



OETC modernizes
operational technology
with Hitachi Energy's
MPLS-TP Network

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Case study

Oman Electricity Transmission Company (OETC)

Introduction

Overview

Like many utilities, Oman Electricity Transmission Company (OETC) has traditionally utilized time-division multiplexing (TDM) technology for their mission-critical operational applications. With the pressing need to digitalize their operations and support a growing number of bandwidth-intensive services, utilities are now looking to migrate their communication networks to packet-switched technology. However, preserving the operational continuity of vital services that demand guaranteed network performance, like control and protection systems, is paramount.

For OETC, a secure and modern communication network is not just an essential requirement to provide the entire country with dependable and uninterrupted power supply. It represents the key enabler for the expansion of its operations and the enhancement of its network to enable advanced applications and services for greater efficiency and visibility into a highly connected grid; a smart one.

Project goals

- Support the expansion of the electric grid and respective communication network
- Prepare the infrastructure for advanced digital power utility applications
- Modernise OT network with state-of-the-art packet technology designed for mission-critical services
- Enable a truly multi-service communication infrastructure for high-bandwidth capacity
- Ensure a risk-free and smooth migration from legacy to advanced packet-switched technology
- Simplify management of legacy & packet networks



Technology solution

- FOX615 Hybrid Multiservice platform for concurrent operation of TDM and packet-switched network
 - Transport: 10GbE MPLS-TP-capable
- Quantum-safe encryption for superior network security
- FOXMAN-UN: a centralized, end-to-end management solution for large OT network

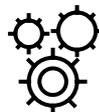


About OETC

Formed in 2005, OETC plays a vital role in the Oman electricity sector, as it owns and operates the main power network that transmits electricity from the generating stations to the distribution load centers across all the governorates of the Sultanate. The main electricity transmission network operates at 132kV, 220kV and 400kV voltage levels. It is monitored and controlled through a load dispatch center (LDC) in Muscat, the capital of Oman. OETC also has the responsibility of balancing generation and demand at all times of the day as part of its responsibilities for the economic dispatch of power across the Sultanate.

Benefits

- Provided operational continuity of vital services during migration
- Running multiple applications on a single packet-switched OT network
- Mission-critical services hosted with guaranteed performance
- Simplified network operation with a unified network management solution
- Increased security



The challenges

With an entire country to serve, delivering reliable power is a top priority for OETC, but that can be especially challenging in a region with a tough climate. Encompassing 93 transmission substations across 7000 km of energized wires, OETC needed a utility-grade, secure and stable communications solution to support the modernization and evolution of its operational infrastructure. The gradual but continuous shift toward packet-based services and the related data traffic was placing a significant demand on its existing communication architecture, highlighting the limitations of SDH networks in supporting data-intensive applications. As an innovative electric utility and with a forward-looking view, OETC decided to migrate the technology for the communication network to advanced MPLS-TP technology – one of the first of its kind in the region.

With this transformational initiative underway, OETC needed to ensure that its new infrastructure could support the anticipated data traffic growth as efficiently as possible, while delivering guaranteed performance in terms of availability, latency, jitter and channel symmetry. The network also had to deliver dependable end-to-end quality of service (QoS) and accurate network synchronization capabilities, which are absolutely necessary for mission-critical services like protection and control.

Another critical need was to maintain separation and prioritization of mission-critical traffic over the less-critical operational applications and data while sharing the same infrastructure. This is absolutely necessary in a truly multiservice architecture, wherein legacy and new packet technologies would coexist, thus minimizing disruption of any critical services during migration.

Security was another key requirement for the deployment. Embarking on a modernization program toward packet-switched technology makes the communication network vulnerable to a variety of security threats. Substations are remotely controlled through supervisory control and data acquisition (SCADA) systems, but SCADA was not designed with modern cybersecurity measures in mind and that can make

every utility station a potential security target. Thus, to protect the energy grid, OETC recognized the need for advanced data integrity and authentication of mission-critical traffic at wire-speed. This was to ensure there was no deterioration of performance of the new packet-based communication network, potentially resulting in maloperation of the grid.

In 2019 OETC proceeded with a thorough evaluation of packet-switched technology in its new Load Dispatch Center (LDC) in Salalah Dhofar region demonstrating the ability of the Hitachi Energy's MPLS-TP network solution to provide a reliable communication foundation for the increasingly challenging utility requirements in the new era of digitalization.

Key network services

- High-capacity IP services
- Virtual private LAN service (VPLS)
- Hierarchical VPLS (H-VPLS)
- Virtual private wire service (VPWS)
- Virtual routed private network (VRPN)
- IEEE1588v2 PTP network time synchronisation
- Quantum-safe real-time encryption
- Quantum-safe real-time PTP encryption

Key applications over packet

- Distance protection
- Differential protection
- SCADA
- Voice over IP (VoIP)
- Video surveillance (CCTV)
- Energy metering
- Phasor measurement Units (PMU)
- Metering data
- Fault recorders

“With a vision to expand our infrastructure to provide the connectivity and meet the growing demand for power in the country, OETC wanted to ensure that its infrastructure could support the anticipated demand growth.”

Badar Al Mamari
Telecommunication and SCADA Manager, OETC



“By working with Hitachi Energy to migrate our communication network to advanced MPLS-TP technology, we expect to deliver guaranteed performance in terms of key parameters such as availability, latency and jitter, especially for the most demanding protection applications.”

Badar Al Mamari
Telecommunication and SCADA Manager, OETC

The network solution

Building a communication network that supports mission-critical applications along with advanced packet services – delivering a truly hybrid capability where TDM-based legacy and modern MPLS-TP packet-switched technology coexist – hinges on an optical network solution from Hitachi Energy. Following best practice in the industry, OETC deployed a dedicated OT network to interconnect its operations centre, substations and peripheral equipment over four redundant 10Gbit/s MPLS-TP transport links. After vetting multiple vendors, OETC chose the FOX Multiservice platform from Hitachi Energy to build an MPLS-TP core network interconnected with the existing infrastructure.

The FOX615 MPLS-TP network solution enabled OETC to meet all of their requirements in a single product. In the new communication infrastructure for OETC, FOX615 multiplexer operates in pure MPLS-TP packet mode and, when integrated into the existing SDH network in hybrid mode, helps minimize operational complexity and eliminate migration risk and service disruption. Thanks to its modular design, the FOX615 device can easily scale to support multiple services, each with its own set of specific requirements, over a shared packet infrastructure with guaranteed performance. Flexible port options for service distribution in the substations and ability to provide time synchronization with the highest accuracy for the most demanding differential protection schemes, enabled OETC to seamlessly support vital services over the new MPLS-TP capable architecture.

All of these services were singularly configured on dedicated Virtual Private Networks (VPN) over MPLS-TP. Virtual private LAN service (VPLS) and Virtual private wire service (VPWS) were deployed to ensure high traffic separation for voice over IP, video surveillance, teleprotection and SCADA. All managed through a unified network management system, FOXMAN-UN, for greater network visibility and service agility.

This new communication system for OETC is also among the first in the world to feature a quantum-safe security card which provides end-to-end encryption for mission-critical utility networks. Hitachi Energy's quantum-safe cybersecurity solution uses cutting-edge technology based on the physical properties of light to generate truly random encryption keys, guaranteeing quantum-safe security with unparalleled real-time performance for any data traffic, including IEEE1588 PTP.

Future

Using Hitachi Energy's MPLS-TP network solution, OETC deployed a proven communication architecture capable of meeting the stringent demands of any power utility. With the intention of further evolving its network environment under the FOX615 multiservice platform, OETC has decided to advance its communication infrastructure with Hitachi Energy MPLS-TP technology in 38 additional substations for their main transmission network and is currently deploying FOX615 multiplexer across the larger network in the northern Oman region.





“In order to build resilience into our power transmission networks, OETC recognized the need for advanced data integrity and authentication of mission-critical traffic at wire-speed,” said Yousuf Al-Jassasi, Senior Communication engineer, OETC. “By installing Hitachi Energy’s quantum-safe encryption card, OETC will be able to ensure there is no deterioration of performance of the new packet-based communication network and provide a high level of cybersecurity to our transmission network.”



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