

Trends in Utility Smart Grid Communications Management

A GTM Research Whitepaper

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Abstract

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Network management systems represent an emerging and critical market for the utility industry. As utilities deploy more intelligent endpoints and communications networks to support their smart grid activities, many of today's homegrown and proprietary solutions are insufficient to address the problems that utilities face. Utilities are struggling to extract value from existing systems and equipment because of the prevalence of siloed networks, and these difficulties in managing multiple AMI platforms are only going to increase as utilities deploy additional applications. Robust, central tools to manage telecommunications can help utilities eliminate operational and personnel inefficiencies, optimize the capacity of deployed equipment, and consolidate the management and views of multiple networks.

CHAPTER 1

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Executive Summary

Utilities around the globe are heavily investing in communications infrastructure to support advanced metering infrastructure (AMI), demand response (DR) and distribution automation (DA), fueled by government grants, regulatory requirements and the high cost of inefficiently delivering energy. With new smart grid systems falling into place, many utilities are now looking to optimize the performance and efficiency of their deployed assets.

Network management systems represent an emerging and critical market for the utility industry. Utilities are beginning to seek comprehensive, technology-agnostic solutions to help manage their multi-technology, multi-vendor communications networks that are built for an exponentially growing number of intelligent endpoints. Many utilities are struggling to extract value from existing systems and equipment because of the prevalence of proprietary, siloed networks, and these difficulties in managing multiple AMI platforms are only going to increase as utilities deploy additional applications. Robust, centralized tools to manage telecommunications can help utilities eliminate operational and personnel inefficiencies.

Many of today's homegrown solutions are insufficient to address the problems that utilities are beginning to face. To avoid an ecosystem of fragmented communication networks, utilities must start thinking about network infrastructure in parallel with the electric grid structure. This white paper explores the solutions that utilities have deployed to date, as well as their future plans for communications management and emerging concerns as they invest more in telecommunications for the grid.

Key findings from this report:

- Utilities of every size, type and location expect the number of endpoints to grow over the next five years, and they are planning significant investments in communications as they build out the infrastructure for their networks.
- The lack of standards in communications and networking is creating real concern in the utility community, and the problem is viewed as becoming larger as the number of endpoints increases. IOUs almost universally respond with the argument that standards are a moderate to significant challenge.
- Most utilities are confident in their ability to deal with communications challenges, but few report that their communications networks are ready to support their two- to five-year plans. Only 4% of utilities say their current communications management systems are adequate going forward, with more than a quarter (28%) saying it's a serious problem or increasingly unmanageable.
- Utilities want to take full advantage of the network capacity they have deployed and make systems more efficient with added intelligence. Although utilities have not traditionally allocated funds for network management solutions, they are beginning to recognize the numerous potential benefits of integrated and consolidated network platforms.

CHAPTER 2

Background and Methodology

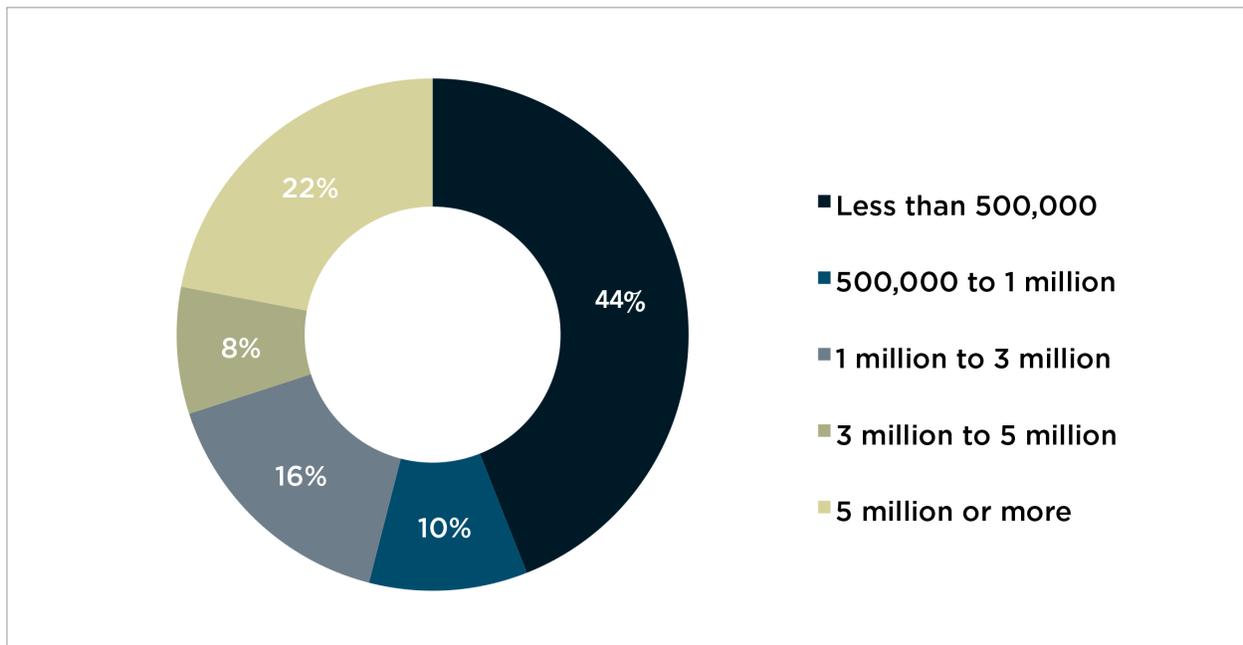
This report provides information about the current and projected status of global utility telecommunications networks through 2018, as well as highlighting key areas of concern for utilities and potential areas of growth for new solutions. The qualitative and quantitative data is based on the findings from an online survey of utilities developed by Ericsson and GTM Research, a division of Greentech Media.

The survey was distributed to a statistically representative sample of global utility employees that are fully or partially responsible for smart grid communications, third-party communications provider relationships, or IT that supports the communications network. North American utilities made up the majority of survey respondents, accounting for 76% of responses. Europe and Israel accounted for the next-largest category with 12%, with the remaining 12% made up of utilities in South America, Asia and Australia.

At 44%, nearly half of the respondents were from investor-owned utilities, while 34% came from municipal utilities and 6% from cooperative utilities. The remaining 16% included responses from independent power producers, regional transmission organizations, providers of hosted network operations for a utility, and other foreign entities that didn't fit into the other classifications.

The respondents typically represented larger utilities, with 46% reporting they have more than 1 million customers.

Figure 2-1: Number of End Customers at Respondent Utilities



Source: GTM Research

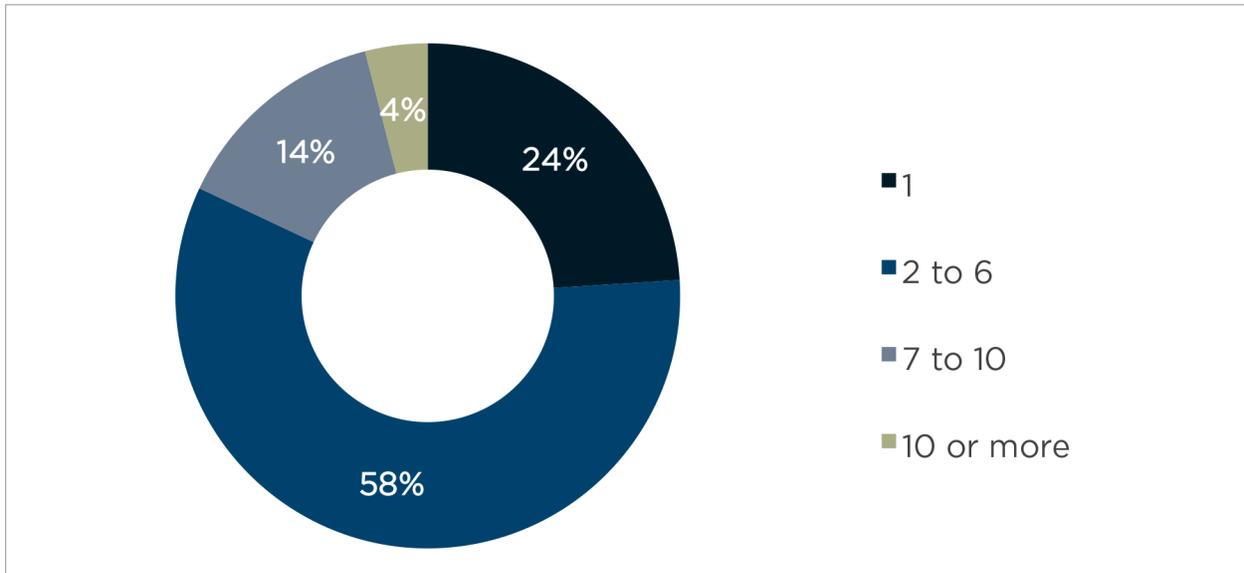
CHAPTER 3

Utility Communications Networks

3.1 Current Deployments

There is no one-size-fits-all communications technology for the smart grid. The diversity in variables such as population density, service territory size, topology and budget of global utilities for new deployments—as well as the different bandwidth and latency requirements of applications within each utility—has resulted in the majority of utilities deploying and managing several communications solutions. Less than a quarter of utilities have just one communications network to manage, with 58% of utilities reporting that they have between two and six networks operating, 14% with seven to ten networks, and 4% with ten or more networks.

Figure 3-1: Number of Communications Networks Operating at Respondent Utilities



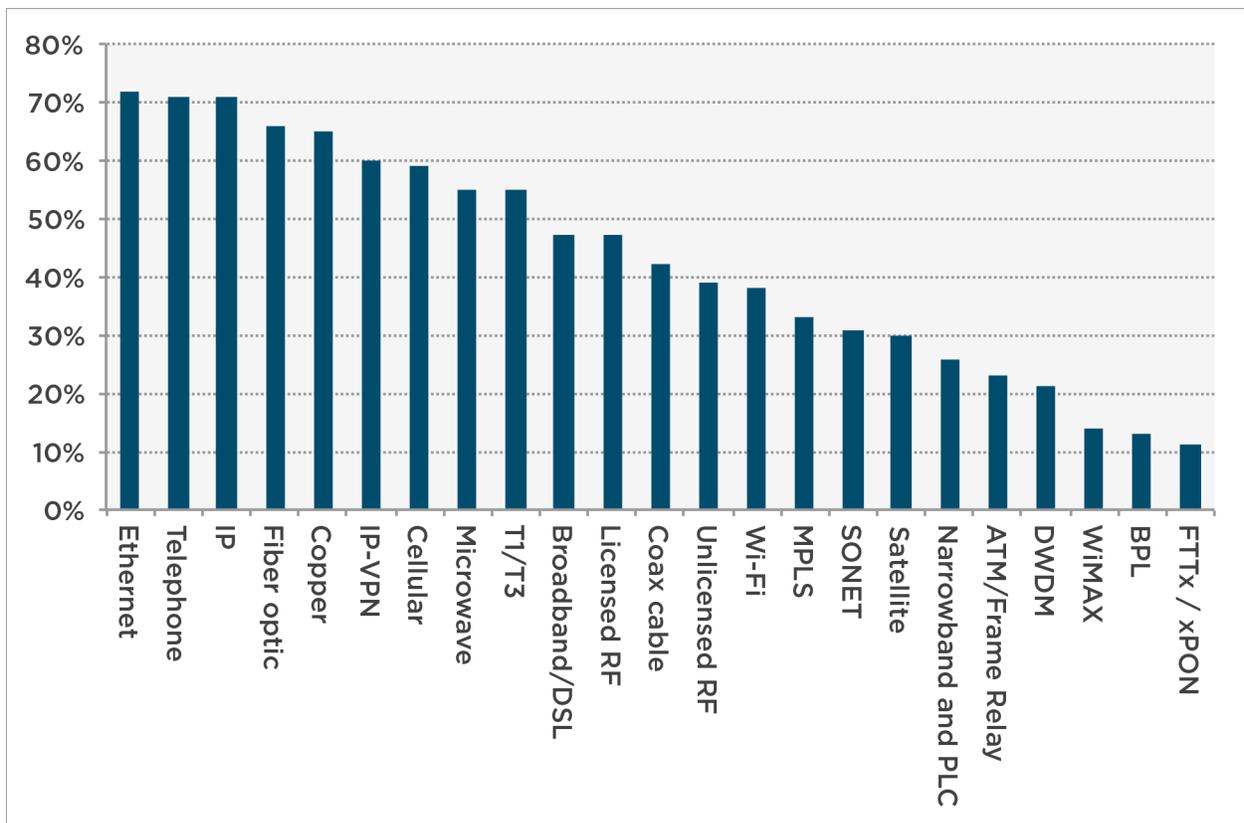
Source: GTM Research

Utilities also have numerous communications platforms and networking protocols operating in their networks today. The majority of network communications still rely on private networks. The most widely deployed communications by utilities are telephone, fiber, copper, cellular, Ethernet, internet protocol (IP), IP virtual private networks (IP-VPN), microwave and T1/T3, which are cited as being used by at least 50% of respondents. The interoperability challenges of multiple networks have led many utilities to adopt IP-based networking, while mediums such as fiber optic and Ethernet—both of which are low latency, high bandwidth technologies—are being used in utility data backhaul.

Conversely, broadband over power line, WiMAX and FTTx/xPON are the least commonly deployed technologies, in use at less than 15% of utilities surveyed. Powerline communication (PLC) is also

infrequently deployed, in use at less than 30% of the surveyed utilities. Although these results reflect the state of communications in the global utility industry, it's important to note that there are regional differences in technology adoption. For example, WiMAX has been widely deployed in Australia by SP AusNet, while PLC is a dominant technology for access communications in Europe. Neither technology has gained significant footing in the rapidly evolving smart grid markets in North America or Asia. Long Term Evolution (LTE), an advanced cellular communications technology, is in limited deployment in private utility networks, including Ausgrid in Australia and a partnership between Green Mountain Power and Vermont Telephone Company in the United States, but it's quickly gaining traction as the first global cellular standard because of its performance characteristics and support for IP.

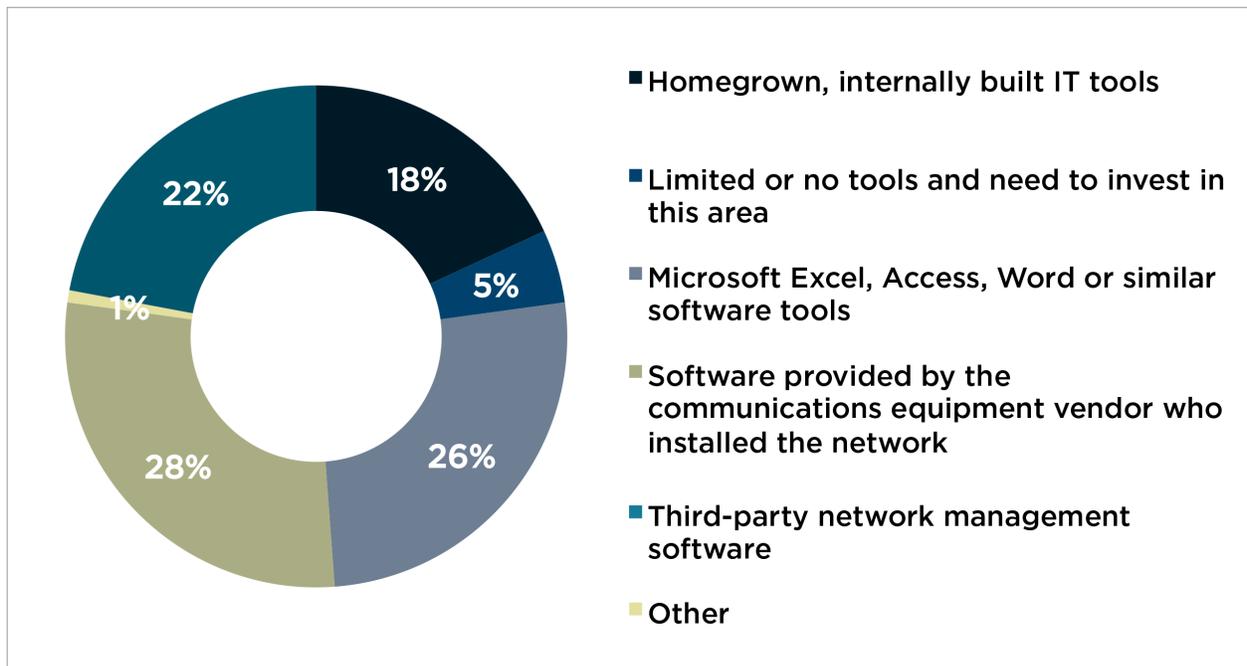
Figure 3-2: Types of Utility Communications Technologies Now in Use



Source: GTM Research

The large array of technologies in use by utilities is not necessarily a bad thing, but with more technologies in play, utility networks can be more difficult to manage. Only 22% of respondents have already purchased third-party network management software, with 72% of utilities using vendor-specific, homegrown or basic spreadsheet tools to manage their networks.

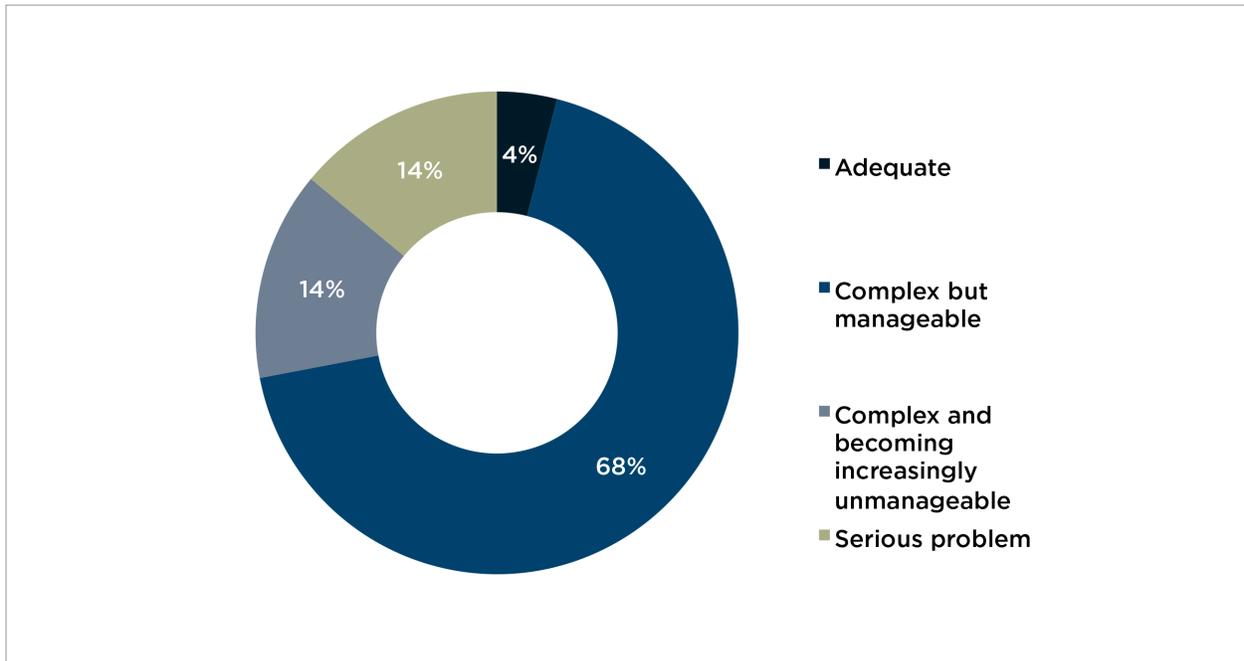
Figure 3-3: Tools Used to Manage and Analyze Communication Networks



Source: GTM Research

Many of today’s homegrown or proprietary solutions are insufficient to address the interoperability challenges that utilities are beginning to face, creating a significant market for growth for third-party network management vendors. Only 4% of utilities said today’s network management tools were adequate for the future, which indicates that utilities are prepared to invest additional money in network management. A combined 28% said today’s network management capabilities were increasingly unmanageable or constituted a serious problem. While 68% of utilities reported that their networks are manageable, there is a substantial margin to increase network efficiencies through consolidation and integration, resulting in tangible savings.

Figure 3-4: The State of Smart Grid Communication Networks at Utilities



Source: GTM Research

Demands on utility employees that manage communications are increasing with the deployment of new AMI networks in recent years, but communications teams remain relatively small at the respondent utilities, with half reporting teams numbering one to 25 employees. Nearly a quarter said their communications network teams were 50 to 100 FTEs, while only 10% had 100 or more employees. The size of these teams will increase as utilities increase the number of devices and networks being used, with one-third of utilities saying they plan to hire additional communications staff and consultants to improve the management of communications networks.

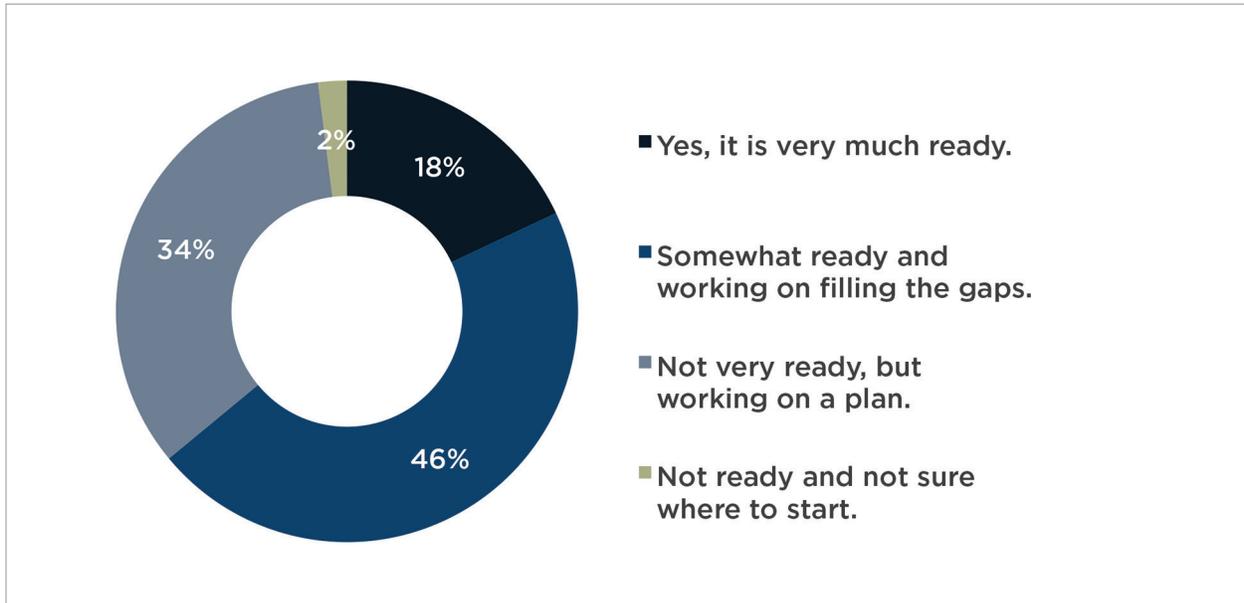
3.2 Future Plans

The drivers for smart grid communications spending at global utilities have changed now that the initial boosts provided by stimulus funding and government investment have run their course in many countries. The introduction of additional applications and devices is forcing utilities to expand their networks, as is the need to integrate deployed assets into existing networks and to consolidate siloed networks.

There is also still a significant market for AMI communications. In the U.S. market, where the vast majority of IOUs have made their AMI decisions, growth markets for AMI communications are primarily in the small and mid-size utility space, particularly municipal utilities, as well as water and gas utilities looking to take advantage of advances and cost reductions in communications thanks to the proliferation of AMI for electric meters. Distribution automation is increasingly being cited by utilities as a justification for smart grid network investment, with a particular emphasis on reclosers, capacitor banks and voltage regulators.

Most utilities say their current networks aren't sufficient to support their smart grid activities over the next two to five years, and as a result, many are planning to increase spending to acquire additional employees, and to deploy more intelligent endpoints and communications networks. Only 18% of utilities say their networks are ready to support their future smart grid projects, with the remainder still developing a plan for communications—a critical step to developing an interoperable, cost-effective communications environment.

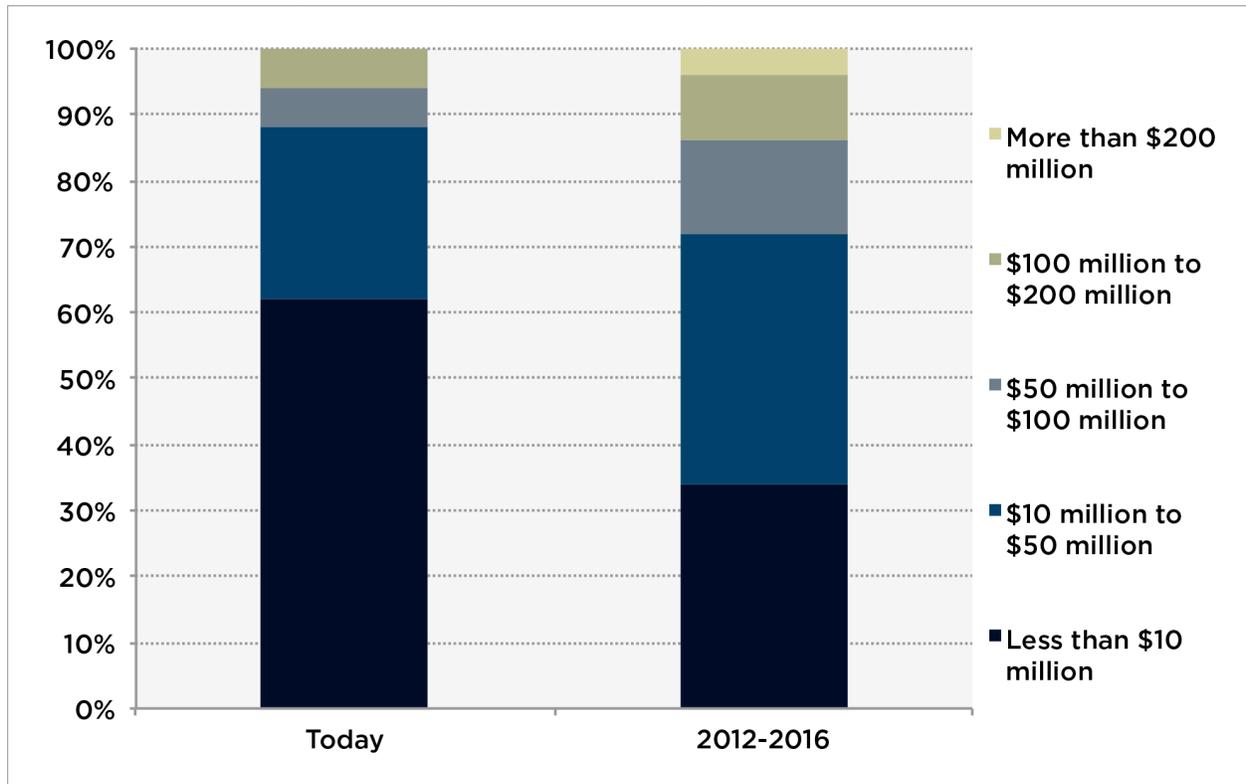
Figure 3-5: Future Demands on Current Communication Networks at Utilities



Source: GTM Research

Utilities will continue to develop and implement plans for smart grid communications for the next several years, with the majority planning to increase their spending during the next five years. While 62% of utilities plan to spend less than \$10 million on communications in 2012, only 34% of utilities expect to have a similar communications budget during the next five years. A total of 38% of utilities plan to spend \$10 million to \$50 million over the next five years, up from 26% in 2012; 14% are planning \$50 million to \$100 million, up from 6% in 2012; and 10% plan to spend \$100 million to \$200 million, up from 6% in 2012. In addition, 4% of utilities expect to spend more than \$200 million, as compared to no utilities reporting plans of that magnitude in 2012.

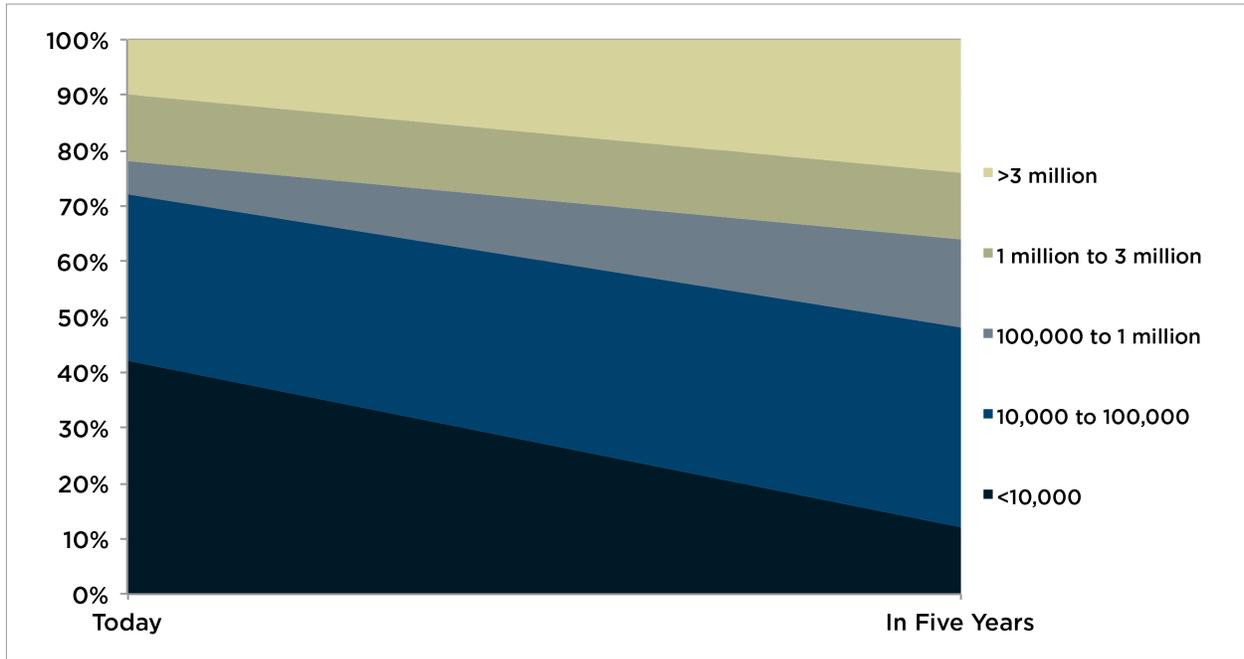
Figure 3-6: Current and Projected Spending on Communications by Utilities



Source: GTM Research

Variables that are driving an increase in the number of intelligent communication devices and the types of communications technologies being deployed by utilities include the completion of current AMI deployments; the growth of new applications in DA; and the escalating adoption of distributed generation and electric vehicles. Half of the utilities surveyed expect to increase the number of networks they operate in two years, while no utilities expect that the number of networks will decrease. More than two-thirds of utilities expect the number of communications devices deployed to increase drastically within five years. Although 40% of utilities currently have fewer than 10,000 communication devices, only 10% expect that to hold true in five years. On the other end of the spectrum, just 10% of utilities have more than 3 million devices in their networks today, but roughly a quarter of respondents expect to have that many or more devices in their networks in five years.

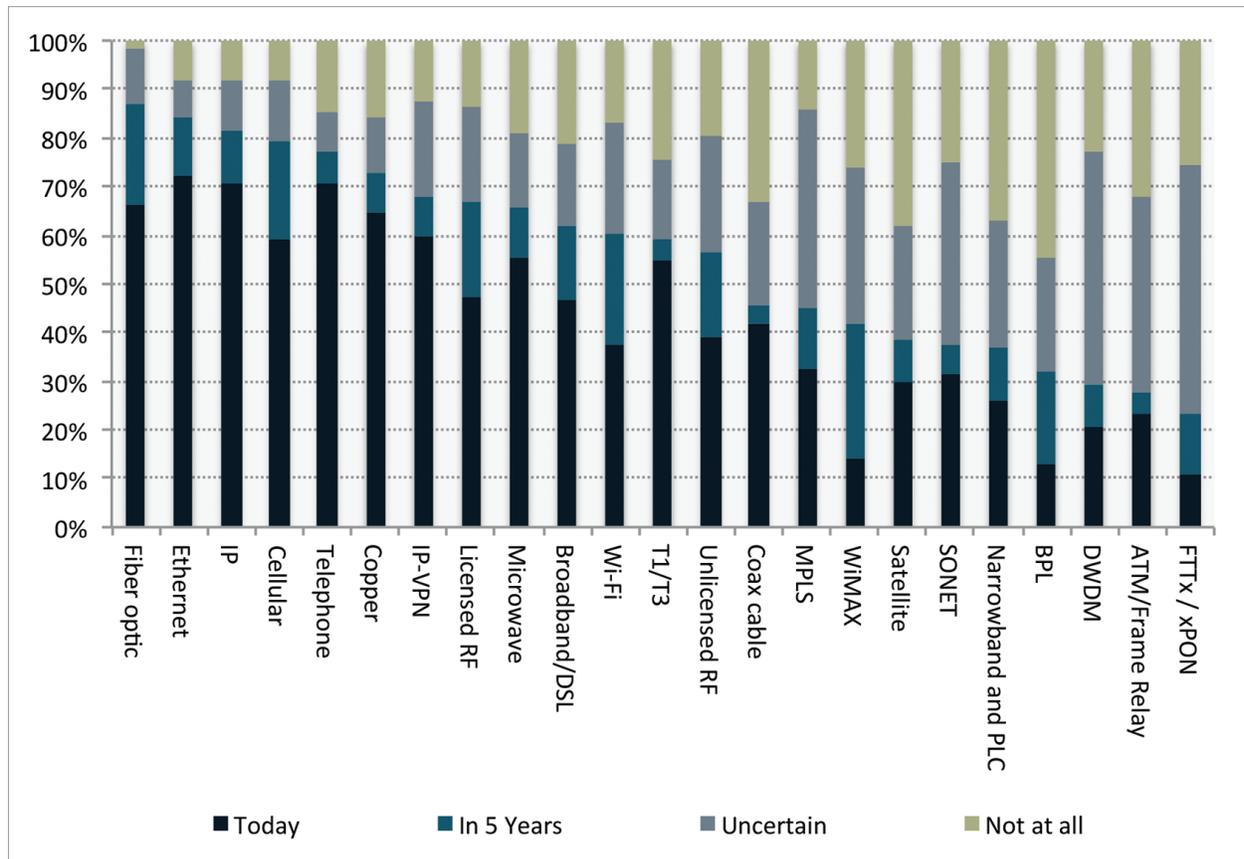
Figure 3-7: Current and Projected Number of Communications Devices at Utilities



Source: GTM Research

The growth in endpoints is causing the volume of data transmitted for utility operations to skyrocket. The overall trend for utilities is moving toward higher-bandwidth and lower-latency networks to address the increased supply of data. Although wired technologies such as fiber can provide some of the most reliable, high-performance networks, the high cost of deploying such technologies is in many cases a barrier. As such, wireless technologies are likely to dominate new global communications deployments for AMI and DA, with utilities expecting the biggest gains in WiMAX, Wi-Fi, fiber, cellular and licensed RF deployments during the next five years, with gains of 20% to 27%. Conversely, lower-performance technologies including telephone, copper and coaxial cable, as well as satellite, which can be costly for data transmission, will see the least amount of growth in the next five years due to the bandwidth and latency demands of new applications.

Figure 3-8: Current and Projected Types of Communication Networks at Utilities



Source: GTM Research

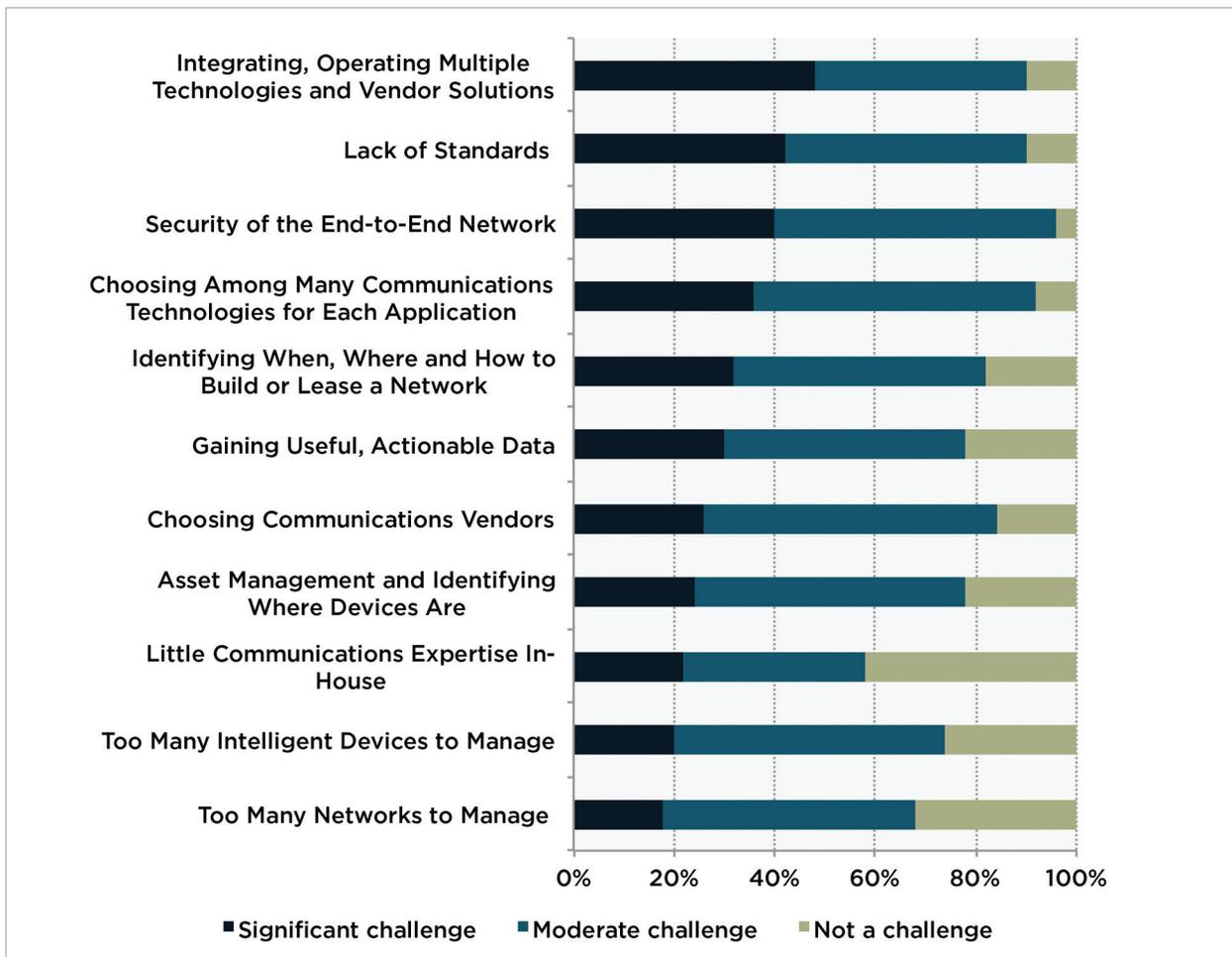
More than 60% of utilities expect their communications technologies to include fiber, copper, broadband, telephone, microwave, cellular, Wi-Fi, licensed RF, Ethernet, IP and IP-VPN in the next five years. Meanwhile, the technologies that utilities say are most likely to be excluded from their five-year plans are BPL, PLC, satellite, coaxial cable and ATM/Frame Relay. Utilities were the most uncertain about whether they would incorporate FTTx / xPON, DWDM, MPLS, ATM/Frame Relay, SONET and WiMAX during this timeframe.

A utility's choice of communications technology is frequently dependent on the location within the network and existing utility communication equipment that can be leveraged. Cost, reliability, performance and technology longevity will play the biggest roles in utility decision-making pertaining to communications technologies during the next several years, with each technology requiring the utility to make some tradeoffs. For wireless technologies, for example, the increasing demand for wireless communications across all industries can positively impact the cost and performance of wireless utility networks. Increasing interference means higher latency and increased read failures on unlicensed networks such as RF mesh and Wi-Fi, while there are high costs and significant barriers to entry for utilities looking to acquire licensed spectrum for RF long-range radio, cellular and some WiMAX solutions. Utilities are more likely to consider the impact of these reliability concerns when choosing solutions for mission-critical DA applications.

3.3 Top Utility Concerns

Utilities cited several main concerns related to operating their current networks and making additional investments in communications. The foremost problem is that utilities are struggling to integrate and operate vendor-specific networks, with 48% reporting it as a significant challenge. This problem will be exacerbated as more grid assets are deployed without a clear utility communication strategy. Particularly at utilities that have merged with or acquired other energy companies, there are challenges associated with the lack of a standardized approach to managing communications networks, whether caused by different vendor choices at each property or by operational practice differences such as the way devices are configured. Network management solutions can help utilities by providing a unified configuration standard and a unified view of networks, which can produce workforce efficiencies and provide information to help reduce faults and inefficiencies in power delivery.

Figure 3-9: Top Concerns About Communications at Respondent Utilities



Source: GTM Research

Standards also pose a significant challenge for utilities. The promulgation of numerous interoperability standards has led to the widespread adoption of proprietary networking solutions and protocols. Integrating these networks is a challenge that will persist with future versions of software and hardware.

A total of 42% of utilities called the current state of standards a significant challenge for deploying and operating communication networks, with only 10% indicating no challenges due to standards. Of that 10%, 80% consists of respondents that have fewer than 500,000 customers, indicating that the lack of standards is less of a problem in small deployments.

Security of end-to-end networks is the third-most cited concern, with 40% of utilities calling it a significant challenge, and only 4% saying security is not a challenge.

Utilities are having difficulty choosing technologies, deciding where to deploy them, and picking vendors, with more than 80% reporting these decisions as significant or moderate challenges. That could be in part because utilities are concerned by the lack of communications expertise in-house, with 22% of utilities reporting that in-house communications expertise is a significant challenge and 36% calling it a moderate challenge.

Less of a concern for utilities is having too many communications networks or devices to manage, as many utilities have managed multiple communications networks prior to deploying new smart grid technologies. A total of 18% of respondents said having too many networks is a significant challenge, while 32% said this is not a concern.

3.4 Network Management Solutions for Utilities

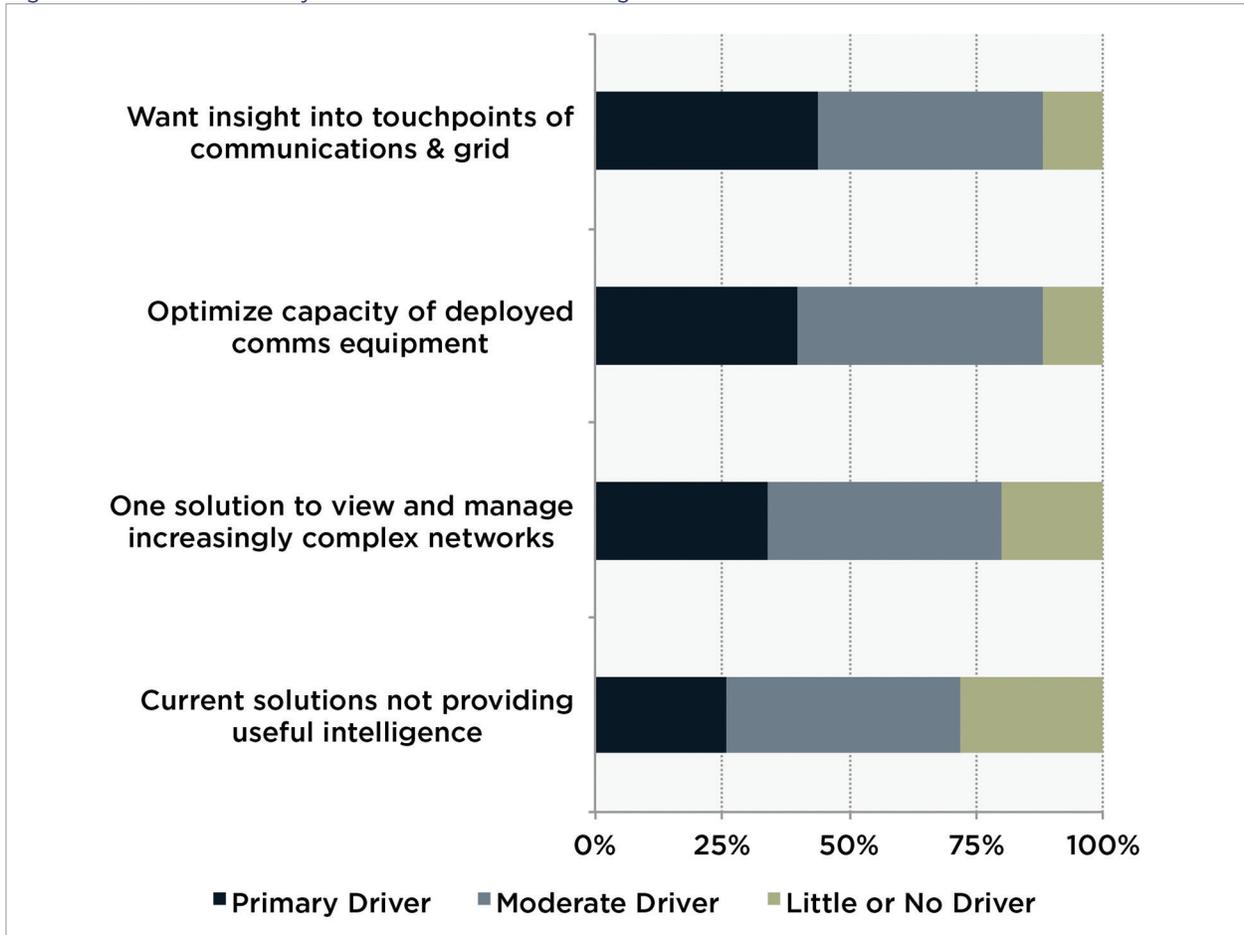
The interoperability and standards problems that utilities face today are likely only to worsen as utilities deploy more communications equipment to support their expanding smart grid portfolios. As such, utilities looking to maximize their investments should consider deploying network management software to assist them with:

- Integrating proprietary networks
- Supporting multiple applications
- Managing the health of numerous networks

A network management solution integrates all of a utility's systems into one interface for monitoring and control. Network management systems that provide comprehensive, technology-agnostic solutions represent an emerging and critical market.

Utilities increasingly view network management as a necessary piece of their communications strategies. One key driver of adoption will be the ability for network management software to provide insight into the touch points between power and communications equipment. A total of 88% of utilities said that this capability is a reason to invest in network management, with 44% calling it the primary driver.

Figure 3-10: Drivers for Utility Investment in Network Management



Source: GTM Research

Other key features of network management that utilities cited as driving their investments are the ability to optimize the capacity of deployed equipment and the ability to consolidate the management and views of multiple networks.

CHAPTER 4

Case Study: Hydro One and Ericsson

Figure 4-1: Network Management Case Study at Hydro One

CHALLENGE
<ul style="list-style-type: none"> • Improve communications network management through better tracking of assets to ensure the reliability of the network in support of the grid
<ul style="list-style-type: none"> • Provide quality commercial services and assure SLAs
<ul style="list-style-type: none"> • Implement process automation to quickly identify the impact of telecom network failures on the power grid and support fast restoration
SOLUTION
<ul style="list-style-type: none"> • Ericsson’s Granite Inventory and Network Engineer communications network management systems
<ul style="list-style-type: none"> • COMMON LANGUAGE® Information Services
<ul style="list-style-type: none"> • Deployment support, including system installation and configuration, modeling of the communications network and power grid elements, data migration and user training
RESULTS
<ul style="list-style-type: none"> • Power line service impact assessment time reduced from hours to less than a minute
<ul style="list-style-type: none"> • More efficient use of network capacity due to improved visualization of the network
<ul style="list-style-type: none"> • Year-on-year business volume growth in commercial services

Source: Ericsson

Safety and reliability have always been top priorities for electric utility companies. With new devices being added to the mix, from wind turbines to smart meters and more, there are now thousands of new potential points of failure. Managing the grid’s increasingly complex telecommunications network is critical to ensuring reliable power delivery. Hydro One Telecom has risen to the challenge, using Ericsson’s communications support solutions as the foundation for its network and service management efforts.

Hydro One Telecom was faced with an expanding telecom network that had outgrown its management tools. Its disparate network inventory systems were built around ad hoc data. As a result, the information they contained was inaccurate and unreliable.

Hydro One Telecom recognized the need for a comprehensive inventory management system for its telecommunications assets – one that would maintain up-to-date, accurate information on all key network elements, attributes and configurations. This system would become the cornerstone for allowing it to quickly and efficiently identify network issues and impacted grid elements.

Ericsson was selected to deploy its Granite Inventory, Network Engineer and COMMON LANGUAGE® solutions. Tero Kontio, IT Director at Hydro One Telecom, explains what the rollout meant for the company: “The platform was a significant enabler for us to move ahead with various automation initiatives, and gave us our inventory ‘book of record.’ It quickly became the center of our telecommunications network universe.”

Since then, Granite Inventory has become an essential part of Hydro One Telecom's expanding operations. It stores information about the entire multi-vendor, multi-technology communications infrastructure, topology, IP addresses, firmware and configurations. Supporting its need to document the location of all physical cable and network equipment, Ericsson Network Engineer provides the company's personnel with a graphically rich view of its network, while COMMON LANGUAGE® provides a uniform set of location identifiers.

Having fast access to reliable network information has helped Hydro One Telecom in a number of areas, one being its Service Impact Analysis (SIA).

"Our SIA tool can pull out the information it needs to determine what services are down and identify the remaining level of network redundancy to the power system," explains Dan de Jesus, IT Program Manager at Hydro One Telecom. "With this information at hand, the power specialists can decide whether to shut down the power line entirely, reduce the power load, or take no immediate action." Since its deployment, service impact analysis time has been reduced from hours to less than a minute.

The Ericsson solution plays a key role in managing equipment installation and configuration, circuit and service provisioning, and planned and unplanned outages. It has become integral to Hydro One Telecom's management of the communications network infrastructure, supporting critical grid elements from power lines to smart meters. It is also essential for successfully conforming to service-level agreements (SLAs) with its commercial broadband customers.

Future Ericsson projects at Hydro One will enable the utility to bring alternative sources of energy onto their network, as well as to support 4G wireless backhaul. "We've clearly come a long way in the last ten years," says Tero Kontio. "But as we continue to roll out new smart grid applications, I can see that we will have to keep getting better in terms of telecom network management and assurance. Ericsson will be an important part of that, no question."

CHAPTER 5

Recommendations for Utilities

Many early smart grid deployments, especially in the U.S., saw utilities deploy dedicated networks for each vendor or application, resulting in an ecosystem of fragmented networks that can be difficult to manage. Taking lessons from those early adopters, utilities are now embracing the idea of building comprehensive communications networks that can serve a number of smart grid applications.

There is no silver bullet for building utility communication networks. Utilities are finding that the most cost-effective networks often consist of numerous platforms that serve the varying bandwidth, latency and prioritization needs of various smart grid applications.

With the rapid evolution of communications technologies over the past two decades, utilities must carefully consider their options. Although higher-performance networks are increasingly available at lower costs, utilities must consider strategies for managing, integrating and operating various technologies and vendor solutions in order to optimize their investments.

Similarly, the recent transition of market drivers for smart grid communications from AMI to DA illustrates the uncertainty of selecting the key performance characteristics of a network that will be in place for decades. The interoperability and manageability of networks are vital to maintaining the value of these assets in the long term, and network management solutions can effectively address these problems.

Trends in Utility Smart Grid Communications Management

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