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Distance, wattage considerations drive power decisions

There's more to powering network devices than Power over Ethernet, especially when wattage and distance requirements increase

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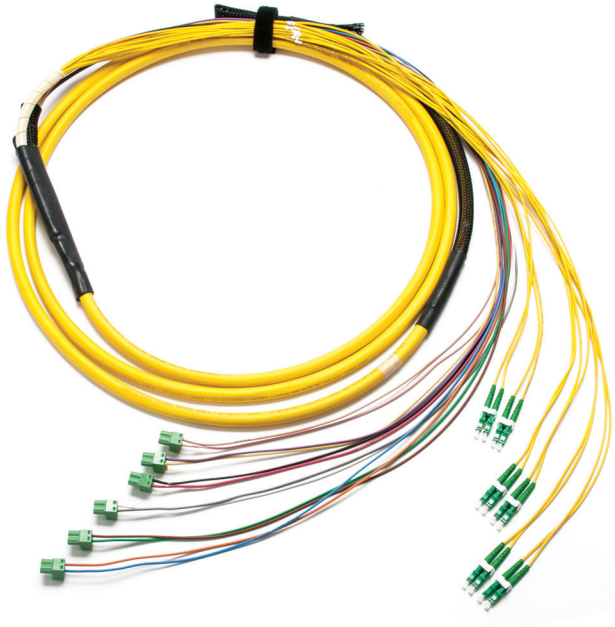

This composite cable combines the distance and bandwidth capabilities of singlemode fiber with the power-carrying capability of 14-AWG copper conductors.

Power over Ethernet—it may be an old concept, but new applications continue to be identified that are redefining its capabilities. As the concept is re-imagined, it could be the perfect time to also re-imagine your network infrastructure and align data and power for the future of the building. New power solutions being introduced today enable high-power options with traditional low-voltage labor and safety. One such option is intelligent power, which parallels the distance and space savings of optical fiber, reducing runs of copper cabling and enabling Power over Ethernet for today's applications as well as those in the not-too-distant future.

By definition, Power over Ethernet (PoE) is a system that passes electric power along with data over cabling. Traditionally, this has been done over an unshielded twisted-pair (UTP) cabling system. It may seem simple in concept, but the execution has not been without challenges.

Since the introduction of networking devices in our premises, the industry has struggled with providing power to allow those devices to work their magic. The 2003 PoE standard 802.3af

A power supply unit like this one from Corning Optical Communications is a key element of a powering system that can accommodate distances unachievable by current and upcoming 802.3 PoE standards.

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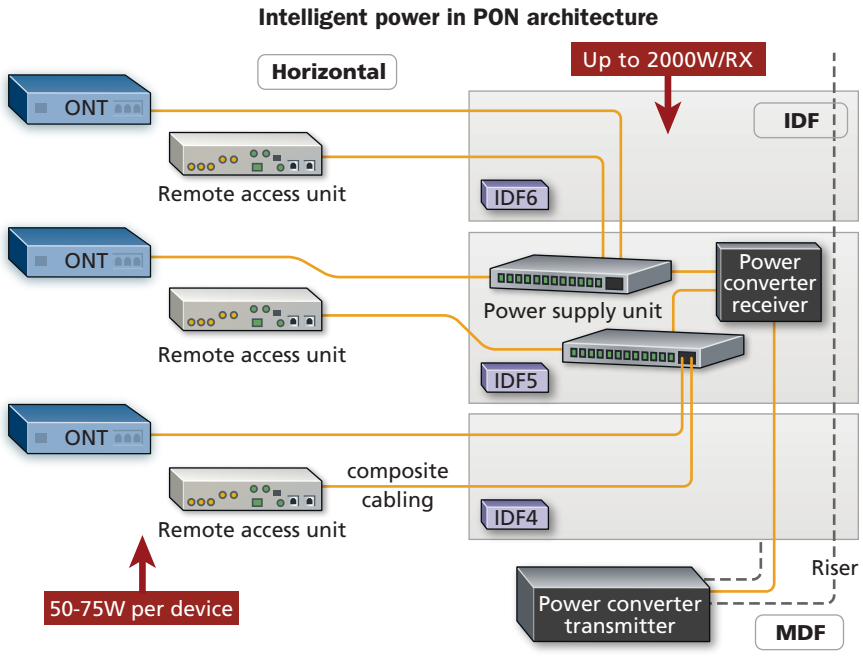


An intelligent power system can reside within a passive optical network architecture. Power supply units are housed within IDF rooms, and are connected to devices like remote access units with composite cabling.

provided a meager 15 watts of power. This allowed some smaller devices to benefit from a single hybrid network/power cable connection via the common RJ45 plug. Unfortunately, this standard enabled only basic devices such as VoIP phones and IP cameras; all other power-hungry devices and/or devices more than the Ethernet distance limit of 90 meters from a PoE switch still required AC outlets close by.

As signal strength and device functionality became more robust, the need for more power to support these requirements also increased. Around 2009, the 802.3at PoE+ standard pushed the power limit up past 25 watts, allowing slightly more power-hungry devices such as WiFi access points and pan/tilt/zoom cameras to benefit from the single point of connectivity. While this showed progress, we were still limited by the 90-meter Ethernet distance. Additionally, 25 watts was still too low a power level to provide massive migration of hardware over to PoE.

Higher demands

So what has changed? Today we are seeing the ratification of a new PoE standard, 4PPoE or PoE++ (802.3bt), which will enable 55 and 90-100 watt transport, opening up many additional applications. Next-generation multiband WiFi, cellular small cells, and LED building lighting systems can now all be driven off of PoE++. This is a tremendous step forward, but is still, unfortunately, limited by the Ethernet 90-meter distance as well as existing bandwidth and application limits of UTP cabling.

The PoE march toward higher power, as well as the explosion of technologies spurred by the Internet of Things, has pushed the number of devices powered in our spaces through the roof. In addition to the above-mentioned devices already demanding higher-strength PoE, we are also seeing security, telecommunications, life-safety, and building automation systems join traditional enterprise network infrastructures. This can challenge a UTP-exclusive infrastructure from distance, bandwidth, pathway space, and flexibility points of view. For example, IP cameras and security devices are now common throughout indoor and outdoor spaces, but may not be close to existing telecom rooms or a PoE-based switch. New *National Electrical Code* rules require specific cable designs and materials for PoE++ runs, which eat up space in already-congested pathways because each high-power PoE++ device has to be homerun to its power source.

So what's the challenge? UTP, and by natural extension PoE, is already showing its limitations. Our devices aren't always within 90 meters of an intermediate distribution frame (IDF) closet or telecom room (TR). Sometimes we have to power devices that are outdoors and require outdoor cables that exceed many hundreds, if not thousands, of feet. Many devices require more than the existing 30 watts provided by 802.3at and even more than the 55 or 100 watts promised in the future 802.3bt standard.

LED televisions now require both power and a network connection, and a high-powered connection of 100 watts or more would make it possible to do away with the power cord. Instead of forcing all of our power and data-hungry devices to go to PoE switches located in telecom rooms via homerun cables, we could break up the switches and place the power and data distribution closer to the devices. This comes with an added benefit of reducing cable loads in the horizontal. Due to the proliferation of devices, our pathways cannot support the space and weight of tens or even hundreds of UTP drops homerun to our already crowded TR and/or IDF.

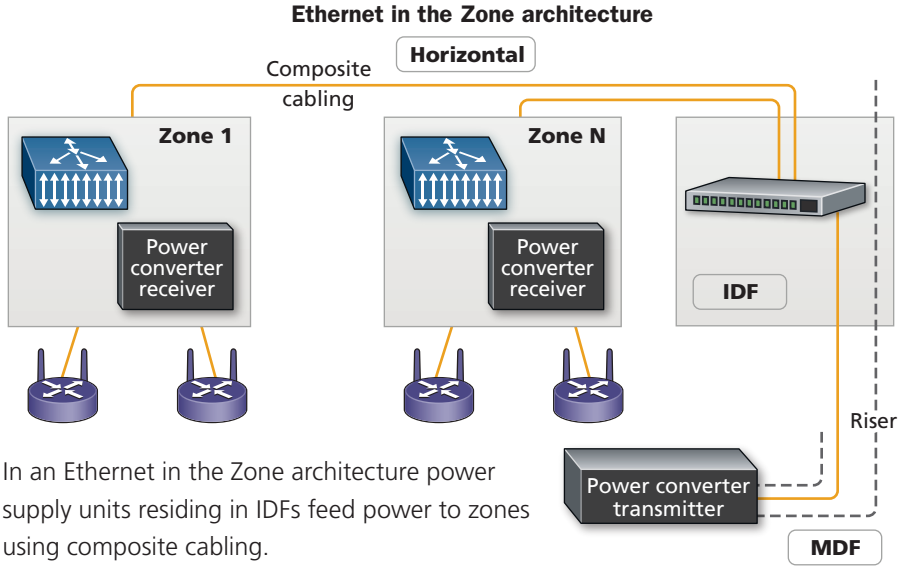
The power of fiber

For those who need to provide cellular and/or public safety systems inside

their facilities, many manufacturers still rely on singlemode fiber for the signal transport via analog RF over glass (RFoG) technology. Many of these devices require hundreds to thousands of watts of power, and in many cases this power has to be run hundreds or thousands of feet back to the main distribution frame (MDF) rooms or headends, due to centralized power backup requirements. These and other high-power devices such as the TVs, lighting systems, and distributed PoE switches outlined above cannot rely on even the best UTP or PoE systems planned today. When looking at the possible pathway congestion and distance limitations the proliferation of PoE devices foretell, even the latest solutions are limited to 100 watts over 90 meters. Thankfully, we are seeing new technologies as well as evolutions of existing well-known technology rising to fill the gaps.

The *NEC* seems to agree with the need for new or emerging technology, as the producers of the *NEC* have started to pay more attention to network powering. While Sections 725 and 830 both cover some "types" of powering, the codes are playing catch-up with the latest devices. Recently, the *NEC* has taken notice of the levels of power being transported over the relatively small wire gauge typically used in Category 6A and other UTP/FTP cables. A very healthy, and sometimes confusing, debate has ensued, adding to the uncertainty around the newer standard.

One alternative to address the limitations of PoE is Class 2 power, which can service longer distances than traditional PoE. The power level is still less than 100 watts, but the lack of requirement to use Category UTP cable gives designers more flexibility with respect to distance via larger-gauge conductors. If we pair the bandwidth and distance capabilities of singlemode fiber with the ability to use larger-gauge copper conductors, we can far exceed the 90-meter limitations of even the best PoE.



In an Ethernet in the Zone architecture power supply units residing in IDFs feed power to zones using composite cabling.

However, there is a more promising alternative. Traditional PoE can now be strengthened by combining the bandwidth and distance advantages of fiber-optic cabling mentioned above with an intelligent power solution enabled by composite cabling. For example, a 75-watt device requiring a minimum operating voltage of 48 VDC over 1100 feet can be powered from a source using 14-AWG cable. If the wire gauge is bigger or the end device requires less than 48 VDC, distances increase even more. Intelligent power technology paired with smaller "micro zones" could power a number of 25-watt PoE devices using a combination of a single small composite fiber and copper cable, combined with short patch cables running to and from the micro zone.

Adding to the promise is the development of new "touch-safe" power under *NEC* 725 and 830. Using IEC 60950-21 (Information Technology Equipment – Safety – Part 21: Remote Power Feeding) and IEC 62368-1 (Audio/Video, Information and Communications Technology Equipment – Part 1: Safety Requirements) for guidance, people are developing and deploying technologies that far exceed thousands of watts over thousands of feet of the same composite fiber and copper cable.

It is an exciting time for network designers, with the long-respected bandwidth/distance/power boundaries for Layer 1 in our networks crashing down. We are now able to deliver services to customers where, when, and how they want to use them instead of forcing square pegs into round holes. Optical fiber offers unmatched bandwidth and distance advantages and will undoubtedly be a key component in the networks of the future. Combining optical fiber with higher-power solutions via composite cable provides a robust extension to traditional PoE systems, allowing us to bring future-ready bandwidth and power to our devices safely and easily. And perhaps even more exciting is that the "wire-it-once" capability of optical fiber can simplify future upgrades and reduce cost over the lifetime of the network. ◆

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