

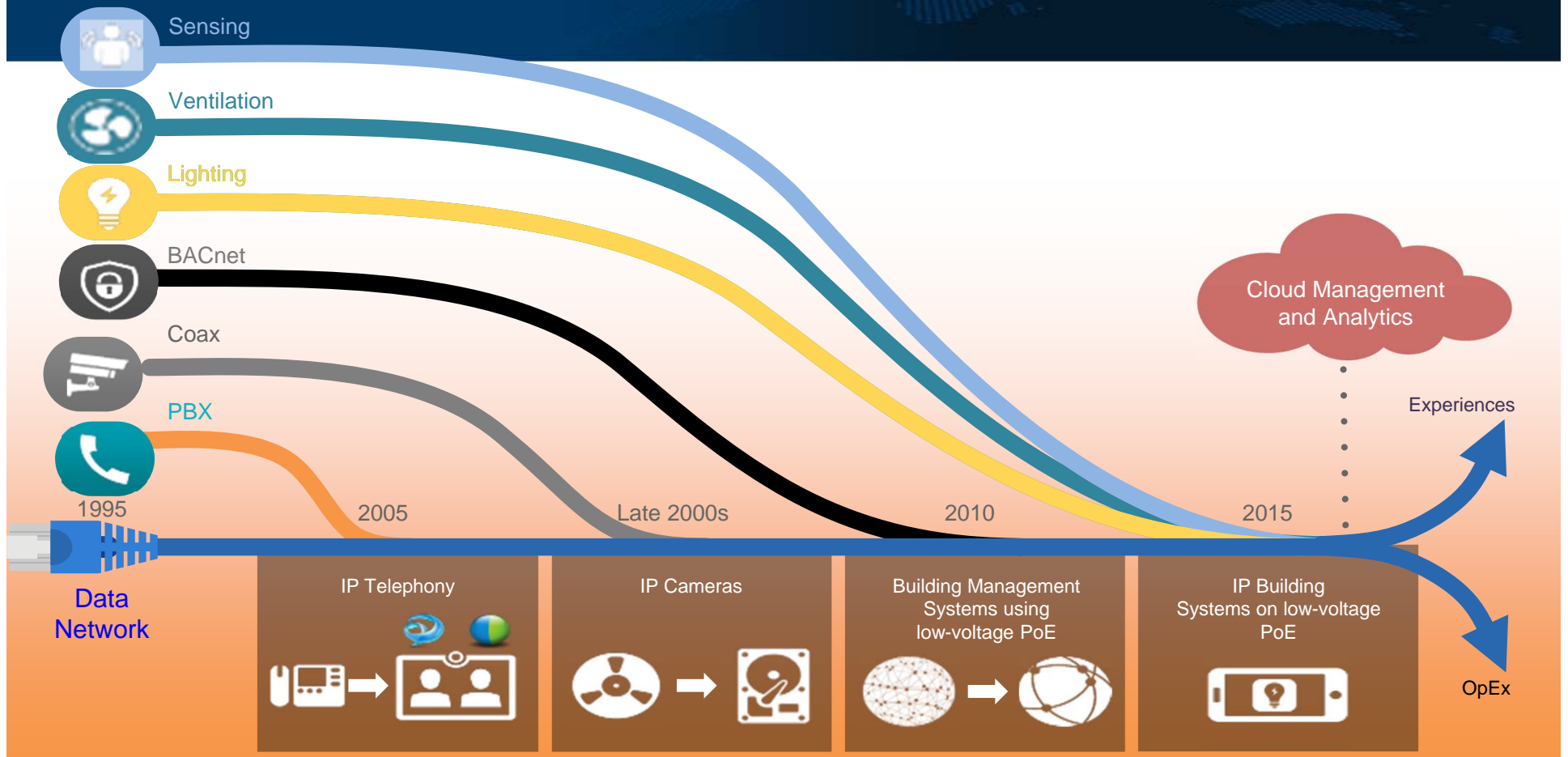


Digital Building and the PoE evolution

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IP Convergence for Digital Building Technologies



Building management impact



- **Safe Low Voltage**
- Moves, Adds & Changes without turning circuit power off
- **Common cabling** system
- Potential **energy savings**



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What is a Digital Ceiling

- Wireless Access Points
- Security cameras
- Speakers
- Clocks
- Signage
- Life safety systems
- **Lighting**



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Intelligent lighting transforms the Enterprise



- **LED** technology
- Sense **occupancy**
- Control individual **light levels**
 - adapt to ambient
- Control **colour temperature**
 - Improve mood & productivity

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Waterpark Place III Toronto CANADA



“The possibilities of this connected lighting system are endless. There are so many capabilities of this system that we haven’t even explored yet.”

Richard Lees, Senior Project Manager at CBRE Limited, a commercial real estate and investment services firm

- Digital ceiling implementation
- **Converged** network
 - HVAC
 - LED Lighting
 - Access control
 - Metering
 - Security cameras
- **Green** certification
- **Lower CapEx (10%)**
- **Lower OpEx (600k PA)**



PoE lighting adoption



- Intel research campus - **Bangalore**
- Torre Europa office building - **Madrid**
- Alliander campus – **Netherlands**
- Waterpark place – **Toronto**

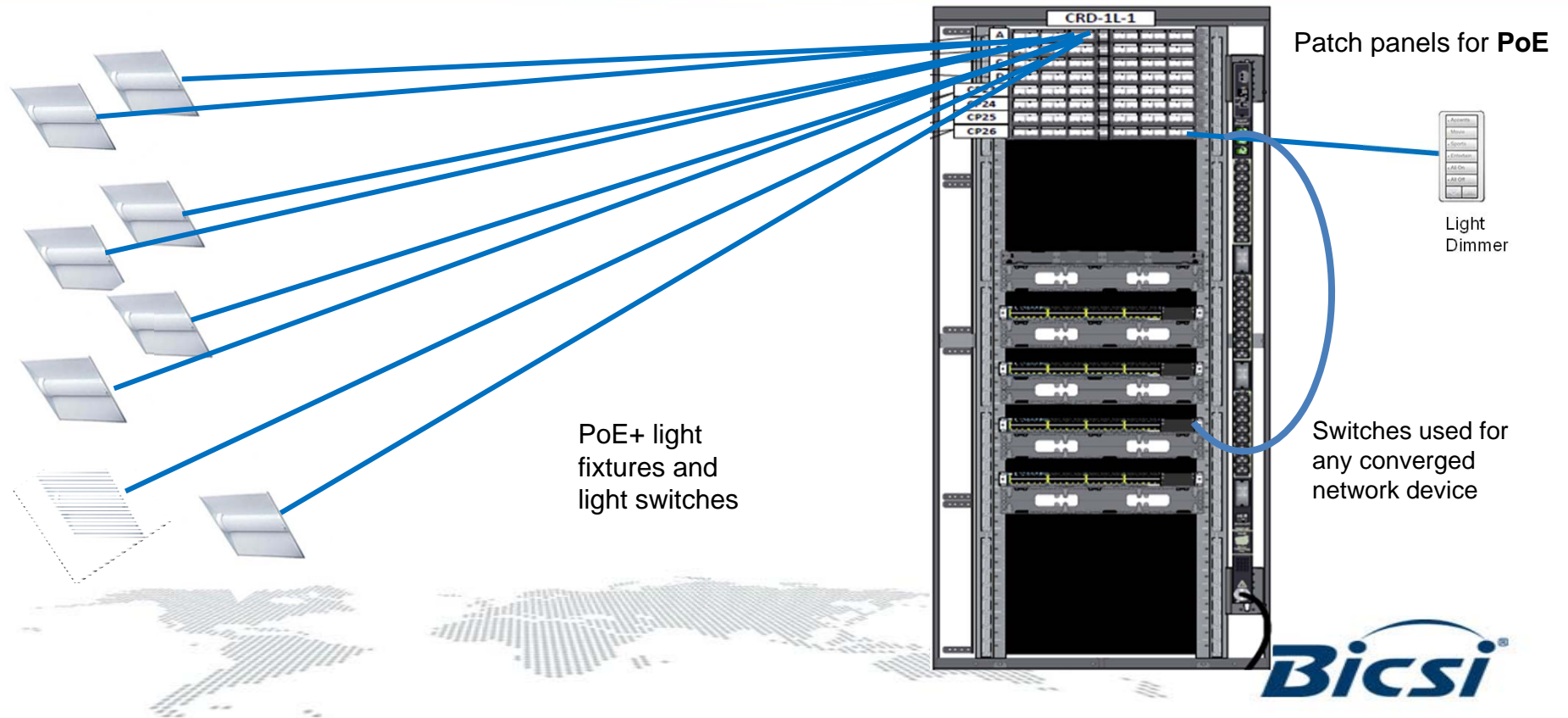


Current State of Digital Building

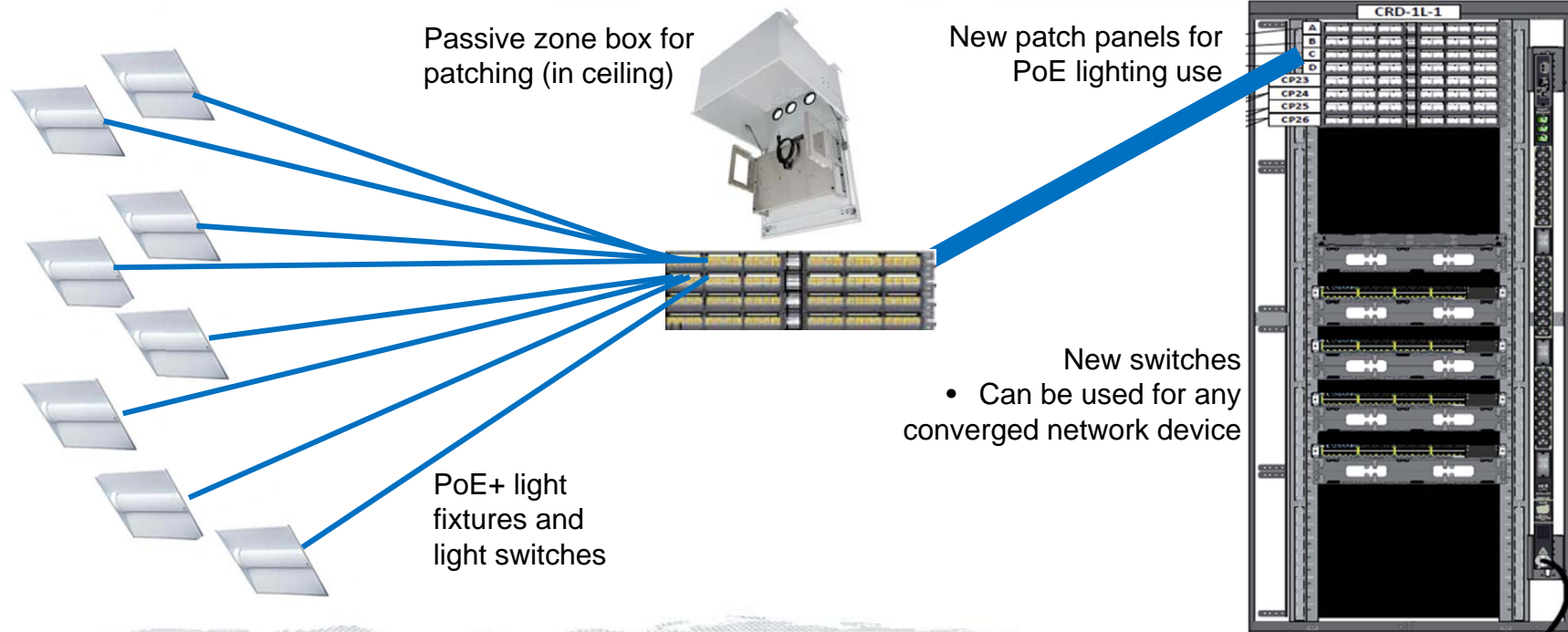
- So far some **early adopters**
- CapEx cost considerations
 - Network **switch port required for each device**
 - **Common cabling infrastructure** simplifies deployment
 - Cabling installation **does not require Electrician**
 - **LED lighting** technology can use PoE
- Hardware, sensors and software are available today
- Legacy building management systems difficult to switch over.
- **Green field** opportunity



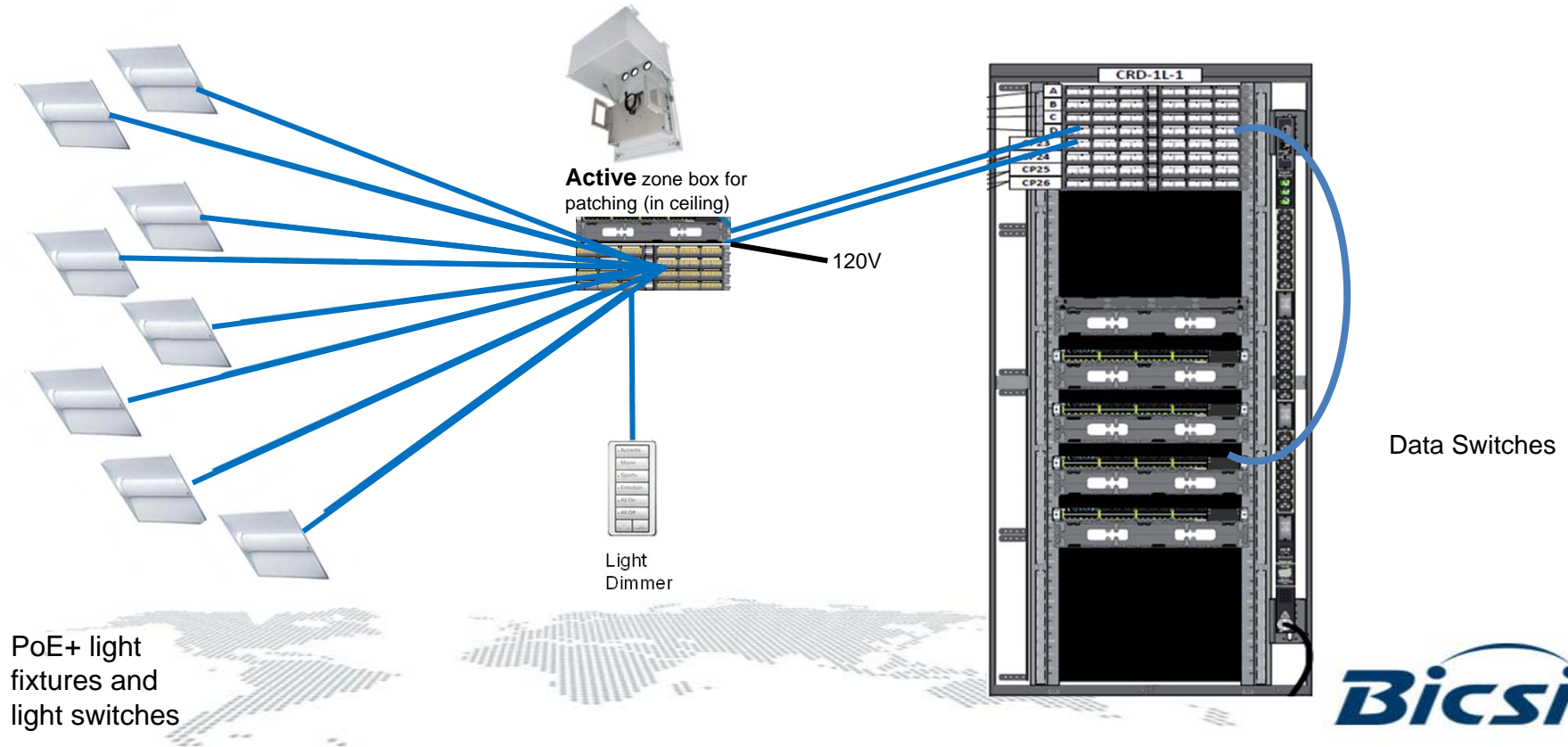
PoE Lighting Topology – Home Run



PoE Lighting Topology – Passive Zone



PoE Lighting Topology – Active Zone



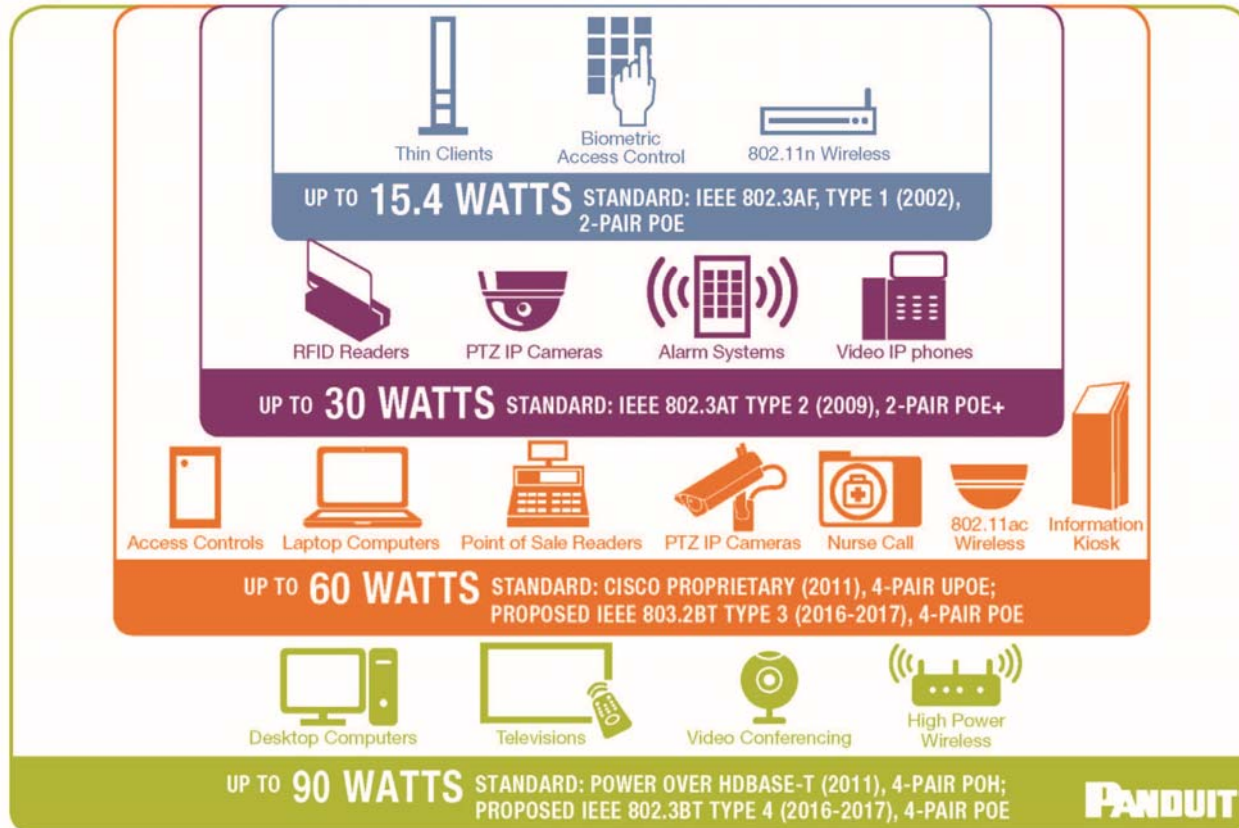
Standards for PoE cabling



- **IEEE 802.3bt**
 - PoE electrical interface standard
- **TIA TSB-184-A**
 - Guidelines for Supporting Power Delivery Over Balanced Twisted-Pair Cabling
- **IEC 60512-99-002**
 - Standard for connectivity with engaging / disengaging PoE
- **ANSI/TIA-568-C.2**
 - Cabling performance standard
- **ANSI/TIA-569-D**
 - Additional guidelines for pathways
- **ISO/IEC TR-29125 and CENELEC TR 50174-99-1**
 - International cabling guidelines for PoE++



PoE technology migration



← 2002

← 2009

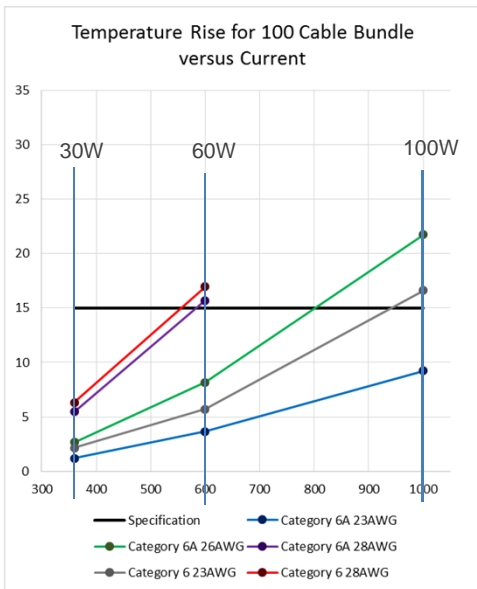
← Today



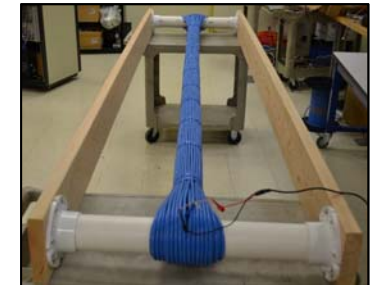
PoE standards

Type	Standards	Maximum Current	Number of Energized Pairs	Power at Source	Power at Device	Maximum Data Rate	Standard Ratified
PoE	IEEE 802.3af (802.3at Type 1)	350 mA	2	15.4 W	13 W	1000BASE-T	2002
PoE+	IEEE 802.3at Type 2	600 mA	2	30 W	25.5 W	1000BASE-T	2009
PoE++ (4PPoE)	Proposed IEEE 802.3bt Type 3 Proposed IEEE 802.3bt Type 4	600 mA 960 mA	4	60 W 99 W	51 W 71 W	10GBASE-T	Expected 1Q2018
No IEEE standard	Cisco UPOE HDBaseT (www.hdbaset.org)	600 mA 1000 mA	4	60 W 100 W	51 W 100 W	Varies	Exists today – no official ratification

PoE Temperature rise in cable bundles



- **TIA TSB-184-A**
 - Sets guidelines
- Limit temperature rise to less than 15°C above ambient
- Temperature rise in centre of bundle
- Temperature rise concerns:
 - Signal attenuation
 - Physical damage
- **Cat 6A has best performance**



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PoE Maximum Cable Bundle Size Guidelines

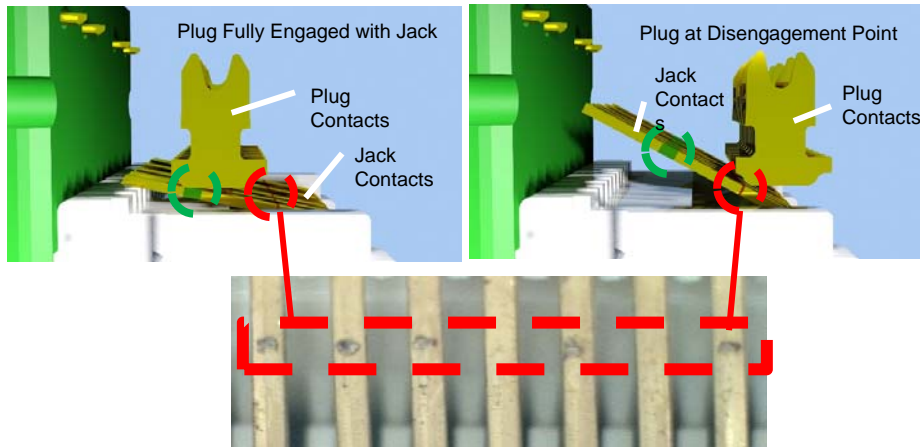
Cable Type	PoE++ Type 4
Cat 5e 24 AWG	52
Cat 6 23 AWG	64
Cat 6A 23 AWG	74

- **TIA TSB-184-A**
 - Sets guidelines
 - Conservative
- Cat 6A has best performance



PoE causing “sparks to fly”

Image shows a plug mating with a jack (plug and jack housings removed)



- **IEC 60512-99-002**
 - PoE connectivity performance testing standard
- **Unplugging live PoE causes a spark** between plug and jack contacts
- Potential **carbon build up**

PoE Effect of Heat on Channel Length

Temperature °C	Maximum* horizontal length, unscreened (m)	Maximum* horizontal length, screened (m)
20	90.0	90.0
25	89.0	89.5
30	87.0	88.5
35	85.5	87.7
40	84.0	87.0
45	81.7	86.5
50	79.5	85.5
55	77.2	84.7
60	75.0	83.0

* Assumes 10 meters of patch at 20 degrees C
From ANSI/TIA-568-C.2, Table G.2

- **ANSI/TIA-568-C.2**
 - Structured cabling standard.
 - Guidance on link length with respect to temperature.
- Insertion loss increases with temperature
- **Derating of maximum channel length**
- Shielded has better heat dissipation



PoE Pathway implications



Temperature



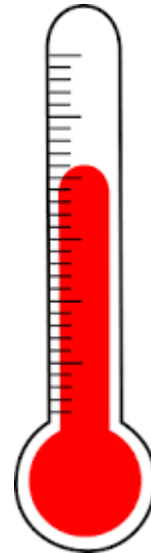
Resistance



Insertion Loss



Network
Performance



- **ANSI/TIA-569-D**
 - Pathways and spaces

Summary

- The digital building is a reality
 - On going migration and adoption of IP enabled devices
 - More power available for devices with PoE ++
- Designs need to consider
 - Updated standards
 - Cabling topology & performance
 - Category 6A recommended for PoE ++
 - Temperature rise due to PoE

