Solutions for managing a utilities telecoms network

Contents

Introduction

All electrical utility companies have a telecoms network. This is currently used for SCADA, for internal telecoms, occasionally to lease out to third parties, and sometimes to provide telecoms services to their end customers. In all cases, this telecoms network needs managing, in the same way that the electrical network needs managing – knowing where the network assets are, how they are connected, and how they are performing to deliver service to end customers.

However, the electric industry is going through an evolution. With world energy consumption predicted to increase by 35% between by 2040, and the renewable share of world electricity generation set to increase by 150% by 2040[1], the electric networks of today need to change. As the electrical grid becomes ever more intelligent deploying a wide range of sensors and intelligent devices so the telecoms network that supports the grid becomes ever more critical to enable the intelligent control, operational efficiency and flexibility, and increased network reliability of the grid.

This white paper discusses the challenges facing the electric industry, both managing the existing network and moving towards an intelligent grid infrastructure, and highlights the central role an advanced asset management solution will play in managing the telecoms network. Based on such a solution, the electric utility will be in a position to deliver more network reliability, faster response times to outages, reduced cost and increased efficiency.

The Challenge

The implementation of integrated telecommunications is essential to the intelligent grid, because the intelligent grid cannot function without the various intelligent electronic devices (IEDs), smart meters, control centers, power electronic controllers, protection systems, etc. but this introduces an exponential number of new network devices and technologies. Spending on the telecoms infrastructure can represent as much as 9% of total spend on smart grids[2] and with the estimated spend being $600 billion by 2023[3] this represents a significant portion of the investment made. As a result this will require significant planning and management of the resulting communication assets.

The following highlights some of the challenges facing electric utilities as they move towards the deployment of an advanced network infrastructure:

- **Increasing energy demand.** Increasing energy demand will drive development of an advanced network infrastructure that will require efficient network planning, design and asset management.

- **Network investment is huge**: Detailed planning of both the electrical distribution network and the related telecoms network is critical to control capital expenditure and reduce on-going operational costs.

---

[1] http://instituteforenergyresearch.org/analysis/exxon-forecasts-growth-in-global-energy-demand/

[2] http://www.innovationobservatory.com/content/smart-grid-technology-investment-forecasts

[3] https://www.navigantresearch.com/newsroom/spending-on-smart-grid-technologies-will-total-nearly-600-billion-from-2014-through-2023

- **Bandwidth capacity is a critical resource**: The amount of data required to ensure optimal performance and resiliency of the network will rise exponentially. Planning a reliable, secure telecoms infrastructure with the capacity needed to carry this data traffic is critical.

- **Telecoms experts are scarce:** Most electric utilities have limited telecoms expertise. With the telecoms network central to the future grid, decision support tools to help plan, build and operate the telecoms network will be vital.

- **Telecoms network reliability is vital:** For effective network operations, the telecoms network needs to be planned to have the highest possible degree of reliability in order to support the mission critical data and applications that control the grid.

Telecoms networks will come in three flavors:

- wireless connections to the meter with Radio Frequency "Tower Systems" as hubs and mesh networks consisting of pole-mounted routers providing the access network.
- telecoms over medium and low voltage distribution power lines for the access network (e.g. Power Line Carrier) with pole-mounted couplers connecting downstream meters in the electric network to the upstream backhaul fibre network and ultimately tie into the utility's sub-stations and control centres.
  traditional fibre based networks, with some operators deploying Fibre To The Home (FTTH) solutions.

In all cases, the telecoms network will have the same challenges as any other telecoms network, including deployment, network management, bandwidth management, Quality of Service (QoS) and security. Indeed, there are grounds for arguing that the telecoms industry has been through the BSS/OSS adaptation process already and, even at this early stage of network evolution, can teach the energy industry a lot.

When integrated communications are fully deployed, they will optimize system reliability and asset utilization, enable competition within the energy market, increase the resistance of the grid to attack, and generally improve the value proposition for electricity. Integrated telecoms will allow real-time control and data exchange to optimize system reliability, asset utilization, and security.

The intelligent grid brings with it an exponential growth in the amount of data that must be gathered, verified, stored, and transformed in near real time for intelligent responses and decision support. For instance, moving from monthly kilowatt-hour reads to hourly interval meter reads will increase data-handling requirements many hundreds of times. The accurate, cost-effective design of the telecoms infrastructure needed to carry this volume of data is critical to success.

Utilities need to make a decision on what telecoms technology is needed to acquire and carry all the smart grid data. For instance, for mesh radio networks there is a need to plan these networks in terms of how to provide optimal and cost effective broadband access to the thousands of meters in a service area. This requires that the network (e.g. towers, transmitters, repeaters and backhaul fibre) be in place and positioned correctly based on coverage area and signal strength calculations to support the data and reliability requirements. Utilities will also have the requirement to manage bandwidth and latency across their telecoms infrastructure especially for value-added consumer services.

Benefits of UTIM

Nearly every component of the intelligent grid, for example AMI (Advanced Metering Infrastructure), HAN (Home Area Networks), DA (Distribution Automation), Load Balancing and Demand Management, relies on a next generation telecoms network. Therefore establishing these telecoms must be of the highest priority since it is the first step in building the advanced network infrastructure of the future. Many utilities are using this as a driver to completely revamp their telecoms infrastructure, upgrading to an all IP based network that caters for voice, data and control, and provides the high level of telecoms and data security required for monitoring and control.

This will require significant planning and management of the communication assets. GE's Smallworld solutions address the planning, design/engineering, inventory, assignment and capacity management of the telecoms network. Effective deployment and management of this telecoms infrastructure is critical to control capital expenditure, lower operating expenses, minimize network downtime, ensure optimal network performance, and deliver sufficient bandwidth and capacity to carry the increased network traffic.

The following table summarizes the key benefits offered by GE's solutions to meet the new business challenges facing the electric utility:

The Business Challenge	The UTIM Solution
The wide spread introduction of distributed generation, and intermittent power-flow from renewable energy sources.	Provide intuitive and proven design and engineering tools for the development of a telecoms network infrastructure that will help manage the variable supply of distributed, renewable energy.
Ensuring service reliability as energy demand increases.	Design the telecoms infrastructure to ensure it delivers the data needed to manage the electric network to meet increased demand
Reduce costly outages and move from inefficient scheduled maintenance to proactive support of grid assets.	Provide up-to-date knowledge of network assets with a comprehensive network inventory to support pro-active network maintenance
Reduce delivery losses in distribution systems. The current grids operate with reliability engineered through over-capacity, resulting in wasted energy.	Manage an integrated telecoms network that supports device-monitoring solutions and delivers real-time information about grid condition and performance, enabling greater utilization of available network capacity.
Reduce the cost of planning and building a	Enable the fast and efficient development of an

common, converged telecoms infrastructure network	advanced telecoms network infrastructure.

Customer Examples

GE's solution is built upon a comprehensive and successful track record in utility and telecom markets, with hundreds of customers, thousands of end-users and millions of network connections.

Successful Smallworld telecoms solutions are being used by many utilities across the world including AEP, TNB, Energy Australia, ENMAX Envision, Iberdrola, Manitoba Hydro, Powercor, RheinEnergie, Sho-Me Power, RZE, UE Comms and Salt River Project (SRP).

Energy Australia has rolled out a utilities-specific next-generation telecommunications platform including Smallworld solutions. According to George Maltabarow, Energy Australia managing director, "To build a smarter electricity network, we first needed to create a single, reliable telecommunication backbone."

TNB (Tenaga Nasional Berhad) are the Malaysian national electricity provider. They use Smallworld Physical Network Inventory to manage their internal telecoms network. This is integrated with Smallworld Electric Office which is used to manage their electricity network.

Similarly, **Salt River Project (SRP)** is a major utility company that successfully uses Smallworld solutions to manage both their electric transmission and telecoms networks. Smallworld Physical Network Inventory has been fundamental to managing their fibre-optic network and reducing the time needed to perform a number of key business processes.

GE's Smallworld Solutions

Whether managing an existing network supporting SCADA or a new network deployment, the utility must have a solution to the management of their telecoms infrastructure, just as they do for their electrical infrastructure. Utilities must prepare for the transformation to an intelligent grid by having a centralized asset infrastructure system in place that incorporates technology rules and business process best practices. Without this foundation, far too much effort will be spent on manual record keeping and playing catch up after the fact. The system will need to be built upon telecoms industry standards and well-established workflows.

GE's geospatial network infrastructure management solutions, based on the Smallworld platform, are foundational elements in helping to simplify the challenges of designing and maintaining the complex assets and configurations of the electric and communication networks throughout their entire life cycle. In particular, GE's Smallworld Network Inventory solution is fundamental to the management of the telecoms network within a utility, enabling cost effective planning, design, build, operation and maintenance of the network. Smallworld is used to check available network capacity, generate network plans to meet demand and produce detailed engineering designs for network build. Smallworld provides a single consolidated cross-network end-to-end view (both inside and outside plant) of the telecoms network with detailed physical connectivity.

The Smallworld portfolio of applications includes:

- **Smallworld Physical Network Inventory -** Network planners can model the entire physical network (wired and wireless), both inside and outside plant. The accurate database of record supports the full asset management lifecycle, including network planning, design and build.
- **Smallworld Logical Network Inventory** - Circuit designers can document and design the logical network (network elements and bearer circuits) that run across the physical network to provide telecoms capability. There is likely to be a fairly standard logical layer - IP/MPLS will be common across the backhaul and distribution access, whether the underlying physical infrastructure layer is fiber, microwave, copper, wireless mesh, BPL/PLC, etc. LNI will provide:
    - One end-to-end asset/inventory database for all the logical layers
    - Capacity/traffic design and planning
    - Topology management: SONET, DWDM, GigE, VLAN, VPN, WAN, HAN, etc.

- **Smallworld Network Inventory Gateway** – Data can be made available across the enterprise, with Internet and Intranet access to the data in the Smallworld Network Inventory database.
- **GeoSpatial Analysis** – Is a map-centric business intelligence product suite that turns your data into actionable information. GeoSpatial Analysis provides fast, relevant, actionable insight to everyone in a utility via client or web based access - resulting in better decisions, more informed actions and more efficient business processes. GSA provides the ability to turn spatial and other operational data from across the Utility into actionable information which is:
    - Consistent
    - Accurate
    - Current
    - Affordable
    - Timely

Additionally, the Smallworld portfolio supports integration to other business critical systems within the utility environment. For instance, the Smallworld Business Integrator for use with SAP® ERP facilitates the synchronization and consistency of data passing between both systems and provides functionality for business processes navigating between applications in these systems. More generally, the Smallworld GeoSpatial Server solution is a Service Oriented Architecture (SOA) platform for system integration and business process integration, supporting common business services for utility and telecoms applications.

Summary

GE's solutions for managing the telecoms networks that electric utilities will need to meet the business challenges of the next-generation power network will provide a number of competitive advantages:

- **Deep and broad domain expertise -** GE has over ten years experience providing telecoms solutions to over 150 customers worldwide. Combined with GE's extensive knowledge of the electric T&D industry, we can offer unparalleled expertise to our customers.

- **Proven telecoms network engineering capability** - GE has become an industry leader for designing and engineering the telecoms networks of telecom service providers throughout the world. Utility telecoms network face the same challenges as major telecoms operators networks and require a mature, proven solution to meet this demand.

- **Comprehensive technology coverage -** Utility telecoms are based on a standard logical layer - IP/MPLS will be common across the backhaul and distribution access. Smallworld is able to manage all logical technologies (SONET/SDH, DWDM, GigE, VLAN, VPN etc.) needed. GE's solution will also support the entire physical infrastructure (fiber, microwave, copper, wireless mesh, BPL/PLC etc.) of the network.

- **Best-in-class solutions** - GE's solution provides best-in-class solutions to help customers reduce network capital and operational expenditure by:
    - Improving network utilization through greater knowledge of the use of existing network assets.
    - Reducing network capital expenditure through cost-effective network upgrades leading to up to 20% reduction in new build costs.
    - Reducing operational expenditure through efficient planning and engineering and increased workforce productivity, resulting in up to 30% reduction in planning time.
    - Accelerating response to network outages through accurate knowledge of network location, leading to up to 25% reduction in network downtime.