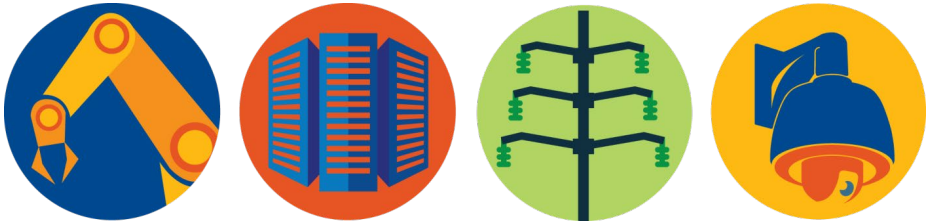
NEXT GENERATION PREMISE NETWORKS

Products.
Technology.
Services.
Delivered Globally.

MORE THAN A DISTRIBUTOR

Anixter helps **build**, **connect**, **power** and **protect** valuable assets and critical infrastructures around the world. For more than 150,000 customers in 50 countries, Anixter is more than a distributor: **we are a business partner**.



MARKETS WE SERVE INCLUDE:

- Contractors/integrators
- Commercial building
- Data centers
- Education
- Finance
- Government
- Healthcare
- Manufacturers
- Marine/shipboard
- Natural resources
- Power utilities
- Public safety
- Retail
- Transportation

AGENDA

- Market Trends
  - New applications driving change
  - Next generation networks
- Infrastructure Standards Update
  - Data Center
  - Commercial Buildings
- Best Practice Guidelines

SMART BUILDING EVOLUTION

By 2020, one in five buildings will be a smart building, supporting **50 billion** connected devices, with cloud-based software and services growing at a rate of **33 percent.**

Source: Memoori, Big Data for Smart Buildings: Market Prospects 2015 to 2020.

CONVERGENCE

information technology

IT

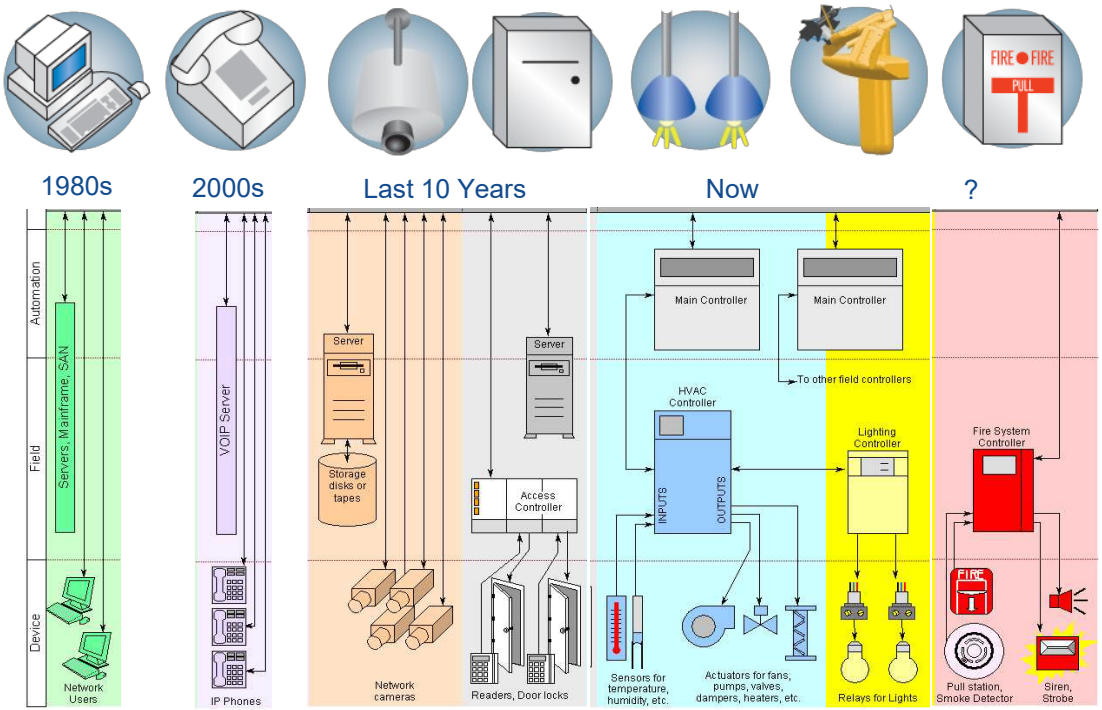
IOT

ENABLEMENT

operational technology

OT

EVOLUTION OF PREMISE NETWORKS



- Disparate communications cabling and protocols consolidated around Ethernet in 1990s
- Voice systems integrated onto IP-based networks throughout 2000s
- Physical security applications have migrated to network over last 10 years
- Operational Technologies related to lighting, BMS, and industrial control beginning to migrate onto network
- Fire and life safety systems unlikely to fully migrate onto network in the short term

NEW APPLICATIONS DRIVING CHANGE

TODAY'S INTERNET

INTERNET WE NEED TO BUILD

Smart Homes
- Sensors
- Residential A/V
- Video surveillance

Smart Buildings
- Video surveillance
- Access control
- Professional A/V
- Connected lighting
- IoT (Sensors/analytics)

Smart Factories
- IoT (sensors/analytics)
- Cybersecurity

Smart Cities
- 5G enablement
- Autonomous vehicles
- AR/VR gaming
- IoT (sensors/analytics)
- Cybersecurity

10s | 100ms | 10ms | 1ms | 10 µs

LATENCY

DATA CENTERS

EDGE APPLICATIONS

IOT APPLICATIONS	CONNECTED HOME 	SMART BUILDING 	INDUSTRIAL IOT 	SMART CITY IOT 
CONTENT DELIVERY	VIDEO STREAMING 	SOCIAL MEDIA 	CLOUD APPLICATIONS 	GAMING 
DISRUPTIVE MODELS	BITCOIN 	BLOCKCHAIN 	MICROGRIDS 	VEHICLE SHARING 

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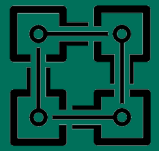
DISRUPTIVE MODELS	BITCOIN 	BLOCKCHAIN 	MICROGRIDS 	VEHICLE SHARING 

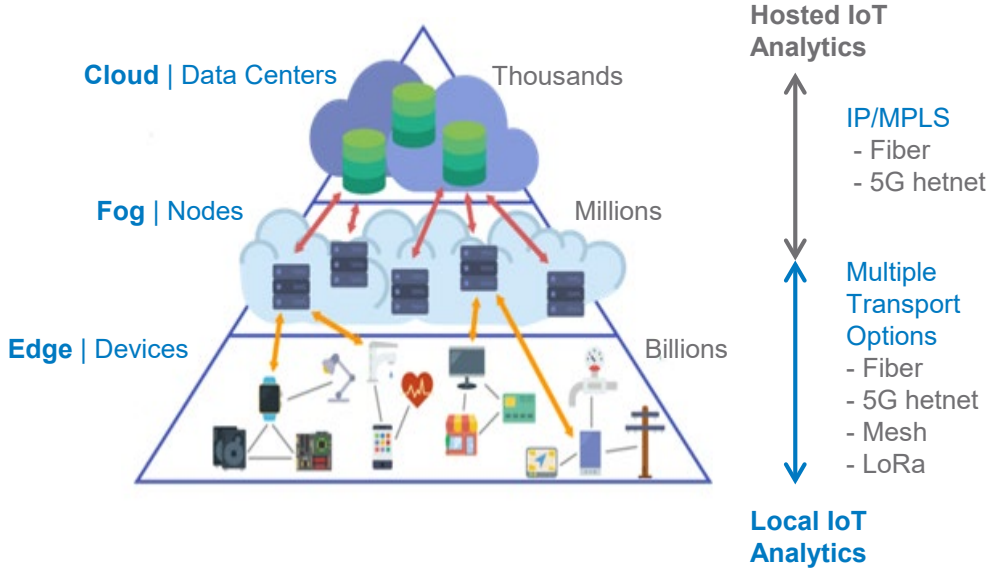
LOWER LATENCY REQUIRES NEW NETWORK ARCHITECTURES – RISE OF EDGE COMPUTING

Where's the edge?

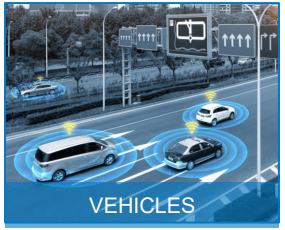
- End user focused
- Device that generates data
- Data center, micro data center, racks, converged appliance

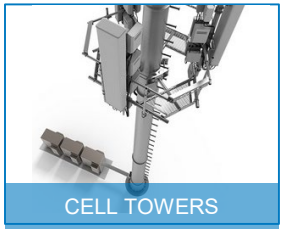
Edge computing

- Extends cloud network, computing, storage services to edge devices
- Fog computing is a derivative approach focused on IoT applications



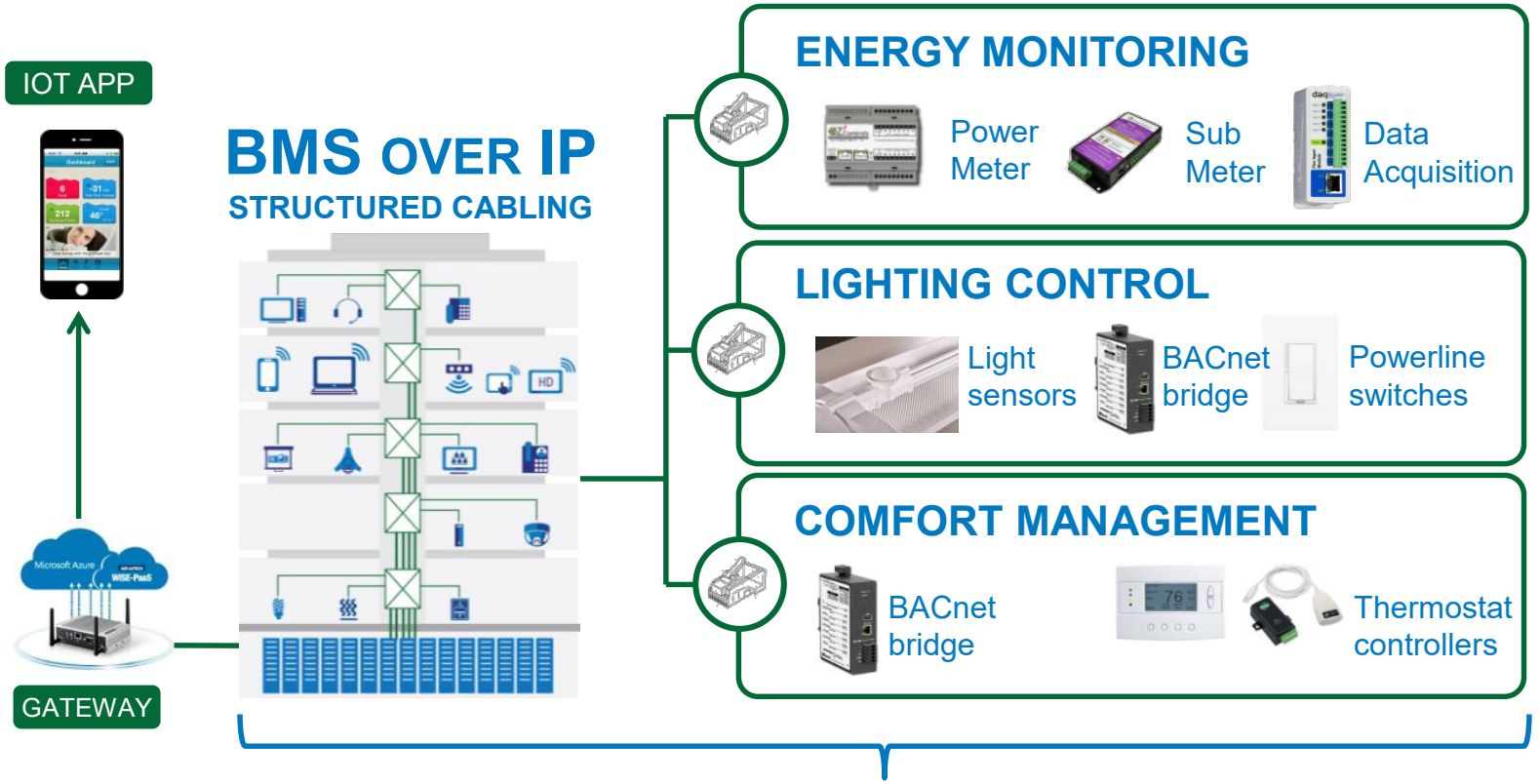
EDGE DELIVERY METHODS



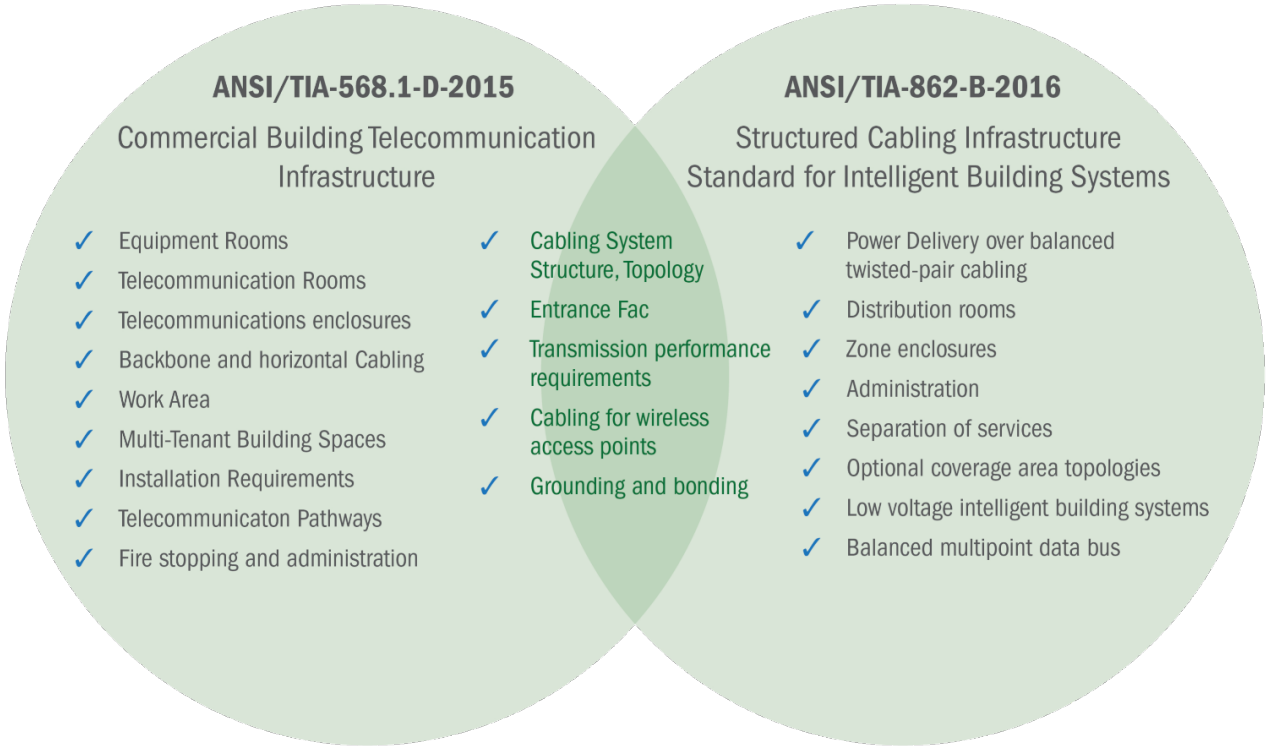


COMMERCIAL BUILDINGS

STRUCTURED CABLING—PLATFORM FOR IOT



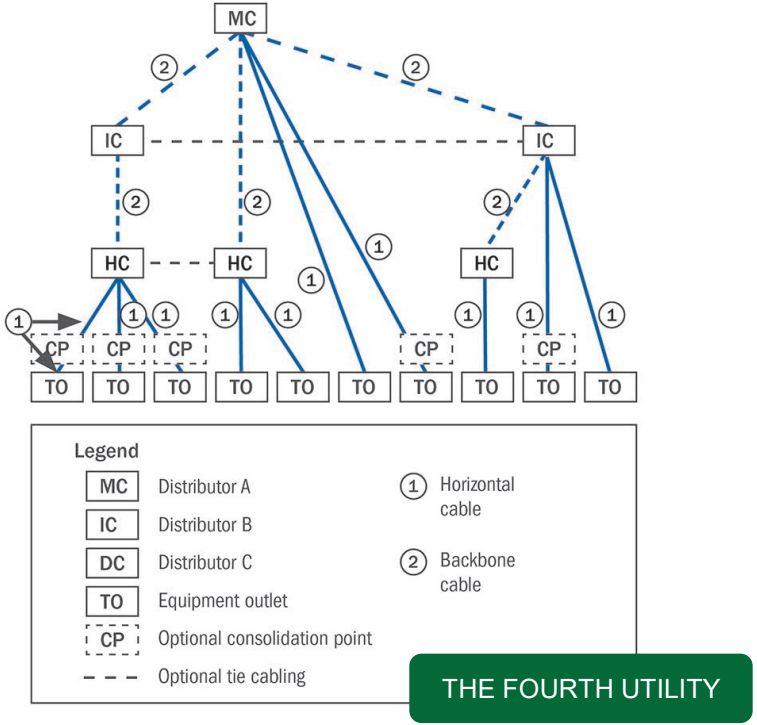
CABLING SYSTEM STANDARDS



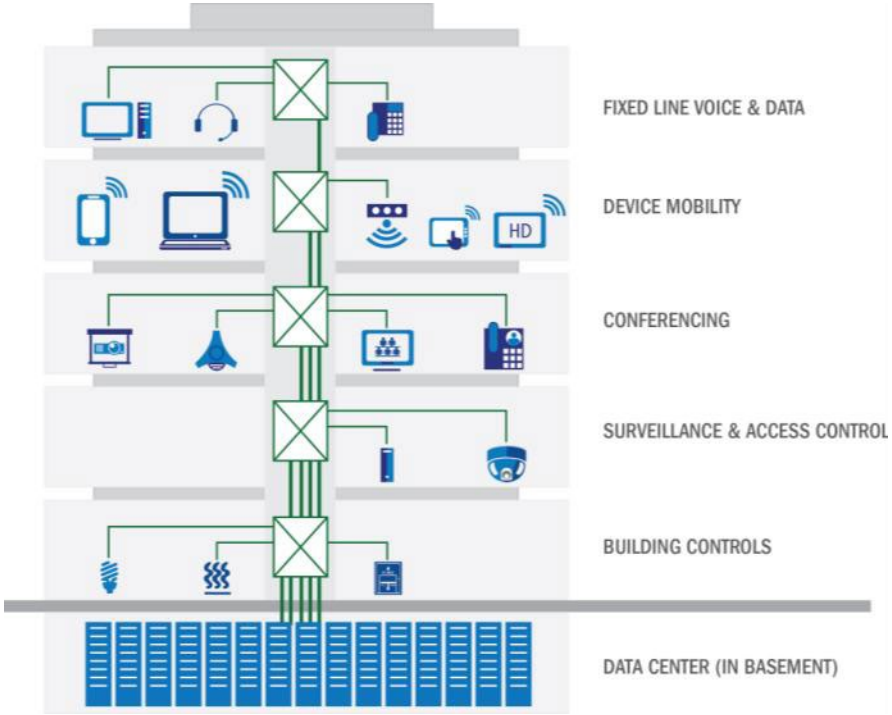
ADVANCING GLOBAL COMMUNICATIONS

International Organization for Standardization

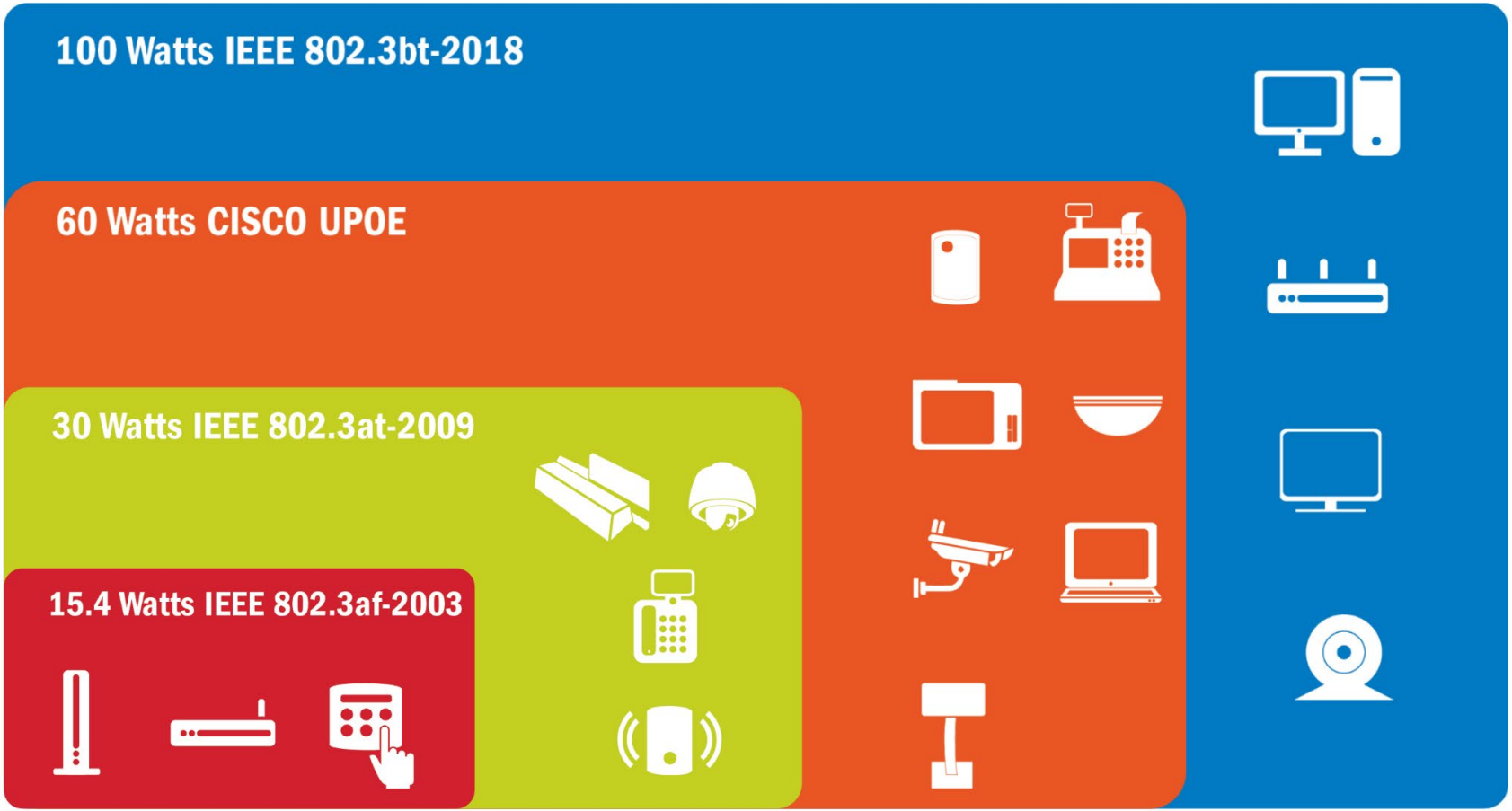
HIGH-PERFORMANCE STRUCTURED CABLING



THE FOURTH UTILITY



EVOLUTION OF POWER OVER ETHERNET



IEEE 802.3BT
4-PAIR POWER OVER ETHERNET

Applications Requiring More Than 30 Watts of Power

Markets	Typical power consumption
Nurse call systems — healthcare	80% market needs >30 W (typically 50 W)
Point of sale — retail (POS — credit card readers and printers)	40–50% in 30-60 W range
IP turrets — banking, financial trade floor phone systems	Typically 45 W
Building management (lighting fixtures and controllers, access controllers, etc.)	40–50 W
Thin clients, virtual desktop infrastructure (VDI) terminals (high-end configuration)	-50 W
Videoconferencing, hospitality (e. g.,: PoE-powered switches)	Typically 45–60 W
IP security cameras (pan, tilt, zoom cameras)	30–60 W range
Industrial (brushless and stepper drives, motor control units)	>30 W

Source: IEEE 802.3 CFI_02_0313

IEEE 802.3BT
4-PAIR POWER OVER ETHERNET

ANIXTER

PoE Capabilities

Type	Standard	PSE Minimum Output Power	PD Minimum Input Power	Cable Category	Cable Length	Power Over
Type 1	IEEE 802.3af	15.4 W	12.95 W	Category 5e	100 meters	2 pairs
Type 2	IEEE 802.3at	30 W	25.5 W	Category 5e	100 meters	2 pairs
Type 3	IEEE 802.3bt	60 W	51 W – 60 W	Category 5e	100 meters	2 pairs Class 0-4 4 pairs Class 0-4 4 pairs Class 5-6
Type 4	IEEE 802.3bt	90 W	71 W - 90 W	Category 5e	100 meters	4 pairs Class 7-8

PSE – Power Sourcing Equipment
PD – Powered Device

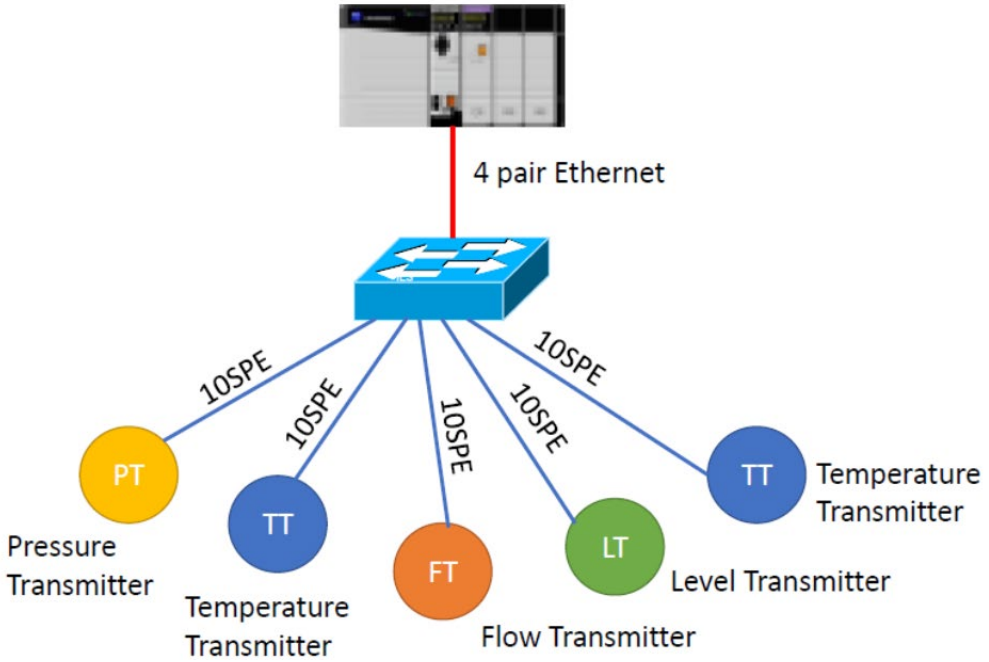
Source: IEEE 802.3bt - 2018

IEEE 802.3CG—10 MBPS SINGLE PAIR ETHERNET TASK FORCE

- Target Markets
  - Industrial Automation
  - Building Automation
  - Automotive
- Objectives
  - Support 10 Mb/s operation in automotive and industrial environments (e.g. EMC, temperature) over single balanced twisted-pair cabling.
  - Maintain a bit error ratio (BER) at the MAC/PLS service interface of less than or equal to 10-10 on link segments up to at least 15m, and 10-9 on link segments up to at least 1km
- New TIA project: ANSI/TIA-PN-568.5, “Single Twisted-Pair Cabling and Components Standard” under development

802.3CG DC POWERING USE CASES

- Based on DC Resistance Values—18 AWG is optimal for 1km reach
- Copper-Based LC Connector
- Link performance TBD



WIRELESS

Wi-Fi

IEEE 802.11 a/b/g
IEEE 802.11n
IEEE 802.11 ac

ZigBee

IEEE 802.15.4
Highly Scalable, Full Mesh Topology

Bluetooth

Bluetooth BR/EDR
Bluetooth Low Energy
Bluetooth 5.0

Cellular

3G
4G LTE
4G LTE Advanced
5G
Public Safety
Distributed Antenna Systems (DAS)

Technology	Application	Success Metrics	Data Rate	Range
802.11ac	LAN, Internet	Speed, flexibility	.1-7 Gbps	100m
ZigBee	Sensor Networks	Reliability, power, scalability, cost	.250 Mbps	70-300m
Bluetooth 5.0	PAN, Mobile Credentials	Cost, convenience	48 Mbps	<300m
LTE Advanced	Cellular	Reach, quality	3 Gbps	Cellular Network
5G	Cellular, Sensor Networks	Reach, quality, latency	1-30 Gbps	Cellular Network

- WiFi and ZigBee are pervasive in commercial building applications
- Bluetooth 5.0 will drive new use cases for mobile appliances in residential, commercial, and industrial applications
- Need for ubiquitous cellular coverage driving DAS deployments
- 5G has potential to displace incumbent wireless technologies in commercial buildings

BEST PRACTICES

POWER OVER ETHERNET – ARTICLES 725 AND 800

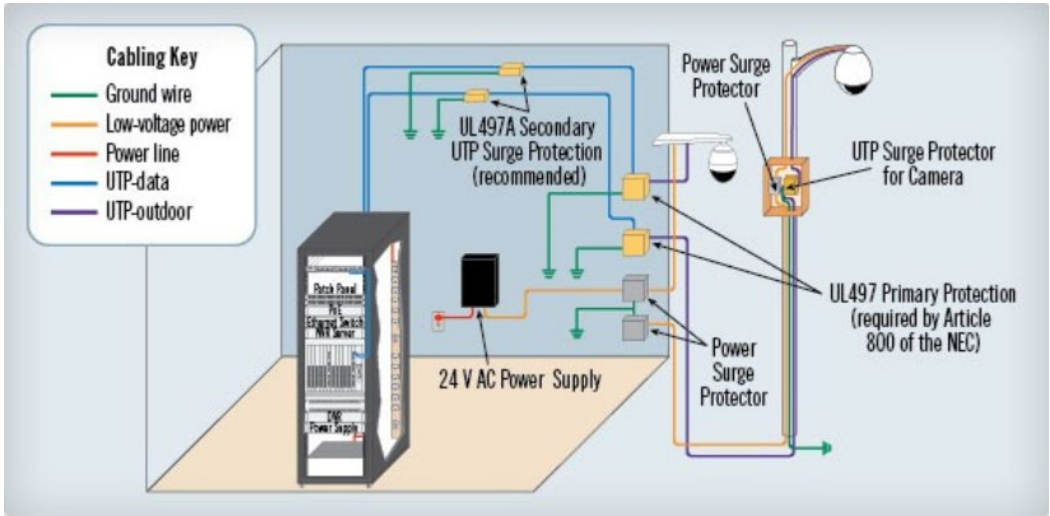
- **Article 725 - Class 1, Class 2, and Class 3 Remote - Control, Signaling, and Power-Limited Circuits**
  - Class 2 Circuit not to exceed 30VAC, 60VDC, 100VA
  - Due to its power limitations, a Class 2 circuit is considered safe from a fire initiation standpoint and provides acceptable protection from electrical shock
  - Class 2 and 3 systems do not require the same wiring methods as power, light, and Class 1 systems
    - There are cases when a 2-in. separation is required between these systems.

POWER OVER ETHERNET – ARTICLES 725 AND 800

- **Article 800 – Communications Circuits**
  - 840.160 Powering Circuits
    - Communications cables, in addition to carrying the communications circuit, shall also be permitted to carry circuits for powering communications equipment.
    - Where the power supplied over a communications cable to communications equipment is greater than **60 watts**, communication cables and the power circuit shall comply with 725.144 where communications cables are used in place of Class 2 and Class 3 cables.
  - 2020 Code Cycle
    - Harmonization of accepted current (< .3A per conductor) between 840.160 and 725.144
    - Exempts IEEE 802.3af and IEEE 802.3at from additional bundling requirements

RE-THINKING POWER PROTECTION

- Network enabled endpoint device growth will continue
- Class 2 remote powering over communications cabling gaining broad adoption
- Endpoint devices are largely unprotected from power surges and spikes
- Proposed architecture



IN CONCLUSION

Prepare your infrastructure as markets transition to new technologies.

- IoT use cases and market applications developing
  - Edge Data Centers
  - Commercial buildings
  - Industrial environments
- Infrastructure standards will facilitate IoT adoption

THANK YOU