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POWERING TECHNOLOGIES FOR NETWORK DEVICES

AN EXAMINATION OF USE, FAMILIARITY, AND INTEREST

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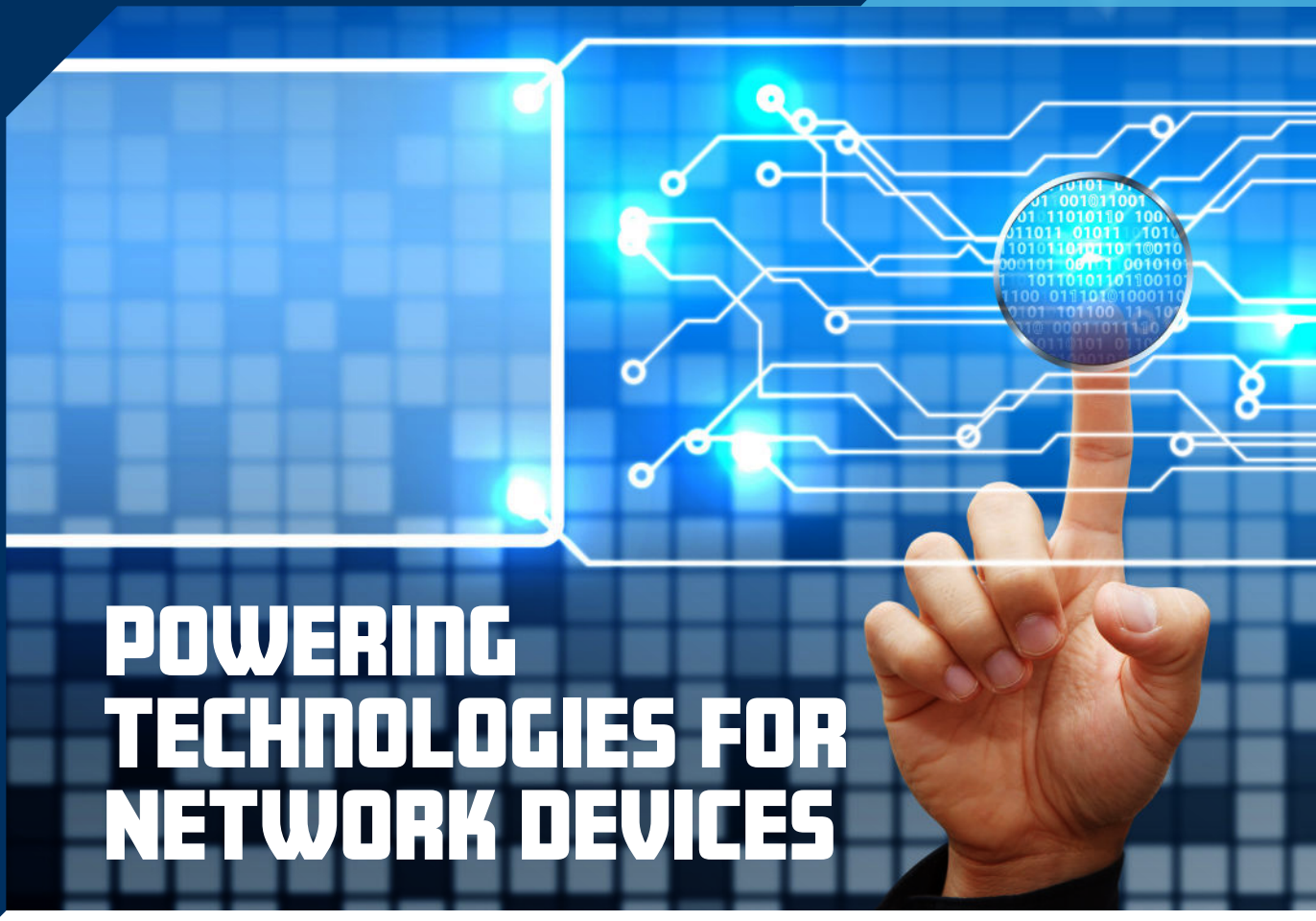

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POWERING TECHNOLOGIES FOR NETWORK DEVICES

An Examination of Use, Familiarity, and Interest

More than 20 years ago, Power over Ethernet transformed the world of network-device powering by providing the capability to deliver both data and direct-current power over the conductors of a single twisted-pair copper cable. In the decades that have followed, network devices of all types have become PoE-enabled, and the standards defining remote powering have specified increased wattages deliverable via PoE. The worldwide adoption of PoE has made the 8-position, 8-contact interface the only truly global power connector.

Meanwhile, other technologies have emerged to power network devices. While not as widely deployed as Power over Ethernet in enterprise networks, technologies including Fault Managed Power (FMP) and Single Pair Ethernet (SPE) offer power-delivery capabilities that have serviced environments as diverse as campuses and in-vehicle automotive networks.

In this report, we examine results of a survey we conducted among information and communications technology (ICT) industry professionals about the deployment and use of Power over Ethernet. We also examine these professionals' familiarity with Fault Managed Power and Single Pair Ethernet, along with the likelihood that they will adopt either of these technologies in the future.

Introduction

In September and October 2024, Cabling Installation & Maintenance conducted a survey among professionals in the ICT field. Respondents were asked to identify the type of organization for which they work. The 375 participants' workplace types included 151 contracting companies that design and/or install cabling and networking systems; 62 consulting firms; 48 telecommunications service providers, internet service providers, or multiple systems operators; 60 end-user organizations that own one or more local area networks; and 54 "other." Among those responding "other," product manufacturers, manufacturers' representatives, and

training/education providers were most common.

For the purposes of reporting information from sources most-closely associated with the technologies we explored in the survey (PoE, FMP, SPE), we focus primarily on the responses from contracting companies and end-user organizations. We asked those two groups different questions about the technologies, based on their relationships with them (i.e. a contracting company designs and installs networks with PoE hardware or the cabling that will support PoE transmission, while an end-user organization owns, maintains, and upgrades the powering systems as well as all the network devices that receive power). Herein are results we garnered from those two organization types.

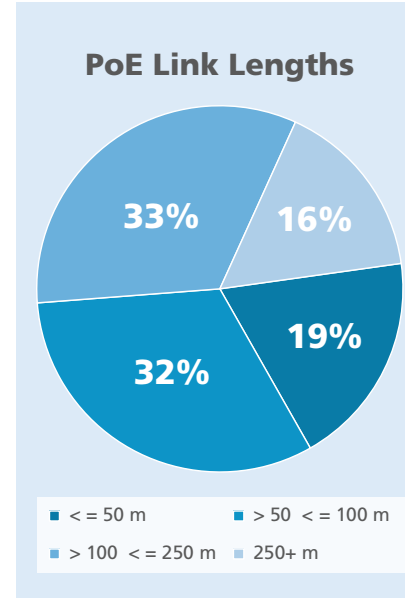
Power over ethernet deployment and technologies

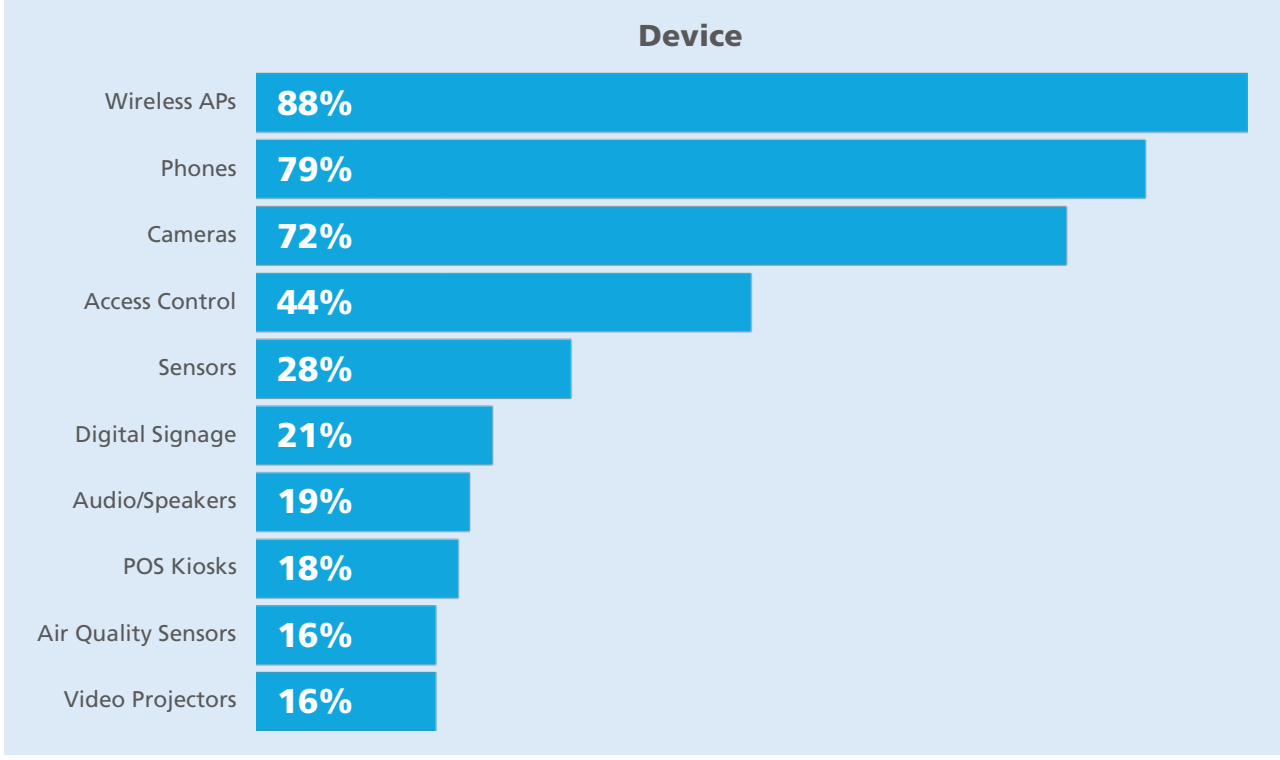
All end-user organizations responding to our survey have some version of PoE technology deployed within their networks.

- 63% use IEEE 802.3af (up to 15.4 W)
- 61% use IEEE 802.3at (up to 30 W)
- 34% use IEEE 802.3bt (up to 90 W)
- 5% use another form of PoE-style remote powering, such as HDBase-T or Cisco's UPOE technology

Three types of network devices—wireless access points (88% of user organizations), phones (79%), and surveillance cameras (72%)—are most commonly powered via PoE, followed by access-control equipment (44%), sensors (excluding air-quality sensors; 28%), digital signage (21%), audio/speaker systems (19%), point-of-sale kiosks (18%), air-quality sensors (16%), video projectors (16%), LED luminaires (16%), and actuators (14%).

Because PoE is delivered over the copper conductors of a twisted-pair cable, constructing and maintaining a standard-compliant cabling infrastructure requires the complete channel to be no more than 100 meters in length. However, the practicalities of enterprise and campus networking often mean network devices reside more than 100 meters from the nearest intermediate crossconnect. That reality bears itself out in our survey results. Fifty-one percent of user organizations tell us the longest PoE link in





their networks is equal to or less than 100 meters. For 19%, the longest link length is 50 meters or less and for 32%, the longest link length is between 50 and 100 meters. The other 49% have PoE links that exceed 100 meters.

Users who implement PoE in links longer than 100 meters have several options to do so, including using highly capable twisted-pair cabling that enables the delivery of both power and data to the required distance. We asked survey participants to tell us the type(s) of twisted-pair cable—by performance level—they use in their networks' PoE systems. Category 6 cable is most popular, in 70% of networks. Next is Category 6A, which is in place in 66% of networks. Forty-five percent of end users have Category 5e cable in their PoE networks.

In recent years, concern over the possible generation of heat within bundles of cable delivering DC power via PoE, gave rise to the development of a cable rating called LP (Limited Power). Cable manufacturers can have their products tested to specific parameters that provide assurance the cable's temperature will not rise above a defined number, when bundled. Several manufacturers offer LP-rated cable. According to our survey, 7% of end-user organizations use LP-rated cable in their PoE networks.

End-users also deploy other products and technologies commonly used to deliver PoE beyond 100 meters; 38% have PoE media converters in their networks, and 30% use PoE extenders.

The installation of new PoE circuits is not slowing down. Essentially half (49%) of end-user organizations plan to add new cabling circuits to their networks for the specific purpose of delivering PoE to network devices sometime within the next year. And another 24% plan to do so between 12 and 24 months in the future. Among most of the users who will be installing cabling circuits for PoE, standard and code compliance is a popular requirement. Here are the percentages of user organizations that plan to require compliance with the specified code or standard for their next project.

- ANSI/TIA-568: 93%
- National Electrical Code: 85%
- TIA TSB-184-A Guidelines for Supporting Power Delivery over Balanced Twisted-Pair Cabling: 79%
- BICSI-N2 PoE Installation: 64%

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A final question to end users about PoE asked them to rate their level of satisfaction, overall, with the extent to which the PoE technology they employ today satisfies the network's needs for delivering power to network devices. Each respondent was asked to choose a number between 0 and 100, with 0 being not at all satisfied and 100 being completely satisfied. The mean average was 81, indicating a high overall level of satisfaction with PoE among the end-user population.

Survey results from contracting companies provide complementary information to that provided by end-user organizations. Ninety-four percent of them have, within the year preceding the survey, completed a project that included the installation of a network-powering system such as PoE, UPoE, or PoHDBase-T.

We asked contractors how frequently, during PoE-related projects, their end-user customers ask for guidance or recommendations related to device powering. When asking this question, we stated, "Examples could include the best way to deliver the amount of power the devices need,

specific locations to place devices, the type of cabling needed to support certain power levels, bundle sizes, etc." Respondents used a 0-100 scale to characterize the frequency, with 0 equating to "never happens" and 100 equating to "always happens." The mean average response from installation contractors was 46—indicating it is fairly common for contractors to provide guidance of some sort to their customers about PoE deployment.

Contractors also relayed their experiences with code and standard compliance on PoE projects. We asked how often their end-user customers have required PoE-related installations to comply with the same code and standards about which we asked end-users. We gave contractors the opportunity to respond with "always," "most of the time," occasionally," "rarely," or "never." Following are the combined percentages of contractors' "always" and "most of the time" responses for codes and standards.

- ANSI/TIA-568: 70%
- National Electrical Code: 71%
- TIA TSB-184-A Guidelines for Supporting Power Delivery over Balanced Twisted-Pair Cabling: 51%
- BICSI-N2 PoE Installation: 35%

Forty-three percent of contractors believe the design and installation of cabling systems that will support PoE transmission require particular skills that are not necessary when the cabling system will not support PoE. Among the most-frequently cited skills by these respondents are: bundling and bundle sizes, pathway (conduit and tray) fill, voltage drop, and heat generation.

Fault managed power

Familiarity with, and interest in, fault managed power (FMP) is strong among survey respondents. We asked about familiarity using a 0-100 scale, with 0 being "not at all familiar" and 100 being "extremely familiar." Among end-user organizations, the mean average was 48; among design and installation contractors, the mean average was 37.

End users were asked how likely they will be to explore the possibility of using FMP if, within the following year, they encounter the need to power new network devices. 9% said they are extremely likely to explore FMP; 41% are likely; 30% answered "maybe"; 17% said it is unlikely; and 3% said it is extremely unlikely.

We presented several characteristics of FMP to respondents and asked them to characterize the usefulness of each characteristic. The options were "extremely useful," "useful," "slightly useful," and "not at all useful." Following are those FMP characteristics, and the percentage of end-user organizations that deemed them to be "extremely useful" or "useful."

- Ability to transmit power thousands of meters: 57%
- Use of existing data pathways, eliminating the need for conduit: 80%
- Single, centralized UPS, eliminating the need for backup power in remote locations: 78%
- Ability to monitor power from a centralized location: 87%
- Ability to remotely control power cycles: 81%

Among contractors, 16% told us they have designed or installed cabling in support of one or more FMP systems for customers.

We also asked these contractors the extent to which they are interested in learning more about FMP

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and the possibility of adding this technology to the service portfolios they offer to their clientele. 25% indicated they are extremely interested in doing so. 29% are very interested; 38% are somewhat interested, and 8% are not interested.

Single Pair Ethernet and Single Pair Power over Ethernet

We asked similar questions about Single Pair Ethernet (SPE)—a technology that offers the capability to deliver power to networked devices over a cable's single pair of copper conductors.

The mean average, on a 0-100 familiarity scale, was 57 for end-user organizations and 37 for contractors.

We asked end users how likely they are to learn more about SPE or Single Pair Power over Ethernet (SPoE) for the potential purpose of using either technology in their networks within the coming 24 months. 20% are extremely likely to learn more; 37% are likely to do so. 20% said "maybe" to the prospect, while 19% are unlikely to do so, and 4% are extremely unlikely.

For contractors, the prospect of adding SPE to their service offerings is appealing. 26% said they are extremely interested in learning more about SPE and SPoE. 31% are very interested; 38% are somewhat interested, and 6% are not at all interested.

We posed questions about SPE's beneficial characteristics, as well as barriers to adoption, to end-user organizations and contractors. The tables below show their responses to these questions.

Benefits of adopting Single Pair Ethernet in building automation

	End-User Organizations	Contractors
Ability to transmit power and data over a single pair of conductors, including over existing cabling	82%	87%
Streamlined regulatory burden during installation/ maintenance	42%	28%
Edge-to-edge Ethernet networking, enabling remote building management	46%	43%
Single, centralized UPS, eliminating the need for backup power in remote locations	52%	34%
Ubiquitous IT-grade networks allow for increased accessibility of equipment health and environmental data	42%	29%

Barriers to adopting Single Pair Ethernet in building automation

	End-User Organizations	Contractors
Interested, but lack of product availability	31%	25%
Production cost	33%	21%
Installation cost	29%	20%
Lack of skilled workforce to implement	35%	23%
Lack of support from enterprise switching vendors	25%	30%
Lack of familiarity with SPE	44%	47%

Conclusion

Power over Ethernet has been successfully deployed globally for decades. When introduced in the early 2000s it was a groundbreaking technology that, in the years since, has reset the dynamic of delivering power to network devices. Worldwide, users largely are satisfied with the extent to which PoE meets their networks' needs for device powering.

Designing, installing, and managing the cabling infrastructure that supports PoE often includes collaboration between the network owner and the design/installation contractor. Issues that can make a PoE-cabling installation project challenging include cable-performance specification, pathway planning, and link-distance considerations.

These installations must comply with relevant parts of the National Electrical Code, and multiple industry standards have been published to guide best practices and approaches to them.

Fault managed power is a technology that also has been successfully deployed for a number of years—slightly more than one decade. The power needs of modern local area networks, including data centers, campuses, and digital-focused buildings, have raised awareness of and interest in fault managed power.

Single Pair Ethernet technology has served automotive applications for years, and the characteristics that have made SPE valuable in the automotive industry also make it an attractive option in several LAN environments. Along with transporting data in these connected environments, SPE has the ability to deliver power to networked devices through Single Pair Power over Ethernet (SPoE). Network owners as well as design/installation contractors see opportunity to deploy SPE and SPoE in LAN environments. ◆