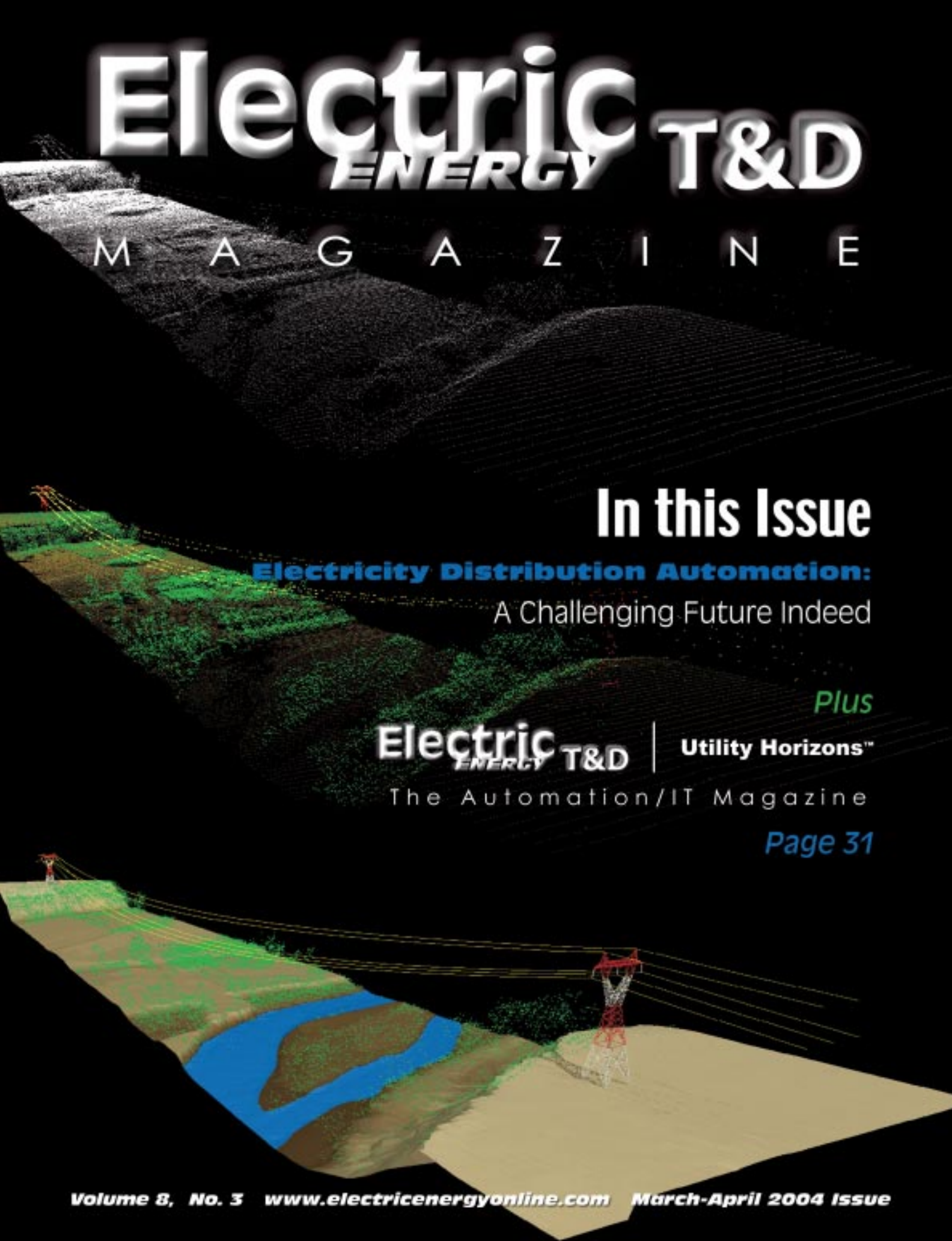
Electric ENERGY T&D MAGAZINE



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The Automation/IT Magazine

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Electric Energy T&D | Utility Horizons™
The Automation/IT Magazine

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Electricity Distribution Automation: A Challenging Future Indeed

By: Francis Bradley, Vice-President
Canadian Electricity Association, bradley@canelect.ca

The state of the electricity distribution business is at a crossroads. Changes in technology, the business environment, regulatory requirements, and customer expectations are impacting the electricity distribution business today, and those pressures will only increase in the future. The end-use market served from the distribution grid will inevitably change from analog-equipment-using consumers to digital-dependent consumers. The growth of the digital society will demand improved power quality. And if that isn't enough to keep distribution companies busy, there will also be a convergence of electric and telecommunication technologies such as broadband over power line (BPL) communications.

On the other side of the meter, as more micro-generation technologies reach commercial viability and are connected to the distribution grid, the volume of two-way power flow on the distribution grid will increase. Distributed generation technologies will radically alter the traditional regulated electricity business by bypassing the installed infrastructure and use the distribution system as a backup service.

Distribution automation, automated metering technologies (AMT), distributed generation, and the wired and connected home will radically alter the current electricity distribution business. Distribution utilities will need to adapt to stay competitive in this new environment. To survive, the electricity distribution industry will need to move to managing in real-time, using an intelligent, reliable two-way distribution infrastructure to support a digital society, where the power network of the future will be real-time, responsive, adaptive, eco-sensitive, flexible, price-smart, self-diagnosing, self-healing and interconnected with everything else.

The August 14, 2003 power outage in Ontario and eight eastern US states underscored the need to re-examine the current state of the electricity system, including the distribution network. The report, "The Cost of Power Disturbances to Industrial & Digital Economy Companies" indicated that across all business sectors, the US economy was losing between $104 to $164 billion per year due to power outages and another $15 to $24 billion to power quality phenomena. While there have been incremental improvements in distribution system and equipment, the distribution assets have not had revolutionary changes in the past 50 years.

Many Canadian utilities will face massive infrastructure replacements in their distribution grid serving their customers – residential, commercial, and industrial. Governments at all levels, regulators and stakeholders are continuing to push distribution companies for improvements in reliability, cost of service, power quality, consumer service and safety. Distribution utilities will be operating in a more complex regulatory environment where performance rather than investment drives most of the operating profits. Rather than today's "one-size-fits-all" service, customers will be able to customize their electricity service to suit their needs including cots, environmental impacts (i.e., green power), and levels of reliability and power quality which will require distribution utilities to offer much more sophisticated tariff structures.

In a report entitled "Electric Distribution Utility Roadmap" (CEA Technologies Inc. & Cap Gemini Ernst & Young) which provides a view of the electricity distribution utility environment 22 years into the future, it is predicted that the future of the electricity distribution industry is secure to 2025 since there is no technology that will replace the grid but that choosing to retain current "design standards and equipment and opting for small incremental changes in the way business is done today will result in an unprofitable future for a distribution utility". The Roadmap project reviewed more than 150 technologies and placed them on a 22 year (to 2025) timeline. It projects the investment level, the parts of the distribution value chain that would be impacted the most, the costs for finishing the technologies and the opportunities. The top ten (10) critical technologies include:

1) Asset Management IT Systems
2) Asset Effectiveness Monitoring
3) Automated Fault Detection & Reporting
4) Broadband Over Power Line (BPL)
5) Device Self-Reporting
6) Maintenance – Reliability Centered
7) Rates – Market-Based
8) Modeling, Real-Time Dynamic Load
9) Photovoltaic (solar cells)
10) SCADA Network Penetration

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The key Roadmap findings include:

— The distribution grid has to become more intelligent;
— The emerging technologies will impact all aspects of the distribution value chain and needs to be planned into the standards and designs for the distribution system;
— Rates, tariffs and operating rules will have the largest impact on the ability of distribution companies to operate. Utilities will be offering much more sophisticated tariff structures;
— The organization itself has to become much more capable to deal with the complexity of the future distribution system;
— The mix of people and skills will change radically over the next 20 years;
— Distribution utilities will be serving more demanding customers;
— The focus will be on affordability, reliability and power quality;
— The electric distribution grid will be self-diagnosing and self-healing;
— There are a number of technologies that allow for making both regulated and non-regulated income from asset utilization in the future for distribution companies; and,
— Distributed generation will open the grid for more two-way flows of electricity, increase the level of live-line work, and require the greater intelligence to operate.

The electricity distribution automation infrastructure upgrade to an intelligent, reliable two-way system is estimated to be about $2 trillion investment globally by one set of estimating tools. The portion of investment for upgrading Canada's distribution infrastructure is roughly estimated between $60 billion to $200 billion.

To many in the distribution side of the electricity business, this is the reality, and the environment within which they are planning to deliver the future. As an association supporting the industry, CEA has been crafting its approach to support the changes which will inevitably be required. Central to these activities is CEA's Distribution Automation and Regulatory Innovation Proposal.

Through this initiative, CEA is seeking to build a partnership alliance among electric distribution utilities, Natural Resources Canada and Industry Canada in order to accelerate innovation and the implementation for electricity distribution infrastructure automation, advanced metering technologies (AMT) technology, BPL communications services and distributed generation in support of Climate Change, Canada's Innovation Strategy, and Canada's Broadband Communications deployment. This proposal is the first step in creating the distribution utility-supplier-government partnership necessary to foster leadership in distribution automation, technology and regulatory innovation as well as strategic partnerships in support of sustainable development and economic opportunities. ■

Coming soon: The Future…Stay tuned.

A retraction is being issued for the company description of Doble PowerTest LTD which appeared in the 2004 International Conference Show Guide of Electric Energy Magazine. This is to correct the statement made that Doble Engineering purchased the National Grid. In the Fall of 2002, Doble Engineering entered into a consultant service agreement with the National Grid Company, the largest electrical transmission company in England and Wales. Doble also expanded its presence in the UK with the acquisition of the specialty test division of Powermann, a leading UK based Electrical Engineering Company. Renamed Doble PowerTest, this team of specialist test engineers operates throughout the world providing the highest standards of rotating machine testing, diagnostics and condition monitoring, including condition assessment of all power and industrial site High Voltage apparatus, including step-up transformers.

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Bar Code Takes Pole Tracking to New Level

MASON CITY, IA – Using Metalcraft bar code products in pole inventory and tracking processes can help provide the foundation for an efficient and effective automated asset management system.

Identifying and tracking utility poles and their inventory with Metal Bar Code Nameplates will reduce maintenance costs and downtime, as well as provide more accurate data collection. These nameplates are designed to resist abrasion, solvents, sun, salt air and high temperatures and can be applied directly to the poles using mechanical fasteners. An image intensification process protects the image from damaging UV rays and ensures that the bar code will ready accurately with every scan for the lifetime of the pole.

Premium Stylemark™ Labels are ideal for identifying and tracking transformers, junction boxes or any other equipment mounted on utility poles. The subsurface printing process used to produce these labels combined with the polycarbonate material makes this label perfect for highly abrasive applications. Plus, the Tedlar® film protects the bar code and/or copy from UV rays ensuring that the label reads correctly every time.

Ceramic-on-Stainless Steel Nameplates are another possible solution for identifying and tracking transformers, junction boxes or other equipment – both above and below the ground. These nameplates are built to withstand the toughest environments and are resistant to water impurities or run-off if flood conditions occur with transformers underground. The bar code is printed on a ceramic layer which is then fused on the stainless steel substrate making it resistant chemicals as well as temperatures over 1000°F.

For more information about Metalcraft utility products, call Metalcraft's customer service staff at 800-437-5283 or visit www.idplate.com.

Note to editors: Metalcraft (Mason City, IA) has been providing identification solutions for over 53 years. In 1950, the company began producing metal nameplates for the advertising specialty industry. In 1952, Metalcraft added nameplates for property management and identification to their product line. Since then, the company has provided thousands of property managers throughout the U.S., Canada and overseas with a wide range of choice in bar code, serialized and unserialized nameplates and labels for mild, moderate, and extreme environments. ●

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Low Income Energy Assistance: EEI Survey Shows Wide-Ranging Industry Support

WASHINGTON, - The results of a national survey by Edison Electric Institute show that the nation's shareholder-owned electric power companies are offering a wide variety of programs and services for their low-income customers.

In total, the industry is offering over 750 programs and activities nationwide. These include billing assistance, weatherization, efficiency, community development and outreach, and more. Sixty operating companies serving over 62 million residential customers responded to the EEI survey, representing approximately 75 percent of the total number of residential customers served by EEI member companies.

"Given the importance of electricity to the quality of life for all people," said Michael McGrath, EEI's Executive Director, Retail Energy Services, "it is especially important to offer help to those who need it. The recent natural gas price increases, and the potential costs arising from the need to strengthen the country's electric infrastructure make this help all the more vital."

Attached is a fact sheet on the industry's support for its low-income customers. Detailed information from the EEI survey can be viewed at: www.eei.org/retail/low-income

McGrath added that by sharing the survey results, "hopefully we will be able to inspire electric companies in developing new and effective programs for their low-income customers. One extremely important national action we can take is to further encourage the good work being done by the industry to increase Low Income Home Energy Assistance Program (LIHEAP) and Weatherization 2004 funding to $3.4B and $281M respectively."

Edison Electric Institute (EEI) is the association of United States shareholder-owned electric companies, international affiliates and industry associates worldwide. Our U.S. members serve approximately 90 percent of the ultimate customers in the shareholder-owned segment of the industry, and nearly 70 percent of all electric utility ultimate customers in the nation. They generated almost 70 percent of the electricity generated by U.S. electric utilities.

Electric Company Low Income Energy Assistance: EEI 2003 Survey Results

Some of the key findings from the 2003 EEI survey of electric company programs and activities for low income customers include:

- Sixty companies (100 percent) are offering programs or activities targeting some type of billing assistance. Typical programs include LIHEAP, fuel funds (with customer donations), average payment plans, and discounts on energy or customer charges.
- Forty-seven companies (78 percent) are offering weatherization-type programs. Typical programs include attic insulation, window sealing, and/or caulking.
- Forty-two companies (70 percent) are offering general residential efficiency programs or programs targeted to low-income customers. Typical programs include heating/cooling system incentives and rebates, Energy Star high efficiency appliance programs, or energy audits (on-site or on-line).
- Thirty-five companies (58 percent) are providing economic programs. Typical programs include Economic Development Councils (at the local or state level), special tariff/rate riders, or tariff/rate discounts based on specific economic development criteria.
- Thirty-seven companies (62 percent) provide at least one type of community outreach program. Typical activities include food drives, senior citizen programs, or employee volunteer activities (sponsored by the EEI member company).
- Twenty-six companies (43 percent) offer other programs that are targeted to low-income customers. Examples of "other" programs include scholarships, charitable trusts, budget counseling, medical needs programs, and individual development accounts.

EEI surveyed its member companies about their low-income programs during the summer of 2003. Data was compiled and finalized in December 2003. The detailed information from the EEI survey can be viewed at: www.eei.org/retail/low-income

Edison Electric Institute (EEI) is the association of United States shareholder-owned electric companies, international affiliates and industry associates worldwide. Our U.S. members serve approximately 90 percent of the ultimate customers in the shareholder-owned segment of the industry, and nearly 70 percent

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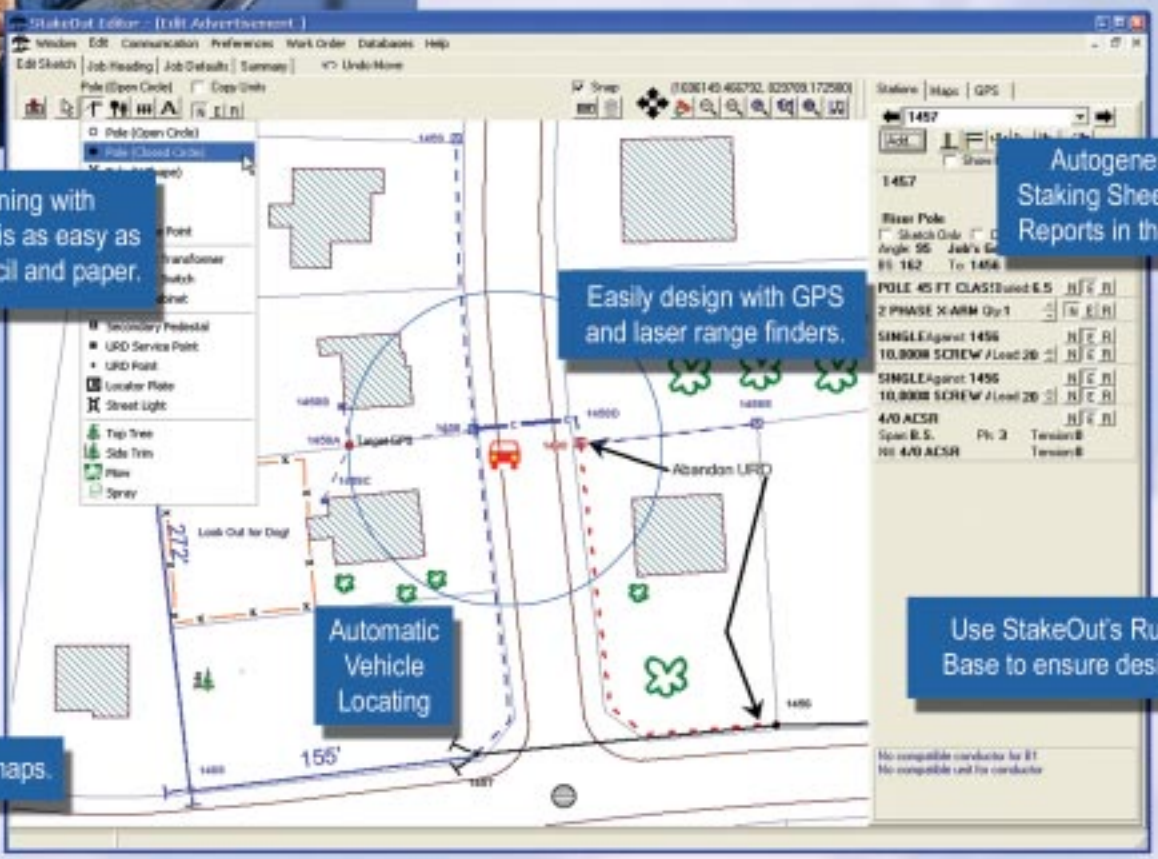

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- Bryan Bowen, Line Extension Supervisor
Sulphur Springs Valley Electric Cooperative

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of all electric utility ultimate customers in the nation. They generated almost 70 percent of the electricity generated by U.S. electric utilities. ●
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KEMA Launches Geospatial Design and Development Consultancy Spinoff - VELOCITIE Integration Inc.

BURLINGTON, MASSACHUSETTS - KEMA, an independent provider of technical and management consulting services to the electric power and gas energy industries, today announced the formation of VELOCITIE Integration Inc. VELOCITIE is a GIS software design and development consulting firm focused on geospatial utility operations.

KEMA formed VELOCITIE as part of its strategy to reorganize its operations employing GIS software development resources. The move is designed to create low cost, price competitive software development and system integration services for utility clients while maintaining KEMA's standards of excellence.

"We are very excited about the new launch and about the prospects for success," said Kelly Warner, president of KEMA Inc. "KEMA stands for quality. Creating VELOCITIE gives us the flexibility to continue to provide clients with world class IT services in a more flexible, cost-competitive manner."

Warner continued, "Forming VELOCITIE is a key component of KEMA's strategy-to-implementation consulting model. The move allows KEMA to continue to focus and build on our energy industry and utility operations domain expertise while letting VELOCITIE concentrate on delivering best-in-class software implementation services. KEMA's continuing IT consulting operations will be centered on higher end services that leverage our industry expertise, including IT strategy and planning, business design and implementation, IT architecture, software vendor evaluation and selection, project management of implementations and integration, and client acceptance of project deliverables."

KEMA's IT consulting focus includes systems integration for transmission and distribution utility operations. Specific areas of expertise include enterprise application integration, project management, operational real-time data marts, asset management, billing and settlement, and energy data management and analysis.

Under the new organizational structure, KEMA will partner with VELOCITIE to deliver client engagements where complementary services are a good fit with client needs. KEMA will continue to serve existing clients with VELOCITIE as a subcontractor.

Headed by former KEMA Director of Strategic Alliances Bart Koenig, Green Bay, Wisconsin-based VELOCITIE provides GIS software design and development services in conjunction with KEMA's business process, system architecture, and project management services. VELOCITIE will also focus on utility market sectors that are not a key focus for KEMA, including small municipals and co-ops, telecommunications, water and wastewater utilities.

"The formation of VELOCITIE signals KEMA's continuing commitment to providing quality end to end implementation services to the GIS utility market," said Koenig. "The VELOCITIE team is poised to carry on KEMA's tradition of affording our clients experienced personnel, best practice implementation strategies and cost effective solutions for the energy, municipal and telecommunications GIS markets."

About KEMA

KEMA is an independent company with an international reputation for high-level technical consultancy, testing, inspections and certification for businesses in the energy industry, assisting more than 500 clients in more than 70 countries. Headquartered in Arnhem, the Netherlands with subsidiaries and offices worldwide, KEMA employs more than 1,500 full-time professionals and leading experts in many facets of the energy utility industry. Founded in 1927, KEMA serves the complete spectrum of participants in the energy marketplace and offers a full complement of services supporting generation through the consumer side of the meter. KEMA's North American business operations are headquartered in Burlington, Massachusetts. ●
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British Columbia Transmission Corporation Announces Ebrahim Vaahedi as Chief Technology Officer

Vancouver, BC — Michael Costello, President and CEO of British Columbia Transmission Corporation (BCTC), is pleased to announce the appointment of Ebrahim Vaahedi as Chief Technology Officer.

As CTO, Dr. Vaahedi is responsible for developing and executing a consolidated Technology Plan for BCTC. He joined BCTC from his role as a Senior Manager at Perot Systems providing energy consulting

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Because Armilian is also a provider of integration services, the Armilian Substation Design System can be integrated into your organization's existing information technology such as work order management, purchasing, maintenance, continuing property records, outage management and engineering analysis. Our application utilizes XML and system specific integration tools that can provide real time access to the data created by and contained in the system.

What now takes an experienced operator many hours can now be done in a matter of minutes with the Armilian Substation Design System.

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Armilian Technologies has been serving the market since 1988 and has grown to become one of the leading providers of enterprise engineering solutions and systems integration services in the United States. With Armilian Technologies, you get a company that provides the greatest flexibility for implementing the most affordable, technologically sound, and dependable solutions available. Please contact us at ***800.713.3830*** *or visit us on the web.*

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services as well as leading Perot's team engaged in developing Mid-West ISO's Integrated Control Center System. Previously at Perot Systems, he worked at the California Energy Office as a Senior Specialist Consultant engaged in the management and development of application programs for California Power Exchange. Before working for Perot Systems, Dr. Vaahedi was the Manager of Control Centre Technologies Department for B.C. Hydro.

Dr. Vaahedi holds a doctorate from the Imperial College of London with an emphasis on the secure and economic operation of power systems. He is a Fellow of the Institute of the Electrical and Electronic Engineers (IEEE), a Fellow of the Institute of Electrical Engineers (IEE) in UK, serves as the Chairman of the Operation Methods Subcommittee of IEEE and is an Editor of the IEEE Transactions in Power Systems.

Established in legislation on May 29, 2003, British Columbia Transmission Corporation was created to support the delivery of low-cost, reliable energy to meet the needs of British Columbians and our economy now and in the future. It is responsible for operating, managing and planning the electricity transmission system of wires, and directing new investment in transmission infrastructure upon receiving approval from the BC Utilities Commission. BCTC began operation in August of 2003. ●

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For more information, please contact:
Moira Chicilo, Director of Communications
E-mail: moira.chicilo@bctc.com
www.bctc.com

Hitachi Software Announces Any*GIS™ Version 3.5

Enterprise GIS Solution Continues Support for Open Standards While Incorporating Additional Functionality

Westminster, Colorado – Hitachi Software Global Technology (HSGT) announces the March 1st release of its open spatial data integration solution, Any*GIS Version 3.5. This release includes a document management extension, GPS support on the Any*GIS mobile client, and several new functions within the Spatial Information Module (SIM) and Network Information Module (NIM).

Any*GIS is a Geographic Information System that allows organizations to adopt open standards while preserving legacy spatial data and work flows. Any*GIS is based on Open GIS Consortium standards that include the OpenGIS® Simple Feature Specification (SFS), Coordinate Transformation Services (CT), and Geographic Markup Language (GML). It also employs open industry standards, including Java 2 Enterprise Edition (J2EE), Common Object Request Broker Architecture (CORBA), eXtensible Markup Language (XML), and Structure Query Language (SQL).

New Key Features of Any*GIS Version 3.5:

- A robust document management extension that allows geographic features to link to multiple document sources such as Office documents, CAD drawing files, graphics files, and scanned images.
- GPS support for the Any*GIS mobile client with location tracking and automatic map orientation to indicate directional heading.
- An improved Network Information Module (NIM) that includes support for the GIS interface of the MultiSpeak Version 2.2 specification.
- An enhanced Spatial Information Module (SIM) with expanded relationship query that performs value calculations from attribute data.
- Native support of IBM DB2 Spatial Extender datastores.
- Support for Red Hat Enterprise Linux Version 3 operating system.

"Any*GIS has always supported open standards and the integration of disparate GIS data sets," stated Mr. Robert Carroll, Vice President of Hitachi Software Global Technology. "With the release of Version 3.5, we are expanding our solution to support customer challenges - including facility and resource management and field data access."

Any*GIS Version 3.5 Enterprise Server, GeoAdapters, and clients will be generally available in March 2004.

About Any*GIS

Built on Open GIS Consortium standards and open systems architecture, Any*GIS is a multi-tiered interoperable framework that allows data access and dynamic updating to multiple GIS data sources, without compatibility and translation issues. Any*GIS supports spatial data access and updating to OpenGIS® Simple Feature Specification datastores in Oracle and SQL Server, as well as proprietary formats including those from Autodesk, ESRI, Intergraph, MapInfo and GE Smallworld. Users can access data from the Any*GIS Enterprise Server via three clients: Any*GIS Pro, Any*GIS Web, and Any*GIS CAD. Developed using Java 2 Enterprise Edition (J2EE), Any*GIS is highly customizable and can be tailored to meet the needs of any organization that depends on accurate geographic and associated non-spatial data.

The system makes it possible for organizations that manage large infrastructures (utilities, telecommunications, and government agencies) to integrate disparate facility spatial data sources, enable business workflows, facilitate GIS data management with CAD, and maintain legacy GIS applications and data.

More information can be found at www.anygis.com.

About Hitachi Software

Hitachi Software is a leading software, data, and solution provider for companies seeking to maximize their potential through spatial information. Hitachi Software solutions combine Open GIS Consortium standards; imagery and vector data products; and award-winning automatic vectorization software. Headquartered in Tokyo, Japan and with operations in Colorado, USA and Orleans, France, Hitachi Software continues to pioneer new technologies and services for customers such as utilities, telecommunications companies, and governments. Hitachi has been a technical member of the Open GIS Consortium, Inc. since 1997. For more information about the company, please visit www.hsgt.com.

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Hindlepower, Incorporated, one of the leading manufacturers of battery chargers and specialty power supplies, announces the compliance to meet DNP3 protocol

The newest addition to their already successful line of AT10.1 and AT30 Series Battery Chargers, is the AT Series Communications Board. This option allows the user to remotely monitor and control the AT Series Battery Charger over a serial connection. This product

complies with the DNP3 Subset Level 2 Test. DNP3 has been designed to meet current and future North American protocol standards for telecontrol applications. DNP3 offers flexibility and functionality to the already conventional communications protocol, while providing a very efficient layered protocol that is ensuring high data integrity. Users can expect many benefits from this protocol and that is why the AT Series Communications Board is so successful to this line of AT10.1 and AT30 Battery Chargers. The DNP3 is based on the IEC 870-5 requirements which also make it an acceptable choice for a SCADA environment.

This compliance serves as an endorsement of the company's products for meeting the industry's highest standards for quality and safety worldwide. Headquartered in Easton, Pennsylvania, HindlePower manufactures and distributes products primarily to end users in the stationary and utility markets throughout the United States, Canada and Europe. For more information visit www.hindlepowerinc.com and request brochure #JF5014. ●

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For immediate release contact: Art Salander/VP, Sales & Marketing

HindlePower, Inc.; Email: batchgr@aol.com www.hindlepowerinc.com

Elster Electricity's EnergyAxis® System with intelligent two-way communications gains momentum worldwide

Raleigh, North Carolina, U.S.A. — Elster Electricity, LLC (formerly ABB Electricity Metering) announces that its EnergyAxis System has gained worldwide acceptance by various utility companies in North America, South America, the Caribbean, and Asia. Since the EnergyAxis System's introduction in September 2003, Elster Electricity has received commitments from nine utilities totaling over 6000 system meters, with the average initial project deployment ranging from 500 to 1000 system meters. The size, scope and stage of deployment of each project vary. The utilities include large investor-owned and public power utilities that own and operate over 20 million meters.

Utilities are testing various advanced features of the EnergyAxis System's intelligent, two-way network including remote disconnect and reconnect; kWh energy consumption; demand metering; time-of-use metering; load profiling; special reads for high turnover and difficult to read areas such as apartment complexes; and extended network coverage areas using minimal infrastructure.

"The EnergyAxis System is designed to address targeted deployments as well as large-scale deployments. The system's scalability is an attractive feature that allows utilities to deploy surgical implementations with the option for future growth as their business needs require. Utilities now have the opportunity to install a two-way intelligent radio frequency (RF) network and have immediate access to the advanced metering functionality provided by the EnergyAxis System with a minimal initial investment," remarked James Andrus, manager or AMR systems and market development at Elster Electricity.

About the EnergyAxis System

The EnergyAxis System for residential and small commercial and industrial metering automation uses a powerful two-way RF communication system with Elster's new, electronic single phase REX™ meter. The system's advanced architecture uses Elster's A3 ALPHA® meter as the host for local data collection from a network of REX meters. Revenue metering data is stored in each REX meter. A3 ALPHA meters equipped with both wide area network (WAN) and RF LAN option boards function as data collectors and manage LAN networks of up to 1,024 REX meters. A3 ALPHA meter collectors store data collected from REX meters on the LAN and periodically upload the data to Elster's EnergyAxis Metering Automation Server (MAS) via a public WAN. Because A3 ALPHA meter collectors are also system meters, capital expenses, installation, and maintenance costs are reduced. Both the A3 ALPHA meter collector and REX meter are programmed and configured using Elster Electricity's Metercat™ Support Software release 1.4.

The LAN uses an intelligent, two-way spread spectrum frequency-hopping technology with self-registration to provide secure, reliable communications between network meters and data collectors. This technology enables individual meters to act as repeaters, creating a dynamic communications path that optimizes signal strength and reliability.

About Elster Electricity, LLC

Elster Electricity (formerly ABB Electricity Metering) is located in Raleigh, North Carolina and is a leading provider of electricity metering products and services throughout the world. Elster offers a comprehensive portfolio of innovative, cost-effective electricity metering products, communications solutions, and metering automation systems for residential, light and heavy commercial and industrial applications, and sub-metering applications. Designed to meet the diverse electricity metering requirements of a global customer base, Elster's metering products include advanced high accuracy ANSI and IEC electricity meters, featuring the EnergyAxis System with the new electronic REX™ meter and the ALPHA® meter line. Elster Electricity serves customers through a global sales force. Visit Elster Electricity's website at www.elsterelectricity.com. ●

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For more information contact:

Gabrielle Puccio, Director, Corporate Communications

Elster Electricity, LLC; gabrielle.puccio@us.elster.com

New Adventures in Submetering

Going beyond the billing meter to increase visibility into energy usage data and create greater efficiencies

By: Vance Hall, Vice President, MeterSmart, L.P.

For years in the utility industry, submeters were viewed as a collection of rather simple measurement devices used for one main purpose – utility bill allocation. Later, the manufacturing world discovered that submeters could be valuable tools not only in allocating, but also in analyzing, managing, forecasting and controlling energy usage. In this role, submeters act as a helpful window into the energy consumer's business processes.

Load Research Project Checklist

- ✓ Sample Design and Selection
- ✓ Customer Recruitment
- ✓ Customer Site Survey
- ✓ Equipment Procurement
- ✓ Equipment Installation
- ✓ Commissioning
- ✓ Data Collection with VEE
- ✓ Reporting

In the electric utility world, the story is different. Here the submeter has not played a significant role until very recently. Today, new uses for submetering technology are being realized by utilities to enhance load research programs, measure energy demand and provide important data for marketing programs that offer customers a chance to track their own energy usage on the Web in the middle of a billing cycle. All of these new uses are finding a place as valuable customer retention tools for leading utility companies.

In a world of costly blackouts, high energy demand and high energy prices driven mostly by high natural gas prices and low generation and transmission capacities, utilities are beginning to use submeters as tools to help their customers reduce operating costs and drive loyalty, especially among commercial and industrial business customers.

Effective Load Research

With numerous technological advancements and rising costs facing the electric utility industry, utilities are doing more homework. Case in point, load research programs and individual customer research efforts are gaining popularity because of their ability to show utility customers when and how they can save money on the monthly energy bill. Capabilities made possible by today's more advanced submeter are playing a critical role.

Electric load research provides end-user data with a wide range of uses. It is the basis for cost-of-service studies used in the ratemaking process; the driver for load profiling for billing and settlements; and the enabler of demand and energy requirement forecasting. It also proves value in the creation or revamping of utility marketing programs.

Load research involves the process of defining the population or target customer segment to be analyzed, creating a sample design that accurately represents the target, selecting the sample set of customers, recruiting the sample of customers, installing interval data recorders, collecting and analyzing the sample data and finally reporting the results. The objective in recruiting the sample set of customers is to obtain as many of the primary sample customers as possible or a certain amount of bias may enter into the sample. To minimize the amount of rejections of the primary sample set, care must be taken in the recruiting phase of the project.

In past years, metering with interval data storage capability was large and bulky, therefore customers often rejected them because they did not want a large, unsightly piece of equipment installed within or attached to their premises. With the advent of electronic metering came smaller recorders under glass, which are less intrusive. One issue remained, however, which was that installation of the recording equipment required a service interruption in order to install the research meter. This presented a problem for the end user.

For most residential customers this was not a major issue, but for most commercial and industrial customers turning off the power isn't even an option. A service interruption at a large industrial facility means idle workers, wasted wages and compressed deadlines for products and services – all very costly predicaments. Therefore, installation was most likely deferred until a time that would cause the least impact to the industrial customer. In turn, this meant overtime expenses for the utility to have workers install meters on the weekend or on a holiday. For smaller commercial customers, like a dentist office or a small grocery, a service interruption means the business cannot service its clients during the outage, which affects their ability to earn an income.

So what is the impact of customer rejection? In the context of load research, it leads to inaccurate data. For example, if all customers that

refuse to let a research meter be installed because of the service interruption are rejected, the sample becomes one of only customers that will allow a service interruption and not a representative sample of the target population. These customers could easily have a different set of energy usage patterns than the population-at-large.

The latest submeters solve this predicament as they can be installed without a service interruption to the customer. Split-core current sensors are installed around the conductor or wire, thereby maintaining continuity of service to the facility. This also allows the submeter to be installed behind the billing meter, yet on the same supply circuit; therefore, accurate load profile information is obtained as it comes from the same power supply line as the billing meter. Removing the service interruption requirement virtually eliminates customer rejection once the utility customer is educated on the benefits and added control they're given over their own energy use.

The next hurdles are hardware and software compatibility, ease-of-use and cost of communications. Most utilities use a standard interval data-collection software platform that reads and stores interval data in 15-minute increments from their billing and research meters. But most submeters are not directly compatible with this software and data must be gathered by one software platform, translated to the utility software, then handed off to a display medium or Web presentation tool. This is obviously very cumbersome, prone to error and expensive to say the least. Therefore, meter and software compatibility as well as a simple display medium (i.e. Web presentation) are essential elements to any effective program. A seamless approach is desirable for both utility research and "end customer" usability. Energy information stored on a secure Web site allows both the utility and the customers to access the data from any Web enabled location to assess energy usage data in near real-time. This allows proactive decision-making and rejuvenates demand-side management (DSM) projects. Program costs are also driven by the cost of communication, if a dedicated phone line is required, installation may take several months and be priced at $30 to $50 per month, plus the cost of installation at $250 to $500. On the other hand, if a shared phone line can be used, the meter dials a 1-800 number in the middle of the night, enabling considerable savings.

Validating Demand-Side Management

One recent project in California is using the benefits of load research to validate an existing demand-side management project. The large investor-owned utility is in the midst of conducting a load research study to validate the accuracy of a remotely driven thermostat-control initiative.

The purpose of the program is to measure usage data and confirm the magnitude and timing of reductions in consumption during control periods. In this case, thermostats at a sample group of approximately 150 small businesses can be remotely controlled by the utility to be increased or decreased by between 2 and 4 degrees Fahrenheit.

The desired result, obviously, is to reduce electricity demand during the control period (critical peak demand periods), while providing minimum (often unnoticed) environmental changes at the customers facility. In full turnkey fashion, the California utility had its submetering solution vendor install submeters behind the billing meter to eliminate the need for a service interruption, and conduct interval data collection, processing, analysis and reporting services as well as Web presentation. Again, multiple meters were used as well as runtime sensors on the HVAC units. In each case, the customer's phone line is shared, which reduces communication costs to the utility for retrieving timely submeter data. Information from the submeter is transmitted in off hours, usually from midnight to 6 a.m., to eliminate interference with business operations. In addition, each submeter is equipped with "off hook detection" that enables the meter to disconnect from the phone line

and give control back to the customer if the customer picks up the phone to dial out. The submeter is designed to retry the communication at a later time in the event that "off hook detection" is encountered.

Currently at its midway point, the project has already achieved some intriguing results showing a 10Mw reduction of demand for a one hour period based on 5,000 participants.

Again, the use of industry-standard equipment is key. Compatibility between metering and software means utilities no longer face the burden of trying to maintain multiple platforms for reading interval data; it can all be done on a single platform. This, coupled with the fact that a vendor's submetering falls within the requirements of meeting billing accuracy standards, makes the submeter a very useful tool in the electric utility industry for load research.

Providing Critical Data for Troubleshooting

Metering used for load research or customer profile information often provides valuable information on individual customer usage characteristics. This information can lead to true and immediate savings for the customer. This is especially true when a utility customer incurs high demand charges for electricity caused by inefficient operation of that facility.

In a real-world example from a Texas-based cooperative, one of the utility's customers, an Episcopal Diocese retreat facility, experienced an alarming $8,000 increase in its electricity bill. The camp welcomes more than 40,000 visitors annually and likely had a number of places where energy usage could be better controlled. However, the facility lacked proper metering.

To gain visibility into the problem, the utility first installed an interval meter with an associated secure Internet account that allows camp officials to view their own energy usage via the Web. The Coop offers this program to its commercial and industrial customers via the utility's generation and transmission partner and a third-party submeter and energy information service provider. Camp officials could now view when their energy usage was peaking, but they could not yet see where and, most importantly, why it was going up. This was a perfect job for a bit of customer research.

As the project manager, the Coop determined that submeters should be installed at the camp's conference center, the chapel and within the facility's two hotels. The project manager, along with its partners, identified metering equipment that allowed the use of industry-standard interval data retrieval software to retrieve usage data every 15 minutes. And, because the facility has guests year-round, turning off the power for any period of time was not an option. So, the Coop installed submeters with split-core current sensors around the conductor, thereby maintaining continuity of service to all buildings involved in the program.

Soon facility managers were able to see when and where energy was being used, plus the Web-based energy management program from the generation and transmission partner, and automated meter reading and data analysis became a regular part of operations at the camp. With meter installation completed by March 2003, payback for the project was achieved about three months later in June. Equipment costs were covered by the utility, which now had a happier long-term business partner in the Episcopal Diocese facility.

In both of these cases — the validation of the California utility's demand-side program and troubleshooting at the Episcopal campsite æ the common threads were maintaining service to the facility during installation, and submeter compatibility with industry-standard interval data software. The common lesson? Load research and demand-side management prove that it pays to do your homework.

Vance Hall is Vice President for MeterSmart, L.P. He can be reached at vhall@metersmart.com. ■

METERING AMERICA 2004

BILLING AMERICA 2004 CRM/CIS AMERICA 2004

theconnectedfuture

24-26 March, 2004

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The 5th annual Metering, Billing, CRM/CIS America takes place in San Diego, California 24-26 March 2004.

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- a key-note address from Chairman William Keese of the California Energy Commission;
- Compos Mentis Live!;
- a round-table discussion encompassing Mike Shames, Consumer Advocate of UCAN, Irene Stilling, Executive Director of San Diego Regional Energy Office and Jeff Nahigan, Senior Economist of JBS Energy.

A number of additional industry leading events will be co-located with Metering, Billing and CRM/CIS America:

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Registration and program information can be found at: http://www.metering.com/events/mam2004.

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23 March 2004
-> Training Workshops:

- Demand Response Pricing Products hosted by Utilipoint
- Segmenting the Utility Billing Market hosted by Utilipoint
- Cost Justifying a Revenue Recovery Program hosted by Arnett Consulting
- How to Establish a Successful Revenue Recovery Program hosted by Arnett Consulting

24-25 March 2004

-> The Peak Load Management Alliance (PLMA) annual Spring Meeting

24-26 March 2004

-> Exhibition: Answers from the industry's principal manufacturers are featured in dedicated exhibit hours that do not compete with the conference sessions.

24 March 2004

-> Executive Workshop: The Future of IT and customer Care at Utilities: This executive workshop, presented by Warren B. Causey, Ltd., top-ranked industry professionals and futurists will examine how CIS/CRM has been caught up in the changing paradigms of the industry as a whole.

20 – 27 March 2004

-> Tour: The first international AMR Technical Study tour to the USA, will precede Metering, Billing, CRM/CIS America 2004. and includes site visits to the leading and some of the largest sites in the United States. Utilities, consultants and vendors will demonstrate the fundamentals of and give in-depth knowledge and comprehensive information surrounding, AMR projects. Extended services beyond AMR compliant with or supported by AMR technology, such as customer billing, appliance monitoring, energy management, and home security monitoring will also be looked at.

METERING AMERICA 2004

BILLING AMERICA 2004 CRM/CIS AMERICA 2004

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24-26 March, 2004

Saturday 20 March 2004

- AMR TECHNICAL TOUR

Philadelphia:
AMR Technical Tour (Primer)

Sunday 21 March 2004

- AMR TECHNICAL TOUR

Philadelphia:
AMR Technical Tour (PPL Electric Utilities)

Monday 22 March 2004

- AMR TECHNICAL TOUR

Cincinnati:
(Greater Cincinnati Water Works Offices)

Tuesday 23 March 2004

- AMR TECHNICAL TOUR

AMR TECHNICAL TOUR

AM
Las Vegas, NV: (Nevada Power)

Session A 0.1
IURPA Accredited Revenue Protection Training

TRAINING/WORKSHOPS

AM
Session B 0.3
Demand Response Pricing Products

AMR TECHNICAL TOUR

PM
Fly to San Diego

Session A 0.2
IURPA Accredited Revenue Protection Training

TRAINING/WORKSHOPS

PM
Session B 0.4
Segmenting the Utility Billing Market

Wednesday 24 March, 04

PRE-CONFERENCE SEMINARS

AM
- Session F 0.5
- Session F 0.6
  Financing Metering and IT Assets
- Session D 7.1
  Executive Workshop on the Future of IT and Customer Care at Utilities
- Session E 5.1

PM
- Session F 0.5
- Session F 0.7
  ASP/Web Technologies and Metering
- Session D 7.1
  Executive Workshop on the Future of IT and Customer Care at Utilities
- Session E 5.2

LUNCH

Wednesday 24 March, 04
(continued)

PM

Joint Networking Opportunity: Welcome Reception

Day 2:
Thursday 25 March, 04
- Session 1.1
  - *Joint Opening Session*
  - *State and Federal Programs*

Joint Lunch on exhibition floor

PM
- Session C 2.1
  Regulation and Standards
- Session C 3.1
  Emerging Technologies for Metering
- Session C 4.1
  Technologies
- Session E 5.3

Afternoon Refreshment Break on Exhibition Floor

Day 2:
Thursday 25 March, 04
(continued)

PM
- Session C 6.1
  Metering for Energy Management and Energy Efficiency
- Session C 3.2
  Asset Optimization
- Session C 4.2
  Technologies
- Session E 5.4

4-8 P.M.: Joint Networking Opportunity: Cocktail Reception - Official Opening of the Exhibition

Day 3:
Friday 26 March, 04

AM
- Session C 6.2
  Demand Response Management and Advanced Metering
- Session C 3.3
  Technologies for Revenue Enhancement: AMR
- Session C 4.3
  Case Studies

Joint Lunch on exhibition floor

PM
- Session C 6.3
  Demand Response Management and Advanced Metering Pricing
- Session C 3.4
  Technologies for Revenue Enhancement: AMR
- Session C 4.4
  Outsourcing

PM
Session C 1.2
- Joint closing session

27 March, 04

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103	AMRA
205	Brooks Utility Products Group (Ekstrom)
313	Byram Laboratories
402	Calfirst Utility Finance Group
208	Cogsdale Corporation
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101	Datamatic
403	DB Microware
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302	GE Energy
401	Gruner AG
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206	Hunt Technologies
307	Itron
102	Kema Consulting
301	KG Technologies
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406	Marwell Corporation

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309	Public Utilities Fortnightly
312	Radiopath Metering Automation
310	San Diego Regional Energy Office
201	SAP America Inc.
107	Schlumberger Electricity Inc.
308	Schweitzer Engineering Laboratories Inc
207	Segway
210	South African Micro Electronic Systems (SAMES)
408	Spintelligent/Metering International
204	Tantalus Systems Corporation
212	TWACS by DCSI
305	Unikom-Ug
202	Utilipoint International
407	Viterra Energy Services

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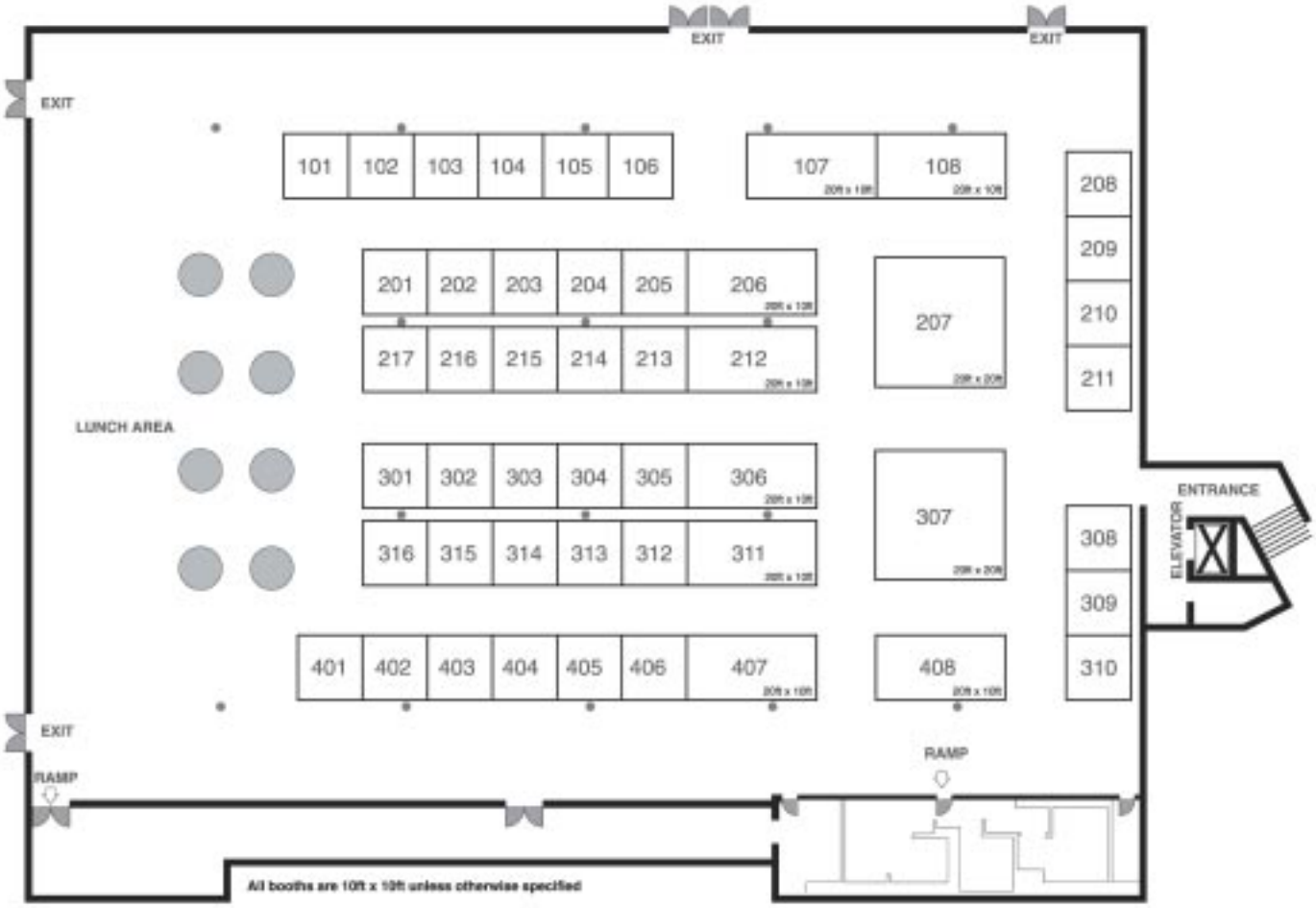
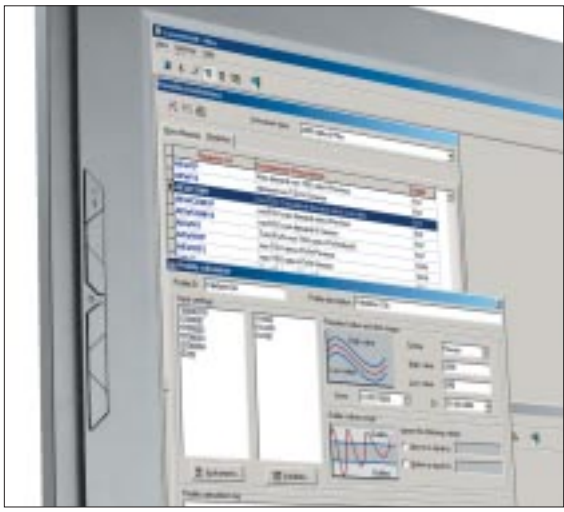


Sheraton San Diego Hotel & Marina
Lower Exhibit Hall

System Solutions to C&I Data Collection

By: Shawn Fields
Director of Market Development
Datamatic Energy Systems

Utilities have traditionally collected data from their commercial and industrial (C&I) customers once a month. This data has been collected via remote interrogation over phone lines or manual probing of the meter. Recent market changes and improved communication technologies have driven utility managers, energy service providers and meter data management agents to search for new methods and products that react to these changes while streamlining operations in an effort to improve their bottom line.



These forces have made collecting and delivering the C&I data much more challenging. One of the ways to help manage these obstacles is to consider C&I data retrieval systems that support customer diversities, emerging communication technologies and energy conservation programs. This article is an analysis of market conditions, technology trends and available system solutions.

An Industry in Flux

Deregulation, new additional complexity to service territories and customer switching has created new challenges for energy service providers and data collection agents. They have been forced to become more innovative in their approach to tracking customers, delivering bills and collecting meter data while trying to reduce the cost of doing business.

In many cases, energy costs are the third highest expense an organization must contend with, yet it's a variable that few end-users understand. While these customers are diverse in their businesses, they share a common need to manage or reduce costs. Energy companies must not only deliver reliable energy and energy services, but also offer value added products and services to teach end-use customers how to better manage their energy bills and consumption.

Market Drivers

Due to changes in the marketplace, customers are beginning to ask energy providers for more timely and accurate energy information including web-based representation of data, value added services and competitive rates. Although it is still important to use multiple meter manufacturers, it's becoming just as vital to have the ability to support existing and emerging communication technologies that enable faster and cheaper methods of data collection. The following areas identify market drivers and changes that are creating the need for improved C&I data collection solutions:

- **Deregulation** - Energy shortages through transmission & distribution shortfall and more timely settlement has enhanced the need for understanding customer load on a timely basis. Where deregulation exists, so do energy service providers (ESP's) or energy marketers that give customers a choice. In most cases, these energy providers span multiple service territories, which can create complexity and frustration to the data collection process. As margins on the energy commodity itself are thin, energy providers need not only accurate and timely data for customer billing and settlement, but also a cost effective means in which to collect it. Thus, they are moving toward the digital data technologies that support GPRS and 1xRTT. This also holds true for the meter data management agents (MDMA's) and meter service providers (MSP's) that offer data collection services for energy providers.
- **Energy Conservation** - Demand Response Programs provide a method to help reduce load and slow the need to build additional generation. Load Response Programs are used by Independent System Operators (ISO's), utilities, or load-serving entities to ask customers to reduce load during periods of high demand or generation shortfall. There are also price response programs where end-users will react to high-energy prices during certain periods of the day.

In many cases, the data for these programs must be collected in hourly or sub-hourly intervals requiring, near real-time data collection. In order to measure the success of these programs, accurate and timely metering must be in place to measure compliance and help determine settlement to the participants.

Traditional telephone dial up methods are too costly and may exceed the data retrieval capability of most dial-up systems, like MV-90. Utility Commissions not only require 15-minute resolution, but also mandate the interval data from a broader/lower range of demand customers; this increases the number of meters that a utility needs to interrogate. Additionally,

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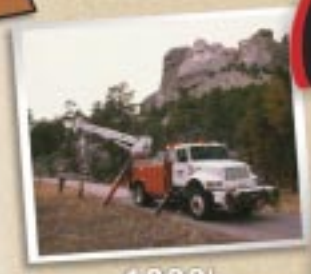

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1992 – Developed the Commander 7000 Series

1995 – Introduced the Commander 4000 Series

1997 – Introduced the latest Generation of Radio Controls

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2002 – Introduced the Captain 3900 Digger derrick

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utilities are supporting new and more complex rate structures; this increases the need for load profile information for the various classes of customers and to satisfy PUC requirements. The dramatic increase in meter collection may stress or surpass the limits of existing data retrieval methods.

- **Emerging Communication Technologies** – As communication technologies improve, communication providers are adopting various platforms such as digital voice, digital data and Ethernet – TCP/IP; this gives utilities better choices for many types of data transfers between devices. Wireless data capabilities are becoming more widely available and analog cellular services are being phased out.

The newer data packet technologies offer full two-way communications, higher reliability, faster connections and lower costs than traditional telephone, cellular modems, or two-way paging. As the market continues to drive toward higher resolutions of data, it also drives the need for near always-on connections. C&I data retrieval systems will be expected to validate, aggregate, report and provide all the normal data management functions but in addition, are expected to seamlessly manage the various communication networks that are emerging as technology improves.

Enhanced Customer Service

Whether a utility is in a regulated or deregulated environment, providing top-notch customer service to help improve customer loyalty and customer retention remains an important goal. C&I customers are demanding more reliable and timely access to usage data to help make operational decisions that could result in measurable energy savings. Detailed profile information can also help customers predict their energy budgets or help with rate negotiations. Providing the data can improve customer service by reducing billing errors and help provide quicker response time to customer requests.

Providing value-add products and services such as Web-based energy information services can deliver better information to end-use customers. Immediate access to the meter data via the Internet will help customers understand usage patterns and provide immediate billing calculations rather than waiting to the end of month.

In addition to billing or profile information, customers are concerned with power quality and reliability. C&I data retrieval systems should have functionality that allows for event notification and information on the quality of the power being delivered.

In summary, the following functionality within a C&I data retrieval system provides end-use customers additional value:

- Web-based energy information (profile data)
- Event notification
    - Demand thresholds
    - Response to curtailment programs
    - Outages
- Power quality
- Web-based bill analysis

System Flexibility/Architecture

Current data retrieval systems need an open and expandable architecture so that utilities, or their third party agents, can develop real time interfaces for the systems that need access to the data such as billing, load forecasting, outage management, and CIS systems. While most utilities' processing systems historically "pushed" data at some periodic interval through custom file transfer programs,

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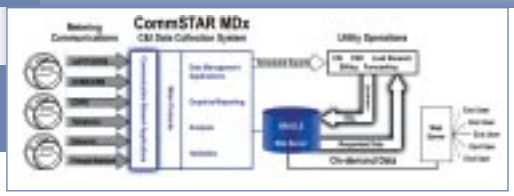

these systems are now requiring the option of real-time access to the data on-demand or "pulling" it through direct open access via SQL, APIs, or web services. The ideal system provides all these technologies / techniques since different systems have different data access requirements; the best solution for a report generator is not necessarily the most efficient interface for a billing or an event notification system.

Retrieval systems need to support an architecture that provides flexibility to expand the system vertically into multiple tiers or multiple boxes for system throughput, division of labor and the efficient utilization of available computing resources. Additionally, the system must be expandable horizontally at each tier to support multiple users/clients, communication ports, and application processors, as well as provide for functional redundancy to eliminate single points of failure.

Along with these architectural requirements, the retrieval system must provide support for multiple meter protocols, as has been accepted as a standard requirement for C&I data collection. However, they now need to provide the capability to integrate the various wireless public and private communication networks as well as Internet based metering. Just as multi-vendor was the key word for the 1980's and 1990's; multi-network for communications is the key requirement for the next decade. Utilities will begin to mandate the economics and ease of use of a single system that is open, expandable, and supports multiple metering protocols and communication networks.

Supporting Multi-Protocols and Communication Networks

New C&I meters are continually being introduced that incorporate higher functionality, as well as the ability to communicate over different platforms. As long as there are diverse meter manufacturers, there will be a continued need for multi-vendor data retrieval support.

The new variables are the communication networks used to collect the data from the C&I meters. The C&I data collection systems currently in use need to provide traditional telephone (POTS), Internet, as well as the new wireless public networks through a single user interface / system.

Cellular carriers are now providing data communication within their next generation digital wireless networks including GSM/GPRS and CMDA/1xRTT. These capabilities are offering new technologies that can be utilized for more robust meter communications.

In addition, cellular providers are switching their data communications from analog packet data (CDPD) to the two digital standards mentioned above. With these new standards comes a fundamental architectural change in IP addressing techniques and communications with end point devices (meters). The challenge for the future data retrieval system is in handling the new architecture of dynamically assigned IP addresses for the communication devices (meter modems).

Traditional outbound IP communications use a static IP address, which was assigned to the CDPD modem just like a phone number is assigned to a cell phone. For the new packet switched standards (GPRS and 1xRTT), cellular providers are requiring the communication end point devices to retrieve an IP address from the system whenever they want to communicate. This is acceptable for "inbound" calls since the host system does not need to know the IP address. However, this system creates a problem for "outbound" calls since the host system does not know the IP address ahead of time.

The various communication equipment/ modem manufacturers are seeking solutions to this problem, but each seems to be designing their own techniques. Therefore, data collection systems must be able to support these varied solutions. In some cases, there is a need to implement another protocol layer while in others, the solution includes developing a seamless interface to a manufacturer's backend communication server application. No matter which technique is implemented, the key requirement is that it remains transparent to the end-user and other interfacing systems that collect data from the meter.

Below is a graphical depiction of what C&I data collection systems must to look like in an effort to support new demands and technologies:

Adapt and Survive

The electric utility market has undertaken its most significant evolution over the past decade since regional power grids were introduced. The effects of deregulation, new customer demands and the explosion of technology has irrevocably changed the landscape. Utilities are learning to work faster, leaner and smarter while providing even more value; they expect their vendors and equipment to match those parameters.

The combination of recent market changes and improved communication technologies have dramatically impacted C&I data collection systems as utility managers, energy service providers and meter data management agents seek new ways to streamline operations.

These forces have made collecting and delivering the C&I data much more challenging. Systems that provide maximum capabilities, multi-vendor flexibility and adaptability are beginning to emerge in the marketplace. Systems that do not meet these criteria will be eventually phased out in the ultimate Darwinian competition. The days when a vendor could dictate the meters, software and collection systems that a utility must use are numbered as utilities regain control of this critical function. ■

About the Author

Shawn Fields is the Director of Market Development for the Datamatic Energy division. Fields has extensive experience in managing key accounts and business processes. He was previously Director of Business Development at Invensys Energy Management, global manufacturer of meters. He served as Director of Technical Services at Home Town Connections, a subsidiary of American Public Power and was Manager of Implementation & Support Services for Itron/Utility Translation Systems, which is a global manufacturer of Automated Meter Reading Systems. Fields graduated from Roberts Wesleyan College in Rochester, NY, with a Bachelors in Business Management.

Shawn can be reached for comments and questions at sfields@datamatic.com.

2004

geotec event

GeoTec Event
Pathways to Integration
March 28 – 31, 2004

Metro Toronto Convention Centre, South Building
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Geotechnology Conference Focuses on Integration

Integrating geotechnology within an enterprise provides the focus for the content of the 2004 GeoTec Event, March 28-31 at the Metro Toronto Convention Centre in Toronto.

GeoTec, formerly the GIS Conference, is in its 18th year as an international conference and exhibition on geotechnology. The 2004 event features 12 training workshops, 55 technical sessions and more than 150 individual presentations, along with a trade show with broad offerings of interest to utilities, municipalities and GIS developers.

The three-day conference includes program tracks on enterprise integration, environment, geospatial data, GIS and public policy, GIS development, geotechnology education, municipal technology issues and solutions and resource management.

Geotechnnology is increasingly finding a home in the information technology (IT) departments of large enterprises. The conference theme, "Pathways to Integration," is designed to explore the adoption of geotechnology in mainstream IT and the adaptation that is extending the reach and functionality of the technology.

The general session on Monday, March 29, will feature a keynote presentation from David Sonnen, senior consultant with IDC, on the topic, "Geospatial Competition is Changing from Geo-centric Specialization to Integration-centric Information Systems." A CTO-level panel discussion will follow, with participation from Autodesk, ESRI, Intergraph, MapInfo and Oracle, on the topics of enterprise integration, geodatabases, Web services, Web portals and interoperability.

The GeoTec Event is produced by GeoTec Media, publisher of GeoWorld Magazine. Corporate sponsors include Autodesk, ESRI Canada and Hewlett-Packard. Conference details can be found at www.geoplace.com/gt.

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The GeoTec Event exhibit hall will be filled with leading spatial technology companies. Come to compare products and services and view tomorrow's technology and trends. GIS software leaders will showcase solutions for data visualisation, image processing, field work and more. Computer hardware vendors will display cutting-edge workstations, printers and scanners. GPS and survey vendors will present their latest precision location products. Remote sensing, photogrammetry and satellite and aerial imagery products and services will be on display. Data vendors will be on hand with geodemographic, street network, environmental data and more. Government agencies, GIS consultants and leading academic institutions will showcase their latest projects and services. View the latest list of exhibitors on the conference Web site at: www.geoplace.com/gt

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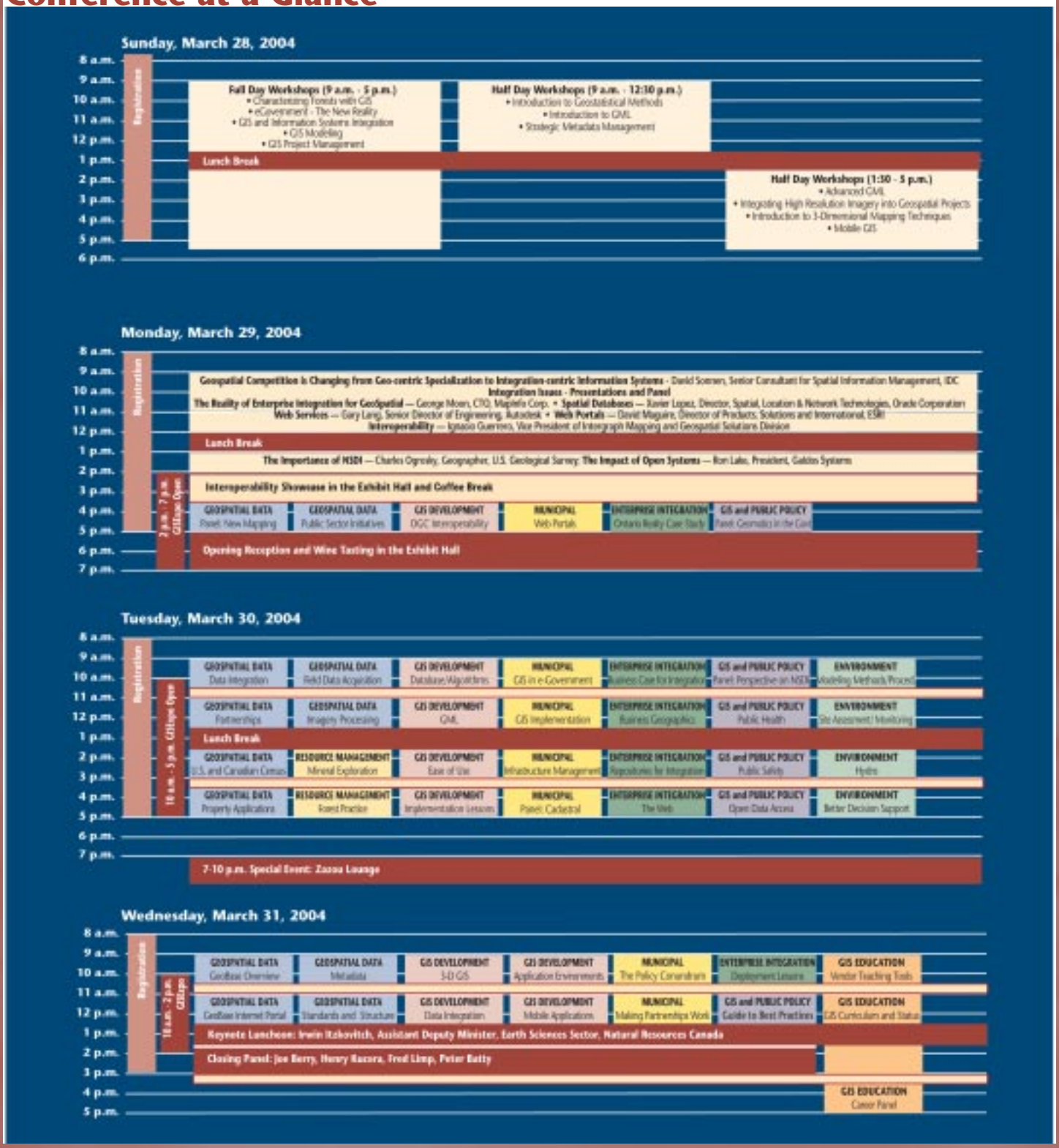
Conference at a Glance



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Austrian Trade Commission	415
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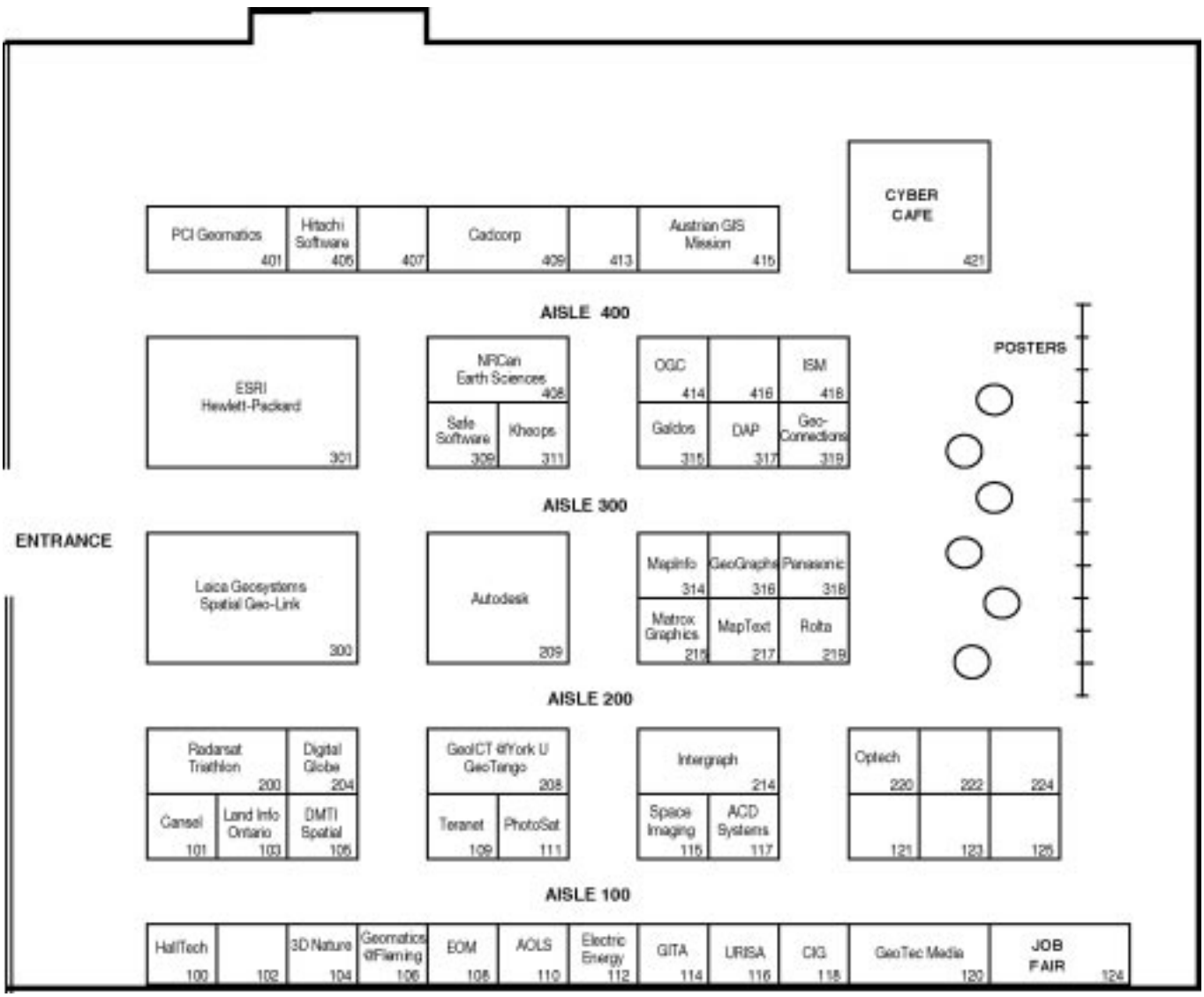

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Electric Energy T&D | Utility Horizons™
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In this Issue

Is this newscast in our future?

- The temperature in New England today will be above normal, with highs expected in the upper 90's.
- The Power Grid Stability Index (PGSI) is expected to hold steady today at 85, down 10 points from yesterday due to increased load on the grid and scheduled transmission line maintenance in northern Ohio.

XML Web Services in the Utility Automation/IT World

By: Tim Huneycutt, Gridlogix, Inc.

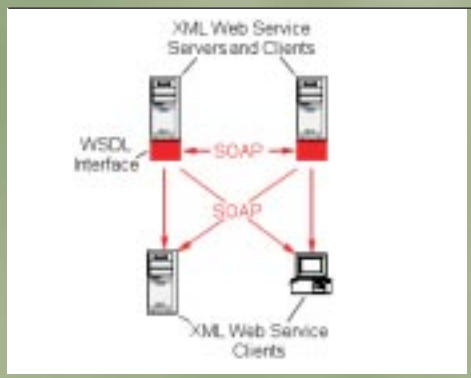
The PGSI isn't a reality today, but the collapse of the northeast power grid on August 14, 2003 is an indicator to some that a higher level of utility automation system integration is warranted. The concept of a real-time stability measuring stick is an extreme example of what the future holds for sharing information between utilities and the public, but today's real-time automation systems are poised to benefit significantly from modern integration technologies, technologies already embraced by the real-time world of IT. This article examines how utility automation systems will benefit from XML Web Services integration technology. For the purposes of this article, a real-time automation system is defined as any utility system expected to process and respond at or near actual event time. Some will argue that in the not-too-distant future this definition may well include virtually every utility computer system and process.

What are XML Web Services?

"Web Services" is actually a catchall name for any integration friendly software application created using a new set of standards developed to allow software services to be shared across large-scale distributed computing systems. Even though the name implies the use of the Internet, the standards and the resulting integration technologies provide robust machine-to-machine and system-to-system connectivity solutions being embraced at the department, inter-department, and enterprise level on private corporate networks.

At the core of XML Web Services, and one of the most important standards used in the creation of a web service, is the Simple Object Access Protocol (SOAP). SOAP is a vendor neutral integration protocol that standardizes network communications between software applications. Simply stated, SOAP is a general-purpose protocol for sending messages from one software application to another. The power of SOAP is that it can be used to invoke remote procedures between systems in a standard way that is platform, programming language and geographic location independent.

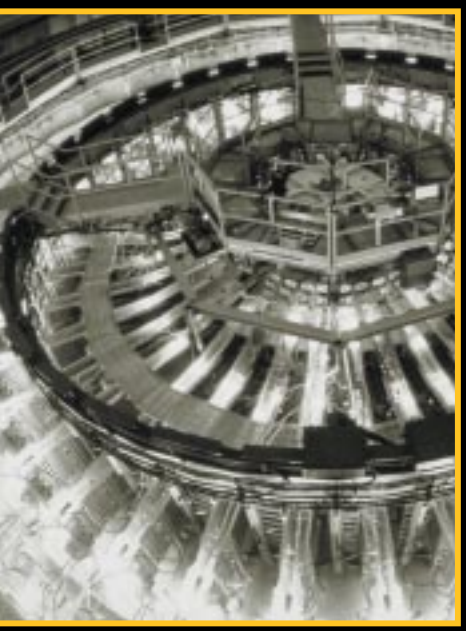
A second standard and a valuable component of web services is the Web Services Description Language (WSDL). WSDL is used to "expose" data sources to data consumers without a need to address or understand the differences between the participating systems.



A powerful integration tool known as the WSDL file, programmatically describes an interface to a private and often proprietary system. The WSDL file acts as a published rulebook for accessing valuable data sources. In some ways it acts as a contract or agreement between a data producer and a data consumer. A web service publishes an agreement – in effect it tells dissimilar computer systems, "I have this core functionality and data to offer, if you will request it in this way". The powerful result is a loosely coupled and secure relationship between the data source and the data consumer.

A third specification, one that is growing in value in the software development and integration community is UDDI (Universal Description, Discovery and Integration). The UDDI specification enables businesses to publish electronic information about their core business as well as information about web services the company hosts. The three software giants, IBM, Microsoft and HP each host their own public UDDI registry for the benefit of their customers and synchronize their content with each other on a regular basis. The use of UDDI as a centralized repository of web service descriptions, including published locations of WSDL files is expected to play a significant role in e-commerce on the public Internet and is positioned to play a vital role inside corporations with large private intranets. UDDI will likely play a significant role in private and public utility integration schemes.

These three standards; SOAP, WSDL and UDDI come together to create XML Web Services. The result is robust, real-time integration between software applications.



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Most real-time systems are still islands of automation and information silos.

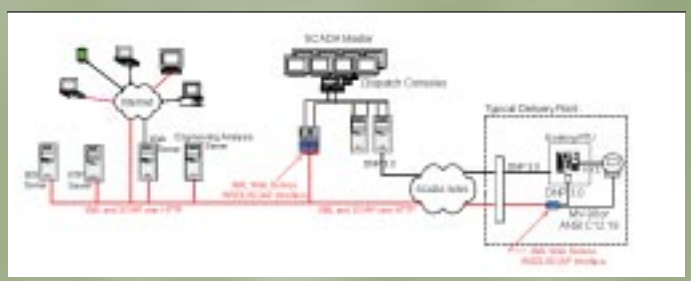
Until just a few short years ago, almost every component of real-time systems, from the individual hardware components, to the protocols used for system communications were built on proprietary technologies. This is due in part, to the mission critical nature of utility automation systems and a genuine need to perform reliably in real-time with the utmost regard for safety. Historically, everything from remote terminal units to operator consoles was sole-sourced from the original vendor. In recent years, significant effort has been put into standardizing many aspects of automation systems. One only needs to look at the speedy adoption of DNP 3.0 as the de-facto standard protocol for SCADA system communications to see that significant benefits can come from standardization. Even though standardization is taking place, the motivating reason for embracing standards has not been to turn systems into powerful sources of business information through large-scale integration. Very few utility automation standards have originated from a desire to share information or functionality with other utility business applications, channel partners or competing utilities. Instead, most standardization work has been to create an open and more competitive procurement process.

Automation Systems will become data providers in a larger information network.

Today, there are many different automation systems operated by every utility. Many more systems are deployed across the landscape that makes up our tightly coupled power grid. One of the challenges for utilities, system managers, and IT departments is that there has never been cost effective, standards-based integration connecting these mission critical systems to each other and to corporate information systems. Ideally, utilities need to transform their mission critical systems into real-time data sources that can co-exist with and support the growing information requirements of not only the local utility, but the interconnected network of utilities and customer base.

The IT world knows all too well that legacy systems and disparate data platforms are too valuable to toss out or rebuild. Rarely is an enterprise-class business system dumped because a newer, more robust system comes along. Instead, the IT solution is to provide robust integration capabilities that squeeze even more value out of those critical business systems. Innovative technologies are migrated into the enterprise and are expected to co-exist with the systems already in use. Legacy automation systems also represent significant capital investments, not easily abandoned and replaced. Automation vendors can now play by the same rules as IT and use modern integration technologies to transform closed automation systems into open, real-time data providers. By leveraging the power of XML Web Services, utility engineers and system operators will be able to provide access to disparate automation system data sources in the same way, using the same technology, the IT world is using to deliver access to disparate corporate data centers and legacy business systems.

XML Web Services offer loosely coupled, system-to-system integration.



The ability of one computer system to "describe" its capabilities and available services to another is one of the most important benefits of XML Web Services. This important feature helps guarantee loosely coupled, system-to-system integration.

Example: SCADA systems are highly tuned, complex systems designed from the ground up to deliver a real-time view of a power system to skilled system operators. It is also true that some (not necessarily all) of the real-time information collected by a SCADA system has significant value to many other computing systems inside and outside of a typical utility. For this example, let's imagine an external system or entity would benefit from knowing the status and availability of every transmission line operated in a utility's service area. For this example, no distinction needs to be made between external systems owned by the utility and systems owned by third parties.

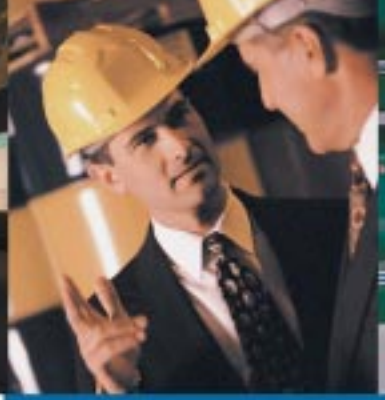
An interface needs to be implemented between the SCADA system and the system interested in accessing this vital status information. XML Web Services is an integration solution that will allow the owner of the SCADA system to publish a real-time interface without regard for the external system. It is important to remember the role of the Web Services Description Language (WSDL). The WSDL file is a published rulebook (specific to the provider system) that makes the announcement; "I have this core functionality and data to offer, if you will request it in this way". Armed with this digital rulebook and proper authorization, any third party software provider can make sanctioned, real-time requests (remote procedure calls) to the SCADA platform.

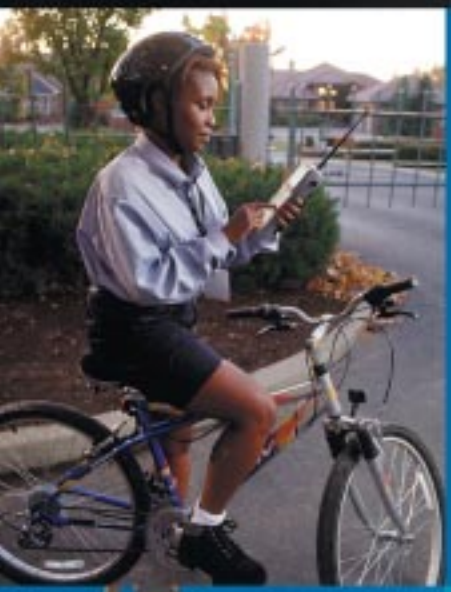
The problems solved by using web services integration are not trivial. The loosely coupled nature of this standardized method of integration allows the SCADA system owner or the third party to make upgrades and changes to their own system without impacting the other system. Third party systems won't be affected if and when the SCADA system is upgraded or replaced. The original functionality will be provided by the new SCADA system and any additional functionality will be described to the third party system via the WSDL file.

Accurate and automated responses will force system-to-system integration.

System operators of real-time automation systems almost always have access to pieces of information that help explain or identify the reasons for certain activities on a system. Published maintenance schedules, for example, and verbal communication with field crews prepare system operators to treat an open transmission line as a normal condition, instead of treating the condition as an emergency. The cascading blackout of 2003 may be providing proof that knowledge about local system conditions is not enough information to properly manage a dynamic, highly connected power grid. Many other examples exist that show significant value can come from real-time, machine-to-machine or process-to-process integration at the local utility level and the wide area network level.

The multiple sources of information made available to system operators helps to guarantee accurate responses to system events. Not every system event is an emergency, but most require immediate analysis and quick action. In some cases, the proper action may be to do nothing at all. Let's revisit the example of a third party system monitoring the real-time status of transmission lines. In reality, a real-time alert of a transmission



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line being out of service is probably not enough information for most systems to work with. Other pieces of data would normally be required to derive any useful information about the condition. How long will the line be out of service? Was it scheduled and accounted for in other areas of the system? These are valuable pieces of "big picture" information, not often provided in a single real-time data stream.

Only the third party entity knows for sure what information is required in order to perform their function. An automation system owner does not need to know what is done with data collected via a real-time XML web service. Web services will allow third parties to submit ad-hoc real-time queries to multiple automation systems, work management systems, any system in fact that helps provide a computerized big picture.

Integration is a two-way street. Will utilities want to integrate with customer owned systems?

The obvious answer to this question is yes. Many techniques are used by utilities to achieve higher levels of interaction with customers and their systems. Everything from utility owned control devices to meters fitted with signaling equipment are used to interface with energy consuming equipment. Even the time tested telephone call to enterprise energy managers is slowly being replaced by email alerts and web page bulletin boards. History also shows that utility companies appreciate two-way communications to obtain feedback from systems. Real-time feedback can be a helpful tool for gauging the success or failure of a particular program. In light of all this history and with so many programs continuing today, it would be hard to imagine a utility not wanting to integrate with a customer system if given the opportunity.

The not so obvious answer may be that a highly integrated information network will give customers enough information to make informed decisions about energy use that they were never able to make before. Significant advancements are being made in the world of industrial, commercial and residential automation. The standardization of protocols and the acceptance of networking technologies like Ethernet, wireless and TCP/IP in automation environments is making it easier and easier to create a web of services that could ultimately result in coordinated programs between utilities and their customers. Web Services integration has the potential to do away with proprietary black boxes that interrupt power at the worst possible time.

But what about security?

Unfortunately it will probably always be true that critical data and critical systems will be the targets of individuals interested in doing harm. For this reason, the standard concerns and all the safeguards normally associated with networking need to apply to XML Web Services. Modern integration technologies, including XML Web Services can help create important lines of demarcation between mission critical systems and the external network. The days of giving unfettered access to databases (e.g. ODBC and SQL) are probably behind us. Only data elements should be passed over the demarcation line, not important hints about the structure of the database or the system.

The capabilities of a web service interface need to match the requirements of the integrated network. There is no reason to publish a bi-directional interface with control capabilities if the goal of the integration is to create a read-only data source. On the other hand, if two-way access is required, the highest level of care in all areas of security is warranted. The power of web services needs to be respected and hopefully understood by the provider. Some individuals may argue that the layers of security imposed by the IT community far out weigh the work being done to add security to some automation protocols like Modbus™ or DNP 3.0, but that hot topic is material for future articles.

Conclusion

Modern integration technologies, including XML Web Services are being made available to utility automation designers and managers at a time when utility business managers, customer care representatives, Regulators and even John Q. Public are demanding real-time information about the state of the power grid. Even if a Power Grid Stability Index isn't in our immediate future, deregulation and the changing relationships between energy producer, seller, deliverer, buyer and user are creating a need for integration that has never been considered before. Given the availability of the Internet and the connected world we are all growing accustomed to, we have the potential to create an information and control network that extends from the power plant to our pop-up toasters. One can quickly see how the standards behind XML Web Services; including SOAP, WSDL and UDDI are poised to have a significant impact on existing and future utility automation systems. ■

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4:11 Preparing for the Perfect E-Storm

By: Dick Lord, CEO, The Steadfast Group

"4:11," the Northeast blackout that began on August 14th, 2003 at 4:11p.m. EDT, immediately brought to mind the events of 9/11. Although quickly dispelled, our first thoughts at 4:11 jumped to more physical terrorism. Next, many of us considered cyber terrorism. After all, it had been only two days since the Blaster worm had struck around the world. And, it had been only a few months earlier, in January 2003, when a computer worm disabled a safety system in a US nuclear power plant.

Ironically, just as 911 is the emergency telephone number, 411, now known as directory assistance, was formerly called information by telephone service providers.

At 4:11, Internet border gateway router chatter spiked orders of magnitude above normal levels, just as it had done when the SQL Slammer worm took out huge sections of the Internet a few months earlier. This time, the large numbers of network withdrawals were caused by the power outage rather than a cyber attack. However, the cyber symptoms were virtually identical, underscoring the interoperability of the power grid and the Internet. Independent attacks or failures on either can cause serious harm to the other. A coordinated attack on both would wreak havoc, e.g., a broad Slammer-like worm strike on the Internet simulcast with a distributed denial of service attack on critical grid asset communications.

The North American power grid is both a marvel and an enigma. It encompasses 15,000-plus generators, 10,000-plus power plants, transmission and distribution lines that could encircle the globe more than ten times and millions upon millions of networked devices. With no central control, the grid works remarkably well. Or, at least it had until recently.

Was 4:11 a harbinger of the grid of the future? A grid driven more by greed than by reliability? A grid willing to sacrifice future capacity for today's profits? An antiquated grid operating in the 21st century under 1950's design constraints? An industry unwilling to invest in the future? We can expect to see more 4:11-like events if we don't take some action.

From what we have learned about 4:11 so far, it appears that it wasn't caused directly by a security breach – a computer worm, virus or hacker attack. However, it is clear that multiple computer failures in the hours preceding 4:11 set off the cascade of events resulting in the largest power outage ever.

By comparison, meteorologists called the storm that hit North America's eastern seaboard in October 1991 a "perfect storm" because of the rare combination of factors that created it. The boat in the true story was armed with electronic navigational tools and signaling systems, but the sheer force of the violent seas overwhelmed them and rendered them useless.

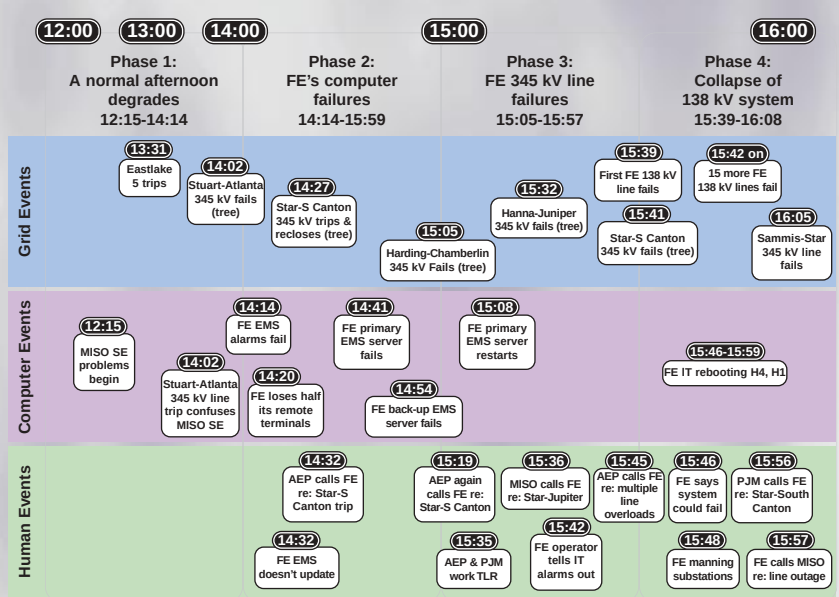

Figure 1. Interaction of Grid, Computer and Human Events (Source: Interim Report: Causes of the August 14th Blackout in the United States and Canada, U.S.-Canada Power System Outage Task Force, November 2003)




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Sound familiar? At 4:11, the northeastern portion of North America's electrical grid encountered a "near-perfect e-storm." It collapsed because of a rare combination of factors. System operators were armed with electronic supervisory control tools and telecommunication systems, but the sheer force of the violent power swings overwhelmed them and rendered them useless.

Figure 1., above, depicts on a timeline the juxtapositioning of the power grid, computer and human events occurring just before 4:11. Taking a closer look…

At about 2:14 p.m. on August 14, FirstEnergy's Energy Management System (EMS) lost its capability to process and to communicate alarms to system operators. Such alarms provide vital notification of power system events and out-of-acceptable-range condition measurements. FirstEnergy control center operators were unaware of the alarm processing malfunction and did not know that power network conditions were changing.

A few minutes later, a number of FirstEnergy's substation remote terminal units (RTUs) stopped communicating with the EMS master. These failures may have resulted from buffer overflows in the master and some RTUs.

FirstEnergy's EMS architecture utilizes multiple primary servers running various applications and one backup server able to run any of the applications.

At 2:41 p.m., the primary EMS server hosting the alarm processing function failed, probably because of the buffer overflows. At that point, the EMS performed an automatic "failover" to the backup server. The backup server continued running the stalled alarm processing function for 13 minutes until it also failed.

At 2:54 p.m., both the primary and the backup EMS servers running the alarm processing function stopped running all their applications. The EMS continued operating without these two servers, but with diminished performance. Operator screen refresh rates slowed from a few seconds to almost a minute per screen, further inhibiting the operators' capabilities to observe what was happening to their power system.

At 3:05 p.m., a FirstEnergy 345 kV line into Cleveland contacted an overgrown tree, faulted, tripped and locked out. The loss of this 345 kV path caused the remaining three southern 345-kV lines into Cleveland to pick up more load. FirstEnergy control system operators received no notification of these major events and went about their duties unaware of what had happened.

At 3:08 p.m., FirstEnergy staff successfully rebooted the primary server. However, the alarm processing function was still stalled and the server was taken out of service again at 3:46 p.m.

At 3:32 p.m., another 345 kV line into Cleveland contacted a tree, faulted, tripped and locked out. Loading on the remaining two 345-kV lines increased again. Once again, because of their failed EMS alarming capability, FirstEnergy control system operators were unaware of what had happened.

At 3:41 p.m., FirstEnergy operators watched the lights flicker as the control center lost line power and automatically switched to an emergency backup power source.

At 3:42 p.m., an alert FirstEnergy system operator concluded that the EMS alarm system had malfunctioned and began to take independent action.

Because of the alarm and RTU communication failures, FirstEnergy control center operators did not know they were losing significant portions of their power system. By the time they began to assimilate and respond to external reports of the true power system condition, it was too late to stop the cascading sequence of events leading up to the 4:11 blackout.

Although most folks outside the electric power industry — at least the ones I talk to — believe 4:11, the largest blackout in history, was caused by a couple of overgrown trees in Ohio, it's clear that computer failures exacerbated the physical events. Had the computers not malfunctioned, FirstEnergy control center system operators would have been able to react appropriately and prevent the blackout cascade.

FirstEnergy's EMS servers apparently suffered no malicious attacks on August 14. Had they been attacked and had they succumbed, 4:11 would have been much worse.

To reduce risks to the reliability of the bulk electric systems from any compromise of critical cyber assets (computers, software and communication networks) that support those systems, last June, the North American Electric

Some websites for more electric utility cybersecurity information…

- NERC: www.nerc.com
- FERC: www.ferc.gov
- Electricity Sector Information Sharing and Analysis Center: www.esisac.com
- Department of Homeland Security: www.dhs.gov
- Department of Energy: www.energy.gov
- The Steadfast Group: www.thesteadfastgroup.com
- Computer Emergency Response Team: www.cert.org
- National Institute of Standards and Technology: www.nist.gov
- North American Energy Standards Board: www.naesb.org
- American National Standards Institute: www.ansi.org

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Reliability Council (NERC) membership voted to adopt Urgent Action Standard 1200 -- Cybersecurity. NERC's Board of Trustees adopted the Standard in August.

Initially, control areas and reliability coordinators are required to complete cybersecurity self-assessments in early 2004. Ultimately, the permanent version of the standard currently under development will require all entities performing the reliability authority, balancing authority, interchange authority, transmission service provider, transmission operator, generator, or load-serving entity function to create and maintain a cybersecurity policy for the specific implementation of this standard. NERC anticipates that full compliance requirement implementation will become effective in early 2005.

NERC's Cybersecurity Standard 1200 transcends existing checklists and guidelines, requiring North American electric utilities to plan and implement specific security programs, with sanctions and financial penalties for noncompliance. The standard mandates specific NERC due diligence security reporting requirements, authorized by an officer of the entity, with random spot checks to monitor compliance. It includes a whistleblower provision for entities appearing to disregard the standard.

Under the new standard, utilities must identify and protect their critical cyber assets -- certain computer hardware, software, networks and databases, including control center systems, contained within defined cybersecurity perimeters. Perimeter protection must include physical security of the cyber assets and electronic security of any communications crossing that perimeter.

The latest version of the permanent standard goes on to provide more detail concerning what constitutes a minimum list of critical cyber assets. It specifically includes those cyber assets providing telemetry, SCADA, automatic generator control (AGC), load shedding, black start, real-time power system modeling, substation automation control and real-time inter-utility data exchange.

The standard even expands compliance requirements to non-critical cyber assets contained on a network accompanying critical assets within a cybersecurity perimeter. The permanent standard draft also provides some metrics for data communications between critical cyber assets. Each such data communication stream must provide 99.5% availability over the period of a year regardless of the communications technology employed – leased-line or dial-up telephone, point-to-multipoint or spread-spectrum radio, microwave, fiber optics, etc.

Most importantly, the standard calls for all such data communications conducted over shared public network resources to be encrypted utilizing appropriate confidentiality, integrity and authentication and (in some cases) non-repudiation functionality. What does that mean? In simple terms…

- Confidentiality means that nobody should be able to see the data that ought not to.
- Integrity means that no portions of the data should go missing or be replaced by bogus data.
- Authentication means determining whether someone is, in fact, who he or she says they are.
- Non-repudiation means if someone messes with the data, they will not be able to deny it later.

Given the state of utility communications today, these are some pretty serious requirements and we all need to take them seriously. Exercising due diligence, every entity potentially covered by the standard should, at the very least, begin setting up an internal cybersecurity task force right away.

The first step is to identify a high-level internal cybersecurity advocate – someone who is well respected, above reproach and at a high enough level in your organization to command authority. This isn't as easy as it sounds. Many organizations assign top level cybersecurity responsibility to the head of information technology (IT). I've seen situations in some of the largest utilities where that IT head had little understanding of the real-time EMS and SCADA systems. On the other hand, I've also seen organizations assign all security functions, including cybersecurity, to the head of physical security – the person in charge of the gates, guards and guns.

Either of these two extremes could lead to cybersecurity standard compliance failure. It's important to assemble a balanced, multi-functional team within your organization – one thoroughly knowledgeable both about IT and about operational cyber assets (don't forget telecommunications paths and remote sites). In some organizations, this can prove difficult because of internal hierarchies and balances of power. In that case, you may need neutral outside help.

In response to what I've said above, you may be saying, "We don't have a budget for cybersecurity. Who's going to pay for this?" The answer is that we all are – one way or another. ■

Energy/Utility Automation & IT Event Calendar

EVENT NAME	ORGANIZATION	DATES	LOCATION
Automatic Meter Reading Association	AMRA: www.amra-intl.org	Sep 26-29	Kissimmee, FL
CIS Conference (Customer Information Systems)	CIS: www.cisconference.org	May 04-07	Miami Beach, FL
Edison Electric Institute Annual Conference	EEI: www.eei.org	Jun 06-09	Orlando, FL
Energy Telecommunications & Electrical Association	ENTELEC: www.entelec.org	Apr 14-16	San Antonio, TX
Geospatial Information & Technology Association	GITA: www.gita.org	Apr 25-28	Seattle, WA
IEEE PES Annual Meeting	IEEE-PES: www.ieee-pes.org	Jun 06-10	Denver, CO
Int'l Conference on High Voltage Electric Systems (CIGRE)	CIGRE: www.cigre.org	Aug 29-Sep 03	Paris, France
Instrument, Systems & Automation Society Conference	ISA: www.isa.org	Sep 26-29	Houston, TX
Power Systems Conference & Expo (PSCE)	IEEE-PES: www.ieee-pes.org	Oct 10-13	New York, NY
T&D World Expo	T&D World: www.tdworldexpo.com	May 25-27	Indianapolis, IN

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New! Critical Infrastructure Protection and Federal Assets track topics. See gita.org for details.

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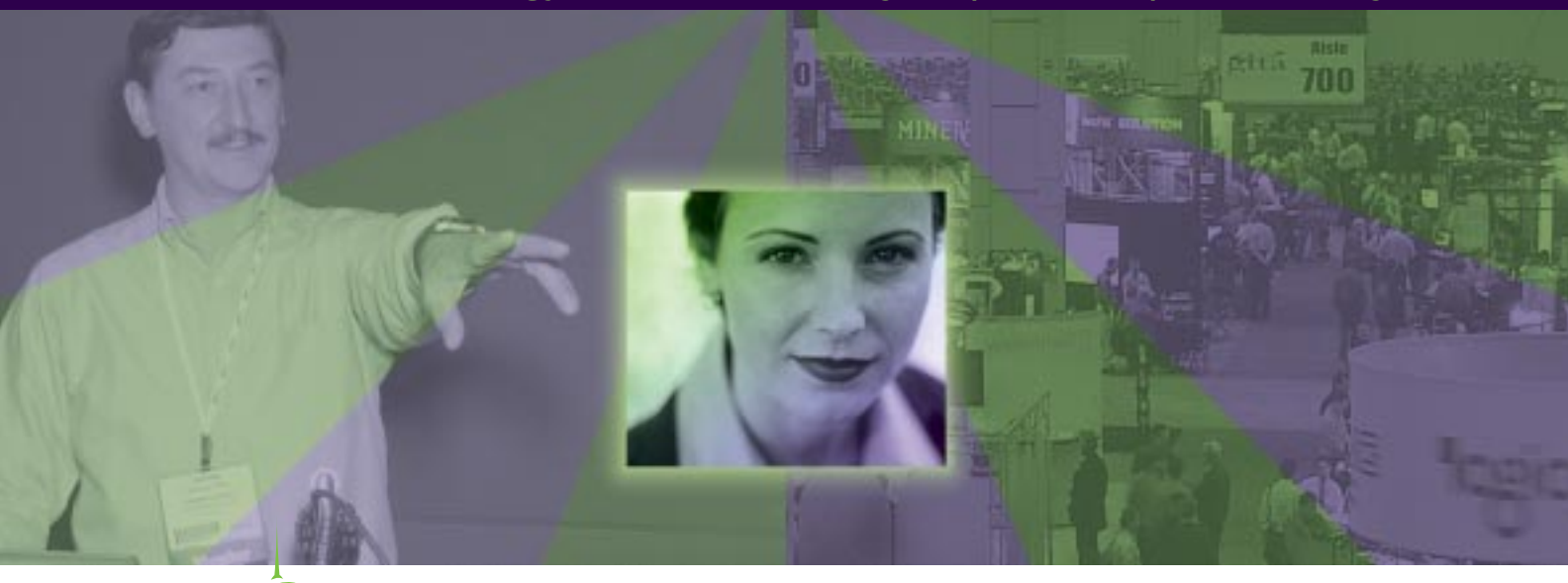

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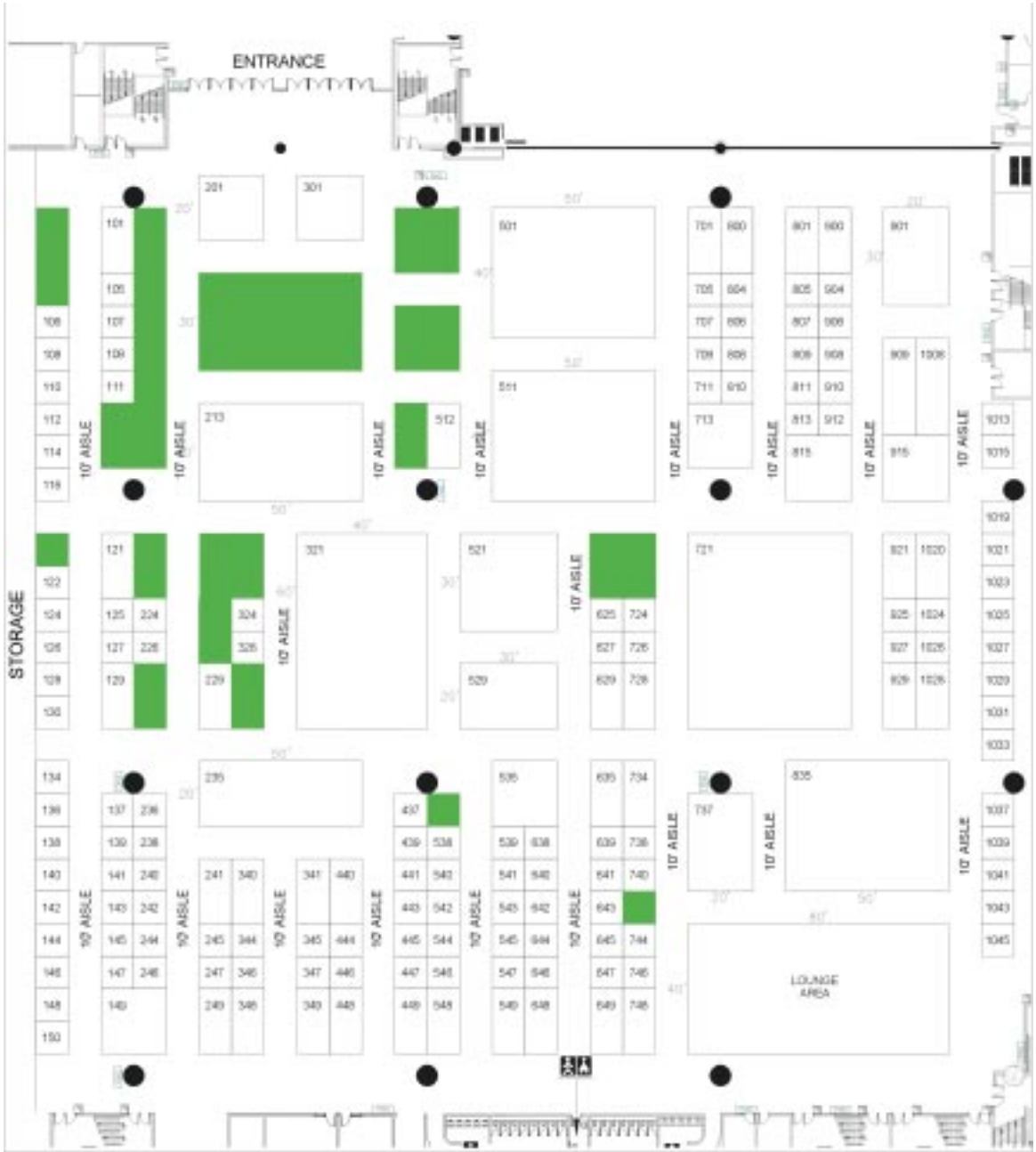

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Non-Operational Data Can Provide Valuable Benefits to Utilities That Exploit It

Georgia Power Kicks Off Pilot to Investigate Non-Op Data Automation

By: Mitch Cowan

Like money left on the table, too many utilities are failing to retrieve and analyze all of the valuable data collected in their substations. With SCADA doing an adequate job of reporting substation events, utilities have not been proactive in attempting to mine digital fault records, transformer gas measurements, lightning strike archives and other critical data sets that can help them fully understand why these events have occurred.

In recent years, interest in these long-ignored data sets has slowly built to the point where the term 'non-operational' data has been adopted. Although some variations in definitions still exist, non-operational data consists of the records of power fluctuations, current loads, voltage levels, fault events, breaker positions, transformer health and environmental conditions. These are typically stored in non-point formats, such as oscillating wave forms, not designed for transmission via SCADA protocols, which means they must be retrieved manually.

Conversely, operational data generally refers to the instantaneous measurements of volts, currents and breaker status transmitted in near real-time by the SCADA system to the control center. These data sets are often linked to alarms or automatic control devices and stream continuously from substation.

The irony surrounding the non use of non-operational data is the fact that most utilities have already built vast storehouses without realizing it. Non-operational data is routinely recorded in digital fault recorders, intelligent electronic devices, protective relaying devices and a host of other automated equipment installed in many substations. Some utilities have a decade worth of historical non-operational data in their substations, capable of providing valuable insight into equipment performance and reliability.

A handful of utilities, including Georgia Power, tap into these applications manually when fault events occur. But the lack of an automated technique to easily access, integrate and analyze these data sets has prevented most utilities from using them on a regular basis. This tradition of non use, however, is about to change.

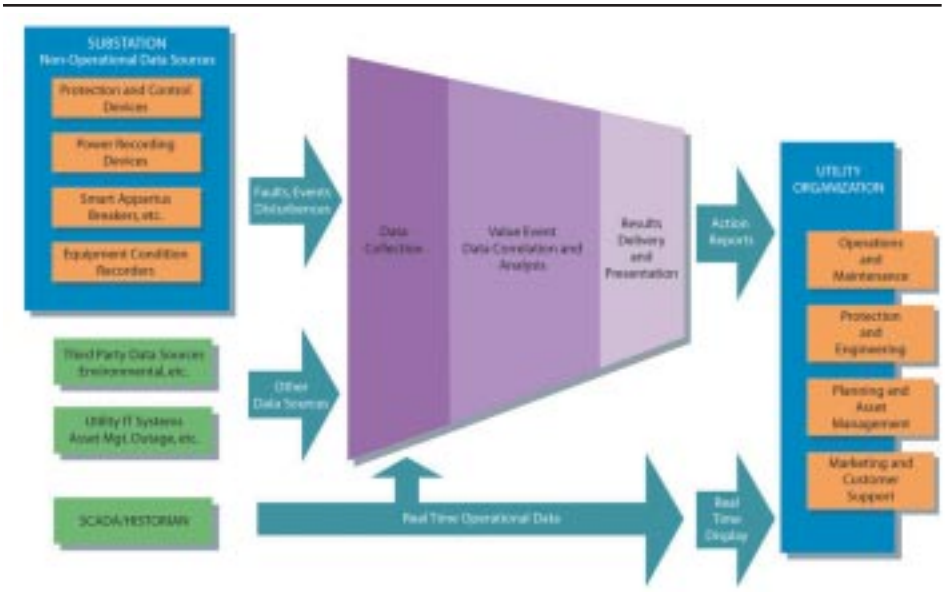
In early 2003, Georgia Power participated in a study with Kreiss Johnson Technologies of San Diego that revealed these data sets can indeed be retrieved and analyzed in an automated fashion. As a result of this study, we are now moving ahead with a substation pilot to further demonstrate how the data can be accessed, interleaved and delivered as useful information to multiple departments within the utility.

Based on our experiences, Georgia Power believes these data sets – especially when analyzed together – have great potential in identifying fault sources more quickly and recognizing the early warning signs of system weakness. By tapping the full power of this data, utilities can potentially restore outages faster, plan maintenance more accurately and replace malfunctioning equipment before a major event occurs.

Tapping Non-Op Data

Georgia Power, a subsidiary of Southern Company based in Birmingham, Ala., provides electric power to 2 million customers spread across the entire state of Georgia. For nearly 20 years, Georgia Power has investigated the practical uses and potential benefits of non-operational data. We are among a small group of utilities that actually makes regular use of this data, but believe much more can be done with it.

Our two primary sources of non-operational data are digital fault recorders (DFR) and a lightning strike database. For DFRs, we have chosen products from Utility Systems, Inc. a division of Magnetic Instrumentation, Inc. because they provide virtual channel capabilities allowing us to monitor a larger number of lines at a lower cost. The lightning data comes from Vaisala – GAI, Inc. of Tucson, Ariz., as part of a subscription service.



In the past, Georgia Power relied solely on smart relays to collect fault data, but we have found these devices do not perform as well as DFRs. The primary difference is the sample rate. The smart relays on system sample anywhere from 4 to 32 samples per cycle, while DFRs run at 80 samples per cycle. Much more information is captured at the higher sample rate. As a result, we have installed DFRs at all switching stations rated at 500 kV or higher and all 230 kV plants and other switching stations considered critical to observe a system disturbance.

Georgia Power has also invested in event recorders for installation in the same switching stations as the DFRs. The event recorders monitor breaker status, primary and secondary relay outputs and other miscellaneous substation alarms. Today these devices serve as back-ups to the DFRs. They were installed several years ago as supplements to DFRs when earlier versions of fault recorders were incapable of capturing all of the necessary data points.

It is important to note that we have not abandoned SCADA. Georgia Power has implemented a SCADA that scans each substation every six seconds. This interval is sufficient to notify the control center that a fault has occurred, but it cannot define the series of events that led to the fault. Many things happen in six seconds, and operational SCADA data cannot pinpoint which breaker tripped first, where it tripped or precisely when it tripped.

Our primary goal in harnessing fault and lightning data, therefore, is to fill in the blanks in SCADA data to quickly and accurately identify the fault event – was it an over-current or under-voltage condition, for example – and determine where it occurred. This basic fault information assists the control center in determining how to handle the situation. It helps them decide whether to clear the fault remotely or send a field crew to perform equipment maintenance. And if the field crew must be dispatched, the control center knows where to send them.

By collecting and integrating this non-operational data for analysis, we are turning a substation fault event into what Kreiss Johnson Technology's call a Value Event – a situation where the additional data analysis enables us to restore service quickly, better maintain equipment and prevent small system problems from cascading. These value events positively impact the bottom line.

Analyzing Data Manually

By installing this network of DFRs and subscribing to the lightning strike service, Georgia Power has created a manual system for accessing and analyzing non-operational fault data. In a typical fault scenario, this system is activated when the SCADA detects an event at one of the substations. This triggers an alarm at the control center, where a Transmission Operator then places a call to me or another of our transmission specialists asking where the fault occurred.

The first step for the transmission specialist is to check weather reports and determine if storms are in the area. If weather is present, we then access the live Vaisala database to see if lightning may be the cause. This is accomplished by correlating the timing of the fault with those of lightning hits. If a correlation is established, we can use the lightning data to pinpoint the fault location to within 500 meters. This information is relayed to the control center so that a truck can be dispatched to inspect this section of the line.

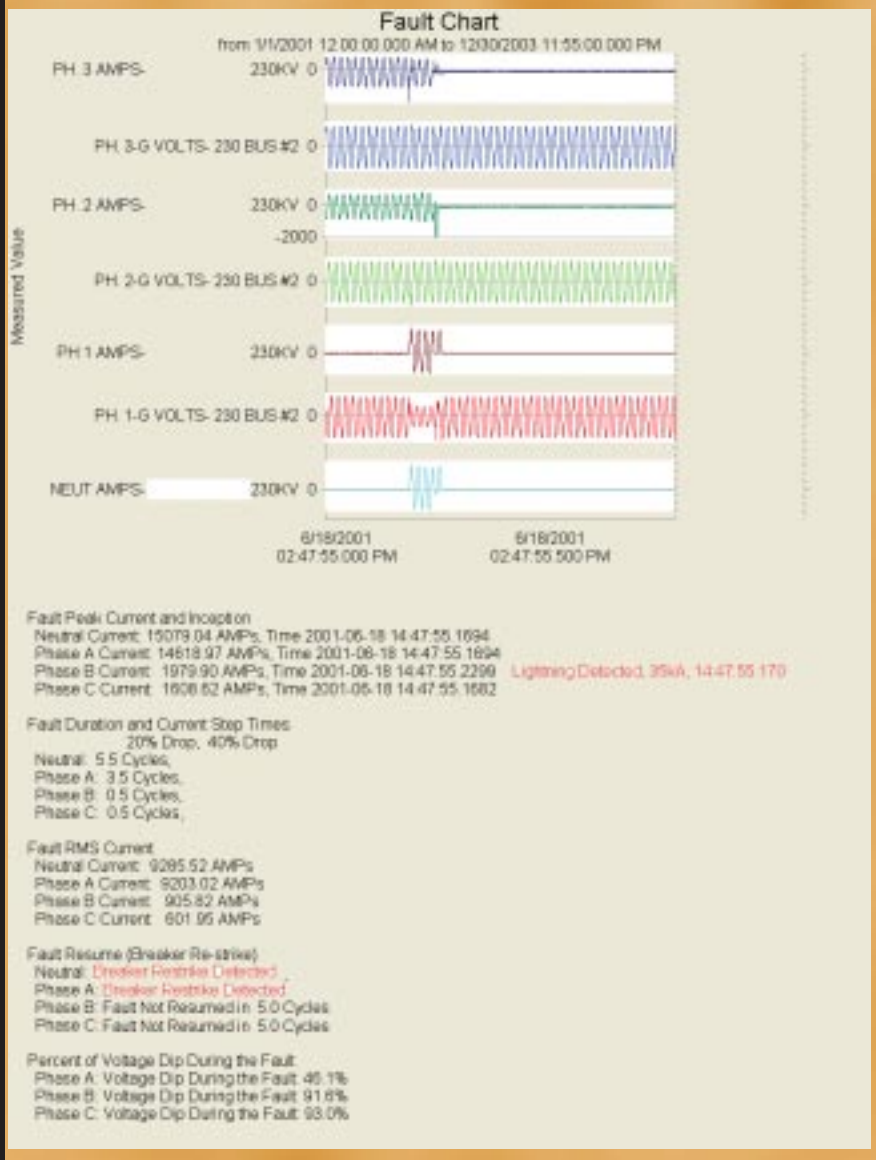
In approximately 40 per cent of fault events, lightning is quickly ruled out. In that case, our job is to call the DFR at the substation in question and download the fault data. We can examine certain characteristics of the fault by viewing its wave form on screen. We try to interpret the following:

- Fault inception time – By pinning the time down to a millisecond, we can more accurately correlate with lightning strikes.
- Fault amplitude – Our protection group reviews these measurements and verifies that our transmission system model is performing correctly and protective devices are properly set.
- Voltage dips – Georgia Power provides this information to large electricity customers to determine if the dip impacted their activities.
- Fault duration – By analyzing amplitude and duration of faults, we can determine whether a breaker operated properly. Duration can also indicate a low- or high-impedance event.

For immediate action, fault location is the most important characteristic for us to ascertain. The newer DFRs can automatically calculate which line the fault occurred on and its distance from the substation. The transmission specialist takes the distance information and pulls the transmission network map up on a computer screen. Using the distance as a guide, we can usually measure the fault location to a precise transmission structure, which is identified by number on the map. This information is relayed to the control center transmission operators so they can decide whether to clear the fault remotely or dispatch a crew to the scene.

Depending on the DFR download time, this retrieval and analysis process requires 30 minutes to two hours for completion.

Georgia Power's use of non-operational data has accelerated restoration times, but we see several other value events coming from this data as better technology becomes available. If the entire retrieval and analysis process can be automated, the fault location information could be fed continuously, perhaps by email or a web page, directly to the control centers. Instead of waiting hours for manual interpretation of the DFR data, transmission operators could act on it as soon as the event occurs.



Automating the Process

With so few utilities pursuing the non-operational data issue, Georgia Power assumed we would have to develop the technology required to break down the barriers to data access and integration. In early 2003, however, we were introduced to Kreiss Johnson (KJT), a technology software company that has been working on a solution to allow utilities to leverage this data. We agreed to conduct a joint study using the KJT software.

Georgia Power provided a database of historical fault records downloaded from a Georgia Power DFR. This data related to faults whose data we had already manually deciphered. We asked the software developer to run the fault data through its automated analysis routine to determine fault inception time, phase involvement, voltage dip, clearing times, clearing results, restrike occurrence, and fault current.

We were not expecting the results we received. After two weeks of analysis, KJT provided us with a report of each fault event, complete with oscillography, answering the questions we had posed. We were impressed with the results, which convinced us that automated analysis of DFR data was possible. Immediate plans were made for a field pilot.

For the study purposes, we had intentionally limited the focus to DFR data only, but data integration is clearly where the greatest potential for non-operational data lies. So the pilot will introduce a second data set – lightning. We have selected a very long line in South Georgia that gets numerous lightning strikes. In cooperation with USI, Georgia Power will place a DFR at either end of the line to record events that occur.

Instead of communicating with these DFRs through dial-up connections, the utility will establish a live high-speed link that will allow them to quickly feed data back to our Atlanta headquarters. A direct lightning strike feed from Vaisala will also be established. KJT will install its non-operational analysis software on Windows computer at headquarters that will be receiving the DFR and lightning data streams.

In this automated pilot, we fully expect the software to receive the fault data, correlate it with lightning strikes and determine the same fault characteristics as we now do manually. Once this aspect of the technology has been field tested, we expect that non-operational data use will quickly move into the mainstream at Georgia Power and other utilities.

In the near future as we envision it, information of much greater value will be extracted from the DFR and lightning data when these data sets are integrated with power quality, dips, and flicker data from line panel meters, and with dissolved gas, temperatures and vibration reports from transformer monitors. Combined analysis of these and other non-operational data sets will allow control room personnel to narrow a fault down to its precise cause within a piece of equipment and determine if it requires maintenance.

Exploitation of non-operational data in these and other applications will directly impact a utility's bottom line by accelerating restoration time, keeping equipment more well maintained, and reducing the field time of crews. Most important of all, early identification of minor system or equipment problems can avoid major outages such as the blackout of 2003. ■

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2004 Geospatial Information & Technology Association - ANNUAL CONFERENCE IN SEATTLE -

From the Conference Chair

Dear Colleague,

It's time to let you in on some of the excitement we're experiencing as we plan the many new and revamped educational opportunities for the 2004 Geospatial Information & Technology Association (GITA) Annual Conference in Seattle.

The 2004 conference theme is *"Information, Strategy, Vision… Building Performance in a New Age"* and, accordingly, this year's outstanding program of educational tracks, seminars, and panel discussions will cover new territory as well as provide the basics of geospatial technology.

This year's conference provides an excellent opportunity to see what kinds of challenges the leaders in our industry have successfully overcome, how they did it, and what they see on the horizon. In addition to technical sessions, panels, and seminars, many other networking opportunities will also be available that you just won't find anywhere else. This open exchange encompasses all levels of expertise, from the basics of geospatial information technology to the very latest trends, high-end tools, and processes that are paving the way for our industry's future.

The conference will feature updated technical tracks, including three new ones: *Critical Infrastructure Protection—Damage Prevention and Emergency Response, GIS in Telecommunications and Federal Geospatial Strategies—What's In It for You?* You won't want to miss our two new half-day seminars on critical infrastructure protection and e-government. Three new panels addressing public health, homeland security, and outsourcing strategies will be presented. We've also changed the format of GITA's ExecuNet Forum this year to give all attendees the opportunity to participate.

I encourage you to finalize your arrangements so you can take advantage of the many enlightening experiences this conference has to offer, not the least of which is the opportunity to explore the beauty of our setting this year — Seattle, Washington.

This unique forum for the sharing of expertise with like-minded professionals has always proven to be as much fun as it is educational. We look forward to seeing you in Seattle as we explore the ever-changing world of geospatial technology and the many ways in which it is more relevant to our lives today than ever before.

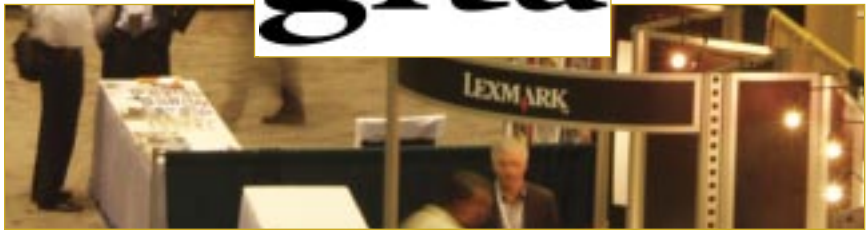
Sincerely,

C. Douglas Leibbrandt
Annual Conference 27 Chair
M.J. Harden Associates, Inc.

2004 Geospatial Information & Technology Association (GITA)

- CONFERENCE 27 AT-A-GLANCE -

Saturday April 24	Sunday April 25	Monday April 26	Tuesday April 27	Wednesday April 28
	Registration 7:00 a.m.-5:00 p.m. **Continental Breakfast** 7:00-8:00 a.m.	**Registration** 7:00 a.m.-7:00 p.m. **Continental Breakfast** 7:00-8:00 a.m.	**Registration** 7:00 a.m.-6:00 p.m. **Continental Breakfast** 7:00-8:00 a.m. **Scheduled Private Demos** 7:00 a.m.-11:00 a.m.	**Registration** 7:00 a.m.-3:00 p.m. **Continental Breakfast** 7:00-8:00 a.m. **Scheduled Private Demos** 7:00-11:00 a.m.
	Pre-Conference Seminars 8:00 a.m.-noon	**Pre-Conference Seminars** 8:00 a.m.-noon	**Educational Sessions** 8:00 a.m.-noon	**Educational Sessions** 8:00 a.m.-noon **Exhibits Open** 10:00 a.m.-2:00 p.m.
Registration 1:00-5:00 p.m.	**Henry A. Emery Educational Awards Luncheon** Noon-1:30 p.m.	**Lunch** Noon-1:00 p.m.	**Lunch** Noon-2:00 p.m. **Exhibits Open** Noon-6:00 p.m.	**Lunch** Noon-1:00 p.m.
	Pre-Conference Seminars 1:30-5:30 p.m.	**Opening Session** 1:30-2:45 p.m.	**Birds of a Feather** 1:00-2:45 p.m. **Panel Discussions** 3:15-5:00 p.m.	**Homeland Security Panel Discussion** 2:30-4:00 p.m.
		Exhibits Open 3:00-7:00 p.m.		**Closing Reception and Grand Prize Drawing** 4:00-5:30 p.m.
		President's Reception 7:00-8:30 p.m.	**Exhibit Hall Reception** 5:00-6:00 p.m.	



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LogicaCMG has a broad-based, international track record in energy and utilities ranging from setting up markets to running mission-critical business processes and applications. Serving clients with over 70 million utility customers worldwide, the company provides management and IT consultancy, systems integration, and outsourcing services to clients across diverse markets.

LogicaCMG employs around 21,000 people located in offices in 34 countries and has 40 years of experience in IT services. The company is a global provider of asset and resource management solutions for utility organizations, and our utility offerings are developed and delivered by a team of 3,000 experts focused exclusively on the energy and utilities industry sector.

Globally, LogicaCMG provides services and products to the largest companies in the energy and utilities, telecoms, financial services, industry, distribution and transport, and public sector markets.

LogicaCMG In Asset and Resource Management for Energy and Utilities

In North America, LogicaCMG's Energy and Utilities Division is the leading provider of fully integrated Asset and Resource Management solutions including work management and GIS. Asset and Resource Management (ARM) refers to an enterprise-wide solutions approach that includes the systems and processes needed to more effectively manage a utility's physical assets and human resources. More effective management equals operational excellence and this excellence in turn can drive improved financial performance in distribution organizations.

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The ARM Solution enables utilities to streamline business processes, manage the entire business work flow, improve resource scheduling, control operational costs, manage maintenance and regulatory compliance activities, extend the useful life of existing assets, increase systems reliability, expand performance and analysis reporting capabilities, and improve customer service and customer retention.

The ARM Solution Product Components that Support these Benefits Include:

- **WMIS,** the Work Management Information System
- **Work Scheduler*Plus*,** a constraint-based scheduling tool
- **InfoServer,** a web-enabled data retrieval and reporting solution
- **IMF*Plus*,** a flexible, scalable tool supporting message and service-based integration across the enterprise
- **Mobile Solution,** an integrated work and asset management capability for the field
- **FMDR,** the Facilities Management Data Repository, which serves the enterprise as the asset database of record
- **CTS,** the Compliance Tracking System, which manages utility inspection and maintenance work
- **ARM Web Portal,** a web-based work and resource management tool for use by utility, contractor, builder and developer personnel

Supported by a dedicated Product Center and Solution Team, ARM is the definitive answer for utilities that want to position themselves as market leaders.

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- We deliver concrete results using solution approaches that are demonstrated and proven.
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If performance excellence is your goal, LogicaCMG is the right partner. By providing the tools, the best business practices and the recognized industry expertise, we can help you achieve new efficiencies in your business processes.

The LogicaCMG ARM Solution product components include:

WMIS, the Work Management Information System

Work Scheduler*Plus*, a constraint-based scheduling solution

InfoServer, a web-enabled data retrieval and reporting tool

IMF*Plus*, a flexible, scalable tool supporting message and service-based integration across the enterprise

Mobile Solution, an integrated work and asset management capability for the field

FMDR, the Facilities Management Data Repository, serves the enterprise as the asset data base of record

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Multi-Drop Multiplexing Solves Multiple Communications Issues

By: Russell A Straayer
President
Data Comm for Business, Inc.

One MAS radio system, multiple channels required

The Rural Electric Convenience Co-Operative (RECC), with headquarters in Auburn, Illinois, is migrating its SCADA system from ILEX proprietary protocol RTUs to open protocol DNP3 RTUs. Migrating a SCADA system from one protocol to another can be very time consuming and expensive.

To keep the SCADA system operating on a non-stop basis, a migration normally requires all the new SCADA units with their new protocol to be deployed into the field at all the locations, installed, tested, and as the final step, all turned up at the same time. "This is bad economics" says Tom Jones, SCADA Systems Manager at RECC.

For RECC, replacing and turning up all the new RTUs at the same time would mean sending personnel into the field to disconnect the old protocol equipment and then connect to the new equipment within minutes in order to keep the SCADA reporting real time, not to mention the cost of replacing all of this hardware at the same time. RECC is a relatively small Electrical Co-Operative, but they have 9 remote SCADA sites. They do not have the personnel to perform the migration quickly.

The Multiplexing solution

RECC chose instead to convert their single channel radio system into a multiple channel radio system. RECC uses Microwave Data Systems model 9710, 900 MHz licensed digital radio operating at 4800 bps. Adding multiple channels is accomplished by using the 4-port SCADA Multi-Drop Multiplexer (SMD Mux) from Data Comm for Business, Inc.

Going to multiple channels over the radio system enables RECC to convert one location at a time. A four port SMD Mux is deployed at the host site, another SMD is deployed at each remote site. With four channels, RECC operates the original ILEX protocol on the first channel. The new DNP3 protocol RTUs are deployed on the second channel. The deployment time for adding the SMD to the communications system is a fraction of the time necessary to replace all of the RTUs, and will not have to be repeated in the future when there is another change to the system.

The SMD allows simultaneous, independent operation on all four ports. The channels do not interfere with each other. The SMD divides the MAS system channel into 4 ports by digitally time-dividing the radio bandwidth. One might assume that this process will greatly slow down the collection of SCADA information, but it does not. The SMD divides up the data channel without noticeably slowing down the SCADA system polling.

A typical SCADA system polls at a rate much below the capability of the MAS radios. In the case of RECC, the ILEX RTUs were polled at a rate of 1 or 2 polls per second. The SCADA system does not need to poll as fast as possible to keep informed about the status at the substations. There was a lot of excess bandwidth available. Now with the SMD installed at the RECC host site, the polling rate is 25 times per second, far faster than the ILEX polling requires. This faster polling by the SMD results in a four to five time increase in the data transmission capacity of the MAS radios.

The SMD at RECC also performs data rate conversion. Data rate conversion is used to further speed up the polling process. The RECC MAS radios are 4800 bps, but the RTUs and the host computer operate at 9600 bps. The speed conversion increases the polling rate of each channel and is transparent to both the radios and the RTUs. The SMD momentarily buffer up the excess data. The RTU interface rate and the host

computer interface rate were changed from 4800 to 9600 bps when the SMDs were installed. Comparing 4800 bps to 9600 bps, a small 10 character poll or response takes about 20 milliseconds to be transmitted or received by a serial port at 4800 bps, while the same 10 characters take only 10 milliseconds at 9600 bps.

Adding an AMR channel for free

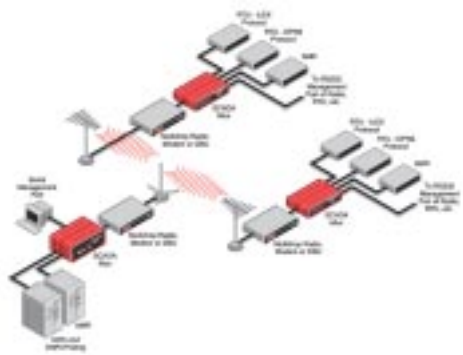
The RECC SMDs are four port units, with the ILEX and DNP3 operating on 2 of the four ports. RECC uses the third port for Automatic Meter Reading. The AMR system at RECC is the DCSI TWACS AMR system. The AMR system is a polling system operating at 9600 bps. Adding the AMR onto the existing MAS radio system results in huge cost savings for the utility. To implement AMR without the SMD, RECC would have to install a duplicate, parallel communications system.

Another radio system would cost in the range of $30,000, installed. This is 3 times the cost of the SMD. If RECC decided that a licensed radio system was necessary, they would incur the additional cost of licensing. At 900 MHz, it is often difficult to find an available frequency. In addition, radio system maintenance often involves climbing a radio tower to check cables and align antennas. The SMD is serviced at ground level and does not require periodic preventative maintenance.

Access Switch function

With only 3 of the 4 ports used for polling communications, one more port is available on the SMD. Any SMD port can be a type called an Access Port. When an SMD port is set to the Access Port function, a point-to-point link is established from the host to any one of the drops. RECC has 9 remote sites. At each site is an RTU with an RS232 setup port, and each radio has a management port. When the system was initially installed, the MAS radio management port was attached to the fourth port of the remote SMD. The installer, from the host site, was able to remotely control any one of the 9 remote radios, one at a time, to check settings, signal strength, etc. Now the setup ports of the RTUs are being cabled into the extra port of the SMD. RECC will be able changes RTU options from the host site, rather than travelling out to a sub-station.

Other devices may be plugged into the ports of the SMD. Non-polled meters for example. The non-polled devices can be used on any of the 4 ports of the SMD. RECC can attach a terminal or PC to the host end SMD, then select a specific remote port to communicate with. By selecting a specific remote port, non-addressed devices can be managed while other ports are carrying polling traffic.



Ethernet/LAN/IP in the future?

RECC will move all the ILEX SCADA RTUs over to DNP3 over the next year, which will free up a port on the SMD. Once the ILEX to DNP3 conversion is complete, RECC will be able to add Ethernet bridging to the system if it is required. There are many new devices coming onto the market for electric utilities that utilize Ethernet ports, in lieu of, or in addition to serial ports. These devices, whether SCADA, AMR or other data collection and monitoring equipment, are typically very low data volume. These low data volume devices are an ideal fit with the SMD multiplexers.

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Adding Ethernet is accomplished using an external box, a "SCADA Bridge". The SCADA Bridge connects to the SMD through a serial port. The SCADA Bridge Ethernet port connects to the LAN equipment at the host and remote ends. Bridging (versus routing) involves just plugging in the units after setting the serial port speeds, a process that avoids the more complex setup used by routers.

How the multiplexed system performed

RECC did some minor tweaking of the system. Every few weeks RECC experienced the loss of a drop or two. This turned out to be a very subtle timing problem. Data was buffered at a drop for just enough time, a couple of seconds at most, to cause the SCADA host to timeout a poll, even though the RTU response eventually reached the host. With a number of older protocols that do not have numbered blocks or source addresses on the responses from the RTUs, delayed RTU responses coming to the host after the timeout period confuse the host polling software. RECC's temporary fix for this problem was to reset an SMD, an event that occurred an average of once a week.

The problem was solved with updated SMD firmware. Port buffer sizes were changed and a buffer timer was added. The timer is used to insure that data will not be buffered in the remote SMD so long that the host computer has already timed out the drop response. Now, with the updated firmware, if the RTU response sits in the SMD buffer too long, the data is discarded by the SMD, allowing the host computer to do its normal timeout and re-poll without getting an extra, delayed response.

The delays in RTU responses may come from heavy traffic, but the most typical cause of delays are errors on the communications links. The SMD must recover from errors on the radio link, just as a SCADA host must recover when an RTU fails to respond. While taking the time to recover, the SMD is not sending user data across the link. This is the time when the data was buffered at the drop and came into the host so late that the SCADA host assumed the data was lost and polled for the data again.

How the SMD improves the radio system throughput

The SCADA and ARM systems each poll at a rate of two times a second. They poll fast enough to keep the system control information up to date. The SMD does its polling at a rate of about 30 polls every second. Since the SMD polls so much faster than the SCADA and AMR systems, the SMD fills in the idle time gaps when the SCADA and AMR systems are not sending or receiving data. The SCADA system and the AMR system each use the MAS radio system at about 15 to 20% of capacity. The SMD fills in the time gaps, greatly increasing the efficiency of the communications channels.

Polling and response times will vary as the polling sequence of the SMD and the host computers go in and out of sync with each other. The SMD shares the network bandwidth by delivering data from all ports of the host SMD to the remote SMDs. At the same time that the host SMD is delivering data to the remote SMDs, it is also retrieving data from the remote SMD ports. The SCADA system and AMR systems are also polling systems, each operating on its own polling schedule. The SMD, SCADA and AMR polling rates are not in sync with each other. Consequently, the response times for the SCADA and AMR systems will vary. In the case of RECC, the average response time is about 250 milliseconds, with response times varying from about 100 to 400 milliseconds. This is typical for an MAS radio system application.

Conclusion

The bottom line for RECC has been the substantial cost savings. RECC has added 3 channels to their single channel radio system. Considering the alternatives of a parallel radio system or phone lines, the SMD multiplexer approach has saved months in time and at least $20,000 in new hardware and installation costs. A few small glitches had to be worked through, but all of the technical issues were solved with little or no impact on the SCADA and AMR systems. The impact was less than adding a new communications system for AMR and changing out all the RTUs from ILEX to DNP3. ■

About the Author

Mr. Straayer is President of Data Comm for Business, Inc., a position he has held since founding the company in 1981. Prior to that, Mr. Straayer was Vice President of Compre Comm, Inc, from 1977 until 1981.

Mr. Straayer is a graduate of the University of Illinois Springfield with a degree in Communications. Mr. Straayer has consulted for AT&T, Harris Bank and Trust, General Telephone and other major companies. He has been an instructor in data communications courses for the Federal Reserve, EDS/GM and for many public data communications courses.

Mr. Straayer was a telecommunications manager with the State of Illinois where he was responsible, in 1977, for a $35,000,000 budget. He was responsible for the 1977 implementation of a credit card calling system that included voice recognition equipment to automate the placing of credit card calls.

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