Power over Ethernet (PoE) Watts in your Network?

Jake Edler

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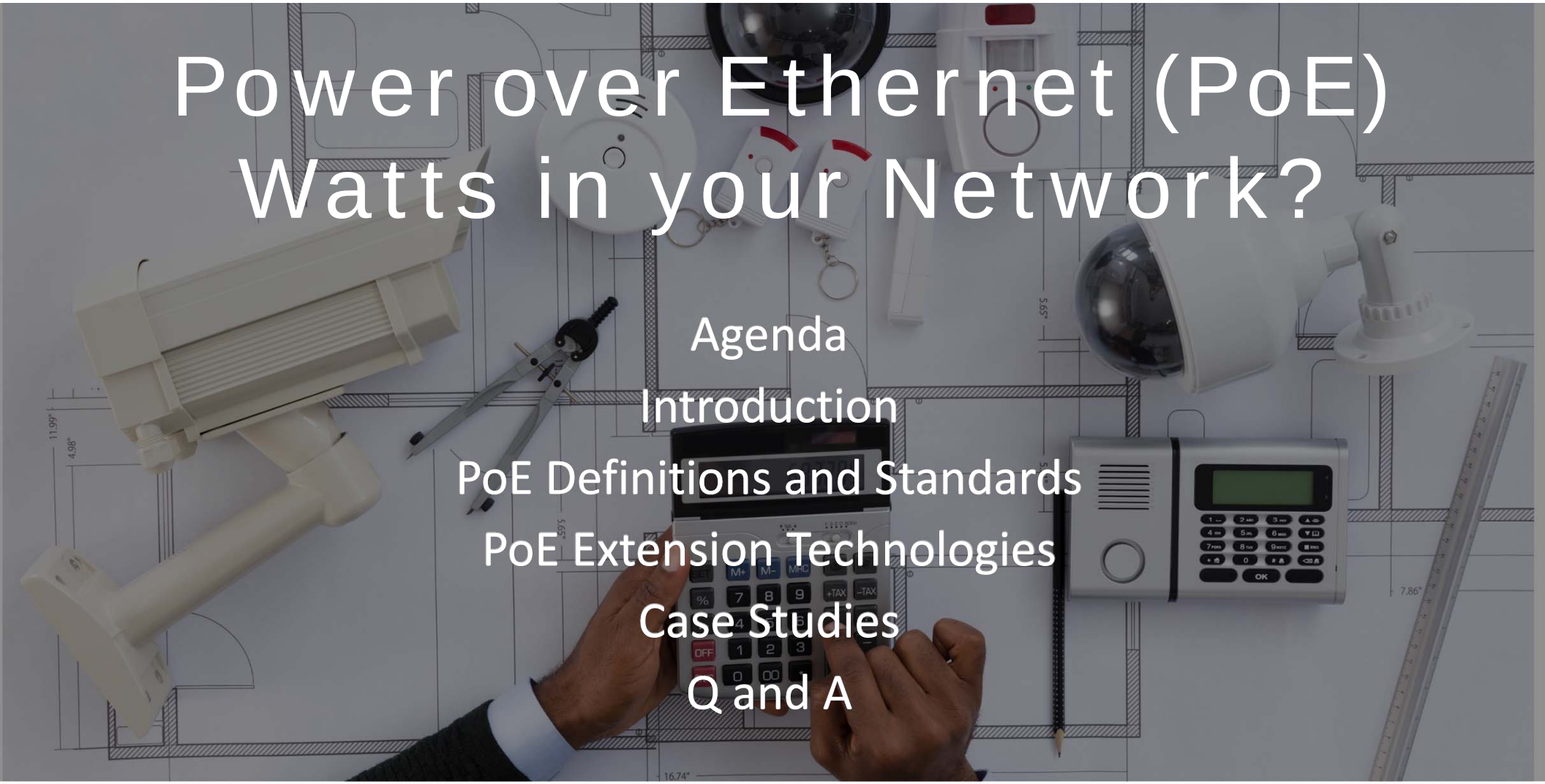


Power over Ethernet (PoE) Watts in your Network?

Agenda

Introduction

PoE Definitions and Standards

PoE Extension Technologies

Case Studies

Q and A

About Omnitron Systems

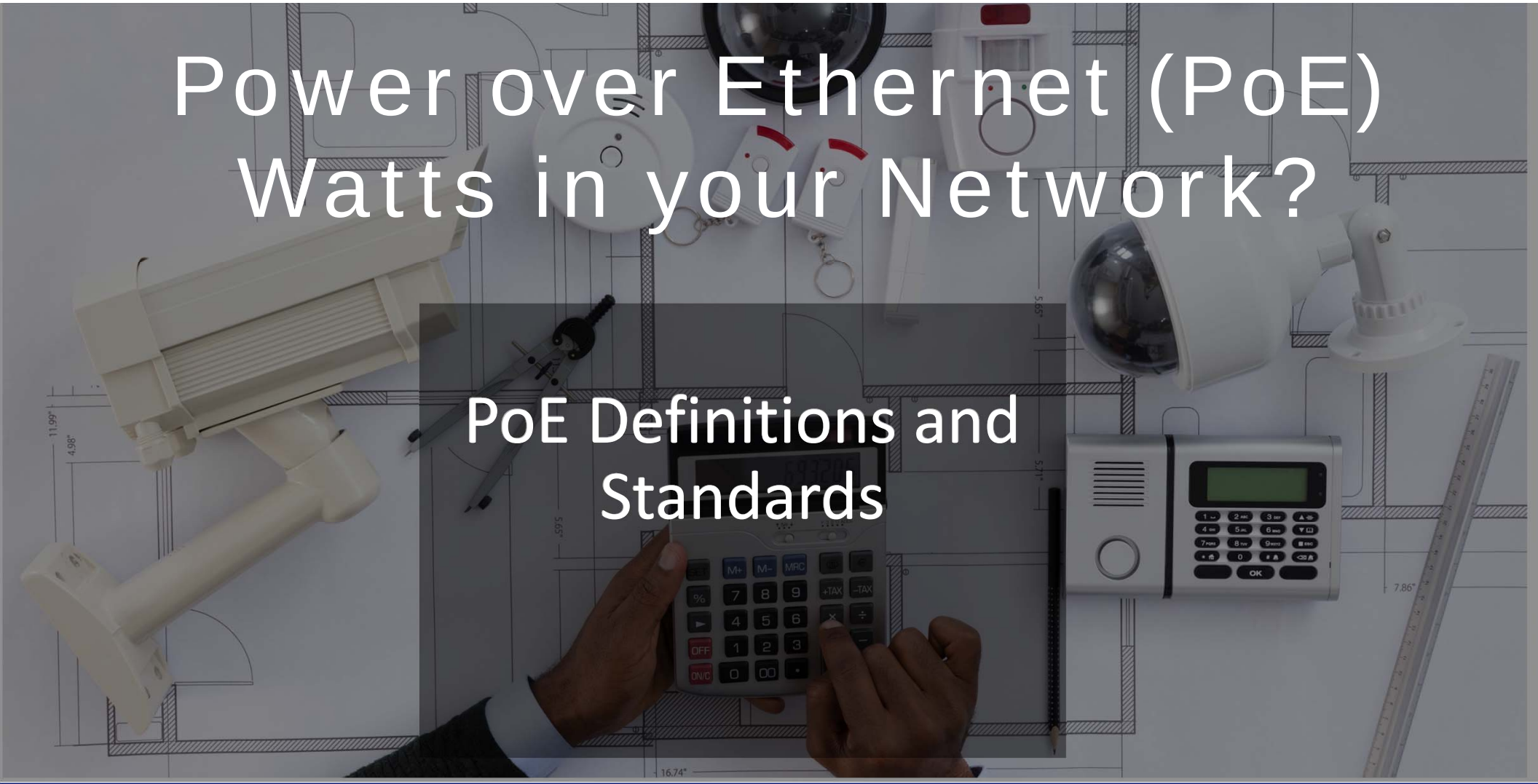
Corporate Profile

- Design and Manufacture PoE, fiber optic, and Ethernet network connectivity products since 1992
- Corporate headquarters and manufacturing facilities are based in Irvine, California

Markets Served:

- Enterprise
- Government
- Industrial
- Telecom
- Security
- Data Center

Power over Ethernet (PoE) Watts in your Network?

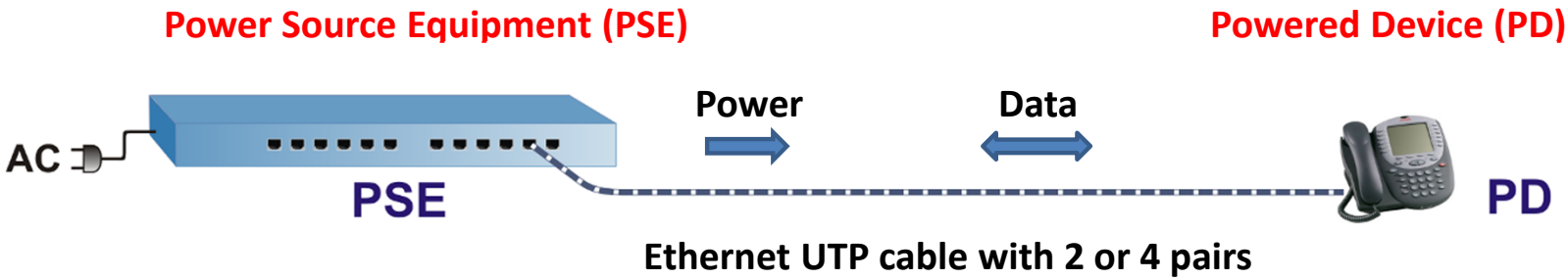


PoE Definitions and Standards

What is PoE?

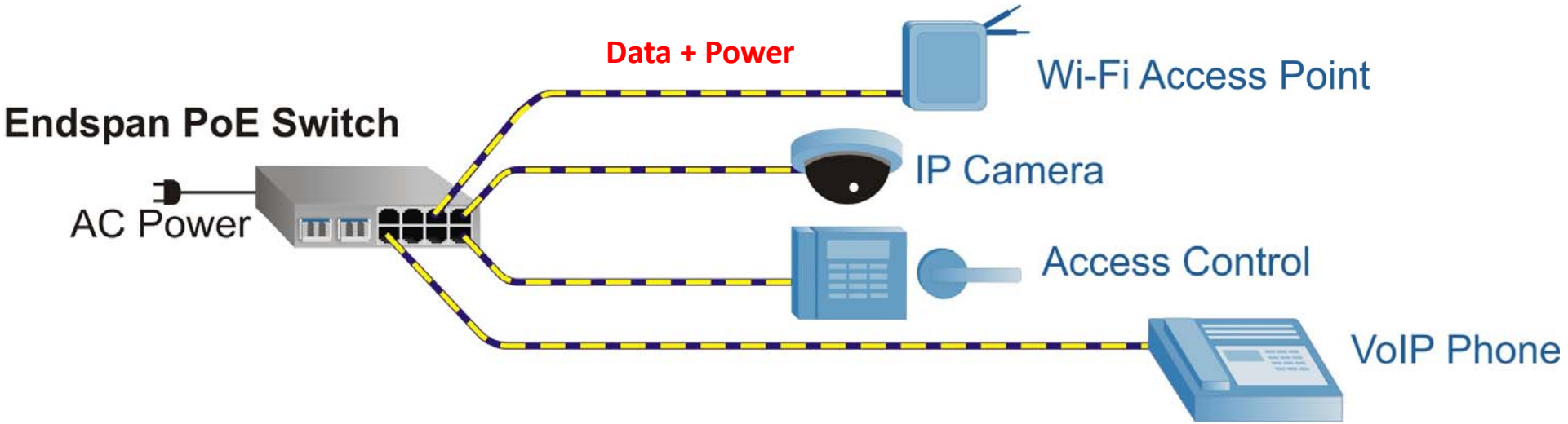
Power over Ethernet (PoE) is a standard based technology for the safe delivery of data and power to remote devices over copper cabling.

- Uses standard Ethernet UTP cables
  - Ex. Cat 5e or Cat 6 cable
- Power and data co-exist on same copper conductors



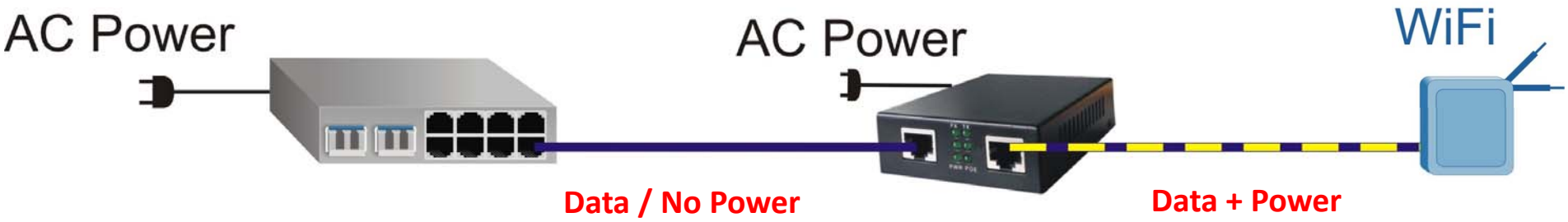
PoE Terminology

– **Endspan PSE** – located at the end of a link segment



PoE Terminology

- **Midspan PSE** – located in the middle of a link segment



IEEE PoE Standards

IEEE 802.3af PoE

- Ratified in 2003
- Allows up to 15.4W per connection
  - 12.95W assured to be available at the PD at 100m

IEEE 802.3at PoE+

- Ratified in 2009
- Allows up to 30.0W per connection
  - 25.5W assured to be available at the PD at 100m

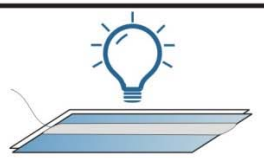
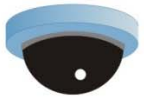
IEEE 802.3bt – 60W – 100W High-Power PoE

- Ratified in 2018
- Allows up to 100W per connection
  - 71W assured to be available at the PD at 100m

IEEE PoE Standards

Spec / Name	Ratified	Pairs needed	PoE Type	PoE Class	Power at PSE	Power at PD	Cable Type	Data Rate
802.3af PoE (15 W)	2003	2 Pairs (10M/ 100M)	**Type 1**	Class 1	4W	3.8W	Cat 3, 5, 6, 7	10M 100M Gigabit
				Class 2	7W	6.5W		
				Class 3	15.4W	13W		
802.3at PoE+ (30W)	2009	4 Pairs (Gigabit)	**Type 2**	Class 4	30W	25.5W	Cat 5, 5e, 6, 7	
802.3bt 4 Pair PoE (60/100W)	2018	4 Pairs	**Type 3**	Class 5	45W	40W	Cat 5e, 6, 7	10M 100M Gigabit 2.5G 5G 10G
				Class 6	60W	51W		
			Type 4	Class 7	75W	62W	Cat 5e, 6, 7	
				Class 8	90W	71.3W		

PoE Standards Reference Chart

Type	Standard	Watts	PoE Powered Devices		
Type 4	802.3bt	60-100W	 Digital Signage	 Small Cell	 Smart LED Lighting
Type 3	802.3bt	45-60W	 PTZ Camera	 WiFi 6 Access Point	 POS Terminal
Type 2	802.3at	15-30W	 IP Camera	 WiFi 4 or 5 Access Point	 Video Phone
Type 1	802.3af	0-15W	 IP Camera	 Fire Alarm	 Access Control

IEEE Standards – Compatibility

- **Future-Proof networks – all IEEE PoE Standards are backward-compatible to support the lower wattage requirements ☺**

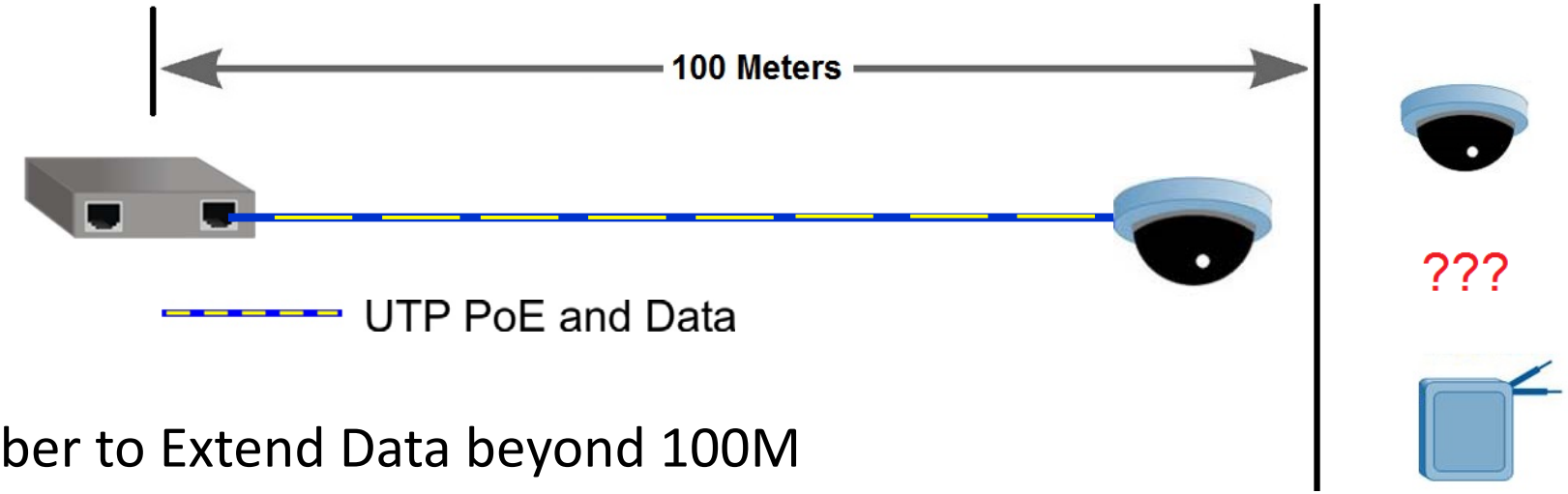
	IEEE Standard PoE Standard			
	802.3af 15W	802.3at 30W	802.3bt 60W	802.3bt 100W
15W	X	X	X	X
30W		X	X	X
60W			X	X
100W				X

How Does PoE Work?

- PSE asks connected device if it needs PoE power, and how much?
- If it's a PD, it will let the PSE know how much power it requires
- Power is then supplied by the PSE to the PD
- If it's not a PD, the PSE will NOT send power (equipment is safe)
  - But WILL still pass data

Ethernet Data Can Only Travel 100 Meters over Copper

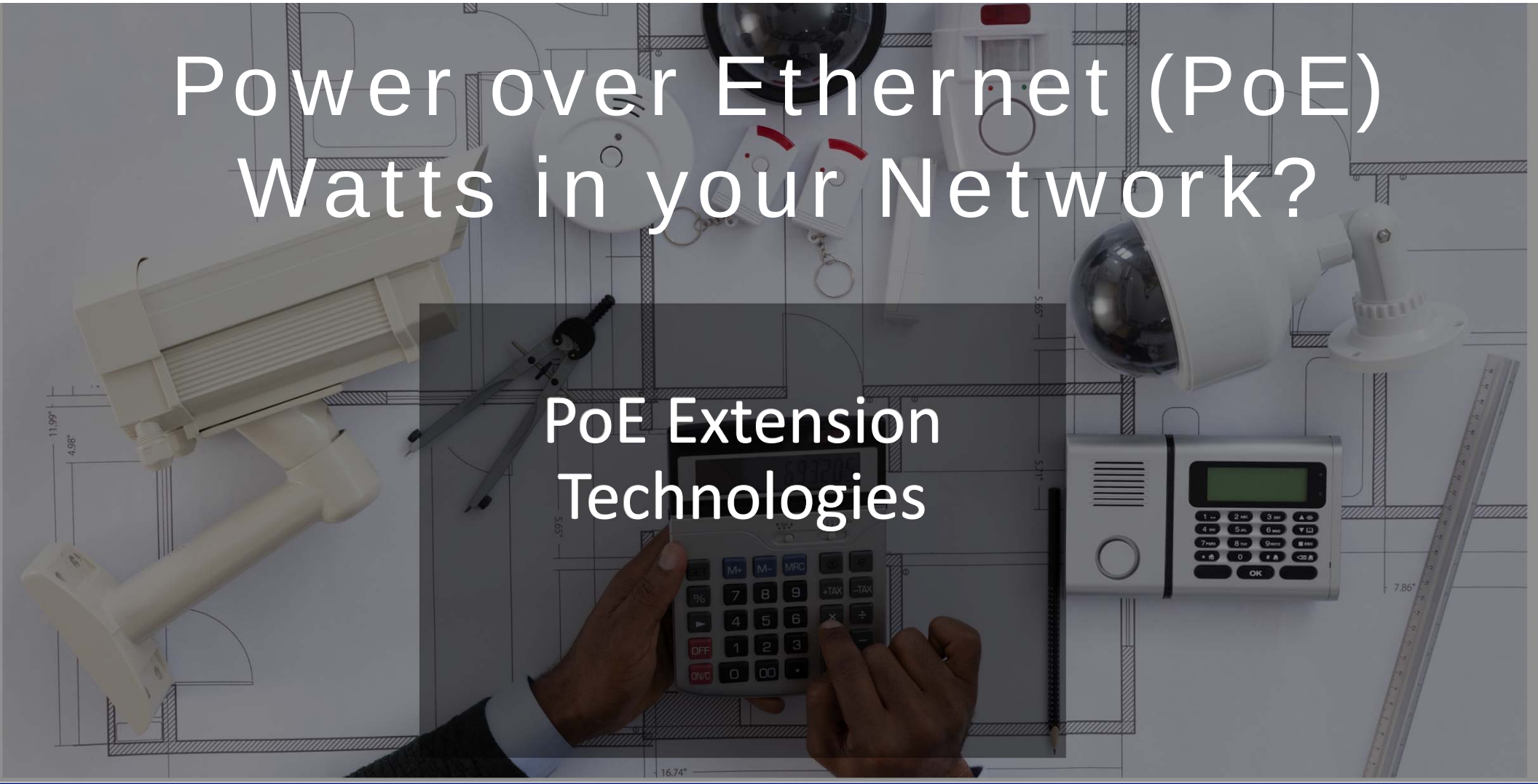
- Data deteriorates after 100m (might be undetectable by receiver)



- Use Fiber to Extend Data beyond 100M
  - PoE Media Converters & Switches
- Use Copper to Extend Data and Power beyond 100M
  - PoE Extenders

Power over Ethernet (PoE) Watts in your Network?

PoE Extension Technologies



PoE Extension

PoE Extension Technologies

- Ethernet (VDSL) Extenders
- PoE Copper Extenders
- PoE Fiber Media Converters
- PoE Fiber Switches

Comparison and Contrast

- Distance
- PoE PSE Power Provided
- Bandwidth
- Availability of Local Power
- Features
- Cable Media
- Price

PoE VDSL Extenders (Very High Speed Digital Subscriber Line)

- Two port or multi-port devices
- Requires external AC or DC power
- Up to 30W PoE+ over short distances

Strengths

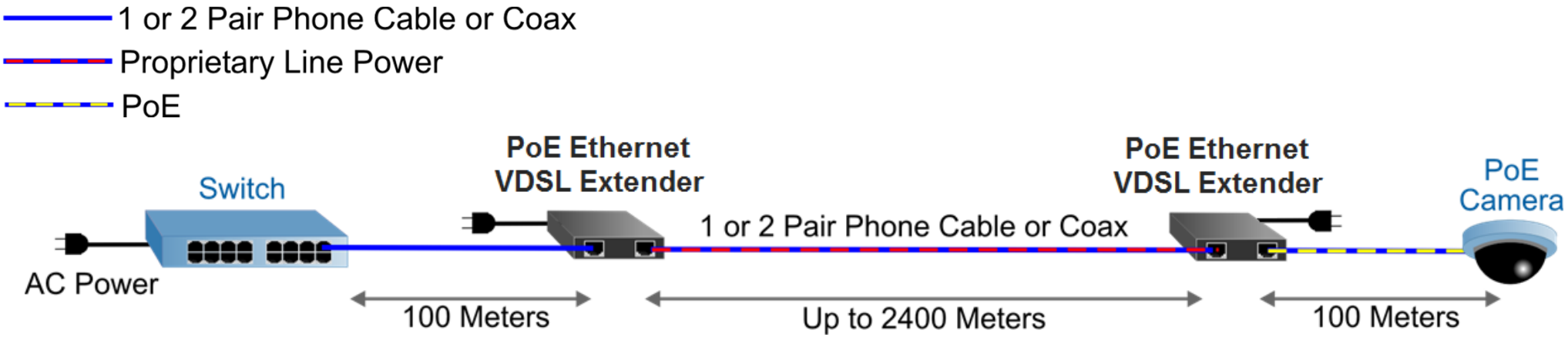
- Plug and Play
- Up to 2400 meters over RJ11 Copper

Weaknesses

- PoE power only at short distances
- Limited bandwidth at long distance
- Proprietary, unique to manufacturer

How do VDSL Extenders Work?

- Where twisted pair or Coax is available, and installing fiber is cost prohibitive.
- Head end device is powered, and requires a power injecting device
- Line power is proprietary over extended cable distance

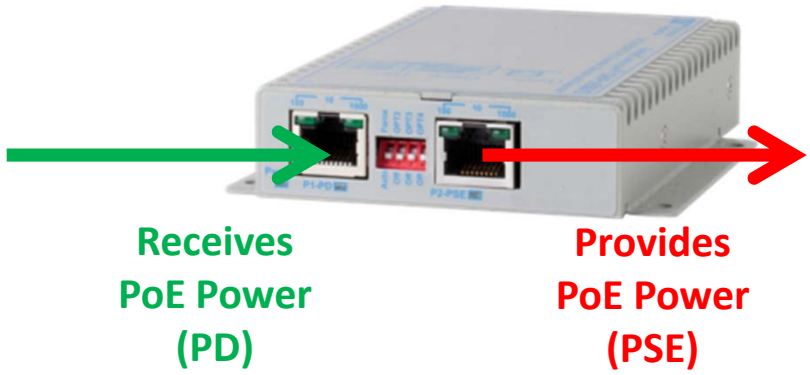


VDSL Extenders

Criterion	PoE Ethernet Extenders
Distance	Up to 2400 meters over Coax
PoE PSE Power	Up to 30W PoE+ over short distances
Local Power	• AC or DC power required for VDSL Extenders • May require additional power injectors
Number of PDs	1 or 2
Bandwidth	• 100Mbs over short distances (200 to 300 meters) • 1 to 4Mbps over longer distances (1000 to 2400 meters)
Features	• Typically unmanaged, plug-and-play devices • Auto-negotiation of duplex modes and data rates

PoE Copper Extenders

- Two port or multi-port devices
- Functions as both Powered Device (PD) and Power Sourcing Equipment (PSE)
- Requires no external AC power



Strengths

Plug-and-play

Full Gigabit data rate to end device

Powers PoE, PoE+, and HPoE devices

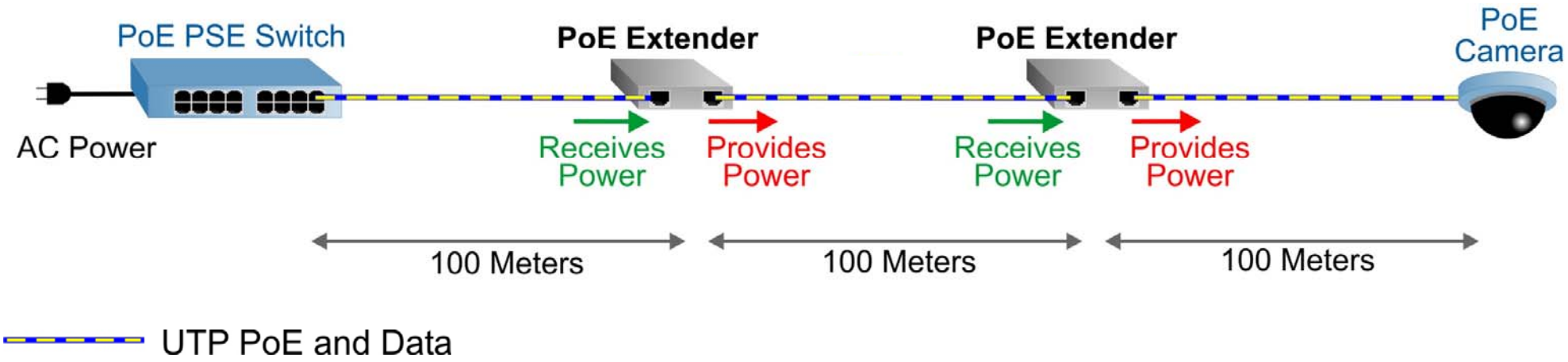
Weaknesses

Extender required every 100m

Head end must provide power

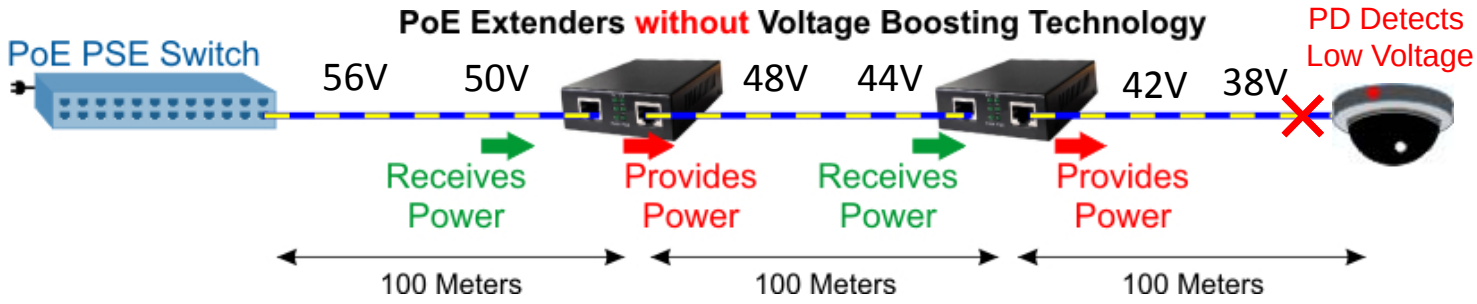
How do Copper Extenders work?

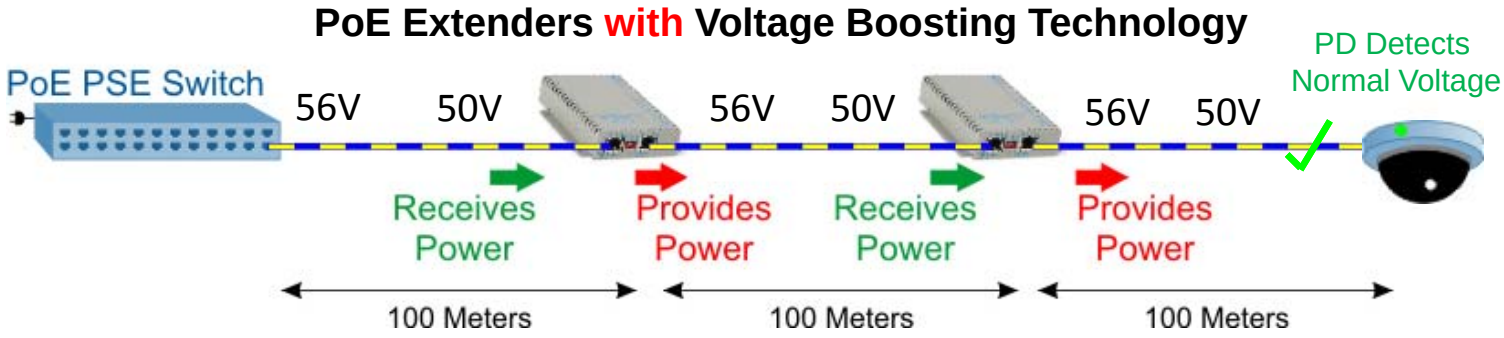
- PoE Extender Receives Power through PD Port
- PoE Extender Provides Power through PSE Port



Voltage Boosting Technology

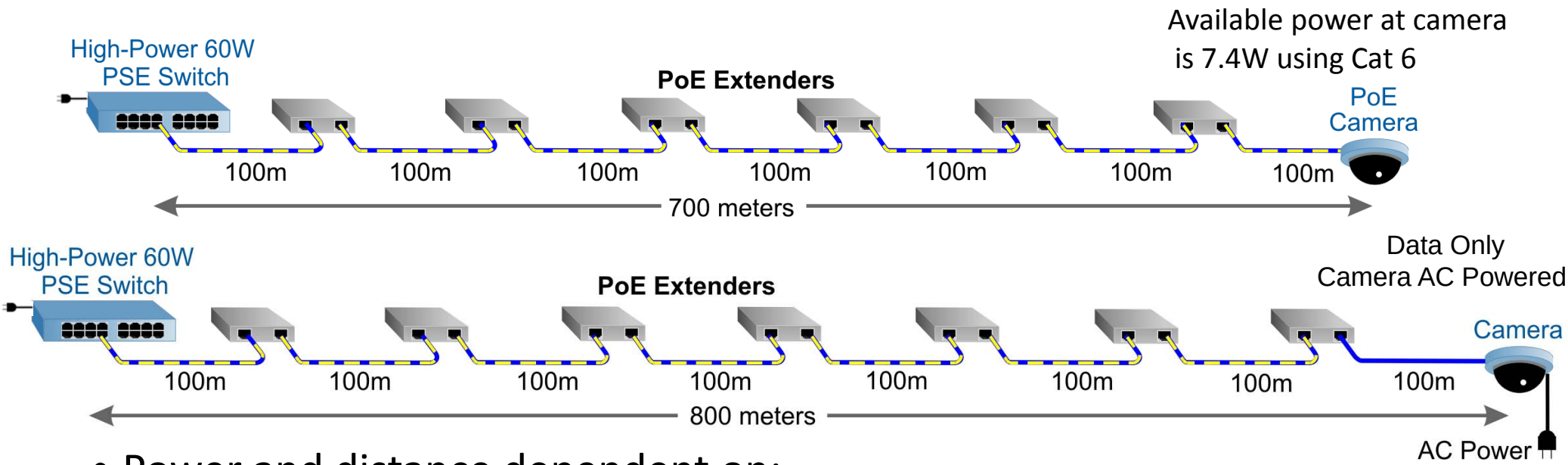
- Installing PoE Copper extenders with Voltage Boosting Technology guarantees voltage requirement to the PDs





PoE Copper Extender Distances

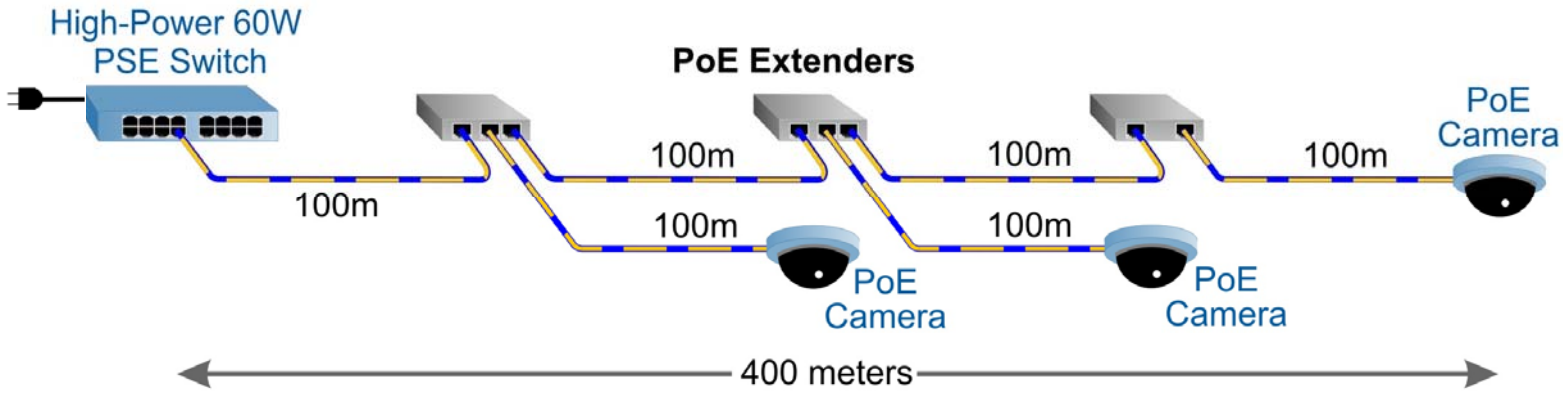
- Up to 700m to 802.3af PD, up to 800m to non-PoE (AC/DC powered) device



- Power and distance dependent on:
  - Power provided by PSE (Power Budget)
  - Power consumed by PoE Extenders and PD(s)
  - Type of Cabling

PoE Extender with Drop Locations

- Additional ports enable PD drop locations along daisy chain
  - Power consumption reduces overall distance
  - Provides network design flexibility



PoE Copper Extenders

Criterion	PoE Copper Extenders
Distance	Up to 700 meters in daisy chain (Extender provides power)
PoE PSE Power	~55W @ 200 Meters, ~25W @ 500 Meters, ~7W @ 700 Meters
Local Power	No AC or DC power required for PoE Copper Extenders
Number of PDs	Up to 4 (deployed with drop locations)
Bandwidth	Gigabit data rate at all distances
Features	• Voltage Boosting Technology • Typically unmanaged, plug-and-play devices • Auto-negotiation of duplex modes and data rates

PoE Media Converters

- Extend distances to PoE devices with fiber
- PoE Media Converter is powered by AC or DC power
- Multiple Fiber and RJ-45 PoE port configurations

Strengths

Plug and Play, or Configurable features:

Remote PoE Reset

Enables distances up to 140 Km (87 miles)

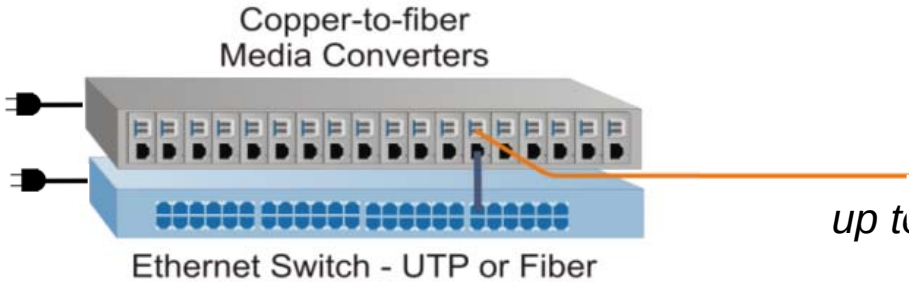
Weaknesses

Requires local AC/DC Powering

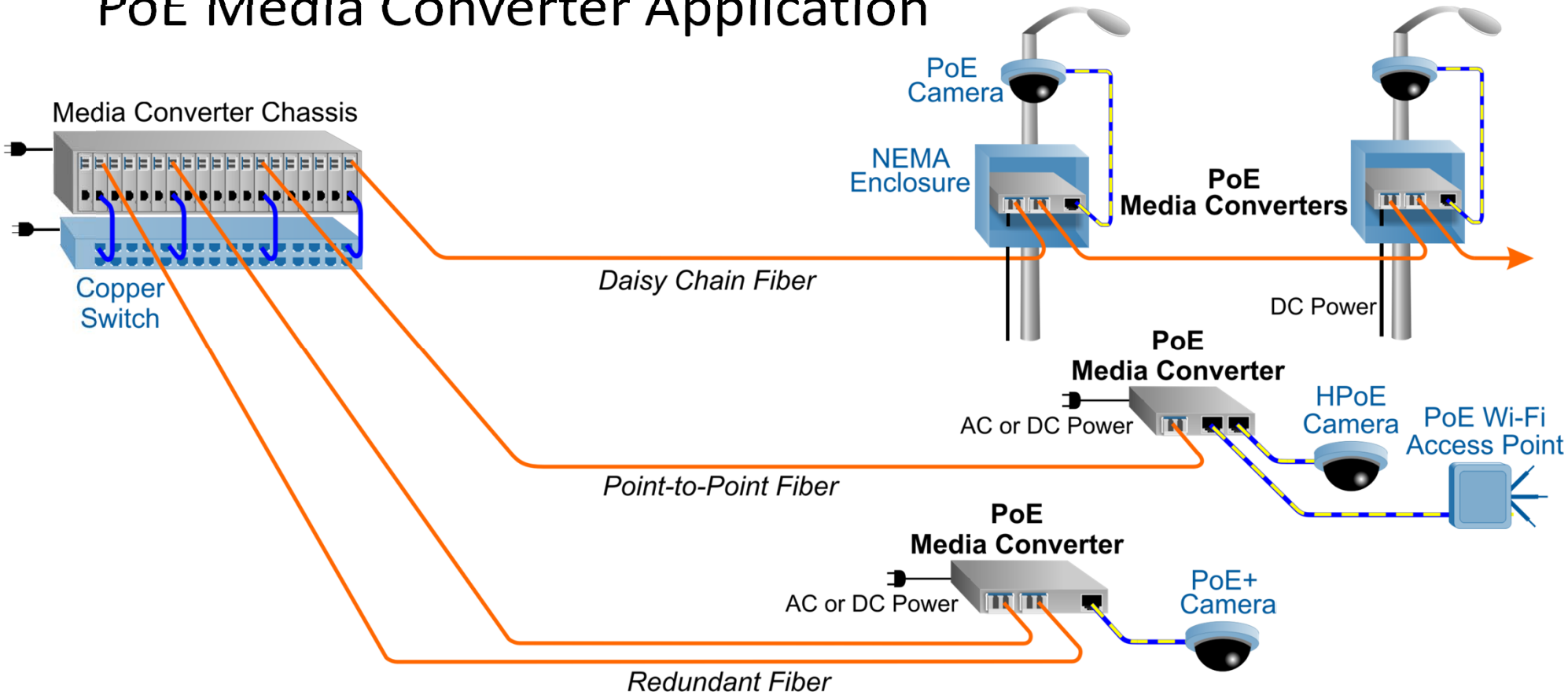
Requires fiber

How PoE Media Converters Work

- Use switch fiber ports at the Head End
- Or copper switch with media converters
- Install **PoE Media Converter** near AC or DC power
- Install PDs on Poles, Ceilings, Enclosures etc.
  - 100m Copper max. from the media converter



PoE Media Converter Application



PoE Media Converters

Criterion	PoE Media Converters
Distance	Up to 140 Km (87 miles). Can be daisy chained for additional links
PoE PSE Power	PoE, PoE+, HPoE and 4 Pair PoE (802.3bt)
Local Power	• AC or DC power required for PoE Media Converter
Bandwidth	Up to 10 Gigabit data rate at all distances
Features	• Managed or unmanaged • One or Two Fiber Ports • DIP-Switch configuration of PoE reset, restore modes, …. • Auto-negotiation of duplex modes and data rates

PoE Fiber Switches

- Compact PoE Fiber Switches extend distances to MULTIPLE PoE devices
- Requires AC or DC power
- Enables distances up to 140 Km (87 miles)

Strengths

Remote PoE Reset, Dual Device Mode, VLANs, Heartbeat, QoS, MRP and RSTP, Link Aggregation

Powers PoE, PoE+, and 60W / 100W BT PDs from same PoE Fiber Switch

Managed or Unmanaged devices

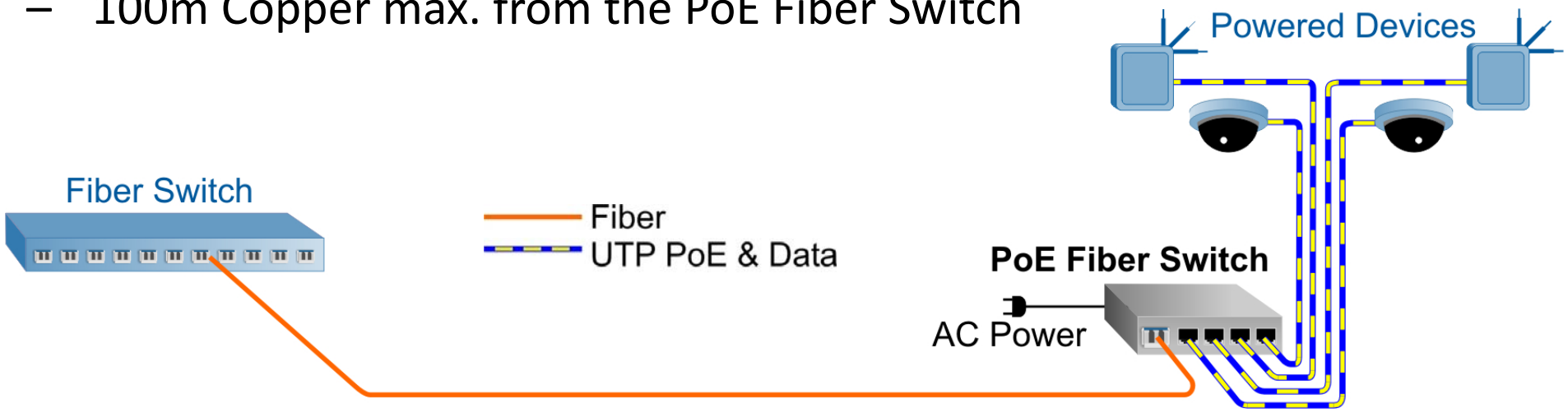
Weaknesses

Requires local AC/DC Power

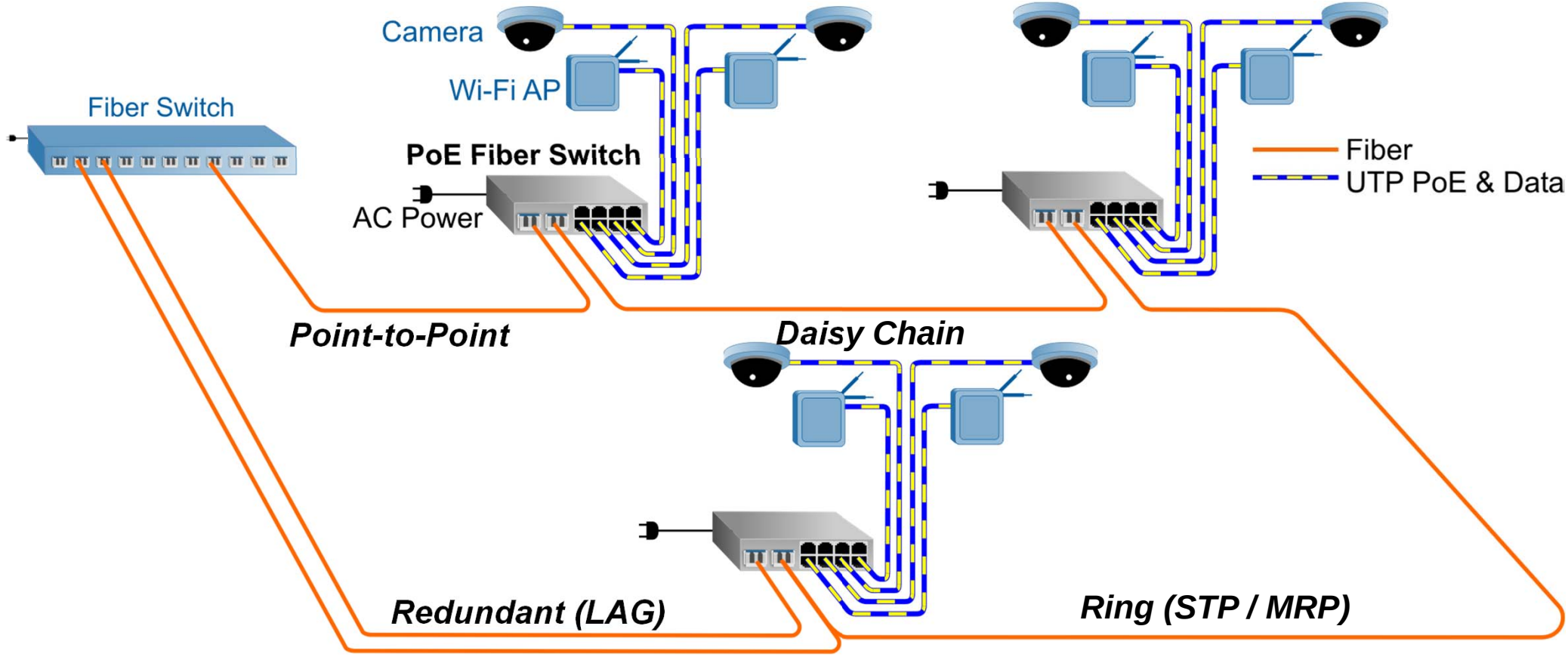
Requires fiber

How PoE Fiber Switches Work

- Run fiber from head end (fiber switch or copper switch and media converters)
- Install **PoE Fiber Switch** near AC or DC power
- Install PDs
  - 100m Copper max. from the PoE Fiber Switch



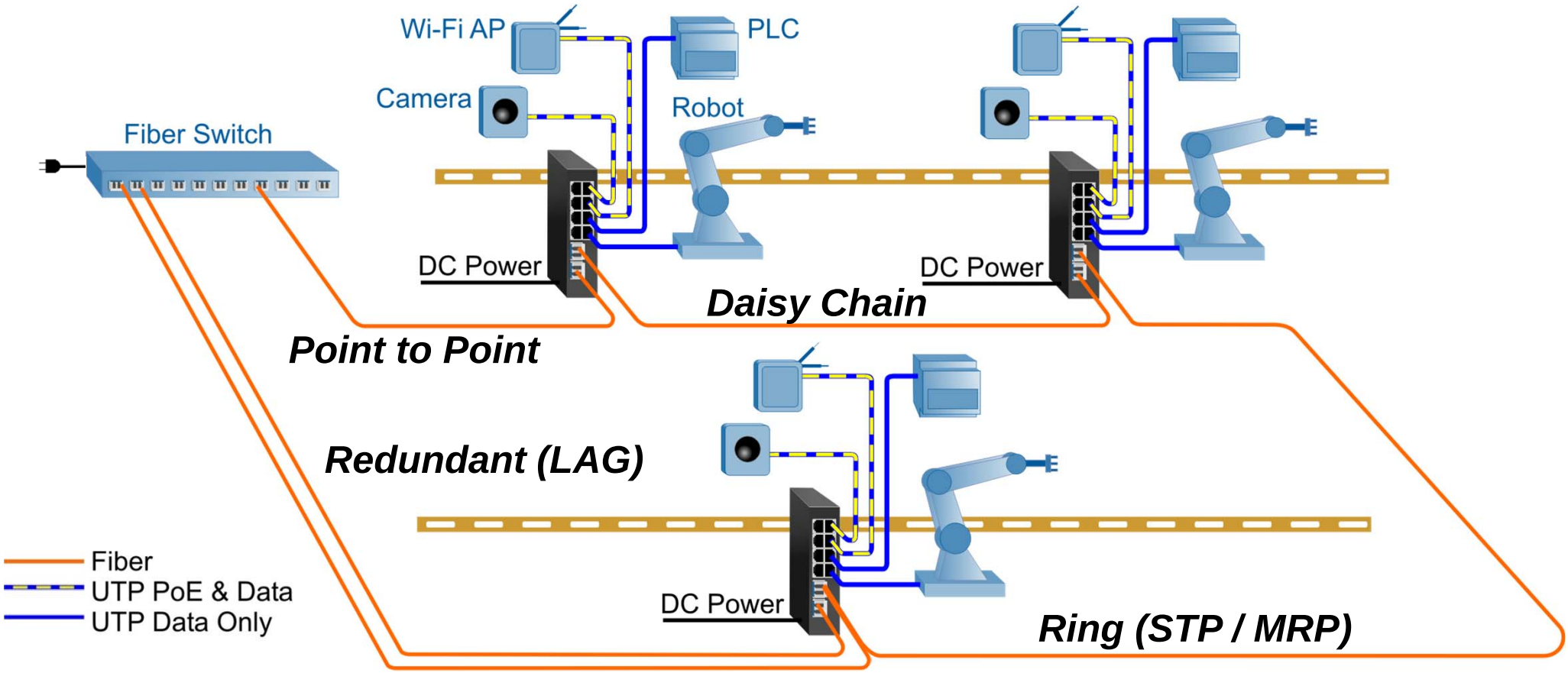
PoE Fiber Switch Application – Topologies



Industrial PoE Fiber Switches

- Also available as ruggedized industrial products
- Similar features as commercial products
- Temperature hardened: -40 to 75 deg C
- Industrial hardened enclosure
- DIN-Rail mount included standard
- Managed or Unmanaged devices

Industrial PoE Fiber Switch Application



Other Industrial PoE Fiber Switch Applications

Critical Infrastructure

Perimeter Security

Historic Sites

Sports Arenas

Transportation

Cell Towers

PoE Fiber Switches

Criterion	PoE Fiber Switches
Distance	Up to 140 Km (87 miles). Can be daisy chained for additional links
PoE PSE Power	PoE, PoE+, HPoE, and 4 Pair PoE (802.3bt) for multiple devices
Local Power	AC or DC power required for PoE Fiber Switch
Number of PDs	Typically up to 48 PDs (mixed power levels)
Bandwidth	Up to 10 Gigabit at all distances
Features	• Managed or unmanaged • One or Two Fiber Ports, and up to 48 RJ-45 PSE ports • Remote PoE reset, PoE heartbeat, Dual Device Mode, VLAN, QoS, MRP and spanning tree

PoE Extension Technology Comparison




Criterion	VDSL Extenders	PoE Copper Extenders	PoE Media Converters	PoE Fiber Switches
PoE Power	PoE, PoE+	PoE, PoE+, BT	PoE, PoE+, BT	PoE, PoE+, BT
Distance	2400 M	700 M	140 Km	140 Km
Bandwidth	1- 100Mbps	1 Gigabit	1 Gigabit/10G	1 Gigabit/10G
# of PDs	1 or 2	Up to 4	1 or 2	Up to 48
Local Power	Yes	**No**	Yes	Yes
Cable	Phone, Coax	UTP	Fiber, UTP	Fiber, UTP
Price	$	$	$$	$$$

Power over Ethernet (PoE) Watts in your Network?

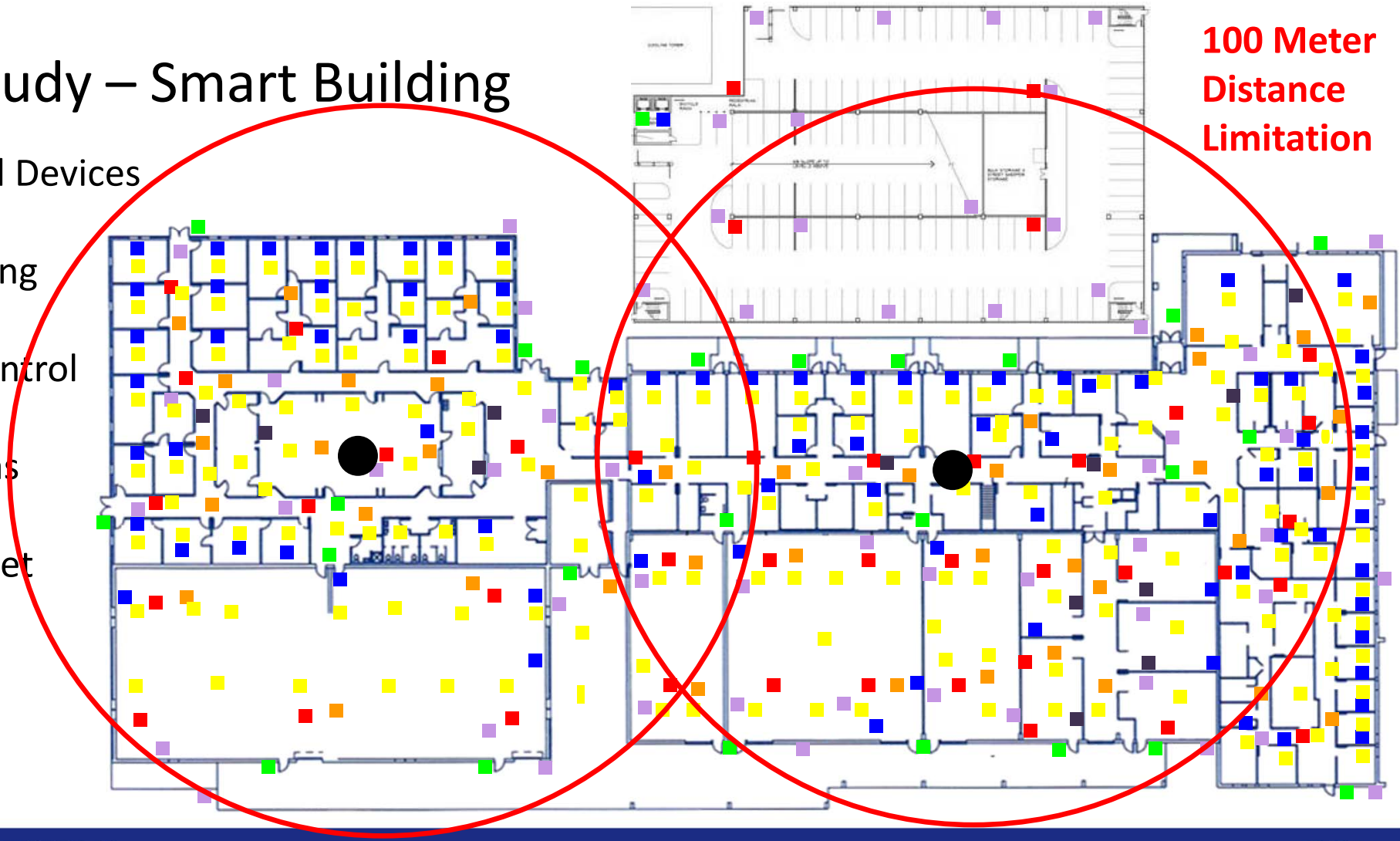
Case Studies

Case Study – Smart Building

- Integrates all of a facility's systems into a centrally controlled Ethernet network with IP-based structured cabling
- Benefits include:
  - Energy efficiency
  - Improved safety
  - Reduced labor costs
  - Reduced operating costs
  - Simplified asset Mgt.
- PoE enables PDs at any location, regardless if a site has electrical outlets

Case Study – Smart Building

PoE Powered Devices
- IP Phones
- LED Lighting
- Sensors
- Access Control
- Wi-Fi APs
- IP Cameras
- Displays
- Data Closet



100 Meter Distance Limitation

Case Study – Smart Building

PoE Powered Devices

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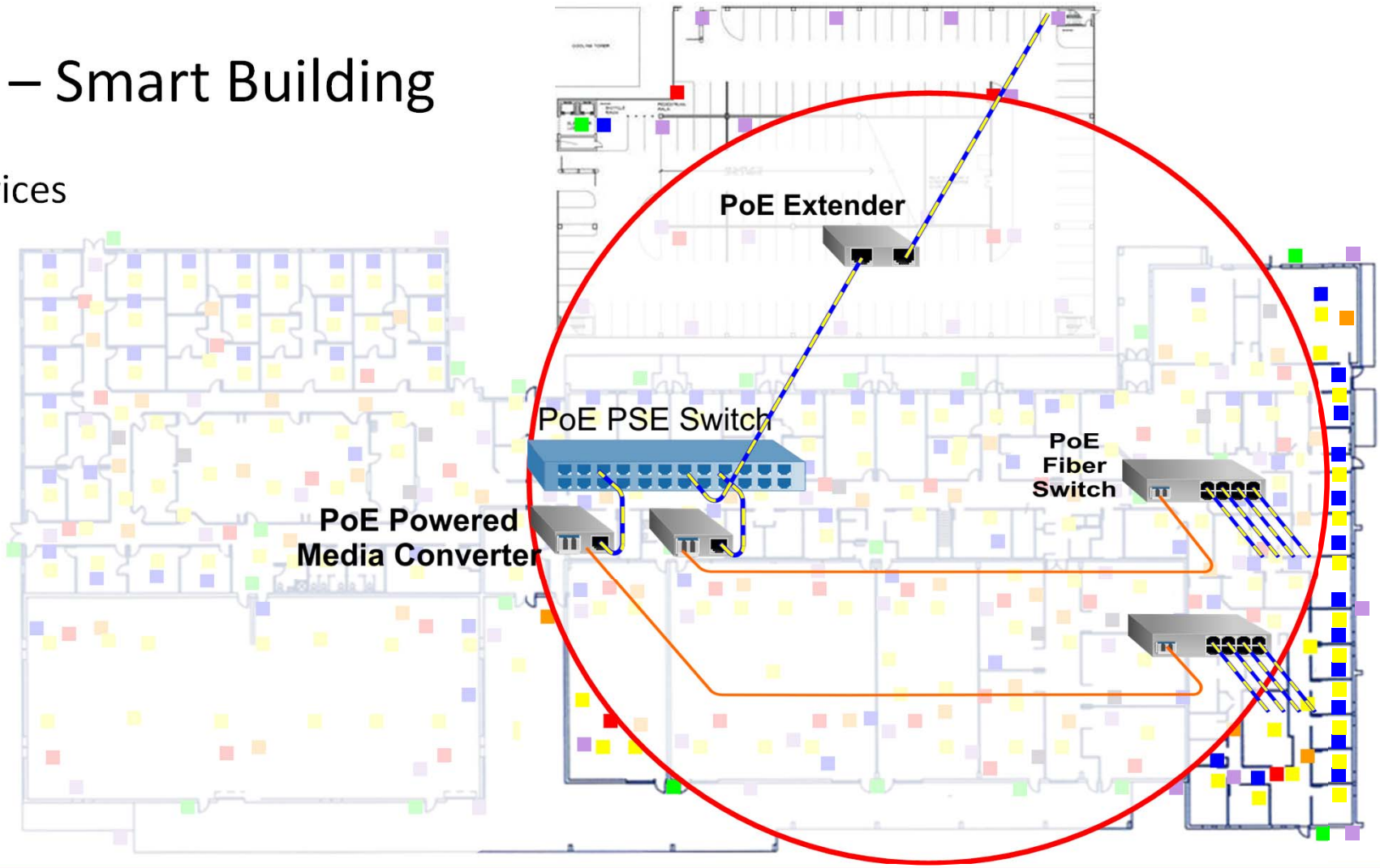


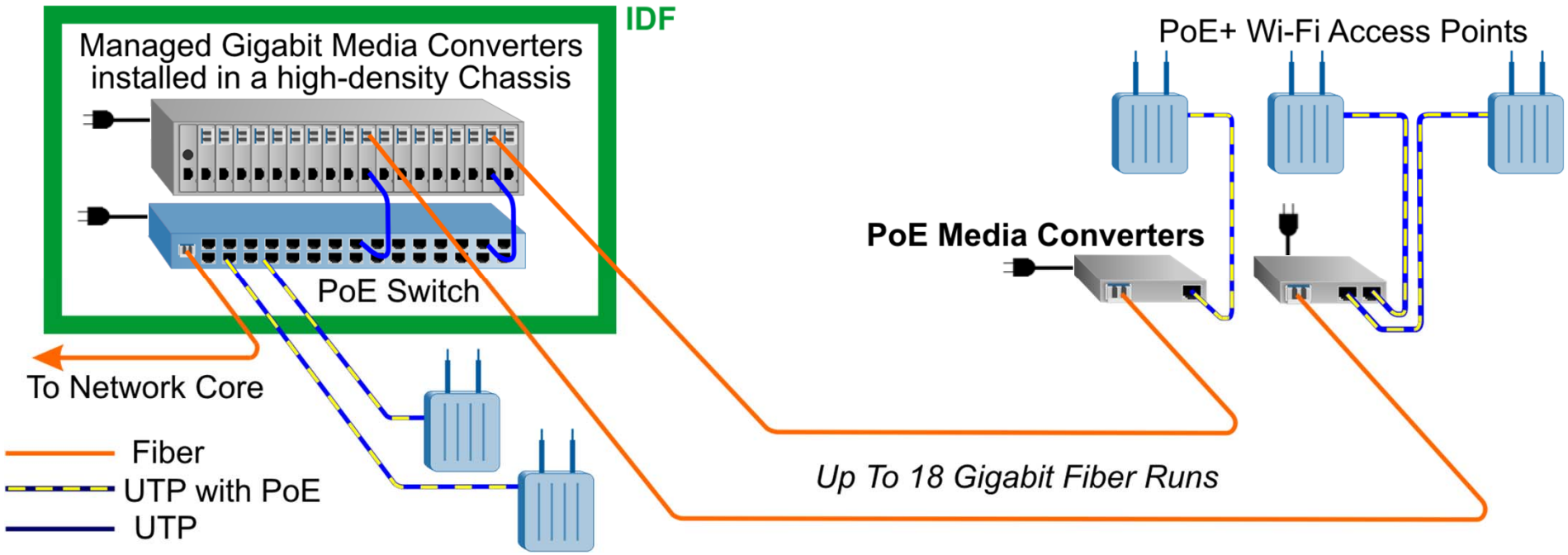
Case Study – International Airport

- Due to customer demand, a new Wi-Fi network was installed throughout the airport terminals and concourses
- Required over 300 Wi-Fi access points throughout the 6.8 million square foot terminal complex
- The new Wi-Fi network was installed in less than 30 days
- The network provides access to 15,000 simultaneous users

Case Study – International Airport

- Each concourse has multiple Intermediate Data Frames (IDF)
- Each IDF provides connectivity to Wi-Fi Access Points
- Fiber is used to extend distances to PDs outside the reach of copper
- PoE Power Reset feature saved time and technician costs

Case Study – International Airport

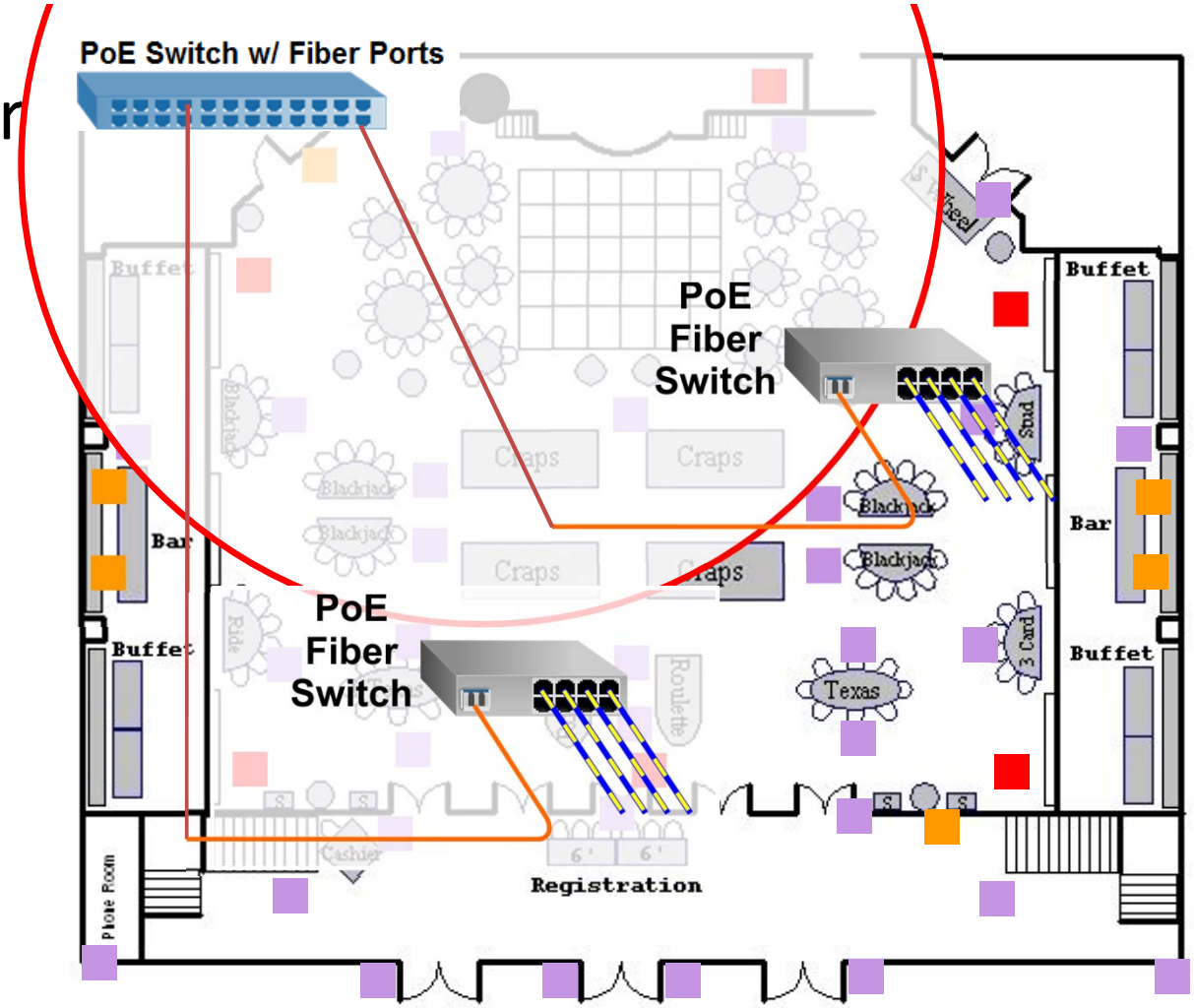


Case Study – Casino Floor

PoE Powered Devices

- Wi-Fi APs
- IP Cameras
- Displays
- Data Closet

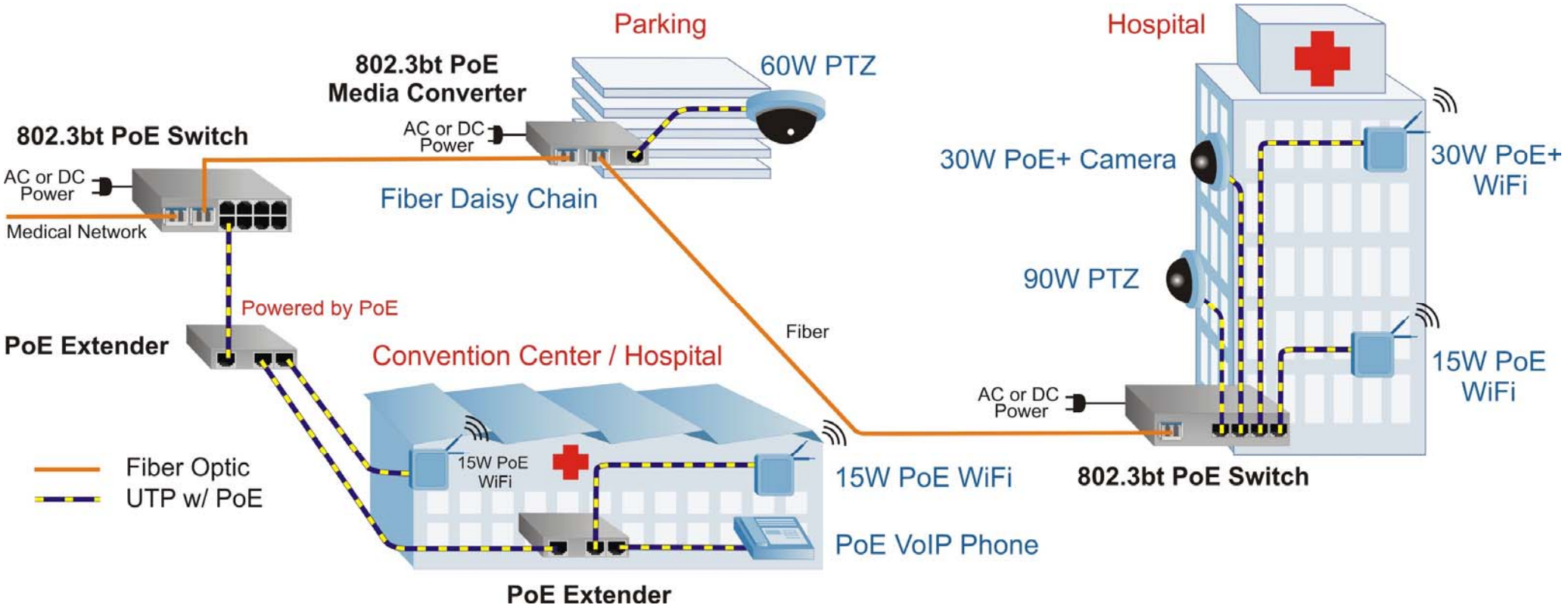
100 Meter Distance Limitation



UTP with PoE & Data

Fiber with Data

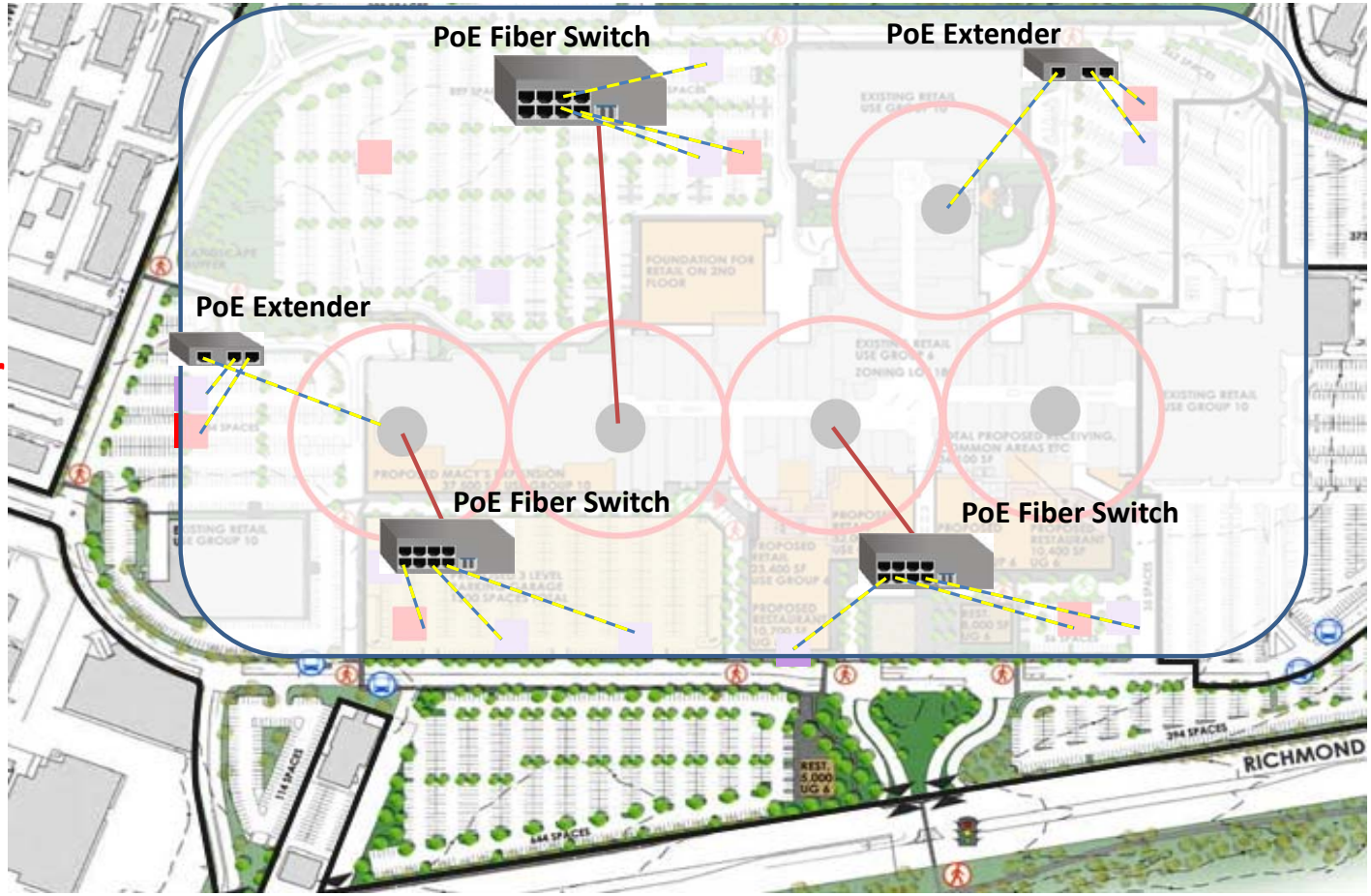
Case Study – Hospitals



Case Study – Shopping Mall – Security and WiFi Installation

PoE Powered Devices
- Wi-Fi APs
- IP Cameras
- Data Closet

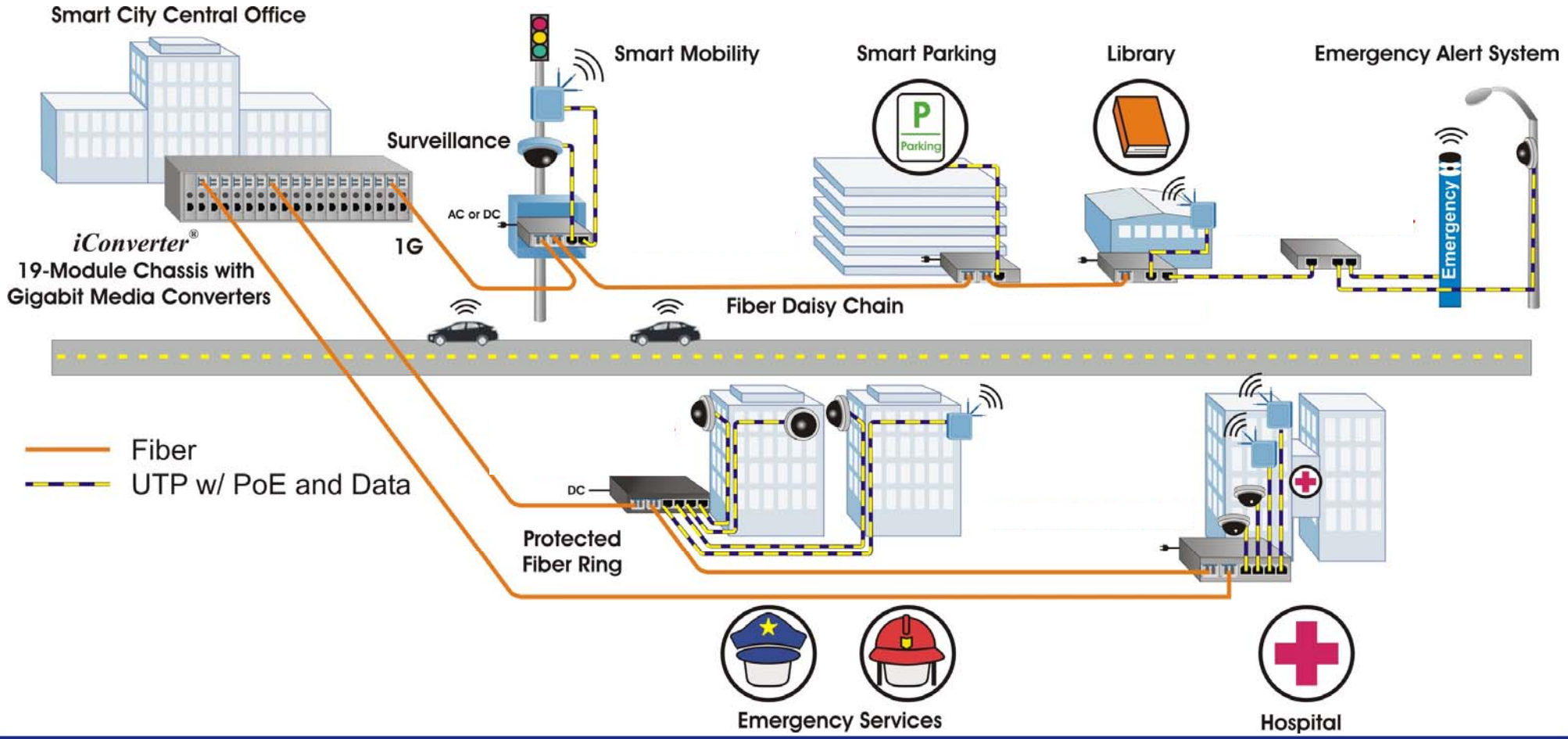
100 Meter Distance Limitation



UTP with PoE & Data

Fiber with Data

Case Study – Smart City



Choosing the Right Type of PoE PSE

- PoE/PoE+/60W or 100W PoE power sourcing
- Commercial Temperature or Wide / Industrial Temp
- Number of Fiber and Copper Ports needed
- Connector Type - SFP, ST, SC, LC
- Ethernet Data Rate (speed) - 10/100, 10/100/1000, 10G
- Fiber Type - Multimode, Single-Mode, Dual or Single
- Fiber Distance - up to 140km
- Managed or Unmanaged
- Powering option - AC, DC, PoE (extenders only)
- Mounting – Tabletop, Wall or Rack Mount Shelf, DIN-Rail

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Thank You!

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