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July 11, 2013

Via Email
Jeffery Goldthorp
Chief, Communications Systems Analysis Division
Public Safety and Homeland Security Bureau
Federal Communications Commission
445 12th Street, SW
Washington, DC 20554

Re: Network Reliability Steering Committee (2010-2012) Operational Report

Dear Jeff:

I am pleased to present the most recent Operational Report of the ATIS Network Reliability Steering Committee (NRSC). The enclosed report provides an overview of the NRSC's guidance and recommendations for improving network reliability practices and processes during the 2010-2012 period.

The NRSC and its member companies are dedicated to examining issues affecting network reliability and to recommending actions that can mitigate the impact of outages on end-users. The NRSC appreciates the Commission's willingness to collaborate with the NRSC in the accomplishment of these goals.

If you have any questions, please do not hesitate to contact me.

Sincerely,

Thomas Goode
General Counsel

cc: John Healy, Associate Division Chief, Cybersecurity and Communications Reliability Division

ATIS-0100039

NETWORK RELIABILITY STEERING COMMITTEE 2010-2012 OPERATIONAL REPORT

As a leading technology and solutions development organization, ATIS brings together the top global ICT companies to advance the industry's most-pressing business priorities. Through ATIS committees and forums, nearly 200 companies address cloud services, device solutions, emergency services, M2M communications, cyber security, ehealth, network evolution, quality of service, billing support, operations, and more. These priorities follow a fast-track development lifecycle – from design and innovation through solutions that include standards, specifications, requirements, business use cases, software toolkits, and interoperability testing.

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ATIS-0100039, *Network Reliability Steering Committee 2010-2012 Operational Report*

Published by

Alliance for Telecommunications Industry Solutions
1200 G Street, NW, Suite 500
Washington, DC 20005

DATE: April 2013

TO: Stakeholders of the Nation's Public Communications Networks

Every year natural and man-made disasters remind us how dependent the nation is on its communications infrastructure. Last spring, a fast-moving wind storm brought a wave of destruction across the Midwest, the mid-Atlantic, and the Northeastern regions of the country, significantly impacting communications services in general and 911 facilities in particular. In late spring wildfires raged across swaths of the Southwest and the Midwest, and in the fall Hurricane Isaac and Hurricane Sandy impacted a multitude of cities along the south and east coasts. 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.

These robust communications networks enable consumers and businesses to contact emergency services, to communicate with family, friends and colleagues, and to conduct day to day business. They also enable our financial institutions, the economic engine of the country, to function. Because of this, the owners and operators of these networks 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 NRSC and its member companies are dedicated to furthering this effort by analyzing outage and reliability trends and recommending actions that can either eliminate outages or reduce their impact. While the member companies are all strong competitors in the marketplace, they work together through the NRSC to ensure that communication systems continue to remain secure and reliable. These efforts ultimately benefit consumers, business, the industry, and the country as a whole.

This Operational Report provides a snapshot of the issues addressed by the NRSC over the last three years. As you'll see, the efforts of the NRSC, guided by input from member company experts and the FCC, are primarily directed toward ensuring that meaningful data is being collected and analyzed to better understand outages. Ultimately, the NRSC utilizes this information to develop industry guidance that directly impacts and improves the nation's network reliability and resiliency. These efforts often build upon previous NRSC work efforts, and in turn form a strong foundation for ensuring that communication networks continue to be reliable and resilient as they evolve and additional reliability challenges are recognized. As industry moves into the next generation of communications and beyond, the primary goal of the NRSC will remain the same – to ensure the continued reliability of the communication networks that this country depends on.

Stacy Hartman

STACY HARTMAN
NRSC CO-CHAIR
CenturyLink

Richard E Krock

RICHARD KROCK
NRSC CO-CHAIR
Alcatel-Lucent

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1 Executive Summary

1.1 About the NRSC

The Alliance for Telecommunications Industry Solutions' (ATIS) Network Reliability Steering Committee (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 Public Safety and Homeland Security Bureau (FCC 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 2010 through 2012. A brief summary of the history of the NRSC is provided in the *Introduction* of this report (Section 2).

Figure 1: April 2013 NRSC Full Committee Meeting, Minneapolis, MN. [2]

[1] Mission Statement of the NRSC, < http://www.atis.org/nrsc/index.asp >.

[2] From left to right (standing): Sarah Wolff, Harold Salters, Robin Howard, Rick Griepentrog, Gail Linnell, Tim Collier, Jeff Hubbard, Rose Fiala, From left to right (sitting): Stacy Hartman, Rick Krock.

1.2 Changing Regulatory Environment and Changing Industry

Since the previous NRSC industry report in 2009, there have been a number of regulatory initiatives related to network reliability and resiliency and to the obligations of the industry to report communications outages. A common thread to these proceedings is the need to address the changing industry and ongoing transition of legacy communications network to an IP-based ecosystem.

Extension of Outage Reporting to Voice over Internet Protocol (VoIP). In February 2012, the FCC adopted an extension of its outage reporting rules to interconnected VoIP service providers, noting that consumers are increasingly using interconnected VoIP services in lieu of traditional telephone service. Under the new rules, interconnected VoIP providers are required to report outages: (1) within 240 minutes of an outage of at least 30 minutes affecting a 9-1-1 special facility; and (2) within 24 hours of an outage potentially affecting 900,000 user minutes or any special offices and facilities.

Inquiry into Network Reliability and Resiliency. The evolution of the Time-division multiplexing (TDM) network was also the focus of a notice of inquiry on network resiliency in April 2010. This inquiry, which examined the effect of severe overloads or physical damage to network resiliency and reliability, was initiated in response to the FCC's National Broadband Plan and recognized that "people are no longer tied to a single public-switched telephone network (PSTN), but communicate through a wide range of interconnected networks (*e.g.*, cable networks, fiber networks, local exchange carriers, licensed wireless broadband communications networks and unlicensed wireless internet service providers)."

NG911. In December 2012, the FCC released a request for input regarding issues related to the deployment of next generation E9-1-1 (NG911) services. The further notice of proposed rulemaking (FNPRM) continued the examination that began in 2010 focused on how to bridge the gap between the capabilities of NG networks and devices and today's 9-1-1 system.

Cybersecurity. The transition of the PSTN and its impact on network security has also been a topic of examination by the FCC and its advisory committees. An April 2010 inquiry delved into whether, based on the fact that an increasingly greater amount of the nation's daily business depends the nation's rapidly growing broadband communications infrastructure, the FCC should establish a voluntary program under which participating communications service providers' would be certified for their adherence to a set of cybersecurity objectives. The acknowledgement that broadband now plays an increasing important role in communications was also seen in the active cybersecurity work programs of the FCC's Communications, Security, Reliability, and Interoperability Council (CSRIC) and the Technical Advisory Committee (TAC).

Derecho Storm Recommendations. Most recently, the FCC's inquiry into the impact of the June 2012 Derecho storm, which severely affected communications and other physical infrastructure in the Midwest and Northeast, raised the issue of how the transition to an all IP network will impact network resiliency and robustness. The inquiry, recommendations and proposed rules on this issue, while focused primarily on the impact of the event on existing communications networks, also examine the impact of the transition to NG911 on issues such as network monitoring and diversity.

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 the US communications networks remain highly reliable and robust, even during their constant evolution.

1.3 Highlights

During the 2010 to 2012 timeframe, the NRSC convened nine special studies, undertook three special initiatives, as well as reviewed and commented on numerous filings. Along with the special study teams, the NRSC also has three standing Subcommittee and Task Force groups. The covered topics included:

- Special Studies:
  - Large DS3 Outage Investigation Subteam
  - E9-1-1 Outage Subteam
  - E9-1-1 CAMA Trunk Throughput Optimization Subteam
  - Mass Call Overload Subteam
  - Normalization Subteam
  - Outage Index Review Subteam
  - Standard Outage Classification Subteam

- State Legislation for Copper Theft Deterrent
- Wireless Outages Subteam

- Subcommittees & Task Forces:
  - Outage Reporting Advisory Subcommittee
  - Best Practice Task Force
  - Regulatory Task Force

- NRSC Initiatives, Studies, and Filings:
  - Initiatives
    - Established ATIS Website for Industry Best Practices
    - Created a Best Practices Tutorial
    - Collaborated with the Association of College and University Telecommunications Administrators (ACUTA) on a review of the Hurricane Preparation Checklist
  - Filings
    - Broadband Outage Reporting Public Notice and FCC Ex-Parte (2010)
    - California Public Utilities Commission Request to Access NORS (2010)
    - Comments on Burden of FCC's Communications Disaster Information Reporting System (DIRS)
    - Survivability Notice of Inquiry (NOI) (2010)
    - Cyber Security Certification NOI (2010)
    - Nebraska Network Reliability and Service Interruption Workshop Correspondence (2010)
    - 2010 Biennial Review of Regulations Administered by the Public Safety and Homeland Security Bureau (2011)
    - Modernizing the FCC Form 477 Data Program (2011)
    - NORS Point of Discovery Drop Down Boxes (2011)
    - FCC-11-55A1 Resiliency and Reliability & Ex-Parte (2011)
    - FCC-11-74A1 Notice of Proposed Rulemaking (NPRM) Extension of Part 4 rules to Broadband/IP Outage Reporting (2011)
    - Cyber Security Information Reporting System (CIRS) (2011)
    - Cyber Security Roadmap (2011)
    - 9-1-1 Resiliency & Reliability Public Notice (2012)
    - Extension of Part 4 Rules to VoIP Outages (2012)
    - Network Resiliency and Reliability (2012)
    - Universal Service Fund & Inter-Carrier Compensation System (2012)
    - State outage reporting issues (including CA PUC Request to Access NORS) (2012)
    - Part 4 Outage Reporting Rule Review (2012)
    - Derecho/9-1-1 Network Resiliency and Reliability PN (2012)
    - Post Superstorm Sandy Field Hearings Public Notice (2012)
    - DIRS Expansion to include Broadband, VoIP & Video
    - DIRS Test Exercise

Additionally, the following activities were completed:

- One (1) NRSC Bulletin was published.
- Twenty-three (23) new Best Practices were developed and referred to CSRIC for confirmation.
- Nine (9) Subcommittees, Task Forces, and study teams provided over forty-six (46) analysis reports to the industry during quarterly public meetings.
- Two (2) ATIS Standards were published.

2 Introduction

2.1 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 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.[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 Industry Formation of the NRSC

In its 1993 *Report to the Nation*, the NRC[6] recommended 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]

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[3] Daugherty, H.T., Klein, W. J., *U.S. Network Reliability Issues and Major Outage Performance*, IEEE Computers and Communications, 1995. Proceedings., IEEE Symposium on Volume , Issue , 27-29 Jun 1995, Pages: 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.

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

2.2 Factors Affecting Network Reliability

The NRSC has historically recognized that identifying and understanding the underlying causes of outage trends are an important part 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 membership works to identify the direct and root cause(s) associated with particular trends, evaluates these against existing Best Practices, or appropriately develops new or modifies existing Best Practices. Additionally, members develop new or modify existing cause code categories, review other completed studies, review internal company outage data, determine contributing factors, and review associated federal and state regulations.

3 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.

3.1 Introduction to Special Studies

The NRSC had nine (9) special study teams and initiatives during 2010-2012. The purpose of these special studies and initiatives 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 protect their sensitive and critical infrastructure data, a Non-Disclosure Agreement (NDA) between the NRSC member companies is in place.

The special studies presented in the following pages address the areas of Large DS3 Outages, E9-1-1 Outages, E9-1-1 CAMA Trunk Throughput Optimization, Mass Call Overload, Normalization, Outage Index Review, Standard Outage Classification, Copper Theft Deterrent, and Wireless Outages. The highlighted studies represent the thousands of hours that NRSC members have contributed to the painstaking scrutiny, documenting, and publishing of publically available findings and results. These efforts are instrumental in providing expert industry guidance and ensuring high network reliability in the United States.

[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.

3.1.1 Large DS3 Outage Subteam

Background

In 2011, the FCC noted that the number of large DS3 events appeared to be rising at a significant rate, and asked the NRSC to investigate these types of outages. In response to this request, in January 2012 the NRSC initiated the "Large DS3 Outage Investigation" to analyze the trend and determine whether they could provide guidance to the industry to mitigate and/or reduce these outages. Following the start of this investigation and per the FCC's request, this investigation was expanded to include DS3 Simplex events.

Team Activity

The team scope was defined and included the review of outages that impacted 1,350 DS3 minutes and impacted 1,000 or more DS3s. As well, objectives were established and the team completed a thorough and expert analysis of the NRSC member company's aggregated large DS3 outage data. Data charts and tables were created and utilized to further research and examine the quantity, frequency, direct causes, root causes, and contributing factors of qualifying events. During the analysis, the NRSC considered five major points:

- Network transition to larger capacity systems
- Diversity
- Large DS3 outages and percentage of the total number reported
- Part 4 outage reporting rules in effect since 2005 for DS3 failures
- Standard Outage Index

The team review indicated that Hardware Failure and Cable Damage are the predominate drivers for large DS3 outages. Outages were also analyzed by Time of Day, which indicated that there appeared to be a trend for outage spikes during the service provider's normal maintenance window and mid-day. Cable Damage and Hardware Failures demonstrated a significant trend during these times. This demonstrates that these are significant drivers for large DS3 outages. The team also analyzed the outages for trends related to external environmental issues such as storms or large scale disaster events. The data ruled out environmental issues as a major contributing factor.

Another part of the team's analysis was educational in nature. The team recognized the transition of network infrastructure to larger capacity systems, driven by customer demand and acknowledged customer designed diversity is not captured in the data. The team also recognized customers are knowingly purchasing more unprotected services and this appears to be influencing the outage trend. Historically a single DS3 failure was defined as impacting 672 unique voice or data customers and this definition carries over the paradigm from the Outage Reporting rules prior to 2005 that focused on 30,000 potentially affected customers. When applying this historical view of DS3 usage to higher bandwidth circuits it overestimates the number of unique customers affected and results in a mathematical equivalent that can easily exceed 1,000 calculated DS3s.

Conclusion

Findings from this team acknowledged that member data is not a complete view of the overall industry. The trend appears to be mostly in control, with some monthly spikes; however it is important to note that Large DS3 events represent a small percentage of the total number of DS3 reports. Other findings include:

- The studied outages are largely unprotected high bandwidth wavelengths and the analysis cannot determine if customers are self-designing their diversity.
- The data does not support an issue of repeat failures and reflects a level of reliability for unprotected services.
- The data analyzed indicates that hardware failures are not the result of a single vendor's product(s).
- Optical Lasers and Pumps appear to be one of the highest contributing factors regarding hardware.
- Customer's purchasing unprotected wavelengths are large enterprises with the sophistication to understand the design and associated risks.
- These large capacity circuits appear to have a high IP/Layer 3 usage with some traditional voice and data traffic.
- Customers that do not purchase diversity from a single carrier will either purchase or provide diversity themselves to ensure they do not see a loss of service on mission critical circuits.

The Large DS3 Outage and Simplex Investigation will continue into 2013 as the team completes an industry Best Practice review and develops a technical report related to large DS3 outages, entitled ATIS-0100038, *Analysis of*

Large DS3 FCC Reportable Outages[9]. At the completion of the white paper, the team will begin work on the simplex loss of diversity issue.

3.1.2 E9-1-1 Outage Subteam

Background

During 2011, the FCC requested that the NRSC re-initiate the E9-1-1 Study Team because the number of Phase 2 events was much higher during May and June of 2010 than they had historically seen.

Team Activity

Data was collected from NRSC member companies covering January 2009 through September 2010. Initial analysis of the outage data indicated that outages reported by participating NRSC member companies had declined sharply. In fact, a decline of approximately 50% was observed in NRSC member reported outages beginning in May 2010.

In order to further the analysis, the NRSC member companies expanded the E9-1-1 reported outage trending to include 2011 data. The team identified an inconsistency between the NRSC member company data and FCC data, which included non-NRSC member company data. Because of this, the FCC provided the NRSC with an NRSC member only data analysis, which confirmed the NRSC's findings.

NRSC E9-1-1 Study Group Observations

NRSC findings indicted that since May 2010, E9-1-1 Outage Reports by NRSC members had steadily decreased. E9-1-1 Outage Reports from NRSC member companies were at the lowest point in several years and a large percentage of reports only affected location services, not call completion. 45% of NRSC Outage Reports indicated Automatic Location Identification (ALI) only affected with an additional 20% of NRSC Outage Reports indicating wireless Phase 2 only affected. 18% of reports indicated Diversity as a factor in the reported outage.

Conclusion

The NRSC E9-1-1 Study Team determined that the outage reporting numbers were trending downward significantly. The analysis also determined that NRSC member companies were not the source of E9-1-1 outage reporting increases that had been shown in previous FCC Analysis presentations. Following the completion of this study, NRSC members agreed to move this team to inactive status. Further, the NRSC recommended that the FCC consider addressing any specific increases in 9-1-1 outage reports with the non-NRSC companies that had contributed to the trend because the NRSC does not have access to data related to these providers.

3.1.3 E9-1-1 Focused Overloads (CAMA Trunk) Subteam

Background

During a winter storm in Washington, D.C., in January 2011, 9-1-1 trunks were automatically taken out of service when Selective Routers (SR) experienced "wink" failures, which caused 100% blockage of wireless 9-1-1 calls. The FCC requested the NRSC to investigate these outages, as well as to review these types of incidents across the country along with the current 9-1-1 architecture. The NRSC was also asked to provide the FCC with recommendations that would not only avoid these types of incidents in the future, but minimize impacts on affected counties. Further, the NRSC was requested to work closely with vendors of Selective Routers and Private Branch Exchanges (PBXs) to review their current settings. More specifically the FCC asked the NRSC to:

- Determine the cause of the wink failures.
- Recommend methods to prevent the problem for each equipment scenario.
- Recommend methods for monitoring and responding to this type of problem.
- Recommend procedures for carriers and PSAPs to engage in discussions around the NSRC's technical findings, and how, to make modifications or adjustments to the services the PSAPs obtain from carriers, including notification and communications around network-affecting events.

[9] This document is available from the Alliance for Telecommunications Industry Solutions (ATIS), 1200 G Street N.W., Suite 500, Washington, DC 20005 < http://www.atis.org/docstore/product.aspx?id=28004 >.

- Coordinate the NRSC's finding and recommendations with the ongoing efforts of National Emergency Number Association (NENA) in its evaluation of the situation.
- Explore the pros and cons around commencing a further inquiry into any potential long term solutions, including possibly a strategy for moving away from Centralized Automatic Message Accounting (CAMA) trunks.

Team Activity

Between May and August 2011, the NRSC held twenty-one (21) subject matter expert or technical writing sessions, bringing together industry experts in 9-1-1 SR network design and network operation.

Testing of the issue was performed in a laboratory environment to confirm theories developed by the NRSC team. These findings confirmed that upon two successive no-wink conditions, certain legacy 9-1-1 SRs will remove the trunk from service. This would result in fewer trunks remaining to receive and handle additional calls. There is the potential that all the trunks could be taken out of service due to a no-wink condition. In this case, all incoming 9-1-1 calls will be routed to treatment if the PSAP has not requested an overflow route to another PSAP, administrative line, or other location to receive the call.

Existing technical specifications, trunk sizing for 9-1-1 trunks, pros and cons for trunk busy percentage configurations, trunk overflow routes, trunk alarm recommendations, and industry Best Practices, were all addressed during the investigation. The team documented a Root Cause Analysis (RCA) that included steps to prevent reoccurrence and recommendations for 9-1-1 SR service provider mitigation and PSAP operations.

Conclusion

The NRSC was asked by the FCC to review the situation where certain SR platforms can remove 9-1-1 PSAP trunks from service during periods of heavy emergency call volume. The NRSC developed an in-depth ATIS Standard which addresses the ATIS NRSC's review of CAMA trunks used in some 9-1-1 configurations. As part of this review, incidents of high call volume and the current 9-1-1 architecture were reviewed. This standard provides the industry with recommendations to assist in mitigating these types of incidents in the future; as well as, to maximize 9-1-1 call throughput to PSAPs during high call volume conditions.

The full ATIS Standard ATIS-0100034, *ATIS NRSC 9-1-1 CAMA Trunk Throughput Optimization Analysis*[10], was made available free of charge to the industry.

NRSC leadership was invited to present an overview of the issue at the September 23, 2011, Communications Security, Reliability and Interoperability Council's (CSRIC) meeting in Washington, D.C. On November 3, 2011, ATIS also presented a webinar on the 9-1-1 CAMA Trunk Throughput Optimization Analysis, which was moderated by the FCC with NRSC leadership as panelists.

3.1.4 Mass Call Overload Subteam

Background

In 2011, there was industry concern regarding the number of mass and targeted call overloads that were adversely impacting communication provider's networks. The NRSC's Mass and Targeted Call Overload Task Force was formed to analyze this issue and to determine whether mass and targeted overloads were increasing at a statistically significant rate, what the most apparent root cause(s) of the increase was, and to determine what the industry can do or recommend to maintain network reliability during these types of events.

Team Activity

In order to ensure consistency, the team developed standard definitions for Targeted Call Overload, Mass Call/Focused Overload, and Exceeded Engineered Capacity:

- **Targeted Call Overload** - use of equipment such as auto dialers to broadcast recorded messages from a single origination point to multiple destination points for reasons such as school closings, political solicitations, gas leaks, and advertisements.

[10] This document is available from the Alliance for Telecommunications Industry Solutions (ATIS), 1200 G Street N.W., Suite 500, Washington, DC 20005 < http://www.atis.org/docstore/product.aspx?id=25661 >.

- **Mass Call/Focused Overload**-increased call volume by multiple origination points to a single destination point due to emergency situations, or media stimulated events for reasons such as vehicular accidents or radio/television contests.
- **Exceeded Engineered Capacity**- increased call volume by multiple originating points to multiple destination points due to holidays, severe weather, natural and/or man-made disasters.

The NRSC became aware that the ATIS' Next Generation Interconnection & Interoperability Forum (NGIIF) was working on a related issue, "Managing Mass Calling Generated by Auto Dialer Devices" (ATIS NGIIF Issue 32) and met with the NGIIF to coordinate activities.

Conclusion

The NRSC provided data templates to the NGIIF for consideration to incorporate with their work effort related to NGIIF Issue 32.

3.1.5 Normalization Subteam

Background

The resolution of this issue, Normalization of Reliability Metrics for FCC-Reportable Service Outage Data, provided techniques for the analysis of FCC-reportable outage data as recorded by the FCC NORS system. The techniques included the definition of an outage index, as well as methods for creating control charts and identifying trends in outage frequency and aggregated outage index.

Team Activity

The Normalization Subteam was formed in 2009 to examine normalization methods for analyzing outage frequency and outage magnitude relative to network growth. The team also considered whether NORS-specific techniques could be utilized to replace comparable techniques presented in T1.TR.42-1995, *Enhanced Analysis of FCC-Reportable Service Outage Data*[11]. The team met bi-weekly over a period of about eighteen (18) months to review and discuss possible resolutions. The team discussed various sources of data with the principal limiting factor that the method to be used needed to depend only upon publicly available data.

Conclusion

After many meetings and extensive discussions, it was concluded that no publicly available data was appropriate for use in normalizing the outage reports. It was decided to close the issue, but to continue looking for future potential data sources.

3.1.6 Outage Index Review Subteam

Background

The outage index calculation method contained in ATIS-0100021, *Analysis of FCC-Reportable Service Outage Data*, was approved and published in 2008. In the years since this methodology was accepted, the networks that are being reported upon have changed significantly. Thus, the methodology for the calculation of the index needed to be re-examined, and the Outage Index Review Subteam was formed in December of 2011 to address the issue.

Team Activity

The Outage Index Review Subteam met bi-weekly from January to August of 2012. The principle discussion centered on finding a replacement method for determining the level of pain customers experience or the "pain" index for DS3 related outages. Once that was decided upon, it was necessary to determine the updates needed to the technical report to reflect the change in the methodology.

[11] This document is available from the Alliance for Telecommunications Industry Solutions (ATIS), 1200 G Street N.W., Suite 500, Washington, DC 20005 < http://www.atis.org/docstore/product.aspx?id=9054 >.

Conclusion

The output of the team was a revision to ATIS-0100021, *Analysis of FCC-Reportable Service Outage Data*[12]. This revision is focused on updating the "pain" component of the index as related to DS3 outages. The original index used a DS0 count per DS3 to calculate the number of customers affected by a DS3 outage. In the revised index, the DS0 count is replaced with a DS1 count. This modification was influenced by the change in bandwidth consumed by typical customers over the past several years as reflected in publically available FCC broadband data.

3.1.7 Standard Outage Classification Subteam

Background

ATIS-0100012, *Standard Outage Classification*, is an American National Standard (ANS) describing an outage classification methodology. The standard was initially developed in 2007. During the American National Standards Institute (ANSI) 5-year Review Process, the Standard Outage Classification Subteam was formed to examine the document and determine what action should be taken.

Team Activity

The team began its work in August of 2012 by comparing the Standard Outage Classification (SOC) with the current FCC Network Outage Reporting System (NORS) list of outage cause codes. The team jointly worked to create a mapping from the NORS cause codes to the SOC cause codes. This mapping was used in discussions to determine if the SOC document needed to be updated.

Conclusion

As a result of the work of the team, it was determined that the SOC standard required very minor changes, and an appendix would be added to the document that demonstrate the mapping between the NORS cause codes and the SOC cause codes. Additionally, it was noted that the NORS cause codes frequently did not adequately identify the "what", "why" or "who" that are specified in the SOC cause codes. Also, it was noted that the SOC cause codes did not go to the same depth in the "what" and "why" components as the NORS cause codes did. A revised version of ATIS-0100012.2013, *Standard Outage Classification*[13] was published in April of 2013.

3.1.8 Copper Theft Deterrent

Background

The NRSC member companies had observed that an increase in copper theft and facility damage was negatively impacting communication provider's network reliability and increasing operational costs. The increase in these events and their potential impacts has driven multiple states to develop and pass more rigid metal recycling laws. The primary objective of the Copper Theft Deterrent Subteam was to provide industry guidance on methods to improve network security, reliability and resiliency related to copper theft. The team analyzed the current laws and developed recommendations regarding a suggested minimum set of requirements for metal recycling that states should consider turning into law.

Team Activity

During 2012, the Copper Theft Deterrent Subteam solicited topics of interest from the NRSC members and other affected industries. Based on input from these stakeholders, the team identified areas that it felt would provide the greatest benefit. During 2012, the team developed productive partnerships with tower companies, a metal theft Task Force, and a metal theft workgroup. In 2013, the team will continue to look at Legislative issues and review state metal theft legislation work that has been completed by the National Conference of State Legislatures (NCSL). Partnering with industry organizations, tower companies, recycling companies, and other

[12] This document is available from the Alliance for Telecommunications Industry Solutions (ATIS), 1200 G Street N.W., Suite 500, Washington, DC 20005 < http://www.atis.org/docstore/product.aspx?id=27898 >.

[13] This document is available from the Alliance for Telecommunications Industry Solutions (ATIS), 1200 G Street N.W., Suite 500, Washington, DC 20005 < http://www.atis.org/docstore/product.aspx?id=22781 >.

relevant groups, the team will determine the best approach for educating state legislators and influencing upcoming legislative activity and develop implementation and communication plan.

Conclusion

The Copper Theft Deterrent Subteam continues to be a valuable resource to advise industry on the reliability and resiliency of the nation's networks related to copper theft issues. In addition, the team will seek to identify Best Practices based on company practices currently used to prevent copper theft. These will likely be proposed to a future CSRIC for consideration as new Best Practices, aimed at improving reliability through the mitigation of copper theft.

3.1.9 Wireless Outage Subteam

Background

The Wireless Outage Subteam was convened in order to investigate the upward trend in wireless outages, as identified by the FCC. The NRSC agreed to analyze this trend and determine whether it could provide guidance to the industry to mitigate the increase. The primary objective of the Wireless Outage Subteam was to provide guidance, based on collected and analyzed NORS reported wireless carrier outage data from NRSC members, and to verify whether NRSC member companies were experiencing a similar increase in wireless outages as depicted in the FCC December 7, 2011 quarterly report.

Team Activity

During 2012, the Wireless Outage Subteam issued a report (*Network Reliability Steering Committee (NRSC) Bulletin No. 2012-001, Wireless Outages[14], December 2012)* that summarizes the findings and recommendations of its investigation into the wireless outages reported by the communications industry. During its analysis, the Wireless Outage Study Subteam observed a significant downward trend in the number of outage reports beginning in November 2011. It also determined however, that the duration of outages appeared to be increasing. The team found that 65 percent of the outage reports were "sympathy" reports (*e.g.*, outages reported by one or more companies that occurred as the result of problems in another company's network) and that the leading cause of those outages was cable damage. The team also completed a thorough analysis of keywords mentioned in the non-sympathy reports for both direct and root causes of the outages. This analysis identified the causal label "Procedural-Service Provider-Other" as the number one reason cited for outages across the industry. Further analysis of the keywords contained in the reports of these procedural outage events showed that 88 percent of them contained the words "planned" or "maintenance," indicating that the outages likely occurred during a maintenance window.

Conclusion

In response to these findings, the Wireless Outage Subteam notes that as new technology is deployed and consumer demand continues to increase, more planned outages associated with equipment upgrades also may occur. Communication providers select the maintenance window based on the measured traffic handled by the specific location in order to minimize subscriber impact. Therefore, in its bulletin, the NRSC recommends that the FCC consider revising its rules (47 C.F.R. Part 4) on outage reporting requirements associated with planned activity during designated maintenance windows to provide a more accurate depiction of an outage's actual customer impact. ATIS *NRSC Bulletin No. 2012-001*[14] also identifies specific Best Practices to help ensure that outage durations are kept to a minimum.

[14] This document is available from the Alliance for Telecommunications Industry Solutions (ATIS), 1200 G Street N.W., Suite 500, Washington, DC 20005 < http://www.atis.org/docstore/product.aspx?id=27992 >.

3.2 Subcommittees & Task Forces

3.2.1 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 is 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.

Most types of communications service providers – including wireline, wireless, cable telephony, SS7, E911 providers, and facility owners – are required to report telecommunication service disruptions pursuant to the FCC's rules. These reports are filed using an internet-based system, the Network Outage Reporting System (NORS) and analyzed by the FCC.

The FCC also developed a web-based system, the Disaster Information Reporting System (DIRS), to collect the information needed to determine the status of communications services in areas affected by major disasters (*e.g.*, Hurricane Katrina). DIRS collects information on the status of equipment, such as switches, public safety answering points used for E911, inter-office facilities, cell sites, broadcasting facilities, and cable television systems. DIRS is only to be activated for major disasters (*e.g.*, category 2 hurricanes). For smaller disruptions, a federal agency including the FCC may need information on the status of communication assets during a disaster. The FCC established DIRS-Lite for these cases. DIRS-Lite is a limited data collection effort aimed at determining the status of major wireline/wireless assets. It is a scaled back version of DIRS, in which the information is collected via e-mail and phone calls.

Team Activity

NORS

A review of the NORS User Manual - Version 6 (April 9, 2009) was undertaken to develop recommendations that would provide clarification and assure consistency between the User Manual and the NORS production system. The subcommittee also developed recommendations to enhance descriptions of Root Cause, Direct Cause and Contributing Factors ("Cause Codes") used in NORS and associated revisions to the User Manual. In a further effort to assure consistency between NORS and the available reference information, the subcommittee developed recommendations to revise the "Help File" that can be accessed from NORS. Based on the final changes to NORS Cause Codes implemented in the production system, the subcommittee finalized the User Manual and Help File revisions and provided the recommendations to the FCC.

Upon release of the Report and Order on Extension of Part 4 of the Commission's Rules Regarding Outage Reporting to Interconnected Voice Over Internet Protocol (VoIP), the ORAS examined the NORS Cause Codes, developed recommended revisions to improve applicability to VoIP service, and provided the recommendations to the FCC.

The subcommittee also developed criteria for a new slide for inclusion in the FCC's presentation, *Analysis of Network Outage Reports*, given during the quarterly NRSC meetings, that displays outage reports associated with environmental impacts. This slide, entitled "Environmental External" facilitates the NRSC's understand of the relationship between total outage frequency trends and environmental factors.

DIRS

In response to a request by the FCC for input on a DIRS Frequently Asked Questions (FAQ) document, in August 2010, the subcommittee provided questions, with appropriate responses, that would be helpful to first-time users of DIRS.

Based on experiences of member companies during DIRS exercises and activations, the subcommittee developed the DIRS Quick Reference Guide. This document provides clarification and guidance to users on points of process and procedure throughout a DIRS activation. It was provided it to the FCC in February 2012 along with a recommendation that it be published as a supplement to the existing DIRS User Manual and joint National Communication System (NCS) and FCC Standard Operating Procedure.

In response to a request by the FCC, the subcommittee provided recommendations in February 2010 regarding the possible expansion of DIRS to VoIP services. These recommendations minimize changes to the DIRS templates and combine reporting for infrastructure that carries VoIP with reporting for infrastructure that carries traditional voice service, while providing the Commission with status and situational awareness information during times of crisis. Also in response to a request by the FCC, in August 2012 the subcommittee reviewed and provided recommendations on the FCC's draft DIRS User Manual, Version 3. This draft addressed DIRS expansion to include VoIP subscribers, video subscribers, and broadband access users.

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

DIRS-Lite

In response to the FCC's announcement of the implementation of a streamlined disaster information reporting process, DIRS-Lite, in June 2010 the subcommittee provided input on the reporting process and the basic information that should be provided. Also, in response to a request by the FCC, in July 2011 the subcommittee provided feedback on DIRS-Lite activations based on experiences with the Mississippi floods and the tornado in Joplin, Missouri.

The subcommittee has collaborated in the development of the DIRS Lite Standard Operating Procedure (SOP) with the FCC, and the process is still ongoing.

Conclusion

The NORS, DIRS, and DIRS-Lite processes are complex and are undergoing significant changes. Efforts aimed at improving the value, accuracy, and consistency of the information provided by these dynamic processes is a continuous challenge. Meeting this challenge requires commitment and collaboration from all of the stakeholders, industry and government alike. The results achieved by the subcommittee are significant, and are based on maintaining a positive working environment for its members and an active channel of communication with the FCC.

3.2.2 Best Practices Task Force

Background

The Best Practices Task Force is charged with improving the quality of Best Practices and updating and/or expanding them as appropriate. This NRSC Task Force operates with the understanding that Best Practices are *not* standards, *nor* regulations. Mandated implementation of Best Practices is inconsistent with their intent. The primary objective of Best Practices is to provide guidance, based on assembled industry expertise and experience, to improve network security, reliability and resiliency. Best Practices are developed with the understanding that decisions regarding their applicability can only be made by individuals with sufficient competence and knowledge of relevant factors, including specific network implementations, technology, operational models and business considerations.

Team Activity

During the past three years, the Best Practices Task Force has solicited topics of interest from its members and from the FCC. Based on input from those stakeholders, the team has identified areas that it felt would provide the greatest benefit. During 2010 through 2012, the Best Practices Task Force has enjoyed a close relationship with the FCC's Communications Security, Reliability and Interoperability Council (CSRIC) II and III and any Best Practices proposed by this task force are submitted to CSRIC for inclusion in the set of industry Best Practices. In 2010, the team looked at Best Practice issues associated with reporting outages, and identified four (4) new Best Practices, which were later confirmed by CSRIC II and added to the official Best Practices data base. At the request of the FCC the team also created a training document on Best Practice creation and structure, to help foster consistency between the various CSRIC working groups. This training was used by the CSRIC II working groups that had already begun their work, and was also presented to CSRIC III working groups when they were initially formed.

In 2011 the industry Best Practices website, which was previously hosted by Alcatel-Lucent Bell Labs, was transferred to ATIS, where it is hosted today at http://www.atis.org/bestpractices/Default.aspx.

The FCC also maintains a Best Practices web site (https://www.fcc.gov/nors/outage/bestpractice/BestPractice.cfm) and updates to these websites are coordinated to ensure consistency.

By the end of 2011, CSRIC II had identified over 200 new Best Practices, and modified over 170 existing Best Practices. Following the conclusion of the CSRIC Charter, the Best Practices Task Force reviewed all of these, specifying appropriate identifiers (*e.g.*, industry functions, network types, and keywords) to associate with each. These identifiers are used on both the ATIS and FCC websites to help users identify Best Practices applicable to a specific topic, user, or network type. As part of this review, the team also suggested changes to some of these practices; proposing wording changes to improve understanding or to bring the Best Practice into conformance with the wording standard set forth in the training document, identifying apparent duplication of ideas between two or more Best Practices, and questioning the applicability of ideas that did not seem to be Best Practices. All of these proposed changes have been referred to the FCC for review by a future CSRIC Council. After this effort, the team undertook the task of reviewing all existing Best Practices that had not been reviewed by CSRIC II, a total of 639 Best Practices. This review resulted in 136 suggested changes, which have been referred to the FCC for confirmation by CSRIC.

Conclusion

Industry Best Practices continue to be a valuable resource for improving the reliability and resiliency of the nation's networks. Owing to their voluntary nature, they represent the output of industry's experts in various fields and are able to change rapidly to meet the evolving communications landscape, without the need for regulation or standards. The Best Practices Task Force and CSRIC continue to complement each other, ensuring that the set of industry Best Practices remains current, usable, and applicable for today's communications providers.

3.2.3 Regulatory Task Force

The ATIS NRSC Regulatory Task Force was formed to address and respond to network reliability, resiliency, and outage reporting related regulatory activity. To accomplish this work, the task force monitored, reviewed and responded to various local, state, and federal regulatory activities. Where appropriate, the NRSC developed and filed comments. Refer to the *NRSC Initiatives, Studies, and Filings* section of this report for a comprehensive list of these filings.

4 Conclusion

As documented in this report, throughout the 2010 to 2012 timeframe, the NRSC has actively researched and documented network reliability information, provided valuable guidance regarding a multitude of industry specific issues, and investigated and responded 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. The NRSC would like to recognize Robin Howard for his leadership as the NRSC Co-Chair from 2009 to 2012. Mr. Howard's unwavering dedication to the NRSC has proven to be a steadfast force in improving the nation's network reliability and resiliency.

4.1 Future Plans

While the NRSC remains focused on the network reliability and resiliency of today's networks, it is also planning for the future. The NRSC's work will assist with the upcoming transition to from Time Division Multiplexing (TDM) all to Internet Protocol (IP) networks and will ensure that the industry appropriately anticipates the reliability issues that may impact the transition. Additionally, the NRSC will be engaged in various cyber security issues and will partner with other ATIS Committees to ensure that this critical topic is thoroughly addressed. The NRSC's unique perspective of the future, through the filter of the present, will prove again to be invaluable to the Nation during this 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.

4.2 For the Common Good

The NRSC is an example of the spirit of service in the communications industry. Companies that are normally fierce competitors in the marketplace participate in the NRSC, putting competition aside to work together for the benefit of all consumers and the general advancement of network reliability. Working together towards the common good of all communications customers is the finest product of the NRSC.

NRSC Participating Companies

Alcatel-Lucent
Applied Communication Sciences
AT&T
CenturyLink
Cox Communications
CSI Telecommunications
Ericsson
MetroPCS
Nokia Siemens Network (NSN)
Office of Emergency Communications (OEC)
Sprint
T-Mobile
Verizon

NRSC Subcommittees, Task Forces, and Subteams

- Outage Reporting Advisory Subcommittee
- Best Practices Task Force
- Regulatory Task Force
- Large DS3 Outages
- E9-1-1 Outages
- E9-1-1 CAMA Trunk Throughput Optimization
- Mass Call Overload
- Normalization
- Standard Outage Index Review
- Outage Classification
- Copper Theft Deterrent
- Wireless Outages

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