

BIOGRAPHICAL INFORMATION

Darren Payne
Principal Consultant
Red Planet Consulting, Inc.

Specific Responsibilities

One of the founders of Red Planet Consulting, Inc in 2000. Responsible for managing Red Planet's overall operations and individual projects such as OMS implementation, integration and support.

Past Experience

Darren has been implementing spatial IT in the utility and telecommunications sector for over fourteen years. Darren's career began at North West Water, in England, where he played a major roll in the company's pioneering geo-spatial technology projects using IBM-GFIS. Moving to the U.S. in 1991, Darren joined an implementation team at SRP in Phoenix and two years later joined Emery Datagraphic in Denver, Colorado, where he was responsible for supporting the company's clients using Intergraph FRAMME. From 1996 to 2000, Darren worked for GeoData Solutions, providing Smallworld consulting services. While at GeoData, Darren's responsibilities focused on spatial data modeling, database migration, and QA. Since joining Red Planet, Darren has successfully managed several PowerOn OMS implementations and upgrades. He has also provided data QA consulting services aimed at preparing GIS data for OMS rollout and ensuring optimum performance of OMS through ongoing data QA.

Educational Information

B.S. – Information Technology, University of Salford, Lancashire, England.

DATA QUALITY FOR OUTAGE MANAGEMENT SYSTEMS

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ABSTRACT

Effective operation of an Outage Management System is not possible without high-quality GIS data. Struggling with bad device predictions, un-located calls and troublesome OMS network model updates puts pressure on a Utility's support resources. A well-structured approach to identify and address GIS data problems significantly reduces errors in the OMS, consequently increasing OMS operational efficiency while reducing costs and downtime.

This presentation examines problems commonly found in GIS data and their potential impact on an Outage Management System. Options for resolving these problems will be discussed in detail. In addition, this presentation will cover methods by which QA/QC of network data can be effectively incorporated into the business process so that the true source of data problems can be found and corrected. This iterative approach results in constant improvement of data maintenance processes, thus reducing OMS support costs and other operational side-effects on additional integrated systems (such as CIS).

INTRODUCTION

Outage Management Systems (OMS) demand network data that is near one-hundred percent error-free. This represents considerable challenges for people responsible for managing the GIS data that provides the source for building the OMS network model. Prior to large-scale applications such as OMS, GIS have been primarily used for producing map products. Data quality has emphasized positional accuracy and conformance to mapping standards. While nearly all GIS model the underlying connectivity of the network, making the connectivity accurately reflect the real-world has often taken a back seat to other drivers.

Widespread deployment of operational support systems like OMS, has placed more emphasis on the quality of network data in the GIS. This becomes even more of a challenge given the level of growth-driven change utilities are faced with. Engineering design departments have traditionally focused on cartographic clarity of GIS data for map production. Oftentimes data-model correctness, including network connectivity, goes unchecked. Connectivity errors or omissions are posted to the master database, where they are used to build the OMS data

model. Data errors cause the network build to fail, leading to partially built circuits. This leads to unlocated trouble calls, bad prediction or even failure of OMS processes.

This paper discusses the effects that bad data can have on the outage management process. It includes a brief look at commonly occurring GIS data problems, and discusses QA/QC measures that utilities can adopt both to prepare data for OMS deployment, and to ensure ongoing quality.

WHAT IS AN OMS?

OMS use a real-time model of the distribution network to support trouble-call management service restoration. Trouble calls are received from the Customer Information System (CIS) and/or Interactive Voice Response (IVR) systems. By correlating calls with load devices, the OMS predicts the probable outage device. Multiple calls received on a circuit over a period of time enables the OMS to continually re-predict the outage. Typically, an OMS also provides crew management and task assignment, what-if analysis and switching task management. It also archives outage records for SAIFI, CAIDI and SAIDI reporting.

The network data model that the OMS uses is built from the distribution network data stored in the GIS. Typically, the OMS network model is built on a circuit-by-circuit basis. As the GIS data is updated for a circuit, the network model in the OMS is updated by rebuilding the entire circuit, a portion of the circuit, or by passing incremental inserts, update, delete commands to the OMS.

Network model build processes are complex and need to be tuned so that the utilities custom GIS data model can be converted into the OMS vendor's proprietary network model. Intermediate formats and/or data models such as the Common Interchange Model (CIM) and or eXtensible Markup Language (XML) may be involved in the process.

THE COST OF BAD DATA

OMS deployment requires a significant investment. Implementation costs can range from several hundred thousand into the millions of dollars. A utility hopes to offset implementation costs with costs saved through improved customer restoration times, service reliability, and conformance to FERC requirements. Return on investment, however, can be seriously hampered when errors exist in the GIS data, or are introduced as part of an engineering work order and design process.

Researching data problems found during operation of the OMS takes up valuable resources both on the IT side, and in operations dispatch. If circuits have not

been built correctly, the number of unlocated trouble calls grows rapidly, especially during storm situations. Dispatchers must then manually analyze each call, assigning them to known outages or dispatching crews to investigate the cause in the field. This does little to help customer service restoration times.

It is not unusual for utilities to have at least one IT person dedicated to supporting the OMS, and dealing with network model build problems tends to take up most of their time. Furthermore, network model update processes tend to be run at night, leaving the dispatchers with problem circuits until support staff arrive.

WHAT CAN GO WRONG? GIS DATA PROBLEMS DEFINED

In the process of addressing network data quality, it is useful to know the kinds of data problems that affect an OMS network model build. We shall assume that the underlying GIS data model fully supports the OMS network model build. This paper deals with errors that can exist in the GIS data and not in the underlying data model or are caused by bugs in network model build code.

Detached/Missing Customers

Many unlocated calls can be attributed to a mismatch between customer records in the CIS and those in the GIS. Furthermore, customers in the GIS may not be connected to a load device, or they may be connected to the wrong load device.

Connectivity Problems

Connectivity problems cover a broad spectrum of data errors that make the network model build stop prematurely. The underlying connectivity model used by the GIS may differ depending on the platform. In the GIS, however, each circuit must be fully traceable from the circuit breaker to each customer being fed by that circuit. Not all connectivity issues are caused by simple disconnects in the network. In GIS such as GE Smallworld, where connectivity is built from geometries, overlaps or duplicate geometries can cause small loops in the built network, or in some cases duplicate device records in the OMS.

Orphan span is a term commonly used to describe a portion of a circuit that cannot be reached by a trace. Unlocated calls are far more prevalent when portions of circuits remain unbuilt.

Attribute Problems

Network model build processes often use attribute values to determine where to stop tracing and how to build the OMS network model. For example, a circuit ID attribute on conductors or devices may be used. Phase values are

also read, and some network model builds will stop if phases encountered do not match (for example an AB phase line is connected to a C phase line).

Phase confluence can complicate the network build process. In fact, some OMS versions do not support confluence, and work-arounds are required for successful build. Phase confluence also presents unique challenges in validating the data because the network tracing is more complex.

Missing Devices – Closed Loops and Bad Circuits

An incorrectly closed switch can cause closed Underground Residential Distribution (URD) loops. In some cases the device may be missing completely.

Incorrect or missing tie-switches can cause the boundary between two circuits to be incorrect, leading to bad device prediction in the OMS. Open switches with dead spans behind them can also cause sections of a circuit to be missed completely, leading to unlocated trouble calls.

LOCATING DATA PROBLEMS

Network Trace

Most OMS network model builds are based on a network trace. The best way to find errors that will crash the model build is to perform similar tracing. Tracing each circuit can find missing tie-switches, circuit ID problems and phasing issues. However, tracing out from the circuit breaker is not likely to find disconnected portions of a network. Ideally, each customer or service point must be checked for tracability back to the circuit breaker, which raises performance issues. One solution is to perform step-by-step connectivity checks. Can a load device be found for each customer or service point? Is every load device attached to a primary conductor? Can you trace from the load-device, upstream to a protective device? Can each protective device, recloser and other fallible equipment on the circuit trace back to the circuit breaker?

Tracing can also find loops in the network and other network problems.

Spatial Scanning

Another approach to finding disconnected network is to perform a trace with spatial scanning at end-points. If a facility is disconnected, it is usually spatially close to the facility to which it should be connected. A spatial scan can find connection candidates for investigation by QA team members.

Other Checks

Other simple QA checks include finding duplicate geometries or objects in the database and overlapping geometries.

DATA QA BEST PRACTICES

There are two main challenges to GIS data QA:

- Performing a comprehensive data scrub to get the data clean at the start.
- Introducing on-going data QA at all the points where GIS data can be changed.

GIS Data Scrub

A GIS data scrub involves locating data errors and repairing them. Data repair may be done manually or using some degree of programmatic automation. Most GIS provide facilities such as network trace and query functions that can be used to manually check the data. A QA application, however, provides the most efficient means of checking GIS data. Configurable QA applications for some GIS are available from the GIS vendors, or from third-party software consulting companies. Features of a good QA application include:

- Clear and intuitive user interface.
- Suite of standard QA processes that can be configured to work with the utilities specific data model.
- Modular design, allowing the construction of custom QA processes.
- Flexible means for specifying the QA objects. For example, by area, query result, or by performing a network trace.
- Ability to define scripts of QA operations that can be named and saved for standard QA processing.
- Error listing with map go-to and highlight capabilities.
- Error messages that accurately describe the problem found.
- Ability to save and reload error lists.
- Support for automatic fix routines for errors.
- Ability to manually check-off errors as they are corrected.
- Ability to interrupt the processing and suspend and resume.

Ongoing Data QA

Ongoing data QA presents some unique challenges. Ideally data problems should be caught and resolved at their source, which is most likely during the

engineering work order and design processes. For example, a business rule could be implemented that says designs cannot be posted until they pass QA. This approach helps designers become responsible for the integrity of the network. Designers who are concerned more with cartographic correctness and adherence to mapping standards, however, are sometimes reluctant to take on additional workload in checking underlying connectivity. Work order backlogs exacerbate this problem. In addition, it is sometimes difficult for data QA processing to focus just on the work completed by the designer. GIS data does not always show which way is source, and which is feed. QA processes that check the entire circuit must be careful not to reject a designer's request for posting, based on an error found in another part of the network.

Another solution involves running comprehensive QA prior to OMS network model update. The advantage of this approach is that errors arising from other database update processes will be caught and flagged for repair. It also relieves designers of extra workload. However, network model update processes often struggle to complete in a reasonable timeframe. Adding a QA step to the process does nothing to help. In addition, finding errors in data that will immediately be used to build or update OMS circuits does nothing to prevent failure of the circuit build. There must be time for an operator to investigate and repair problems.

For there to be significant reduction in support costs, OMS network model build and update must be run against a version of the GIS that is guaranteed 99 percent error free. Where upfront QA cannot be introduced into the engineering work order and design process, it may be necessary to introduce a QA step between "as-built" posting and final post to the master database. Here, "as-built" changes are posted to an intermediary version of the database. QA processing is run against this version and errors reported for automated or manual correction. On passing QA, changes are posted on a circuit-by-circuit basis. One key issue to consider when implementing this kind of solution is potential lag time in getting network updates from the GIS to the OMS. For the OMS to run smoothly, the OMS model must accurately reflect what exists in reality. Data QA can present additional delays in keeping the OMS up-to-date.

SUMMARY

Return on investment for OMS implementations are seriously affected by GIS data quality. Bad data leads to circuit build and update problems, which in turn leads to unreliable device prediction and unlocated trouble calls. Such problems take up valuable IT support resources and can lead to dispatchers' and crews' lack of confidence in the system.

A well-thought-out procedure for GIS data QA is essential if the OMS is to bring the anticipated benefits to network operations. Data QA should include a

thorough up-front data scrub, with automated error fixing where possible. Data QA also needs to become part of the process for maintaining the GIS so that network errors, in addition to cartographic errors, are caught at the point-of-creation and corrected prior to final posting.