Commission's Rules Concerning Disruptions to Communications, ET Docket No. 04-35 (Comments July 2015)
  - Ex Parte Providing Additional Input on Major Transport Facility Outages, PS Docket No. 15-80, ET Docket No. 04-35 (August 2015)
  - The Proposed Extension of Part 4 of the Commission's Rules Regarding Outage Reporting to Interconnected Voice Over Internet Protocol Service Providers and Broadband Internet Service Providers, PS Docket No. 11-82 (Comments August 2016; Reply Comments September 2016)

Publications

- NRSC Bulletins:
  - ATIS-0100062, *NRSC Bulletin No., 2016-001: Fiber Cut Related Outage Data Analysis & Recommendations*
  - ATIS-0100040, *NRSC Bulletin No. 2013-001: Copper Theft Deterrent*
- ATIS Standards:
  - ATIS-0100018, *NRSC Pandemic Checklist, Version 2*
  - ATIS-0100054, *Disaster Roaming Guide and Resource*

1 Introduction

1.1 History of the NRSC

Several Catastrophic Outage Events

From 1988 through the early 1990s, the United States communications industry experienced several network outages that impacted a large number of subscribers. Beginning with the "Great Hinsdale Fire" of 1988, through several Signaling Transfer Point (STP) outages in 1991, the nation increased its focus on the reliability of its public networks.

The Network Reliability Council is Established

In November 1991, the Network Reliability Council (NRC) was established by the FCC to bring together telecommunications industry leaders and telecommunications experts from academic and consumer organizations to explore and recommend measures to enhance network reliability.[3]

The FCC Mandates Outage Reporting

In April 1992, the FCC required the reporting of outages by exchange and interexchange service providers. In order for an event to be reportable, it had to last 30 minutes or more and potentially affect at least 50,000 customers.[4] The industry-led NRC afterward recommended that the reporting criteria be lowered to 30,000 customers. Another NRC recommendation was to report all outages affecting 911 emergency call centers, major airports, nuclear power plants, major military installations and key government facilities. Carriers began reporting outage events using the lowered threshold criteria in June 1992. Because of the sensitive nature of some of the outage events (e.g., military installations), in May 1993, the National Communications System (NCS) accepted the task of reporting such outages to the FCC. In August 1994, FCC outage reporting regulations were revised.[5] Most of the changes had already been accounted for by industry in their voluntary reporting of events that began in June 1992. Other major changes included the reporting of fire-related incidents potentially affecting 1,000 or more lines, and the requirement that final reports include root cause analysis and a review of how Best Practices could have prevented or mitigated the impact of such events.

The NRC Recommends the Formation of the NRSC

In its 1993 *Report to the Nation*, the NRC[6] recommended the formation of the NRSC, under the auspices of the ATIS, for the purpose of monitoring network reliability on an ongoing basis. As defined at that time, the NRSC's mission was to "analyze the industry's reporting of network outages to identify trends, distribute the results of its findings to industry, and where applicable, refer matters to appropriate industry forums for further resolution, in order to help ensure a continued high level of network reliability."[7]

The FCC Makes Changes in Outage Reporting

In 2005, FCC regulations regarding outage reporting were put in force.[8] These mandates can be summarized as having three major aspects: (a) expansion regarding who was required to report; (b) new reporting thresholds, timeframes, and concepts; and (c) limited access to the outage data due to confidential protection under the Freedom of Information Act (FOIA). Regarding the reporting expansion, in addition to wireline providers, the new requirements included wireless, satellite, paging, and cable telephony service providers. Changes in the thresholds and concepts include events that affect 900,000 user-minutes and events impacting DS3 facilities. Because of these

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[3] Daugherty, H.T., Klein, W. J., "U.S. Network Reliability Issues and Major Outage Performance," *Proceedings: IEEE Symposium on Computers and Communications, 1995,* June 27-29, 1995, pp.114, 119.

[4] *FCC Report and Order, CC Docket No. 91-273*, Federal Communications Commission, Washington, D.C., adopted February 13, 1992, released February 27, 1992.

[5] *FCC Second Report and Order, CC Docket No. 91-273*, Federal Communications Commission, Washington, D.C., adopted July 14, 1994, released August 1, 1994.

[6] Since the subsequent re-charters under the name "Network Reliability and Interoperability Council (NRIC)", this first Council is sometimes referred to as "NRC-1".

[7] *Network Reliability: A Report to the Nation*, Network Reliability Council, June 1993. Section I, p. 6.

[8] *Report and Order and Further Notice of Proposed Rulemaking*, ET Docket No. 04-35, adopted August 4, 2004, released August 19, 2004; E*rrata*, ET Docket No. 04–35, released September 3, 2004.

criteria, the overall number of reportable events substantially increased. In 2012, the FCC expanded the outage reporting criteria and thresholds to include VoIP services.

In July of 2016, the FCC published a Report and Order[9] updating several of the Part 4, Disruption to Communications, rules with some significant changes. The changes: better defined required reporting at airports; shortened the threshold for reporting Simplex conditions from 120 hours to 96 hours; increased the minimal reportable transport outage from DS-3 to OC-3; defined the methodology for determining Wireless Potential Users; implemented required reporting for Partial PSAP Outage Reporting; and applied Telecommunications Service Priority (TSP) as the way of defining Special Offices and Facilities.

1.2 Factors Affecting Network Reliability

The NRSC has historically recognized that identifying and understanding the underlying causes of outage trends are important parts of learning from past experiences and preparing for future challenges as networks evolve. When evaluating negative or positive trends that affect network reliability, having standard analytical methodologies and trending schemas has proven to be a solid link to the past, while providing a bridge into the future. The NRSC works to identify the direct and root cause(s) associated with particular trends, evaluates these against existing Best Practices, and develops new Best Practices or recommends modifications to existing Best Practices when appropriate. Additionally, the NRSC will recommend the development of new (or modification of existing) cause code categories, review other completed studies, review internal company outage data, determine contributing factors, and review associated federal and state regulations.

2   Health of the Nation's Public Networks

The members of the NRSC have a historic and unique perspective on network reliability. Nowhere else in the world have subject matter experts from competing companies gathered regularly for the purpose of analyzing network outage data, developing consensus determinations about the data analyzed, and offering expert guidance on actionable countermeasures to improve network reliability. Through this collaboration, high reliability for the nation's public networks is promoted, expert guidance is offered, and an ongoing accurate view of the health of networks is provided at a national level. The NRSC continues to believe that the reliability of the nation's public network is the best in the world.

2.1 Introduction to Special Studies/Task Forces

The NRSC had or established five special study teams, or Task Forces, during 2015 and 2016. The purpose of these special studies was to bring industry experts' attention to network reliability issues or concerns, to determine the underlying cause/s behind national trends, to determine the most effective Best Practices or other means for preventing and ameliorating the impact of such events, and to provide industry level guidance regarding the issue or concern. The keys to the success of these teams are open dialogue, meaningful information sharing, and collaboration among the industry participants on potentially sensitive issues. To protect the interests of participating companies and their sensitive and critical infrastructure data, a Non-Disclosure Agreement (NDA) between the NRSC member companies is in place.

These studies represent the thousands of hours that NRSC members have contributed to the painstaking scrutiny, documenting, and publishing of publicly available findings and results. These efforts are instrumental in providing expert industry guidance and ensuring high network reliability in the United States.

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[9] FCC 16-63, *Amendments to Part 4 of the Commissions Rules Concerning Disruptions to Communications, PS Docket No. 15-80, ET Docket No. 04-35, PS Docket No. 11-82, Report and Order, Further Notice of Proposed Rulemaking, and Order on Reconsideration,* available at https://apps.fcc.gov/edocs_public/.

2.1.1 Non-Affiliated Task Force (Mary Boyd and Kim Scovill)

Background

In 2015 the FCC outage reporting rules[10] imposed outage reporting obligations upon wireless service providers (WSPs) when defined reporting thresholds have been met, similar rules are also imposed upon "…affiliated and non-affiliated entities that maintain or provide communications networks or services used by the provider in offering such communications."[11]

It was industry's perception that non-affiliated entities providing traffic aggregation and delivery of wireless 911 voice calls and/or involved in the delivery of wireless caller location information to a PSAP meets the definition of a *communications provider.*[12] Accordingly, communication providers providing such services to WSPs are obligated to report outages when FCC reporting thresholds have been met.

Should one of these entities or a similar entity experience a disruption of its communications networks or services associated with "…any facilities that they own, operate, lease, or otherwise utilize,"[13] causing FCC reporting thresholds to be met, the affected entity has an obligation to file an outage report with the FCC by entering a FCC Notification Report into the FCC Network Outage Reporting System.

Although it was recognized that such outage reporting expectations exist, current FCC rules did not clearly define a viable method for determining the number of wireless users potentially affected by such disruptions (a necessary component used to determine whether FCC outage reporting thresholds has been met). Consequently, each entity had defined their own respective method for calculating the number of wireless users impacted; resulting in inconsistent reporting of outages to the FCC.

Issue: Determination of the Number of Wireless End Users Potentially Impacted

Although the FCC outage reporting rules contained a detailed explanation of how a WSP should determine the number of wireless end users potentially impacted by an outage (which are again being considered for revision by FCC staff[14]) the lack of clear direction for "nonaffiliated entities" resulted in each entity adopting their own respective method for determining how many end users are potentially impacted by an outage, as shown in the table below:

Entity	Number of Wireless End Users Potentially Impacted
Company A	Number of Towers Impacted x 800
Company B	Number of Towers Impacted x 50
Company C	Number of Towers Impacted x Number of PSAPs Impacted

As the table indicates shown, each company was using a different multiplier to estimate the number of end users potentially impacted by an outage. Each entity then multiplied the derived value by the minutes of outage duration to determine whether the 900,000 End User Minutes threshold has been met. The varying multiplier resulted in significant reporting disparity between the non-affiliated entities.

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[10] 47 C.F.R. Part 4, *Disruptions To Communications*, available at http://www.ecfr.gov.

[11] 47 C.F.R. Part 4, §4.3, *Communications providers covered by the requirements of this part*, (f) *Wireless service providers* "include Commercial Mobile Radio Service communications providers that use cellular architecture and CMRS paging providers. *See* §20.9 of this chapter for the definition of Commercial Mobile Radio Service. Also included are affiliated and non-affiliated entities that maintain or provide communications networks or services used by the provider in offering such communications," available at http://www.ecfr.gov.

[12] 47 C.F.R. Part 4, §4.3 Communications providers covered by the requirements of this part, (b) *Communications provider* "is an entity that provides for a fee to one or more unaffiliated entities, by radio, wire, cable, satellite, and/or lightguide: two-way voice and/or data communications, paging service, and/or SS7 communications," available at http://www.ecfr.gov.

[13] 47 C.F.R. Part 4, §4.9 Outage reporting requirements—threshold criteria, (e) *Wireless,* available at http://www.ecfr.gov.

[14] FCC 15-39, *Amendments to Part 4 of the Commission's Rules Concerning Disruptions to Communications*, available at https://apps.fcc.gov/edocs_public/.

Remedy Sought

To ensure outage reporting does not become overly burdensome, yet still provides FCC staff with meaningful metrics and data that might lead to the creation of Best Practices intended to improve overall 911 network reliability, the NRSC is encouraged to consult with members of industry involved in the delivery of wireless services to establish a viable, universal approach to determining the number of wireless users potentially impacted by an outage.

Team Activity

Upon introduction of this Issue in December 2015, the NRSC created the Non-Affiliated Entity Task Force to review and recommend a reasonable "potential end user impact calculation". During 2016, the Task Force held meetings to review "Call Flow Use Cases," and evaluate potential formulas based on population, PSAPs, and Towers, etc.

Conclusion

In the summer of 2016, the FCC issued a Notice for Proposed Rule Making revising its rules on outage reporting. It was the opinion of the Task Force that the proposed revisions would address any concerns expressed by the non-affiliated service providers. Given the FCC's pending rule-making, the Task Force requested the NRSC close the Non-Affiliated Entity Task Force.

2.1.2 Cause Code Consistency Task Force (Gail Linnell and Deborah Diamond)

Background

The FCC requested the NRSC examine consistency in outage reports. Beginning with a review of small number-out situations, NRSC established the Cause Code Consistency Task Force to provide a thorough examination of definitions and uses of the current cause codes. NRSC's goal was to clarify cause code definitions in order to reduce inconsistent use.

Team Activity

The Task Force met numerous times to examine the definition of a root cause and a direct cause – this resulted in a clearer understanding of how these terms should be used. The team then examined the definitions for each of the existing cause codes. Each cause code's definition was examined and, if appropriate, updated. In instances where a definition was lacking, it was created. Additionally, each cause code was examined to determine if it was appropriate to use as a root cause, a direct cause, or if it could be used either way.

Conclusion

The Task Force provided recommendations to the FCC and the industry. These recommendations included revised definitions of root cause and direct cause, updated definitions for all cause codes, and a guide to using each of the codes.

2.1.3 Ongoing Studies

The following studies began at the end of 2016. NRSC continued these studies through 2017 and will give a full report on the studies in its next 2017-2018 biannual report.

NRSC DS3 Non-Simplex Task Force (Gail Linnell and Deborah Diamond)

In 2015, DS3 Non-Simplex outages were identified by the FCC and confirmed by NRSC as a significant contributor to an increase in outages. The NRSC established the DS3 Non-Simplex Task Force, which investigated DS3 Non-Simplex Outages. While there were no actionable causes identified by the Task Force, the NRSC published a bulletin in 2017 identifying findings and Best Practices to help mitigate these DS3 Non-Simplex Outages.

Hurricane Checklist Task Force (Christopher Oberg and Richard Chew)

The NRSC maintains a checklist (ATIS-0100019-NRSC Hurricane Checklist) for hurricane preparedness and response to the effects of a hurricane. The last publication date was October 2006. A brief review of the document resulted in identification of additional activities and best practices that should be incorporated. NRSC is in the process of updating the Checklist.

Silent Failures/Alarming Investigation (Andy Gormley and Stacy Hartman)

The FCC identified that there are outages that appear to only be detected once service impact triggers investigation (e.g. non-intrinsic alarming for translation failures, input errors, etc.) and requested the NRSC to review the issue and determine whether industry recommendations could be provided. The NRSC found that there were no predominant actionable causes for these silent alarm failures and identified existing industry Best Practices, which could help mitigate such failures, and recommended an additional Best Practice. The recommendations of this investigation were published in 2017 as ATIS-0100064, NRSC Bulletin No. 2017-002: "Silent Alarm Failures" Investigation.

2.2 Subcommittees

2.2.1 Best Practices Subcommittee (Andy Gormley and Christopher Desmond)

Background

The Best Practices Subcommittee, which is a standing NRSC Subcommittee, is charged with improving the quality of Best Practices and updating and/or expanding them as appropriate. The Subcommittee operates from the premise that Best Practices are voluntary, are *not* standards, *and implementation of any Best Practices should not be mandated.* Best Practices provide guidance, based on assembled industry expertise and experience, to improve network security, reliability, and resiliency. The applicability and possible implementation of any Best Practice by an organization is best determined by someone with expertise in both the topic of the Best Practice and the particulars of the organization itself.

Team Activity

During the past two years, the Best Practices Subcommittee has reviewed the work of the fourth Communications Security, Reliability and Interoperability Council (CSRIC IV) to prepare them to be integrated into the Best Practices online databases. Due to the nature of the changes made by this CSRIC, the updates are still being implemented into the online databases. The Best Practice tutorial, created by this Subcommittee, was updated and presented to the Cyber Security Working Group of the CSRIC V at the request of the FCC as they began their work to ensure the Best Practice process was well understood.

ATIS manages one of the two Best Practices web sites[15], with the FCC maintaining the other site[16]. The Subcommittee monitors these websites and suggests enhancements as appropriate to improve their usefulness.

Conclusion

The fact that an FCC Advisory Committee (i.e., CSRIC) continues to regularly advance new and revised Best Practices along with frequent reference in both industry and government documents bears strong witness to the value that this collection of industry knowledge holds, and to the influence that Best Practices have on improving network security, reliability and resiliency. Their value is derived both from the collective industry knowledge that created them, and the voluntary nature of their implementation. This allows users to benefit from their guidance while maintaining their flexibility to be applied appropriately as determined by experts. The Best Practice Subcommittee will continue to work with the FCC and CSRIC to ensure consistency and usability of this valuable resource.

2.2.2 IP Reliability Subcommittee (Mark Peay and Christopher Oberg)

Background

As the Public Switched Telephone Network (PSTN) and wireless networks transition to all-IP communications, many aspects of the way networks are managed must also change, presenting new challenges. One such challenge is how outages are measured and reported in IP networks, and how faults that cause outages can be identified for reporting and restoration activity.

In the PSTN, discrete voice switches and voice lines and trunks of deterministic voice call capacity makes the determination of the number of lines impacted by any given fault (e.g., a switch port card failure, or TDM trunk

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[15] The ATIS Best Practices website is available at < http://www.atis.org/bestpractices/Default.aspx >.

[16] The FCC Best Practices website is available at < https://www.fcc.gov/nors/outage/bestpractice/BestPractice.cfm >.

failure) fairly straightforward. In contrast, IP networks are converged service networks where voice traffic typically represents a small proportion of the aggregate traffic through any given link or switch, and the throughput per voice connection varies significantly and continuously over time. In addition, IP congestion control mechanisms, depending on how the network is engineered, may not fully restore impacted voice connections. The question arises: how to achieve the level of visibility and control needed to both accurately measure and to minimize network outages in IP networks?

The IP Reliability Subcommittee was formed at the request of ATIS NRSC member companies and the FCC. The subcommittee's mission is to define what IP network availability and/or outage reporting metrics can be consistently reported across the industry

Key areas being explored:

- Determine when a network event creates an IP Multimedia Subsystem (IMS) VoIP outage[17]
- When an outage is detected, can the impact be quantified
- To what level of granularity can customer impact be depicted

Team Activity

The IP Reliability Task Force was formed in May 2013, to gain knowledge and review deployment strategies. The Task Force encouraged NRSC members to involve engineers and operations subject matter experts (SME), bringing together industry experts across cable, wireline, and wireless networks. This action and interaction with other ATIS forums, focused on the transition to IP networks, advanced the Task Force's ability to understand key functional components and redundancy features inherent to an all IP network. In 2015, NRSC agreed to transition the Task Force into standing subcommittee given the complexity and projected longevity of NRSC IP's work.

NRSC IP developed a generic network topology diagram of an IP network. The team then ran simulated call flows for on-net, off-net, and emergency 911 call types. This analysis validated that the access (e.g., last miles / local loop) section of the network remained relatively unchanged. The major changes in IP network occur north of the access network in the local metro and core networks. Local metro and national backbones are transitioning to cloud architectures.

NRSC IP has leveraged work from the ATIS TOPS Council PSTN Transition Functional Group Assessment and Recommendations (January 2013). ATIS NRSC members have been able to work from a high-level functional block diagram detailing new hardware and software components of an IMS IP network. Where these components reside either in the core or Regional Data Center (RDC) will depend widely on individual company deployment strategies and business drivers. Operation, Administration, Maintenance & Provisioning (OAM&P) components have been added to denote the need in an IP environment for both Element Management Systems (EMS) and Service Assurance (SA) tools to monitor end-to-end call completion activity.

NRSC IP partnered with the TOPS Council Leveraging Network Intelligent (LNI) Focus Group, adding a use case for outage alerting, avoidance, and reporting. This use case articulated the need to identify, monitor, trigger, and take action on mission critical outage events in an IP network. The concept of using other network intelligent data points was discussed, identifying gaps in current standards.

In 2016, NRSC IP partnered with the ATIS Emergency Services Interconnection Forum (ESIF) Next Generation Emergency Services Subcommittee (NGES) to further define break points in Next Generation Emergency Service architecture. NGES will look at both legacy and NG platforms along with hybrid states as the network transition to all IP. This partnership continues and will be further reported on in a future biannual report.

NRSC IP also worked extensively with the 3GPP, an international standards body, to review end-to-end network availability metrics to gauge the health of these critical IP networks. In 2016, monitoring a rise in the number of UE(s) not registered on the network was a focus of this joint effort. Using IMS core statistics provides aggregation points in the network that can identify issues quicker. The need for these metrics is two-fold—it is critical for all service providers to have insight into their networks when an event has occurred impacting network availability, service, and/or customers, and it can help service providers prioritize fix activity on core alarms that are truly

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[17] NRSC consideration of this issue does not indicate a consensus of its membership that VoIP-related outage reporting should be considered or required.

impacting user ability to utilize vital services. This partnership continues and will be further reported on in a future biannual report.

Conclusion

The IP Reliability Subcommittee will continue meeting bi-weekly and will work to identify monitoring points in the core of the IP network that can signify a voice outage. The subcommittee will also determine what automated outage reporting metrics can be consistently reported across the industry.

Key areas being explored:

- Device Alarms
- Registration
- Blocked Calls

Future considerations:

- Call Trending
- Active Polling

2.2.3 Regulatory Subcommittee (Andis Kalnins and Nathan Subramaniam)

Background

The ATIS NRSC Regulatory Subcommittee addresses and responds to network reliability, resiliency, and outage reporting related regulatory activity. To accomplish this work, the Subcommittee monitors, reviews, and responds to various local, state, and federal regulatory activities. Where appropriate, the NRSC develops and files comments. Refer to the *NRSC Initiatives, Studies, and Filings* section of this report for a list of these filings.

Team Activity

With the FCC filing the 911 Governance and Accountability Notice of Proposed Rule Making (NPRM), the Amendments and New Rules to Part 4 of the Commission's Rules Concerning Disruptions to Communications NPRM, the Amendments and New Rules to Part 4 of the Commission's Rules Concerning Disruptions to Communications Further Notice of Proposed Rule Making (FNPRM), the Amendments and New Rules to Part 4 of the Commission's Rules Concerning Disruptions to Communications Report and order, and the Submarine Cable Outage Reporting Improvements Report and Order, it was a very busy time for the NRSC Regulatory Subcommittee as the team came together to review, discuss, and comment on these proposed rule changes. The Subcommittee also monitored and kept membership appraised of significant regulatory activity from state legislatures and commissions.

The Regulatory Subcommittee held many meetings to establish and refine the issues for the NRSC membership and to provide a forum for members to contribute to the comments on each of the Rule Making procedures that were provided on behalf of ATIS / NRSC. The comments provided to the FCC are available on the ATIS and FCC websites.

The Regulatory Subcommittee provides discussion on the timing and impact of the proposed and pending legislation and rule changes with the NRSC membership through member only meetings and updates at the NRSC Public Meetings.

Through the NRSC and the Regulatory Subcommittee, several clarifications of the FCC rule changes were discussed, brought to the FCC staff, and provided to the membership and general public through the Public Meeting reviews.

Conclusion

The Regulatory Subcommittee provides a platform to address and respond to network reliability, resiliency, and outage reporting related regulatory activity. The Subcommittee monitors, reviews, and responds to various local, state, and federal regulatory activities. Where appropriate, the NRSC has developed and filed these comments.

2.2.4 Outage Reporting Advisory Subcommittee (ORAS) (Rick Canaday and Christopher Desmond)

Background

The NRSC established the Outage Reporting Advisory Subcommittee (ORAS) to review issues associated with reporting communication service disruptions pursuant to Part 4 of the FCC's rules. The ORAS was formed as a standing subcommittee that utilizes the experience and expertise of its members to improve the value, accuracy, and consistency of outage data submitted to the FCC, and since its establishment has expanded its role to address disaster information provided to the FCC on a voluntary basis. The ORAS works with the FCC to maintain a mutual understanding of the needs and expectations regarding submitted information, identifies process and system improvement opportunities, and develops appropriate recommendations, from the users' perspective, regarding enhancement of system interfaces, processes, and documentation.

Team Activity

Network Outage Reporting System (NORS)

In May 2016, NRSC agreed to re-activate[18] NRSC ORAS to conduct a review of the NORS User Manual based on FCC migration of NORS to a new platform. NRSC accepted Issue 31, *Review of New NORS User Manual* to conduct this review. NRSC continued this review through 2018 and will provide an update in the next biannual report.

Disaster Information Reporting System (DIRS)

ORAS supports continued evaluations of changes made in DIRS and the DIRS test system, including the annual testing of DIRS.

Conclusion

Since the reactivation of ORAS in May 2016, progress has been made in ensuring consistency between the NORS user manual and changes in NORS. This work continues into the next year.

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[18] NRSC ORAS was sunset in December 2014 after the NRSC provided recommendations to the FCC to modify the NORS, DIRS, and DIRS-Lite User Manuals, and other supporting documentation between 2009 and 2014.

3 Conclusion

As can be seen in this report, throughout the 2015 to 2016 timeframe, the NRSC has been active in researching and providing guidance on many network reliability issues and responding to various FCC issues and concerns regarding network events. It continues to work closely with the FCC to improve outage reporting procedures, refine Best Practices, and provide a forum for collaborative industry and government work efforts. The continued efforts of NRSC member companies have directly and positively impacted the resiliency and reliability of the Nation's networks, which ultimately benefits all users.

For the Common Good

The NRSC clearly demonstrates the spirit of service in the communications industry. Companies that are fierce competitors in the marketplace collaborate via the NRSC, to advance network reliability for the benefit of all users. Working together for the common good is the finest product of the NRSC.

Future Plans

While the NRSC continues its focus on the network reliability and resiliency of today's networks, it does so with an eye on the future. Considerable effort has been expended in defining a generic model of what an All-IP network will look like, and the industry's knowledge of today's networks will be imperative in addressing reliability and outage reporting issues associated with an All-IP network. The NRSC's unique model of industry cooperation, along with its perspective of future networks, based on current expertise, will serve the Nation well during the coming technological evolution. The NRSC continues to welcome input on topics to be addressed in the future and looks forward to the participation of both existing and new communications provider.

4 Participation

Participating NRSC Member Companies (2015-2016)

Alcatel-Lucent

Applied Communication Sciences (Vencore Labs)

Aqsacom

AT&T

Bandwidth

CenturyLink

Comcast

Comtech (Formerly TCS)

Cox Communications

CSI Telecommunications

CenturyLink

Eltek

Ericsson

FairPoint Communications

Intrado (West Safety Services)

Nokia

Office of Emergency Communications (OEC)

Sprint

Somos

TDS Telecom

T-Mobile

Time Warner Cable (Charter Communications)

Verizon

NRSC Members at the December 2017 NRSC Meeting[19]

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[19] *Back row, from left to right*: Gail Linnell (Vencore Labs), Andis Kalnins (Verizon), Mark Longstaff (Comtech Telecommunications), Pat Margherio (Comtech Telecommunications), Chris Oberg (Verizon Wireless), Mark Peay (Cox Communications, Andy Gormley (T-Mobile). *Front row, from left to right:* Kim Scovill (Comtech Telecommunications), Stacy Hartman (CenturyLink), Bill Hackett (T-Mobile), Mary Boyd (West Safety Services), Chad Hall (Charter Communications).

NRSC Subcommittee Participants

Outage Reporting Advisory Subcommittee (2015-2016)

Co-Chair: Richard Canaday, AT&T
Co-Chair: Christopher Desmond, Verizon Wireless
Gail Linnell, Applied Communication Sciences (Vencore Labs)
Jason Decuir, AT&T
Erik Lawrence, AT&T
Rodney Browning, CCI
Stacy Hartman, CenturyLink
Nathan Subramaniam, Charter Communications
Nancy Gaillard, Charter Communications
Lynette Van Someren (Keese), Comcast
John Wilson, Comcast
Ruobo Lu, Comtech Telecommunications
Mark Peay, Cox Communications
Becky Wormsley, Ericsson and Sprint
Andy Gormley, T-Mobile
Chris Oberg, Verizon Wireless
Andis Kalnins, Verizon
Ken Dausy, Verizon

Best Practices Subcommittee (2015-2016)

Co-Chair: Rick Krock, Alcatel-Lucent (2015)
Co-Chair: Robin Howard, Verizon (2015)
Co-Chair: Andy Gormley (2015-2016)
Co-Chair: Christopher Desmond (2016)
Becky Wormsley, Ericsson and Sprint
Erik Lawrence, AT&T
Andy Kalnins, Verizon
Stacy Hartman, CenturyLink
Ken Dausy, Verizon
Rodney Browning, CCI
Ken Biholar, Nokia

Regulatory Subcommittee (2015-2016)

Co-Chair: Stacy Hartman, CenturyLink (2015-2016)
Co-Chair: Harold Salters, T-Mobile (2015-2016)
Co-Chair: Andis Kalnins, Verizon (2016)
Co-Chair: Nathan Subramaniam, Charter Communications (2016)
Rick Canaday, AT&T
Jason Decuir, AT&T
Erik Lawrence, AT&T
Richard Chew, Charter Communications
Lydia Brown, Charter Communications
Deborah Diamond, Charter Communications
Nathan Subramaniam, Charter Communications
Lynette Van Someren (Keese), Comcast
Tom Breen, Comtech Telecommunications
Roger Marshall, Comtech Telecommunications
Kim Scovill, Comtech Telecommunications
Jose Jimenez, Cox Communications
Dick Purser, Cox Communications
Terry Reese, Ericsson

Jay Tumas, FairPoint Communications
Roger Hixson, NENA
Ken Biholar, Nokia
Eric Hagerson, T-Mobile
Andy Gormley, T-Mobile
Christian Militeau, West Safety Services
Mary Boyd, West Safety Services
Bob Sherry, West Safety Services
Gail Linnell, Vencore Labs
Ken Dausy, Verizon
Chris Oberg, Verizon Wireless
Christopher Desmond, Verizon Wireless

IP Reliability Task Force (2015) and Subcommittee (2015-2016)

Subcommittee and Task Force Co-Chair: Mark Peay, Cox Communications
Subcommittee and Task Force Co-Chair: Chris Oberg, Verizon
Hong Xie, Alcatel-Lucent
Paul Wolfson, Alcatel-Lucent
Gail Linnell, Applied Communication Sciences (Vencore Labs)
Jason Decuir, AT&T
Rick Canaday, AT&T
Erick Lawrence, AT&T
Justen Davis, CenturyLink
Stacy Hartman, CenturyLink
Kyle Blackwell, CenturyLink
Jeff Liester, CenturyLink
Firdaus Aryana, CenturyLink
Nathan Subramaniam, Charter Communications
Deborah Diamond, Charter Communications
Greg Devlin, Charter Communications
Matt Cannon, Charter Communications
Nancy Gaillard, Charter Communications
Lynette Van Someren (Keese), Comcast
Eric Dreas, Comcast
Tom Breen, Comtech Telecommunications
Todd Kechter, Cox Communications
Kirk McCalla, Cox Communications
Jose Jimenez, Cox Communications
Becky Wormsley, Ericsson
Shawn Swearngin, Ericsson
Norris Simmons, Ericsson
Gerald Doaks, Ericsson
Scott McClain, Ericsson
Ken Biholar, Nokia
Vijay Gurbani, Nokia
Rick Krock, Nokia
Pierce Gorman, Sprint
Bruce Clark, Sprint
Terry Boley, Sprint
Timothy Collier, Sprint
Andy Gormley, T-Mobile
Christopher Hoffman, T-Mobile
Harold Salters, T-Mobile
Mark Natale, T-Mobile
Joan Vaughn, T-Mobile
Robert Sherry, West Safety Services
Mary Boyd, West Safety Services

Mike Nelson, West Safety Services
Andis Kalnins, Verizon
Robin Howard, Verizon
James Castagna, Verizon
Sarah Wolff, Verizon
Christopher Desmond, Verizon Wireless

Companies in Attendance at the 2015-2016 Public NRSC Quarterly Meetings

Alcatel-Lucent	Office of Emergency Communications
AT&T	OUC
Bandwidth	PCIA
Cable Vision	Ring Central
Cellcom	RT Communications
CenturyLink	SCE
Charter Communications	SMS800
Cincinnati Bell	Sprint
Comcast	Suddenlink
Comtech Communications	T- Mobile
Consolidated Communications	TCS
Cox Communications	TDS Telecom
Ericsson	TNSI
FairPoint Communications	University of Michigan
FCC	Vencore Labs (Formerly Applied Communications Sciences)
GCI	
Innovative Vi	Verizon
Kymeta	Verizon Wireless
Level 3	Via Sat
Lightsquared	West Safety Services
MCTV	Windstream
NITCO	XO Communications
Nokia	
nSight	