BHB
Industry
Insights

A BRIGHT FUTURE IN STORE FOR POWER OVER ETHERNET (PoE) POWERED LIGHTING

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Executive Summary

Power over Ethernet (PoE) lighting is an evolving technology that could possibly be the lighting industry's next disruptor. While the term is somewhat unfamiliar to the general public, the concept—and its applications to power computers and VoIP phones—is not new. The known component is Ethernet, and the evolution is in providing electric power and data through this cable. In its simplest terms, PoE brings electric power over the same Ethernet cable that is used to bring data to a device, thus eliminating the need for a separate power feed. Ideal for many types of buildings, both renovations and new construction, Power over Ethernet simplifies the electrical wiring needed for powering lighting fixtures, while creating a comprehensive network to oversee all lighting controls.

This white paper will provide a detailed overview of PoE, the components it requires, how to know if PoE is the right match for your project, as well as an in-depth look into the advantages and challenges listed below.

Advantages of PoE:

- Safety
- Simplicity
- Communicates on a Single Network
- No Electrician Required
- Integrates with Other Technology

Current Challenges of PoE:

- Availability of Fixtures
- Learning Curve
- Watt Limitation

Power over Ethernet is still a wary topic for many providers, manufacturers, and engineers due to the relative newness of the technology and the lack of research and case studies. However, just as LED lighting started as a new and somewhat skeptical technology, we see a bright future ahead for PoE lighting and other PoE-compatible products such as appliances, televisions, motorized shades, and more. In fact, according to a recent study done by Reports and Data, the PoE lighting market is anticipated to reach $1.27 billion by 2026.[1] BHB has grasped the concept, and we have started implementing PoE in our projects for owners who want a safer and more efficient lighting option. The Sinclair building, featured in this white paper, is a great example of how PoE can be used, lighting the way for the 90-year-old building's new purpose as a state-of-the-art hotel.

1 Reports and Data. (2019). Power Over Ethernet (POE) Lighting Market by Type (Power sourcing controllers and ICs and Powered devices controllers and ICs), by Device Type (Power sourcing equipment and Powered devices) By Application (Connectivity, Infotainment, Led Lighting control, Security and access control and Others) and by Vertical (Commercial, Residential and Industrial) And Segment Forecasts, 2017-2026. Retrieved from the Reports and Data website: https://www.reportsanddata.com/report-detail/power-over-ethernet-poe-lighting-market

A Bright Future in Store for Power over Ethernet (PoE) Powered Lighting

With the ever-changing technological advancements in today's modern world, it seems as if what was considered a mere concept or idea a few years ago, is now a reality. More than that, technologies are starting to converge so that everything is becoming connected to a single control system. From opening an app on your phone that unlocks your front door to heating a house via voice control, the possibilities seem endless with what has been coined as the "Internet of Things," or IoT. These digital control systems can be applied for more than just consumer use and have a growing presence in industries such as commercial, transportation, infrastructure, and more.

Here at BHB, we are starting to see trends in IoT—specifically, technology that is changing the way engineers work, and ultimately, how engineering will be altered in the years ahead. One major technological advancement that is starting to grow in popularity is Power over Ethernet, also known as PoE. In its simplest terms, PoE brings electric power over the same Ethernet cable that is used to bring data to a device. This eliminates the need for a separate power feed and simplifies wiring.

While many businesses already utilize PoE to power their Voice over Internet Protocol (VoIP) phones, security cameras, and access controls, to name a few, it can also be used for other purposes—including powering low-voltage lighting fixtures.

Did You Know?

PoE can also be used for powering:

- Clocks
- Mini fridges
- Televisions
- HVAC Equipment
- Bluetooth Mirrors
- Wayfinding

Modern LED lighting requires both power and controls to meet ever-evolving energy code requirements. Powering an LED light source in a fixture by PoE is provided by a device known as a driver. The driver takes the incoming power, typically line-voltage alternating current (AC), and converts it to direct current (DC), which then sends power to the fixture over the same Ethernet cable that delivers data. The low-voltage DC that is transferred through the data cable does not present the shock hazard or fire hazard of a conventional line-voltage powered lighting system.

The drivers are powered from an upstream PoE data switch of the same type that is commonly employed in IT applications. PoE switches are currently available in either rack mounted configurations or in smaller plenum rated packages intended to be installed above accessible ceilings.

The control system that provides data to the drivers in response to inputs from devices such as switches, dimmer controls, and occupant and daylight sensors vary from one manufacturer to another. Some manufacturers utilize the drivers as a distributed control system and others require use of a dedicated mini-server or PC.

Advantages of PoE:

PoE lighting has distinct advantages compared to the conventional line-voltage powered lighting system. The current advantages we see are:

Safety

PoE lighting is powered by low-voltage DC transferred through a data cable and does not present the shock hazard or fire hazard of a conventional line-voltage powered lighting system.

Simplicity

Wiring between the upstream PoE data switches and the drivers is a standard Cat 5 or Cat 6 Ethernet cable, which are both readily available. Ethernet cables can be ordered in prefabricated lengths once switch and driver locations are determined, making the wiring installation plug-and-play. Wiring from the drivers to the fixtures is accomplished through use of low voltage twisted pair cable.

A Single Network

All LED drivers are networked together and communicate with each other. Light fixtures, switches, occupant sensors, and daylight sensors all connect to the networked drivers. This feature makes it easy to reconfigure controls through software when it is necessary to add or remove fixtures, such as removing a wall to make a room larger. With PoE, you simply use the software to manipulate the lights rather than rewiring the room.

No Electrician Required

The wiring between the PoE data switch and the powered fixtures is Class 2 low voltage wiring and can be installed just like data cabling. Most inspection authorities do not require that the low voltage wiring between the PoE switches and PoE powered light fixtures be installed by a licensed electrician. PoE fixture and wiring installation and any subsequent changes can generally be done by a low voltage contractor or even by the owner's staff. Fixtures are connected to the drivers using a mini twist lock connector, making fixture installation or removal a plug-and-play operation. Not requiring a licensed electrician can significantly lower labor and maintenance costs.

Integrates with Other Technology

Unlike conventional line-voltage powered lighting that has multiple control systems with limited capability of integrating with smart building technology, PoE lighting can integrate seamlessly. From Bluetooth mesh sensing to powering motorized rolling shades and TVs, multiple systems can be integrated on a single network through a PoE switch.

Current Challenges of PoE:

Power over Ethernet does have its challenges compared to a line-voltage system:

Availability of Fixtures

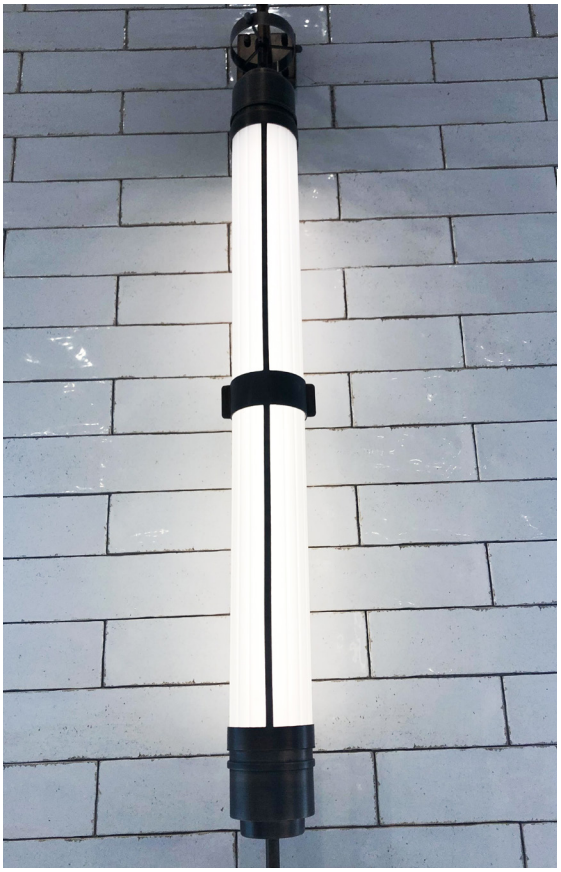
Using PoE to power lighting fixtures is an emerging technology and while it is expected it will eventually become the norm in the lighting industry, not all manufacturers have fully embraced it yet. Although the number of PoE powered lighting fixtures currently available in the marketplace is increasing rapidly, the number of PoE powered fixtures is still limited in comparison to the line-voltage powered fixtures available.

Learning Curve

PoE is an established technology in the IT world; however, using PoE to power lighting is outside the realm of experience of most IT staff. Furthermore, most electricians are typically not familiar with low voltage PoE systems. While PoE powered lighting is generally easy to implement, there is a learning curve involved for all stakeholders as they learn how to install, maintain, and operate a PoE lighting system.

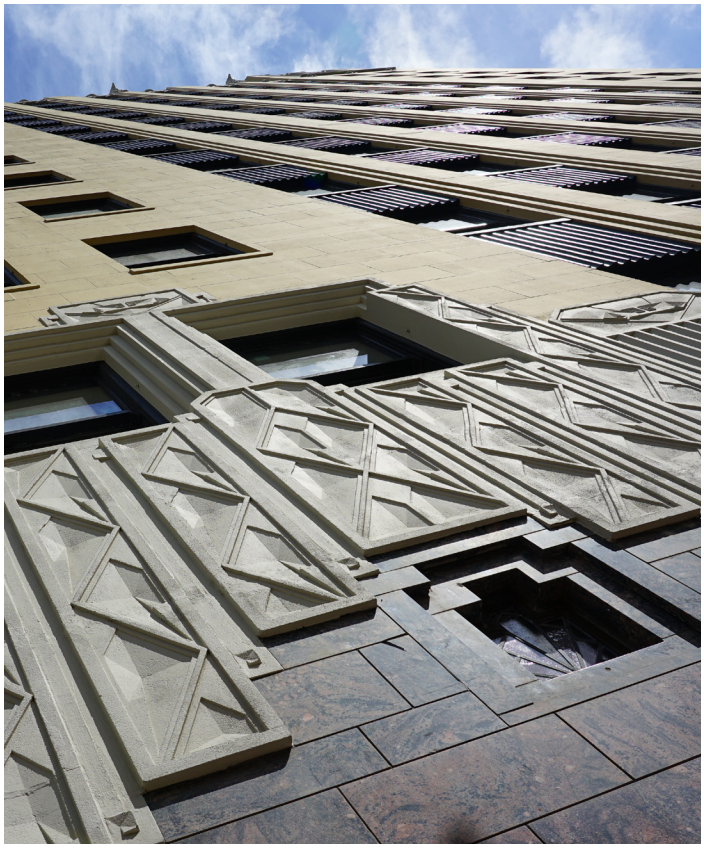
Watt Limitation:

One of the factors that affects the cost of a PoE powered lighting system is the number of PoE network switches required to serve the installed lighting wattage. The Institute of Electrical and Electronics Engineers, Inc. (IEEE) Power over Ethernet standard, IEEE 802.3bt, was recently revised to increase the power carrying capability of a single cable from 60 watts to 100 watts, effectively increasing the wattage per port on a PoE switch. This increase in allowable power available per port on PoE switches will facilitate further use of PoE devices in smart building technology, including the use of PoE powered lighting by reducing the number of switches required to power a given lighting load. However, the immediate potential for gain is limited by the wattage required to power currently available LED fixtures. Typical LED fixtures on the market have a luminous efficacy of around 130 lumens per watt, whereas LED manufacturers now have LEDs available in the range of 200+ lumens per watt. To maximize the benefits of PoE lighting, it is important for fixture manufacturers to produce fixtures that utilize the higher efficacy LEDs so that the same light output can be provided at a lower input wattage.



The Sinclair: Historic Building Gets Brightened Face-lift

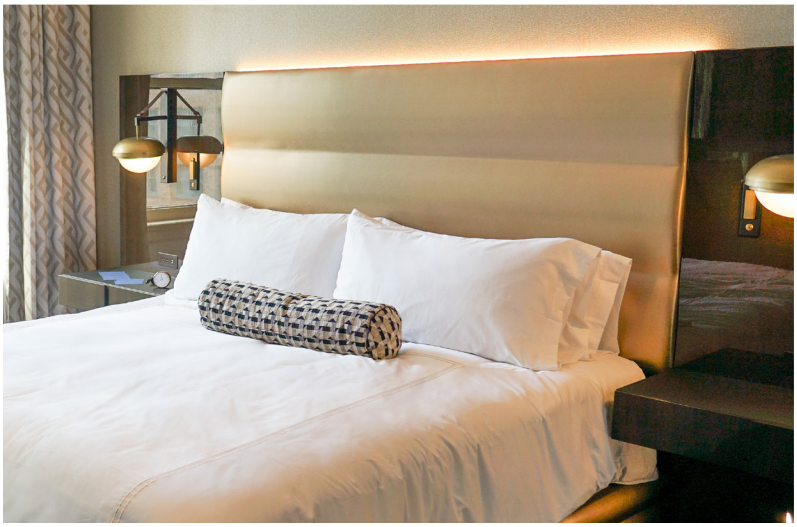
There is nothing ordinary about the improvements and renovations being made to The Sinclair in downtown Fort Worth. What was once an office building built in 1929, the soon-to-be Marriott Autograph Collection hotel will offer a one-of-a-kind experience for guests that will change the way they perceive outstanding amenities and technological advancements for luxury accommodations. The 105,600 square-foot renovation consists of changing the historic office building into a 16-story hotel with 164 guest rooms, a rooftop bar, and a high-end restaurant, while keeping the look and feel of the building's original architecture and art-deco design.



As part of the building's renovation, BHB's electrical engineering team was given an uncommon task — implement the owner's vision to utilize PoE lighting throughout the building. The PoE lighting system in The Sinclair utilizes Cisco 8-port Catalyst Digital Building (CDB) PoE switches, NuLEDS intelligent PoE powered LED drivers with integral networked distributed control, and high efficacy LED lighting fixtures to replace most all of the existing lighting in the building. This includes all guest rooms, the restaurant and bar, decorative and exterior lighting, stairwell lights, and corridor lights. The Cisco CDB switches were powered using VoltServer Digital Electricity™ technology that eliminated line-voltage wiring to the switches, and made all of the lighting system power and control wiring low-voltage cabling.

"While VoltServer technology is not directly a part of PoE, it sends bursts of power in small packets to the PoE receiver. This is similar to the way data is transmitted. The advantage to transmitting power in this way is that the system checks after each packet is sent to make sure that the packet was received correctly. If a packet was not received properly, the transmitter turns off, protecting against ground faults, shorts, and opens," stated Larry Jones, PE, an Associate and Senior Electrical Engineer at BHB. "In total, there are 17 VoltServer transmitters that provide power to the PoE switches."

In addition to the lighting, the CDB PoE switch also powers the motorized rolling shades, OLED TV, and mini refrigerator in each guest room. The existing exterior high-pressure sodium lights illuminating the historic facade of the building were replaced with color-changing LED fixtures that are also PoE powered.



As the electrical team lead for this project since 2014, Jones has seen the renovation of this 90-year-old building from the very beginning. Aside from PoE lighting being installed, the "intelligent building" includes a Variable Refrigerant Flow (VRF) HVAC system, and is about to become one of the most technologically advanced hotels in the world.

"I like historic buildings, so this has been a very cool project," said Jones. "When we started working on The Sinclair, the owner began investigating what else he could do with PoE. Now, the hotel has motorized shades, televisions, mini fridges, and Bluetooth mirrors in order to enhance the user experience."

A main benefit of using PoE for the soon-to-be-open hotel was that it eliminated the need for power wiring in conduit, and made for a simpler, more organized electrical system that can be controlled from a single network. BHB engineers are ahead of the curve when it comes to implementing PoE technology. While it is still considered new and not yet a mainstream solution for lighting needs, signs are pointing to a bright future for PoE.

"I think the acceptance of PoE lighting is going to happen faster than the acceptance LED lighting," said Jones. "The awareness and availability of this technology is growing exponentially, and there are huge advantages from an operating standpoint for owners."

This project has helped the BHB team master their PoE skills, while working to find manufacturers that could support this large effort for The Sinclair. In fact, in the four years BHB has worked on the project, PoE has increased in ease of use and in popularity.

With The Sinclair set to open soon, guests will be able to enjoy one-of-a-kind accommodations and four-star amenities of this "modern historic" hotel, while unbeknown to them, enjoying the benefits of PoE.

That light bulb moment....