

Next Generation Cabling Standards for Next Generation Buildings

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Agenda

- Digital Building Trends
- New and Upcoming Standards
- What Does the Future Hold?

DIGITAL BUILDING TRENDS

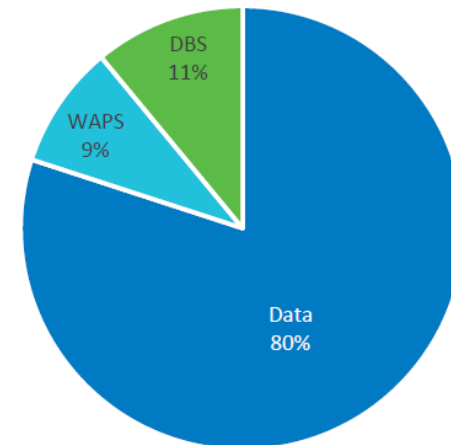
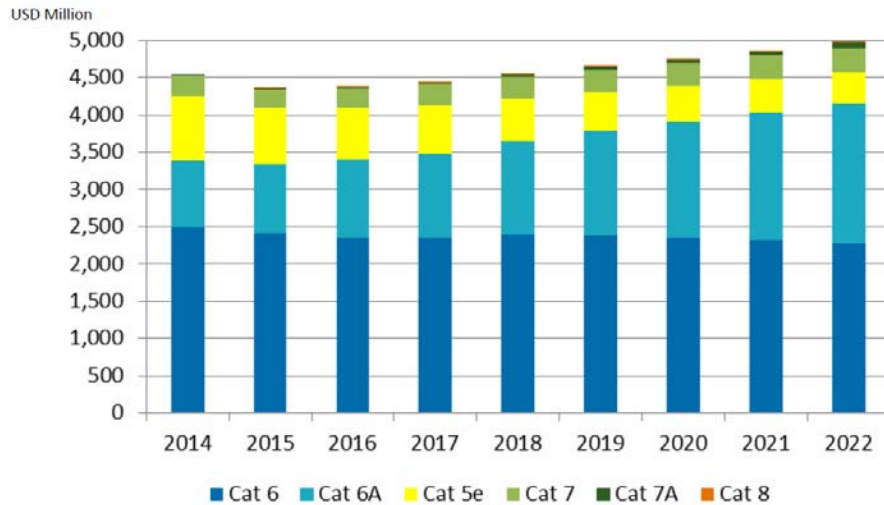


Looking Back and Ahead

Data, WAPs and IoT, million outlets/links, 2018



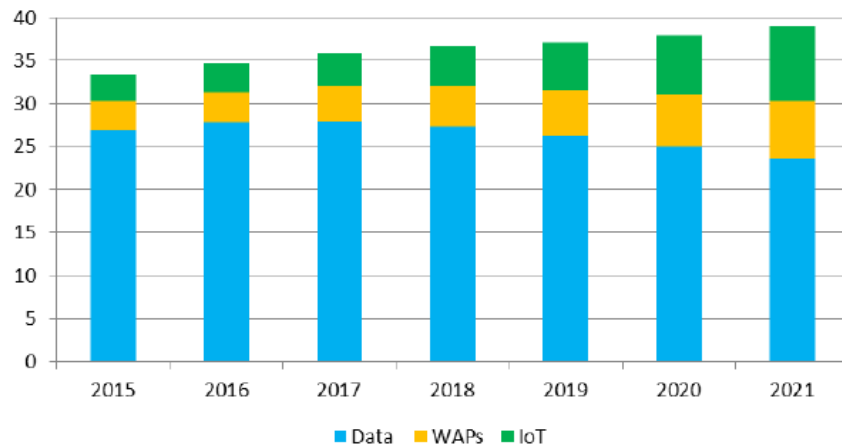
Sales by Category (channel), 2014 - 2022



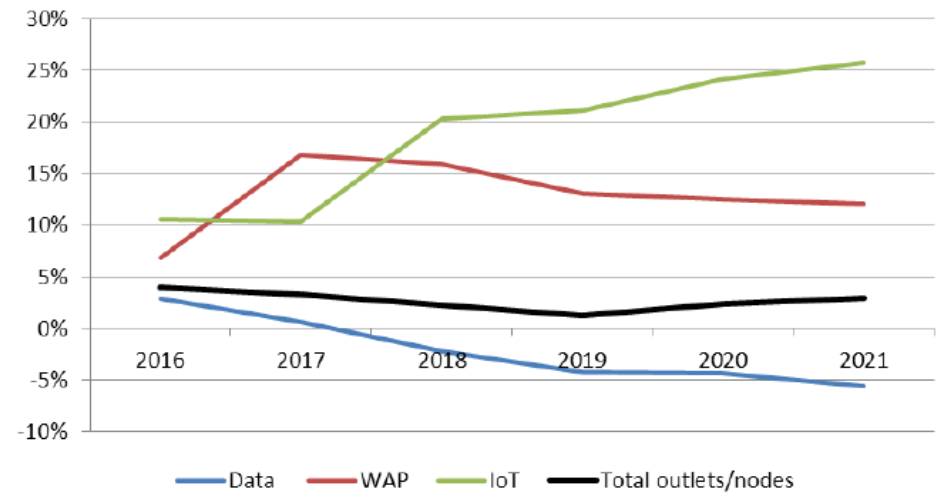
Source: BSRIA Structured cabling reports. Based on LAN copper cables sold worldwide in 2018 (F)

Where is the growth?

Outlets/nodes/links, Data, WAPs and IoT, US, million units, 2015 – 2021






Data, WAPs, IoT and total outlets/links, growth rates, US 2015 - 2021



Source: BSRIA study on Convergence Digitalisation of Buildings from 2017

What is driving digital buildings?

			
Typical Office Building Cost per Sq Foot/Year	Utilities \$3	Rent \$30	Payroll \$300
Potential Savings/Benefit 10% improvement	\$0.30	\$3	\$30

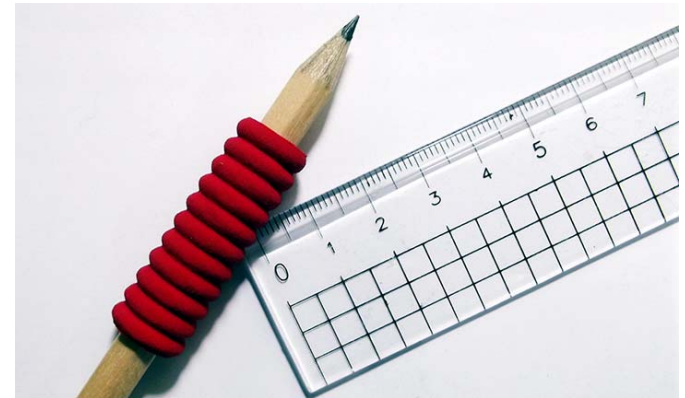


It's about the people...

Jones Lang LaSalle 3-30-300 Rule of Thumb

What *could* drive adoption...

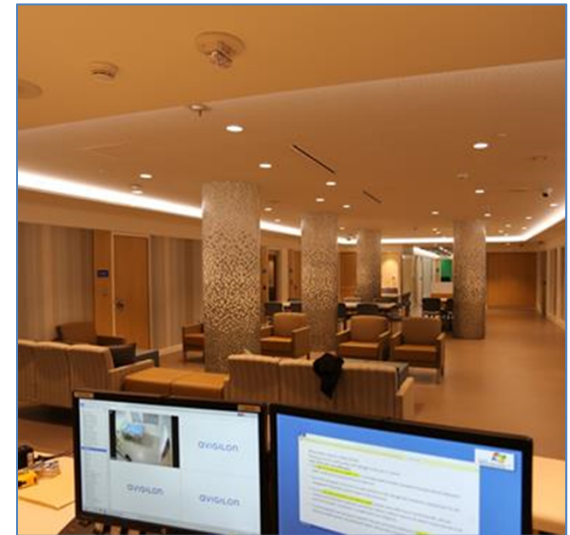
- Codes and standards recommending what digital buildings can do
 - Daylight harvesting
 - Auto-dimming of lights
 - Etc
- ASHRAE 90.1
 - Receptacle control
 - Energy Monitoring
 - Off via: Time of day, Occupancy Sensors, Controls
- NetZero
 - Energy used by building = energy created onsite
 - In last 6 years Verified NetZero buildings up 700%
- International Energy Conservation Code (IECC)
 - Similar to ASHRAE
 - Example: Auto off in 30 minutes of vacancy



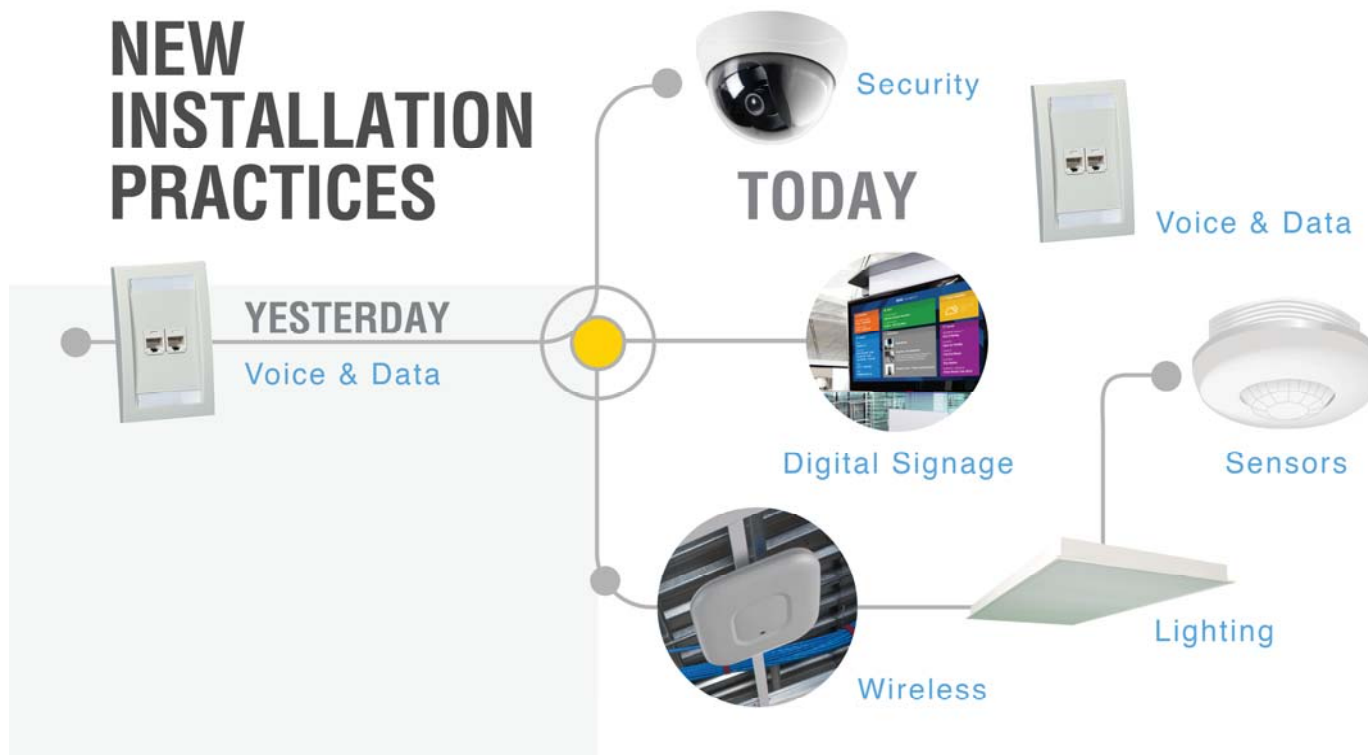
Example: Lighting in Health Care

Helps to Heal and Increase Revenue

- Lighting helps improve well being
 - Adjustable color temperature
 - Exceptional color quality
- Increase HCAHPS scores
- Innovative uses
 - Light the way to rooms
 - Flash lights when noise reach certain level



NEW INSTALLATION PRACTICES



IoT Implications for TR Rooms

- Lighting, security cameras, AV, sensors, etc.
- Opportunity for more connections in TR
- Density more of a concern
- Need cables with smaller diameters



Implications of New Installation Practices

- New installation locations
 - Ceilings
 - More plenum environments
- New cabling installation specifications
 - For example, are the cables and connectors visible?
 - Are there any new requirements?
 - Are there any new regulations?



SPECIFICATIONS

Digital Building Trends Summary

New digital building systems for businesses are growing

PEOPLE are driving adoption of digital building

New devices are driving new installation practices

New installation practices are driving new standards

NEW AND UPCOMING STANDARDS

ANSI/TIA-568.2-D

Balanced Twisted-Pair Telecommunications Cabling and Components Standards

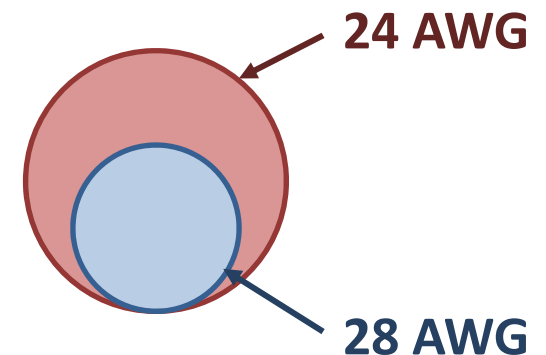
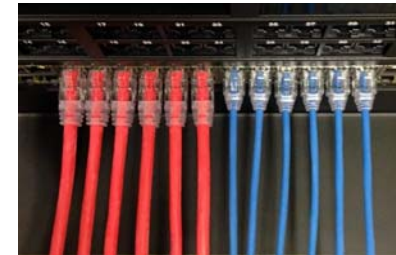
- Replaces ANSI/TIA-568-C.2
- Rolls in Category 8
- Recognizes 28 AWG patch cords
- Recognizes modular plug terminated links



**MANUFACTURERS & SUPPLIERS
OF GLOBAL NETWORKS**

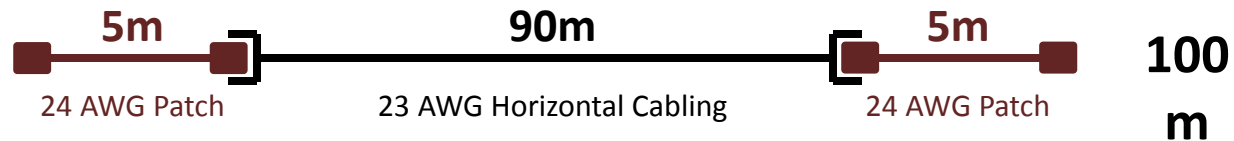
28 AWG Patch Cords Standardized

- ANSI/TIA-568.2-D now recognizes 28 AWG patch cords
 - Recommends maximum length of 15 meters
 - 1.95 de-rating (for reference, 1.2 for 24 AWG)
- Only 28 AWG patch cords recognize
 - Horizontal cable still must be 22 to 24 AWG
- Working on TSB-184-A-1 addendum
 - *Guidelines for Supporting Power Delivery Over Balanced Twisted-Pair Cabling*
 - Adding 28 AWG
 - Bundle sizes and high density bundles
- ***Deploy 28 AWG patch cords with confidence...***

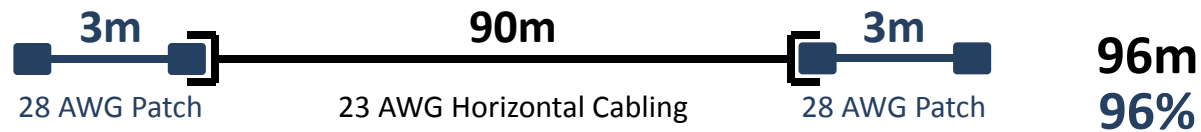


28 AWG Standards Overview

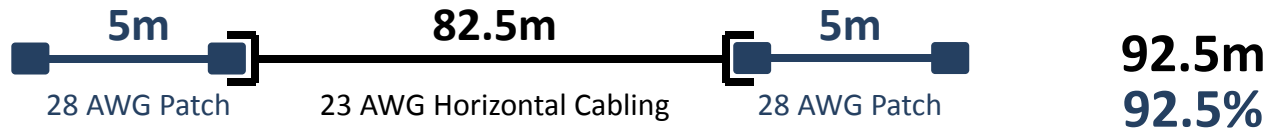
100 meter Channel (24 AWG Patch)



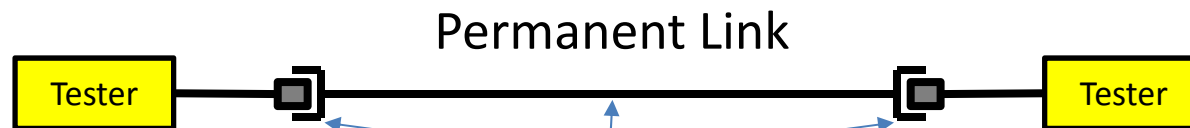
96 meter Channel (28 AWG Patch)



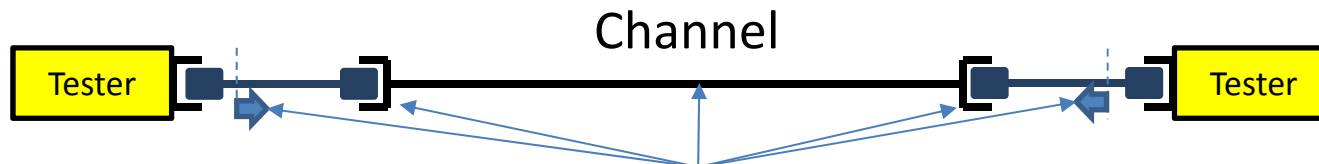
93 meter Channel (28 AWG Patch)



Traditional Methods to Test Links and Channels

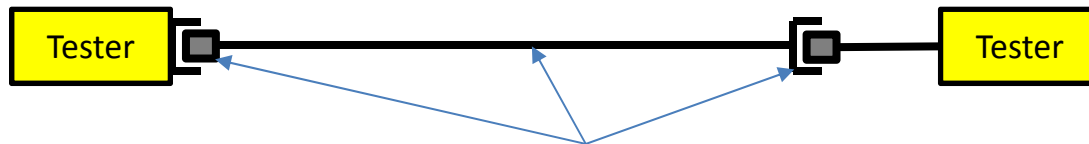


- Tester has plug for inserting into jack
- Tester tests both jacks & cable



- Tester has jack for inserting patch cords
- Tester ignores plug inserted into tester (only continuity)
- Tests performance of rest of channel

Modular Plug Terminated Links

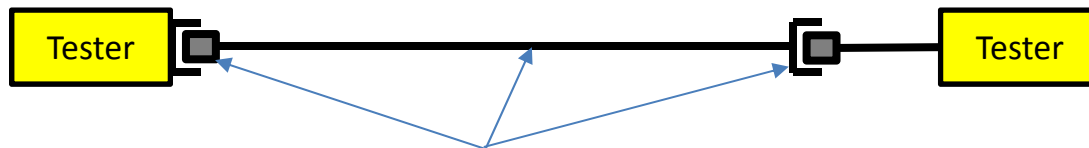


- Tester uses normal permanent link adapter (cord) to plug into one end
 - Tester uses patch cord adapter on other end (could be both)
 - Tests performance of ALL components plug, cable, and jack
-
- Modular Plug Terminated Links = Permanent Link
 - Same test limits
 - Instead of jack to jack, now jack to plug
 - Available on some field testers (called MPTL)
 - Ensures plug meets correct *performance* requirements
 - Important for wireless access points, cameras, etc



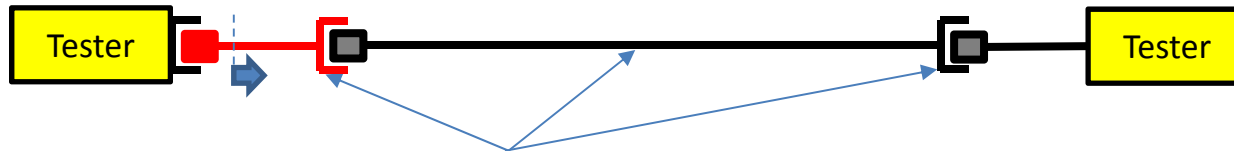
Testing in Practice

Standard Recommended



- Tester uses **special patch cord** adapter on one end, **standard permanent link** on the other
- Select the appropriate MPTL limit

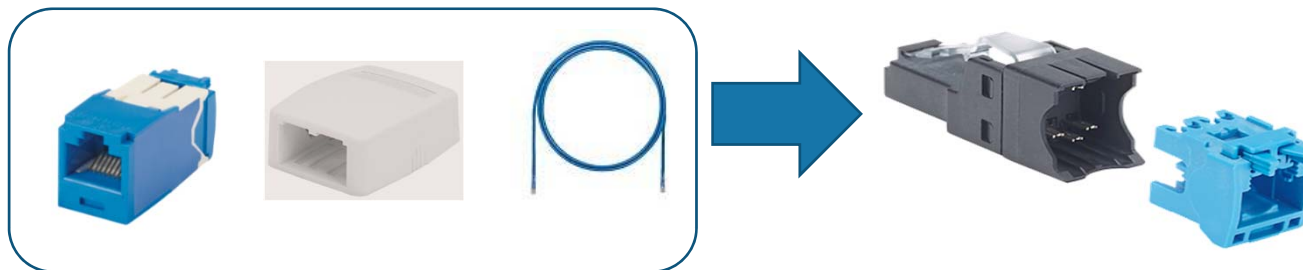
Alternate Method



- Tester uses **standard channel** adapter on one end, **standard permanent link** on the other
- Use **vendor provided jack to plug adapter**
- Select the appropriate **permanent link limit**, and ignore any warnings

Why MPTL?

- Cleaner look in open ceilings
- Replaces additional components
- Ensures safety compliance
 - Plenum patch cords vs plenum cable you have
 - UL 2043 rated plugs





2.5 and 5GBASE-T (NBASE-T)

- Use existing Cat 5e/Cat 6 cables
 - Brownfields, WAP focus
- TIA TSB-5021 on using cables
 - Key is RISK, particularly alien
- **Recommendation = Cat 6A for new**



Bundled Distance	Category	Victim Length		
		1m – 20m	20m – 75m	75m – 100m
Bundled distance up to 20m	5e	Negligible	Negligible	Low
	6	Negligible	Negligible	Low
	6A	None	None	None
Bundled distance 20m – 75m	5e		Medium Low	Medium High
	6		Low	Medium
	6A		None	None
Bundled distance 75m – 100m	5e			High
	6			Medium High
	6A			None

PoE Standards

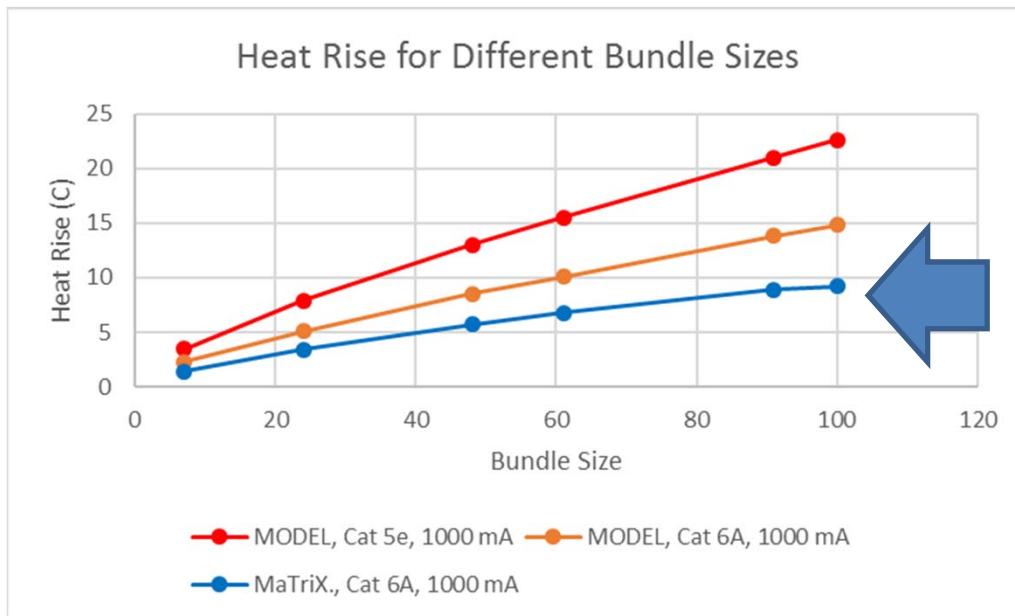
- IEEE P802.3bt Task Force
 - Overall standard governing equipment and cabling
- TIA TSB-184-A
 - Technical Service Bulletin on “Guidelines for Supporting Power Delivery Over Balanced Twisted-Pair Cabling”
-  • TIA TSB-184-A-1
 - Addendum PoE Impact to 28 AWG patch cords
- ISO/IEC TR-29125 and CENELEC TR 50174-99-1
 - International cabling guidelines for PoE++
-  • ANSI/TIA-568.2-D
 - Familiar standard covering cabling performance
- IEC 60512-99-002
 - Standard for connectivity with engaging / disengaging PoE

PoE Performance Summary

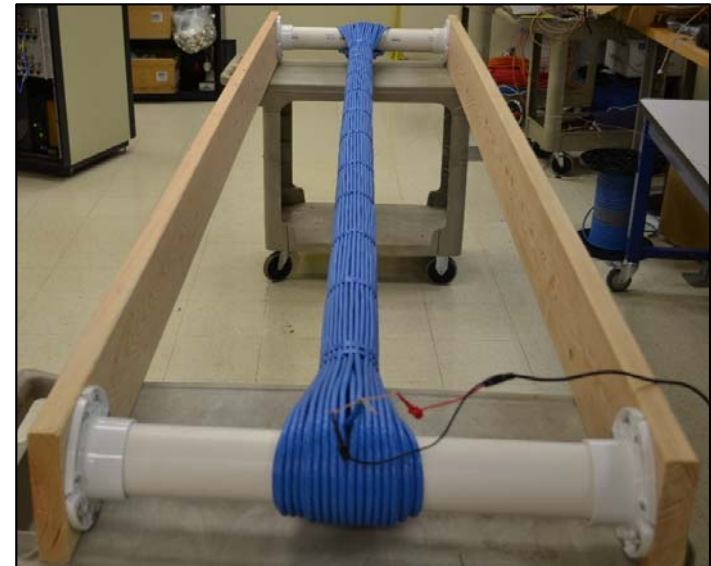
Type	Standards	Maximum Current	Number of Energized Pairs	Power at Source	Power at Device	Maximum Data Rate	Standard Ratified
PoE	IEEE 802.3af (802.3at Type 1)	350 mA	2	15.4 W	13 W	1000BASE-T	2003
PoE+	IEEE 802.3at Type 2	600 mA	2	30 W	25.5 W	1000BASE-T	2009
PoE++ (4PPoE)	Proposed IEEE 802.3bt Type 3 Proposed IEEE 802.3bt Type 4	600 mA 960 mA	4	60 W 99 W	51 W 71 W	10GBASE-T	Expected 4Q2018
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

- Current increase by 1.5X
- Power going from 2 pairs to 4 pairs
- Approximately 3X increase in power

Temperature Rise Per Bundle Size



Model data from TSB-184-A



Impact of United States 2017 National Electric Code

- Recognizes new UL listing for Limited Power (LP) cables
 - LP not required
 - Need at least a 0.5A rating
 - Example: TYPE CMP-LP(0.5A) (UL) 23 AWG 90°C
- LP simplifies installation and inspection
 - With no LP, refer to ampacity table



Type	Standards	Maximum Current	Number of Energized Pairs	Power at Source	Power at Device
PoE	IEEE 802.3af (802.3at Type 1)	350 mA	2	15.4 W	13 W
PoE+	IEEE 802.3at Type 2	600 mA	2	30 W	25.5 W
PoE++ (4PPoE)	Proposed IEEE 802.3bt Type 3	600 mA	4	60 W	51 W
PoE++ (4PPoE)	Proposed IEEE 802.3bt Type 4	960 mA	4	90 W	71.3 W

NEC® 2017 not a concern



NEC® 2017 imposes new requirements

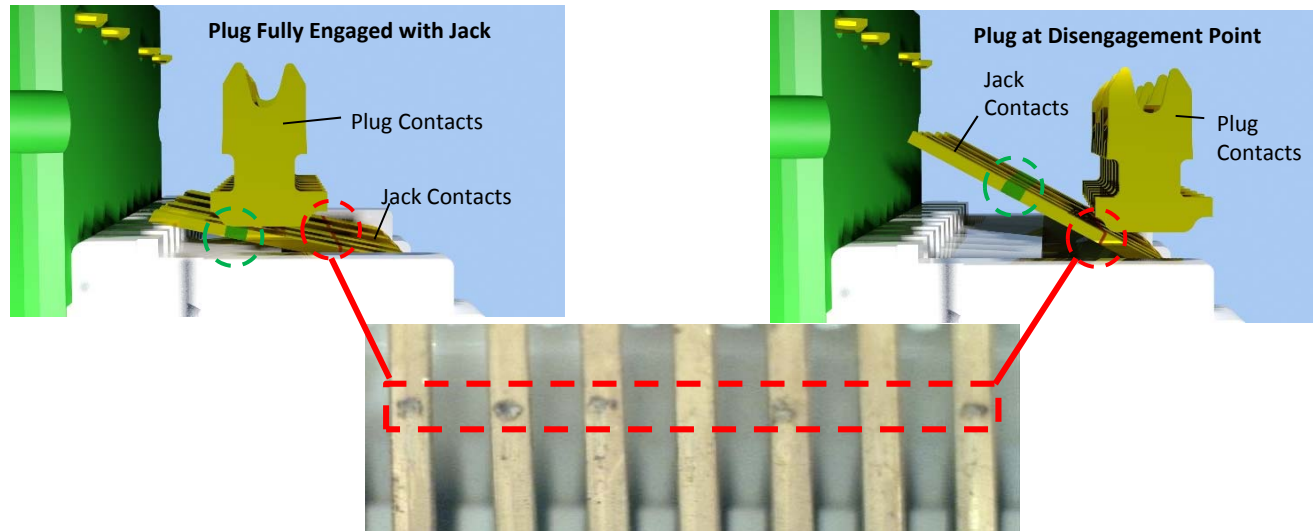
Ampacity Table

AWG	Number of 4-Pair Cables in a Bundle																				
	1			2-7			8-19			20-37			38-61			62-91			92-192		
	Temp Rating			Temp Rating			Temp Rating			Temp Rating			Temp Rating			Temp Rating					
	60°C	75°C	90°C	60°C	75°C	90°C	60°C	75°C	90°C	60°C	75°C	90°C	60°C	75°C	90°C	60°C	75°C	90°C	60°C	75°C	90°C
26	1.0	1.0	1.0	1.0	1.0	1.0	0.7	0.8	1.0	0.5	0.6	0.7	0.4	0.5	0.6	0.4	0.5	0.6	NA	NA	NA
24	2.0	2.0	2.0	1.0	1.4	1.6	0.8	1.0	1.1	0.6	0.7	0.9	0.5	0.6	0.7	0.4	0.5	0.6	0.3	0.4	0.5
23	2.5	2.5	2.5	1.2	1.5	1.7	0.8	1.1	1.2	0.6	0.8	0.9	0.5	0.7	0.8	0.5	0.7	0.8	0.4	0.5	0.6
22	3.0	3.0	3.0	1.4	1.8	2.1	1.0	1.2	1.4	0.7	0.9	1.1	0.6	0.8	0.9	0.6	0.7	0.8	0.5	0.6	0.7

Note 1: For bundle sizes over 192 cables, or for conductor sizes smaller than 26 AWG, ampacities shall be permitted to be determined by qualified personnel under engineering supervision.
 Note 2: Where only half of the conductors in each cable are carrying current, the values in the table shall be permitted to be increased by a factor of 1.4.

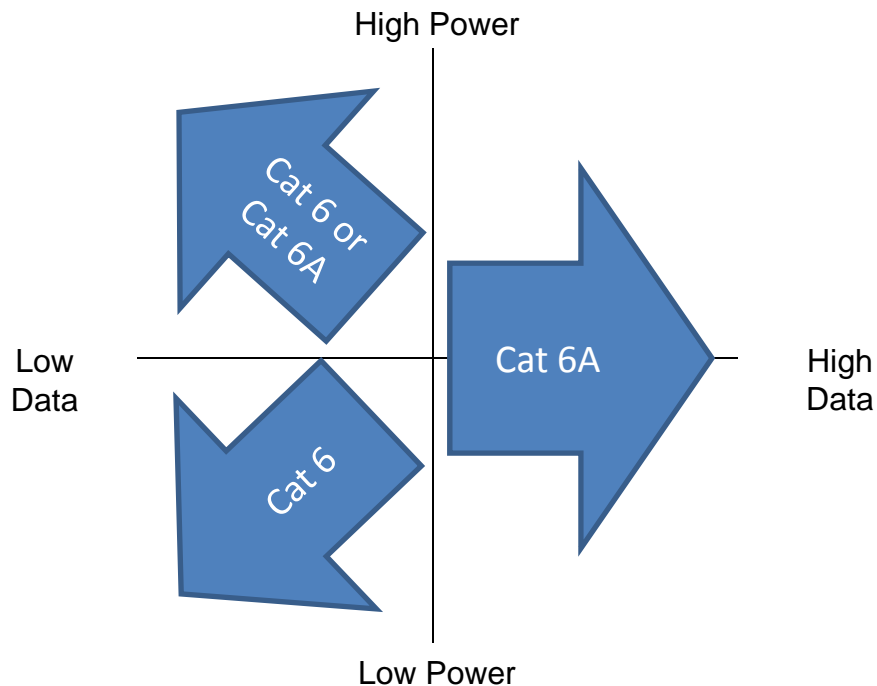
- Cat 5e (24 AWG, 60C): Maximum bundle size of 61
- Cat 6A (23 AWG, 75C): Maximum bundle size of 192

Connectivity and Next Generation PoE



- Arcing (spark) occurs when plug is removed
 - Does not occur when plug is inserted
- Carbon buildup may prevent data transmission
- Jack must be designed for (meet IEC 60512-99-001 for 2 A)

What Cable Should I Install?



- Category 6A provides performance
 - Best thermals
 - Speed up to 10GBASE-T
- Category 6
 - 100% sure you will not need the speed
 - Speed up to 5GBASE-T with NBASE-T
 - Recommend 23 AWG Cat 6
 - Consider LP rated

We always overestimate the change that will occur in the next two years and underestimate the change that will occur in the next ten. – Bill Gates

New Standards Summary

New ANSI/TIA-568.2-D standard

28 AWG patch cords are standards compliant

Modular plug terminated links are standards compliant

New PoE standards & cable choice (23 AWG, Cat 6 vs Cat 6A)

THE FUTURE



Building Systems

- Panduit World Headquarters
- 600,000 feet of 4-pair
- 500,000 feet of 2-wire
 - HVAC
 - Lighting control
 - Access control
 - Etc

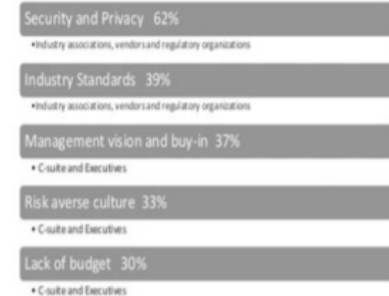


Why Single Pair?

- Traditional structured cabling advantages
- Interoperability KEY to BAS adoption



3 of Top 5 Obstacles to IoT Adoption are C-level issues



Industry of Things World Survey of 1124 decision makers March 2017

we grow value and build leaders

GREY HERON

Accenture Healthcare Report 2017

Privacy concerns 55%
Legacy systems and equipment 55%
Security concerns 54%
Technology immaturity 53%
Lack of budget 53%

Single Pair Ethernet

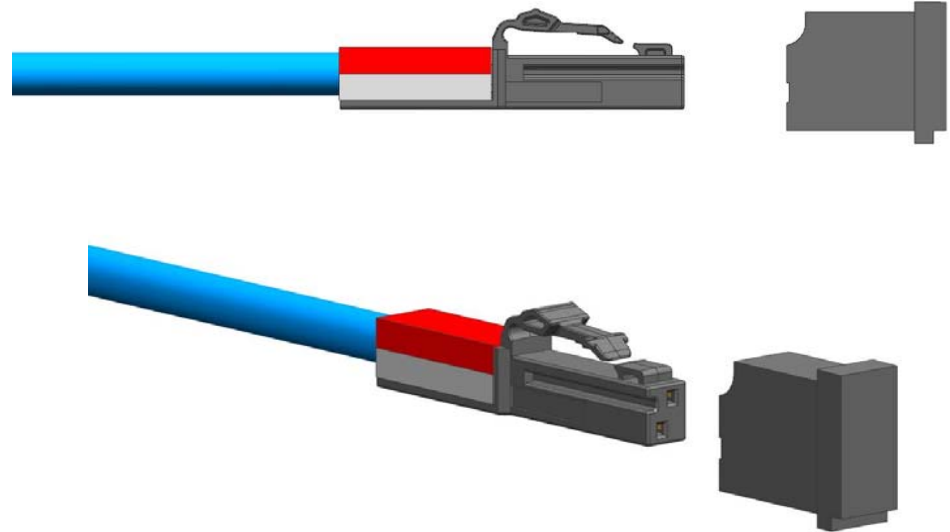
- **It is happening NOW in industrial and automotive**
- 802.3bp 1000BASE-T1: 1 Gbps from 15 to 40 m (published)
 - 15m: Automotive (link segment type A)
 - 40m: Industrial (link segment type B)
- 802.3bw 100BASE-T1: 100 Mbps up to 15 m (published)
 - Automotive and Industrial
- 802.3cg 10BASE-T1: 10 Mbps up to 1 km (published)
- 802.3bu PoDL: Power over Data Lines, up to 50W (published)
- ANSI/TIA-568.5: Single Balanced Twisted-Pair Telecommunications Cabling and Components Standard (draft)
- ANSI/TIA-568.0-D.2 (generic cabling, initial stages)
- ANSI/TIA-862-B.2 (single pair addendum to Intelligent Building Systems initial stages)

ANSI/TIA-568.5: Single Balanced Twisted-Pair Telecommunications Cabling and Components Standard

- Work done in 42.7 group
- Early stages of development
- Expecting publication within 1 to 2 years
- Channels from 15 to 1000 meters
- Generic standard for single pair cabling

Single Pair Connector

- Targets:
 - Easy to install
 - Field terminable
 - Higher density (96 in 1RU)
 - Handle data & power
- LC Connector Design
 - PROVEN latch & connector
 - Modifications for copper
 - IEC 63171-1
 - Up to 600 MHz



Single Pair is Unique

Parameter	4-pair	Single Pair
Data Rate	Up to 10 Gb/s (10GBASE-T)	Up to 1 Gb/s (10 Mb/s at 1000m)
Power Levels	Up to 71 W (PoE++)	Up to 15 W (TBD)
Reach	Up to 100 m	Up to 1000 m
Connector Type	RJ45	Modified LC
RU Density	48 ports in 1 RU	96 ports in 1 RU



The Future

Everything is going on the network

Single pair is a new standard and standards are important

Single pair is coming into the Enterprise (from Industrial and auto)

ANSI/TIA-568.5 and LC-style copper