

Apollo for Power Utilities

Flexible and Robust Optical Networking

Power utilities are continually adding endpoints to their operational networks for purposes such as SCADA, metering, and surveillance equipment, thus driving a need for more bandwidth. More than ever before, utilities can benefit from a flexible and robust optical networking backbone to handle this increased internal traffic.

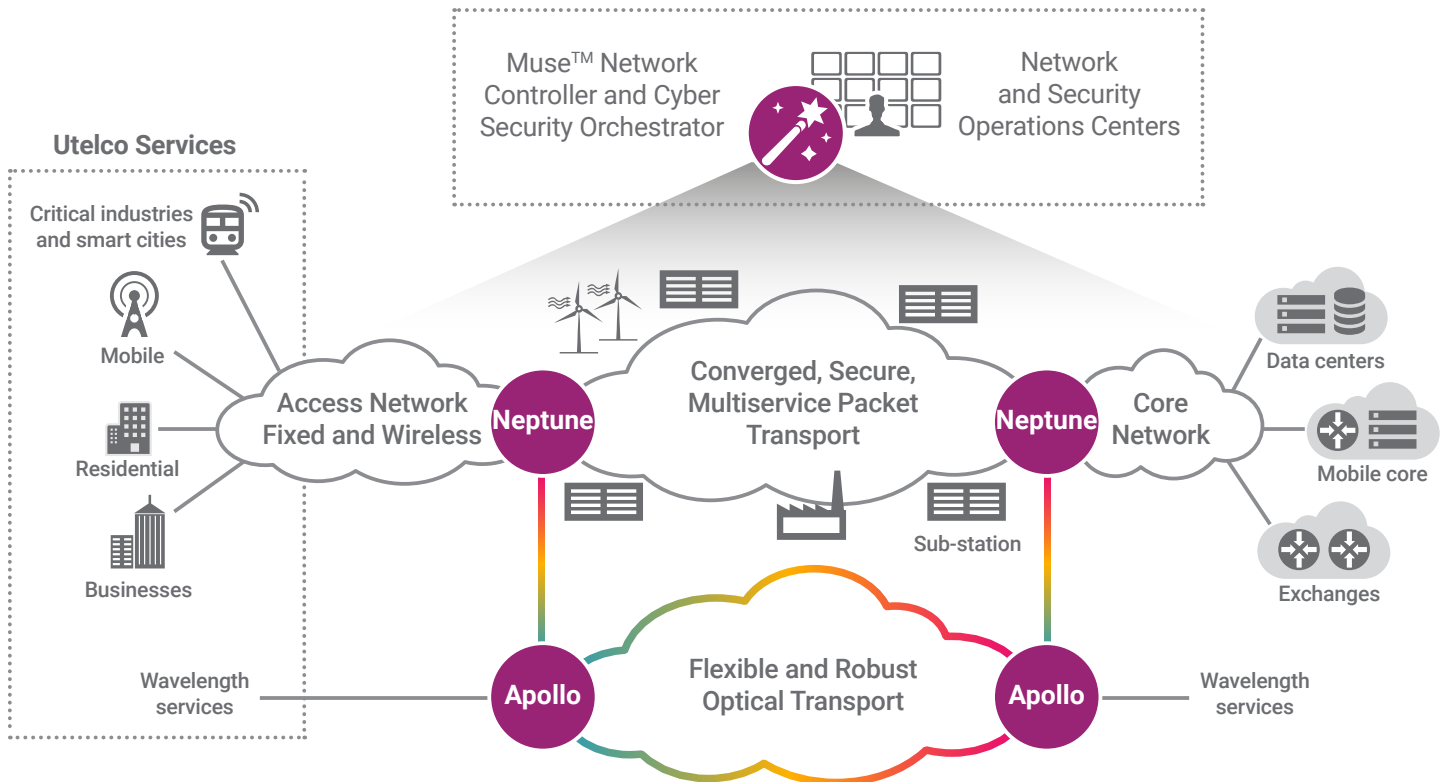
Apollo has a solid record of successfully implementing state-of-the-art optical backbones for dozens of power utilities worldwide. Its modular architecture facilitates a customized fit for the precise needs of individual utilities and its intuitive management system enables a reduced-staff operation. Apollo also makes it easy to sell excess bandwidth to telecom service providers, and even end-users, to transform the optical network into a profit center.

Economical
pay as you grow

Robust
secures traffic from interception or failures

Manageable
comprehensive, intuitive control

Profitable
platform for Utelco revenues



A New Optical Network

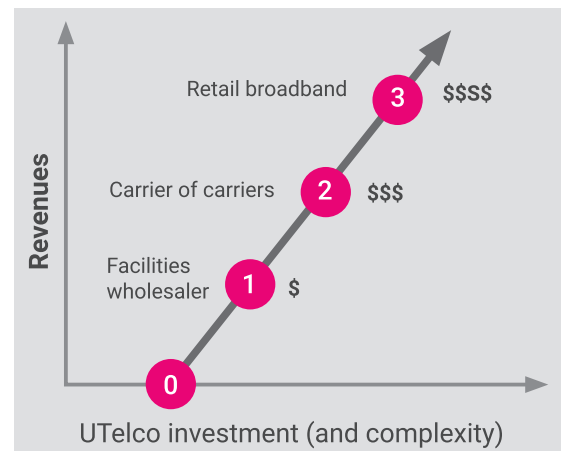
If electrical power generation and transmission is the heart and lifeblood of a power utility, then the telecommunications network carrying its Information Technology (IT) and Operational Technology (OT) traffic is its nervous system. As utilities modernize, they are continually adding endpoints to this network, such as SCADA, metering, and surveillance equipment, in generation stations, sub-stations, and even in towers. This is causing exponential traffic growth, stressing the telecommunications network and its underlying optical layer.

Many utilities use leased lines or a first-generation optical network for the optical layer. Neither of these approaches can scale economically to meet modernization needs. Leased lines have high monthly costs that keep rising as facilities are added for new interfaces and increased traffic, wasting costs for backup protection facilities that are mostly unused. Furthermore, they cannot generate revenues through bandwidth services.

Internal first-generation optical networking systems cannot support new service interfaces or increased traffic without major upgrades, and they were not designed for this. Upgrading these systems is, in effect, throwing good money on unsatisfactory band-aid solutions. Often the best approach is to introduce a brand new optical networking system that can pay back for itself quickly through facility consolidation and operational efficiency, and as a platform for new revenues. For power utilities, Apollo has a successful record of offering such as system.

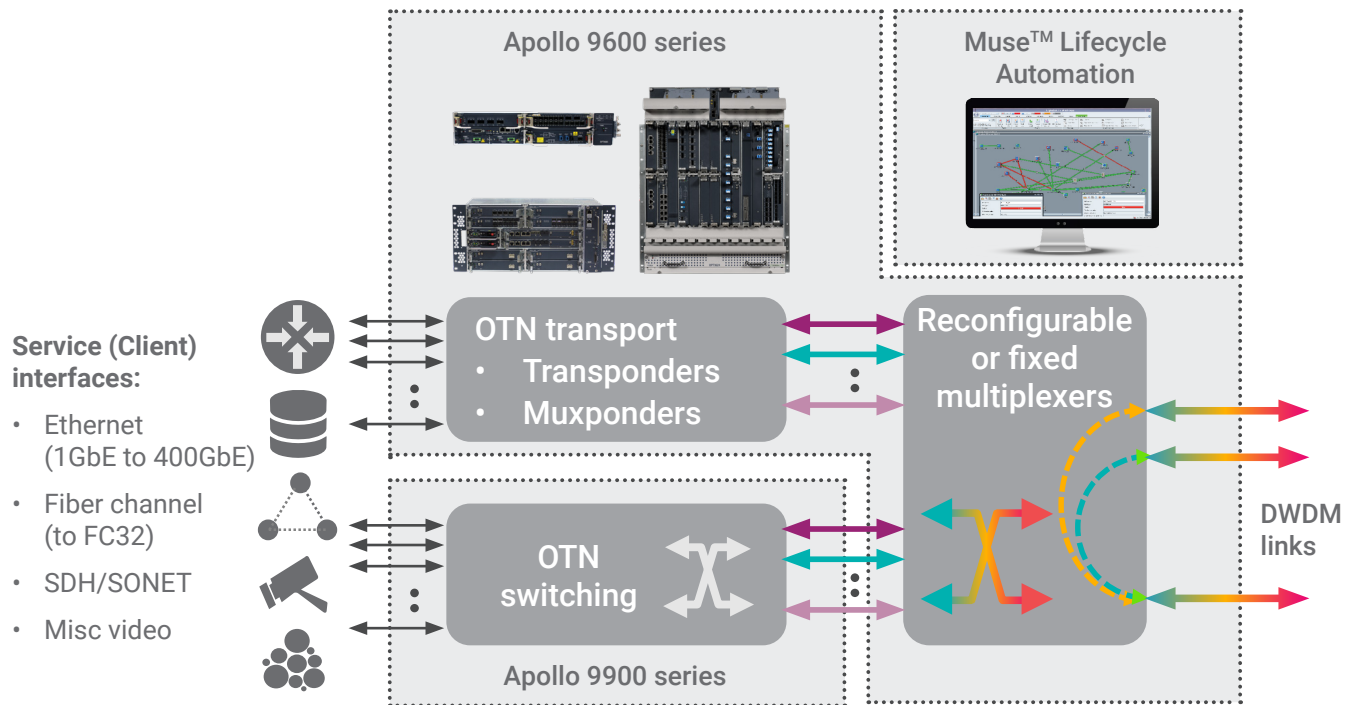
Apollo optical networking is deployable on its own, or as part of a comprehensive connectivity solution for utilities, including:

- Elastic MPLS transport, using any combination of IP-MPLS or MPLS-TP, for IT and OT traffic.
- Cyber security protection against multiple attack vectors and SCADA anomaly detection.
- Consolidated network management for the entire connectivity solution.
- Platform to extend revenue-generating services to end-users as a Utelco.



Apollo Advantages for Power Utilities

Apollo is an advanced optical networking system that combines flexibility and muscle to meet the unique needs of power utilities. The system entails flexibility to support all service interface and transport requirements, while enabling scalable pay-as-you-grow deployment with robustness. This ensures the highest levels of system availability and security against hacking attacks. Apollo offers multiple features that make it ideal for power utilities.



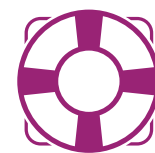
Security Against Fiber Tapping

Fiber optic cables span long distances where they are exposed and susceptible to fiber tapping, endangering all the information they are carrying to interception. This is particularly problematic for unencrypted OT information, such as from SCADA devices. In addition, even when packet level information is encrypted, address fields are not, giving a hacker access to network topologies and traffic patterns.

Apollo solves this problem with a Layer 1 optical encryption capability that totally protects the fiber from tapping attacks. It uses the highest level of AES-256 encryption, and adds no latency to the transmission rate. Moreover, Apollo has a unique capability to selectively encrypt or not encrypt individual services that share the same wavelength, giving the utility complete control over its traffic.

Survivability Against Failures

It is critical for power utilities to be able to maintain their telecommunications networks in the event of failures, such as fiber cuts. Apollo offers sophisticated multi-level automatic protection switching that recovers services within 50ms, and can even sustain multiple fiber cuts! Survivability can be enhanced even further by adding ROADMs that dynamically re-route wavelengths around failures under software control. Apollo network planning tools allow various shared facility protection and restoration schemes that extract maximum value from the optical network.



Economical Configurations

At the heart of Apollo's approach is its 9600 series Optical Transport Network (OTN) and Dense Wavelength Division Multiplexing (DWDM) solution. This comprises a set of OTN transponders and muxponders, and DWDM fixed and reconfigurable optical add/drop multiplexers, which are implemented on line cards that can be deployed interchangeably on small, medium, and large platforms. This ensures deploying the "right-size" solution for any location. Moreover, if a particular location needs to upgrade to more advanced line cards, like to deal with increased traffic, then its existing line cards can be re-used at other locations.

Apollo's modular architecture ensures an economical optical network tailored specifically to a utility's needs at day one. Moreover, the network can scale effortlessly in a pay-as-you-grow mode as traffic increases.

Multiservice Aggregation

Power utilities need to transport various low speed Layer 1 services including general purpose Ethernet, Fibre Channel for storage networking, legacy SDH/SONET protocols, and various video interfaces. Apollo muxponders support all of these interfaces, and are able to aggregate multiple and different services on a single wavelength to make most efficient use of network resources. If needed, Apollo can also devote single wavelengths to high bandwidth services like 100GbE and even 400GbE.



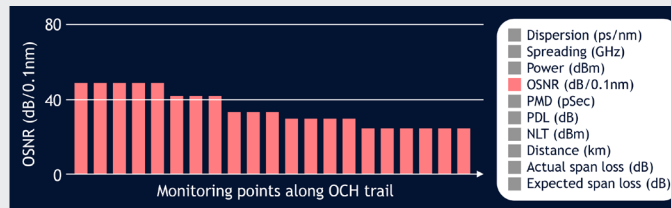
Smooth Migration

After engineering and testing all the new Apollo optical trails, it takes only a few minutes to unplug and re-plug a service interface. An entire network can be migrated smoothly to an Apollo network in a few hours. If for some reason, there is a need to keep a service (temporarily or even permanently) on its original transmission equipment, then Apollo can transport and manage that service as an alien wavelength alongside Apollo wavelengths.

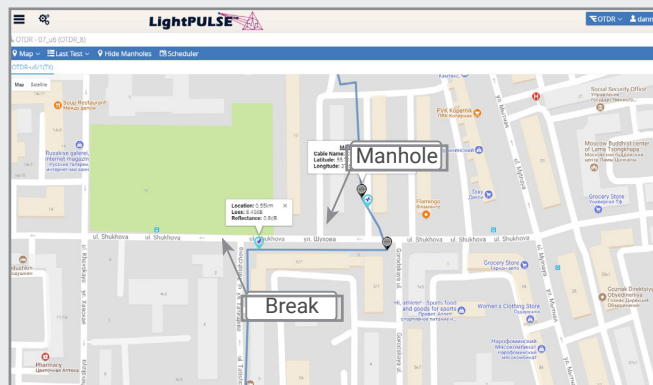
Muse Comprehensive Control and Fiber Health Management

Muse Lifecycle Automation system provides end-to-end control and visibility over Apollo optical trails through a comprehensive and intuitive interface. It allows power utilities to operate, monitor, and maintain their optical network with a small operations staff.

In particular, the LightPULSE module provides unprecedented insight into the health of an Apollo network at all times. By using integrated power measurements (Apollo does not require separate monitoring cards) LightPULSE algorithms report on OSNR and other parameters along the optical trail. By comparing against historical measurements, LightPULSE detects possible problems early on, so they can be addressed before they affect services.



LightPULSE also supports OTDR (optical time domain reflectometry) to monitor the physical health of a fiber, including the integrity of all splices along a fiber's path. In the event of a fiber cut, which can often occur in power utility networks, OTDR can detect the location of the cut to within a few meters. This can be combined with GPS systems to dispatch repair crews with pinpoint accuracy.

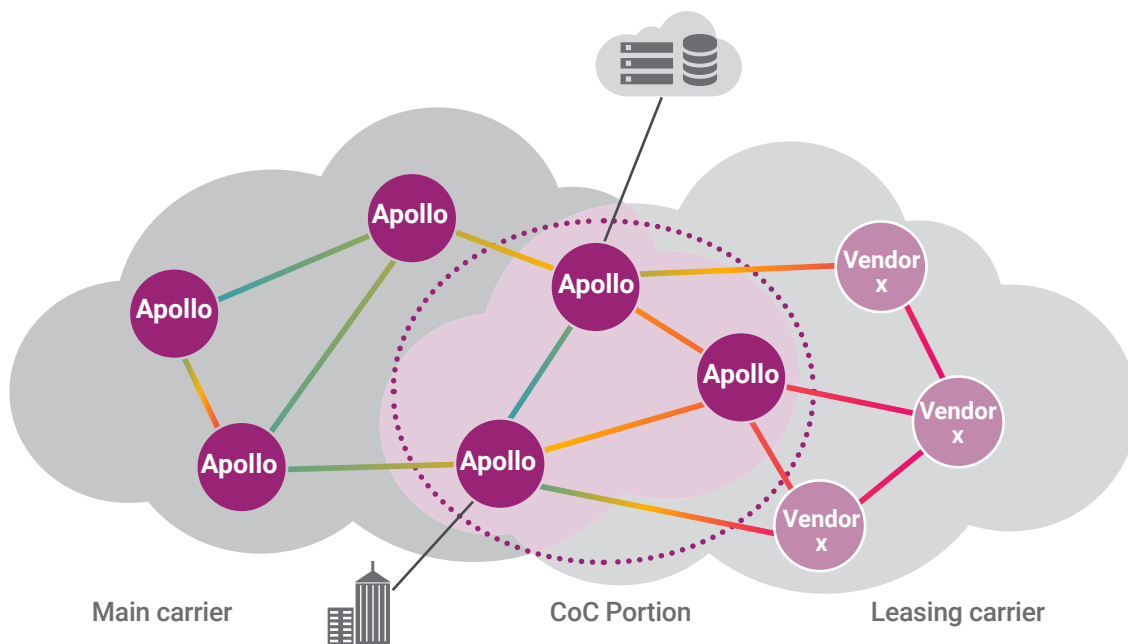


It is important to note that Muse uses multiple layers of platform, link, and user access security to protect it from illegitimate use, in turn, protecting the integrity of the optical network against software attacks.

Monetizing the Optical Network Investment










While the primary purpose of an optical network is to serve a power utility's internal needs, Apollo also enables a utility to turn portions of the optical network into a profit center. There are two usual business models. As a Carrier of Carriers (CoC), the utility leases wavelengths to carriers that need to extend connectivity outside their primary domain, while as a Utelco the utility offers services directly to end users. Other Ribbon documents discuss these models extensively. Here we note several reasons why Apollo is exceptionally well suited to deliver them.

- **Alien wavelengths.** Apollo transports and monitors (using LightPULSE) all third-party wavelengths alongside its own.
- **Shared spectrum.** Apollo makes defined portions of spectrum across multiple nodes available, on which a leasing carrier can arrange their own wavelength schemes.
- **OTN switching.** Apollo's OTN switching line of products complements its OTN transport capabilities, and provides a very efficient solution to handle and extend large numbers of Layer 1 services like 1, 10, and 100GbE directly to business customers in a pay-as-you-grow approach.
- **Muse CNM.** Muse customer network management portals extend visibility and control to leasing carriers over their portions of the network with complete isolation from the utility's own network, and other leasing carriers.



Flexible and Robust Optical Networking for Power Utilities

A power utility can gain many advantages from deploying their own optical network to transport their IT and OT telecommunications traffic. The utility can tailor the solution to their business needs and use it as a platform to generate additional revenues. Yet doing this right comes with its own challenges. Choosing an Apollo optical networking solution addresses all these challenges and delivers additional benefits.

Power Utility Optical Networking Challenges	Apollo Solution Value
 Economical pay-as-you-grow deployment	The Apollo OTN transport family comprises small, medium, and large transport platforms with completely interchangeable line cards, allowing economically efficient “right-sized” implementations.
 Multiservice support, in particular to handle many low-speed services	Apollo muxponders aggregate and transport all commonly used Ethernet, Fibre Channel, SDH/SONET, and video interfaces with high packing density, making the most efficient use of wavelength resources with “right-sized” implementations.
 Surviving fiber cuts and related failures	Apollo supports multiple levels of protection switching with sub-50ms recovery and an ability to recover from multiple failures. With strategic use of ROADM and OTN switching elements, dynamic restoration using shared facilities can augment this even further.
 Protecting OT traffic against interception via fiber tapping	Apollo’s unique layer 1 optical encryption capability enables selectively encrypting individual services on a shared wavelength, providing full protection against snooping via fiber tapping and without adding any latency.
 Smoothly migrating existing services	It is typical to switch over individual services to Apollo in a matter of minutes and migrate entire networks in a few hours. Select services can be maintained on their current transmission equipment as alien wavelengths.
 Managing the optical network with a thin operational staff	Muse lifecycle automation provides end-to-end control and visibility over Apollo optical trails through a comprehensive and intuitive interface. The LightPULSE module delivers real-time performance, monitoring, and historical trend analysis.
 Protecting the network from illegitimate use and hacking	Muse supports multiple layers of platform, link, and user access security to protect the integrity of an Apollo optical network against software attacks.
 Quickly and accurately sectionalizing fiber cuts	Muse OTDR detects the location of fiber cuts to within a few meters, and in coordination with a GPS module, dispatches repair crews with pinpoint accuracy.
 Monetizing excess capacity through Carrier of Carriers or Utelco business models	Apollo, with Muse control, uses features like alien wavelengths, shared spectrum, OTN switching, and CNM, to segment portions of the network for third-party use with complete isolation.

Contact Ribbon to find out how to deploy an optical network for your power utility

About Ribbon

Ribbon Communications (Nasdaq: RBBN), which recently merged with ECI Telecom Group, delivers global communications software and network solutions to service providers, enterprises and critical infrastructure sectors. We engage deeply with our customers, helping them modernize their networks for improved competitive positioning and business outcomes in today’s smart, always-on and data-hungry world. Our innovative, end-to-end solutions portfolio delivers unparalleled scale, performance, and agility, including core to edge IP solutions, UCaaS/ CPaaS cloud offers, leading-edge software security and analytics tools, as well as packet and optical networking leveraging ECI’s Elastic Network technology.