

## BIOGRAPHICAL INFORMATION

William J. Meehan, P.E.  
Director, Utility Solutions  
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### Specific Responsibilities

Bill Meehan joined ESRI in 2002. He has extensive background in utility operations management including the integration of IT and GIS. Bill is the director of the worldwide utility solutions industry for ESRI. This includes electric and gas, pipeline, telecommunications, water/wastewater and transportation. His specific responsibilities include strategic industry planning, marketing, business development, sales support, and project consulting.

### Past Experience

While employed at NSTAR, Massachusetts's largest investor-owned electric and gas utility, Bill held the position of vice president of Electric Operations, vice president of Supply Chain, and manager of Engineering for NSTAR. He championed Boston Edison's GIS project and managed the NSTAR merger process of Boston Edison and Commonwealth Energy Systems. Bill also led the effort to comply with the Massachusetts Utility Restructuring (deregulation) Law.

### Education

B.S. in Electrical Engineering, Northeastern University, Boston, Massachusetts  
M.S. in Electric Power Engineering, Rensselaer Polytechnic Institute, Troy, New York

### Professional Memberships and Affiliations

Registered Professional Engineer, Commonwealth of Massachusetts  
Member GITA  
IEEE, Power Engineering Society

### Awards

Multiple GITA Speaker Award Winner

### Publications and Presentations

Author of Empowering Electric and Gas Utilities with GIS, Power System Analysis by Digital Computer and numerous papers and articles. Bill has lectured extensively and taught courses at Northeastern University and the University of Massachusetts. He has made a number of presentations and keynote addresses at a host of industry and business functions.

## ENTERPRISE GIS: POWERING THE UTILITY OF THE FUTURE

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### ABSTRACT

Utilities depend on customer phone calls to find out what is going on with their system. Rare is the utility that can automatically determine outage location and extent precisely. Rarer is the utility that can reconfigure the distribution network to limit customer outage without human intervention. Ever increasing demand and fuel prices, an aging workforce and infrastructure, power quality requirements, reliability expectations and regulatory oversight are pressing issues. As a result of these issues and an increase in the need to address climate change, utilities must manage their assets and resources more closely.

The utility of the future involves customer self-service, advanced metering, self-healing grids, automated load management and more use of green technology. Enterprise GIS provides the underlying means to display, manage and operate this vast array of spatially dispersed equipment. It can help utilities discover where to deploy new sources of renewable energy systems. Utilities can use GIS as a framework to apply geospatial information to a host of applications. As a result, GIS helps integrate information from many sources, both internally and externally. It can visualize information for the utility executives, managers and operators. Utilities will rapidly deploy new technologies, like smart meters, sensors embedded in distribution equipment and advanced control and communications equipment. These together with Enterprise GIS integrated within the utility IT framework provides a solid framework for the utility of the future.

### GIS IS A BREAKTHROUGH TECHNOLOGY

Mapping at utilities has been around for years. Most utilities had large departments of drafting technicians keeping the electrical and gas plans up to date. After changes in the network were built, the sketches from the field found their way to the mapping department. There, the mapping technicians posted the changes to the maps. They then sent copies of the newly modified maps to the field. Utilities recognized that this process was costly and inefficient. So they adopted CAD technology, and then later GIS to replace the old linen and Mylar maps sheets. This made the process more efficient. While this produced some significant progress, it was hardly a breakthrough. Many utilities, even today, only use the GIS to capture the state of the utility network and to produce the same operating maps that were produced years ago using paper and pencil.

A GIS can be a breakthrough technology. It has the capability to answer tough questions, like, “where are there places in my infrastructure where a single event could bring the network down?” It can provide the backbone for the self healing grid. It can help utilities discover new things about their investments and risks that no other technology can provide. That is because GIS has the ability to perform spatial and network analysis and to visualize the results in the form of a map. It can help utilities discover hidden weaknesses in their networks, where potential environmental problems could exist or help to shore up areas vulnerable to attacks. GIS is not just about mapping, it’s about discovery.

To meet the significant challenges of today, utilities will have to use every resource available to them. Many utilities that have built GIS have a wonderful resource just waiting to help transform them from the utility of today to the utility of the future.

## THE UTILITY OF TODAY

### Utility Processes Today

Despite advances in gas and electric SCADA systems, distribution automation, Outage Management Systems (OMS), Distribution Management Systems (DMS), leak management systems and automated field dispatch systems, utilities are still rather blind to the problems that occur on their systems. For example, utilities rely mainly on customers or police and fire personnel to report gas leaks or local electrical outages. Some people may mistakenly think that when their power goes out, the utility knows about it. Certainly, if a main section of an electric circuit trips or there is a major interruption in a gas line, the utility does know which customers are impacted. For local disturbances, the only way a utility finds out about a problematic event is by getting a phone call. In fact, the old name of an electrical outage management system was a trouble call system. Today, most modern OMS’s use sophisticated prediction engines to determine the probable location of an electric fault and the probable location of the disconnecting device that operated to clear the fault. However, the system still bases the prediction on customer calls.

Even after outage events become known, restoration processes are still very manual.

Despite the implementation of very complex systems, applications and communications, people at utilities still use paper. For example, utilities use trouble tickets to tract trouble calls and paper forms for field audits. When customers request a new service, the utility generates reams of paper. One utility reported that they generated over 500 pieces of paper on a project for a service to an apartment building. Some of the paper comes directly off a computer printer. So workers at the utilities generate lots of paper.

Meter reading is still mainly a manual process, meaning that meter readers walk up and down the streets of cities and towns and visit every meter. While most do not actually copy the meter reading from the dials, the vast majority of the effort is manual. Many utilities still plan meter reading routes manually using large maps on tabletops.

Even companies that have GIS still print out the GIS generated maps and hand draw the new electric and gas designs on the computer generated maps..

Asset managers often use a manual process to reconcile asset information from among several computer systems.

So utilities today still perform many of their important and time consuming tasks manually They use lots of paper and rely very heavily on phone calls to determine abnormal events on the utility network.

### Today's Utility Technology

Much of the utilities' equipment today relies on electro-mechanical components. Electric substations and gas take stations use analog meters, relays and physical contacts, making the flow of system condition difficult.

Some utilities are doing very sophisticated work with Service Oriented Architecture (SOA). However, most do not have a fully integrated set of applications that link work, planning, customer maintenance and asset information and system conditions together. Fewer have all this information integrated with GIS. While utilities around the world are making progress breaking down silos of information, the vast majority still do not have an effective means of sharing information across departments. For example, it is difficult for them to integrate gas transmission information with the distribution department data or distribution information with the customer department data bases. It is probably difficult for system planners to have easy access to land ownership information that the real estate department maintains. For many utilities GIS is a tool to improve the productivity of their mapping operations, as input to their design process and often as a data source for their outage and leak management systems. Rare is the utility that uses the corporate enterprise GIS for long term planning studies, environmental management, customer analytics, logistics support and capital decision making.

Many utilities still rely on old radio systems which are difficult to integrate into modern digital communication systems.

Most electric companies have some level of distribution automation at substation breakers and selected switches throughout the network. Few have sensors regularly dispersed throughout the network to determine the health of the system. Most companies do not monitor distribution transformers. Thus during heavy loads, they can easily run well above their normal rating. If this happens regularly, the transformer will deteriorate and ultimately fail. The vast majority of utilities cannot exactly determine coincident load on distribution transformers. They rely on billing information from the customers connected to the transformers. Gas utilities have very little monitoring of their distribution assets other than the information gleaned from monthly meter reads.

The state of utility technology deployment today consists of few sensors, not much integration and reliance on analog and electro-mechanical systems.

### The Customer Impact of the Utility of Today

Lack of modern process and technology impacts the customer in several ways. Electric customers experience longer and more frequent outages. Gas customers may experience more frequent gas interruptions or accidents from gas leaks. When events occur, utilities cannot accurately inform customers when they will restore their gas or electric service.

Customers are also blind to their usage patterns until they receive their gas or electric bill. They do not receive real time price signals when they turn on the spa heater or air conditioner. They also have no idea what impact their load has on the health of the overall supply system. When they hear of an electric load emergency, they have no way of knowing whether to shut off a light or not use a dishwasher.

Utilities of today do not interact with customers to help them manage their load and ultimately to manage their costs of electricity and gas. Today's bills are difficult to decipher. When customers build new buildings or expand their manufacturing plants, utilities have a huge impact on their construction schedules. Utilities do not generally employ lean supply chain techniques guaranteed to meet customer requirements.

Despite all the technology in place today, many customers still receive estimated bills.

### The Business Impact of Today's Utility

Is today's utility expensive to run? Probably. Utility executives struggle with the business case for implementing new processes and technology. Part of the problem is that it is difficult to even assess the performance easily and proactively, since the technology and systems are not well integrated. So if a segment of the customer base is unhappy due to frequent outages or estimated bills, utility executives may not have systems and processes in place to know that in real time or enough time to take appropriate action. There are generally no processes in place to be able to assess the overall economic impact of less than optimal performance. For example, if a utility crew travels to the field to perform a job, but does not have the correct equipment to do the work, there probably isn't a process in place to capture that event as input to a business case for improvement in the process. Consequently, the process continues unchanged. If for example, during a routine outage event, half of the number of customers out for several hours could have been avoided; there probably is no mechanisms to quantify exactly how many customer hours of outage could have been saved by the implementation of a self healing grid system.

## GIS IS SHAPING THE UTILITY OF THE FUTURE

Utilities are already seeing the value of GIS as they move from where they are today to a utility of the future. Utilities have integrated GIS with ERP's, SCADA systems and OMS's. Gas companies use GIS as the basis for their leak management systems. Utilities with gas transmission are routinely using GIS for integrity management. Modern GIS is open and suited for Service Oriented Architecture implementation. For those utilities adopting advanced metering infrastructures (AMI), GIS is helping the rollout and will serve as the roadmap for where the various devices that make the AMI systems are located.

As utilities respond to the needs of customers, they are relying on GIS to help them understand customer behavior. They are gaining insight into where customers are moving to and moving from, helping them with their planning and capital investment. Utilities are leveraging demographic data to discover patterns of usage and population preferences based on spatial information.

Many utilities now see the value of integration of GIS with their Asset Management Systems. Being able to spatially profile risk along a pipeline, a gas main, a transmission line or distribution circuit gives utility managers the ability to see in an instant what would have taken hours of analysis from tabular information. GIS gives asset managers the ability to see spatial relationships of one class of asset to another. For example, asset managers can ask the spatial question, "Show me the impact of a rupture of a gas transmission line on electrical transmission in the area."

GIS models the utility infrastructure. It captures the inventory of the assets, the location, the condition and the relationships of the asset to each other and to their surroundings. So as utilities move to the utility of the future GIS will play a large role.

## THE UTILITY OF THE FUTURE

### Processes

The utility of the future will have integrated processes. That means it will be able to tolerate multiple levels of control since the information throughout the enterprise will be available to all parties. So control will be from the board room to the dashboard.

Many utilities have distribution automation. Yet today, people still make the decisions about how to operate remotely controlled equipment. In the future, an automated control system (the self healing grid system) will make the decisions about which switches to operate based on the information received from the field sensors, an accurate model of the distribution (from the GIS) and an automated means of assuring safe and proper loading.

The processes will be paperless. Customers will be able to order their new electric and gas service on line and be able to schedule the time and dates when the crew arrives for installation.

Executives will monitor both the financial and the operational performance of the system in real time. They will see a spatially enabled common operating picture of their utility. This will allow them to make investment and operational decisions in near real time.

So the utility of the future will be truly automated, paperless, information driven system. It will provide customers the ability to serve themselves. Systems will populate financial and operational metrics in real time. GIS will play a critical role in an integrated information technology framework.

### The Technology for the Utility of the Future

Utilities will embrace enterprise technology for their communications, back office and control systems and field deployments. They will integrate all these technologies. Gone will be the line worker with two or three radios, a laptop, a cell phone, a PDA, a pager, a GPS module linked to a stand-alone vehicle tracking system and the truck control module linked to a standalone fleet management system.

Digital systems will replace analog and electrometrical devices. Silos of technology will fall. Utilities will replace them with SOA fully Web 2.0 enabled systems. Customers will have full access to their consumption information and be able to interact with their utilities for billing, load management and construction related activities. Contractors will be able to access utilities construction schedules. Utilities will routinely subscribe to and publish web services from and to customers, communities, the government, one call and conservation agencies and other utilities.

There will be a quantum leap in communication and sensor technology. Utilities will monitor and measure not only outages but individual loads within customer premises and business. Perhaps some customers will contract utilities to help them manage their energy systems, turning on and off equipment, adjusting HVAC systems and dimming lights.

At the heart of the technology stack will an Enterprise GIS, modeling the network and the surrounding environment. Near real time high resolution imagery will be a standard element of the GIS. The GIS will be a key component for operating the network, monitoring the sensors and providing the framework for emergency management, among many other things.

### Customer Impact of the Utility of the Future

Outages will be fewer and shorter. Utilities will detect gas leaks sooner and repair them faster. Green technology such as solar and wind systems may be available and funded by the utilities. Utilities will routinely use GIS to model solar radiation and wind densities to help them site renewable distributed generation. Energy bills will be on-line and always accurate. Customers will have the ability to monitor and control their consumption in real time.

Customers will experience the same or better level of customer support and service they have come to expect from retail and internet services. The vast majority of interactions with the utilities will be on-line.

### Business Impact

Utilities will have real time access to business metrics, such as customer service, reliability, restoration, billing and productivity. Automation will significantly speed up work cycles. Information from the field will be readily available to everyone in the enterprise. Decision making will be based on measurement and monitoring not on estimates and prediction. For example, outages or even a momentary interruption of electrical service will be detected, located and acted upon instantaneously without human

intervention or interpretation. The operating costs of running the business will be dramatically reduced.

Utilities will have dynamic access to asset information. Equipment failures will be fewer. Gone will be the specter of distribution transformers catching on fire due to overloading.

#### ENTERPRISE GIS: A KEY PLATFORM FOR THE UTILITY OF THE FUTURE

GIS provides the model of the utility network. It captures the inventory, location, condition of all the utility assets, which includes the new sensor networks and smart meters. It provides the relationship of those assets to each other and the surroundings. GIS provides a visualization of the impact of utility decisions. Since nearly every process that utilities perform involves location in some way, GIS will play a key role in the successful rollout of the Utility of the Future.