GE Energy

Smallworld™ 4 Product Suite

Smallworld Field Information System™ 4: Bringing efficiency to the front line

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Abstract

Historically, network enterprises have been unable to maximize the full business benefits of deploying mobile solutions due to the inherent complexities of the data they use and the high cost of mobile computing. However, with the advent of more affordable mobile devices and the introduction of GE Energy's Smallworld Field Information System™, network enterprises can now liberate their Smallworld network data from the shackles of the office desk and direct it to the front line where it can empower a new generation of mobile workers with the ability to easily access the most up to date information, when they need it and, most importantly, where they need it.

Introduction

For many enterprises much of the worth of their businesses is held in a complex network of assets. These network assets can be underground, spread over great distances or located in the most remote parts of a country.

These networks are not just important to the businesses that own them but also to the customers they serve and to the wider community. Water, electricity, gas, telecommunications are all vital services in today's society. Minimizing outages, maintaining a high standard of service and improving efficiency are all important business goals for a network enterprise.

It is also important to recognize the inherent risk involved with working with these types of networks. For example, to avoid potentially fatal accidents, field crews need to know the types of assets being worked on.

There is a requirement for up to date, accurate and high quality network data when and where it is needed most: at the front line.

Breaking the paper chain

Historically, most enterprises provided this business critical network data to their field workers using paper-based maps. For a long time this was really the only option as mobile computing was prohibitively expensive to deploy on a large scale and the form factor of many of the devices available made them too cumbersome to use.

Paper maps have a number of problems, however, that makes their use less than ideal:

- Paper maps wear out, get dirty, are easily damaged and are often annotated with information that can become confusing.
- The information printed on the paper map itself can become out of date quickly, especially in areas of the network where there is extensive new build or maintenance.
- Paper maps are expensive to produce and, more importantly, expensive to keep up to date. Field crews are often issued with map books that might only get updated once a quarter to minimize printing costs.
- Paper maps can also be cumbersome to use. Finding the correct map to examine can be a chore if there are hundreds to choose from and the classic limitations of a map (for example, assets that straddle two maps) can be frustrating for an engineer working in difficult or cramped conditions.

Paper maps are not only inefficient for the field worker they are also inefficient for the enterprise. Handling, distributing and updating paper maps is simply not the most cost effective way for the enterprise to make network data available to those who need it most. Corrections made in the field (whether textual or in the form of sketches) are typically made to the appropriate paper map in the form of annotated changes submitted by the engineer. These changes are then typically collated every day, once a week or once a month and placed in the in tray of another employee whose responsibility it is to manually apply the changes to the master database. Sometimes these changes will be difficult to process (either because they are illegible or confusing). In these cases contact with the engineer will often be required to clarify the change.

All these steps create opportunities for error and make this a highly inefficient and expensive process.

Making it to the tool belt

Mobile technology has improved dramatically in the last few years. Rugged laptops, though still more expensive than their consumer-focused counterparts, are now a much more attractive business proposition to most enterprises. Tablet devices have also emerged as an attractive form factor and the adoption of Microsoft® Windows XP® Tablet Edition as the platform's de facto operating system have simplified deployment and broadened their appeal in the market. Personal Digital Assistants (PDAs) have seen substantial advances in computing power and storage (although screen size and other usability issues are still of concern). For the first time, businesses are now in a position to offer technology to their field workers that can deliver real business benefits at a reasonable cost.

However, hardware is only half of the solution: a rugged laptop than can store gigabytes of network data is going to be largely ineffective if the field worker finds the user interface confusing, impractical or more time consuming than a paper map. Usability in this context is extremely important. Understanding how the field user works will determine the effectiveness of any field based solution. To understand the significance of this point one only has to look at the tool belts of the most experienced field workers. On each will be the engineer's most frequently used and most valued tools. Tools that are not favored are often left back in the vehicle and may accidentally become damaged beyond repair. This is obviously less of a problem for tools costing $10 but it quickly becomes a more serious issue if the tool is a rugged laptop costing $2000.

The goal should be to create a field based solution that is so intuitive and helpful that it becomes indispensable to the field worker: it becomes one of the most valued tools on the tool belt.

Completing the circle

An intuitive user interface designed to complement the way that field users work allows increased efficiency, but what about the data they generate and the data they need?

Clearly to be effective, a comprehensive solution needs to have an integrated approach to handling data generated in the field. This includes making sure updates are processed correctly and ensuring that field workers are kept in step with the latest network information. This integrated approach is vital when it comes to ensuring the integrity of the data in use. However, the business benefits of a field solution can quickly evaporate with a cumbersome import and export mechanism to transfer data from the field worker to the corporate network database.

Data in the field needs to be quality assured for numerous reasons. This includes increasing safety through the reduction of errors around critical parts of the network and to ensure corporate standards are met. This emphasis on the quality of data is very important for enterprises as it is this data that is used to make important business decisions: poor data leads to poor business decisions.

Another point to note is that network data is voluminous. Even a small geographic area can require surprising amounts of storage if the network data is dense. Many field devices have limited storage and so the ability to deliver the right data to the field worker within the limitations of the hardware in use is an important characteristic of a successful field deployment.

The right data to one user might, of course, be the wrong data for another. So being able to match the data to the user is an efficient way to avoid map clutter, improve usability and allow users to focus on the job in hand. All of these are critical for users dealing with emergency calls, working in inclement weather conditions or even dealing with day-to-day tasks such as leakage detection or scheduled maintenance.

Anywhere, anytime

It is clearly tempting to think that the internet has an important part to play in delivering data to field users. Cellular networks have improved dramatically in the past few years offering greater coverage and faster data throughputs. Providing electronic maps on demand and passing changes back via a persistent network offers obvious benefits when it comes to ensuring the most up to data is in use.

However, it is an approach that is difficult to achieve in practice. Cellular coverage has improved, but most of it is targeted to consumers who conveniently huddle in cities and towns and not in more remote areas of the country where utilities tend to place some of their most important assets. Even in conurbations signal strength can be patchy and, at worst, non-existent when working in out of the way places such as a trench or a basement.

Relying on a network connection is inevitably going to lead to situations where the data most urgently required is simply not available. This will be an inconvenience to the field worker at best, or at worst a real crisis during, for example an emergency repair (when it is least likely that a network will be in operation).

The right technology to the front line

The introduction of the Smallworld Field Information System™ from GE Energy provides network enterprises with an affordable, broad based, workflow centric field solution that integrates seamlessly with an existing Smallworld database. Designed to be deployed using the hardware most commonly in use, the Smallworld Field Information System application consists of three components: a client component for using, editing and gathering data in the field (Smallworld Field Information System), a server tool that manages the data made available to the client (Smallworld Field Data Server™) and a server task management component that manages changes to the master database (Smallworld Task Management™).

Smallworld Field

The key benefits of the Smallworld Field Information System application are:

- Intuitive, easy to learn user interface developed from extensive interviews and design sessions with field workers.
- Simple to use map navigation tools that allow a user to easily traverse a seamless map (including viewing the internal layout of a substation or other site).
- Simple pre-defined, canned queries that allow frequently used assets to be located quickly.
- The ability for users to maintain a location list that allows tasks to be specified and re-ordered to meet an optimized personal schedule that is independent of any central system.
- Dynamic display of asset attributes.
- Easy-to-use sketching tools to annotate a job, emphasize important points or to provide instructions to another crew.
- Support for measuring distances between assets.
- Optimized support for attribute updates using reduced keyboard interaction.
- Support for configurable form based data input supporting specific tasks such as pole inspections.
- Support for viewing external documents associated with existing assets (reports, spreadsheets, photographs and so on).
- Support for direct, client based printing, allowing users to quickly produce paper maps for third party contractors.
- Support for storing updates locally until the user is ready to upload the changes (for example at the end of shift).

- Support for self contained map and asset data eliminating the need for an external network connection.

All this important functionality collectively helps to improve the productivity of the field user. For example, field workers can make sure they have the right tools and equipment for a job before departing because they have access to up to date data (as opposed to setting out on a long trip and upon arrival discovering that a different component has been installed to the one indicated on their paper map).

Smallworld Field Data Server

Smallworld Field Data Server™ supports four important functions. Broadly speaking:

- It defines the type of data required by the user and creates extracts of the master database based on those requirements.
- It defines aspects of the client user interface.
- It keeps the data on the client device synchronized with the master database through the creation of incremental changes.
- It facilitates the easy deployment of data to mobile devices.

Smallworld Field Data Server has a central concept of a profile. A profile is a description of the role of the user that needs the data in the field. For example, a worker who performs pole inspections would have a different profile to that of a maintenance engineer (they both need different types of data in order to complete their jobs).

Each profile defines such things as:

- The required assets. An example might be an operating area that shows only water distribution assets such as valves, hydrants and pipes (but not treatment works or reservoirs).
- The visibility of individual attributes of a type of asset. This feature, for example, can hide superfluous information or protect sensitive data from third parties such as contractors.
- The composition of layers consisting of several assets (with geometry) that the user can manually turn on or off to reduce clutter.
- The other configurable parts of the Smallworld Field Information System application, such as which assets can be selectable, which attributes can be edited, scales to use, and the definition of pre-defined queries.

The real power of this approach is that it allows a single profile to be defined for a group of users providing an efficient mechanism that allows teams of workers to have the data they need. When additional data is required, that change can be easily implemented by modifying the single profile for that group using the wizard-based user interface provided.

The Smallworld Field Information System application uses a self contained data source that, once populated, can be used without the need for a network connection of any kind. This self contained data is in fact an extract of the master database. The Smallworld Field Data Server Program allows an administrator to define the geographic extent of this extract (for example a district) and then save it to disk in a format that can be read by the Smallworld Field Information System application. The actual data extracted will depend on the profile used. Initially this data might be distributed to each field client via a local area network or recorded onto, for example, a compact disc allowing easy distribution to third parties. Once loaded onto the field device the data is ready to be used.

Since each extract is self contained, multiple extracts may be stored on a single mobile device. Users can easily switch between extracts picking the one that best suits the job in hand. This would, for example, allow crews that normally operate in one area to be re-deployed to another area to help restore power after a storm. Multiple extracts also allow very large areas to be more efficiently represented using a more granular approach. This permits very large areas to be represented by several smaller extracts. Only those extracts that are actually needed by a user would be stored on the mobile device (as opposed to the complete area – parts of which are never needed). This saves disc space on the mobile device and makes updating extracts quicker and more manageable.

In some cases, an enterprise might want to create fresh extracts periodically (for example every day) to ensure that field users have the most up to date information. The Smallworld Field Data Server™ application supports the batch creation of extracts and additional servers can also be exploited to handle peak loads.

Refreshing an entire extract might be appropriate in cases where the amount of change is great (for example during a rapid expansion of the network), but this a less efficient approach if the change is small (for example, as in the case of a mature network). In this case the extract can be configured to work in an incremental mode which allows a Smallworld Field Information System client to synchronism its map data by only downloading changes. This is typically a quicker process and results in less data traffic.

Smallworld Task Management

The Smallworld Task Management™ application manages the changes made by a field worker using the Smallworld Field Information System application. Changes made by the field worker are associated with a single task (the user begins a task, makes edits and then marks it as finished when the changes are completed). At this point the edits do not actually change the network data: instead they effectively represent a digital description of the changes made. These changes reside on the user's mobile device until it is convenient to upload them to the master database via the internet or a local area network (for example when returning to the depot at the end of the day). The changes are not applied automatically to the master database. Instead, the Smallworld Task Management application lists each of these tasks and allows an office based user to process each requested change. This important intervention step allows enterprises to sustain the quality and integrity of their network data. Good data leads to good business decisions.

Conclusion

Rapid advances in mobile technology have ushered in a period of real opportunity for many network enterprises. Current paper based solutions to help field workers are becoming increasingly unsustainable in an era of deregulation and increased competition.

Innovative technologies such as the Smallworld Field Data Server and Smallworld Task Management application provide a tightly integrated solution not only for the deployment of rich network data to the field, but also for the management of important changes made in the field.

Cheaper, more powerful and more ergonomic mobile devices coupled with advanced, intuitive software such as the Smallworld Field Information System application now offer network enterprises the real possibility to match the improvements in productivity experienced in the back office to where it now needed most: at the front line.