

A Passive Optical LAN For Amtrak Headquarters

Amtrak chose a passive optical LAN as a simple, green, long-term solution for enterprise bandwidth and wireless connectivity.

By Ed Sullivan

Even before Amtrak began the renovation of the National Guard Building, which will soon become its new 82,000-square-foot headquarters in Washington, D.C., the national railroad was determined to create a state-of-the-art facility. Its goal was to create one of the most modern, sophisticated telecommunications systems available today to meet its present and future telecommunications requirements.

Among the highest priorities was a converged network capable of providing high-bandwidth and wireless connectivity for up to 500 users housed throughout the four floors of newly remodeled office space. A fiber optic network was the obvious choice to achieve these requirements, so Amtrak and its consulting engineers selected passive optical LAN for its affordability, reliability, long life and reduced power consumption.

Passive optical fiber networks (also known as PON, POL, GPON and OLAN) are widely recognized as a solution to eliminating data bottlenecks and leveraging a cabling infrastructure with unlimited bandwidth potential. They are simpler, hence easier, to configure and smaller in footprint than traditional copper LANs. In addition, they are capable of protecting high-security communications through advanced data encryption. Finally, they provide major cost savings over traditional networks, are easily

expandable, and are greener, with significantly fewer energy and cooling/ventilation requirements.

“GPON is transforming the Amtrak IT ecosystem into a highly resilient and scalable network aligned with future technology objectives,” says Richard Thompson, director of network engineering at Amtrak.

STRATEGIC DECISIONS

To undertake this project, Amtrak chose as its collaborating partner VT Group, a global systems integrator whose contracts range from defense projects to fully integrated networks for commercial, hospitality, government, health care and transportation clients.

“Amtrak already had some experience with passive optical networks at some of its passenger stations, including Chicago and Baltimore,” explains Aaron Reale, RCDD, director of operations at VT Group, who designed the optical networks installed at those locations in recent years.

After reviewing all major manufacturers, Reale and his colleagues determined that Optical Cable Corporation (OCC) could provide its newly released, UL-listed Slimline Hybrid cable solution for the project within the strict timelines required.

The solution Reale recommended for the new facility was a GPON fiber network, which provides high bandwidth in both directions –

The Amtrak headquarters in Washington, D.C.



2.48 Gbps downstream and 1.24 Gbps upstream.

“This GPON solution is truly cutting-edge,” Reale explains. “We use cable containing a single strand of single-mode fiber capable of providing hundreds of users’ unlimited bandwidth. People often think fiber optic cabling is fragile, but it has a tensile strength almost three times that of traditional Category 6 copper cable, and it’s a fraction of the size and cost.” VT Group specified OCC’s bend-tolerant, single-mode fiber cable, which has a 1-inch bend radius.

Passive optical networks enable enterprises to converge multiple services such as data, VoIP, video conferencing, building security, management services and wireless devices – applications that are today choking many enterprises’ copper- or Ethernet-based telecommunications capabilities. In addition, similar to optical services such as Verizon Fios, the capacity of

these networks can easily be expanded. For GPON solutions, the use of single-mode (rather than multimode) fiber optic cable ensures that these networks will be able to handle future requirements easily.

“This is significant because many communications electronics have a cycle of approximately five years. Many communications devices require added bandwidth to handle increased traffic and applications,” says Mike Long, LEED Green Associate, senior network consultant for OCC. “The single-mode fiber solution is considered future-proof because in many instances it is capable of handling added loads for decades to come.”

Optical LAN technology has gained significant market share in recent years. VT Group has already deployed GPON connectivity at classified government projects, health care and corporate facilities, and some of the largest resorts in North America.

“A few years ago, nobody even knew GPON was a viable option, but now it makes up a significant portion of our business,” Reale explains.

POWER CHALLENGES

In the case of the Amtrak headquarters solution, maximum uptime and reliability were of paramount importance. Because of this, a hybrid fiber/copper infrastructure was the solution.

“Because Amtrak has operations at many historic sites, such as Baltimore’s Penn Station and Washington Union Station, the company has too often experienced highly disruptive power outages. Our design eliminates this risk by consolidating all fiber and power cabling for all telecommunications to a single, protected space with fully redundant battery backup,” says Reale.

Though it is possible to incorporate copper wire into the same cable jacketing as the fiber, finding a



A customized zone enclosure mounted above the ceiling acts as a distribution node.

manufacturer to supply the hybrid cable within a tight time frame can be an obstacle. In this case, the construction schedule was further tightened just before the cable was due to be installed. This put added pressure on VT Group to find a workable solution.

Reale found that none of Amtrak's traditional cable suppliers could meet the turnaround requirements. Having worked with OCC on many projects in the past, he contacted the company and found that it was flexible enough in its operations to ensure the materials could be manufactured prior to the official purchase order so everything could arrive ahead of schedule.

"The turnaround requirement was our biggest challenge," Reale says. "OCC was able to do it; in fact, they delivered the cable about 10 days early, allowing us to get ahead of the construction schedule."

The finished product is a single strand of bend-insensitive, single-mode fiber that will provide unlimited bandwidth, plus two 18-gauge copper wires to carry electrical power to each work area outlet. The 18-gauge copper is slightly larger than is required today, but it was designed so that no matter what happens in the future, the conductors will be able to handle it.

"If telecom technology keeps advancing at the rate it has, and we

need to power something that exceeds the current Class 2 standard, this design will support it," Reale explains.

Because of the inherent drop in voltage that occurs over copper wire, Reale's team also incorporated digital electricity to enhance transmission performance. This emerging technology combines DC power and data into packets that are transmitted and received in a manner somewhat analogous to the way information packets are conveyed over networks.

"Digital electricity allows us to push power out to much longer distances without having to plan for the normal voltage drop – and without having massive copper wire size," says Reale. "We incorporate this technology into our designs when centralized power is a must and on projects when the facility's design doesn't support traditional cable lengths – such as rail stations, airports and sports venues."

SAVING VALUABLE SPACE

Though Amtrak's new headquarters is expansive, every inch of space was designated for operational use. One result of using a passive optical network was gaining a considerable amount of space that would have been utilized for telecommunications rooms.

"Traditionally with a four-floor space like this, we design eight 10-by-

12-foot telecommunications closets, built out with racks, cabinets and other equipment," Reale explains. "Each closet requires a UPS battery backup, plus additional cooling because of the addition of concentrated heat within the space. Putting that all together involves a lot of setup costs and a lot of recurring costs.

"Instead, just one telecommunications closet with two racks will support all the users, significantly reducing the footprint," Reale continues. "Real estate prices in Washington, D.C., make this a very expensive space, so any additional square footage that we can give back for operational use is immense in the long term. So, rather than taking up 1,000 square feet for telecommunications closets, this system is taking up just 100 square feet. And the rest of the system utilizes much smaller pathways and light loads to distribute connectivity throughout the entire facility."

To eliminate the additional telecommunications rooms, VT Group designed and built customized zone enclosures that mount above the ceiling and act as infrastructure distribution nodes.

GPON technology has been available for more than a decade and is used heavily by the large telecommunications carriers, but many stakeholders are just beginning to become familiar with its benefits in an enterprise local area network.

"It has really only received meaningful attention recently," says OCC's Long. "However, it is the right long-term solution for many of today's companies, and more designers and users are seeing the ROI and other gains that can be realized by adopting it."

The first phase of the Amtrak headquarters project was successfully completed in July 2017, and construction is scheduled to be finalized in September. ♦

Ed Sullivan, based in Hermosa Beach, California, is a writer specializing in high-tech, health care, finance and real estate. For more information about the optical fiber solution, see www.occfiber.com.