The Evolution of Structured Cabling Media

Improving structured cabling starts with understanding its roots

Copper has been used as a cabling solution since the invention of the electromagnet and the telegraph in the 1820s. Due to its conductivity, flexibility, high melting point and various other benefits, it quickly became the dominant solution for structured cabling.

Due to its availability, history has shown us that copper was the easy choice and thus the most dominant means for cabling. In the early stages, coaxial cable was the prominent means for technology solutions until the development of UTP (unshielded twisted pair) copper cabling. UTP, while being less expensive, also allowed for easier improvements. Over time, speed would continue to increase, with UTP copper cabling keeping pace with these new designs.

To date, roughly half of all copper mined is put towards use in electrical wire and cable conductors. As of 2009, copper based solutions for structured cabling have made up a majority of the total market. With the benefits of copper cabling being availability, and transmissions of high speeds early on, it’s no wonder copper had been the dominant player; it had been technology’s only option. Today, copper has met its speed and scalable limitations. With the advancements in speed, distance, and electronics, the smart move for cabling solutions is the move to optical fiber; a solution to keep pace with our global advancements.
The Transition to Optical Fiber

Data systems innovation, marked by measurable results

Despite the traditional penchant for utilizing copper cabling for data systems, a modern transition has begun to focus on optical fiber networks. Optical fiber is now being deployed deeper in the network, allowing for closer proximity to the desktop. Because of this, a valid question has been asked: “what are the benefits for choosing fiber cabling over copper?”

Fiber optic cable is being deployed deeper into the network for installations, including backbone, horizontal and even desktop applications. An optical fiber network allows businesses to create savings in total cost of ownership, streamline network operation simplicity and introduce heightened security, all while providing a higher life expectancy than copper with virtually unlimited bandwidth potential. Passive Optical LAN is viable and more cost-effective—in terms of Return on Investment (ROI) and lifecycle Total Cost of Ownership (TCO)—than a traditional copper based solution.

The major benefits of an optical fiber upgrade include:

Capacity: Conventional copper networks are bound by the physics of the actual wire, whereas the physics of fiber allow for an exponentially higher capacity. The capacity with fiber increases as the technology advances. Optical fiber has virtually no bandwidth limitations, so the replacement of fiber will not be needed as it had been for copper.

Reliability: Optical fiber networks are not affected by interfering noise from florescent lights, running motors or other electro-magnetic emitters. And, over time, moisture has less effect on a fiber solution than it does on a conventional copper cabling system. Fiber based solutions are more reliable due to the fact that fiber can withstand many environmental conditions much better than copper.

Scalability: With virtually an unlimited capacity, an optical fiber network enables users to transmit multiple types of traffic, including data, voice and video. Fiber optic cables lend themselves to easily evolve with the improvements in electronics for carrying voice and/or video signals.
The Passive Optical Network (PON)

The growth of Passive Optical LAN from the innovation of fiber to the premises

The solution of Passive Optical LAN (POL) is a stem from the Passive Optical Network (PON), a system that brings optical fiber cabling and signals to an end-user from a communication company’s hub or office. With PON, depending on where the system terminates will differentiate how the network is described: fiber-to-the-curb (FTTC), fiber-to-the-building (FTTB), or fiber-to-the-home (FTTH).

PON has grown as an effective solution for telecommunications due to its simple consolidation of communications into a single network architecture that is both easy to install and cost effective for the end-user. Typically, up to 32 Optical Network Units (ONUs) at customer sites can be connected to a single transceiver port in the communication company’s Optical Line Terminal (OLT).

Through a Passive Optical Network, bandwidth may be allocated between multiple users, while also being able to serve as a communication link between two larger systems (i.e., CATV system and a home ethernet network working on coaxial cable).

By providing high-speed, high-bandwidth and secure voice, video and data service delivery over a combined fiber network, PON has a proven track record with years of service to millions of residences. This PON technology has now been integrated within your own Local Area Network, to help reduce total ownership costs, equipment storage space, and power consumption. The design and infrastructure of PON shaped what has become Passive Optical LAN.
Copper Structured Cabling vs. Passive Optical LAN (POL)

Quantifying the numerous benefits that come with fiber

The first choice for enterprise networks and LANs is increasingly becoming fiber, especially with the growing call for Passive Optical LANs (POLs). Fiber opens up a range of options for next-generation network infrastructure design, thanks to its increase in distance and bandwidth performance.

Along with performance improvements, a fiber optic solution will have a much broader impact, lower total cost of ownership, reduced hardware components and decreased space for telecommunications closets. All the above equate to efficiencies in energy consumption, space/weight, as well as installation and security benefits.

Though there is still call and reason for conventional copper-based solutions, fiber optic cabling should always be a consideration and may make sense as an upgrade to a predominantly copper based environment.

<table>
<thead>
<tr>
<th>Structured Cabling vs. POL (typical values)</th>
<th>Optical Fiber</th>
<th>Copper</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAPEX cost (2K-user optical LAN)</td>
<td>&lt;$300,000</td>
<td>&gt;$1,000,000</td>
</tr>
<tr>
<td>Lifecycle</td>
<td>30-50 years</td>
<td>Approx. 5 years</td>
</tr>
<tr>
<td>Distance</td>
<td>12 miles</td>
<td>300 feet</td>
</tr>
<tr>
<td>Weight (per 1K Ft.)</td>
<td>4 lbs.</td>
<td>39 lbs.</td>
</tr>
<tr>
<td>Energy consumed</td>
<td>2 watts per user</td>
<td>More than 10 watts per user</td>
</tr>
<tr>
<td>Maximum bandwidth</td>
<td>69 Tbps</td>
<td>10 Gbps</td>
</tr>
<tr>
<td>Security</td>
<td>Hard to tap, easy to alarm</td>
<td>Emits EMI</td>
</tr>
</tbody>
</table>
The POL Solution

Making the leap to a more innovative data system

Passive Optical LAN (POL) is an enterprise network using optical fiber in which unpowered optical splitters are used to allow a singlemode fiber to serve multiple end-users. A Passive Optical LAN (POL) consists of an optical line terminal (OLT) in the main equipment room and a number of optical network terminals (ONTs) near the end users. POL reduces the amount of cable and overall equipment required, when compared to conventional structured cabling solutions. Dependent upon network design, the benefits to a Passive Optical LAN include:

- Up to 70% less CapEx
- Up to 80% less power consumption
- Up to 90% less space utilization
- Graceful migration to a fully converged IP network
- Future-proof fiber optic cabling infrastructure
- 5-9s reliability, physical redundancy and provisional QoS

With over 50 years in the telecommunications industry and backed by a 25-year warranty, 3M has created a portfolio of Passive Optical LAN infrastructure components that are optimized for cross-industry solutions, such as:

- Durable fiber components for better performance.
- Efficient materials in quick install connectors and mechanical splices.
- Components meet varying needs of diverse building spaces through high density, large and small fiber count installation product design.
- Fewer parts and pieces equate to easy installation and a decrease in total cost.
- Metal and plastic rack- and wall-mount enclosures make for better protection of fiber components.
Optimization with Passive Optical LAN (POL)

Bringing 3M’s portfolio of fiber products to the front of enhanced data system solutions

3M provides a wide array of easily configured products to optimize the installation and design of the Passive Optical Network. The 3M POLs portfolio provides a complete infrastructure solution, from the equipment room to the work areas and everywhere in between. Major products in the 3M POL portfolio include:

- **3M™ High Performance Fiber Cabling** uses the latest in fiber optic technology to bring you bend radii specifications as low as 5 mm and plenty of options when it comes to cable construction and fiber count.

- **3M™ One Pass Fiber Pathways** install quickly and discreetly below the ceiling and around the perimeter of walls so that fiber can be run almost anywhere in a variety of buildings.

- **3M™ Passive Optical Splitters** are configured with port counts for POL and with pre-connectorized SC/APC connectors to enable easy interconnect or cross-connect configurations.

- **3M™ MPO Fanout Modules** are pre-connectorized, multi-fiber modules with SC/APC breakout ports to make installations quick and easy for backbones to closets or for zone solutions. Use with 3M™ Pre-terminated Multi-fiber Trunk cable assemblies.

- **3M™ Fiber Connectors.** With millions sold worldwide, 3M mechanical fiber connectors like the 3M™ No Polish Connector and the Crimplok™+ Connector are designed to make fiber terminations even easier than those for copper structured cabling.

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Note: Passive Optical LAN (POL) is an enterprise network using optical fiber in which unpowered optical splitters are used to allow a singlemode fiber to serve multiple end-users.
Take Advantage of All That Fiber has to Offer

Invest in a data system for the future by choosing 3M Passive Optical LAN (POL) products

When it comes to the indoor fiber network design and configuration of the passive infrastructure, system integrators, installers and end users/owners want a product that has been designed to work with their applications. To satisfy this demand, 3M has developed its Passive Optical LAN solutions (POLs) to accommodate POL configurations for indoor environments. 3M has created a POL portfolio that enables easy configuration, easy ordering and easy install, as well as high performance specifications customers have come to expect from 3M.

A huge advantage to a 3M fiber upgrade is the bandwidth radius. Up to 12 miles in length, the distance for a fiber network can help connect large medical facilities, college campuses and military bases. With the actual size of fiber cabling, and a centralized management system, an upgrade to fiber allows for total cost savings due to less closet space and equipment, as well as efficiency in monitoring your system. And with capabilities such as 3M™ One Pass Fiber Pathway technology, fiber can be quickly and easily installed within the confines of a building, without requiring the hassle of a demolition job. Making a system such as this is ideal for hospitals, business offices and historic structures.

Overall, this solution helps decrease overhead costs, while offering better performance and more reliability than your typical copper based configuration. An upgrade to fiber is choosing the many benefits and cost savings it provides, including the major advantage of owning a cabling infrastructure that will be able to accommodate multiple generations of electronics.
Why Choose 3M for Fiber?

Industry-leading solutions, backed by innovation and expertise

Founded in 1902 as a mining venture, 3M quickly moved its gaze to sandpaper products, becoming economically and financially stable by 1916. Within those first fourteen years 3M had developed its first exclusive product and continued to move forward with progressive products and international company expansion.

Today, 3M employs thousands of researchers and scientists around the world and with operations in 70 countries and sales in 200, the global 3M team is still committed to creating the technology and products that advance every company, enhance every home and improve every life.

3M provides:

- Excellent performance in durable fiber components, easy field-terminated connectors and mechanical splices that are quicker to install and more efficient in material cost.
- Products designed for high density, large and small fiber count installations, meeting the varying needs of diverse building spaces.
- Easy-to-install products with few parts and pieces, with low total cost of ownership.
- Rack- and wall-mount enclosures of metal and plastic for the protection of fiber components suitable for a variety of applications.
- Experienced professionals to help plan network design; the ability to draw on experience working with a global customer base and first-hand knowledge of industry best practices.
- Tech service assistance to aid in product installation and post sales support; reinforcing 3M’s commitment to service.

With over 50 years in the telecommunications industry, the 3M has designed that is a portfolio is comprised of Passive Optical LAN infrastructure components that are optimized for the enterprise and backed by a 25-year warranty. 3M provides excellent performance in durable fiber components, while allowing for an easy install process and more efficient materials cost.

3M products are designed with the needs of diverse buildings and businesses in mind, and companies can trust the experienced professionals of 3M to provide industry best practices when it comes to network design.
See product brochures for specific warranty information.

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