



Electric Energy T&D

MAGAZINE

SEPTEMBER-OCTOBER Issue 5 • Volume 19

Grid Transformation

**ASSIGN CREWS WITH
THE RIGHT SKILL SETS,
AT THE RIGHT TIME, AT
THE RIGHT PLACE**



Smart Meters Are Made Smart by People and Processes

By Scott Grafelman
and Forrest Small

Highlights from the BRIDGE Energy Group Utility Industry Survey on Outage and Restoration Management

For the past three years BRIDGE Energy Group has conducted its utility industry survey. Part of the survey examines outage and restoration management, and how utilities are using advanced technology to improve operational performance. This article takes a closer look at some of the ways that smart meters can add value for a utility's outage and restoration management program.



Figure 1. BRIDGE's outage and restoration management vision for leading utilities

Outage Notification

Recent survey results show that 81 percent of respondents have deployed smart meters for at least a portion of their customers. However, a closer look reveals that many utilities still rely on customer calls for outage notifications.

Table 1: Primary source of outage notification by weather conditions (Source: BRIDGE Energy Group)

Primary Source of Outage Notification	Customer Calls	Smart Meters
Blue Sky days	58%	16%
Storm day	54%	12%

Making use of smart meter outage notifications requires good integration between the new metering technology, existing operational technology and IT. It's also important for utilities to modify business processes to take advantage of the capabilities of the new technology. Meters are not inherently smart; but utilities can use them to improve operations, increase efficiency and drive customer satisfaction.

A common use case for smart metering is automatic outage notification. Some meters emit a notification when power is lost or restored. Making good use of this information depends on several factors:

- Power outage notifications (PONs) and power restoration notifications (PRNs) must be received in a timely manner to be processed by the OMS
- PONs should be received from enough meters to provide a good picture of an outage, and improve outage prediction in the OMS
- The reliability of a PON should be as good as a customer call
- A PON should indicate a problem on the utility power system that can be corrected by the utility
- The utility should be able to check the power status of a meter quickly, and reliably

A common problem is that a PON doesn't always indicate a problem that needs fixing – this is known as a 'false positive.' False positives can obscure real outage information and make it harder for utilities to trust the information coming from smart meters. A simple integration between the AMI head-end system and the OMS can result in numerous false positives hitting the OMS. This can flood the OMS and make it difficult for operators to use the system to make decisions. When this happens, the outage business case from smart meters may be diminished.

A Two-Part Solution

Intelligent Filter: The intelligent filter removes false positives. These can be duplicate messages, messages from momentary interruptions from reclosing, or messages from voltage dips. This increases the probability that PONs sent to the OMS represent real outages that require attention from the operator.

Pinger: The 'Pinger' can send a message to a meter to check its status. If an outage message makes it through the filter but is still suspect, the Pinger can try to validate the outage. If the meter responds to the ping, the system knows that the power is on. If there is no response from the meter, the outage is passed on to the OMS for further analysis.

BC Hydro has designed such a solution. After implementation the utility found that 70 to 80 percent of unwanted outage messages from the meter head-end system were eliminated. This left a much smaller number of outage messages to be processed by operators in the OMS.

Outage Diagnosis

An OMS is a primary tool for this, along with supervisory control and data acquisition. Increasingly, Advanced Distribution Management Systems (ADMS) are being implemented along with distribution automation in the field. Capabilities such as Fault Location Isolation and Service Restoration (FLISR) promise to support a dramatic improvement in this area.

Managing Customer Expectations

Expectations of 21st century utility customers will be higher than ever before. Reliable electricity supports virtually all aspects of modern life, and access to information on demand from service providers is raising the bar for utilities. Providing timely and accurate information about outages and restoration is a critical opportunity. Customers expect utilities to:

- Know that the power is out, even if no one is home to call
- Tell them when power will be restored, and provide updates on progress
- Provide two-way communications options according to personal preference

Most customers realize the power will go off from time to time, especially during stormy weather. There are limits, however, to the frequency and duration of power outages that customers will endure.

Proactive Outage Notification

Smart meter information can be provided to customer service systems to proactively inform customers about their outage when they use the interactive voice response system (IVR), such as, "We know there is an outage in your area. The estimated restore time is..." Customer service representatives can also be given the ability to 'ping' a customer meter while the customer is on the phone in order to identify if the outage is on the customer or the utility side of the meter.

Increasingly, utilities are moving to other electronic means for notification. Text messaging and email are common options today. Many leading utilities have launched sophisticated programs for communicating with customers through social media channels such as Twitter and Facebook. These platforms are attractive because they enable large-scale two-way high speed and low cost communications.

Estimated Time to Restoration

Power quality and reliability are key drivers of overall customer satisfaction (J.D. Power). Moreover, timely and accurate information about the estimated time to restoration (ETR) can be a key piece of information, and a great opportunity to engage customers and build credibility and trust. Major storm events in the last few years have drawn attention to ETRs, and the importance of good estimation and timely reporting by utilities for their customers.

BRIDGE survey results indicate that there is room for improvement:

- Approximately one quarter of utilities are not calculating ETRs
- 22 percent are unhappy with the quality of the ETRs they are able to calculate
- 22 percent of respondents are dissatisfied with the quality of their Initial Damage Assessment (IDA)

Utilities provide ETRs based on a number of different variables, ranging from system averages, the time of year, type of weather, type of clearing device or some combination of these and other criteria. The processes for estimating ETRs is also widely disparate across utilities, even within the same state. After Hurricane Irene, the Public Service Commission of Maryland noted (in Order 84445) that ETR inaccuracy and inconsistency throughout the restoration calculation and communication process was a problem across all five utilities under its purview and ordered the utilities to align their ETR practices so as to better inform their customers of the status of their electric service.

ETRs created without knowledge of the actual condition of the grid and what is in need of repair to restore power, are more or less an educated guess. Providing accurate ETRs is premised on a timely and accurate damage assessment process. Several utilities are taking a more detailed look at the ETR process that involves utilizing technology in the damage assessment process and integrating the results with other enterprise systems, such as the OMS and work order systems. Figure 2 below is a conceptual diagram on this approach.

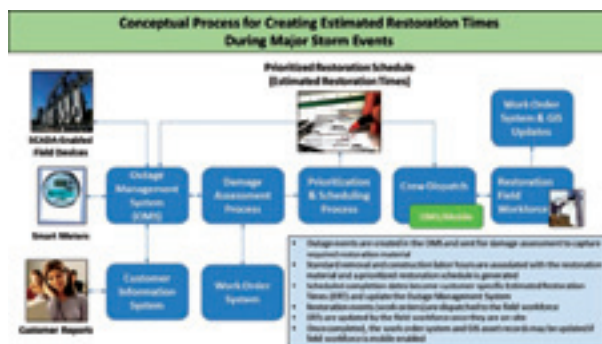


Figure 2: Integrated Damage Assessment

With this approach, restoration work is treated and scheduled like any other utility construction work. Damage assessment information is captured and enhanced with labor hours from the work order system and crew availability to create schedulable units of work that can be assigned to field restoration crews. ETRs are obtained from the estimated completion dates resulting from the prioritization and scheduling process, modified for any specific preferences such as end of day ETRs. These ETRs are then provided to the OMS and CIS systems and made available to customers.

Smart meters can also be used for monitoring of any service level agreements (SLA) that are related to the performance guarantees made by the vendor for the meters themselves. Such SLA measures as communication success rates, a percentage of PONs received relative to number of customers out in the OMS, missed meter reads or number of stale meters can be provided.

Leading Practices for Tech-Savvy Customers

As the tech-savvy customer more actively engages in online and social media platforms, they expect real-time information and updates. Not only do they want options for reporting outages and receiving restoration updates, they also want to receive alerts regarding their energy usage and the ability to conduct routine business such as paying their bill. And they want to do it through channels of their choosing during the times most convenient to them. Online web portals and mobile apps, for example, provide this flexibility and are becoming more available from utilities as they strive to meet the needs of the tech-savvy customer.

Regardless of where a utility falls on the ORM continuum, Outage and Restoration Management is complex. From the time

the power goes out to the time power is restored, numerous business processes and enabling technologies are involved. Improving operational performance starts with applying technology at key points along the end-to-end outage management process that yield shorter outages, lower restoration costs and higher customer satisfaction. That's a meaningful return for the utility and its customers.

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Assigning Work to Crews – With the Right Skill Sets, at the Right Time, and at the Right Place

By Ebra Menon

For utilities, assigning work to crews – with the right skill sets, at the right time, and at the right place – is essential for effective field operations. Today's smart technologies, including workforce automation software, allow dynamic crew management to ensure priority work gets assigned quickly and efficiently. The office team are enlightened with valuable information to improve decision-making and response; while the field team is empowered to act quickly to complete work and restore outages.

Smart workforce automation solutions that have been designed specifically for utilities can provide the necessary forms and workflows – interfaced to back office and GIS systems – required to provide users with all the information they need to complete their work safely, accurately and efficiently. The sharing of information in real-time unifies the field and office to effectively manage utility crews and any type of work they perform – from large AMI deployments, inspections and service work to damage assessment and outage restoration.

Combining a workforce automation solution with optimized scheduling and appointment booking technologies creates a new level of utility engagement with customers and members. Utilities can deliver stellar customer service and improve SLA compliance through these customer-centric features, while reducing operating costs and increasing field resource efficiencies that result in an immediate return on investment.

Assign the right resources to the right job

Enterprise scheduling is an essential component of any workforce automation solution, and utilities can expect to achieve many benefits including:

- Reduced operational costs by reducing unnecessary truck rolls – minimizing expensive overtime and reducing non-productive idle times of your workforce by automatically assigning the right crews, with the right skills and equipment, to a job
- Improved customer satisfaction – by honoring customer appointments, reducing appointment windows and avoiding missed appointments

- Optimized productivity – by assigning routine work automatically, freeing up key resources to deal with complex and priority work
- Getting priority orders into the field quickly – redistributing priority work during the day as needed
- Quick and effective outage response – to emergencies, large-scale or unplanned outages and storms
- Reduced wasteful travel time – by automatically scheduling work based on actual road networks and real travel times between orders



A scheduling solution based on utility industry best practices can solve the challenges inherent with the management of crews with diverse skillsets that are often spread over large service territories, along with dynamic changes in utility field operations.

Ensuring a solution has an interactive user interface – that provides visual feedback – can bring scheduling out of the back room and onto the desktop of schedulers and dispatchers. For utility operations, scheduling systems should not rely on server-based batch processing or be based on predefined rules and parameters. A flexible scheduling engine will support both overnight batch-processing of routine work as well as interactive modes, which can enable utilities to respond effectively to both unplanned and emergency scenarios.

Assigning Work to Crews – With the Right Skill Sets, at the Right Time, and at the Right Place

Having Gantt-style scheduling views, along with shift assignment timeline and utility crew timeline views, can allow users to visualize assigned orders and the results of scheduling runs. A scheduling sandbox is another useful component as it gives users the opportunity to perform 'what if' simulations. Scenario-based scheduling provides specific rules that can be defined to handle a utility's unique circumstances (such as storms, overtime, outages, and year-end field activities).

Street level routing is another important component, which considers the actual road network (such as one-way streets, bridges, rivers and other obstacles on the way) to calculate travel times and directions between orders. This will ensure order assignments are based on real travel times, and that a utility's customer or member commitments are honored.

Booking customer appointments with precision

Appointment booking – when based on actual travel time and workforce capacity – also improves a utility's customer or member satisfaction by providing reliable appointment times.

Utilities that have implemented appointment booking solutions can achieve many benefits from the technology, including:

- Improved customer satisfaction – by honoring customer appointments and reducing customer wait times
- Maximized worker productivity – through appointments booked based on actual travel time and workforce availability
- Improved regulatory compliance – for AMI project rollouts
- Reduced travel times – from street level routing
- Lower fuel consumption and CO2 emissions – as workers need to drive less

Smart appointment booking technology enables a utility's customer service representatives and dispatchers to book appointments with confidence during a customer's first call. Armed with the precise knowledge of their field force capacity and actual travel times, they can reduce appointment windows and ensure customer appointments are honored.

Appointment booking technology works with the scheduling engine, using crews' shifts and shift rotations as well as taking workers' unavailable times into consideration. This provides true insights into a utility's workforce capacity and availability when booking appointments. Smart scheduling solutions use actual travel times based on street level routing to maximize resource utilization and respond effectively to emergency appointment requests.

Enlighten office users with technology applications

Providing an office application for workforce automation allows dispatchers, schedulers, administrators and office supervisors to manage their entire field operations safely and efficiently. A browser-based office application allows for faster deployment and is easier to scale versus an installed desktop application which is typically associated with onerous hardware and software pre-requisites. Moreover, a browser-based application may be accessed from virtually anywhere. With the lines between the office and the field becoming increasingly blurry, office supervisors may access a browser-based application even from the field, as long as they have online connectivity.

Integrated maps will provide the real-time location information of vehicles and workers and the work they are performing in relation to asset infrastructure, helping dispatchers assign resources closest to a job for emergency or higher priority work.

Gantt-style scheduling views can enable schedulers to visualize assigned orders and the output of scheduling runs, helping optimize the productivity of crews, equipment and resources. Dispatchers and CSRs can book customer appointments with confidence when based on actual job duration and travel time.

Summary dashboards with drill-downs on key performance indicators, along with real-time alerts and messages, will help office managers and dispatchers make informed operational decisions and respond effectively to emergencies.

Utilities that have provided their dispatchers, schedulers, administrators and office supervisors with an office application as part of their workforce automation system have achieved many benefits, including:

- Achieving real-time visibility into field operations
- Creating highly personalized views of orders, vehicles and workers
- Administrators can easily make updates from the same application
- Easily identifying, searching and filtering GIS assets, plus creating inspection/maintenance orders from assets, and attaching redlined KML files to orders
- Visualize assigned orders and output of scheduling runs to ensure the right resources are assigned to the right job at the right place

Trinity Meyer Utility Structures: Steel weathers the storm

Tough conditions require tough solutions, and nothing beats steel in a storm. Steel structures outperform wood in any severe environmental condition, whether it involves wind, rain, ice, or fire. Steel's unmatched strength and durability, high reliability, low maintenance, and long life ensure a lower total cost of ownership.

Wood structures by their very nature are subject to damage and decay over time. High winds and ice storms can cause structure or conductor failure. Wildfires, grass fires and cross-arm fires can threaten wooden structures. Aging wood poles are subject to deterioration, fracturing, shrinkage, and groundline rot. Fungi, insect, and woodpecker damage is chronic in certain regions. Any of these conditions will compromise pole integrity and service continuity, and increase power line maintenance costs.

Steel is the most versatile utility pole material with inherent strength and toughness, making it suitable to applications and conditions of all types, and ideal for storm hardening initiatives. It is stronger than wood, more flexible than concrete, and stiffer than composite. The geometry and straightness of steel poles is predictable and consistent. Precision-engineered capacities, rather than approximated ones, ensure structure reliability. Conformance of strength, dimensions, and capabilities is verifiable.

Light Duty steel poles have no comparison

Trinity Meyer Light Duty (LD) steel poles outperform and outlast wood and concrete poles hands down. Installation of the wood-equivalent LD poles requires less time, labor, equipment and maintenance. LD poles are typically used for voltages from 44kV to 230kV.



- **Efficient design:** Steel poles support longer spans, which means fewer poles, insulators, and hardware are needed. Steel poles also are stronger, more durable, and longer lasting than wood poles, offering infinite design possibilities and superior above and below groundline protection options, including UV resistance.
- **Easier handling:** Steel is up to 50% lighter than wood and as much as 80% lighter than concrete, which simplifies construction and installation. LD steel can be erected and installed using smaller crews and standard equipment.
- **Less maintenance:** Steel poles require far less planned maintenance as they don't expand or shrink over time like wood poles so there is no need for periodic hardware adjustments, and they do not require integrity inspections or chemical preservation treatments.

- **Available supply:** LD poles are readily available, ensuring the quickest turnaround time in the industry. Wood poles are dependent on specific tree types that may be in short supply and expensive.

- **Environmentally responsible:** Steel is 100% recyclable, whereas wood is only renewable. Steel poles do not use chemical preservatives that can leach into the environment and produce a carbon footprint. Weathering steel poles, similar in color to wood poles, blend easily into forested landscapes.

Solution for storm response and hardening

In emergency situations, Trinity Meyer's LD poles have shipped in as little as three days. LD poles supplied from existing stock inventories can be quickly shipped and installed, making them an ideal solution for storm response.

Trinity Meyer's LD poles are also well suited for utilities taking storm hardening measures, including switching to higher strength steel poles. Steel poles are highly reliable and will not cascade in the event of a failure.

Efficient response to historic storms

Trinity Meyer maintains inventory of a number of popular sizes of LD steel poles. That practice helps Trinity Meyer and its strong alliance network to deliver swift service during severe weather events. For Hurricanes Katrina and Rita, the company began stockpiling materials and producing poles before the damage reports came in. Several weeks' worth of production of finished Trinity Meyer tubular steel poles were shipped to the Gulf region in just a few days.



In June 2012, Idaho Power needed 230kV single circuit weathering steel H-frame structures to replace 14 miles of storm damaged wood structures. Trinity Meyer was able to greatly expedite delivery by using an existing LD pole design for the legs, along with wood cross arms provided by Idaho Power for the top of the structure, limiting the

engineering requirement to just the cross braces between the legs. The first orders of Trinity Meyer's LD poles were shipped in just four weeks – less than half the normal time for a multi-legged structure. The entire job, 183 structures in total, was completed in just 10 weeks.

Learn more about LD steel poles from Trinity Meyer Utility Structures by calling 901-566-6500 or visiting www.trinitymeyer.com.



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Emergency Planning Rapid Response



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When Poles Stay Up – Power Stays On

Our customers know they can rely on our inventory programs, short lead times and extraordinary supply chain relationships to speed their storm recovery. For decades, the Light Duty (LD) steel transmission pole has been the go-to solution for fast storm restoration.

After hurricane Katrina, Trinity Meyer was able to ship weeks worth of production of finished Meyer tubular steel poles in just a few days, enabling our partners on the Gulf Coast region to begin restoration and rebuilding efforts as quickly as possible.

If your T&D operations or asset management program include emergency storm response, or storm-hardening your lines in critical or vulnerable areas, Trinity Meyer tubular steel solutions are your best choice. For more information, please contact your local Trinity Meyer sales representative.



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Assigning Work to Crews – With the Right Skill Sets, at the Right Time, and at the Right Place

Using mobility to empower the field

Providing a mobile application for workforce automation empowers workers with smart workflows, eforms and interfaces to enterprise systems, along with integrated maps to visualize their work in relation to the utility's asset infrastructure.



A cross-platform mobile application will support multiple mobile operating systems (Windows, iOS, Android) on various form factors, including touch-enabled tablets, laptops and phablets. GIS integration enables users to easily identify, search and filter GIS assets, redline and annotate maps, and create inspection and maintenance orders from the field.

Workers will have instant access to their assigned work, including new work assigned throughout the day. Mobile applications that support store-and-forward can provide seamless operation even in areas with intermittent or no wireless coverage, allowing users to complete their work and have access to their maps when they are offline.

Utilities that have provided their field force with a mobile application as part of their workforce automation system have achieved many benefits, including:

- Using intelligent eforms based on industry best practices and integrations to back office systems, providing the right information at the right time
- Using route optimization – based on actual street network data – to complete more jobs by having to drive less
- Working in offline mode to complete work and access maps, even in areas with poor or no network coverage
- Easily identifying, searching and filtering GIS assets, and creating inspection or maintenance orders in the field, using asset information automatically populated in the orders

- Tracing assets upstream or downstream, to identify paths and connected assets for faster, safer restoration of outages
- Sending important field instructions to the office, including redlined and annotated maps
- Capturing photos, signatures, GPS coordinates and barcode scans in the field, and linking them to orders
- Scanning and validating meter and device serial numbers to ensure you are working on the right equipment
- Using safety timers to ask for immediate help or alert office staff and supervisors prior to engaging in potentially dangerous activity
- Communicating effectively with office staff and field crews
- Using visual and audible alerts to ensure you are notified of emergency conditions
- Monitoring appointments-in-jeopardy and order cancelations to improve customer satisfaction
- Ask for assistance during large-scale outages by viewing nearby vehicles
- Using the right device and operating system based on field activity, including support for bring-your-own-device (BYOD) programs

Smart workforce automation technologies provide valuable information that allows a utility to optimize how they assign work to crews. Matching the right skill sets, as well as the right time and place, will greatly improve a utility's operations. Smart technology truly can enlighten the office and empower the field!

About the author



Edna Menon is a Senior Product Manager at Clevest, with 14 years' experience managing technology project lifecycles. She received her MBA in Executive Management from Royal Roads University. Clevest is a provider of workforce automation and smart grid operations solutions specifically for utilities. Clevest has recently released version 5.2 of its flagship product, Mobile Workforce Management, after extensive consultations with its 150+ utility customer base. Learn more at www.clevest.com.

Six Steps for Implementing a Secure AMI Infrastructure

By Belu Ambady

We live in a connected world, with much of our personal information easily accessible through the tap of a finger or the click of a mouse. This connectivity can improve our quality of life, but with progress comes increased security risks. From medical records to credit card information, if data is available electronically, it is susceptible to an attack. Data breaches can happen to any person, company or industry, and utilities are no different.

More and more public service providers, such as electric utilities, are deploying an Advanced Metering Infrastructure (AMI) to improve operational efficiency, customer service and conserve energy. This combination of smart metering and communications technology can greatly improve operations by giving utilities more insight into their infrastructure than ever before.

AMI systems provide utilities endless amounts of data on a continual basis. While this information can help them address operational issues and streamline efficiencies, it is imperative that utilities are properly safeguarding this data from potential data breaches. That's where data security comes into play. For electric utilities, before beginning an AMI deployment, you should start with a clear plan for making security a top priority to give your customers the best possible protection against cyberattacks.

Protect the Keys to Your Kingdom

Your utility has decided to deploy an AMI network. Now, you must make sure your infrastructure is secure. Here's a 6-step plan to secure your network and protect your customers' data:

Step 1: Create a governance framework

To make security a top priority for your organization, you will need senior level, corporate support for the program. Clearly defined roles, responsibilities and accountability, combined with proper auditing and reporting allows for adequate risk management. While engineers and system administrators provide a wealth of knowledge and expertise for implementing security measures, senior management must back a company culture that requires every employee to comply with the security policies. Security governance and security management programs help align information security strategy with business objectives and compliance requirements, while helping manage risk. This will leave less room for hackers to find an alternate route into your system or for employees to make innocent mistakes that can harm the security of your network.

Step 2: Develop clear policies and procedures

Once you have strategic oversight through the governance and management framework, you need to develop controls that will cover all aspects of your AMI system security, typically designed to protect Confidentiality, Integrity and Availability (CIA). While you strive to obtain company-wide support and compliance for your security program, it is crucial to develop high level policies clearly defining roles and responsibilities for security management and listing the rules and controls required for network access. Your policies also need to be supported with standards and guidelines that detail mandatory and non-mandatory controls. These are supported by procedures that cover step by step instructions for implementation, for example specific operational steps for setting up firewalls, handling the encryption keys or performing backups. A security awareness and training program rounds this out. These steps will help protect your organization, and in the event of a problem, you'll know how to address the issue.

Step 3: Develop and Implement a deployment plan

Proper planning is required to make sure that deploying security controls during your AMI deployment goes smoothly. Working with your AMI vendor, a security assessment helps you identify all assets that need protection, as well as potential threats to your network. For each threat, risk assessment and risk prioritization leads to the development of an actionable plan for secure deployment. Several of the following technologies may be implemented to help you design and deploy a layered defense for your AMI network.

Your demilitarized zone (DMZ)

DMZs with dual firewall architecture provide a layer of security to your organization's network by tightly regulating traffic entering and exiting your network. A DMZ network usually contains three zones, a trusted zone (Internal), a DMZ (Less Trusted) and an External Zone (Untrusted). When deploying your AMI servers, they can be integrated with your existing DMZ network. Typically, the AMI head-end server(s) resides in the DMZ behind the perimeter firewall, while the AMI database and other AMI components reside in a more trusted zone that is separated from the DMZ by the back-end firewall. Other remote components of the AMI system such as Collector/Gateways may be configured to securely communicate with the AMI head-end server over virtual private networks (VPN).

Six Steps for Implementing a Secure AMI Infrastructure

Set up role-based access control

On all the servers that will be part of your AMI network, make sure they are controlled through role-based access control, or RBAC. This is an approach to restricting access to authorized users based on the role of the individual. Operations on the AMI servers are assigned to specific roles, and the RBAC restricts access based on permissions associated with each role. For example, different roles may be assigned for users responsible for managing smart meters versus administrators.

Secure remote access with multifactor authentication

Administrators and other users may require remote access to your systems. The more secure method for your remote users to access your system is using multifactor authentication (MFA). Using only usernames and passwords has drawbacks, for example, users may choose easy to guess passwords for their login, which can pose major security threats to your AMI network. MFA is a security system that requires more than one method of authentication from varying categories of credentials to verify a user's identity. For example, remote users may be prompted to use an entry code generated on a security token in order to access the system in addition to their username and password. This is a more secure method for remote entry and can greatly reduce the attack surface compared to using only username and passwords.

IDS and IPS for your AMI

Creating a properly protected network, including careful placement of intrusion detection systems (IDS), and Intrusion Prevention systems (IPS), is critical to safeguarding against cyberattacks. These technologies should be placed at critical ingress or egress points within the network to ensure maximum coverage of traffic. In addition to network protections, Host Based IDS/IPS software should be deployed on AMI systems to provide additional layers of security against local system threats. During the configuration of all of these technologies you should make sure that the auditing and logging are properly enabled, along with continuous monitoring and recording of all events to alert on suspicious activity.

Encrypt AMI network traffic

When you are deploying an AMI system, it is critical to enable encryption on all relevant portions of your network. Encryption is the process of encoding messages or information in a way that only authorized users with encryption keys can access it. Should someone break into your communication system, message encrypting prevents the interceptor from reading your information. By encrypting network traffic on all parts of your AMI network, you will protect your system all the way from the end points (electric, water or gas meters) to the head-end system.

Create redundant communication channels

In addition to enabling encryption on your communication network, make sure that your communication channels have

redundancy with multiple paths. This protects from denial of service (DOS) type cyberattacks. Your AMI communications networks should be designed so that all endpoints, such as electric meters, can communicate with more than one collector. This way, if a certain collector is taken down (either for regular maintenance or due to a cyber-attack), your endpoint communication with the head of the system can still continue without interruption.

Secure Configuration and Patching

From the very start of your AMI network deployment, make sure that all systems are properly configured to reduce exposure. During configuration, make sure that the underlying operating system, as well as any applications and additional software is securely configured and hardened to prevent intruders from accessing AMI information. In addition, these systems also need be continuously updated with latest software patches and hot fixes from the operating system and application vendors.

Step 4: Test and re-test before roll-out

After you have built up your secure AMI network, make sure that you test and re-test before rolling out your system to your customers. Start by testing in the lab to make sure there are no bugs or errors. Once you have fixed any errors found during your testing, it is recommended to do a small pilot with a few hundred endpoints. This will help you see how your system performs in the field, while keeping the program at a smaller scale so you can resolve any issues before a mass deployment. Once you feel comfortable with the performance and adequacy of your security during the pilot, you can deploy in larger numbers until you have deployed the system to all of your customers.

Step 5: Schedule regular maintenance

While your system may have been secure when you first implemented it, you should also schedule time for regular maintenance and patching to keep it secure. Have an operations team whose sole job is maintaining the security of your AMI system conduct routine maintenance checks. To get the most out of your technology investment, schedule regular updates, patching and maintenance on a monthly basis.

Step 6: Get third-party pen-tests and reviews

You may think you have secured every possible entryway into your AMI network, but it is still important to get a second or even third pair of eyes to review your work. There are third-party reviewers and penetration-test vendors who specialize in checking the security of your system. Consider conducting an annual or bi-annual pen-test, especially if you are going through major system changes. These experts can look at your system security to identify weaknesses and give recommendations on ways to improve upon your program.

Six Steps for Implementing a Secure AMI Infrastructure

There are many moving parts in an AMI deployment, but it is critical to not let security fall to the wayside. Following an organized security plan can greatly cut down on confusion and miscommunication during this process, helping you derive benefits from your AMI system faster.

Find a Trusted Partner

AMI is an extremely useful technology because it helps utilities improve their operations and provide customers with more insight into their energy use. However, the threat of data breaches is growing. To reap maximum benefit from your network, it must be secure. This is why it's important to use multiple levels of defense that can be employed to significantly reduce your risk.

If you are at a loss for where to begin when connecting your network, you can also partner with a communications company to securely host your network. This can be especially helpful for smaller utilities who do not want to invest the additional capital in IT, office space and specialized employees. A trusted partner will monitor your servers and network connections around the clock, provide software patches and updates, and ensure that you have access to the latest features.

Because your utility's main job is to provide customers with a reliable service, it is important to find partners who can defend your network. Having this trusted partner can make the difference when fending off viruses, hackers, or securing against innocent mistakes. You can rest at ease knowing the data you and your customers' rely on is secured.

About the author



Balu Ambady is the director of security for Sensus. As an information security leader with more than 20 years of experience, he has expertise in creating advanced security infrastructure and developing security compliance programs.

Prior to joining Sensus, Balu served as the director of advanced technology and security for CableLabs where he managed the design and development of video architecture and security. Balu is a Certified Information Systems Security Professional and Certified Information Security Manager.



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Outage Management System – Vendor Selection

By Matthew Ferraro

A severe ice storm hit southern Ontario on December 22, 2013 knocking out electricity to thousands of homes and businesses. Heavy ice covered branches and winds gusting to 50 kilometres per hour caused branches to snap and fall on power lines. During this storm Kitchener-Wilmot Hydro had 22 feeders locked out affecting 25,000 customers, almost a third of their customers were without power in the City of Kitchener and the Township of Wilmot during one of the busiest times of the year. The phone lines were flooded with customer calls wanting to know when they could expect their power to be restored. Current outage management processes had call takers hand writing thousands of paper outage slips, which was the easy part; trying to make sense of all these pieces of paper and determine where to focus crew efforts was the real challenge. There has got to be a better way...

With the desire to improve outage management and armed with a mandate from the board of directors, Kitchener-Wilmot Hydro set their sights on an Outage Management System (OMS).



Before we could even think of talking to OMS vendors we decided it would be best to determine how we would like to see power outages handled at Kitchener-Wilmot Hydro Inc. In order to do that, we first identified our stakeholders. Since an OMS has a far reaching impact, it was important to include stakeholders from the Control Room, Customer Service, Engineering, Information Technology, and Operations.

With all the stakeholders together it was time to define what we wanted in an OMS. This started in the form of user stories, high level requirements, with each stakeholder describing what they felt outage management should look like at K-W Hydro. Some user stories were as simple as 'An operating map of the distribution system that has full connectivity.' While simple, this story was expanded into requirements, such as:

- The ability to display an accurate geographic representation of the distribution circuits and the underlying land base information
- The ability to graphically differentiate de-energized sections of circuits
- The ability to display a symbol indicating the location of an outage and customers who have initiated trouble calls
- Standard Pan and Zoom map capabilities

Over twenty requirements were defined from that single user story. Using this process, all the stories were fleshed out into requirements that supported the vision of outage management the stakeholder's had shared. The completed requirements became the Compliance section of the RFP, where bidders demonstrate an understanding of the requirements, objectives, scope of work and deliverables. Bidders provided a numeric response, in the compliance section, based on the table below.

Compliance	Description of Indicator
1	Functionality is not available
2	Functionality is only available through customization to core product (Specify fee structure for each '2' response
3	Functionality is available and may be utilized with product configuration (no additional fee is required; specify if modification is to be maintained and reapplied after upgrade by K-W Hydro or by the vendor)
4	Functionality is part of core product



An OMS solution that fit our requirements would ensure the stakeholders’ vision of improving outage management procedures, enhance the outage response and tracking capabilities through a predictive OMS that interfaces with the current AMI system, SCADA system, GIS, our home grown CIS and Billing system. The system must be capable of interfacing with both inbound and outbound Interactive Voice Recognition (IVR) systems, and be able to easily display outage information on the web.

Upon receiving the RFP responses, all responses were reviewed and information consolidated into a master report for the evaluation committee. The evaluation committee had representation from Customer Service, Operations, Engineering, the Control Room, and Information Technology. All committee members were stakeholders and part of the initial requirements team. All proposals were checked against mandatory criteria and assigned a score for each category based on predefined criteria in the following categories:

Evaluation Category	Weighting
	%
Corporate Profile	2.50
Corporate Experience	2.50
Technical Solution	45.00
System Infrastructure	10.00
Pricing Implementation	12.50
Annual Maintenance Fee	12.50
Warranty	5.00
DMS	10.00
Total	100.00

During the initial evaluation all vendor names were hidden in order to eliminate any bias and focus was on requirements compliance, implementation price, annual maintenance fees and the availability of a DMS solution. The scores for the technical solution were determined by each vendor providing their compliance score for each requirement.

Using the above mentioned criteria the decision was made to eliminate four vendors, and focus on the top four with the best combination of price, maintenance fees, functionality, and available integrated Distribution Management System (DMS) solution. These four vendors were asked to provide a demonstration of their OMS solutions and were provided a script to follow. The evaluation committee was provided with score sheets containing evaluation criteria under the following categories: Bid Overview, OMS Demonstration, Crew Management, Communications, Reporting, and DMS overview. Each evaluator provided a score out of 10 by category, with high and low scores for each category ignored.

The two vendors who received the highest scores during the demonstrations have SCADA-based OMS solutions, an integrated DMS solution and represent a lower overall cost of ownership compared to the other vendors asked to provide a demonstration. Reference checks were conducted via site visits for the remaining two vendors.

Outage Management System – Vendor Selection

The selected vendor represents a combination of the best evaluated bid considering price and the ability to meet K-W Hydro's specifications, requirements, experience, customer references, and the capability of the bidder to provide the service. It was the unanimous recommendation from the OMS evaluation committee that we proceed with the purchase from Advanced Control Systems™ (ACS) for the ACS PRISM™ Real-Time OMS solution.



Throughout the OMS RFP evaluation process, ACS had consistently outperformed the competition. During the initial evaluation of the RFP, and vendor presentations this vendor scored the highest. The evaluation committee also scored the winner's OMS solution the highest during the vendor presentations.

The following advantages were identified, compared to other vendor's solutions:

- Provides a more advanced outage prediction engine that leverages time stamps, and is fully automated
- Provides an easy to use operator interface
- Provides a call taking application which supports both outage and service calls
- Has the ability to generate schematic representations
- Allows operator to perform both up and down stream traces
- Ability to update ETOR
- Create temporary cuts and jumpers
- Mobile crew solutions
- Executive dashboard solution
- Integrated DMS solution
- Optional mobile customer apps

While not the lowest bid (inclusive of procurement, license fee, implementation, maintenance, and support) they represent the lowest overall risk. By comparison the other finalist solution is still green, with many features and functions not yet developed or not working to the level necessary to meet our requirements.

With K-W Hydro's plan to pursue self-healing networks, the new Distribution Management System is an industry leader. Having automated switching (FDIR) solutions implemented at other utilities presents a future opportunity for K-W Hydro to increase system reliability and take advantage of future grid automation. The full integration between the OMS, SCADA, and DMS will ensure all of our operators work from one pane of glass in the future, solidifying K-W Hydro's outage management vision for improved customer communications and outage identification processes.

Kitchener-Wilmot Hydro Inc. is a local distribution company that is responsible for distributing electricity to more than 90,000 homes and businesses within the City of Kitchener and the Township of Wilmot. A wholly owned subsidiary of Kitchener Power Corporation, Kitchener-Wilmot Hydro Inc. is focused on providing a safe and reliable supply of electricity to its customers.

About the author



As Project Manager Information Technology at Kitchener-Wilmot Hydro Inc. Matthew Ferraro is an accomplished leader, problem-solver, and communicator who has successfully implemented and directed projects from procurement, logistics, and operations perspectives for leading, global companies in a variety of industries – each with a focus on innovation and customer-driven success.