Protective Relaying Over Packet Network — A Case Study with Jamaica Public Service Company (JPS)

THE SCENARIO

Jamaica Public Service Company (JPS) is an integrated electric utility company serving the beautiful island of Jamaica. JPS provides electricity service to 2.9 million people through about 600,000 residential and business customers via an integrated system that includes 4 power stations, 9 hydroelectric plants, 1 wind farm, 54 substations, and approximately 14,000 kilometers of distribution and transmission lines.

JPS was running SCADA, Relay Protection, and other services over a combination of TDM, microwave and fiber network. The network was convoluted with several layers of equipment including equipment obsolescence and network failures. JPS was looking to simplify their communications network by replacing aging equipment and improving network performance.

THE SOLUTION

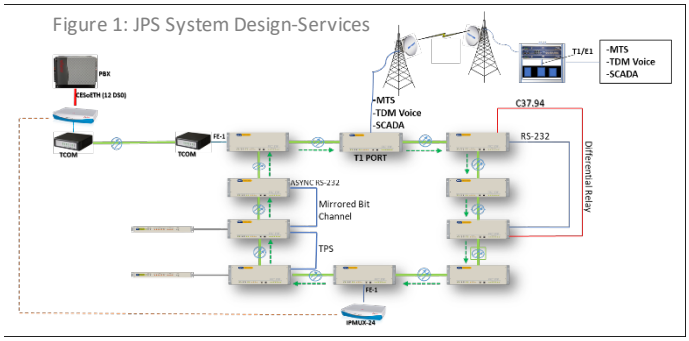
The solution was developed to modernize the substation communications network and migrate to a packet-based communications network and perform a staged migration deployment. The eXmux 3500/3501 IP Access Multiplexer was the proposed communications platform because it allowed for legacy, native Ethernet, and future services to coexist on the same platform and meet the substation environment requirements. The new system as depicted in Figures 1 & 2 would be connected using dark fiber across the island in ring topologies and packet-based radio when fiber is not feasible.

The solution ensured that protective relaying applications, which has the most-stringent requirements, met the deterministic performance required including latency and asymmetric delay.

Network reliability for legacy real-time mission-critical applications, including deterministic performance, was safeguarded by implementing a Pseudo-wire TDM based system over the packet network. In addition, latency and bandwidth were optimized by using varying Frames per Packet (FPP) for data conversion and employed a dynamic jitter buffer implementation to compensate for delay changes in the network.

Included in the communications platform was an integrated Digital Access Cross-Connect System (DACS) for interoperability with legacy T1/E1 channel banks, a phased migration deployment and consolidation of multiple function into a single platform.

Figure 1: JPS System Design-Services



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THE RESULT

The implementation of the new JPS substation communications network provided a migration not only to solve obsolescence issues, but also eliminated the poor network performance by failing aging equipment. It was crucial to understand the differences between TDM and IP services to properly maintain "TDM like" requirements to maintain all the legacy applications, while taking advantage of the flexibility and capabilities of an IP network to pave the way to implement newer applications that are native Ethernet based.

Since its initial deployment in 2009, the JPS substation communications network has been stable with better performance and monitoring tools. Nevertheless, several adjustments had to be made to resolve issues that were not revealed during proof of concepts. Therefore, it was important that HPS/RFL was able to quickly respond and even implemented system software changes to meet the customer expectations.

JPS continues to expand their network and desire to reduce the number of nodes in the Outer Ring as depicted in Figure 2, by creating two smaller rings to allow for greater expansion, eliminate potential issues and finding new ways of improvement, backed by the continuous support of Hubbell/RFL as their trusted partner and solution provider.

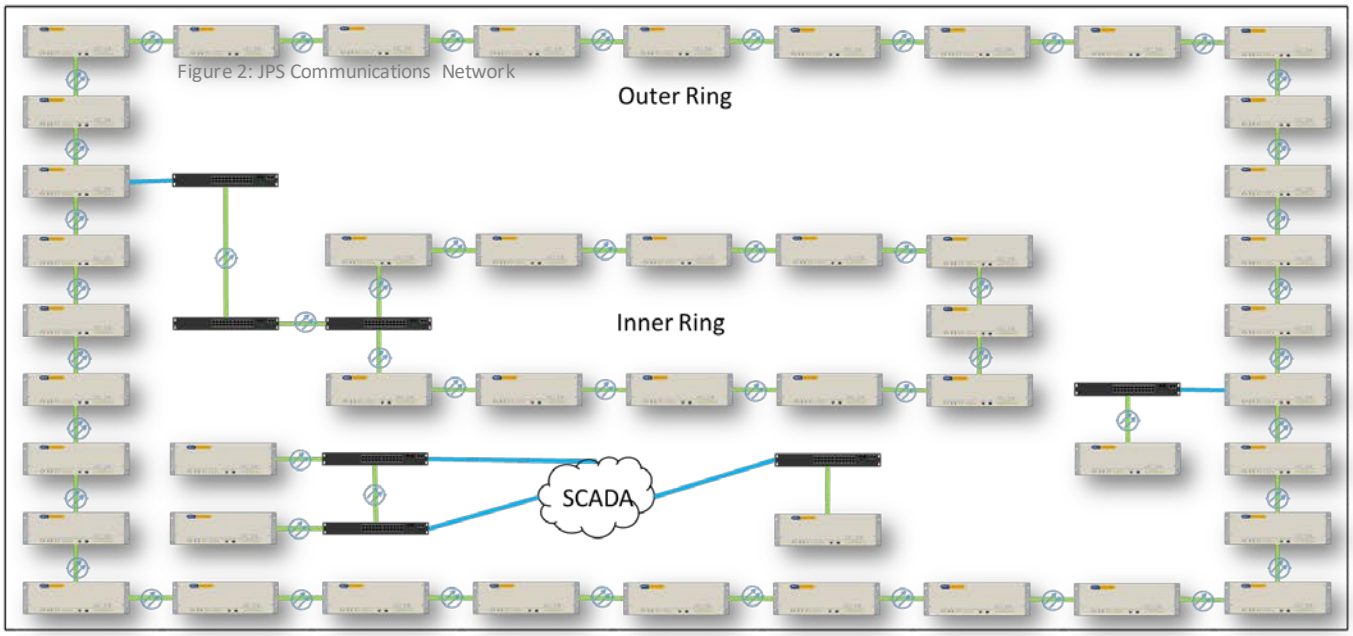

Figure 2: JPS Communications Network

These instructions do not purport to cover all details or variations in equipment nor to provide for every possible contingency to be met in connection with installation, operation, or maintenance. Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes, the matter should be referred to Hubbell Power Systems, Inc.

For product inquiries, please contact your local sales representative or customer service representative.