GE Energy

BIOGRAPHICAL INFORMATION

Naomi Kellett
Product Marketing Manager – Mobile Solutions
GE Energy

Specific Responsibilities
Naomi joined GE Energy in 2000 as part of the acquisition of Smallworld, where she began her career in GIS as a Technical Consultant. Now holding the position of Product Marketing Manager Mobile Solutions, Naomi is responsible for the mobile strategy and direction of the Smallworld product suite. Naomi is located in Cambridge, UK.

Past Experience
Prior to joining Smallworld, Naomi worked in industry, in various technical positions as a land and hydrographic surveyor**.**

Educational Information
Bachelors of Science degree in Surveying and Mapping Sciences from University of Newcastle upon Tyne, UK

Professional Memberships
Chartered Institute of Marketing

BIOGRAPHICAL INFORMATION

James Morrow
Vice President of Americas Utility Sales
ViryaNet, Inc.

Specific Responsibilities
Jim is currently Vice President of Americas Utility Sales for ViryaNet, Inc., a software company providing automated workforce management solutions to the electric, water, and gas utilities market. In this capacity, he is responsible for the utility practice sales in North and South America.

Past Experience
Mr. Morrow has spent the last 25 years serving in various management and executive roles providing technology consulting, professional services and application software to electric and gas utilities in the United States, Japan, Saudi Arabia, Czech Republic and the Philippines.

Throughout his career, Jim has contributed to the success of many electric and gas utility companies by providing software systems related to financial planning, operational planning, distribution and generation maintenance planning, and field force automation. In addition, he was the co-founder of a company providing decision support software to the deregulated electric utility industry and founder of a power trading company buying and selling electric energy in the PJM pool.

Educational Information
Mr. Morrow earned a Bachelor of Aerospace Engineering degree from Auburn University and completed the Cooperative Engineering Program.

The Advances of Integrated Geospatial Application in Workforce Management and Field Service Optimization

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Abstract:

Historically, workforce management and field services meant dispatchers and field technicians working with trucks, phones and paper. Today, there is an opportunity to exploit advancements in mobile technologies that distribute data, and even more importantly, information to the field for greater efficiencies and customer responsiveness. The business drivers that are forcing the technology issues are reduced drive time, centralized and automated dispatch, optimized scheduling, improved availability of information and a closed feedback loop from field activities. Electronic geospatial data has not only been limited in the mobile workforce and field service areas, but in many cases it has been non-existent. This discussion will be looking at the technology revolution that is taking place in the areas of geospatial applications and mobile computing platforms. The specific topics that will be covered at this session include:

- Distributed geospatial field application architectures
- Advanced routing, location tracking and service call optimization
- Integrating network control, design management and asset tracking with mobile field systems

1 Introduction to Mobile Workforce Management

Mobile Workforce Management is the organization and administration of a company's field activities, both scheduled and emergency, which are assigned to their field personnel. It covers the creation, scheduling, dispatch, and completion of work orders, with the key goals of optimizing field crews, recognizing cost savings, improving availability of information and ensuring premium customer service.

The type and duration of work orders varies from scheduled maintenance to emergency situations, with the length varying from minutes through to days. The origin of these work orders can be from a multitude of sources such as Customer Information Systems, Operations Management Systems, Work Management Systems, and Enterprise Asset Management or can be generated in the field. Companies may have to deal with a distributed workforce, consisting of a combination of internal employees and external contractors.

With such diverse variations, a company needs to have all of their work order and crew information brought together in one system to ensure maximum efficiency and customer responsiveness.

2 Introduction to Field Services

Ever since there have been assets in, on or above the ground, there has been some sort of field service in place to ensure that these were maintained, repaired and kept serviceable, so that customers and businesses that were reliant upon them could operate.

Going back twenty years, the communication technologies available were quite different to what is found in common use today. The Internet was yet to be created, e-mail was possible, but in a very limited way and only within companies with mainframe system computers. This method of communication was very basic, more of a memo system, with only text transfer possible and just to other personnel within the company who were fortunate enough to have a mainframe connection.

As technology has advanced, this has had an impact on the organization of utilities and other service companies. Instead of an area based configuration with regional offices, the trend has moved towards a centralized system. For example, an electric utility which twenty years ago may have had fifty Field Service Supervisors now may only have twelve or so. This is due to the more centralized and automated management of crews, especially for scheduled maintenance work.

As the organizational structure has changed, so have the methods employed for managing the work crews. Instead of the dispatch and scheduling of crews being done through a paper system in these area offices, it is now driven from a central site, with instant access to crew schedules, current location and status.

Customer service has improved in recent years through the sharing of data; customer service departments previously would not have been able to give informed responses as to why there might be a power outage. Today with the monitoring equipment available in the control rooms providing real time status updates, coupled with the knowledge of crew location and tasks in progress, means that an instant response can be given. This provides improved service to the customer, but also supplies important additional information to the company in terms of customer details, time of call, problem and resolution, all of which can be recorded and monitored for trends.

3 Technology Trends

Communication and computing hardware technology advances are two of the key areas that have allowed information to be distributed more easily to workers in the field, regardless of location. As these advances have occurred, so the software for use with them has also developed in response.

3.1 Communication Technologies

Schedulers need to maintain contact with their field crews, but traditionally this has been difficult and expensive due to limitations in technology. It is only in the last ten years or so that cell phones have become commonplace in work and home life. Prior to this paging or radio communication was the standard mechanism for communication between the office and the field workers. The majority of enterprises would have had a UHF/VHF Private Mobile Radio system. This type of system has a high cost, both in terms of installation, maintenance and operation. Many of these systems are still in use today. Pager devices became more commonplace in the late 1980's and resulted in 61 million[1] pagers in use globally by 1994 primarily through the advent of wide-area paging.

Cell phones are now a common mechanism for voice communication between office (schedulers) and field crews. Their low unit purchase cost and relatively low running costs, coupled with improved network coverage has increased their usage.

Voice communication is only part of the technology required. Another key use of communication technology is in the transfer of information and data. Examples of data which need to be communicated to field crews includes:

- Calendar schedule
- Work orders
- Geospatial data
- Asset data

The communication is a two way process and data returned from the field to the office can include:

- Current location
- Current status
- Completed work orders

[1] Source - Integrated Electronics Engineering Center (IEEC)

- Updates to asset information
- Sketches detailing new build not in the database

Wireless local area networks at depots or service centers can mean that collecting the work for the coming day can be as simple as a drive-thru process. When out working, the crews can now keep in touch using wireless coverage supplied from a combination of public and private networks. This can provide instant access to corporate information for the field crews and for dispatchers to ensure that they know the current location and status of all work crews.

Coverage is still an issue with any wireless network, and looking into the future there will be improved coverage. For the transfer of large amounts of geospatial data, the current bandwidth available can be a limitation, but this will increase in the future.

2.5G is currently a standard that is widely available with around 56Kbps bandwidth, 3G networks will potentially extend this to 2Mbps. Wireless technology is becoming more common with the advent of WiFi. Several cities are introducing citywide networks, and there is even the possibility of having statewide coverage. WiMAX is a recent addition to the wireless phenomenon. It is expected to provide fixed, portable and mobile wireless broadband connectivity without the need for a line of sight direct with a base station. The range is expected to be between three to ten kilometers with a bandwidth of 40Mbps per channel. Looking to the future WiMAX technology is expected to be incorporated into computing hardware by 2006[2].

3.2 Hardware Technologies

Traditionally, all of the information required by field crews was supplied, either in paper form or on microfiches kept as a series of map books or rolls of plans in the truck. These were expensive to produce and once created could also be immediately out of date. When it was necessary to have access to current data, it was common for fax facilities to be used, sometimes these could be located at local depots, at home for crews working remotely, or even the temporary use of roadside service stations fax facility.

Since the development of mobile computers, the first laptop computer was designed in 1979 by William Moggridge of Grid Systems Corp[3], it was only a matter of time before they were utilized in the field. Today, the dependency on a paper-based system is gradually being replaced by a more comprehensive and technically sophisticated set up comprising of computers, with built in telecommunications and Global Positioning System (GPS) receivers.

The advances in computer hardware in terms of battery life, processing speed, memory, disk space and suitability for outdoor use has meant that computers are now

[2] Source – WiMAX Forum
[3] Source - © 1996 Maine Antique Digest

commonplace in many field trucks. Cost has also made these devices more accessible, but they still represent a significant investment.

Looking into the future, the increased use of computers in the field will continue, as the advances in technology mean that the form factor is optimized, in terms of usability – physical size, weight and screen resolution. In addition, developments to tablet specific operating systems, such as Microsoft XP Tablet PC, will ease the interaction and operation of the devices in field conditions. Increased availability of rugged models, specifically designed to withstand the rigors of outdoor use in extremes of weather, will see the use of remote computing become more accessible and viable.

3.3 Software Technologies

Only since it has become viable to use computers in trucks, has the software for use on these devices been conceived and now begun to mature. The last ten years has seen a gradual increase in the use of computers in the field, with the revolution occurring now and looking to continue into the future.
Various software components are required for efficient field operations:

- GPS
- Calendar information for crew schedules
- Geospatial information
- Asset information

Tablet and Tablet PC hardware devices require specialized interaction, allowing the support of handwriting recognition to aid easy data entry. Windows XP Tablet PC operating system is the first release to support this type of interaction, as well as the standard tools you would expect from a Windows operating system. The latest version of the Tablet PC operating system, shipping with new Tablet PCs, offers deeper pen and ink integration for a more natural computing experience [4].

4 The Role of Geospatial Data

It is only recently that companies have begun to experience the benefits of sharing geospatial data, held in a Geographic Information System, with field crews. This data has historically only been available for the use and benefit of office workers. This is now changing. Some field-based tasks, such as meter readings, have not needed the advantages, which access to geospatial data will bring, but for crews in an outage situation or for maintenance or inspection teams, access to geographic data and asset information is essential. Integration with other technologies, such as GPS, ensures navigational efficiency and accuracy of location information when undertaking data capture exercises.

The challenges that have limited the use of geospatial data until recently is the mechanism of ensuring the data in the field is concurrent with the information held in the

[4] Source – Microsoft website

office. How can these changes be relayed to the crews in a timely manner, to ensure that they have access to the latest up to date data? Improvements in communication technologies have made it possible to transfer data between the office and the field using wireless technology and other communication mediums.

The advantage of making data available to field crews is double sided. It is possible for crews to check the validity of the data in the field and for discrepancies to be reported back to the office. This ensures that the data held in the central system is kept up to date. Another advantage is the time it takes for changes occurring in the field to be reflected in the central system. Previously, changes would have been annotated onto paper maps, which would have been handed into the office for input into the central system. It could have taken several months to see these changes reflected, if indeed they made it at all.

The ability to share geospatial data with various field workers has broadened the scope of users. Historically, network design would have been completed in the office with the designer maybe going out to the site with paper maps. Now, it is possible to take the geospatial data into the field to create the designs, with the ability to insert the correct equipment, estimate costing and complete “best-fit” design whilst in location.

4.1 Other uses for Geospatial Data

Aside from the use of the data from a central Geographic Information System in the field, there are also several other technologies used in a mobile environment. These include Global Positioning Systems and/or Automatic Vehicle Location. Both of these systems provide field crews with geospatial information concerning their whereabouts either as a combined solution or independently.

GPS is inbuilt into the in-car navigation system and provides the driver with direction instructions to assist in reaching the destination. The GPS integration provides the current location and the in-car navigation software provides the street information to assist in guiding the vehicle, in the most effective route possible. Several of these systems receive real-time traffic updates to allow for optimal routing and minimal hold-ups due to traffic. The use of in car navigation is coming more commonplace, as the data improves, the accuracy increases and the hardware costs are reduced.

Automatic Vehicle Location provides companies with the ability to track the location of their vehicles whilst in the field, and again GPS is a key technology used to facilitate this, along with a wireless connection.

4.2 Distributed Geospatial Field Application Architectures

Data from many systems are needed to ensure effective and efficient use of information and resources. This also brings with it the associated problems of ensuring communication between these systems. A typical electricity utility set-up could include:

- Real Time Control System (RTCS)
- Geographic Information System (GIS)
- Enterprise Resource Planning System (e.g. SAP)

Information from all of these systems generates the work required for completion by the field teams. The output from these data sources needs to be handled seamlessly by the Work Force Management System:

- The RTCS system provides real time data in terms of the current state of the electricity network. If an error occurs, such as an outage, a call will be generated, which needs handling by the Work Management System, which in turn needs to ensure that the Work Force Management System responds with the dispatch of an appropriate crew.

- The ERP system could generate maintenance and inspection orders that need to be scheduled and dispatched by the Work Force Management System.

- The Engineering and Asset Management system could also be a source of order generation, especially regarding new network construction.

The work orders generated by these disparate systems can vary in many criteria, including:

- Skill set required from the field crews
- Length of job
- Emergency or scheduled
- Equipment and data required to complete the job

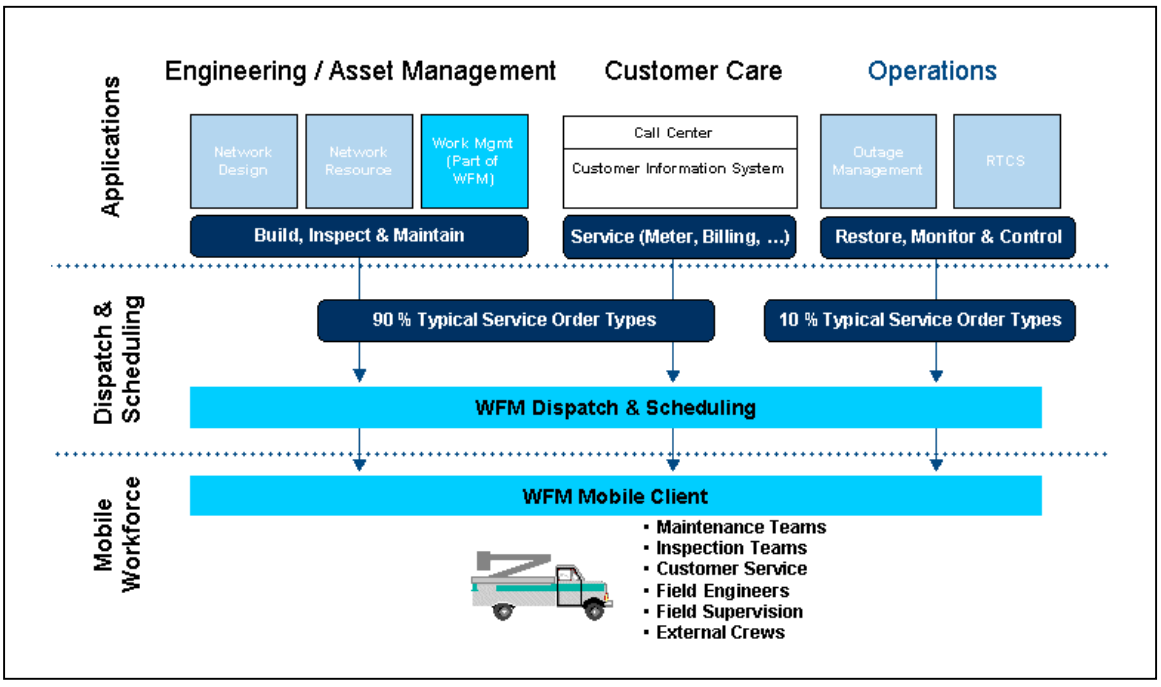

Figure 1: Typical Work Force Management Organizational Structure

5 Advanced routing, location tracking and service call optimization

The key to running an efficient field service department is to ensure the crews with the right skills are sent to the correct location with the right equipment and information to complete the job at the right time.

Optimization of field resources can be obtained through the use of scheduling and routing planning software. This ensures the skills and time of the crews are used to best effect – less time is wasted driving between jobs in opposite parts of their service areas – their route is optimized. This works well for scheduled work, but can also play an important part in emergency work as well. Instantly, the scheduler can see all of the crews' current location and status. Through having access to this knowledge, the closest crew with the right skills can be deployed. All of this is possible by adding the geospatial dimension.

6 Integration is key

It can be seen that, the information required for the smooth running of field operations of an organization comes from various sources. This data cannot be kept in isolation. The real power of information is obtained when all of the disparate systems are brought together to provide a cohesive and seamless system of data transferal.

The sharing of the geospatial data overlaid with the current location of field crews and information about their current job is essential in providing optimum customer service.

Cost savings can be achieved through the optimization of crews, as windshield time is reduced. In addition, providing field crews with the geospatial and asset data ensures that they have the correct equipment in their truck, eliminating the number of revisits.

7 Summary

Technology is everywhere and increasingly it is becoming more commonplace in field services. In the future, trucks will be fitted with GPS, AVL and in car navigation systems as standard equipment. Field workers will be able to connect remotely to the office to access the latest data, to update the asset information, provide new build information, as well as check stock and update inventory levels. All of these advances in technology are possible through improvements to hardware, software and communication technology enabling more work to be completed out of the office by remote crews.