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Centrix™ vs. PRISM™

Determining the right fit for your utility

In February 2014, historic ice storms hit the southeast US. The storms were the worst in the area in over 10 years. The February storm immobilized ground and air travel throughout the south, leaving up to 550,000 residents without electricity in Georgia and the Carolinas. However, the storms had an unexpected consequence. Two Atlanta based utilities had recently implemented a self-healing automation technology from Minsait ACS called Fault Location, Isolation and Service Restoration (FLISR). The storm generated multiple network faults in both utilities' service areas, giving the restoration technology an unprecedented test.

Both utilities witnessed the operation of FLISR in a real stress environment. While running in fully automatic mode, the systems successfully detected faults, generated switching solutions, and automatically executed the remote switching plans. These automated actions isolated the faults then restored power to the un-faulted feeder sections both upstream and downstream (where possible). At the time of the storms, Utility A had implemented FLISR on 220 feeders. They reported that, over a three-day period, FLISR had successfully handled multiple faults, documenting that 5.8 million "customer minutes" of interruption (or CMI) had been saved–translating to hours that those customers would have otherwise spent in the cold and dark.

Utility B similarly reported successful restoration despite the heavy loading on backup feeders. They reported that automatic load transfer was correctly analyzed by the DMS to predict a possible overload if a simple load transfer was implemented. FLISR responded by producing switch plans that created capacity on the backup feeders by transferring load to a third feeder, then safely transferring un-faulted customer loads from the faulted feeder. The restoration was successfully and safely accomplished using the FLISR algorithms, while observing device tags and successfully managing communication errors that occurred because of the storm. During the storm, while the affected feeders were in an "abnormal" yet restored state, FLISR continued to respond to second and third faults on the same area of the network, dynamically adapting to the abnormal network configuration as it implemented full and partial solutions where it was possible. At Utility B, the operators followed the operation on a large video wall display in the control center. It showed the dynamic network diagram from their DMS as it highlighted the isolated sections and colorized the new feeder configurations in real time – as it happened.

Crews worked throughout the storm and afterward to repair the network failures and to remove the network faults. As the crews cleared or repaired the fault conditions on each feeder, the control center operator was able to invoke a "Return to Normal" command directly from the feeder display. The Minsait ACS DMS then responded by analyzing the network configuration of all affected feeders and automatically generating a switching solution that would return the feeders to their normal configuration and restore the isolated sections. The real-time load flow analysis of the solution guaranteed that the switching sequence could be carried out without causing overloads and would avoid momentary outages during any load transfers.

Both utilities reported that during the storm event FLISR did not produce a single mis-operation. The validation of FLISR during the storm has led Utility A to undergo system wide expansion, with plans to expand the implementation to approximately 800 feeders with full self-healing automation. Utility B has already achieved 100% automation with their approximately 180 feeders.

Different Approaches, Same Solution

Utility A and Utility B both implemented the same FLISR application, albeit using different approaches. Utility A's implementation uses a stand-alone approach that does not require a DMS, only monitoring the switch status with their SCADA system. The solution chosen by Utility A is the Centrix Feeder Automation platform from Minsait ACS.

Alternatively, Utility B has implemented the same FLISR application as an integral component of their Minsait ACS PRISM SCADA/DMS.

If both utilities implemented the same model driven FLISR solution algorithm, resulting in the same successful self-healing actions in response to the storm, how do the two approaches differ, and what are the advantages of each?

Uniqueness of Centrix

Two fundamentally unique attributes define Centrix and differentiate it from a classical DMS-based solution:

1. Model maintenance: Centrix provides a less comprehensive but vastly simplified approach to model building and maintenance
2. Operation: Centrix is based on a unique architecture and integrates with existing SCADA systems using DNP protocol

Centrix is compared to a DMS in the following sections.

Centrix Maintenance - Model Building

Both Centrix and DMS rely on an electrical connectivity model from which all applications derive their solution. However, there are two primary differences in the model used by Centrix versus the DMS model:

1. Model connectivity
2. Representation of the elements within the model

The DMS uses a single global model of the electrical network, modeling the entire feeder network with contiguous connectivity from the source to the load. The PRISM DMS model is built from a GIS, using the full geospatial references in a single map-based representation.

In contrast, Centrix builds "islands" of independent connectivity: each island is disconnected from other islands. The Centrix model does not include the non-three phase branch lines, but this approach does offer some advantages in implementation and maintenance.

Centrix builds the electrical model exclusive of the GIS, absent of any geo-references. The result within Centrix is a simplified schematic representation of the model. The advantages of this approach are:

1. Centrix builds the model without the need for a GIS interface, greatly reducing the implementation time and complexity
2. Centrix builds the model automatically, based on input into a specially designed tool that features pre-determined fields in drop down menus, reducing the effort required and the potential for errors
3. Centrix builds a three-phase backbone model, which also reduces time, complexity, and the potential for errors
4. Centrix allows implementation and expansion in phased segments ("Islands"), which can be more efficient on very large networks, reducing time and complexity by automating feeders in segments without disruption to feeders that are not part of the deployment

Centrix vs. PRISM DMS

Implementing and defining a Centrix island is easily accomplished using an interactive model builder application called Centrix Builder. The user provides the necessary device and parameter information using a visual interface and drop-down menus.

The “island” configuration is defined in Centrix Builder, which creates the model from objects contained within a 20-substation feeder configuration template.

The user begins by matching the target island’s automation configuration with the relevant substations and devices needed from the master configuration template. The master template in Figure 1 is used to identify and name the objects as the utility desires. The unused objects are automatically rejected (ignored in the model) for the island that is being built.

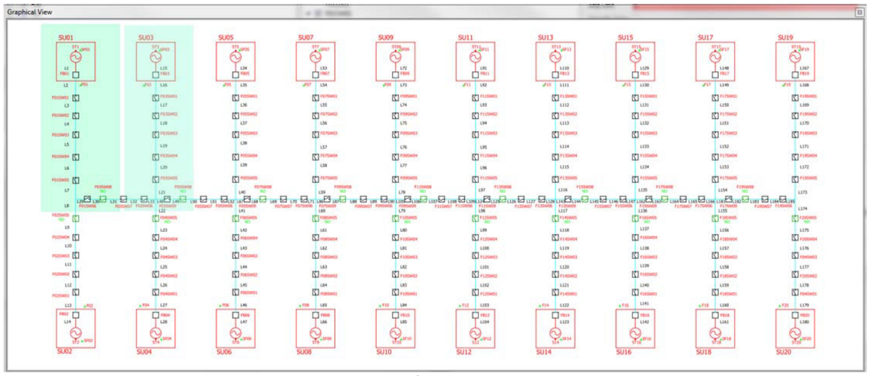

Figure 1: Centrix Model Builder–Master Configuration Model

The Centrix Builder tool guides the user to identify each device location within the feeder, and to select each device manufacturer and its model. Data fields are entered into the form to identify information such as substation name, feeder

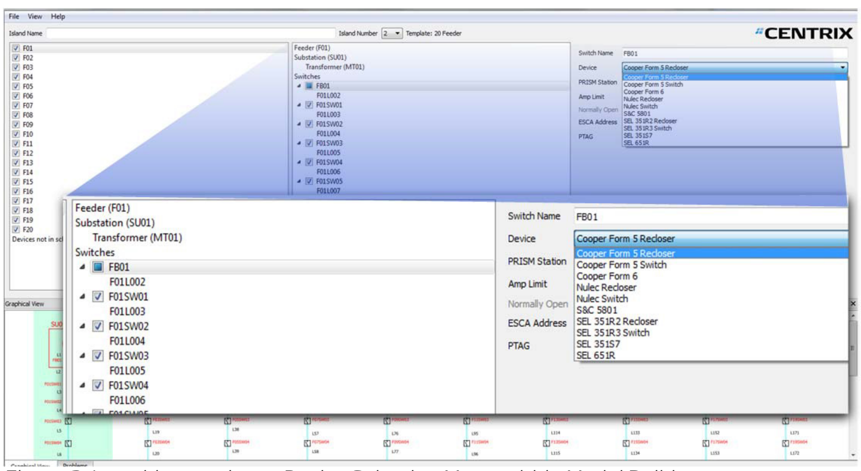

Figure 2: Inset blowup shows Device Selection Menu within Model Builder

name, device ID, etc.

On selecting the switching device with its model, Centrix Builder will automatically load the DNP profile, with its self-describing definition, special calculations and any unique behavior that must be adopted for inclusion in the system’s operation. A major advantage of Centrix is that it is delivered with the DNP point profiles for all necessary device (controller) types already configured, based on those identified by the utility. This greatly simplifies the configuration process, as it frees the user from having to define these each time a new device is used. The pre-defined controls are included in the drop-down menus for each breaker/switch/recloser.

Centrix also includes a communication configuration panel that is used to define the communication protocol, the channel ID and other parameters associated with the communication channels to be used for the deployed islands.

Centrix vs. PRISM DMS

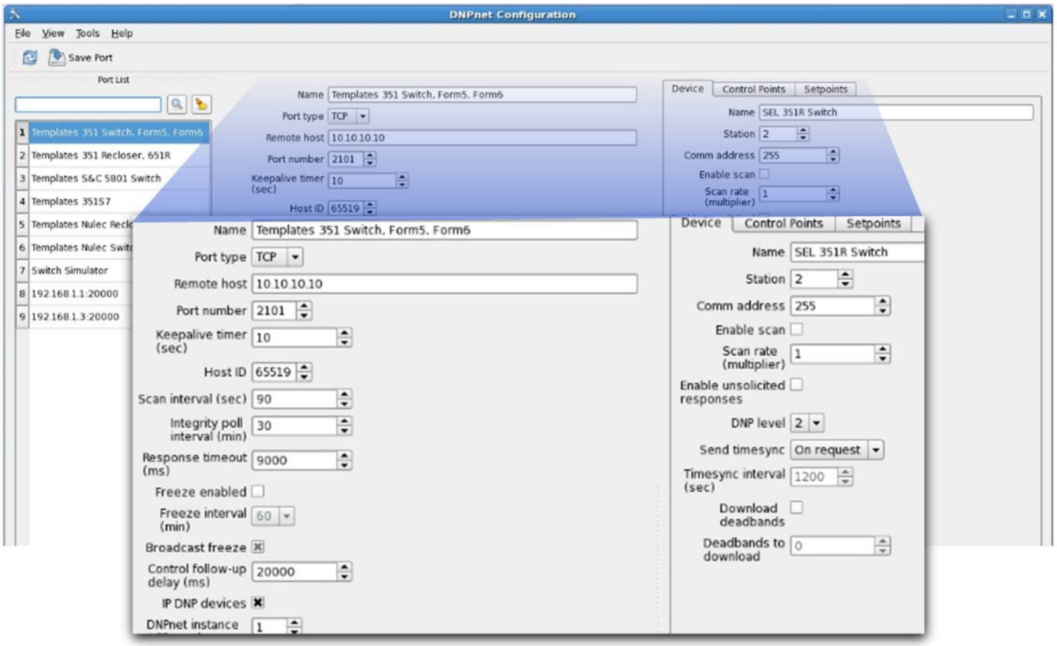

Figure 3: Inset blowup shows Device Communication, Port Setup, IP Address, etc.

Once the user has provided the data required in Centrix Builder and defined the necessary communication parameters, an automated import tool creates the following at the push of a button:

1. builds the island electrical network model for FLISR switching and topology calculations
2. inserts the points into the Centrix real-time database for telemetry and alarm/event processing, tagging, and other localized SCADA type functions, all of which are supported by the runtime application
3. builds a dynamic schematic display of each island under automation, with a full operator user interface for user interactions and monitoring of the island's operation

The total time required to implement a new island of automation within Centrix is typically 30 to 60 minutes, depending on the size/complexity of the island, without requiring access to external systems such as GIS. Utility A typically implements 2-3 new islands on their system each week, using only a single dedicated resource.

This approach is very efficient and very manageable even for large utility networks, especially where scale of network size is an issue and there is a desire to deploy automation only partially or incrementally.

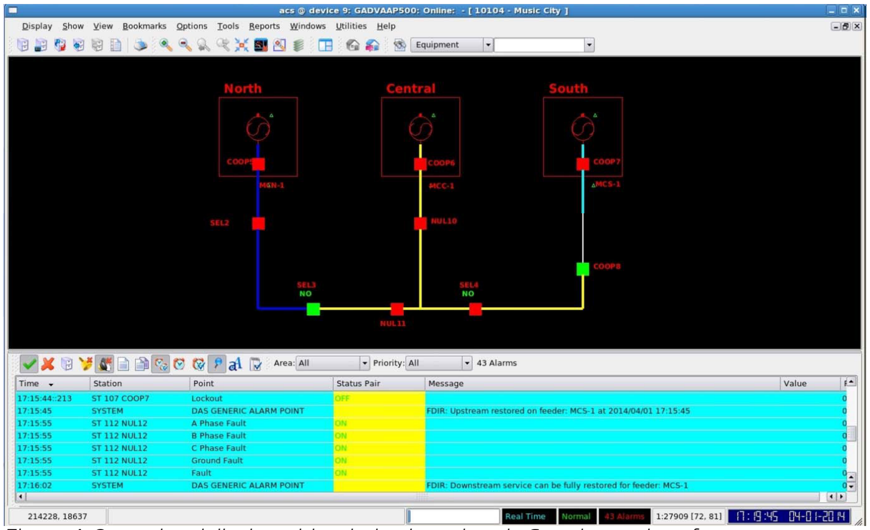

Figure 4: Operational display with colorized topology in Centrix user interface

Centrix vs. PRISM DMS

DMS Maintenance - Model Building

Where Centrix uses a model builder to define a relatively simple island, the DMS uses a GIS import and conversion tool called DASmap™ to define the model for the entire network. DASmap includes a spatial database for inclusion of the geo-references in the map display and model. The model built using DASmap will support all DMS and OMS applications, where the Centrix model only supports automation applications such as FLISR and Volt/VAR control (with additional model inputs). In the DMS, model maintenance is performed by making the changes in the source GIS, then importing and converting them using DASmap.

The DASmap model/map supports a geographic base, as well as a schematic base for DMS, OMS and mobile applications, modeled from the sub-transmission level down to the individual load.

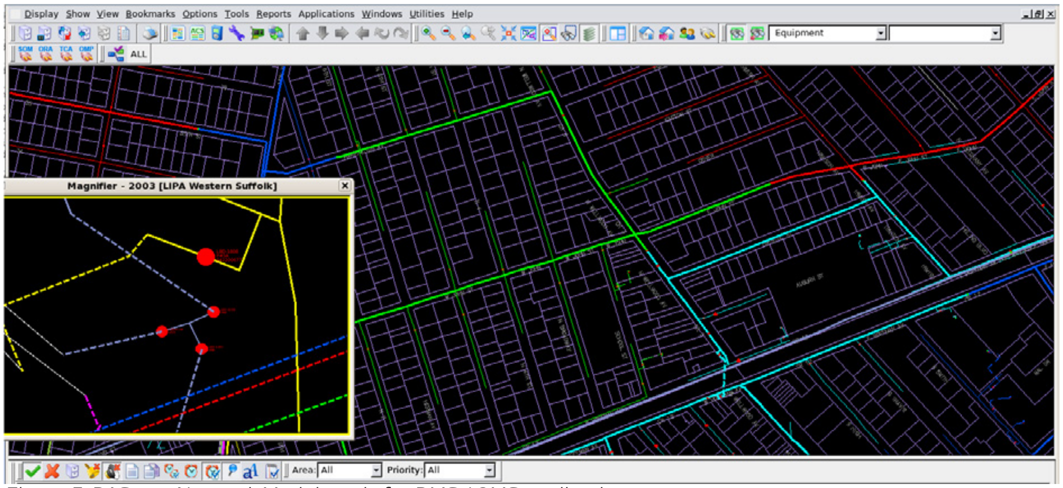

Figure 5: DASmap Network Model ready for DMS / OMS applications

The key advantages of a DMS solution are:

1. The model is a single connectivity model suitable for whole-network DMS advanced analysis, beyond FLISR automation. This includes many applications such as fault location analysis, intelligent and optimal switching analysis, Switch Plan management, and graphical representation of switch plans. Centrix is limited to automation applications only.
2. The model with geography supports the addition of the PRISM Real-time Outage Management System (OMS) using the same model and displays as DMS, with no additional maintenance. OMS visualization includes addition of mobile operation tools and public facing outage maps.
3. The DMS model supports complex user interface representations of the network, as well as an automatic schematic generator for feeders.
4. The DMS can analyze non-automated portions of the network, such as manual switching in switch plans, where Centrix only operates on automatic devices.

Centrix Operation - Architecture

Centrix is a good solution for utilities with an existing SCADA system that they do not intend to replace soon, but who wish to implement automation with a solution that can interface to the existing system.

The Centrix host runs independently of any existing SCADA system (including a Minsait ACS SCADA system), operating on a dedicated Linux server. When Centrix is paired with a legacy SCADA system, the Centrix host is located "between" the SCADA system and the field devices.

From the viewpoint of the SCADA system, the Centrix host looks like just another DNP device, thanks to an integrated "soft RTU" that uses the DNP protocol to communicate upstream to the master. Since no special data link (such as MultiSpeak) is required, the integration cost and complexity are greatly reduced. Centrix essentially functions as a set of virtual RTUs reporting the device addresses to the master and performing the data scan and control for devices used in the automation. The legacy master is not "aware" that the Centrix host is brokering the device messages to and from the RTUs and switch controls. The Centrix host is a de-facto RTU data concentrator, passing all data to the master SCADA, using existing RTU addresses and point numbers.

Centrix vs. PRISM DMS

From the viewpoint of the automated field devices, Centrix looks like the SCADA master.

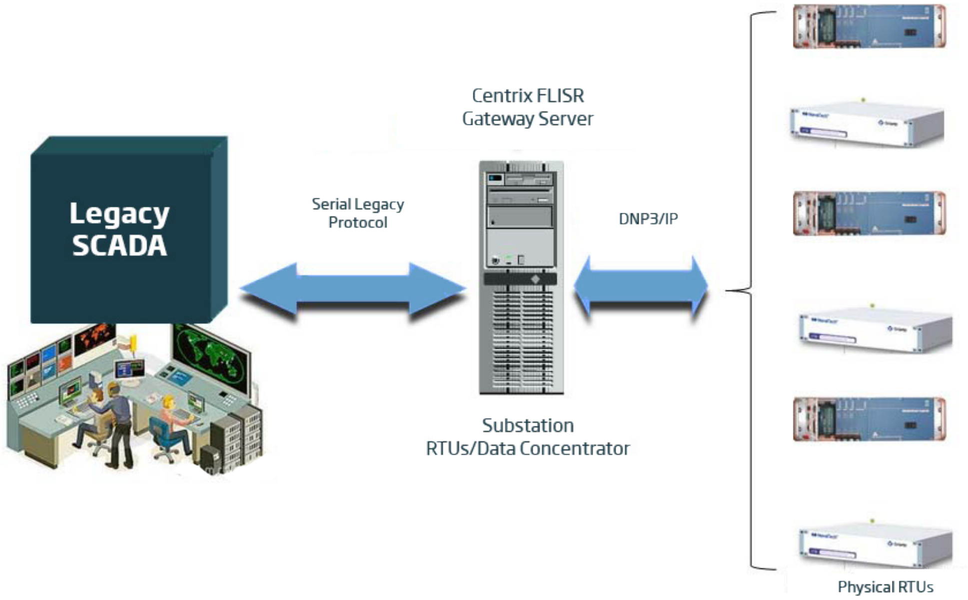

Figure 6: Centrix architecture

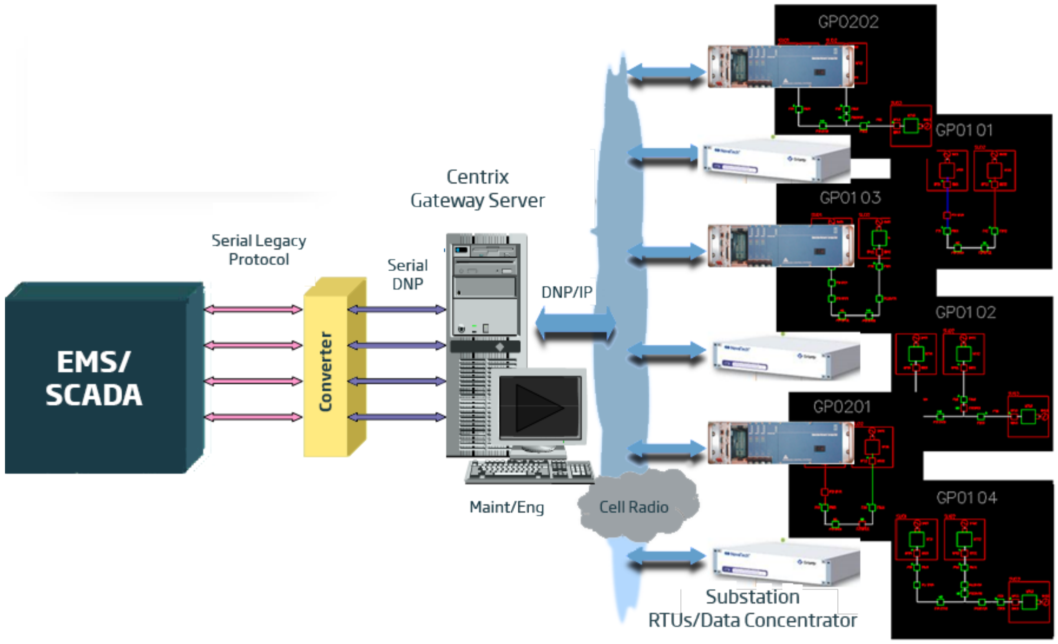

Figure 7: Utility A architecture with legacy SCADA and RTUs

DMS Operation - Architecture

In contrast to Centrix, the PRISM DMS is the primary system for the Control Center. It is the focus of all operations, with the ability to integrate all Smart Grid applications and functions into a single package, including OMS.

PRISM DMS supports backup and tertiary configurations with an unlimited number of users and functions. PRISM DMS supports enterprise service bus (ESB) architecture for full-featured enterprise system integration.

Centrix vs. PRISM DMS

PRISM DMS can be implemented in phases, where the phases can be expanded to meet all Smart Grid objectives and solutions in an integrated fashion.

The model and graphics that are built for PRISM DMS can be expanded to support PRISM Real-time OMS, using a single integrated model and user interface.

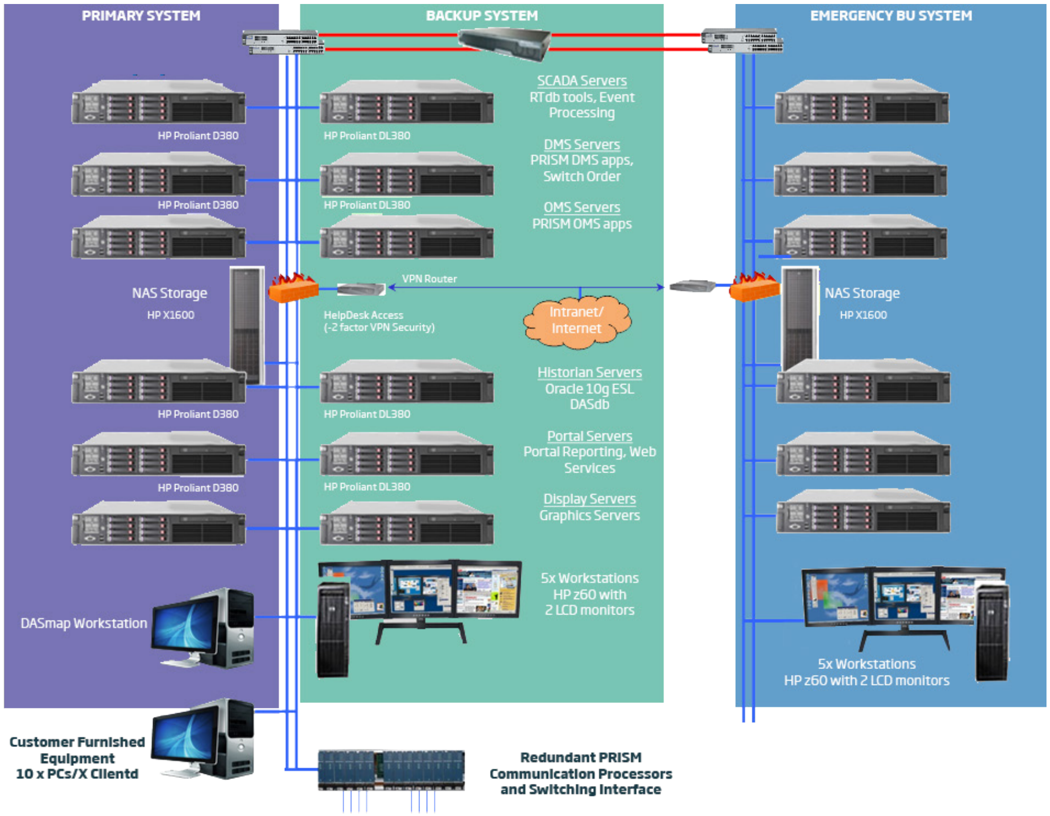

Figure 8: Example PRISM DMS/OMS architecture

Summary

Centrix is a powerful solution for utilities that require a feeder automation solution, but where implementing it within the SCADA or DMS is not practical. Reasons for this could include the inability of the existing system to support this level of automation, or the desire to deploy a solution that does not have to rely on a GIS source. The advantages of the Centrix Feeder Automation solution provide the immediate benefits of an advanced automation solution without some of the additional modeling effort and/or complex interfaces that can be associated with a DMS deployment. And unlike some competing feeder automation solutions, Centrix supports other automation applications such as integrated Volt/VAR Control (IVVC).

While Centrix provides the advantages of a simplified configuration and deployment, as well as the ability to install automation only partially or in an incremental fashion, there are also times when a full DMS will be the preferable solution. When a utility has tie points that create a fully interconnected distribution network or has the desire to implement both automation and OMS from a common source model, DMS will likely be the solution of choice.

In summary, the benefits associated with Minsait ACS' Centrix and DMS solutions are:

- Centrix and PRISM DMS are both Smart Grid friendly, integrating with existing infrastructure (communications, legacy control devices, RTUs, protocols, etc.)

Centrix vs. PRISM DMS

- Both have unlimited expansion capability (Centrix is currently limited to 20 feeders per island, but there is no limit on the number of islands that can be deployed)
- Both adapt dynamically to real-time network topology
- Both solutions are model based; no logic scripts are used to maintain models
- Both incorporate the same configurable safety features in switching automation
- Both support Return-to-Normal functionality
- Both support integrated Smart Grid applications (Centrix is restricted to automation applications only)
- Both solutions are hardware agnostic, working successfully with IEDs/controls from different device manufacturers
- Both use a powerful, yet different, model building technology:
    - Centrix: one person can implement a new three-phase backbone island in less than 30 minutes, without GIS
    - PRISM DMS: one person extracts and builds a three-phase update of the entire network from the GIS in less than 60 minutes
- Both are field-proven solutions, using the same FLISR application
- We understand that there can be other unique considerations in play for a utility deciding on the right automation solution, so please consult Minsait ACS for assistance to determine the best feeder automation approach for your needs.

Minsait ACS, An Indra company

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