CASE STUDY

Smoothing the Rocky Road to Distribution Automation

One major northeastern U.S. utility's efficient and cost-effective path to automating its entire distribution and service restoration system

"T & D automation building blocks (are) the embryonic and emergent stages of what is today termed the Smart Intelligent Grid."

- Charles Newton, Newton-Evans Research

Situation: A prominent utility serving a northeastern United States' major metropolitan area wished to upgrade service by automating its distribution system

After its evolution from a vertical to a horizontal utility, this major enterprise began preparing for the technology revolution and the advent of the intelligent grid. Since the early 1980's, the utility has been experimenting with wireless technology to provide communications with field devices. The challenge was to automate their operation, a process that required the ability to communicate with devices from a wide range of manufacturers and using a number of different protocols including 2179, DNP 3.0, ASCII and ModBus RTU (Remote Terminal Unit). By the early 2000's, the company had run a proof-of-concept pilot network test, and had deployed a network of 400 sites connected by a 900 MHz and VHF wireless network performing traditional Supervisory Control and Data Acquisition (SCADA) functions. By 2005, the company made the decision to automate its entire distribution system, which involved the addition of hundreds of breaker reclosers and other devices and integrating all that equipment into the distribution system.

Solution: a system-wide wireless network featuring distribution management software residing on Motorola MOSCAD and ACE3600 RTUs

To handle the expansion and provide communication with Intelligent Electronic Devices (IEDs) from a variety of manufacturers using numerous protocols, the utility deployed an approximately 2,000-site network equipped with Motorola MOSCAD RTUs to enable a secure and reliable wireless communication network. Later, Motorola's newer ACE3600 RTUs were integrated into the network as more sites were added. Leveraging the communications flexibility of the Motorola RTUs, DigitaLogic implemented a sophisticated Distribution Data Management System (DDMS) using their patented technology IGIN (Intelligent Grid Interface Node) suite of software solutions for automation and management of the real-time data systems. The automated distribution system handles data from 2,000 remote sites and reaches a quarter million analog and digital points through a combination of 900 MHz links (using approximately 20 radio master sites) and VHF frequencies to reach difficult coverage areas.

CUSTOMER PROFILE

Enterprise
Major northeastern U.S. electric and natural gas utility company

Industry
Energy

Solution
- Motorola MOSCAD RTUs
- Motorola ACE3600 RTUs
- DigitaLogic's IGIN Management Suite

Solution features
- 900 MHz and VHF wireless connectivity
- Flexibility of communication with various protocols
- Interface with IEDs from various manufacturers
- Use of IGIN technology to provide:
  - Integration of data with DDMS system and Smart Grid
  - NERC-CIP cyber security compliance
  - Automated monitoring/ control of more than 2,000 IEDs

Results
- Automated fault identification and isolation
- Automated restoration of service
- Enhanced SAIDI performance
- More efficient use of personnel resources
- Enhanced customer satisfaction

"Because a fully automated distribution system can take five to seven years to implement for a large utility, it's important to have an extremely flexible network with the ability to adapt to advancements in protocols and technology as well as additional system requirements over the years."

- Ali Khorramshahi, President, DigitaLogic

"The power and flexibility of the Motorola RTUs have been proven repeatedly in their ability to adapt to the many changes and additions over the years of the project."

- Ali Khorramshahi
President, DigitaLogic

Result: a streamlined system that is improving SAIDI levels and providing exceptionally cost-effective distribution automation

The system is currently functioning smoothly and has significantly improved SAIDI (System Average Interruption Duration Index) performance. It is also increasing power availability and levels of customer service for over a million residential and business customers over a service area of about 2,500 square miles. Automation enables the utility to remotely monitor and control the system, automatically identifying and isolating faults and quickly restoring service. This enables more efficient deployment of the utility's field technicians for repair and restoration. The system is highly cost-effective, eliminating the need for new broadband communication capabilities through its ability to provide real-time data collection and transmission using the utility's existing narrowband licensed 900 MHz and VHF frequencies.

THE MOTOROLA ACE3600 REMOTE TERMINAL UNIT

Motorola's ACE3600 provides exceptional RTU performance for utilities moving to an automated distribution system. Integrated with Motorola's MDLC protocol, the ACE3600 is crucial to the implementation of high-quality Smart Grid solutions. ACE3600 RTUs are designed for wide area SCADA data communications. Providing peer-to-peer and peer-to-master communications, the ACE3600 facilitates intelligent fault handling that includes detection, isolation and restoration. The ACE3600 is seamlessly compatible with the extensive installed base of Motorola's MOSCAD RTUs.

POWER AND FLEXIBILITY: THE KEYS TO DISTRIBUTION AUTOMATION SYSTEMS

In the last decade, the electric utility industry has undergone some major upheavals. In the late 1990's, there was the deregulation of the industry, leading to many utilities dropping their vertical orientation — providing both power and power delivery — to become horizontal organizations, providing one or the other. As if that weren't enough, on the heels of deregulation has come the emergence of the "smart grid."

As defined by the U.S. Department of Energy, the smart grid is "an automated, widely distributed energy delivery network… (incorporating) the benefits of distributed computing and communications to deliver real-time information and enable the near-instantaneous balance of supply and demand. (The smart grid brings) the philosophies, concepts and technologies that enabled the Internet to the utility and energy grid."

Why Automation?

For utilities, making the best use of the smart grid involves significant preparation. The organization must be prepared to leverage the enabling technologies, standards-based interoperability and low-cost communication technologies and electronics of the digital revolution to deliver increased reliability through increased automation.

The move toward distribution automation is hardly surprising. Most utilities have long wished for real-time monitoring and remote control of system elements such as substations, intelligent devices, power lines, capacitor banks, feeder switches, fault analyzers and other physical facilities. Distribution automation systems are key to providing two-way communication with these elements, as well as to identifying and isolating faults, and restoring service… all accomplished automatically.

"Today, the system stands as the first DDMS that allows rapid communications between 20 master sites and 2,000 remote locations each containing multiple devices from diverse manufacturers using different protocols all over relatively low RF bandwidth channels."

- *Dan Brabec*
SCADA Brand Manager, Motorola

Preparing for Automation

Recognizing early the importance of emergent intelligent technology, this utility began preparing for the smart grid even before deregulation. In the late 1980's, the organization began the trial use of wireless communications networks with licensed 900 MHz and VHF frequencies. After a period of trial and error, the utility deployed a proof-of-concept system in the mid 90's, which eventually evolved into a local system of 400 sites performing traditional monitoring and control of remote intelligent devices at certain substations and pole top locations.

Increasing Service, Decreasing Outages

In 2003, based on the success of the local implementation, the utility made the decision to fully automate its entire distribution system. Its goals? Increasing service and power availability, lessening the instances of outages and decreasing outage impact. Over the next five years, the utility worked with a team that included Motorola and DigitaLogic to plan and deploy its current distribution automation system. The utility added hundreds of breaker reclosers and other IEDs that were distributed throughout the network. The system now provides real-time connectivity with the more than 2,000 fixed and a number of portable IEDs populating its network of substations, helping to improve service delivery, power availability, outage management and overall productivity.

The First of Its Kind

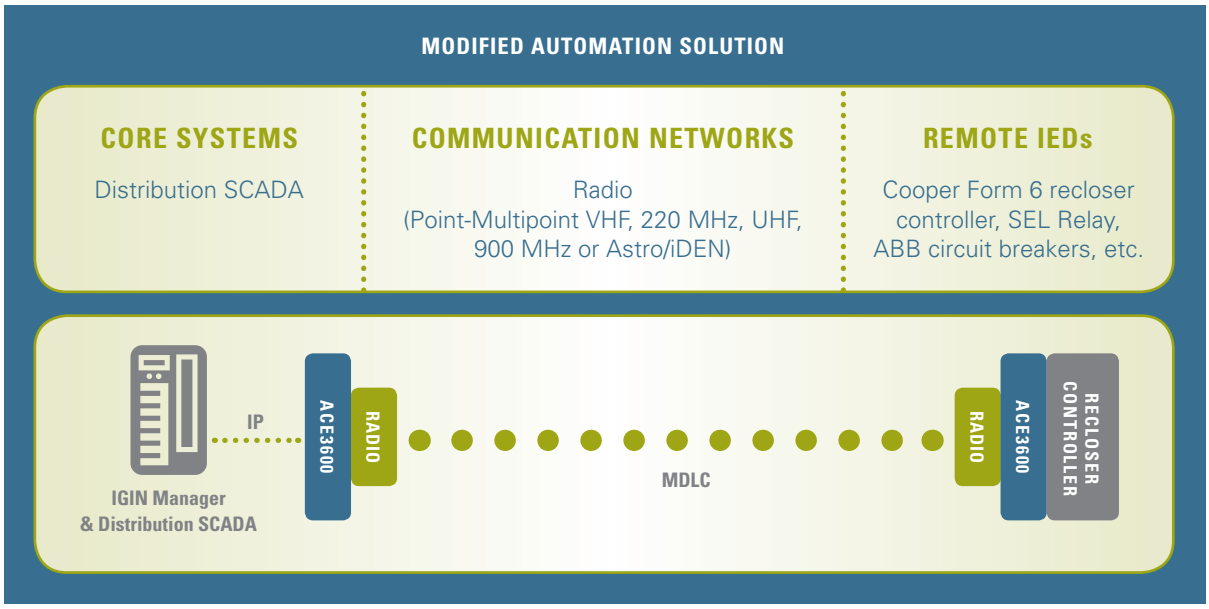
The overall project took almost five years to complete. The distribution automation system combines optic fiber, leased lines, microwave and the utility's legacy licensed 900 MHz and VHF wireless links. It is one of a very few fully automated systems in operation in the United States. It is also the first system of its kind to serve such a large number of remote locations and to incorporate so many disparate devices on such a large scale.

Leveraging Current Systems

The utility's distribution automation network uses approximately 1,800 Motorola MOSCAD RTUs installed over the five-year period. Recently, the organization has started adding Motorola's upgraded ACE3600 RTUs, which have become the new standard as the network continues to expand. As the organization moved forward with implementing distribution automation, one issue it faced was if and how its legacy 900 MHz and VHF wireless systems could be leveraged in the new system.

As the utility discovered, its legacy narrowband, licensed frequencies could be used for their distribution automation solutions. The use of ACE3600 and IGIN supported communications with a myriad of network devices by accommodating more electronic devices per frequency than other solutions. If there are future needs for higher-speed applications, the organization's narrowband systems can be seamlessly interconnected with the utility's iDEN Harmony network or a high-speed wireless broadband network from Motorola.

An integrated approach >



"Using the ACE3600 and the IGIN software suite, utilities can break the 80/90 site traditional bottleneck. On a single 900 MHz MAS paired channel, over 200 remote sites with significant amounts of data exhibit round trip control times of only a few seconds."

- Ali Khorramshahi, President, DigitaLogic

Unique Motorola RTU Benefits

The utility's automated distribution network makes exceptional use of Motorola's industry leading intelligent RTUs. In addition to the ability to communicate with a wide range of third party devices using multiple protocols, Motorola MOSCAD and ACE3600 RTUs provide exceptional time performance. For example, for a large population of remote sites on narrowband wireless channels, they deliver round-trip control times of less than 4 seconds. This is due to the Motorola RTUs' unique ability to combine applications and communications into a single application and system infrastructure.

Equally important, in combination with the DigitaLogic IGIN application, the RTUs provide compliance with North American Reliability Corporation (NERC) Critical Infrastructure Protection (CIP), or NERC-CIP cyber security regulations.

Worst to First

When the utility began its initial 400-site deployment, it started by replacing its 100 worst-performing feeder circuits with Motorola RTUs. The performance of these devices was soon severely tested in a major weather-related emergency situation. In September 2003, Hurricane Isabel hit the area with winds of 165 mph, causing a large number of outages. In its post-hurricane evaluation, the utility discovered that the formerly worst-performing circuits had improved to among the best. This exceptional reliability remains a crucial component of the system as it continues to expand.

Automating the Future

Leveraging the success of its 2,000-site distribution automation system, the utility plans to expand the network with more sites to further sectionalize the circuits in smaller segments, reducing the exposure of outage to a smaller number of customers. With Motorola's reliable, high-performance RTUs to receive and transmit data from IEDs over complex hybrid telecommunications networks — and DigitaLogic's IGIN suite of solutions to integrate and manage the real-time data — the utility will continue to provide higher levels of service and power availability to its business and residential customers for years to come.

DIGITALOGIC'S IGIN MANAGEMENT SUITE

DigitaLogic is an innovative industry leader in microprocessor-based applications for monitoring, control and automation of utility power systems. The DigitaLogic Intelligent Grid Interface Node (IGIN) can transform the operation of the power grid. Integrated with Motorola ACE3600 RTUs, it adds intelligence to the control of remote installations, enhances the performance of the entire system, and converts the vision of the Smart Grid into a reality. Through its patented IGIN software application, DigitaLogic provides a comprehensive suite of solutions for managing and integrating real-time information into multiple enterprise systemsincluding primary and secondary EMS, OMS, Historians, and AutoRestoration.IGIN® over ICCP and OPC protocols.

MOTOROLA

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