ATIS-0100067

Network Reliability Steering Committee 2017-2018
Operational Report

As a leading technology and solutions development organization, the Alliance for Telecommunications Industry Solutions (ATIS) brings together the top global ICT companies to advance the industry's most pressing business priorities. ATIS' nearly 200 member companies are currently working to address the All-IP transition, 5G, network functions virtualization, big data analytics, cloud services, device solutions, emergency services, M2M, cyber security, network evolution, quality of service, billing support, operations, and much more. These priorities follow a fast-track development lifecycle — from design and innovation through standards, specifications, requirements, business use cases, software toolkits, open source solutions, and interoperability testing.

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September 2019

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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 (2017-2018). 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.

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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[1] 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.***

As a trusted expert, the NRSC addresses network reliability improvement opportunities in an open, noncompetitive environment. The NRSC advises the communications industry through developing and issuing standards, technical requirements, technical reports, bulletins, Best Practices, and annual reports.

The NRSC accomplishes this through:

- identifying potential network reliability issues through an opportunity evaluation process,
- establishing subcommittees that address network reliability issues, and conducting special studies that may lead to industry recommendations and/or the development of Best Practices,
- developing industry feedback, both formal and informal, to the FCC on network reliability,
- providing industry feedback to the FCC on the Network Outage Reporting System (NORS) and the Disaster Information Reporting System (DIRS) and providing an opportunity for the public to be informed on network outages and ongoing efforts to resolve network reliability concerns.

This Operational Report covers the period of 2017 through 2018. A brief history of the NRSC is provided in the *Introduction* of this report (page 1).

Changing Regulatory Environment & Changing Industry

The last two Operational Reports (2013-2014 and 2015-2016) 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 were planning on revising those rules, possibly in 2015, to more accurately reflect the realities of an all-IP network.[2] The NRSC continues to investigate and work with other standards setting organizations to provide insight into the best ways of monitoring and reporting VoIP service interruptions.

Network Reliability and Resiliency

On May 25, 2016, the FCC proposed new reporting rules and thresholds aimed at improving the resiliency of mobile wireless networks by simplifying the methodology required to calculate reportable events. These rules, that went into effect in May of 2018, have drastically increased the number of outages reported to the FCC. Looking at the increase one could say reliability and resiliency has decreased, however that would not reflect the true nature of

[1] This mission statement can be found on NRSC's webpage: https://www.atis.org/01_committ_forums/nrsc/mission/

[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.

the outages. The NRSC is committed to partnering with the industry and the FCC to look at reliability and resiliency through the lenses of outage reporting.

9-1-1

On September 11, 2017, the FCC held a 9-1-1 round table with the carriers, industry and public safety. The aim of this roundtable was to discuss outage notifications to public safety and public safety notifications to the public, including reaching out to persons with disabilities. As a result of this roundtable, NRSC formed the Situational Awareness for 9-1-1 Outages Task Force to investigate standardizing a best practice for how to notify public safety during a 9-1-1 outage event. Unlike other NRSC Task Forces, this one was open to the public, which afforded the NRSC the ability to partner with PSAPs, public safety, the Association of Public-Safety Communications Officials (APCO), the National Association of State 911 Administrators (NASNA), and the National Emergency Number Association (NENA).

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 (WG4) 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 U.S. communications networks remain highly reliable and robust, even during their constant evolution.

Highlights

During the 2017 to 2018 timeframe, the NRSC convened six 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

- NORS Cause Code Consistency Task Force
- NRSC DS3 Non-Simplex Task Force
- VoIP Outages Task Force
- Silent Failures Investigation
- NRSC Emergency Preparedness and Response Checklist Task Force (former Hurricane Checklist Task Force)
- Situational Awareness for 9-1-1 Outages Task Force (Public Task Force)

Subcommittees

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

NRSC Initiatives, Studies, and Filings

- Completed and Ongoing Initiatives:
    - Updates to Best Practices Tutorial and guidance for CSRIC VI
    - Review and updates to Best Practices Website
    - Launch of the ATIS NRSC Situational Awareness for 9-1-1 Outages Task Force, a public Task Force with the goal of providing actionable information to Public Safety Answering Points (PSAPS) and service providers in the case of a 9-1-1 outage
    - Completion of the work of the Cause Code Consistency Task Force
    - Completion of the work of the NRSC DS3 Non-Simplex Task Force
    - Completion of the work of the VoIP Outages Task Force
    - Completion of investigation on "Silent Failures"

- Filings[3]
  - *ATIS NRSC Feedback on 2019 DIRS Changes,* December 6, 2018
  - *Ex Parte - PS Docket No.15-80; ET Docket No. 04-35; PS Docket No. 11-82* (Regarding the Use of NORS Data), November 19, 2018
  - *Ex Parte - Reliability and Continuity of Communications Networks, Including Broadband Technologies Effects on Broadband Communications Networks of Damage or Failure of Network Equipment or Severe Overload, PS Docket No. 11-60* (Ex Parte to Discuss Comments on the Wireless Network Resiliency Framework), September 18, 2018
  - *Reply Comments by NRSC on 9-1-1 Reliability, PS Docket No. 13-75*, August 13, 2018
  - *Reply Comments by NRSC on the Network Resiliency Framework, PS Docket No. 11-60*, July 31, 2018
  - *Comments by NRSC on the Network Resiliency Framework, PS Docket No. 11-60*, July 16, 2018
  - *Comments by NRSC on 9-1-1 Reliability, PS Docket No. 13-75*, July 16, 2018
  - *Ex Parte filed by NRSC on its PSAP Notification Template, PS Docket No. 13-75*, June 29, 2018
  - *Letter to the FCC on updates to the Disaster Information Reporting System (DIRS) Standard Operating Procedure (SOP)*, February 12, 2018
  - *Letter to the FCC on Improvements to the NORS 3.0 User Manual*, January 31, 2018
  - *Letter to the California Public Utilities Commission on Automating the Implementation of Major Service Interruption Reporting Portal,* January 26, 2018
  - *Letter to the FCC from NRSC regarding updates to the Network Outage Reporting System (NORS) Glossary of Fields in NORS Reports*, November 29, 2017
  - *Letter to CSRIC WG 1 Submitting ATIS Technical Report Entitled Comparison of Enhanced 9-1-1 (E9-1-1) and Next Generation 9-1-1 (NG9-1-1) Focused on Reportable Outage Data Points (ATIS-0500034) for Consideration by CSRIC VI Working Group 1,* September 21, 2017
  - *Letter to FCC on its Review of the NORS 3.0 User Manual,* September 20, 2017
  - *Letters to the FCC on Behalf of NRSC Regarding NORS 3.0; and the DIRS Activation for Hurricane Matthew,* May 26, 2017
  - *Letter Filed by ATIS on Behalf of the NRSC, Providing the PSHSB with Recommendations Regarding NORS Cause Codes,* February 7, 2017

Publications

- NRSC Bulletins/Reports:
  - ATIS-0100063, *NRSC Bulletin No. 2017-001: DS3 Non-Simplex Outages*
  - ATIS-0100064, *NRSC Bulletin No. 2017-002: "Silent Alarm Failures" Investigation*
  - ATIS-0100065*, Network Reliability Steering Committee 2015-2016 Operational Report*

- ATIS Standards:
  - ATIS-0100066, *Technical Report on Service Providers: Outage Reporting Structure and Potential Types of 9-1-1 Outages*

[3] Filings can be found on ATIS' Legal and Public Policy webpage: https://www.atis.org/01_legal/public-policy/

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.[4]

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.[5] 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 9-1-1 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.[6] 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[7] 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."[8]

The FCC Makes Changes in Outage Reporting

In 2005, FCC regulations regarding outage reporting were put in force.[9] 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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[4] 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.

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

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

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

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

[9] *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[10] 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.

In the summer of 2017, the United States and its territories experienced a number of hurricanes that shattered not only communication networks, but also people's lives. Hurricane Maria, in particular, devastated the island of Puerto Rico in such a manner that had not been seen since Hurricane Mitch of 1998. It was during this hurricane that industry cooperation came together in a such a powerful way during such a traumatic event. Carriers aided each other in procuring and providing generators, security teams, food, water and the basic necessities needed in order to survive. Parts of the island were without power and critical infrastructure for months, and the FCC activation of DIRS lasted 182 days, the longest in the history of DIRS.

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 six special study teams, or Task Forces, during 2017 and 2018. 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.

[10] FCC 16-63, *Amendments to Part 4 of the Commission's 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/.

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.

2.1.1 Cause Code Consistency Task Force

The majority of this work activity was completed in 2016, as reported in ATIS-0100065, *Network Reliability Steering Committee 2015-2016 Operational Report*. In early 2017, 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. For further detail on the work of this Task Force, please see the 2015-2016 Operational Report.

2.1.2 NRSC DS3 Non-Simplex Task Force

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.

In July of 2016, the FCC published a Report and Order, updating the Part 4 Disruption to Communications rules which included shortening the threshold for reporting Simplex conditions from 120 hours to 96 hours. The NRSC provided a study of the impact of this rule change, increasing the number of Simplex Outages which were reported.

While there were no actionable causes identified by the Task Force, in 2017 the NRSC published ATIS-0100064*, NRSC Bulletin No. 2017-002: "Silent Alarm Failures" Investigation* identifying findings and Best Practices to help mitigate these DS3 Non-Simplex Outages.

2.1.3 VoIP Outages Task Force

Background

This Task Force was formed in April 2017 to investigate causes for the increasing trend in NORS VoIP outage reports.

Team Activity

The Task Force reviewed and analyzed data from member companies and industry trends to try and identify if there were any significant issues that were contributing to the increase in NORS VoIP outage reports.

Conclusion

After investigation, no single actionable cause was found. NRSC communicated these findings to the FCC during the 2Q2018 public meeting and agreed to close the investigation.

2.1.4 Silent Failures/Alarming Investigation

Background

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.

Team Activity

NRSC members examined the examples of "Silent Alarm Failures" provided by the FCC and also looked at additional examples internal to their respective companies. The Committee held a series of meetings to discuss and compile the individual findings and to provide a consensus of the issues and concerns around these events. The examples were investigated, and the applicable Best Practices were provided to form a comprehensive list of practices aimed at reducing the frequency of these types of outages and mitigating their impacts when they do occur. Given differences in NRSC member networks and technologies (i.e., vendors, frameworks, services provided, surveillance equipment, infrastructure, etc.), this general approach seems to be most applicable to operators and carriers.

Conclusion

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.*

2.1.5 NRSC Emergency Preparedness and Response Checklist Task Force

Background

In late 2016, the NRSC identified that ATIS-0100019, *NRSC Hurricane Checklist*, needed updates. After determining that the document was last published in October 2006, NRSC established the Hurricane Checklist Task Force, which was later named the Emergency Preparedness and Response Checklist Task Force.

Team Activity

The Emergency Preparedness and Response Checklist Task Force met consistently throughout 2017 and 2018. As a result of the Task Force, the Checklist was reformatted to cross reference applicable Best Practices. Where appropriate, the Checklist was streamlined.

Throughout the process, the FCC demonstrated interest and appreciation for this work effort.

Conclusion

In March 2019, the NRSC published ATIS-0100019, *Emergency Preparedness and Response Checklist*. A subsequent press release was issued to the industry. As of publication of this Operational Report, several new Best Practices, which were proposed as a result of the Checklist are undergoing FCC and CSRIC approval.

2.1.6 Situational Awareness for 9-1-1 Outages Task Force (Public Task Force)

Background

On September 11, 2017, the Federal Communications Commission's (Commission) Public Safety and Homeland Security Bureau (PSHSB) hosted a workshop to discuss best practices for improving situational awareness during 9-1-1 outages.[11] In particular, PSHSB examined how to strengthen Public Safety Answering Point (PSAP) 9-1-1 service outage notifications and how to best communicate with consumers about alternative methods of accessing emergency services during 9-1-1 outages.[12] The workshop participants included state and local 9-1-1 administrators, 9-1-1 call center directors, industry technology and policy experts, public safety advocacy organizations, and disability access representatives. The NRSC continued in its leadership role and created the Situational Awareness for 9-1-1 Outages Task Force, comprised of NRSC Members, as well as Public Safety Representatives to make recommendations to the Commission, as a response to discussions at the workshop. Through the support of the Commission the Task Force will make recommendations to:

- Standardize PSAP Outage Notification Data Elements;
- Standardize Process for annual collection of PSAP data, and specifically PSAP Notification data;
- Standardize and document the data collection process for PSAP databases.

[11] The workshop fulfilled the PSHSB's previously stated intention to convene stakeholders at a workshop to discuss recommended practices for improving situational awareness during 9-1-1 outages. See PSHSB, March 8, 2017 AT&T VoLTE 911 Outage Report and Recommendations, PS Docket No. 17-68, 15, para. 33 (2017), https://apps.fcc.gov/edocs_public/attachmatch/DOC-344941A1.pdf. The Commission defines an "outage" as "a significant degradation in the ability of an end user to establish and maintain a channel of communications as a result of failure or degradation in the performance of a communications provider's network." 47 CFR § 4.5(a). A "911 outage" is one that "potentially affects a 911 special facility." 47 CFR § 4.5(e).

[12] *See* PSHSB, *Announcing Workshop on Improving Situational Awareness During 911 Outages*, Public Notice, DA 17-719 (PSHSB 2017), https://apps.fcc.gov/edocs_public/attachmatch/DA-17-719A1.pdf.

Team Activity

In June 2018, the NRSC published a report and associated PSAP Notification Template, ATIS-0100066, *Technical Report on Service Providers: Outage Reporting Structure and Potential Types of 9-1-1 Outages.*

Conclusion/Ongoing Work

As of publication, this Task Force continues to meet on a bi-weekly basis.

2.2 Subcommittees

2.2.1 Best Practices Subcommittee

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 Communications Security, Reliability and Interoperability Council (CSRIC V and VI) to prepare the Best Practices to be integrated into the Best Practices online databases. In particular, the Best Practices Subcommittee and closely collaborated with CSRIC VI Working Group 1 representatives to edit to align best practices additions/consolidations and updates for Public Safety. The best practice recommendations work was presented to the FCC to verify alignment with expectations during different phases of development.

The Best Practice tutorial, created by this Subcommittee, was reviewed, updated and provided to the CSRICs at the request of the FCC to ensure the Best Practice process was well understood.

ATIS manages one of the two Best Practices web sites[13], with the FCC maintaining the other site[14]. 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

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.

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

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

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 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 mitigate voice impacts. The question arises regarding how to achieve the level of visibility and control needed to both accurately measure IP networks availability.

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 an IP network event creates a VoIP outage[15]
- Resolve whether an impact can be quantified when an outage is detected
- Establish what level of granularity a customer impact can 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 a 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 9-1-1 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 Technology and Operations (TOPS) Council PSTN Transition Functional Group Assessment and Recommendations (January 2013)[16]. 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.

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 NRSC IP's contribution S5-176523, *The Percentage of Non-Registered Users Metric,* received 3GPP endorsement in 2017. To date, NRSC IP continues to work on this metric.

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[15] Consideration of this issue does not indicate a consensus that VoIP-related outage reporting should be considered or required.

[16] *PSTN Transition Focus Group Assessment and Recommendations*, January 2013, available at https://www.atis.org/01_resources/whitepapers/#pstn

Monitoring a rise in the number of UE(s) not registered on the network was a focus of this joint effort. Using Service Assurance Tool 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 impacting user ability to utilize vital services.

Conclusion

The IP Reliability Subcommittee will continue meeting bi-weekly and will work to identify monitoring points in the IP network core that can be consistently reported across the industry. The Subcommittee will also look to identify current standards in this space and document potential gaps.

Key areas being explored:

- Device Alarms
- Registrations
- Blocked Calls

Future considerations:

- Call Trending
- Active Polling

2.2.3 Regulatory Subcommittee

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

In the wake of the implementation of the FCC filing the Amendments and New Rules to Part 4 of the Commission's Rules Concerning Disruptions to Communications NPRM, the NRSC Regulatory Subcommittee came together to review, discuss, and comment on the impacts of rule changes. Data was collected and presented to the industry. 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 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 took on NRSC Issue 41, *Provide Feedback on Proposed DIRS Changes*, to provide feedback to the FCC in light of a proposed update of the DIRS system and platform in 2019. The Subcommittee provided suggestions on various aspects of DIRS reporting and process. The NRSC filed "NRSC feedback to the FCC Regarding 2019 DIRS Changes" with the FCC.

In wake of the various storms in the 2017 and 2018 seasons, and due to the increased activity of the States in legislation around originating call outage reporting the Regulatory Subcommittee proposed and started work on NRSC Issue 42, *Investigating Diverse Requests for Outage and Emergency Data from Multiple Agencies*. Work on this Issue is ongoing.

Through the NRSC and the Regulatory Subcommittee, several clarifications of the FCC rule changes were discussed, brought to the FCC staff, and provided to membership and the industry 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)

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 2018, NRSC ORAS reviewed the NORS User Manual and submitted recommended changes to the FCC. NRSC ORAS also made recommendations to the FCC regarding NORS Coordinators not being able to easily create new user accounts and assign them to the designated company.

NRSC ORAS is waiting on feedback from the FCC.

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.

In 2018, recommendations were sent to the FCC for possible improvements to the DIRS ahead of the expected platform and system upgrade.[17]

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 is anticipated to complete in 2019. The Subcommittee will continue to look for opportunities to improve NORS and DIRS.

[17] This document can be found on ATIS' Legal and Public Policy homepage: https://www.atis.org/01_legal/public-policy/

3 Conclusion

Throughout the 2017 to 2018 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 (2017-2018)

Alcatel-Lucent
AQSACOM
AT&T
Bandwidth
CenturyLink
Charter Communications (Formerly Time Warner Cable)
CISA Emergency Communications Division (Formerly Office of Emergency Communications)
Comcast
Comtech (Formerly TCS)
Cox Communications
CSI Telecommunications
Eltek
Ericsson
FairPoint Communications
Intrado (Formerly West Safety Services)
JMA Wireless
Mobi
Nokia
Perspecta Labs, Inc. (Formerly Vencore Labs)
Somos
Sprint
TDS Telecom
Telnyx
T-Mobile
Verizon

NRSC Members at the August 2019 NRSC Meeting[18]

[18] *From left to right*: Mark Longstaff (Comtech Telecommunications), Andis Kalnins (Verizon), Jason DeCuir (AT&T), Mark Peay (Cox Communications), Tom Smith (CenturyLink), Becky Wormsley (Sprint), Carolyn Brown (CenturyLink), Kathleen Crilley (Sprint), Andy Gormley (T-Mobile), Bill Hackett (T-Mobile), Chris Oberg (Verizon), Christopher Desmond (Verizon)

NRSC Subcommittee Participants[19]

Outage Reporting Advisory Subcommittee (2017-2018)

Co-Chair: Richard Canaday, AT&T
Co-Chair: Christopher Desmond, Verizon Wireless

Mosely, Richard	AT&T
Lawrence, Erik	AT&T
DeCuir, Jason	AT&T
Canaday, Rick	AT&T
Hartman, Stacy	CenturyLink
Brown, Carolyn	CenturyLink
Nobles, Haleigh	Charter Communications
Hall, Chad	Charter Communications
Domagalski, Janeen	Charter Communications
Diamond, Deborah	Charter Communications
Wilson, John	Comcast
Obasuyi, Thomson	Comcast
Van Someren, Lynette	Comcast
Jordan, Beau	Comcast
Dreas, Eric	Comcast
Collins, Kari	Comcast
Marshall, Roger	Comtech
Ruddell, Chris	Comtech
Margherio, Patrick	Comtech
Lu, Ruobo	Comtech
Rubio, Ed	Cox Communications
Peay, Mark	Cox Communications
Boyd, Mary	Intrado (Formerly West Safety Services)
Biholar, Ken	Nokia
Linnell, Melvin	Perspecta Labs, Inc (Formerly Vencore)
Armenta, Julio	Somos
Wormsley, Becky	Sprint
Rothermel, Ray	Sprint
Crilley, Kathleen	Sprint
Ornstein, Susan	TDS Telecom
Terriba, Solape	T-Mobile
Tangirala, Hershy	T-Mobile
Hagerson, Eric	T-Mobile
Gormley, Andy	T-Mobile
Ayoub, Eslam	T-Mobile
Morse, Robert	Verizon
Kalnins, Andis	Verizon
Dausy, Ken	Verizon
Oberg, Chris	Verizon Wireless
Desmond, Christopher	Verizon Wireless

[19] The following lists provide meeting participation for the 2017-2018 period. NRSC participation outside of meetings may not be captured.

Best Practices Subcommittee (2017-2018)

Co-Chair: Andy Gormley
Co-Chair: Christopher Desmond
There were no meetings of the Best Practice Subcommittee; work proceeded via email.

Regulatory Subcommittee (2017-2018)

Co-Chair: Andis Kalnins, Verizon
Co-Chair: Stacy Hartman, CenturyLink

Lawrence, Erik	AT&T
DeCuir, Jason	AT&T
Canaday, Rick	AT&T
Hartman, Stacy	CenturyLink
Brown, Lydia	Charter Communications
Van Someren, Lynette	Comcast
Breen, Tom	Comtech
Scovill, Kim	Comtech
Peay, Mark	Cox Communications
Jimenez, Jose	Cox Communications
Boyd, Mary	Intrado (Formerly West Safety Services)
Linnell, Gail	Perspecta Labs, Inc (Formerly Vencore)
Wormsley, Becky	Sprint
Tangirala, Hershy	T-Mobile
Gormley, Andy	T-Mobile
Kalnins, Andis	Verizon
Dausy, Ken	Verizon
Oberg, Chris	Verizon Wireless

IP Reliability Subcommittee (2017-2018)

Co-Chair: Mark Peay, Cox Communications
Co-Chair: Chris Oberg, Verizon

DeCuir, Jason	AT&T
Canaday, Rick	AT&T
Hartman, Stacy	CenturyLink
Brown, Carolyn	CenturyLink
Nobles, Haleigh	Charter Communications
Hall, Chad	Charter Communications
Van Someren, Lynette	Comcast
Ryan, Randee	Comcast
Obasuyi, Thomson	Comcast
Dreas, Eric	Comcast
Breen, Tom	Comtech
Whitten, Clark	Cox Communications
Peay, Mark	Cox Communications
Fig, Richard	Cox Communications

Boyd, Mary	Intrado (Formerly West Safety Services)
Gurbani, Vijay	Nokia
Biholar, Ken	Nokia
Linnell, Melvin	Perspecta Labs, Inc (Formerly Vencore)
Retka, Mary	Somos
Palcic, Catherine	Somos
Armenta, Julio	Somos
Wormsley, Becky	Sprint
Crilley, Kathleen	Sprint
Tangirala, Hershy	T-Mobile
Gormley, Andy	T-Mobile
Kalnins, Andis	Verizon
Dausy, Ken	Verizon
Oberg, Chris	Verizon Wireless
Desmond, Christopher	Verizon Wireless

Companies in Attendance at the 2017-2018 Public NRSC Quarterly Meetings

APCO
AT&T
AT&T
AT&T
Birch Communications
Cable Vision
Cellcom
CenturyLink
Charter Communications
Cincinnati Bell
Comcast
Comtech
Cox Communications
Fairpoint Communications
FCC
GAO
Intrado (Formerly West Safety Services)
JMA Wireless
Kymeta
Level3
Ligado Networks
Lightsquared
Logix
NASNA
NENA
NITCO
Nokia
Nsight
Perspecta Labs, Inc (Formerly Vencore)
RedSky
Ring Central
Somos
Sprint
Sudden Link
TCS
TDM Mobility
TDS Telecom
T-Mobile USA
TNSI
Union Wireless
US Cellular
Verizon
Weststream
Windstream
XO Communications