The Proliferation of Powering over LAN Cables:
The Powering of Everything (PoE)

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Wire & Cable; UL LLC

PEG PROTECTION ENGINEERS GROUP

Electrical Protection of Communications Networks

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Northbrook, IL

atis

AGENDA

The Proliferation of Powering over LAN Cables: The Powering of Everything (PoE)

- Background & History
- Technologies
- Installation & Use
- Safety Concerns
- Conclusions

Background & History

Powering over Communications Cables

- A general term for technologies that enable network cables to carry electrical power
  - PoE (Power over Ethernet - IEEE)
  - PoE+ (Power over Ethernet Plus - IEEE)
  - PoDL (Power over Data Lines – IEEE single pair)
  - UPoE (Universal Power over Ethernet - Cisco)
  - PoH (Power over HDBaseT – HDBaseT Alliance)
  - PoC (Power over Cable - Non-standardized / proprietary systems)
  - Packet Energy Transfer / “Digital Electricity”

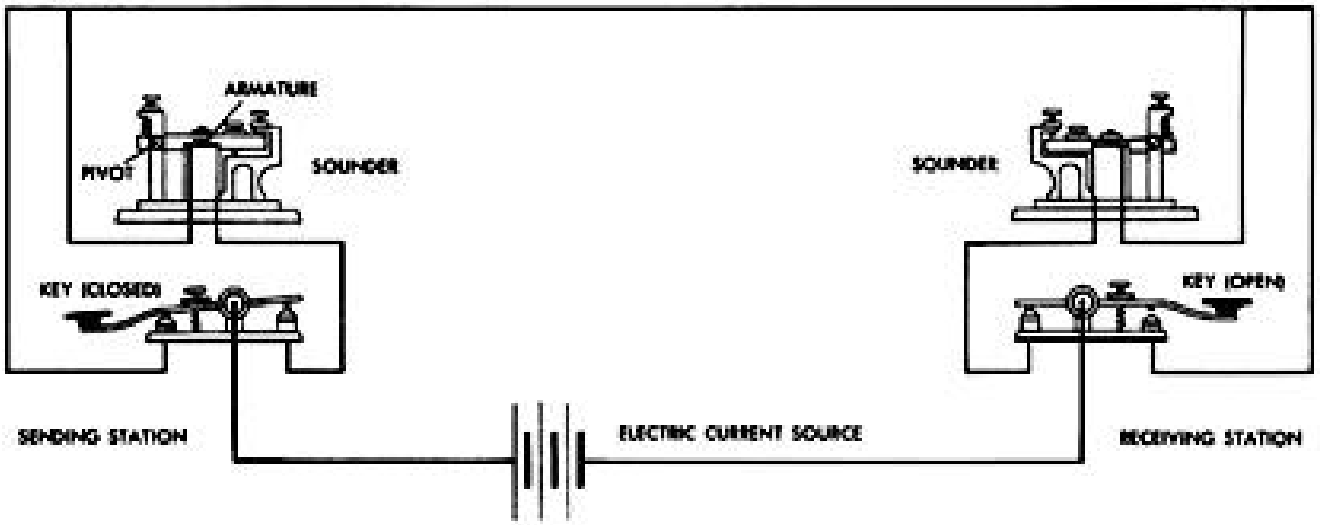
Powering over Communications Cabling
A key powering strategy

Powering over Communications Cabling - A key powering strategy

- 2000: Inline Power (Cisco)
  - ~7 watts
- 2003: IEEE 802.3af
  - Original PoE (Power over Ethernet) standard
  - ~15 watts
- 2007: (Cisco)
  - ~30 watts
- 2009: IEEE 802.3at
  - PoE Plus or PoE+
  - ~30 watts

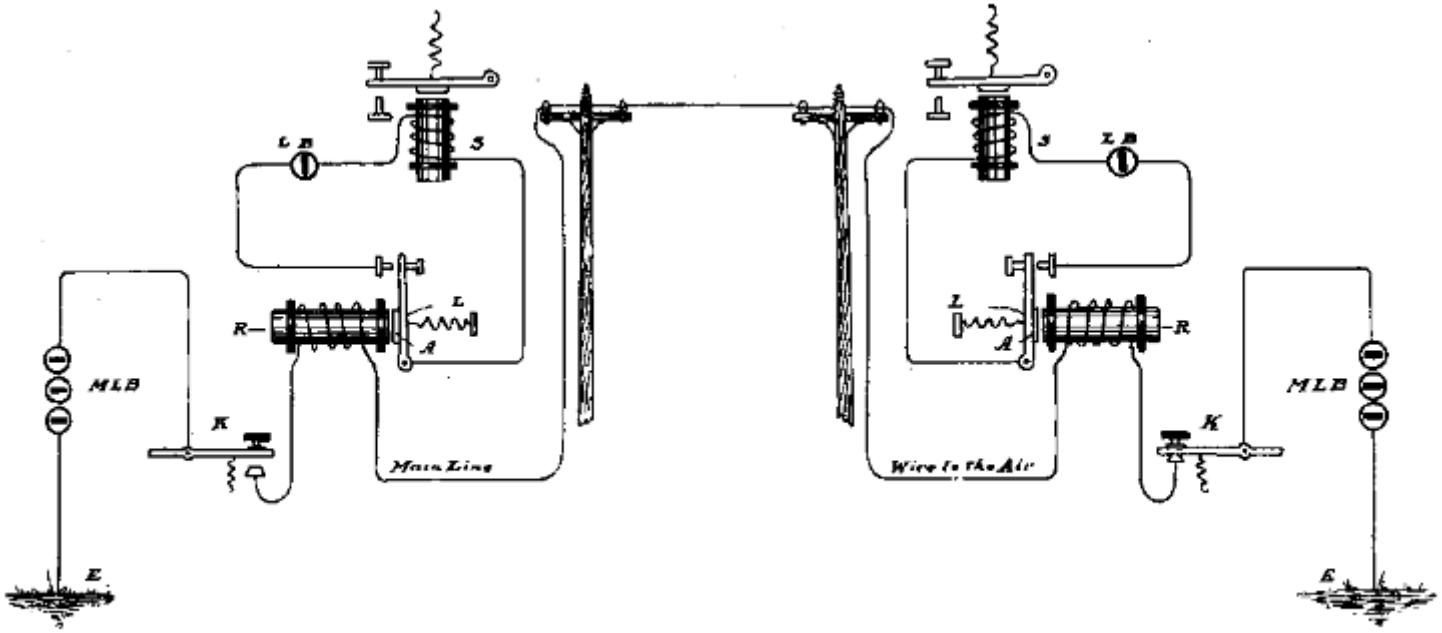
Powering over Communications Cabling - A key powering strategy

- 1838 Simple Morse Telegraph
  - Power was also the signal



Powering over Communications Cabling - A key powering strategy

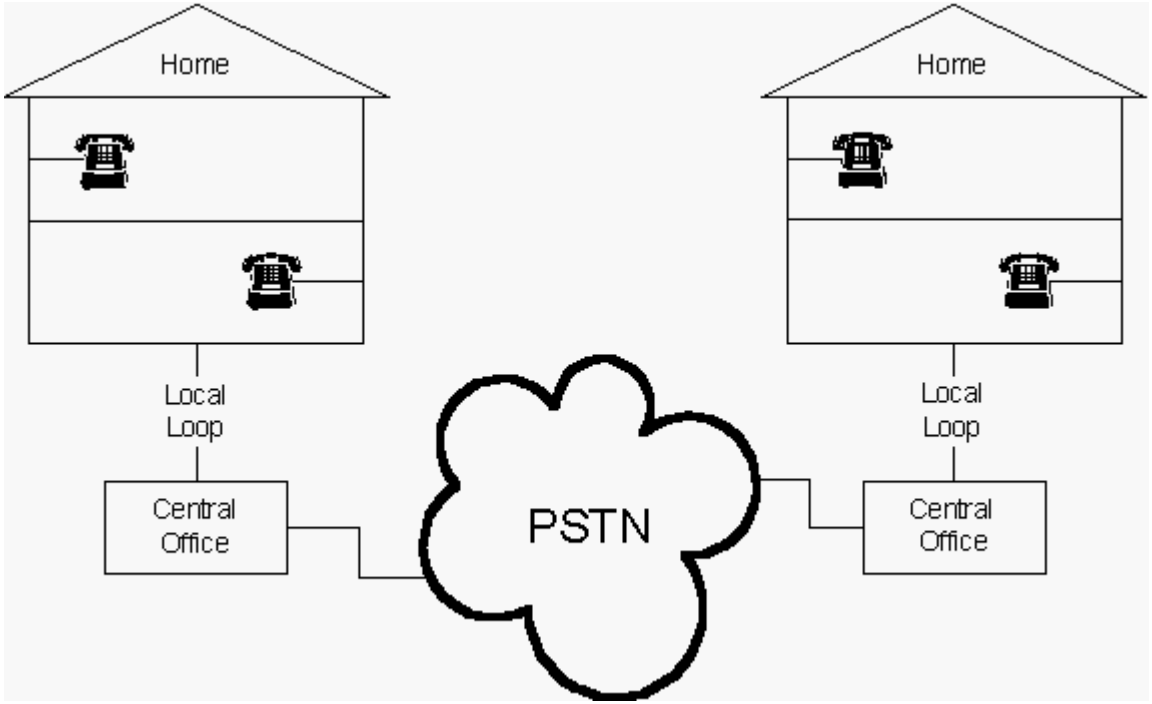
- 1850-1900 Telegraph System
  - Premises Powered
  - Power was also the signal



The Main Line Circuit.

Powering over Communications Cabling - A key powering strategy

- 1877 - 2019 PSTN / POTS



Powering over Communications Cabling - A key powering strategy

- 1877 - 2019 PSTN / POTS

Lamp Powered by Phone Lines Is a Sneaky Way to Get Around Energy Costs

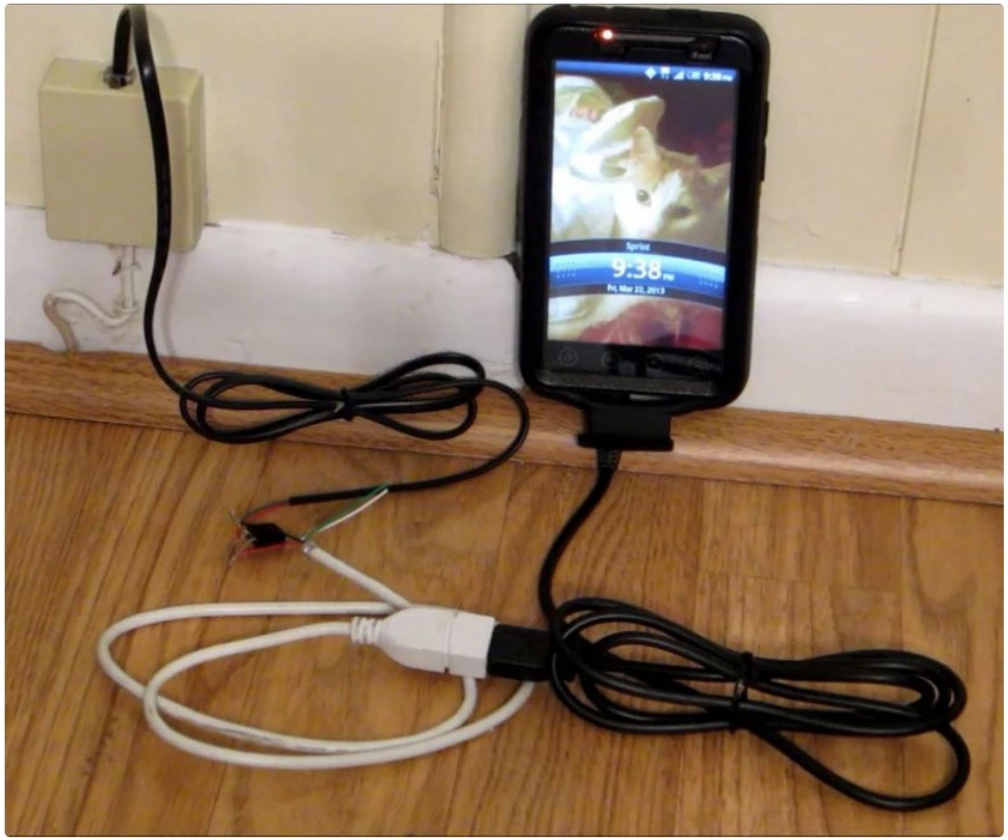
BY ARIEL SCHWARTZ 1 MINUTE READ

Powering over Communications Cabling - A key powering strategy

- 1877 - 2019 PSTN / POTS

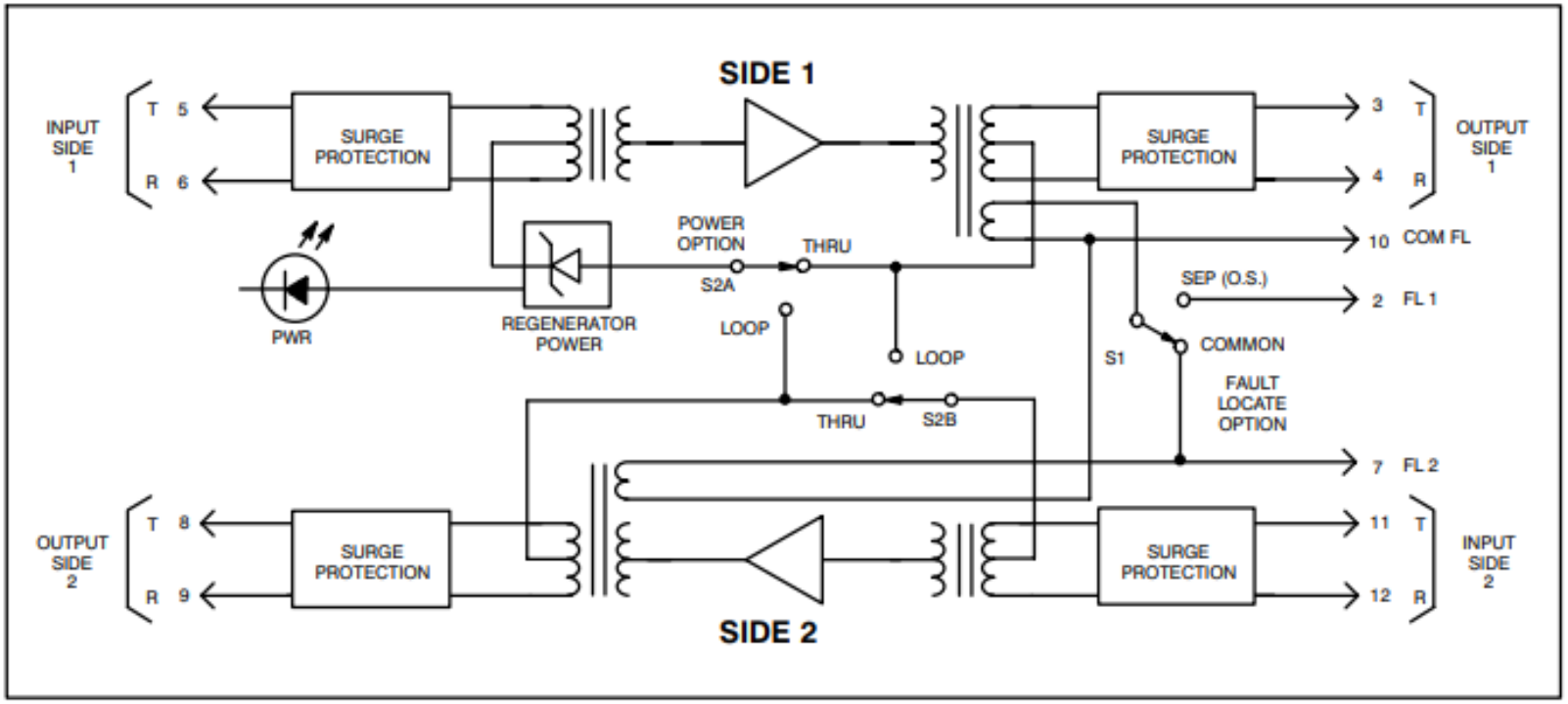
How to Get Emergency Power From a Phone Line

By DIY Hacks and How Tos in Technology > Mobile 561,632 1,055 245



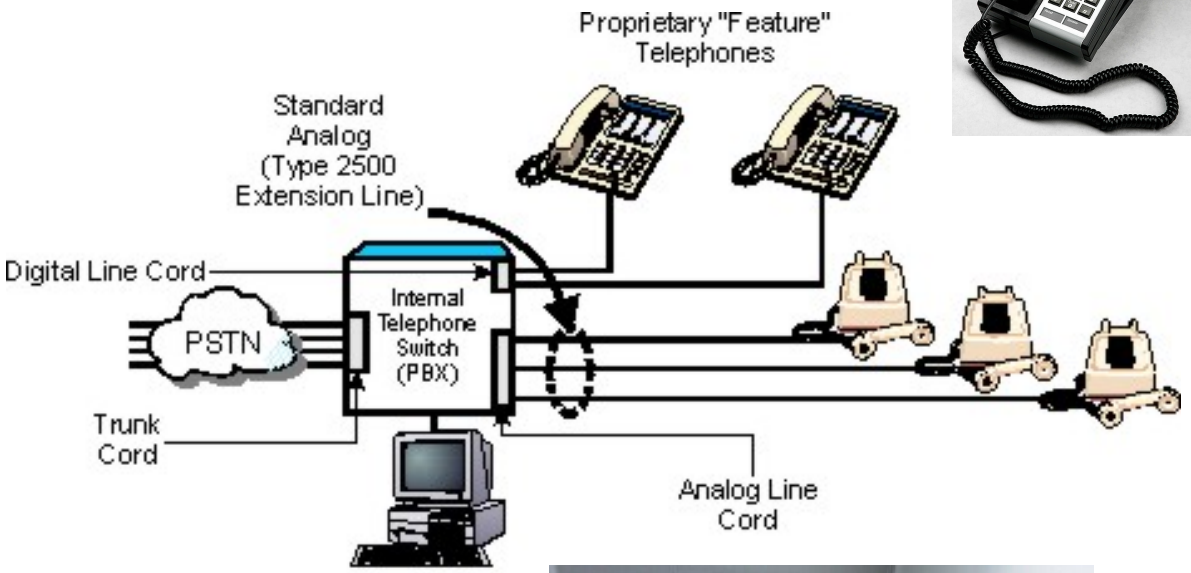
Powering over Communications Cabling - A key powering strategy

- 1960's T-Carrier Span Power
  - Repeater Block Diagram



Powering over Communications Cabling - A key powering strategy

- 1970-1990's PBX & Feature Phones



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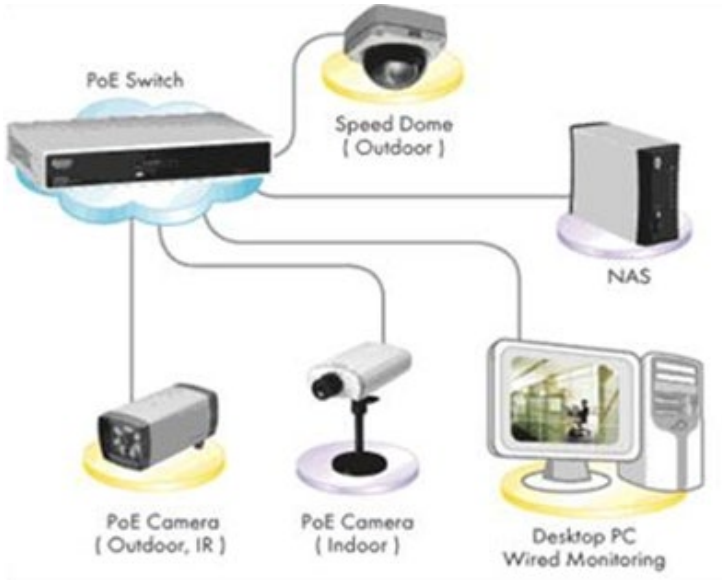
Powering over Communications Cabling - A key powering strategy

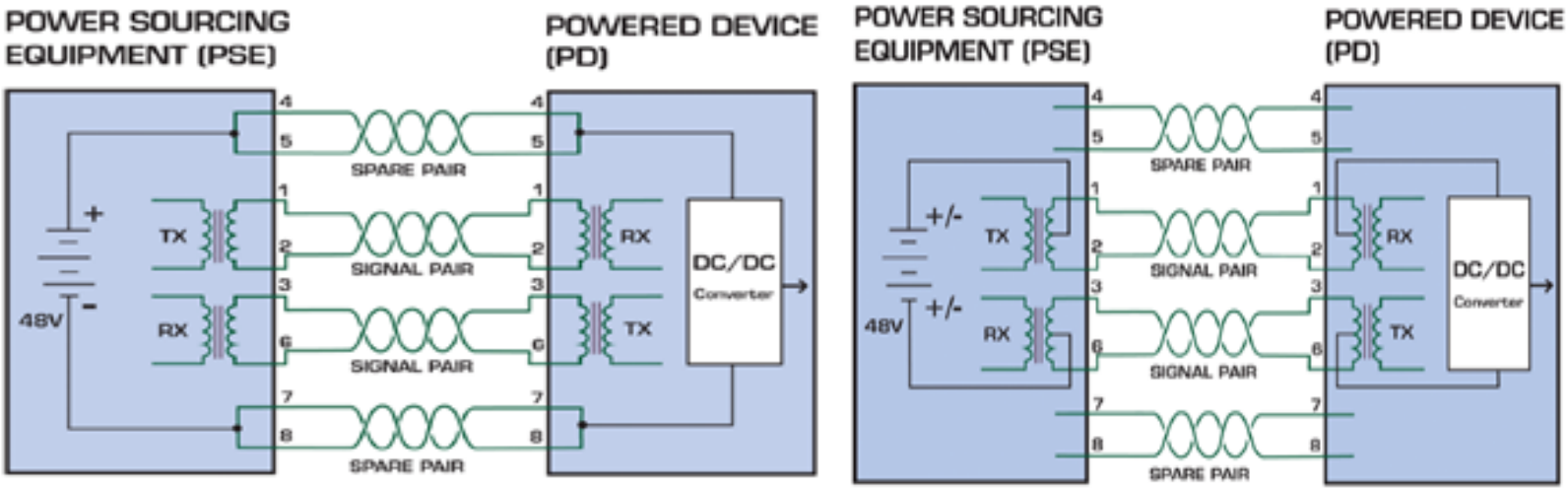
- 2011: UPoE (Cisco)
  - “Universal Power over Ethernet”
  - ~60 watts
- 2011: POH
  - Power over HDBaseT
  - ~100 watts
- 2016 ?: IEEE 802.3bt
  - High power PoE or PoE++
  - ~90 watts
- Future:
  - ~200 watts?



Technologies

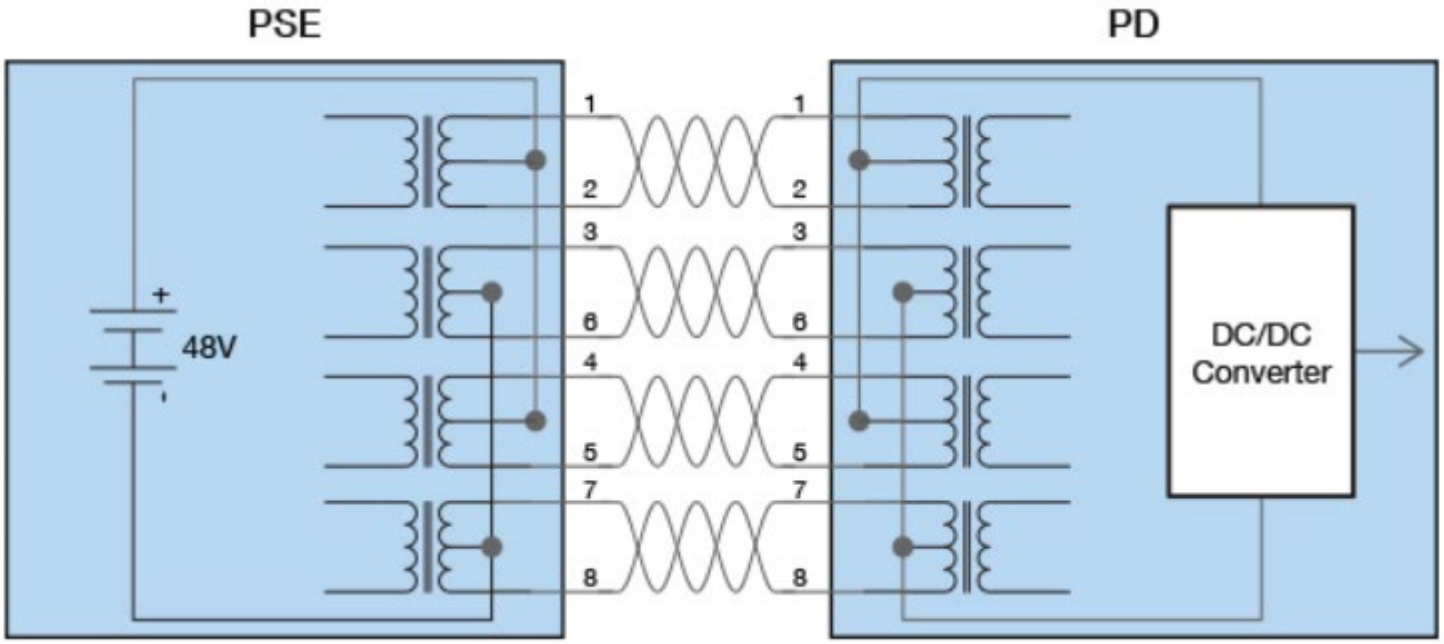
Powering over Communications Cable
Two-Pair Powering

- IEEE 802.3af
- IEEE 802.3at



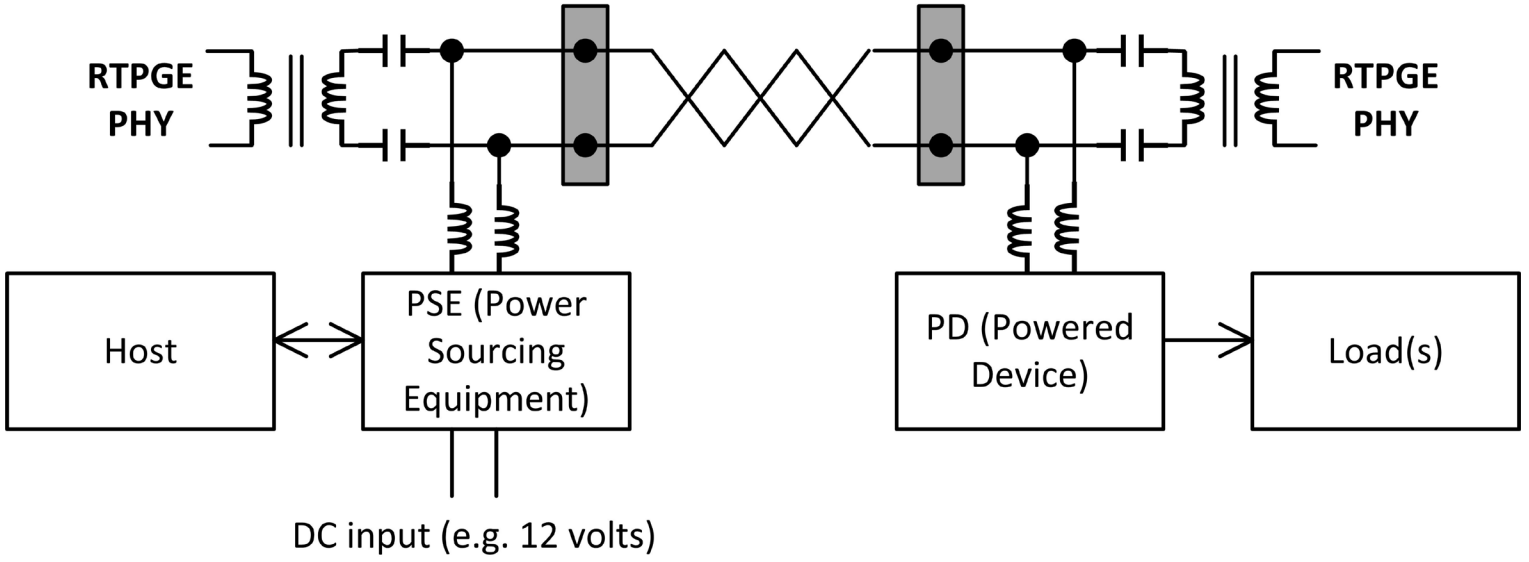
Powering over Communications Cable
Four-Pair Powering

- UPoE
- IEEE 802.3bt
- HDBaseT PoH

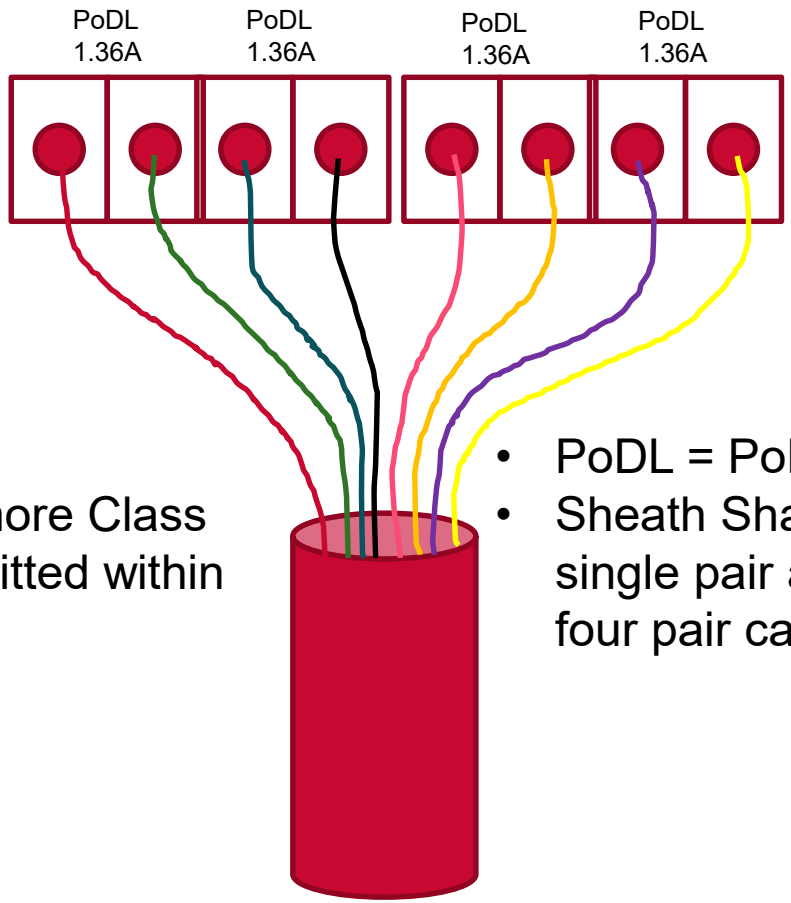


Powering over Communications Cable Single Pair Ethernet

- IEEE 802.3cg 10BASE-T1: 10 Mbps, **1 km**
- IEEE 802.3bu: Power over Data Lines (PoDL)



Powering over Communications Cable Single Pair Ethernet



- NEC 725.139(A)

Conductors of two or more Class 2 circuits shall be permitted within the same cable

- PoDL = PoE for Single-Pair Ethernet
- Sheath Sharing = Four independent single pair applications are run over a four pair cabling system

Powering over Communications Cable Single Pair Ethernet

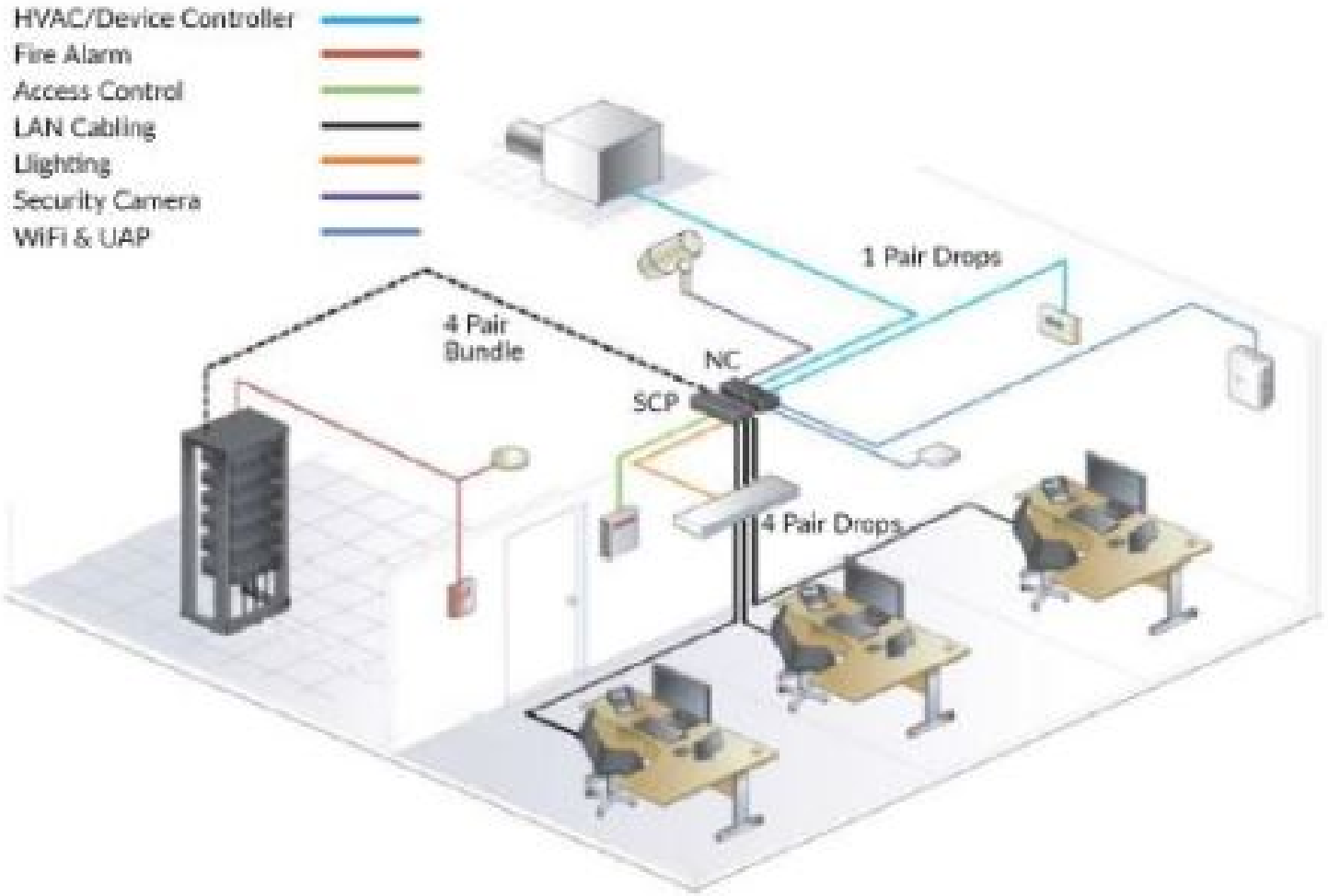
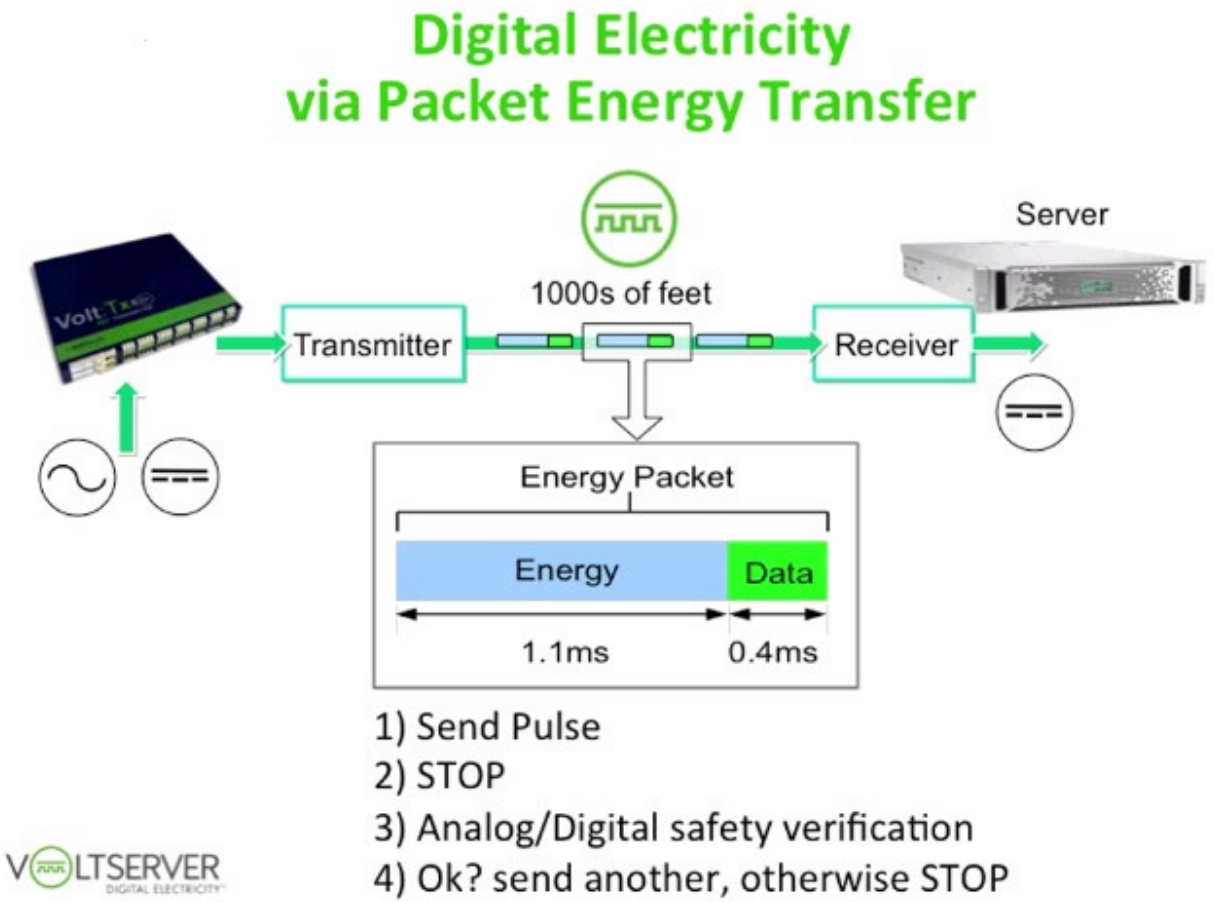


Image from: Commscope Whitepaper - Single balanced twisted-pair cabling infrastructure for IoT and M2M connectivity

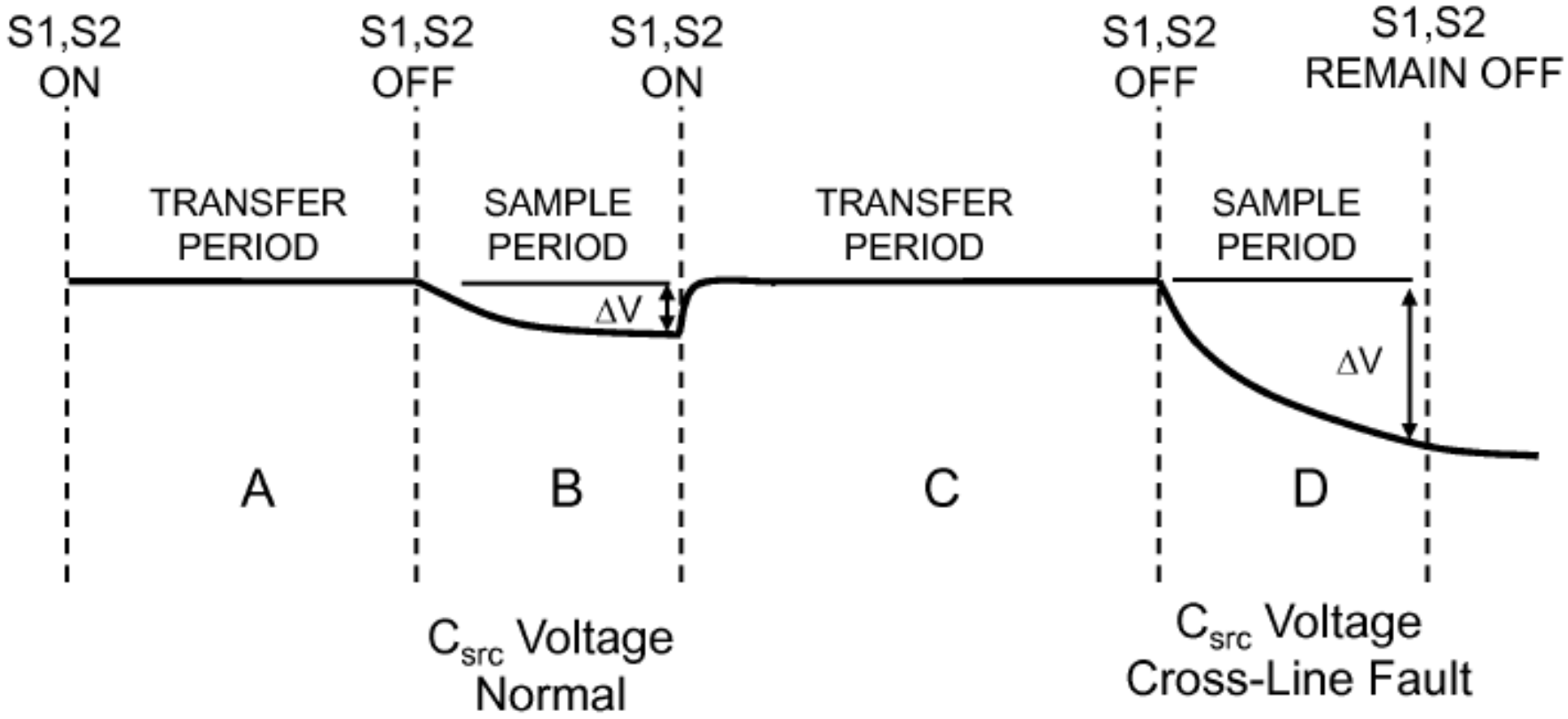
Powering over Communications Cable
Packet Energy Transfer / "Digital Electricity"

20 X power, 20 X distances vs. Traditional PoC Systems



(**Source**: VoltServer)

Powering over Communications Cable
Packet Energy Transfer / “Digital Electricity”

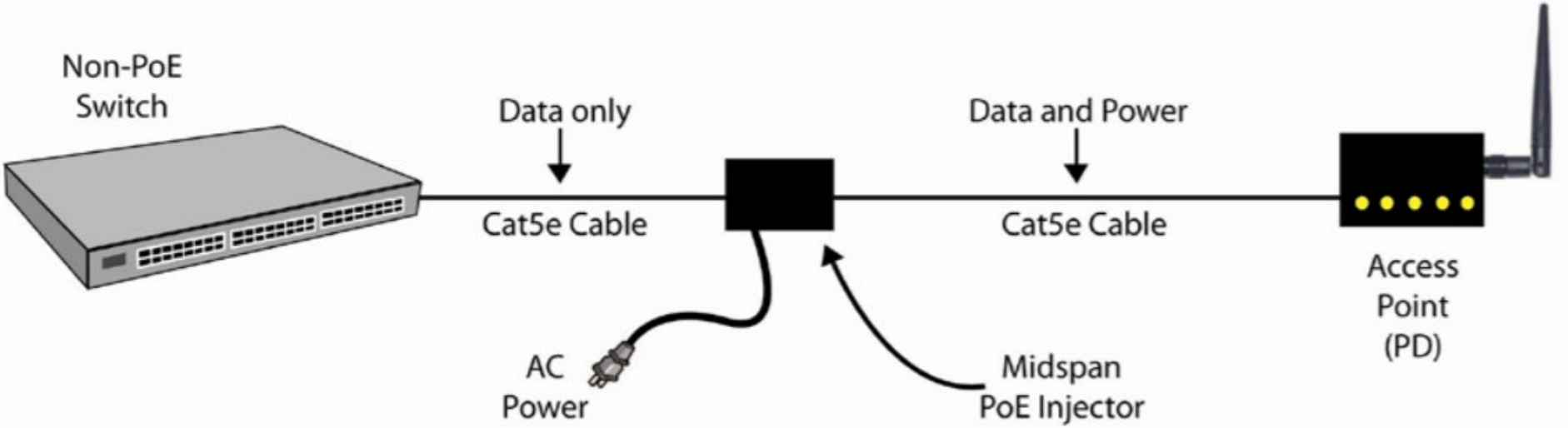


Installation & Use

Powering over Communications Cables - Advantages

- Easier to install
- Cost less than installing traditional power system wiring
- No AC outlet installations; location of equipment is not limited by the availability of AC power
- Flexibility to locate the equipment, such as IP cameras or wireless hotspots, for best use and performance
- Utilize low voltages or safety monitoring systems
- Limited power or overcurrent protection helps protect equipment & wiring from overloads
- Centralized source
  - UPS systems are easy to implement, increasing the reliability of the system
  - Makes command and control of the systems easier
  - Bi-directional flow of data permits each powered device to serve as a monitoring station

Powering over Communications Cabling - Simplifies remote powering



Powering over Communications Cabling - Simplifies local powering

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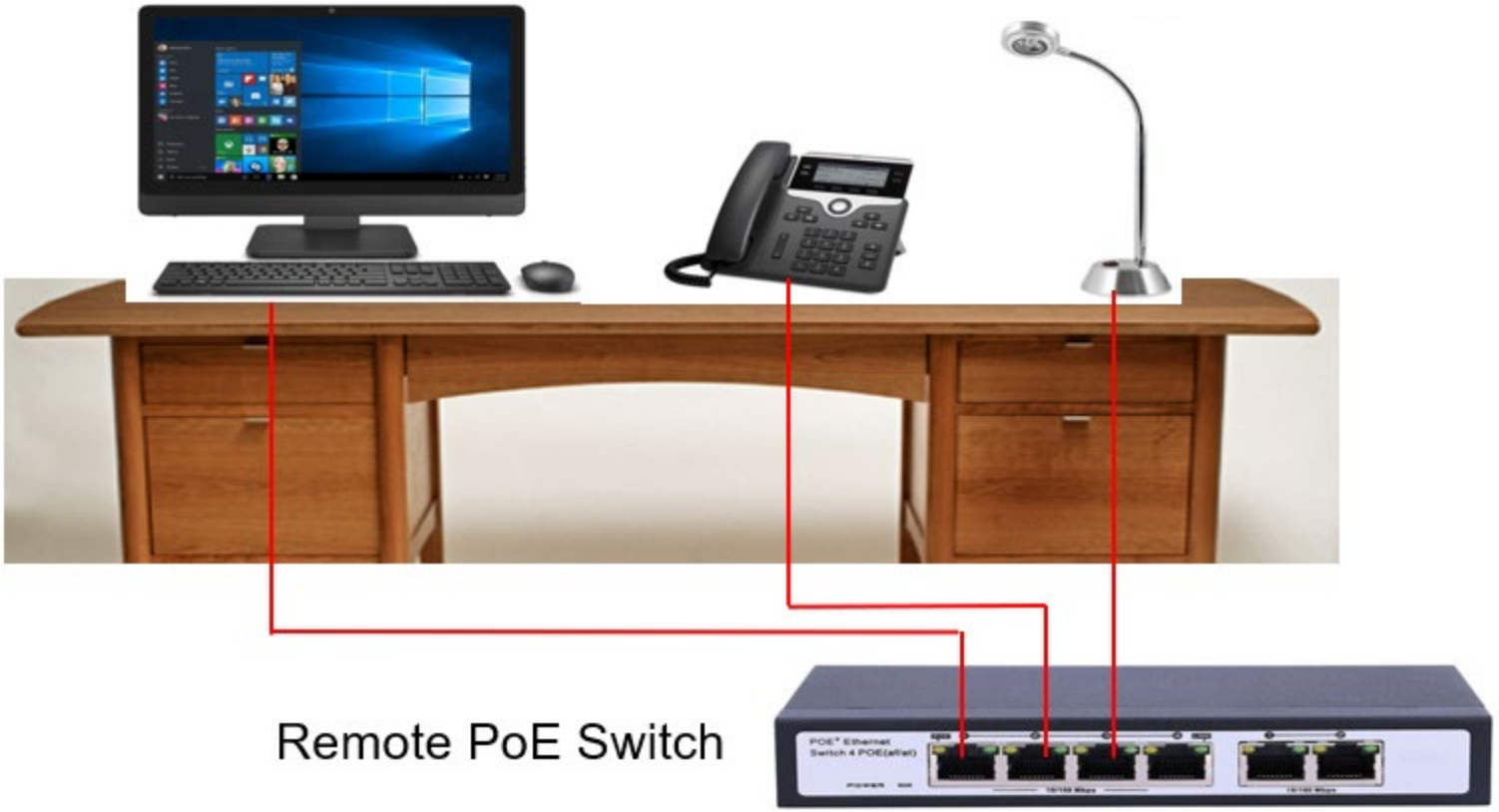

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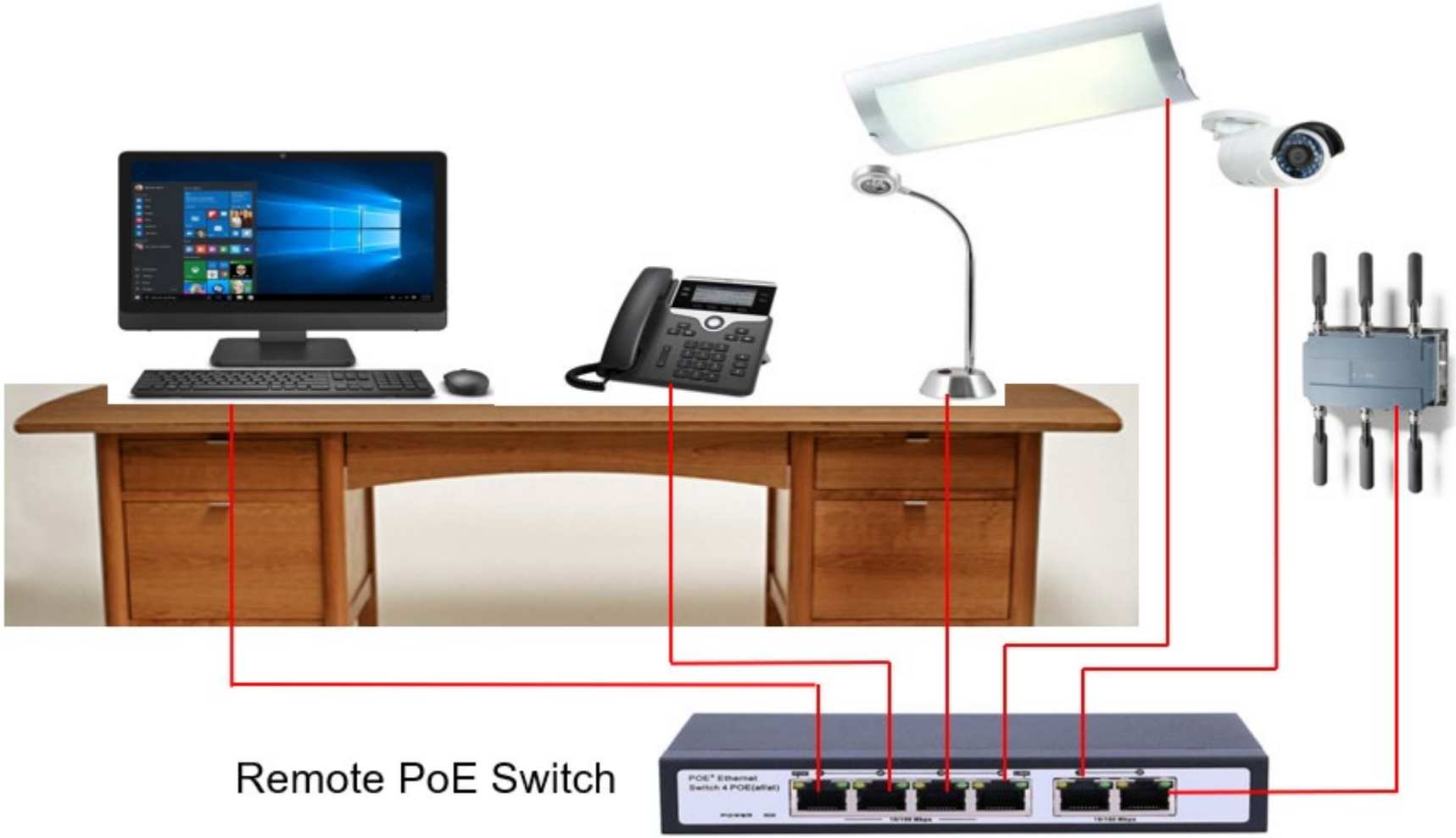
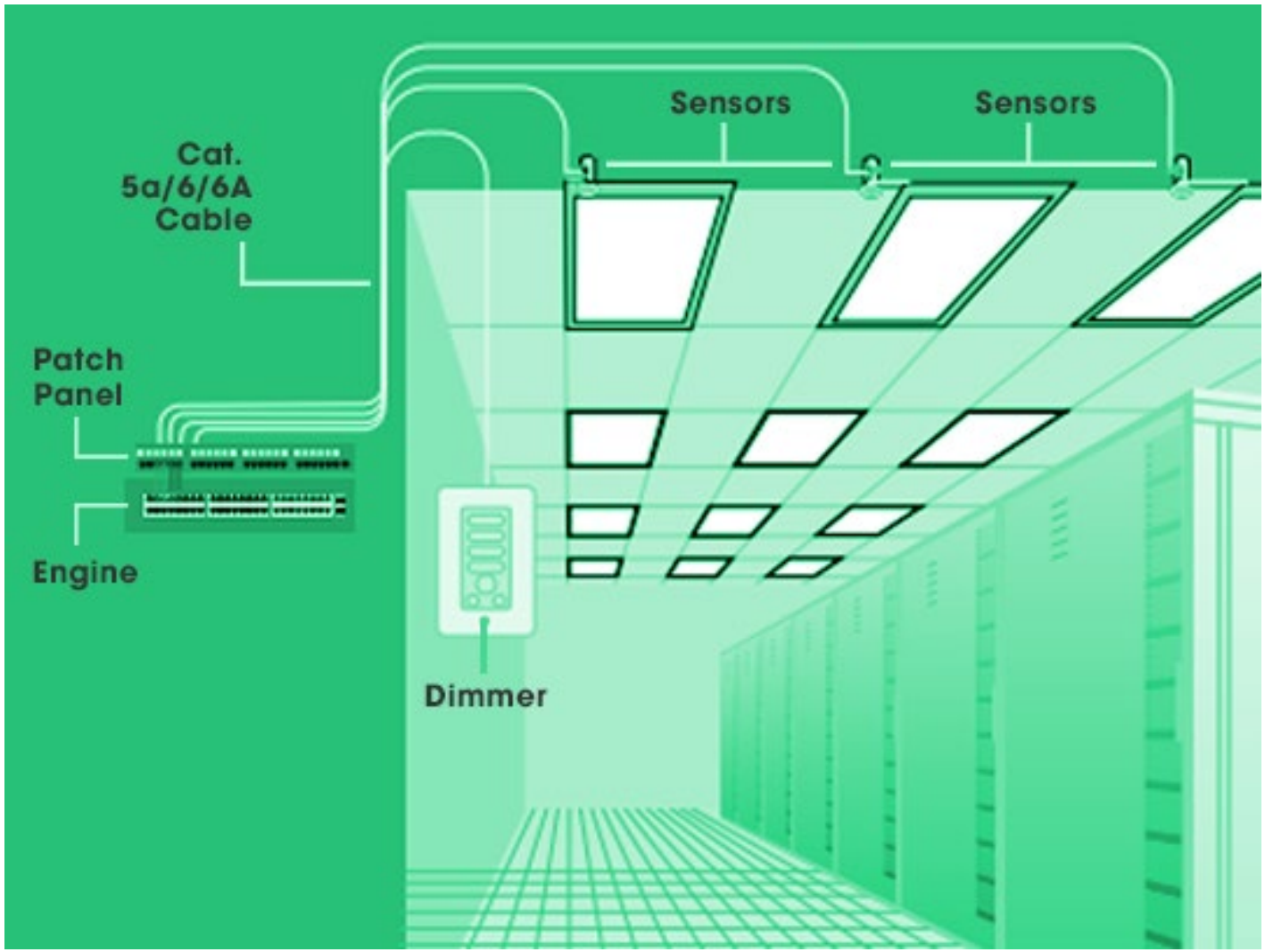
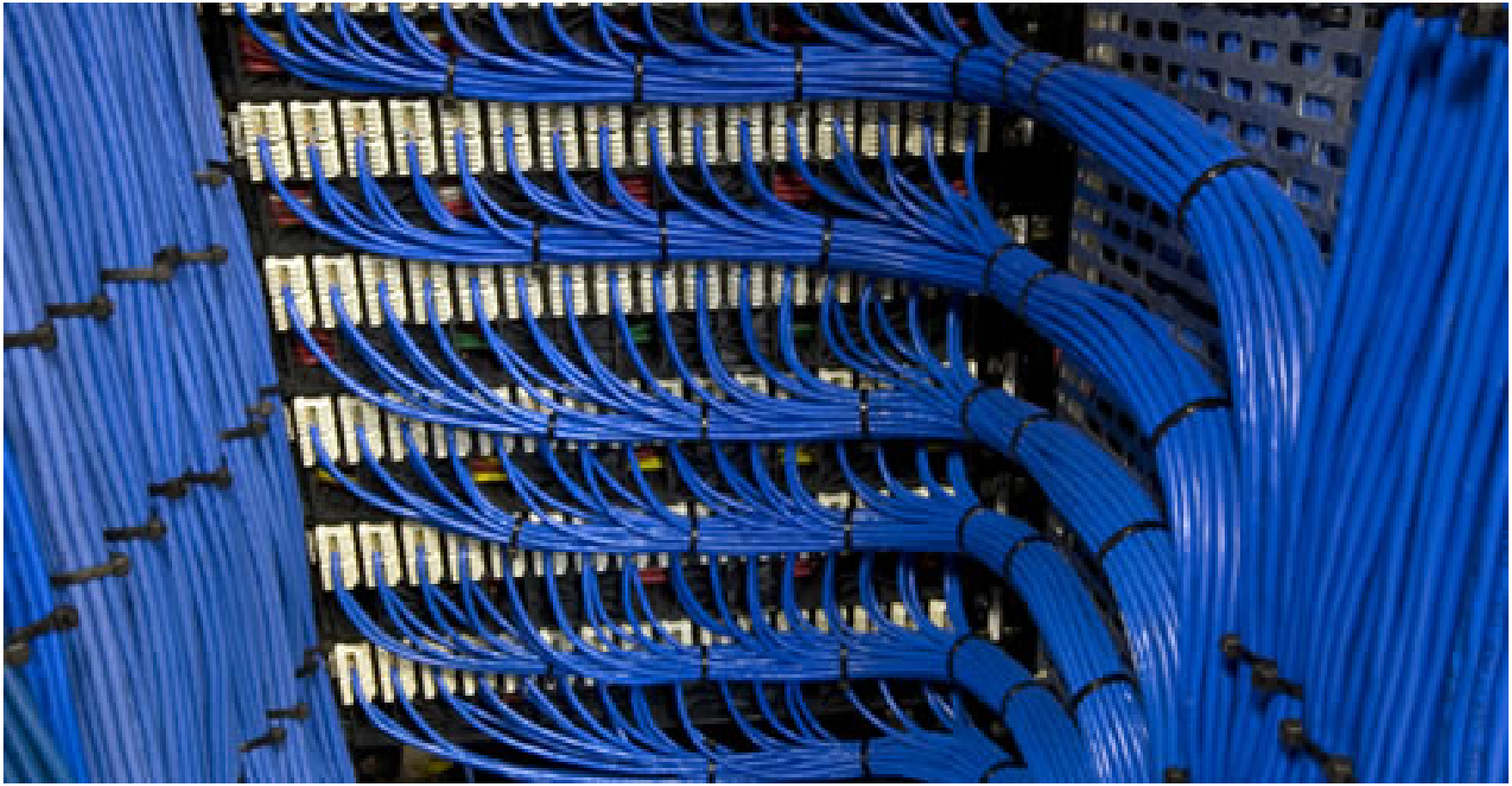


Powering over Communications Cabling - A truly disruptive technology



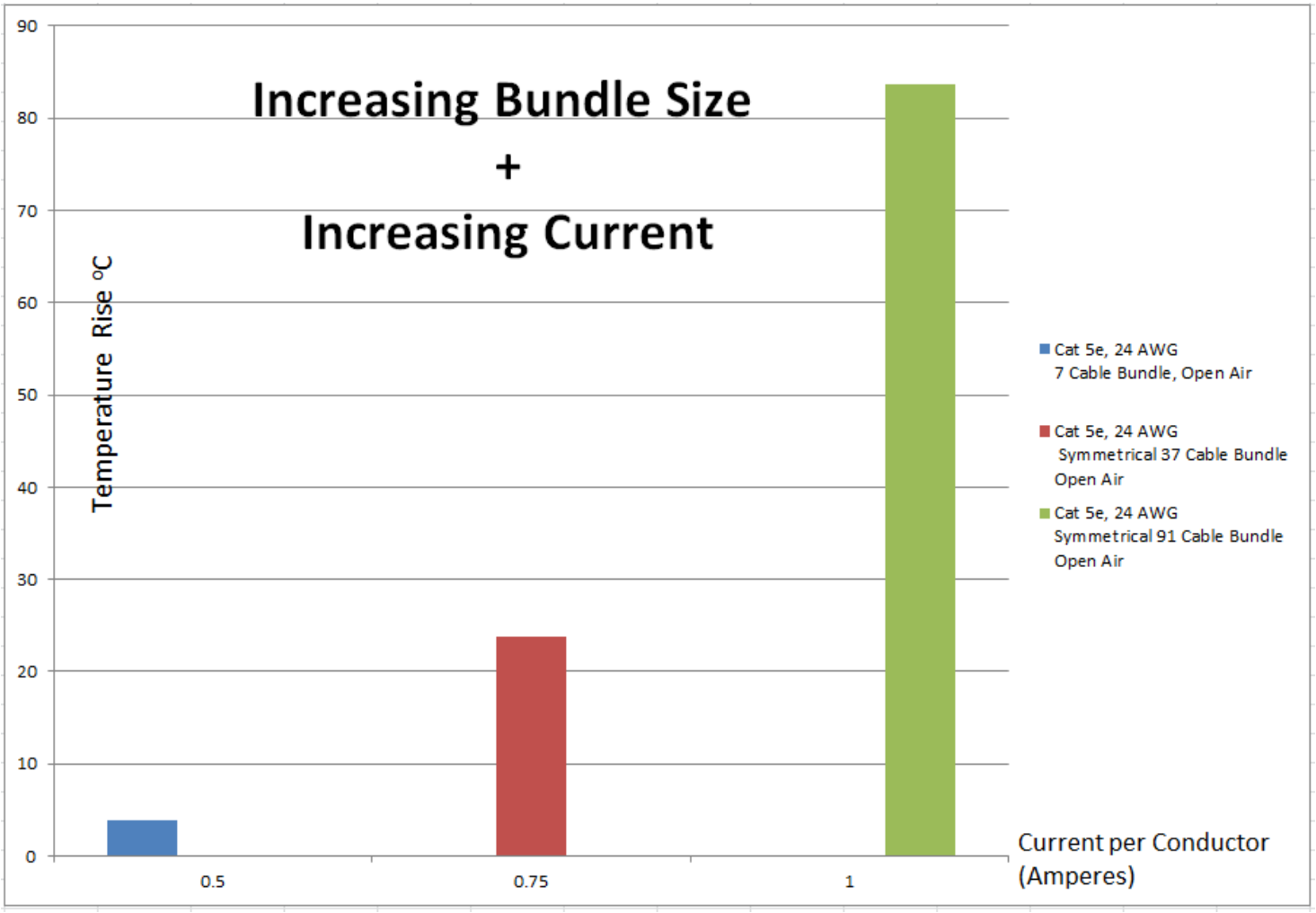
Safety Concerns

Safety Concerns – Overheating of Cables



Fact Finding Study on Cable Heating

Larger Bundles + Higher Currents Produce Excessive Heat



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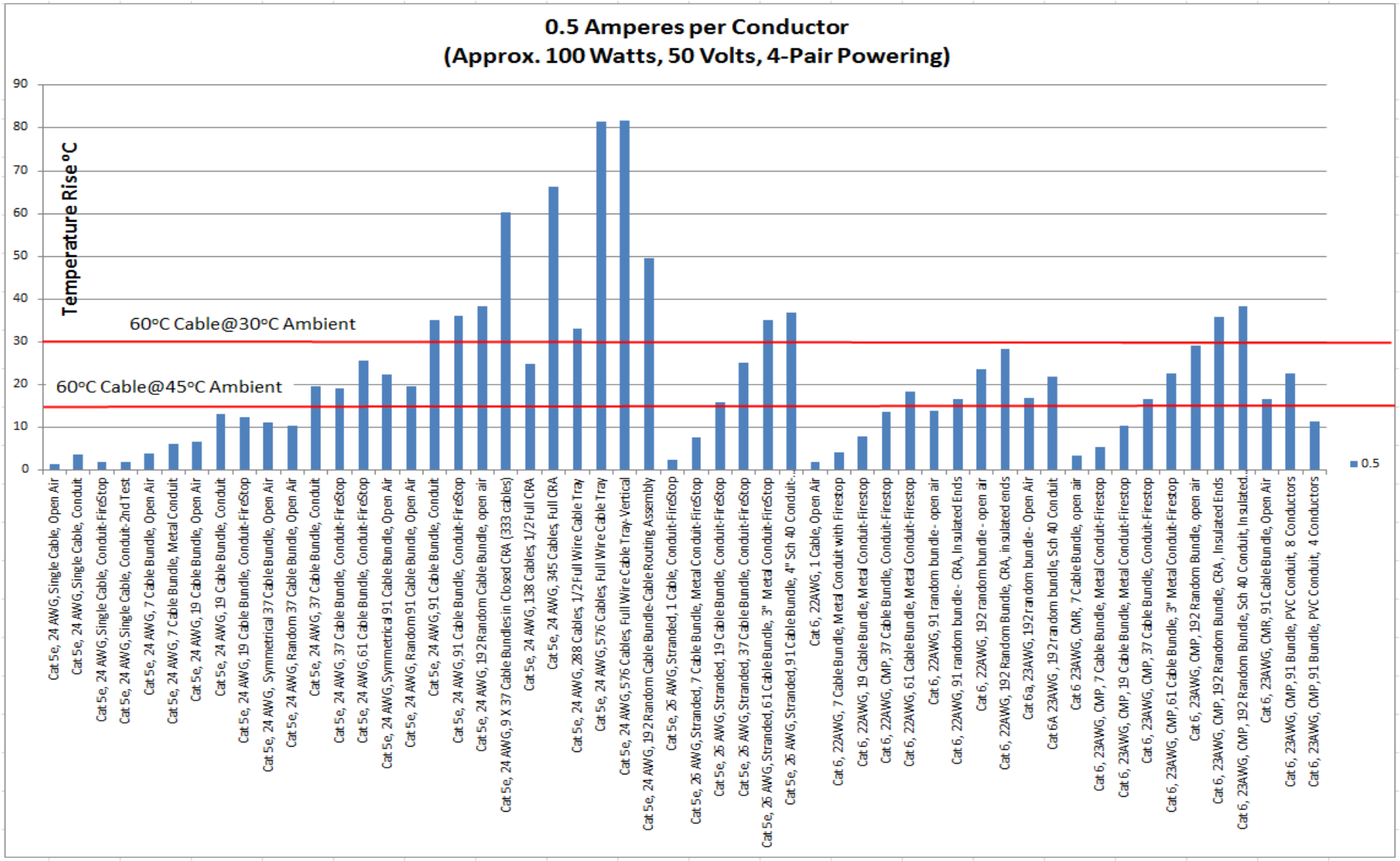
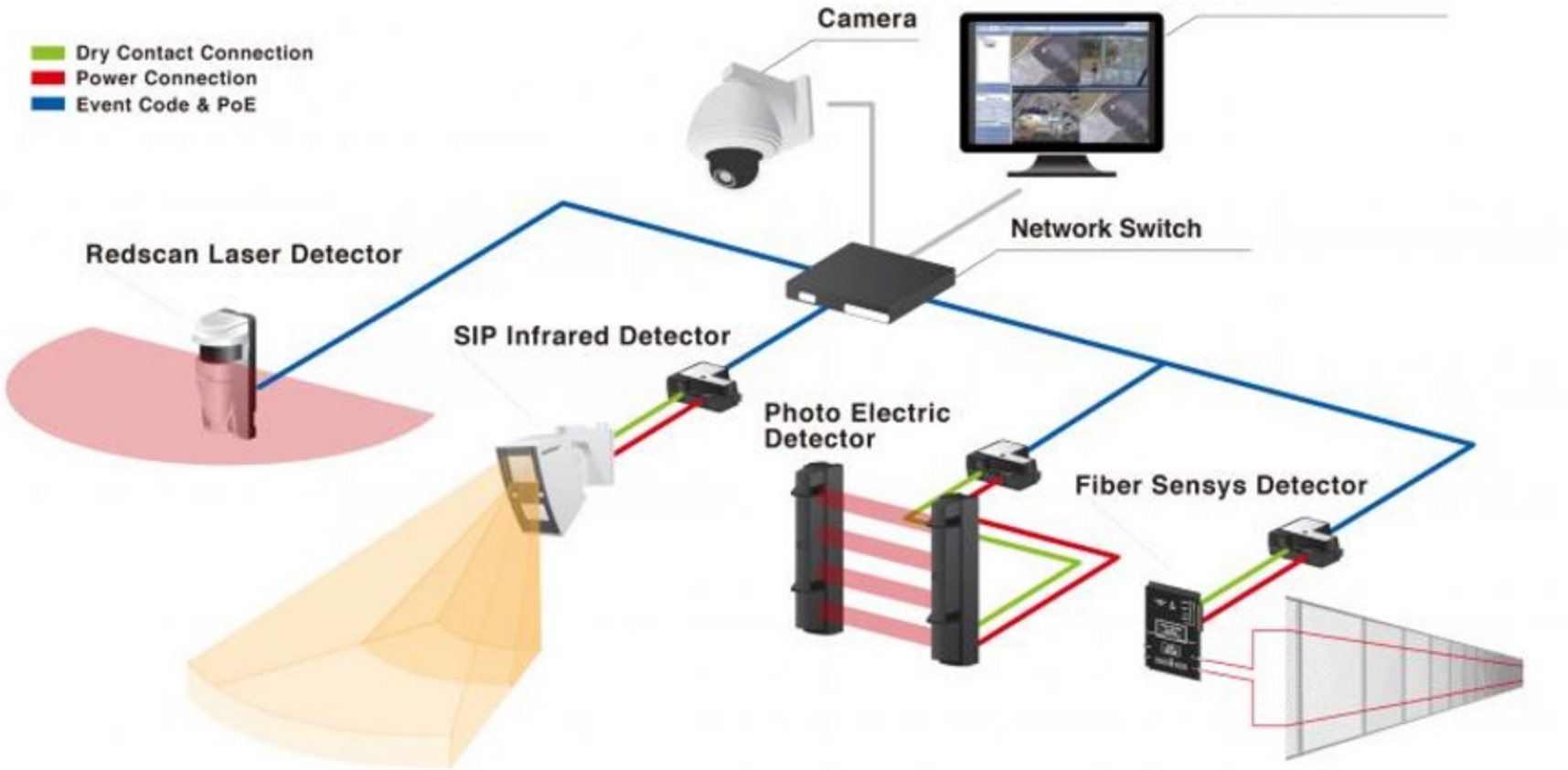
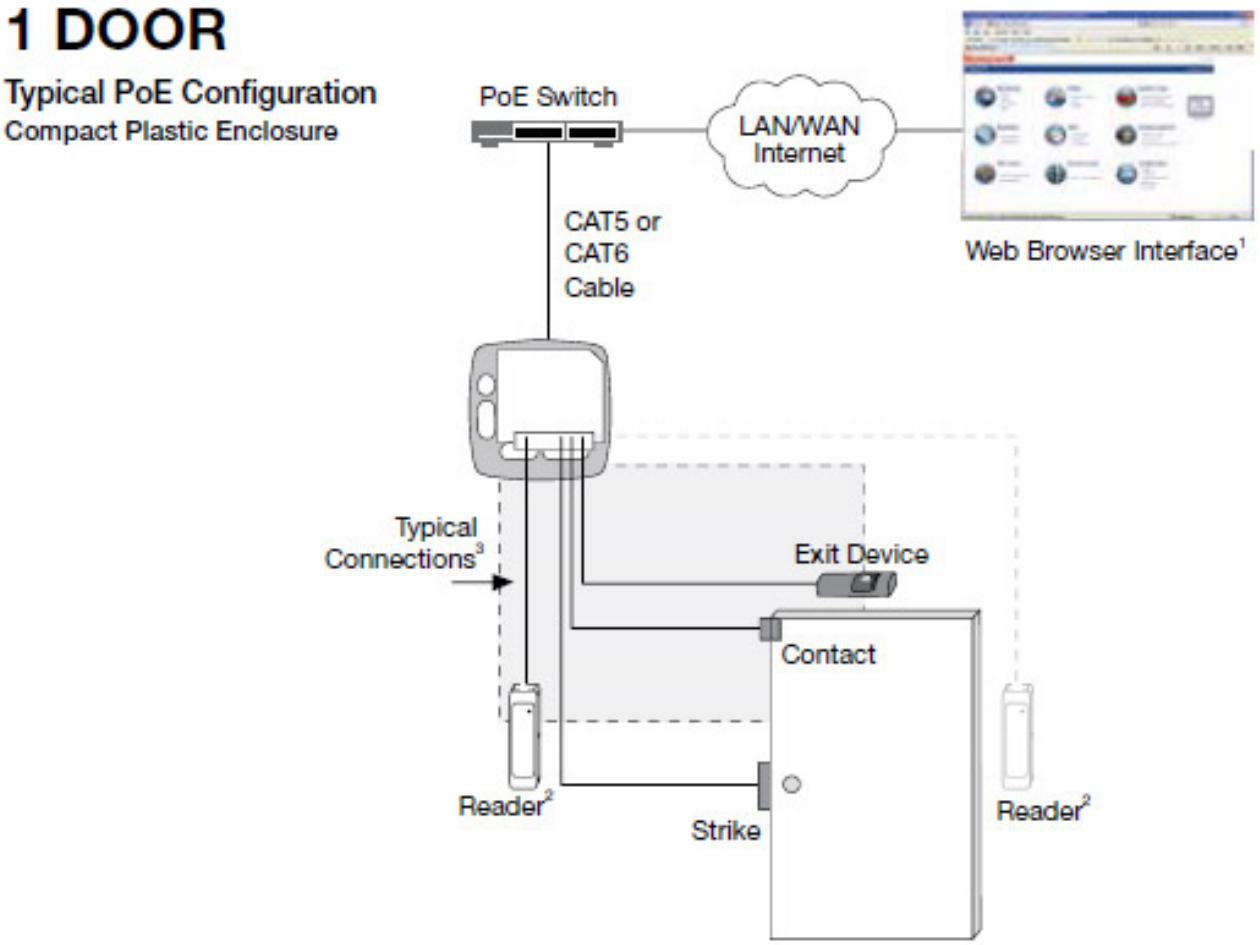


Safety Concerns
WHAT ABOUT PROTECTION????

Powering over Communications Cabling - Safety & Security



Powering over Communications Cabling - Safety & Security



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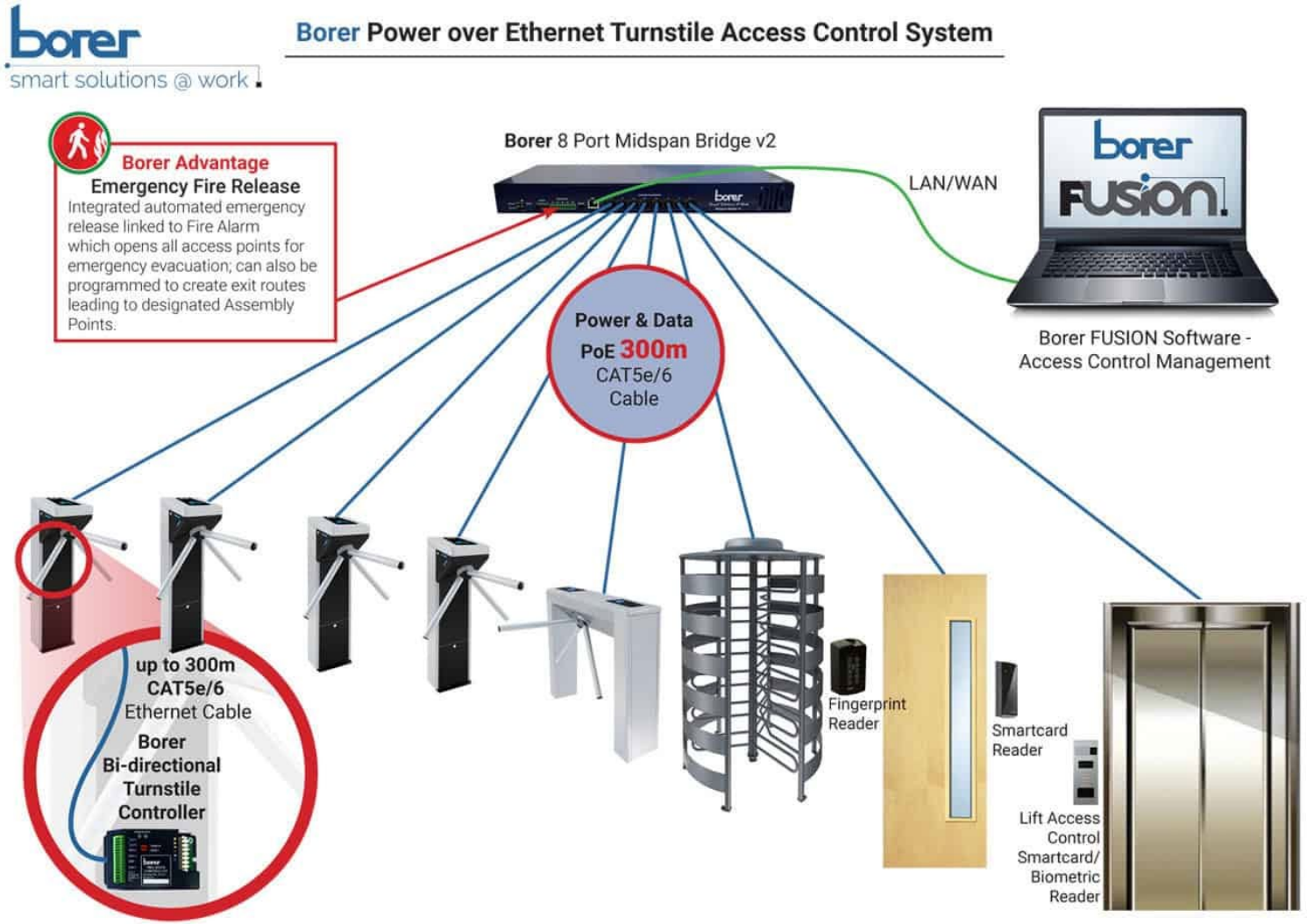

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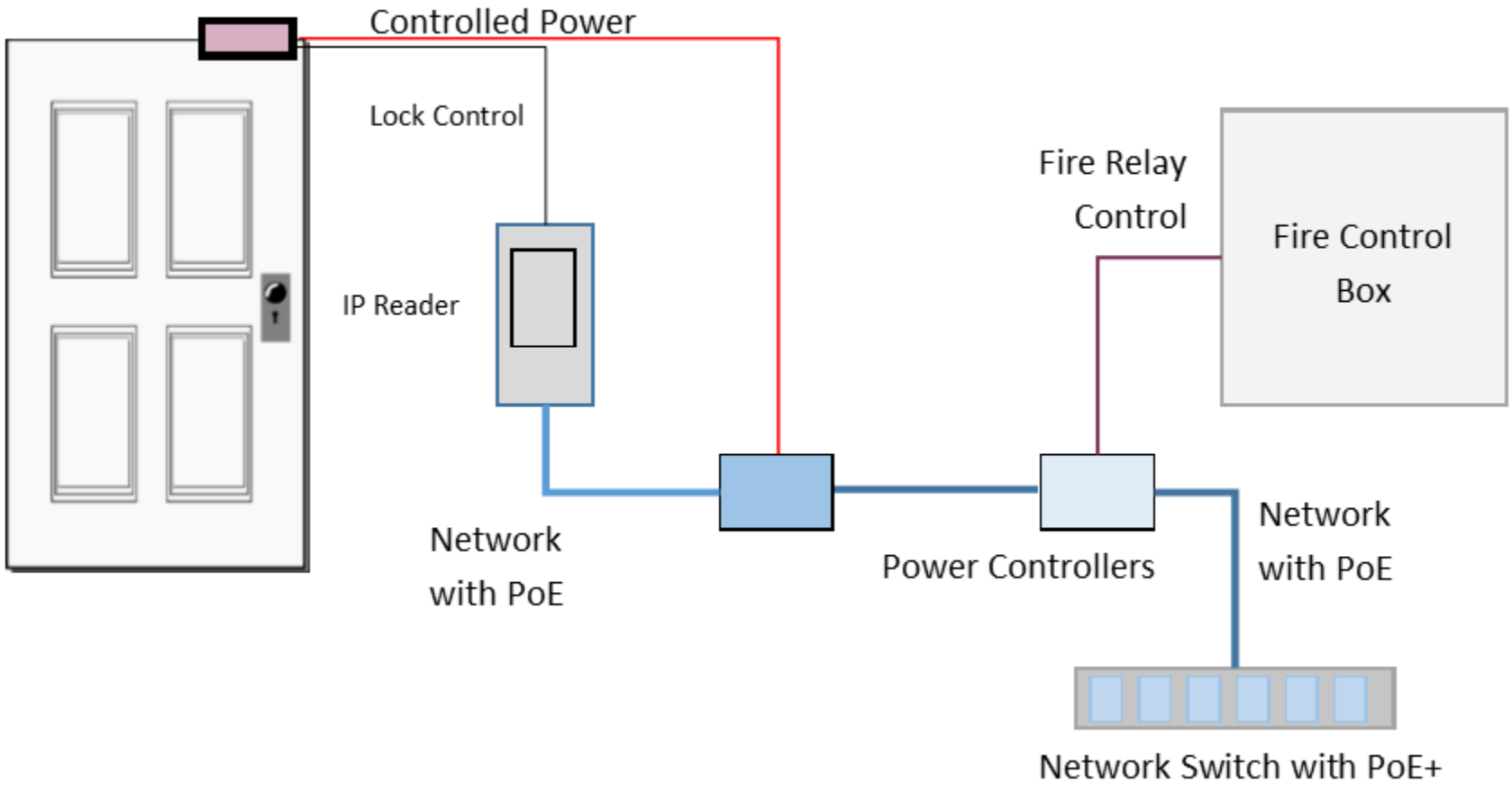

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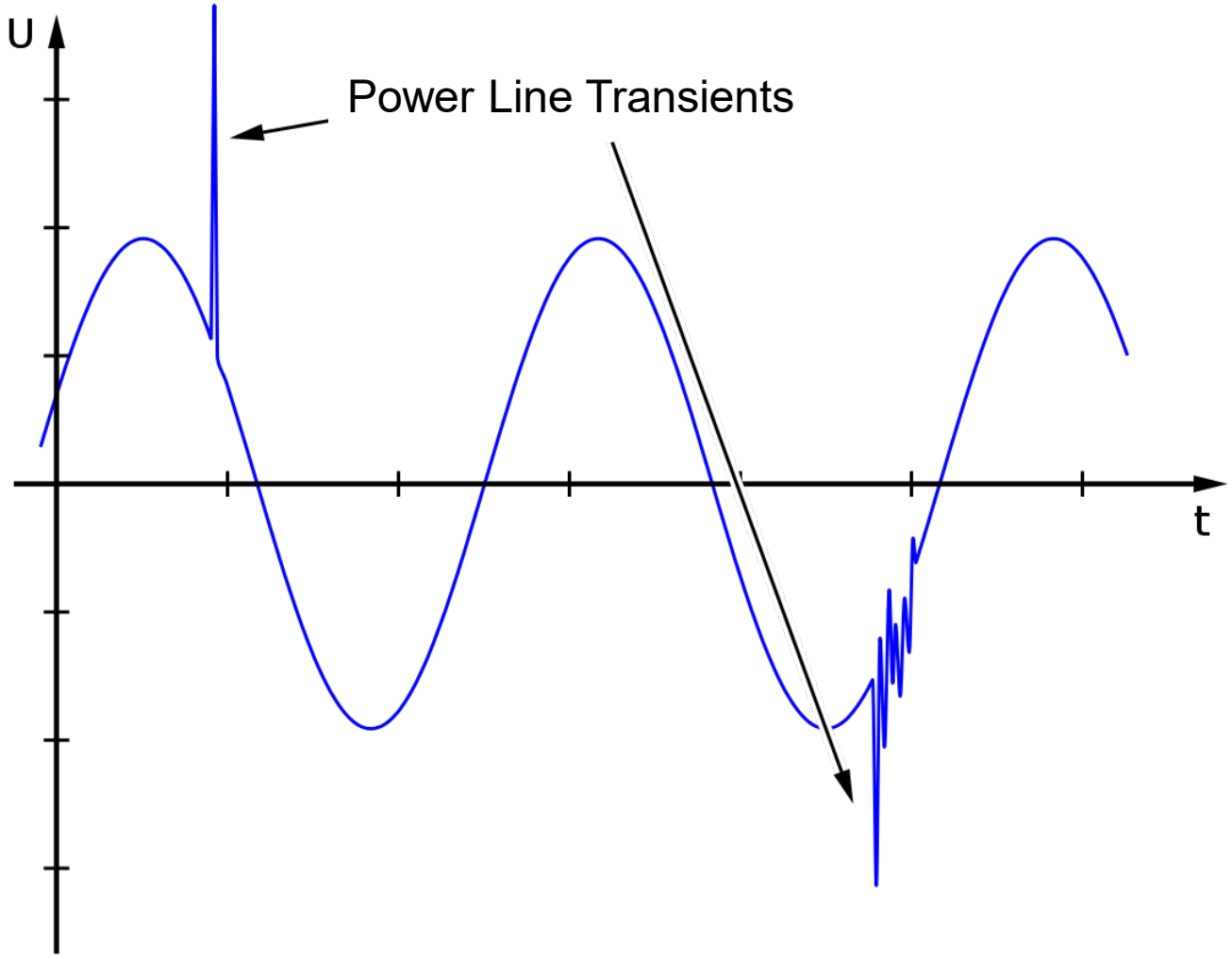

Powering over Communications Cabling - Safety & Security

NFPA Research Foundation: June 2018 PoE Summit Proceedings

"Traditionally, fire alarm systems used a private network with customized copper wiring to connect detection devices to the fire alarm control unit……..However, the world is changing. Utilizing copper telephone lines for fire alarm communication is in the past and integrating building and fire and life safety systems through network technologies is the future."

Powering over Communications Cabling - Safety & Security

Proposal for 2020 NEC

760.36 Surge Protection. A listed surge protective device shall be installed in or on the fire alarm control panel.

Powering over Communications Cabling - Safety & Security

Proposal for 2020 NEC

~~**760.36 Surge Protection.** A listed surge protective device shall be installed in or on the fire alarm control panel.~~

760.36 Surge Protection. If a surge protective device is installed with fire alarm circuit wire and cable, it shall be listed for the purpose.

Powering over Communications Cabling - Exposure to Transients

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NFPA 780 Zone of Protection

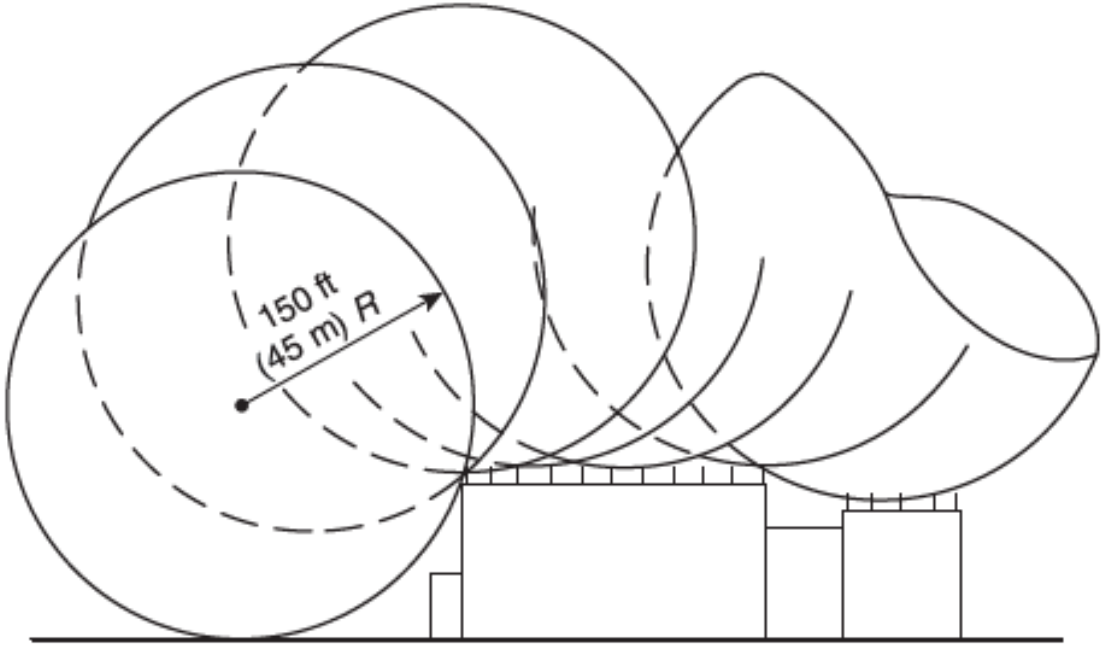
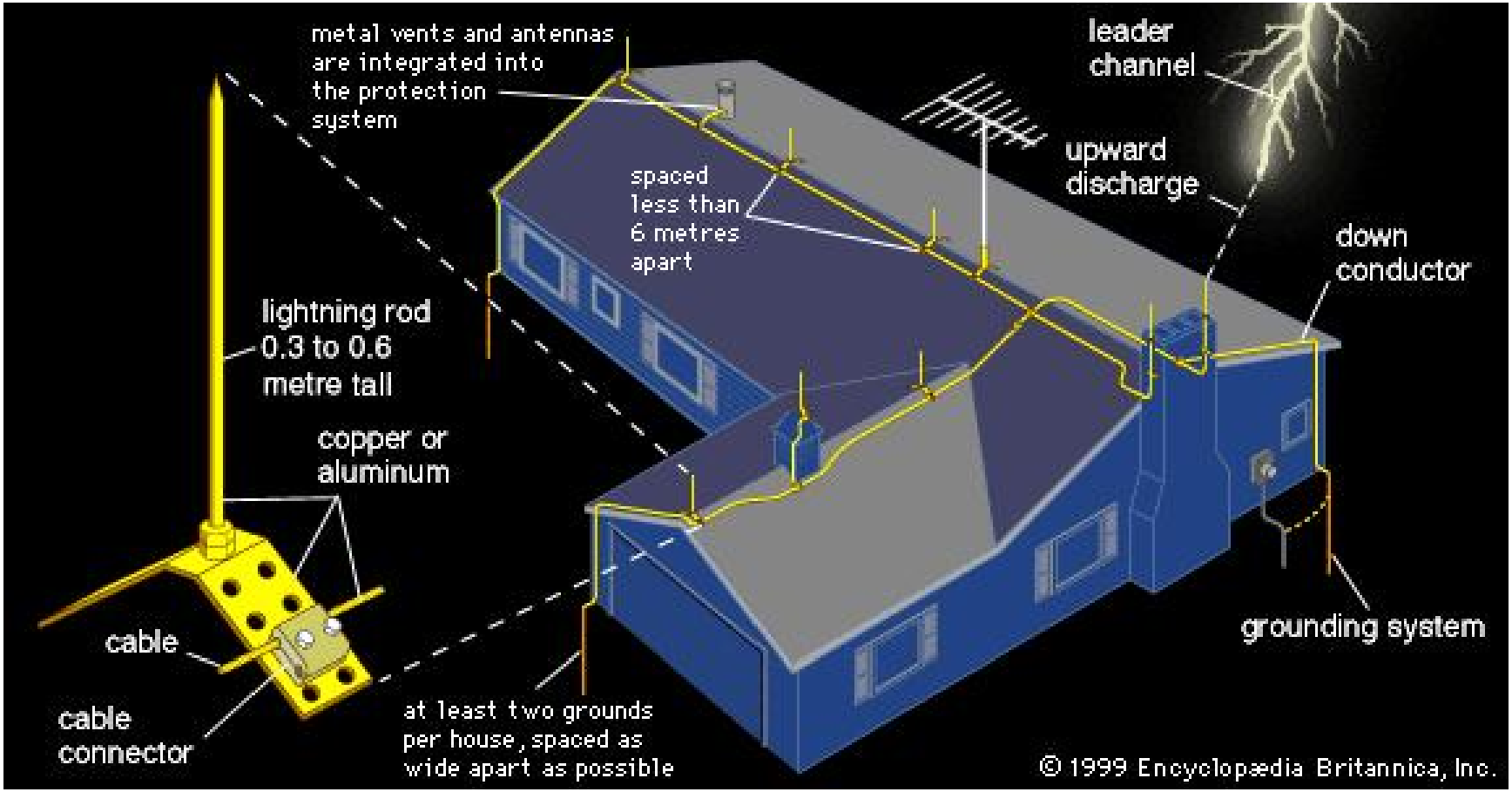


FIGURE 4.8.3.1 Zone of Protection Depicting Rolling Sphere Method.

Powering over Communications Cabling - Exposure to Transients



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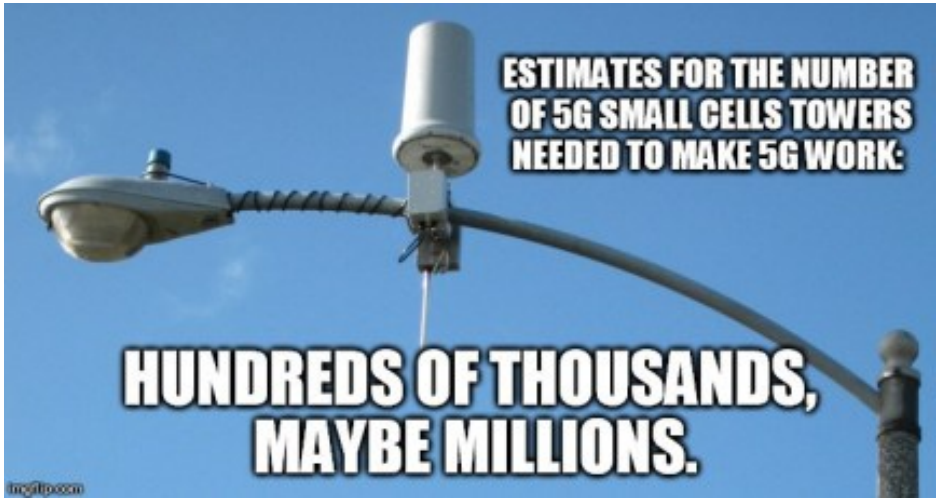
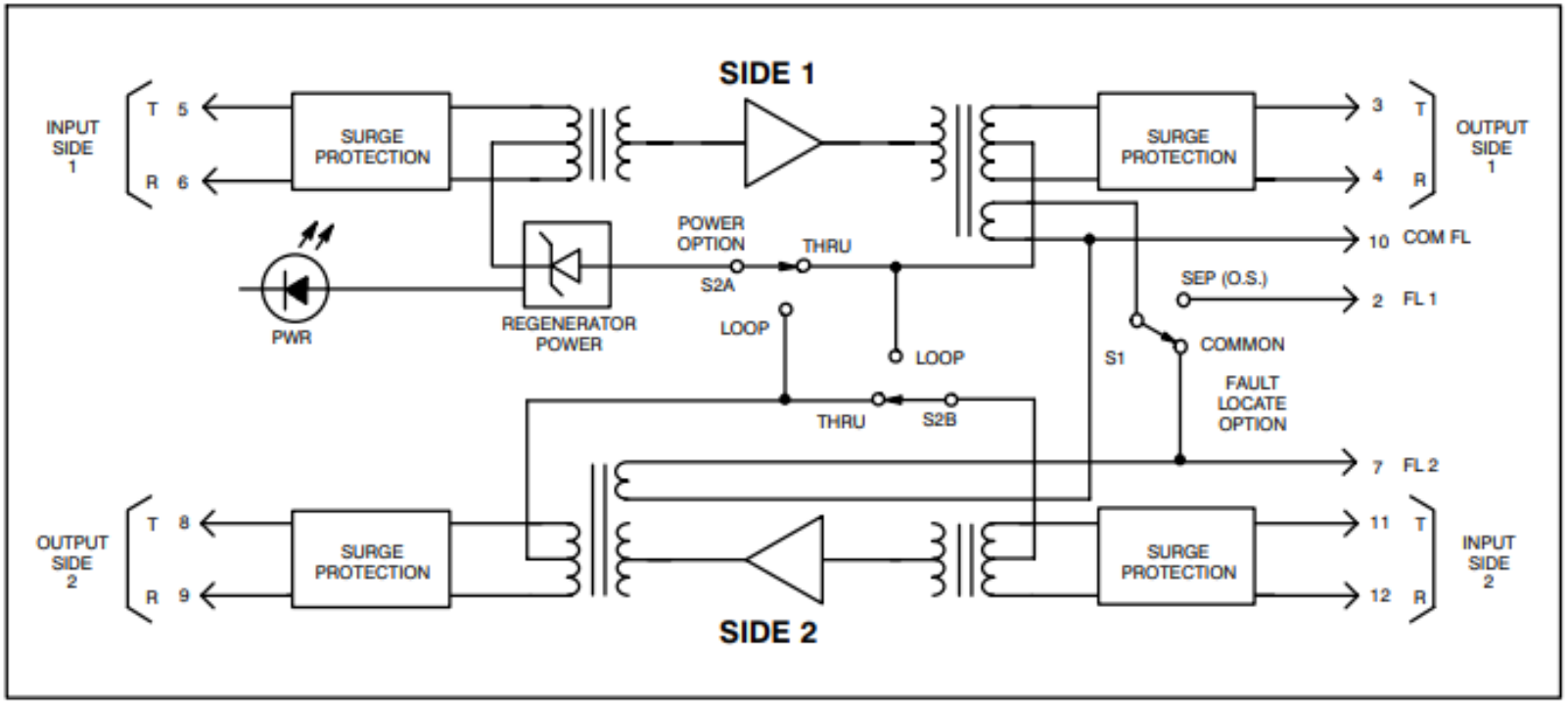


Powering over Communications Cabling - Exposure to Transients

- 5G Smart Pole (Light + 5G Antenna)

Powering over Communications Cabling - Exposure to Transients

- 1960's T-Carrier Span Power
  - Repeater Block Diagram



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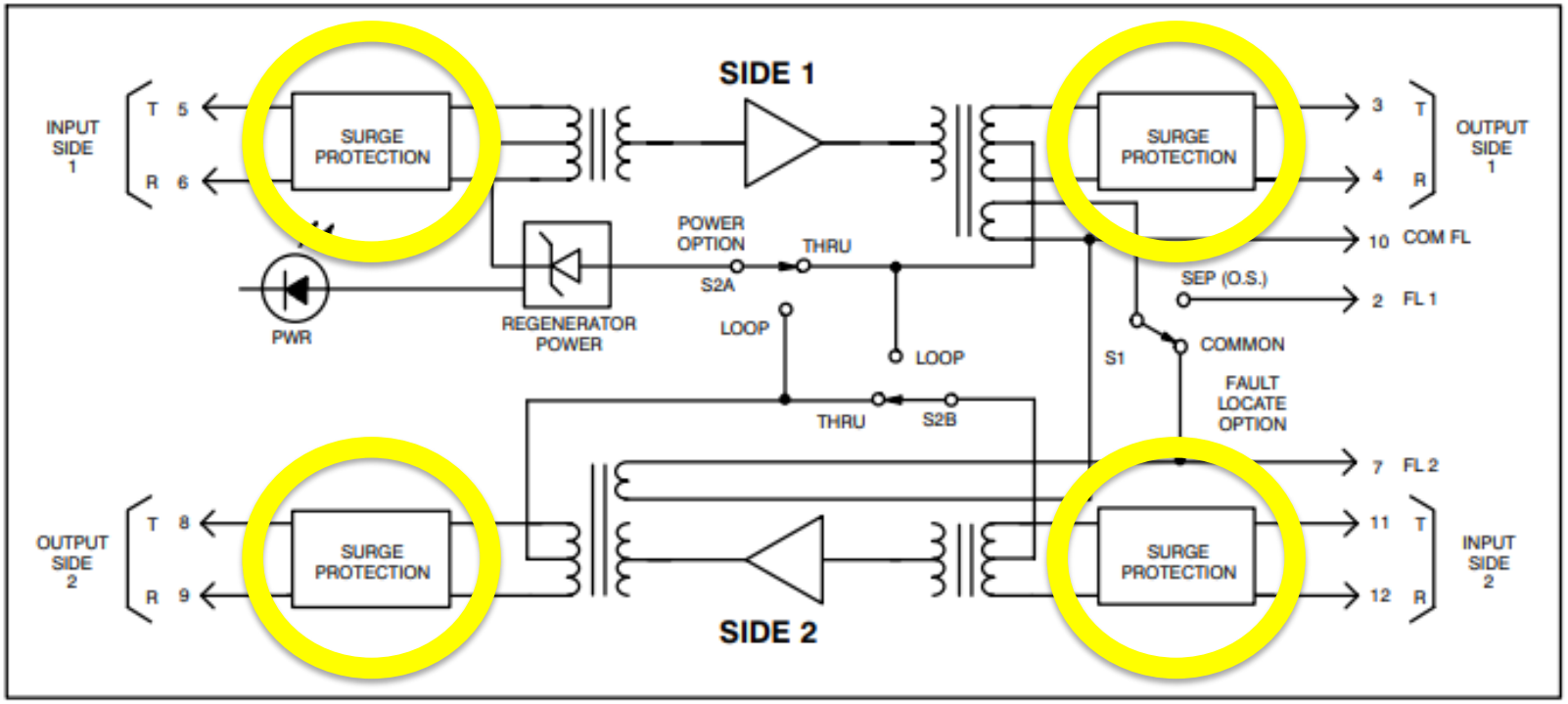

Conclusions

Conclusions

- Growth of power over communications cable systems and applications is moving at light speed
- Quantum shift of the cabling and power distribution status quo; a disruptive technology
- Systems ~~will be~~ **are being** used for life safety and security
- Protection will play an important role in maintaining the integrity and reliability of the networks

THANK YOU