



ATIS-0100055

**NETWORK RELIABILITY STEERING COMMITTEE 2013-2014
OPERATIONAL REPORT**



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ATIS-0100055, *Network Reliability Steering Committee 2013-2014 Operational Report*

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**Network Reliability Steering Committee 2013-2014
Operational Report**

July 2015

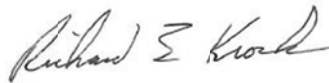
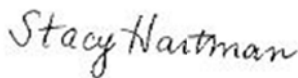
DATE: July 2015

TO: Stakeholders of the Nation's Public Communications Networks

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

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

This report provides a snapshot of the issues addressed by the NRSC over the last two years. As you'll 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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Executive Summary

About the NRSC

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

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

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

- Identifying potential network reliability issues through an opportunity evaluation process;
- Establishing teams to work specific reliability issues;
- Conducting special studies to develop industry recommendations and/or Best Practices;
- Providing industry feedback to the Federal Communications Commission Public Safety and Homeland Security Bureau (FCC) 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 2013 through 2014. A brief summary of the history of the NRSC is provided in the *Introduction* of this report (page 6).

¹ The Mission Statement of the NRSC is available on the ATIS NRSC site < <http://www.atis.org/nrsc/index.asp> >.

Changing Regulatory Environment & Changing Industry

The previous NRSC Operational Report in 2012 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 several years, with numerous regulatory measures being enacted and industry responding to various high profile service interruptions. Continuity of emergency services, cybersecurity, and the move to an All-IP network have received the bulk of attention, although reliability of legacy networks remains a critical piece of the equation.

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

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

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

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

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

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

Highlights

During the 2013 to 2014 timeframe, the NRSC convened seven special studies, undertook three special initiatives, and reviewed and provided comments for high profile regulatory filings. Along with its special study teams, the NRSC also had three standing Subcommittees. The covered topics included:

- Special Studies:
 - Copper Theft Deterrent Subteam.
 - Fiber Cut Task Force.
 - IP Reliability Task Force.
 - Service Provider Procedural Outage Task Force.
 - Large DS3 Outage Investigation Subteam.
 - DS3 Simplex Condition Subteam.
 - Planned Maintenance Task Force.

- Subcommittees:
 - Best Practice Subcommittee.
 - Outage Reporting Advisory Subcommittee.
 - Regulatory Subcommittee.

- NRSC Initiatives, Studies, and Filings:
 - Initiatives:
 - Best Practices Tutorial and Guidance for CSRIC IV.
 - Best Practices Website Review and Updates.
 - Launch of IP Reliability Task Force to address VoIP outage reporting.
 - Filings
 - Improving the Resiliency of Mobile Wireless Communications Networks Notice of Proposed Rulemaking (2014).
 - Improving 9-1-1 Reliability Notice of Proposed Rulemaking (2013).

Additionally, the following activities were completed:

- Three NRSC Bulletins were published.
- One ATIS Standard was published.

1 Introduction

1.1 History of the NRSC

Several Catastrophic Outage Events

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

The Network Reliability Council is Established

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

The FCC Mandates Outage Reporting

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

The NRC Recommends the Formation of the NRSC

In its 1993 *Report to the Nation*, the NRC⁶ recommended the formation of the NRSC, under the auspices of the ATIS, for the purpose of monitoring network reliability on an ongoing basis. As defined at that time, the NRSC’s mission was to “analyze the industry’s reporting of network outages to identify trends, distribute the results of its findings to industry, and where applicable, refer matters to appropriate industry forums for further resolution, in order to help ensure a continued high level of network reliability.”⁷

The FCC Makes Changes in Outage Reporting

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

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*, vol , no. , pp.114, 119, 27-29 Jun 1995.

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

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

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

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

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

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.

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

The NRSC had seven special study teams during 2013 and 2014. The purpose of these special studies was to bring industry experts' attention to network reliability issues or concerns, to determine the underlying cause/s behind national trends, to determine the most effective Best Practices or other means for preventing and ameliorating the impact of such events, and to provide industry level guidance regarding the issue or concern. The keys to the success of these teams are open dialogue, meaningful information sharing, and collaboration among the industry participants on potentially sensitive issues. To protect the interests of participating companies and their sensitive and critical infrastructure data, a Non-Disclosure Agreement (NDA) between the NRSC member companies is in place.

These studies represent the thousands of hours that NRSC members have contributed to the painstaking scrutiny, documenting, and publishing of publically 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 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. This subteam concluded its work in June 2013 with the release of an industry technical document.

Team Activity

The team scope was defined and included the review of outages that impacted 1350 DS3 minutes and impacted 1,000 or more DS3s. Objectives were established and the team completed a thorough expert analysis of the NRSC member companies' 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's review indicated that Hardware Failure and Cable Damage were the predominate drivers for large DS3 outages. Outages were also analyzed by Time of Day, which indicated a trend of 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 as well. 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 that 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. Applying this historical view of DS3 usage to higher bandwidth circuits 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.
- 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.
- Customers who are 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 who 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 NRSC did not believe that there was a network reliability issue associated with large bandwidth systems. With the exception of several months of higher than normal hardware failures and cable damage, the trend was generally stable. The NRSC's investigation concluded that a large bandwidth outage did not necessarily or directly equate to significant network or customer impact. The NRSC also concluded that consumers purchasing large bandwidth services have a responsibility to design and purchase appropriate levels of diversity to protect critical communication services.

The NRSC recommended that providers review a total of 28 Best Practices related to circuit pack failures, network reliability, cable damage, and network diversity. The NRSC further recommended that service providers

that sell unprotected services should appropriately provide customers with the risks and limitations of using those circuits, and that customers purchasing protected or unprotected lightpaths and circuits should review ATIS-I-000041, *National Diversity Assurance Initiative (NDAI) Report*⁹, regarding their diversity.

The analysis and recommendations of the Large DS3 Outage Subteam are available in ATIS-0100038, *Analysis of Large DS3 FCC Reportable Outages*¹⁰.

2.1.2 Copper Theft Deterrent Subteam

Background

The NRSC member companies had observed that an increase in copper theft and facility damage was negatively impacting communication providers' 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 to improve network security, reliability, and resiliency. 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

In March 2013, the Copper Theft Deterrent Subteam published ATIS-0100040, *NRSC Bulletin No. 2013-001*¹¹, that identified Industry Best Practices useful for preventing copper theft, identified a new Best Practice (and referred it to CSRIC for inclusion in the list of industry Best Practices), and included a list of minimum legislative criteria the Subteam believed would be useful in reducing copper theft.

Conclusion

The Copper Theft Deterrent Subteam identified various measures, both operational and legislative, that would help reduce the incident of copper theft and its attendant service disruption. This type of effort demonstrates industry's commitment to identify and address issues that negatively impact reliability, even though they may be outside of their direct control. While copper theft remains an issue, the recommendations of the Subteam, if implemented, will help reduce such occurrences, and the report itself has helped draw outside attention to this serious problem.

2.1.3 DS3 Simplex Conditions Subteam

Background

In 2013, the NRSC completed a study of DS3 loss of diversity simplex conditions reported to the FCC. These conditions are non-service affecting events where there is a failure of one side of a duplex system (e.g., a SONET ring), and the remaining unprotected path will typically maintain service for the duration of the outage, unless this path is also impacted at some point in time and there is a duplex failure. The objective of the study was to address the FCC's concern regarding what it described as an observed increase in the number of outage reports filed based on the FCC's DS3 Simplex reporting threshold.

Team Activity

The NRSC examined DS3 Simplex conditions from January 2010 through December 2012 by utilizing data provided by the participating service providers. During this interval, the top 80% of Direct Causes, which are the

⁹ This document is available from the Alliance for Telecommunications Industry Solutions (ATIS) at <
<https://www.atis.org/docstore/product.aspx?id=27923> >.

¹⁰ This document is available from the Alliance for Telecommunications Industry Solutions (ATIS) at <
<https://www.atis.org/docstore/product.aspx?id=28004> >.

¹¹ This document is available from the Alliance for Telecommunications Industry Solutions (ATIS) at <
<https://www.atis.org/docstore/product.aspx?id=27991> >.

immediate event that results in the simplex condition or procedure that triggered the outage, were analyzed. Service providers coded the NORS final report Direct Causes as:

- 40.6% Non-Service Affecting.
- 16.1% Hardware Failure-Circuit Pack-Card Failure-Other.
- 12.0% Cable Damage-Malfunction-Cable Malfunction.
- 8.7% Hardware Failure-Other.
- 4.6% Cable Damage-Other.

During this interval, the top 80% of Root Causes, which are the underlying reason(s) of why the outage occurred or why the outage was reportable, were analyzed. Service providers coded the NORS final report Root Causes as:

- 41.0% Hardware Failure-Circuit Pack-Card Failure-Other.
- 11.1% Cable Damage-Malfunction-Cable Malfunction.
- 8.3% Cable Damage-Other.
- 6.3% Hardware Failure-Other.
- 5.2% Hardware Failure-Circuit Pack-Card Failure-Processor.
- 3.2% Hardware Failure-Passive Devices.
- 3.0% Diversity Failure-External.
- 3.0% Insufficient Data-Outside Owned Network.

Conclusion

NRSC confirmed the observed increase in the number of reports filed based on the FCC's DS3 Simplex reporting threshold. Findings indicated the primary direct and root causes driving the trend were hardware failure and cable damage. The NRSC recommended that appropriate entities revisit 27 Best Practices found in ATIS-010052, *NRSC Bulletin No. 2013-002 DS3 Simplex Conditions*¹². These Best Practices covered the areas of simplex conditions, circuit pack failures, network reliability, cable damage, maintaining redundancy, and disaster recovery.

2.1.4 Wireless Outage Subteam

Background

The Wireless Outage Subteam was convened in 2012 to investigate an 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 these outages. The primary objective of the Wireless Outage Subteam was to provide guidance based on collected and analyzed NORS reportable 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 ATIS-0100041, *NRSC Bulletin No. 2012-001: Wireless Outage*¹³ (*Network Reliability Steering Committee (NRSC) Bulletin No. 2012-001, Wireless Outages, December 2012*) that summarizes the findings and recommendations of its investigation into the wireless outages reported by the communications industry. In early 2013, the FCC asked the NRSC to reconvene the Wireless Outage Subteam to answer several questions concerning the bulletin and analyze additional data. The subteam did reconvene to analyze the additional data.

¹² This document is available from the Alliance for Telecommunications Industry Solutions (ATIS) at <<https://www.atis.org/docstore/product.aspx?id=28007>>.

¹³ This document is available from the Alliance for Telecommunications Industry Solutions (ATIS) at <<https://www.atis.org/docstore/product.aspx?id=27992>>.

Conclusion

The analysis of the additional data confirmed the findings that were previously reached. The subteam noted that as new technology is deployed and consumer demand continues to increase, more planned outages associated with equipment upgrades also may occur. ATIS-0100041 also identifies specific Best Practices to help ensure that outage durations are kept to a minimum. These findings were communicated to the FCC and the issue was closed in June 2013.

2.1.5 Service Provider Procedural Outage Task Force

Background

Quarterly reports presented to the NRSC by the FCC indicated that there had been an upward trend in procedural service provider related outages. In response, the NRSC formed a task force to examine the data and make recommendations to industry concerning this issue.

Team Activity

The NRSC formed the Service Provider Procedural Outage Task Force in March of 2013 at the request of the FCC, and each of the member companies provided NORS data to Applied Communication Sciences (ACS). ACS combined the data and provided an analysis to the team. The analysis examined company contributions (anonymously), reason reportable, time of day, day of week, equipment involved, etc. The primary reasons reportable were "Wireless – 900,000 User Minutes" and "DS3 – 900,000 User Minutes". Additionally, each company was requested to delve into any additional information that might be available internally within their company. The team met bi-weekly over the April to September timeframe and the issue was closed during the December 2013 meeting.

Conclusion

The NRSC was asked by the FCC to investigate outages with cause codes of "Procedural – Service Provider". This investigation led to the conclusion that the outages were closely tied to the same issues that were being addressed by the Wireless and DS3 Teams and that the recommendations of those teams would be applicable to this team as well. Additionally, it was observed that a large portion of the outages indicated that "Planned Maintenance" was involved and it would be useful to have a cause code that reflected that cause.

2.1.6 Planned Maintenance Task Force

Background

Quarterly reports presented at the AMOC meetings to the NRSC by the FCC indicated there had been an upward trend in outages that have Planned Maintenance as the direct or root cause. At the request of the FCC, the NRSC, as part of its mission, agreed to analyze available data (internal and FCC provided) and determine whether it could provide guidance to the industry to mitigate these outages.

Team Activity

The FCC provided data to ACS for analysis in July 2014 that included all NORS outage reports that had preventative maintenance as a root cause, direct cause, or contributing factor. ACS performed an initial analysis and the team held four meetings in late 2014. During that time, the NRSC member companies revisited their individual trouble reports to attempt to get additional information and insight. During the meetings, industry experts examined all available data to try to determine steps that could be taken to minimize reportable outages during planned maintenance.

Conclusion

The NRSC was asked by the FCC to investigate outages related to planned maintenance. This investigation led to the conclusion that the primary factor behind the outages was network upgrades, particularly in the wireless networks. The recommendation of the NRSC was to review and re-emphasize appropriate Best Practices.

The FCC has requested that the NRSC review additional data and re-evaluate the findings. The NRSC has agreed to this and will conduct this analysis during 2015.

2.1.7 Fiber Cut Task Force

Background

Quarterly reports presented to the NRSC in February 2014 by the FCC indicated that there has been an upward trend in outages that are characterized with the words “fiber” and “cut” during the 2012-2013 time period. The NRSC, as part of its mission, agreed to analyze this trend with respect to NRSC members and determine whether it could provide guidance to the industry to mitigate these outages.

Team Activity

The Fiber Cut Task Force was formed in March of 2014 and began meeting on a bi-weekly basis. NRSC member companies provided data to ACS for analysis. All NRSC companies provided NORS reports to ACS that included all reports classified as “Fiber Cut” reports as defined by the FCC. ACS combined the data provided and prepared an anonymous analysis for the Task Force. In addition to analyzing NORS data, the Fiber Cut Task Force examined data from the 2012 and 2013 Common Ground Alliance (CGA) Damage Information Reporting Tool (DIRT) reports. Based on information from the CGA DIRT report, additional analysis of the NORS data was performed examining the number of damage reports by states with respect to their population, the numbers of exemptions from the state’s “call before you dig” laws, and information on fiber installation from FCC and Telecommunications Industry Association (TIA) sources. The Task Force also examined the Best Practices pertaining to fiber facilities and the CGA Best Practices pertaining to telecommunications service providers. In addition, a number of NRSC member companies were also found to be engaged in work within the North American Telecommunications Damage Prevention Council (NTDPC).

Conclusion

The NRSC was asked by the FCC to examine the NORS reports that were characterized by the words “fiber” and “cut” in certain text fields. The Fiber Cut Task Force examined NORS data and other industry data, reached a conclusion, and provided details of the study in a letter to the FCC, which was sent to the FCC on December 9, 2014. The primary conclusions of the letter were:

- Operating companies should use the “other” category when submitting FCC NORS and CGA DIRT reports only when no other category is applicable.
- Operating companies should review the most recent NRSC DS3 Bulletins.
- Operating companies should be aware of the importance of “Call Before You Dig” programs.
- Operating companies should be aware of the existing CSRIC Best Practices related to buried facilities.
- Operating companies are encouraged to familiarize themselves with the Common Ground Alliance’s (CGA) Best Practices < <http://www.commongroundalliance.com> >.
- Operating companies are encouraged to maintain their support of the objectives and work of the North American Telecommunications Damage Prevention Council (NTDPC) < <http://www.ntdpc.com> >.

2.1.8 IP Reliability Task Force

Background

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

In the PSTN, discrete voice switches and voice lines and trunks of deterministic voice call capacity make the determination of the number of lines impacted by any given fault (e.g., a switch port card failure, or time-division multiplexing [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 restore impacted voice connections. So the question arises: how to achieve the level of visibility and control needed to both accurately measure and minimize network outages in IP networks?

The IP Reliability Task Force was formed at the request of ATIS NRSC member companies. The Task Force'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:

The NRSC will determine:

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

It should be noted that the NRSC's consideration of this issue does not indicate a consensus of its membership that VoIP-related outage reporting should be considered or required.

Team Activity

The IP Reliability Task Force was formed in May 2013, to gain knowledge and review deployment strategies, and the Task Force encouraged NRSC members to involve engineers and operations subject matter experts (SMEs), 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, has advanced the Task Force's ability to understand key functional components and redundancy features inherent to an All-IP network.

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

The Task Force leveraged work from the ATIS TOPS Council's January 2013 report, ATIS-I-0000034, *PSTN Transition Functional Group Assessment and Recommendations*¹⁴. 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 Metro/Regional hubs, will depend widely on individual company deployment strategies and business drivers. Operation, Administration, Maintenance, and 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.

The IP Reliability Task Force partnered with the TOPS Council Leveraging Network Intelligence Focus Group (LNI-FG) to contribute a use case to the Focus Group's report, ATIS-I-0000046, *Emerging Opportunities for Leveraging Network Intelligence*¹⁵, describing 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.

Future Work Items

The IP Reliability Task Force transitioned to a standing NRSC Subcommittee in 2015, and continues to meet bi-weekly. The Subcommittee is working to identify monitoring points in the core of the IP network that can signify a voice outage. The Subcommittee will also determine what automated outage reporting metrics can be consistently reported across the industry.

¹⁴ This document is available from the Alliance for Telecommunications Industry Solutions (ATIS) at < <https://www.atis.org/docstore/product.aspx?id=27904> >.

¹⁵ This document is available from the Alliance for Telecommunications Industry Solutions at < <https://www.atis.org/docstore/product.aspx?id=28186> >.

Key areas being explored:

- Device Alarms.
- Registration Attempts.
- Blocked Calls.

Future Considerations:

- Call Trending.
- Active Polling.

2.2 Subcommittees & Task Forces

2.2.1 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 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.

Most types of communications service providers – including wireline, wireless, cable telephony, SS7, E911 providers, VoIP, and facility owners – are required to report telecommunication service disruptions pursuant to the FCC's rules. These reports are filed using NORS and analyzed by the FCC.

The FCC also developed a web-based 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 activated for major disasters (e.g., Category 2 storms). 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 was undertaken to develop recommendations that would provide clarification and assure consistency between the User Manual and the NORS production system. ORAS provided feedback in March 2013 to include VoIP Provider under Type of Entity Reporting. In addition, the Subcommittee also developed recommendations to enhance the malicious activity field to include if an outage is due to cybersecurity.

The Subcommittee also recommended the inclusion of a check box for Planned Outage reporting.

DIRS

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

DIRS-Lite

ORAS has collaborated in the development of the DIRS Lite Standard Operating Procedure (SOP) with the FCC.

Conclusion

Other industry bodies are providing input on the outage reporting systems and therefore ORAS was sunset in December 2014 after the NRSC provided recommendations to the FCC to modify the NORS¹⁶, DIRS¹⁷, and DIRS-Lite User Manuals, and other supporting documentation between 2009 and 2014.

2.2.2 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 worked closely to improve the quality and accuracy of the 1000+ current industry Best Practices. The Subcommittee previously completed a review of existing Best Practices, identifying suggested changes to wording and reference material, and during 2013 worked with the FCC Public Safety and Homeland Security Bureau to move those proposals through the process. A thorough review of new and modified Best Practices that were approved during the third Communications Security, Reliability and Interoperability Council (CSRIC III) was also conducted to prepare them to be integrated into the Best Practices online databases. The team also worked with the NRSC Copper Theft Task Force to create a new Best Practice dealing with copper theft that was later approved by CSRIC IV. A Best Practice tutorial, created by this Subcommittee, was presented to CSRIC IV Working Groups at the request of the FCC as they began their work to ensure the Best Practice process was well understood.

ATIS manages one of the two Best Practices web sites¹⁸, with the FCC maintaining the other site¹⁹. The Subcommittee monitors these websites and suggests enhancements as appropriate to improve their usefulness. During 2014 the team amended the definitions for Industry Role and Network Type, two identifying markers that help users better pinpoint the Best Practices that may be applicable to their specific situations. The team also debated as to the usefulness of specific Best Practice components (Taglines), which prompted a review by a CSRIC IV Working Group, and ultimately resulted in the elimination of that component.

The team also performed an analysis of Best Practices cited in official NORS outage reports and proposed the creation of an online Best Practice generator tool to ease the development of new Best Practices by CSRIC and others and improve their quality.

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.

¹⁶ The FCC NORS Manual can be found on the FCC site: < <http://transition.fcc.gov/pshs/services/cip/nors/nors.html> >.

¹⁷ The FCC DIRS Manual can be found on the FCC site: < <http://transition.fcc.gov/pshs/services/cip/dirs/dirs.html> >.

¹⁸ The ATIS Best Practices website is available at < <http://www.atis.org/bestpractices/Default.aspx> >.

¹⁹ The FCC Best Practices website is available at < <https://www.fcc.gov/nors/outage/bestpractice/BestPractice.cfm> >.

2.2.3 Regulatory Subcommittee

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.

3. Conclusion

As can be seen in this report, throughout the 2013 to 2014 timeframe, the NRSC has been active in researching and providing guidance on a number of 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.

Participation

Participating NRSC Member Companies

Alcatel-Lucent
Applied Communication Sciences
AT&T
CenturyLink
Comcast Cable
Cox Communications
CSI Telecommunications

Ericsson
MetroPCS
Office of Emergency Communications (OEC)
Sprint
T-Mobile
Time Warner Cable
Verizon



Figure 1 - NRSC Members at the ATIS 2015 Annual Meeting of the Committees (AMOC) in Atlanta, GA²⁰

²⁰ (From left to right: Tim Collier (Sprint), Mark Peay (Cox Communications), Andy Gormley (T-Mobile), Stacy Hartman (CenturyLink), Gail Linnell (Applied Communication Sciences), Jim Shortal (Cox Communications); Robin Howard (Verizon), Lynette Van Someren (Comcast), Harold Salters (T-Mobile), Joan Vaughn (T-Mobile).

NRSC Subcommittee, Subteam, & Task Force Participants

Outage Reporting Advisory Subcommittee (2013-2014)

Chair: Rick Canaday, AT&T, (2013)

Vice Chair: Rose Fiala, T-Mobile, (2013)

Co-Chair: Sarah Wolff, Verizon (2014)

Co-Chair: Becky Wormsley, Ericsson Representing Sprint (2014)

Rick Krock, Alcatel-Lucent

Paul Wolfson, Alcatel-Lucent

Gail Linnell, Applied Communication Sciences

Rick Canaday, AT&T

Richard Griepentrog, AT&T

Erik Lawrence, AT&T

Stacy Hartman, CenturyLink

Mark Peay, Cox Communications

Becky Wormsley, Ericsson

Timothy Collier, Sprint

Shane Finn, Time Warner Cable

Andy Gormley, T-Mobile USA

Harold Salters, T-Mobile USA

Ken Dausy, Verizon

Robin Howard, Verizon

Sarah Wolff, Verizon

Chris Oberg, Verizon Wireless

Best Practices Subcommittee (2013-2014)

Co-Chair: Rick Krock, Alcatel-Lucent (2013-2014)

Co-Chair: Robin Howard, Verizon (2013-2014)

Rick Krock, Alcatel-Lucent

Paul Wolfson, Alcatel-Lucent

Gail Linnell, Applied Communication Sciences

Rick Canaday, AT&T

Richard Griepentrog, AT&T

Erik Lawrence, AT&T

Stacy Hartman, CenturyLink

Mark Peay, Cox Communications

Becky Wormsley, Ericsson

Timothy Collier, Sprint

Shane Finn, Time Warner Cable

Andy Gormley, T-Mobile USA

Harold Salters, T-Mobile USA

Ken Dausy, Verizon

Robin Howard, Verizon

Sarah Wolff, Verizon

Chris Oberg, Verizon Wireless

Regulatory Subcommittee (2013-2014)

Co-Chair: Stacy Hartman, CenturyLink (2013-2014)

Co-Chair: Harold Salters, T-Mobile (2014)

Rick Krock, Alcatel-Lucent

Paul Wolfson, Alcatel-Lucent

Gail Linnell, Applied Communication Sciences

Rick Canaday, AT&T

Richard Griepentrog, AT&T

Erik Lawrence, AT&T

Stacy Hartman, CenturyLink

Jeff Hubbard, CenturyLink

Mark Peay, Cox Communications

Becky Wormsley, Ericsson

Timothy Collier, Sprint

Shane Finn, Time Warner Cable

Andy Gormley, T-Mobile USA

Harold Salters, T-Mobile USA

Ken Dausy, Verizon

Robin Howard, Verizon

Sarah Wolff, Verizon

Chris Oberg, Verizon Wireless

Copper Theft Deterrent Subteam (2013)

Leader: Rose Fiala, T-Mobile

Rick Krock, Alcatel-Lucent

Paul Wolfson, Alcatel-Lucent

Gail Linnell, Applied Communication Sciences

Rick Canaday, AT&T

Richard Griepentrog, AT&T

Erik Lawrence, AT&T

Stacy Hartman, CenturyLink

Jeff Hubbard, CenturyLink

Mark Peay, Cox Communications

Becky Wormsley, Ericsson

Timothy Collier, Sprint

Shane Finn, Time Warner Cable

Andy Gormley, T-Mobile USA

Harold Salters, T-Mobile USA

Ken Dausy, Verizon

Robin Howard, Verizon

Sarah Wolff, Verizon

Chris Oberg, Verizon Wireless

Fiber Cut Task Force (2014)

Task Force Co-Chair: Gail Linnell, Applied Communication Sciences

Task Force Co-Chair: Chris Oberg, Verizon

Rick Krock, Alcatel-Lucent

Paul Wolfson, Alcatel-Lucent

Gail Linnell, Applied Communication Sciences

Rick Canaday, AT&T

Richard Griepentrog, AT&T

Erik Lawrence, AT&T

Stacy Hartman, CenturyLink

Lynette Van Someren, Comcast Cable

Mark Peay, Cox Communications

Becky Wormsley, Ericsson

Timothy Collier, Sprint

Shane Finn, Time Warner Cable

Andy Gormley, T-Mobile USA

Harold Salters, T-Mobile USA

Ken Dausy, Verizon

Robin Howard, Verizon

Sarah Wolff, Verizon

Chris Oberg, Verizon Wireless

IP Reliability Task Force (2014)

Task Force Co-Chair: Mark Peay, Cox Communications

Task Force Co-Chair: Chris Oberg, Verizon

Rick Krock, Alcatel-Lucent

Paul Wolfson, Alcatel-Lucent

Gail Linnell, Applied Communication Sciences

Rick Canaday, AT&T

Richard Griepentrog, AT&T

Erik Lawrence, AT&T

Stacy Hartman, CenturyLink

Jeff Hubbard, CenturyLink

Lynette Van Someren, Comcast Cable

Mark Peay, Cox Communications

Becky Wormsley, Ericsson

Timothy Collier, Sprint

Shane Finn, Time Warner Cable

Andy Gormley, T-Mobile USA

Harold Salters, T-Mobile USA

Ken Dausy, Verizon

Robin Howard, Verizon

Sarah Wolff, Verizon

Chris Oberg, Verizon Wireless

Planned Maintenance (2014)

Task Force Chair: Gail Linnell, Applied Communication Sciences

Rick Krock, Alcatel-Lucent
Paul Wolfson, Alcatel-Lucent
Gail Linnell, Applied Communication Sciences
Rick Canaday, AT&T
Richard Griepentrog, AT&T
Erik Lawrence, AT&T
Stacy Hartman, CenturyLink
Jeff Hubbard, CenturyLink
Lynette Van Someren, Comcast Cable
Mark Peay, Cox Communications
Becky Wormsley, Ericsson
Timothy Collier, Sprint
Shane Finn, Time Warner Cable
Andy Gormley, T-Mobile USA
Harold Salters, T-Mobile USA
Ken Dausy, Verizon
Robin Howard, Verizon
Sarah Wolff, Verizon
Chris Oberg, Verizon Wireless

Procedural Service Provider Task Force (2013)

Task Force Co-Chair: Gail Linnell, Applied Communication Sciences

Task Force Co-Chair: Tim Collier, Sprint

Rick Krock, Alcatel-Lucent
Paul Wolfson, Alcatel-Lucent
Gail Linnell, Applied Communication Sciences
Rick Canaday, AT&T
Richard Griepentrog, AT&T
Erik Lawrence, AT&T
Stacy Hartman, CenturyLink
Jeff Hubbard, CenturyLink
Mark Peay, Cox Communications
Becky Wormsley, Ericsson
Timothy Collier, Sprint
Shane Finn, Time Warner Cable
Rose Fiala, T-Mobile USA
Harold Salters, T-Mobile USA
Ken Dausy, Verizon
Robin Howard, Verizon
Sarah Wolff, Verizon
Chris Oberg, Verizon Wireless

DS3 Simplex Subteam (2013)

Leader: Robin Howard, Verizon (2013)

Rick Krock, Alcatel-Lucent
Paul Wolfson, Alcatel-Lucent
Gail Linnell, Applied Communication Sciences
Rick Canaday, AT&T
Richard Griepentrog, AT&T
Erik Lawrence, AT&T
Stacy Hartman, CenturyLink
Jeff Hubbard, CenturyLink
Mark Peay, Cox Communications
Becky Wormsley, Ericsson
Timothy Collier, Sprint
Shane Finn, Time Warner Cable
Andy Gormley, T-Mobile USA
Harold Salters, T-Mobile USA
Ken Dausy, Verizon
Robin Howard, Verizon
Sarah Wolff, Verizon
Chris Oberg, Verizon Wireless

Large DS3 Outages Subteam (2013)

Leader: Robin Howard, Verizon

Rick Krock, Alcatel-Lucent
Paul Wolfson, Alcatel-Lucent
Gail Linnell, Applied Communication Sciences
Rick Canaday, AT&T
Richard Griepentrog, AT&T
Erik Lawrence, AT&T
Stacy Hartman, CenturyLink
Jeff Hubbard, CenturyLink
Mark Peay, Cox Communications
Becky Wormsley, Ericsson
Timothy Collier, Sprint
Shane Finn, Time Warner Cable
Ken Dausy, Verizon
Robin Howard, Verizon
Sarah Wolff, Verizon
Chris Oberg, Verizon Wireless

Wireless Subteam (2014)

Task Force Chair: Gail Linnell, Applied Communication Sciences

Rick Krock, Alcatel-Lucent

Paul Wolfson, Alcatel-Lucent

Gail Linnell, Applied Communication Sciences

Rick Canaday, AT&T

Richard Griepentrog, AT&T

Erik Lawrence, AT&T

Stacy Hartman, CenturyLink

Mark Peay, Cox Communications

Becky Wormsley, Ericsson

Timothy Collier, Sprint

Shane Finn, Time Warner Cable

Andy Gormley, T-Mobile USA

Harold Salters, T-Mobile USA

Ken Dausy, Verizon

Robin Howard, Verizon

Sarah Wolff, Verizon

Chris Oberg, Verizon Wireless

Companies in Attendance at the 2013-2014 Public NRSC Quarterly Meetings

Alcatel-Lucent
Alpheus
Applied Communication Sciences
AT&T
Brighthouse Networks
CellularOne
CenturyLink
Charter
Comcast Cable
Consolidated Communications
Cox Communications
Cricket Communications
DC PSAP
DC.Gov
DSCI Corporation
Ericsson
FairPoint Communications
FCC
iconectiv
Intrado
Kymeta
Lightbridge Communications Corporation
Leaco Rural

Level 3
LKVS
MCTCOhio
MCTV
Meteor Telecommunications
MetroPCS
NortheastTel
nSight
NTT Docomo
Office of Emergency Communications
Spok
Sprint
Suddenlink
Supernet
T- Mobile
TDM Mobility
TDS Telecom
Telecommunications Reports Daily
Time Warner Cable
USA Mobility
Verizon Wireless
Windstream
XO Communications