The Evolution of Wired Networks for Digital Consumption

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Nearly a century ago, cars overtook horses on city streets. In response, road networks evolved to better serve changing traffic types. Today, a similar disruption is happening in data networks, where new devices utilizing the network are more likely to connect wirelessly. From sensors to surveillance cameras to the devices employees and visitors bring with them to a building's wired network, wireless is the fastest growing edge of any network.

The practice of network planning and design involves an ongoing and iterative process, where evolution is built in. One of the most important considerations in network design is forecasting data growth, which has historically been more of an art than a science. One corollary to Parkinson's law is the observation that data expands to fill the space available to it. Digital consumption over wireless is expanding to fill available bandwidth in two dimensions. The first is the number of devices accessing the network and the second is the amount of data each device requires to satisfy the user.

Members of Generation X—as well as older professionals—can remember a simpler time when networks were designed almost exclusively to move data east-west between devices within the building or campus. The 10base5 and 10base2 technologies that served this traffic well have become obsolete in favor of new technologies that can accommodate higher bandwidth. Anyone reading this certainly understands from experience the complexity and cost associated with required cabling upgrades to deliver more bandwidth.

Fiber cabling infrastructure does not eliminate this consideration altogether. Its capacity to carry bandwidth, however, gives it a much longer usable lifespan compared to copper cabling. And it offers more longevity: new electronics can be connected to existing fiber in a building when evolving a wired network, in comparison to the forced upgrades for both network electronics and cabling when seeking the advantages of new generations of increased bandwidth. While there will certainly be a time when OS1 fiber will need to be replaced, it will likely happen long after Cat7 cable.

The shift to SaaS and mobile has resulted in traffic being nearly 100 percent north-south in a building, and further north to the Internet outside of the building. The shift of workloads from on-premise datacenters to the cloud have also contributed to this prevailing direction of user traffic on a network. This highlights another advantage of fiber in network design, where a single cable can carry traffic from the network edge to the location of the core, eliminating the need for tiers of switches and reducing the weight and size of cabling.

Passive Optical LAN (POL) is a positive example of technology designed to exceed today's digital consumption requirements—or at a minimum move the constraint from the edge to the Internet connection of a building. POL has been around for some time, and adoption has accelerated over recent years, though it is still an emerging technology today compared to classic LAN design in buildings. When designing Passive Optical LANs, single mode fiber is the best choice largely based on its cost, which recently has become lower than that of modern copper cabling.

In the matter of cost, one prevailing perception when designing networks is that fiber involves a high premium in order to use the same technology that service providers use. This is not unlike when power windows first became available. Years ago, being able to control a car window at the touch of a button was a feature available only in luxury vehicles. Now, this ability is commonplace for virtually all entry-level cars. Millennials who have cranked down a window the old-fashioned way did so in their parent's or grandparent's vehicle, but not in their own vehicles. Yet, younger professionals involved in networking planning and design do not think of Passive Optical LAN as an option for evolution. Beyond cost, most network designers (regardless of age) have yet to consider Passive Optical LAN technology.

In a Passive Optical LAN architecture, fiber is used to connect from near the network core to a location close to where devices physically connect. There is another element in the network on the other end of the fiber: the Optical Network Terminal (ONT) or Port Extender. Similar in size and function to the smaller uncooled device that fiber Internet subscribers have in their home, ONTs are available in many configurations, with a combination of ports to support RJ-45 and even registered jack connections for classic telephone, plus options with WiFi.

As a result, wired devices continue to connect to the network using their conventional cabling, with no added complexity. Wireless access points, too, connect with the same wire they would otherwise use to connect to the wired network. Given its advantages in weight and physical size, deploying fiber to the optimal location of Wireless APs is faster and easier, requires less physical support, and compounds the cost-saving advantages. Density of access points in buildings is increasing not decreasing, making fiber the ideal infrastructure when expanding wireless access capacity in a network.

What about power to devices? Today's networks have been designed to carry data and also supply required power for many devices. Among the many choices of ONTs, PoE and PoE+ are commonly available, ready to provide power to wireless infrastructure. PoE++ options are also coming to market in 2019. With advances in low-voltage lighting, the digital nature of LED technology brings illumination and IT together, where lighting systems are IoT solutions. The shift to low voltage allows organizations to deploy lighting and future IoT systems at a much lower cost without the need for electricians.

In an environment where everything is connected to everything, security is an important design factor. This is another area in which fiber infrastructure has physical security advantages. Passive Optical LAN is highly secure and produces no EMI radiation, which is typically associated with traditional copper-wired facilities. Passive Optical LAN provides additional security measures at the physical and data layers and at the user port to greatly reduce the potential for Denial of Service (DoS) redirects or other malicious attacks. In short, wiretapping fiber is possible, but much more difficult to do.

When it comes to Passive Optical LAN as a consideration, we know the core of a wired network will not be replaced by wireless the way cars replaced horses. However, the disruption introduced by new 802.11ax and 5G technologies will result in new levels of digital consumption over wireless. The positive news is that network planning and design can—and will—iterate and evolve. Networks can look to fiber as a viable option that offers proven technology without premium pricing. And, when designed and implemented correctly, evolved networks will serve data to devices not yet invented, and so the design cycle will continue.