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Extending the Reach *of PoE Powered Devices*

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Extending the Reach of PoE Powered Devices

INCREASED CHALLENGES WITH AN EXPANDED NETWORK

As more organizations strive to integrate physical security and building automation systems with their overall IP network, new challenges are brought into sharp relief. Chief among these challenges is how to provide both power and data connectivity to devices that need to be positioned in locations some distance from the network hardware.

Power over Ethernet provides a convenient and cost-effective approach to deliver both power and data connectivity over a single connection. However, this approach has traditionally been limited by the standard 100 meter reach of Ethernet over a twisted pair cabling system. While optical fiber cabling provides significant reach capabilities for data transmission, local power has still been required, and has been both costly and inconvenient for providing local power to a single camera or access control device. What has been needed is a system that combines the best aspects of optical fiber transmission reach and the convenience of Power over Ethernet.

There are options available today to address the challenge of supporting remote devices. Each option will be considered in this paper, which will also highlight the benefits to be realized from a system that extends the reach of PoE and PoE+ well beyond 100 meters with no need for local power, additional power back-ups or additional electrical contractors. The Berk-Tek OneReach™ System will be considered as an example of a complete, simple, integrated solution to deliver just these benefits.

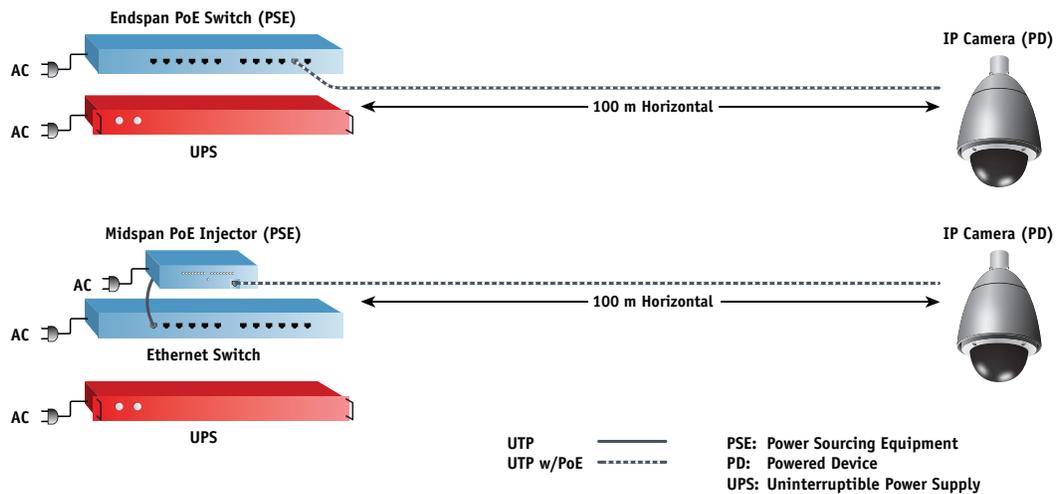
POWER OVER ETHERNET

Power over Ethernet was standardized as IEEE 802.3af in 2003. As the name implies, it provides the power for a device along with an Ethernet connection through one cable. That cable is specified as a Category 5e (or better) four-pair cable terminated with an RJ45 connector. The initial products targeted for support were IP phones, wireless access points (WAP), and IP CCTV cameras. The standard allows the powered devices (PD) to draw up to 12.95W.

Eliminating the need for a separate power outlet provides a number of advantages;

- ▶ Avoids locating power outlets in difficult areas; for example, drop ceilings
- ▶ Consolidates power sources with centralized power back-up supplies
- ▶ Enables low voltage contractors to install the entire system since power cabling is not required

The power supplied across the cable is nominally 48 VDC. Today, voltage is commonly supplied by the Ethernet switch. This configuration is known as an “end span” system, since the power is generated at the end of the cabling channel. However, for legacy switches that lack the capability of providing power, “mid-span” systems can inject the power along the cabling run.



Mid-span power injection typically happens in the patch panel close to where the Ethernet switch resides, but it can be inserted anywhere along the link.

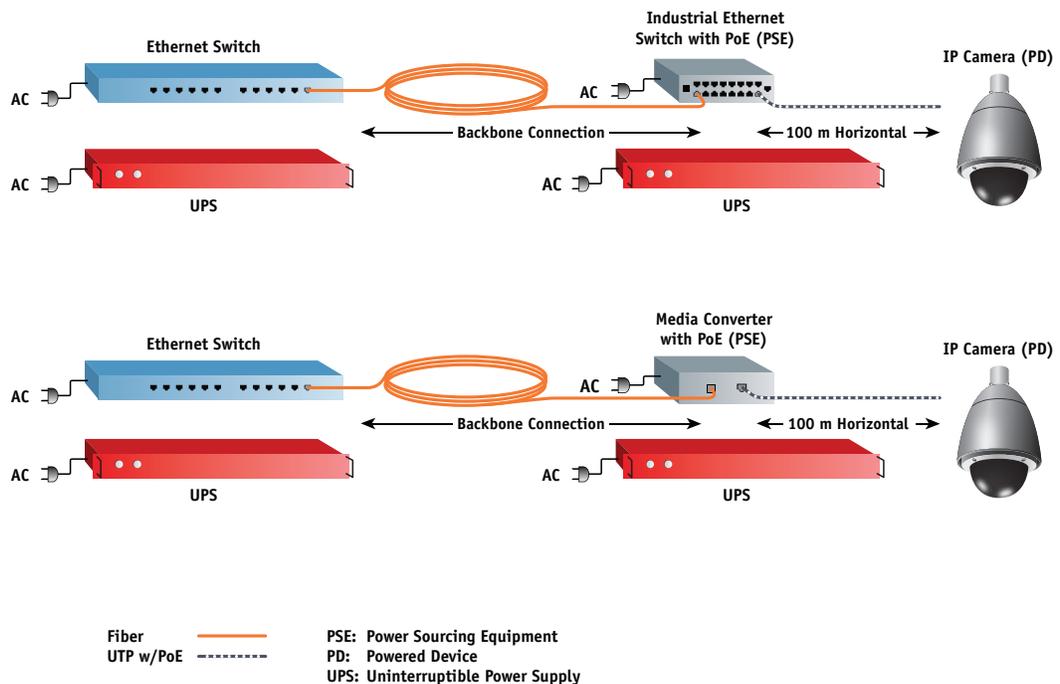
PoE has been a tremendous success with sales growth of devices that utilize the technology exceeding 20% annually. This has contributed to a significant number of devices converging onto the IP network. Along with the original candidates, various building automation devices, such as card readers, door strikes, and thermal controls, have taken advantage of PoE.

In 2009, an enhanced version of PoE was released; IEEE 802.3at, commonly referred to as PoE+. It increased the power available to the PD to 25.5W. The additional power can be used for devices such as video display IP phones, PTZ cameras, etc.

While it is clearly a successful technology, there are limiting factors. One of the most significant issues is the physical reach. Since it is an Ethernet channel, the maximum distance is 100 meters on a category cable. For many applications, this link length is sufficient. But for more and more devices, the traditional 100 m distance is insufficient. In fact, it has become a common occurrence to have an IP camera installed 400 ft. away from the switch. The camera may power up if sufficient voltage reaches the camera, but the distance is too far for the data communication channel, therefore no video signal reaches the closet. It is important to note that the distance is measured by the cable length, which can be significantly longer than the straight line distance between the switch and the PD.

PoE ALTERNATIVES

When these situations are encountered, alternatives must be developed. One solution is to install an electrical outlet somewhere near the powered device. Once an electrical outlet is in place, various options are available. For example, another Ethernet switch could be installed which would be connected back to the main closet with an optical fiber backbone. Or, a traditional media converter could be used, again with a fiber connection back to the main switch.



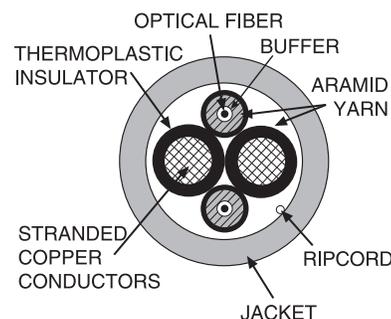
In either of the above examples, several sacrifices are made. The most significant is the cost of installing the electrical power. Depending on various factors, the cost of this installation can range from \$2,000 to \$6,000. In addition, since there is a new outlet, an additional UPS is needed to provide backup power. The cost of this UPS depends on the supportable load but is typically several hundred dollars. And these devices typically need to be housed in a closet to provide cooling and/or security. Therefore, the initial cost could be several thousand dollars.

The addition of the UPS and switch also creates a need for additional maintenance protocols. Over time, UPS batteries lose power and need to be replaced. This creates a maintenance cost for personnel and materials. If a switch is used, a layer has been added to the network tree which adds complexity for the IT manager. These additional switches need to be maintained and the advantages of PoE are lost.

ONEREACH™ SYSTEM

In 2009, Berk-Tek, a Nexans Company, began developing a new solution to address these challenges. The objective was to create a system that allowed power and data to be delivered to PD's beyond 100 meters. The initial development focused on designing a cable that could be used in the appropriate environment. Since many of the longer reach applications involved IP cameras that were installed outside of a building, the cable would need to operate in an indoor/outdoor environment. And since the low voltage attribute of PoE was such a strong advantage, the cable should stay within this category. Another consideration in the design was installation, and a desire to ensure that traditional low-voltage contractors with expertise in data networking would be permitted to install the cable. This meant designing to achieve a low voltage category for the cable.

Ultimately, a riser-rated composite cable containing copper conductors for power and optical fibers for data was designed and listed as a Class 3 cable (or CL3). The resulting cable has both a Power Limited Tray Cable (PLTC) listing and a CL3R-OF listing, placing it in the low voltage category (as is Category 5e cable), which allows the traditional low voltage contractor to install the cable. This provided the needed performance and approvals for the cable to be installed in the target environments.

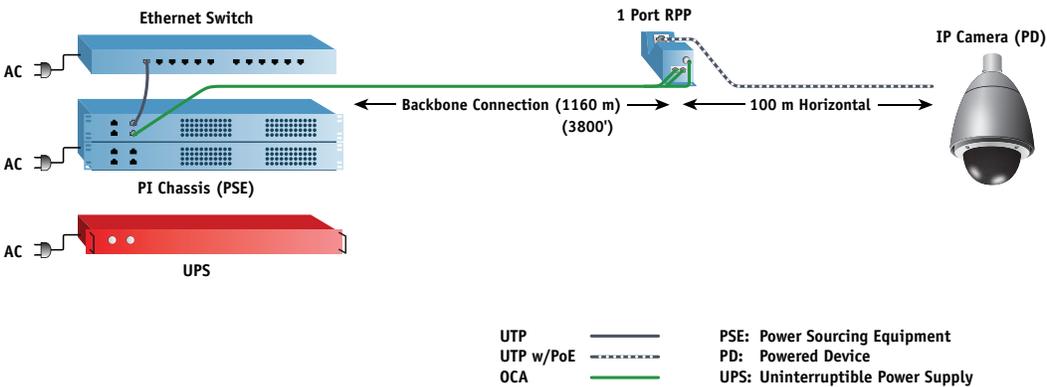


The next step was to determine how to provide the PoE functionality. Media converters have been available for many years to convert a copper Ethernet signal to a fiber Ethernet signal, thereby extending the signal reach from 100 meters to 2 kilometers or more. For these traditional devices, the remote media converter (the one installed near the PD) still needed a local source of power. Therefore, the solution needed to address this shortcoming for the customer to be able to take full advantage of the benefits of PoE.

Since the remote converter would frequently be placed outside, it needed to meet industrial hardened specifications. These included withstanding temperatures as low as -40 degrees and having voltage isolation to withstand ground faults. All of this needed to be contained in a package compact enough to be housed in a small NEMA-rated enclosure.

The answer was to provide the power for the specially designed remote media converter and the PD from the main closet. The power would be carried by the copper conductors. The conductors, as large as #12 AWG, provide a low enough resistance that sufficient power can reach the media converter and PD at distances to 4000 feet. The Ethernet signal would be carried on the fiber where such distances are easily achieved. Both of these components are provided in the CL3R-OF/PLTC composite cable.

Officially launched by Berk-Tek in late 2010, the OneReach™ System is a mid-span PoE system where power is injected between the Ethernet switch and the PD. This proprietary system provides an IEEE compliant PoE port, but extends it well past the 100 meter limit—in fact it can exceed well beyond 1 km. No additional power source is needed outside of the main closet. And since OneReach™ is not a switch, the switch in the closet is communicating directly with the PD.



EXPANDING APPLICATIONS

While IP cameras at extended distances have been the first implementation of the system, the number of applications where this functionality can be used is quickly evident. For example, the logistics of placing WAP's in large, open areas such as warehouses, convention centers, or retail stores have provided traditional installations with recurring challenges and present an ideal application environment for the OneReach™. Another application is the connection of remote access control components in a campus environment. Any PoE enabled IP device can be quickly and easily connected to the IP network at distances well beyond the traditional 100 meter distance limitation.

The key benefit of OneReach™ is its transparent nature. As long as the PD is compliant to the PoE specification, it can be supported by OneReach™. Newer high performance PD's are steadily being released that take advantage of PoE and PoE+. And the OneReach™ System allows those benefits to be enjoyed at longer distances with:

- ▶ No need to locate a power outlet in difficult areas
- ▶ Consolidated power source and centralized power back-up
- ▶ Ability for low voltage contractors to install the entire system

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