minsait ACS

An Indra company

Centralized & Distributed Intelligence applied to Distribution Automation

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Automated Feeder Restoration, Put to the Test

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.

Two Atlanta-based utilities had recently implemented a distribution automation technology from Minsait ACS designed to automate Fault Location, Isolation, and Restoration (FLISR). The storms generated multiple outages in both utilities' service areas, giving the technology an unprecedented test. These utilities witnessed the operation of FLISR in a real-time dynamic environment. In both cases, the complex event processing logic ran without the assistance of a human operator and successfully detected faults, generated switching solutions, and automatically executed the remote switching of feeder devices for optimum restoration.

One of these utilities utilized their advanced distribution management system (ADMS) to analyze and process where the system could safely transfer load in real time. 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 accomplished using the event processing logic within the system, while also observing device tags and managing communication errors that occurred as a result of the storm.

While the affected feeders were in a different normally open / normally closed status, FLISR continued to respond to second and third faults on the same area of the network, dynamically adapting to the abnormal conditions. The operators followed the operation on a large video wall display in the control center. It showed the dynamic network diagram from their ADMS as it highlighted the isolated sections and colorized the new feeder configurations in real time.

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

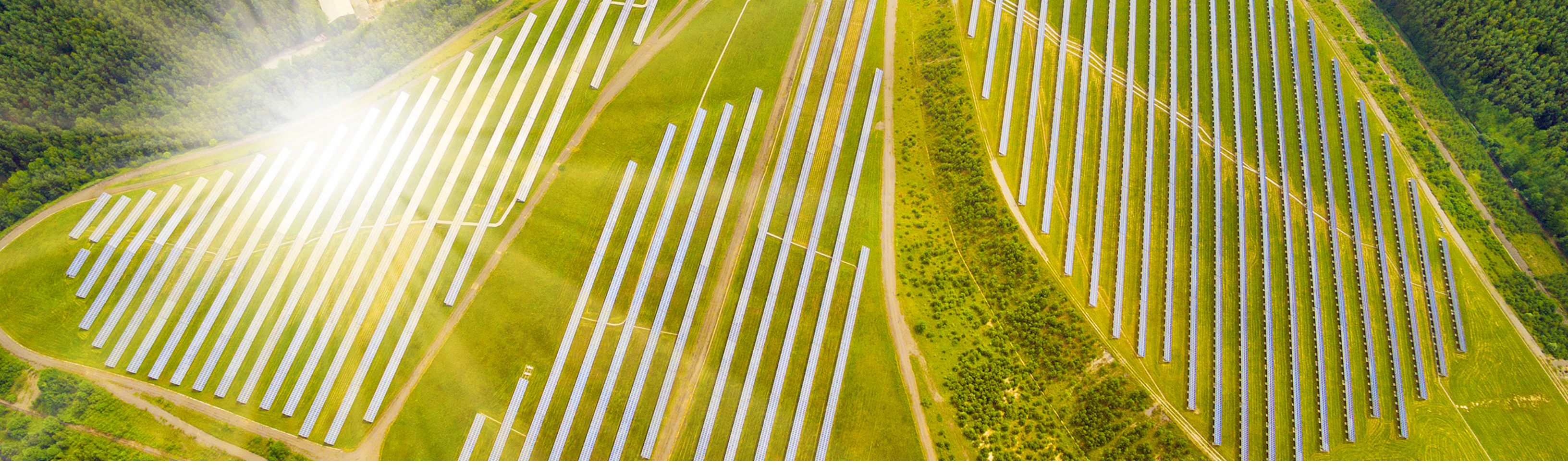
Similarly, a second Georgia utility reported that, over a three-day period, FLISR had successfully detected and isolated multiple faults, documenting that 5.8 million "customer minutes" of interruption (or CMI) had been saved. At the time of the storms, the utility had implemented FLISR on 220 feeders. This translated to hours that those customers would have otherwise spent in the cold and dark.

As of 2016, this utility had over 700 feeders operating FLISR automating more than 2400 devices. When hurricane Irma hit in 2017, this technology helped save 82 million outage minutes in one day with over 8,000 customers served from FLISR implemented feeders. Both utilities reported that during the storm event, the automated FLISR did not produce a single mis-operation.

Centralized Control & Distributed Intelligence

IN BOTH CASES THE SAME FLISR LOGIC WAS IMPLEMENTED IN DIFFERENT WAYS. In the first example Minsait ACS implemented FLISR logic as an application within their Centralized PRISM ADMS.

In the second example Minsait ACS applied distributed intelligence of their FLISR solution in an application called Centrix that performs the complex event processing logic outside of the centralized SCADA system yet logs and reports system operations and events back to the master system. In the following pages we discuss these applications in more detail and explore some of the benefits realized when logic and decision making can be deployed in concert with, but independent of, centralized processing.



Distributed intelligence and System Modeling - Centrix

BOTH CENTRIX AND ADMS RELY ON AN ELECTRICAL CONNECTIVITY MODEL from which the applications derive their solution. However, there are two primary differences in the model used by Centrix:

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

The ADMS 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 ADMS model is built from a Geographic Information System (GIS) referenced and represented as a single map. Centrix adds the ability to build islands, closed loops, or a collection of nodes of independent connectivity. In efforts to develop a solution that is easy to deploy and maintain, the Centrix model focuses on the 3 phase portion of the network. Centrix builds the electrical model exclusive of the GIS, absent of any geospatial references. The end result is a simplified schematic representation of the model. Some of the benefits resulting from this approach are that:

1. Centrix builds an electrically accurate 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 template that features predetermined fields in drop down menus, reducing the effort required and the potential for errors
3. Centrix builds a three phase backbone model, also reducing time, complexity, and the potential for errors
4. Centrix allows quicker time to benefits through an implementation & expansion in segment or Islands of automation as described

Implementing and defining a Centrix island is accomplished using the interactive model builder application Centrix Builder. The operator provides the necessary device and parameter information using drop-down menus and related input screens. The “island” configuration is defined in Centrix Builder, which creates the model from objects contained within the feeder configuration template.

The operator 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

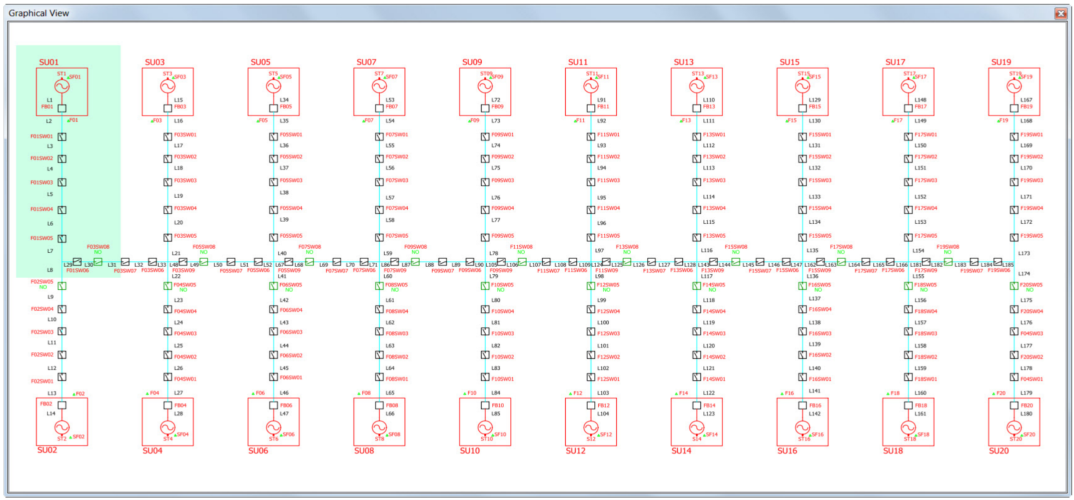


Figure 1: Centrix Model Builder–Master Configuration Model

(ignored in the model) for the island that is being built.

The Centrix Builder tool guides operator 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

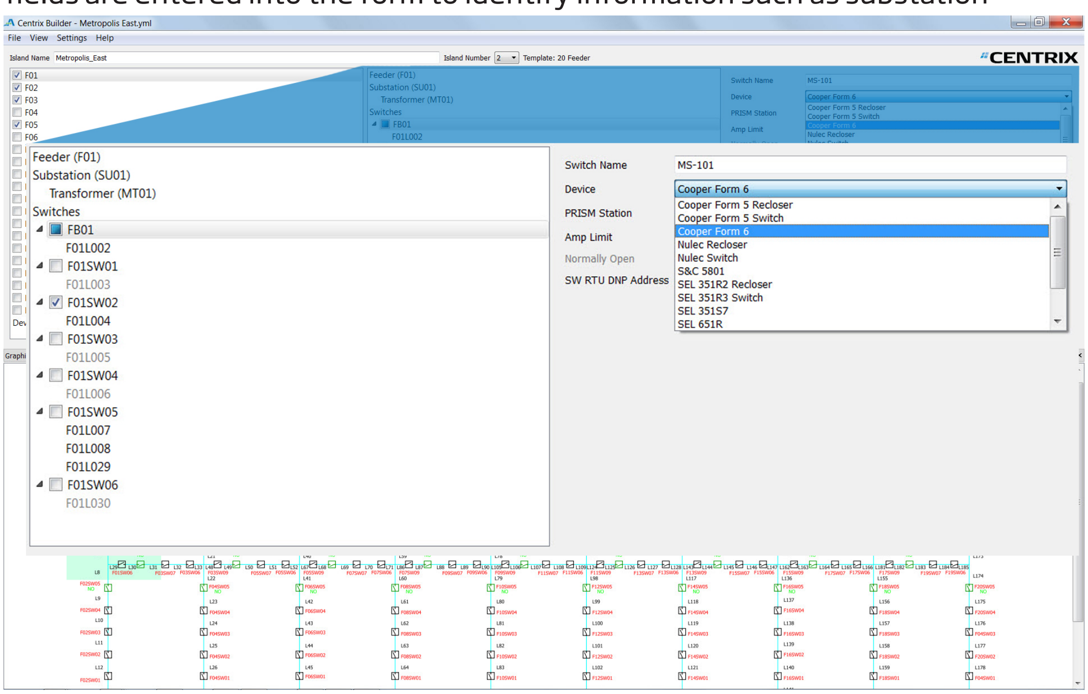


Figure 2: Inset blowup shows Device Selection Menu within Model Builder

name, feeder name, device ID, etc.

On selecting the switching device within the 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. Centrix is preconfigured with the DNP point profiles for all necessary device (controller) types already configured. The library can be added to as devices change or profiles get upgraded. This greatly simplifies the configuration process and frees the operator from having to define these each time a new device is used.

Centrix also includes a 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.

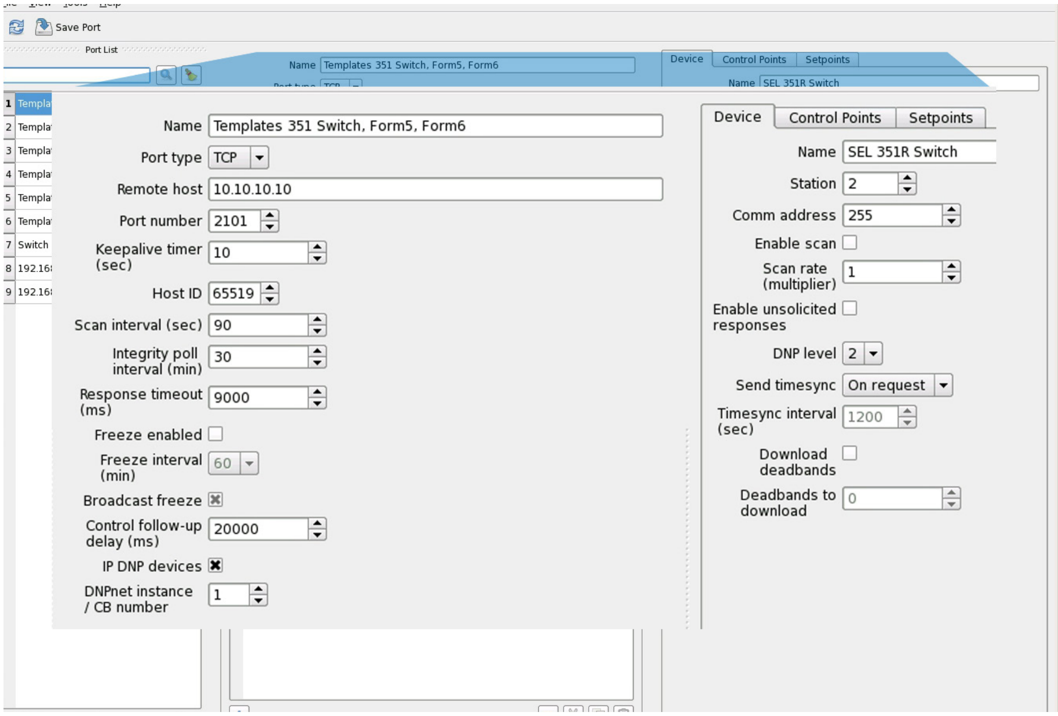


Figure 3: Inset blowup shows Device Communication, Port Setup, IP Address, etc.

Once an operator 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 an 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 functions, all of which are supported by the application

3. Builds a dynamic schematic display of each network island under automation

The time required to implement a new island of automation within is typically 30 to 60 minutes, without the need to access or pull data from external systems such as GIS. This application of distributed intelligence for FLISR can be deployed when and where it is needed the most and can scale to a larger network as the need for automation grows.

Centralized Control and System Modeling – PRISM ADMS

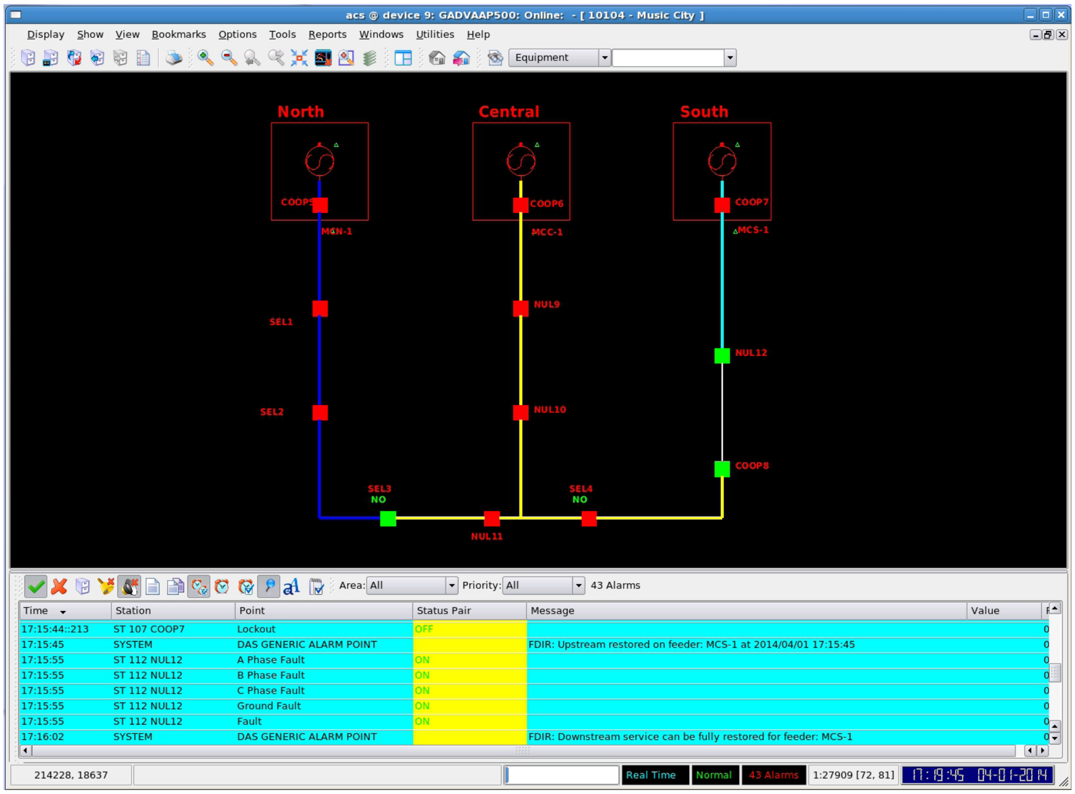


Figure 4: Operational display with colorized topology in Centrix user interface

WHERE CENTRIX USES A MODEL BUILDER TO DEFINE A NETWORK SEGMENT, the ADMS 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 is the cornerstone for all advanced applications such as real time load flow analysis and outage management for example. In the ADMS, 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 ADMS, (Outage Management System) OMS and mobile applications, modeled from the sub-transmission level down to the individual load.

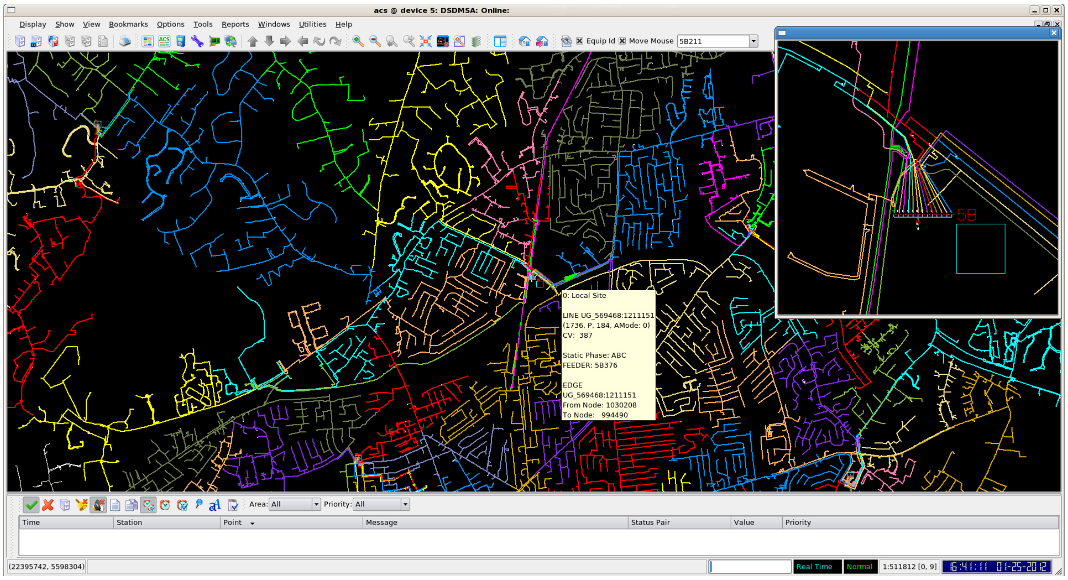


Figure 5: DASmap Network Model ready for DMS / OMS applications

1. The model is a single connectivity model suitable for whole-network ADMS advanced analysis, beyond FLISR and VVO automation. This includes many applications such as fault location analysis, intelligent and optimal switching analysis, switch plan management, and graphical representation of switch plans.

2. An ADMS model supports the addition of the PRISM Real-time OMS using the same model and displays as the ADMS, with no additional maintenance. OMS visualization includes addition of mobile operation tools and public facing outage maps.

3. The ADMS model supports complex user interface representations of the network, as well as an automatic schematic generator for feeders.

4. Centrix builds one segment or island at a time, allowing for easy implementation and expansion.

Summary

MINSAIT ACS REALIZES THAT UTILITIES NEEDS OPTIONS WHEN IT COMES TO DEPLOYING AUTOMATON ACROSS THEIR NETWORKS. CENTRIX IS A POWERFUL DISTRIBUTED INTELLIGENCE APPLICATION FOR UTILITIES THAT SEE A NEED FOR DISTRIBUTION AUTOMATION where implementing it within the existing SCADA or ADMS may not be 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 doesn't have to rely on a GIS source. Utilities can realize the immediate benefits of an advanced automation solution without some of the additional modeling effort and/or complex interfaces that can be associated with an ADMS deployment. Centrix provides the advantages of a simplified configuration and deployment, as well as the ability to install automation on an as needed basis.

CENTRIX and PRISM ADMS systems are designed to integrate with existing infrastructure (communications, legacy control devices, RTUs, protocols, etc.)
Both have unlimited expansion capability
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 solutions are hardware agnostic, working successfully with IEDs/ controls from different device manufacturers
Both use a powerful, yet different, model building technology to suit the different needs of the modern utility

We understand that there can be many unique considerations in play for a utility when making a decision on the right control and automation solutions. As we continue work to modernize our systems, please contact Minsait ACS so we can determine the right solution for your needs.

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About Minsait ACS

Minsait ACS was born in the power industry, from our beginning as a manufacturer of state-of-the-art remote terminal units, to our present as a supplier of utility automation systems throughout the world.

MINSAIT ACS HAS CREATED A RECORD OF INDUSTRY FIRSTS THAT PARALLELS, AND HAS OFTEN LED, THE EVOLUTION OF ENERGY DISTRIBUTION AND MANAGEMENT. We have provided supervisory control and data acquisition (SCADA) systems, energy management systems, distribution management systems, and system components for electric, gas and water utilities since 1975. We offer the broadest range of high performance, scalable, grid modernization solutions for SCADA, distribution management, distribution automation, substation automation and energy management available today–all on a common platform.

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