Case study

Smart Grid deployment
Town of Wellesley, Massachusetts

In November of 2012, ABB's Power Products Medium Voltage group working with the WESCO sales team, engaged the town of Wellesley's Electrical Operation Superintendent for deploying a Smart Grid project.

The Wellesley Municipal Light Plant (WMLP) was wanting to take advantage of new developments in technology and smart grid products to deploy a self-healing or fault detection, isolation, and restoration (FDIR) system, on one of the towns 15 kV feeders.

The discussion turned into an opportunity to provide the town with a reliability solution to improve service to 20% of the town's customer base. The solutions joined ABB's Center of Excellence team, Tropos communications team, and PPMV DA team which together designed and engineered a solution for the town.

What is FDIR for Smart Grid?

FDIR stands for fault detection, isolation, and restoration and is used for feeder automation on radial distribution networks. ABB's COM600 which is a grid controller gathers data from protection and control IED's and runs a fault detection, fault isolation, and load restoration algorithm. Before a fault happens, FDIR updates the network status by receiving switch status and load signals from the IED. When a fault happens in the network, FDIR on the COM600 detects the location of the fault and issues switch operation commands from an algorithm to isolate

faulted feeder sections from the network and restore service to the non-faulted zone. It then sends commands to the IED's controlling switches to return to the normal pre-fault condition after the fault is cleared. FDIR creates a more reliable and sustainable grid for customers while also creating a more efficient grid by reducing downtime and locating where in the grid the outages occur.

ABB was awarded the smart grid pilot in March 2013 and proceeded with detailed engineering and procurement. The feeder circuit chosen was suitable for an FDIR deployment because of the tie points and existing ganged-operated switches that could sectionalize the feeder if necessary. For the implementation of this project, the town expected a combination of reclosers, current and voltage sensors, sectionalizers and a combination of fiber and radio equipment. The system specification required a micro-processor based main unit that could process the input data from the field and send commands to those devices, thus enabling isolation and restoration to occur within the feeder. Figure 1 shows the landscape of the city as well as the existing fiber network.

The system is intended to be expandable and cover other adjacent feeders in the future. The town would only entertain systems with a centralized main controller and not peer-to-peer proprietary systems or other non-communication-based solutions.

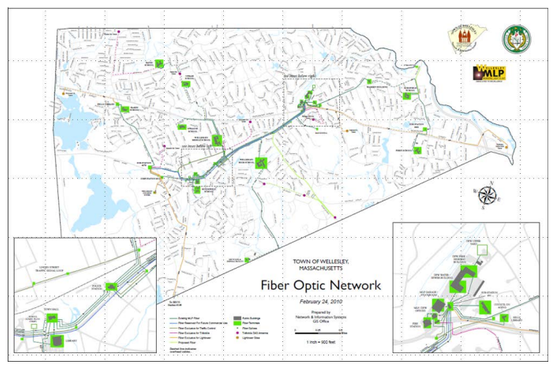

Figure 1 - Topology and existing fiber network

The ABB products for this project are as follows:

15KV ABB GridShield Reclosers with RER620 controls	
Tropos high speed communications mesh networking equipment using a mesh router at the fiber locations and nodes in the system create a mesh network which automatically self-organizes and partitions itself to take advantage of the added backhaul capacity	 Tropos 6310 Mesh Router Tropos 1410 Mesh Router
The COM600 provides connectivity between substation devices, feeder devices, and utility network level control and management systems. It automates the grid for monitoring, control, and automatic FDIR.	 COM600 grid automation controller
DistribuSense VLS-110 15kV voltage line post sensors.	

Existing field equipment such as the T&B Recloser, SEL 351, and SEL 2020, along with an existing fiber network was integrated into the COM600 and Tropos systems. The Smart Grid Center of Excellence lab located in Raleigh, NC played a pivotal role for validation, functional, and interoperability testing prior to field deployment. The Center of Excellence team, working together with the Tropos application team and the DA teams in both Coral Springs and Lake Mary, were crucial in delivering this pilot.

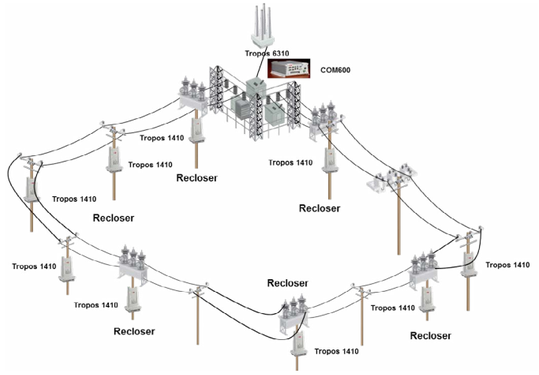

Figure 2 - Wellesley feeder smart grid configuration

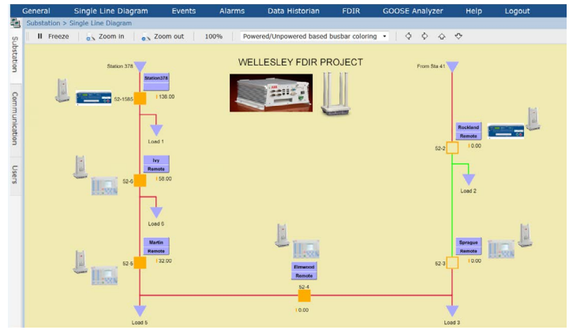

Figure 3 - COM600 configuration

The engineering, design, and testing of this system was made considering the customers currently being served could not experience a service interruption as part of any testing upon installation of the system. The finalized design is shown in Figures 2 and 3. Figure 3 is the visual from ABB's COM600 screen which displays the electrical connectivity for the network and will be used as the FDIR system.

Tropos is shown in the Figures 2 and 3 with the Tropos 1410 mesh router and Tropos 6310 mesh router. Tropos provides a high performance broadband wireless communication network for the town of Wellesley MLP. The open standards-based radio network architecture enabled Tropos to build one network that aggregates communications for all applications and systems, including broadband–low latency connection for automatic feeder isolation & restoration, future capabilities for AMI, mobile field worker communications including GIS, VoIP telephony, Wi-Fi connectivity and infrastructure security with video surveillance. In other words, the solution supported the application requirements of today as well as future enabling WMLP to implement mission and non-mission critical applications to improve personnel security and safety, and by minimizing operational costs while maximizing field management efficiency.

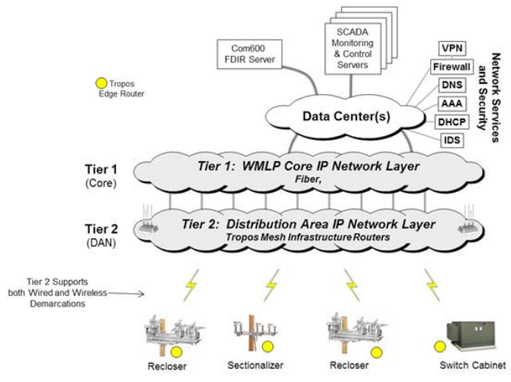

Figure 4 - WMLP system integration

The Tropos network architecture uses an optimized combination of 802.11 and fiber backhaul technologies which supports WMLP's current and future needs economically and securely (Figure 4).

The teams commissioned the system in August of 2013. The standards based design using IEC61850 reduced commissioning time to 3 on-site days with the customer. With IP connectivity extended throughout this part of the system together with RER620 protection functionality, WMLP engineers have visibility from their office or mobile utility trucks to manage fault data, maintenance data, operational data, and system performance.

The customer commented that "better visibility of their system, high-speed communication to their devices, and easy to use tools to improve reliability, coupled with quality ABB people on site" have made this a great endeavor to this point. We have yet to have an opportunity to restore power due to an outage, but all the testing on site with the customer has been very successful.

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