Extending Ethernet Beyond 100m: Myths, Truths, and Possibilities

Advanced Communications Networks

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Presenter

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Learning Outcomes

Extending Ethernet Beyond 100m:

- Understand Myths and Misconceptions
- Explore Advanced Technologies
- Evaluate Practical Solutions
- Discover Use Cases and Possibilities

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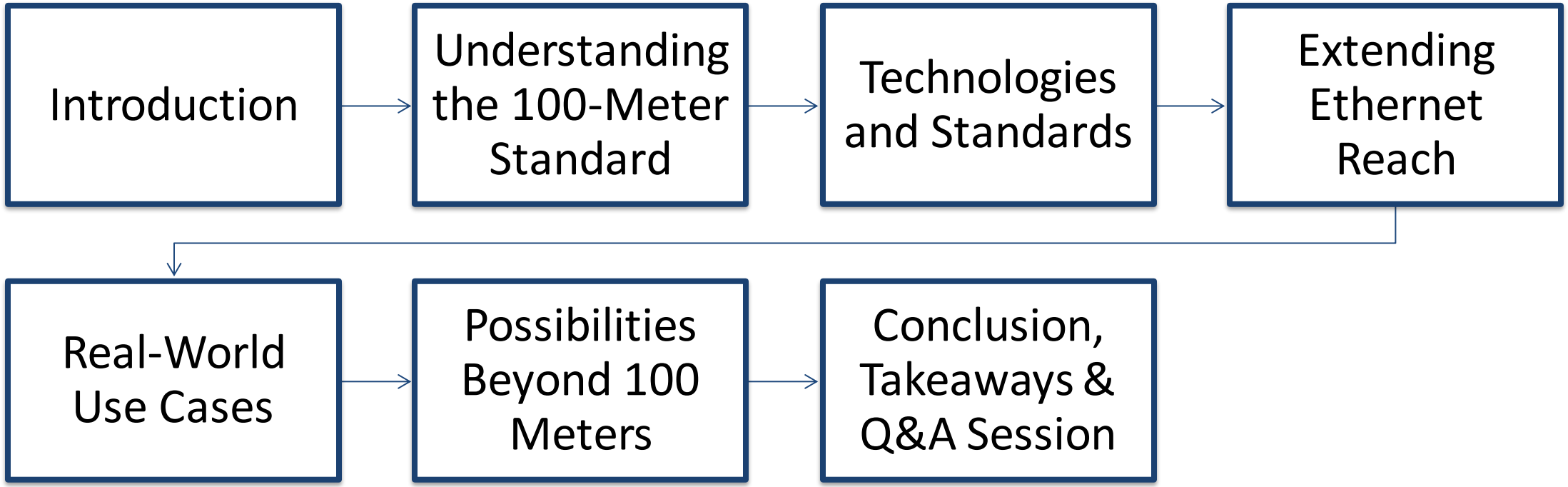
Agenda



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INTRODUCTION

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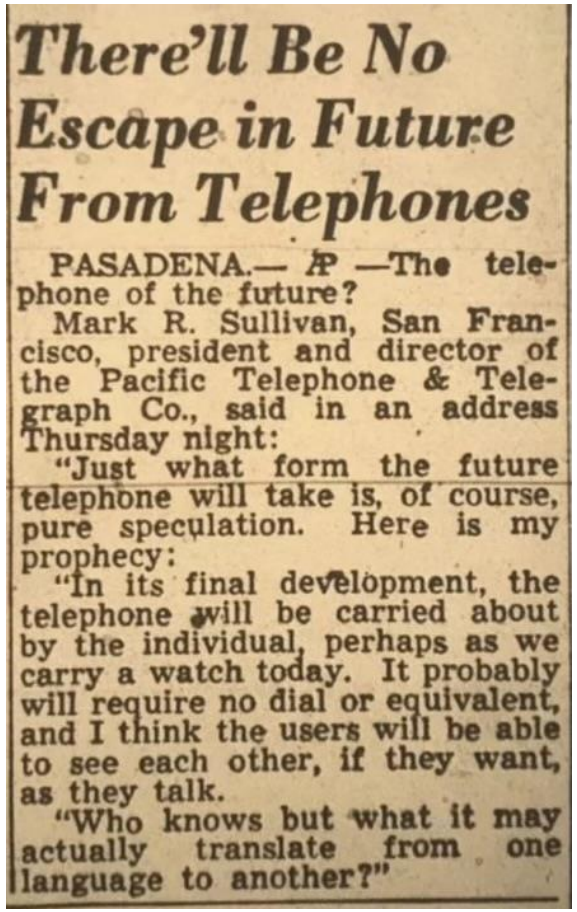
The Tacoma News Tribune, April 11, 1953



There'll Be No Escape in Future From Telephones

PASADENA.— AP —The telephone of the future?

Mark R. Sullivan, San Francisco, president and director of the Pacific Telephone & Telegraph Co., said in an address Thursday night:

"Just what form the future telephone will take is, of course, pure speculation. Here is my prophecy:

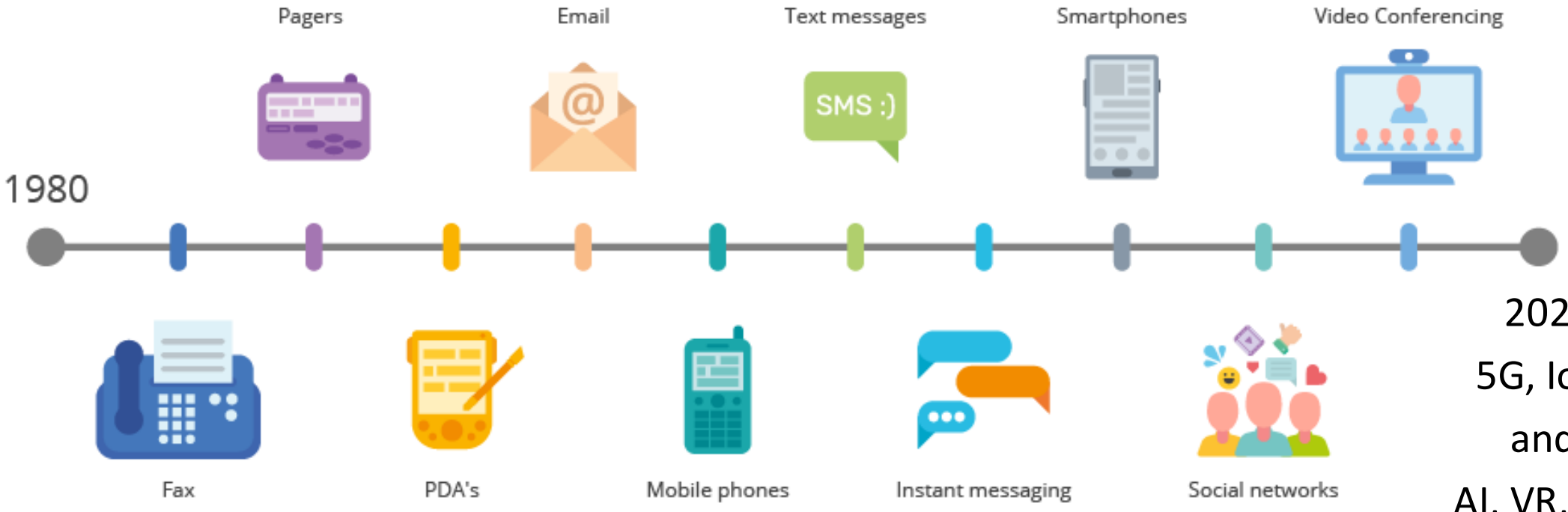
"In its final development, the telephone will be carried about by the individual, perhaps as we carry a watch today. It probably will require no dial or equivalent, and I think the users will be able to see each other, if they want, as they talk.

"Who knows but what it may actually translate from one language to another?"

A Telephone Company Executive Predicts the Rise of Modern Smartphones and Video Calls

Source: OPEN CULTURE

Evolution of Digital Communication



Source: Unified Communications: History, Features and Technology, Dmitriy Odintsov

A New Paradigm for the Building Industry

CAR INDUSTRY

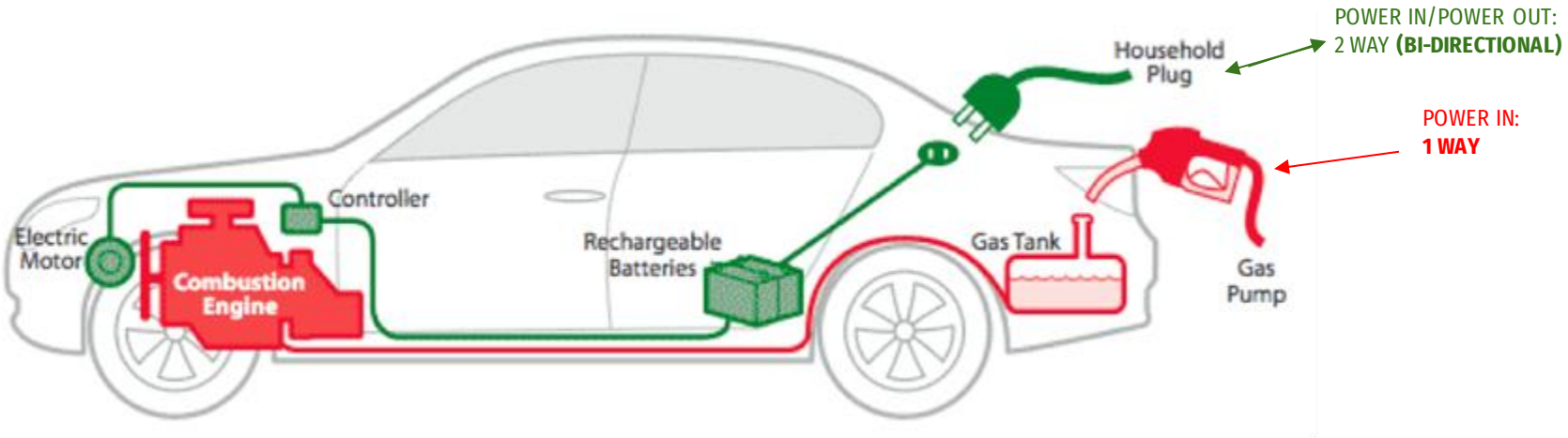
ELECTRIC vs GASOLINE

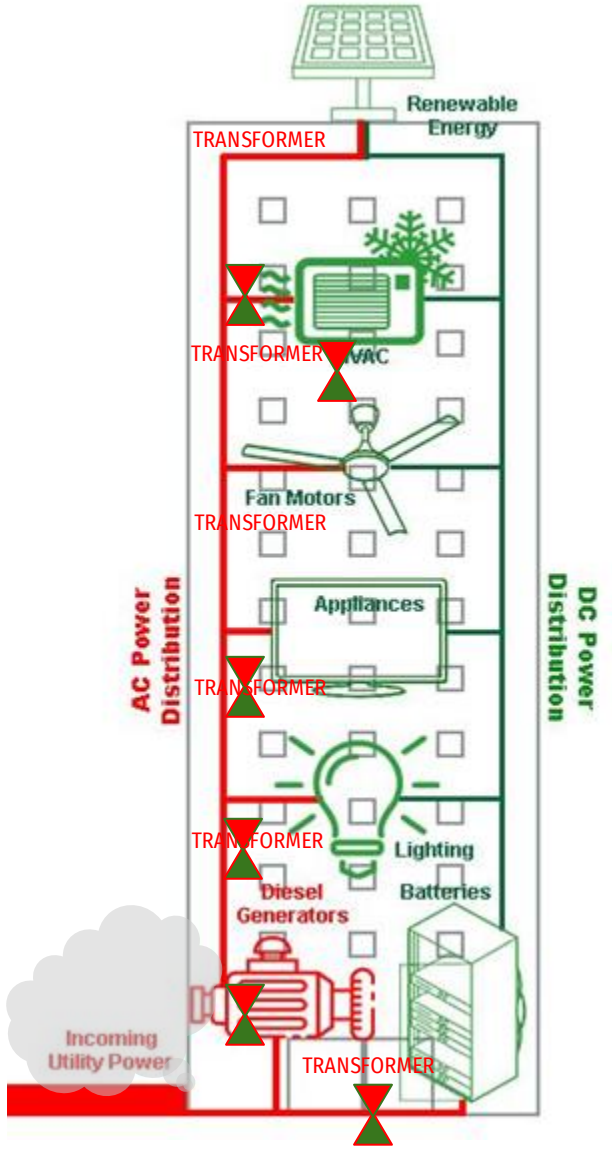
- Entirely new vehicle power plant.
- Propelled by regulation.
- Software plus batterie.s
- Vehicles are simpler & require less maintenance.
- No emissions means healthier people.

BUILDING INDUSTRY

DC vs AC

- New building power system.
- Propelled by new regulations.
- Software plus batteries & renewables.
- Simpler to build and simpler to maintain means less embodied carbon.
- Less (soon to be no) emissions means no climate change.





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Why Smart Buildings?

What is PoE?

- Technology that provides power over twisted-pair ethernet cables to powered devices and the data signals for devices to connect and communicate with the network.
- DC Power up to 90 watts + Data up to 10 Gbps.

ENHANCED OCCUPANT SATISFACTION

Occupants can experience advanced control and customization using connected technology, and Operations will be made easy with accessible centralized control and notification platforms.

CAPEX & OPEX COST SAVINGS

By using fewer physical materials, utilizing less expensive labor, and reducing energy consumption, buildings can save money on both capital projects and operational costs.

REDUCED ENVIRONMENTAL IMPACT

Using DC Technology, we can eliminate the use of fossil fuels, and substantially reduce the operational and embodied carbon being used in the project.

MORE USABLE SPACE

Using intelligent distributed design gives the opportunity to generate more usable space by eliminating the need for IDFs and Electrical Closets.

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UNDERSTANDING THE 100-METER STANDARD

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Why 100 Meters?

The 100-meter Ethernet standard is closely related to various IEEE 802.3 standards, specifying different types of cabling and technology for Ethernet networks. For instance, the 100BaseTX standard (IEEE 802.3u) utilizes Category 5 UTP cabling and supports data transmission speeds of 100 Mbps over a maximum distance of 100 meters. This limitation stems from the physical properties of the cables and the signal quality over distance. Such standards ensure reliable data transmission within specified distances, using twisted-pair cabling or fiber optics for higher speeds or longer distances in different scenarios

Channel – Two Connectors

Source: Computer Networking Notes – Ethernet Standards and Protocols Explained

Standards Beyond 100 m . . . There are None!

- Smart Buildings are driving a need to go beyond the TIA/ISO 100m Standard.
- No standard for beyond 100m over copper cables, but UL-verified claims[1] ensure performance.
- Full 1G performance[2] up to 160 meters (525 feet), and application-specific up to 305 meters (1000 feet).
- Full 10G performance[2] up to 108 meters (354 feet).

[1] **B561825** and **B284835**

[2] Heat, connectivity, attachments, and channel patch cords may alter the actual performance

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Myths & Misconceptions about the 100m Rule

A common myth is that the 100-meter limit for Ethernet cabling is arbitrary. In reality, this limit is based on electrical signal degradation over distance. Ethernet standards, such as 100BaseTX, use twisted-pair cabling to maintain signal quality up to 100 meters. Beyond this, signal loss and interference can affect network performance. The rule ensures reliable data transmission by balancing cable length with signal integrity, considering factors like electromagnetic interference (EMI) and crosstalk within the specified distance. Methods to extend distance beyond 100 meters include:

1. **Ethernet Extenders/Repeaters/Switches**: Utilize to amplify signals for longer distances and need to be installed every 100 meters to regenerate the signal.
2. **Segmentation**: Break down the network into smaller, interconnected segments.
3. **Higher-grade Cabling**: Use performance-optimized cables for slight increases in distance capability.
4. **Active Ethernet**: Incorporate powered devices to boost signal strength over longer runs.

Most cables are designed and manufactured to the 100m Standard.

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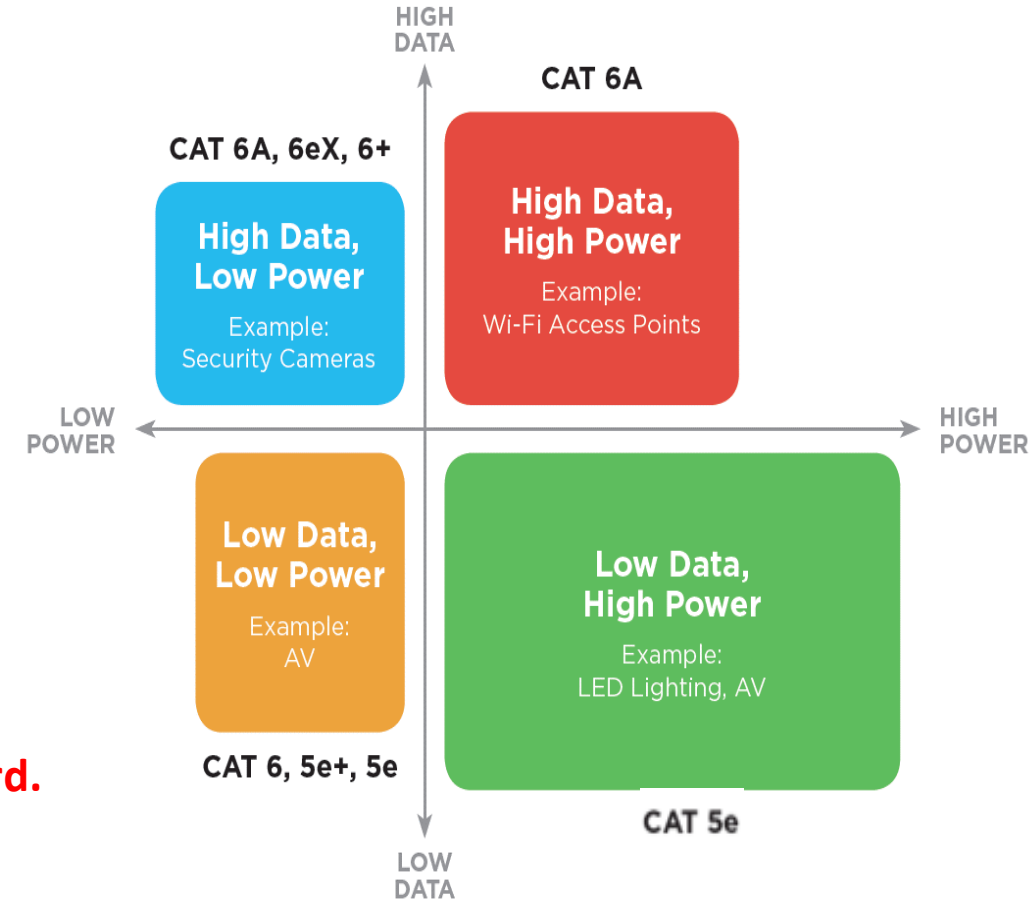
Performance Beyond 100m over Copper Cables is . . .

- Not a question of Category.
- Depends on the Application.
- Depends on the Cable Type.
- Depends on the Number of Connections.

Most cables are designed and manufactured to the 100m Standard.



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TECHNOLOGIES AND STANDARDS

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What Are Standards?

- Standards are published documents that establish technical specifications and procedures designed to maximize the reliability of the materials, products, methods, and/or services people use every day.
- A standard can be thought of as an agreed-upon norm used by people, industry, and government that outlines the best way to complete a task – whether it's about developing a product, providing a service, controlling a process, or interacting with the world.
- Technology standards can also provide a framework that enables devices from different manufacturers to communicate with one another. That's why, for example, your EV automatically connects to your home Wi-Fi network as soon as you pull into the garage. You didn't have to think about connecting. It all happened automatically, behind the scenes, ensuring that your maps and playlists are always up to date.
- In the process, standards provide a stable but continually evolving foundation that enables entire industries to develop and thrive. Think of standards as recipes. By following them, manufacturers get highly detailed information about how devices identify one another, how data flows between them, and how it's kept secure, to name just a few examples.

Source: IEEE SA Beyond Standards

What is a Standard, Really?

A standard is a document that provides rules or guidelines to achieve order in a given context.

Source: ETSI – Why Standards

Why Do We Use Standards?

- They address the need for interconnection and interoperability.

  This is particularly important for open markets, where increasingly mobile users can ‘mix and match’ equipment and services and where suppliers can benefit from economies of scale.

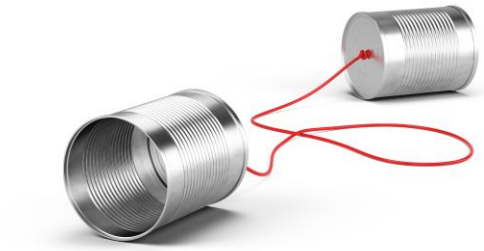
- They are equally important for ensuring safety, reliability, and environmental care.

  They are also frequently referenced by regulators and legislators for protecting user and business interests and in support of government policies.

Source: ETSI – Why Standards

When do you Deviate from Standards?

"Standards are in constant development and must also provide sufficient flexibility to allow for entrepreneurship and innovation."



Source: Oxford University Press's Academic Insights for the Thinking World

Ethernet Cabling Categories

- **Cat 5e:** 1 Gbps over distances up to 100 meters. Typically uses 24 AWG conductors and has enhanced shielding to reduce crosstalk.
- **Cat 6:** 10 Gbps networking over distances up to 55 meters and 1 Gbps up to 100 meters. It features tighter twists and more stringent shielding to mitigate crosstalk and interference, making it suitable for environments where performance and reduced noise are critical.
- **Cat 6A:** 10 Gbps networking over 100 meters. It uses thicker wires (typically 23 AWG) and tighter twists to reduce crosstalk further and increase performance. The increased shielding and wire gauge make Cat 6A cables thicker and less flexible but ideal for high-speed networks requiring maximum distance without loss of signal quality.

Advanced Signal Processing Techniques: Advanced signal processing techniques such as error correction and crosstalk cancellation are employed to achieve higher data rates and longer distances. These techniques allow for more efficient use of the available bandwidth and improve the signal-to-noise ratio, enabling faster data transmission over longer distances without significant loss of quality.

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Sources: Truecable - The Difference Between Cat5e & Cat6 Ethernet Cable
Cable Matters - Cat5e vs. Cat6: What's the Difference?
Cabling Installation & Maintenance - Cat 5e vs. Cat 6 vs. Cat 6A - which should you choose?

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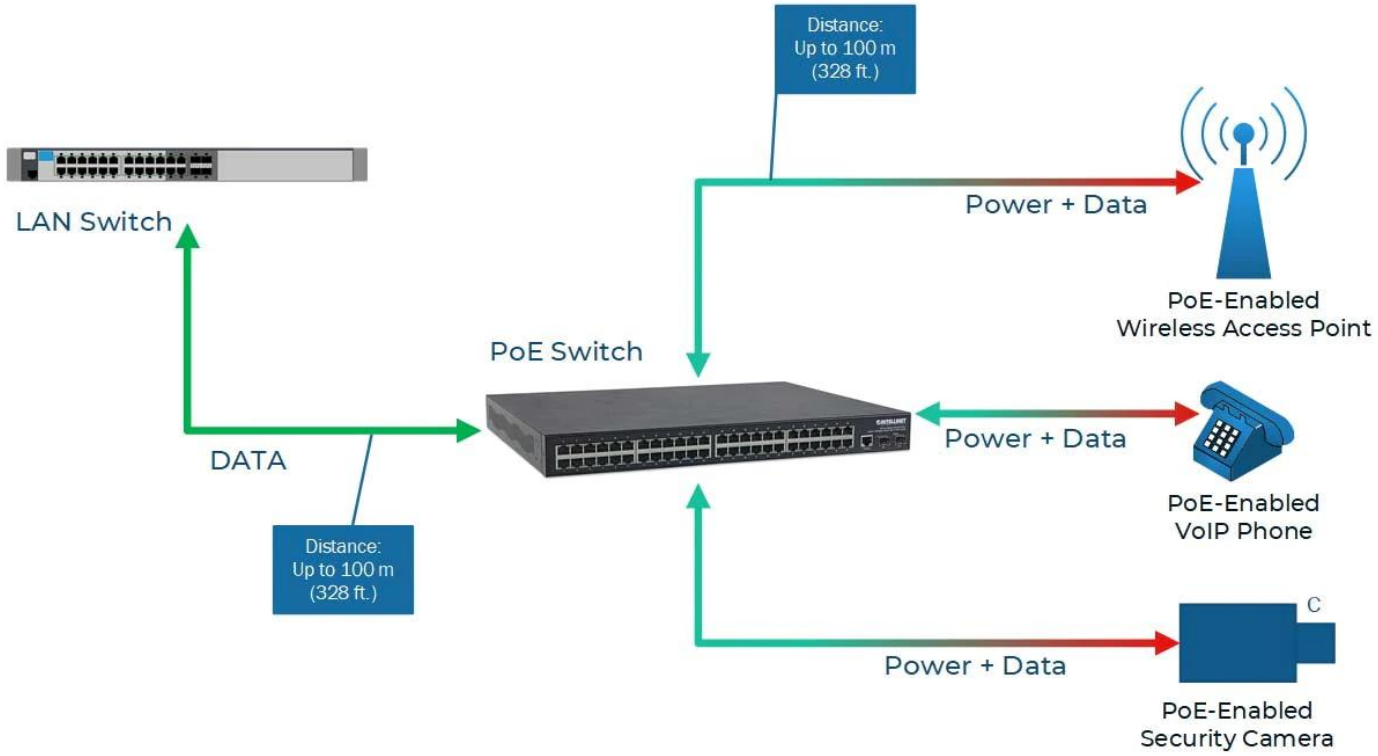
What is PoE?

Power over Ethernet (PoE) is a technology that passes electric power over twisted-pair Ethernet cable to powered devices (PD), such as wireless access points, IP cameras, and VoIP phones, in addition to the data that cable usually carries. It enables one RJ45 cable to provide both a data connection and electric power to PDs instead of having a separate cable for each.



Source: Intelligent Network Solutions

PoE Standards

PoE Standard	PoE Common Name	Power Output	Year	Comment
IEEE 802.3af	PoE	15.40 W	2003	12.95 W power available for connected device (PD)
IEEE 802.3at	PoE+	30 W	2009	25.50 W power available for connected device (PD)
IEEE 802.3bt Type 3	4PPoE, Ultra PoE, UPoE	60 W	2018	51 W power available for connected device (PD)
IEEE 802.3bt Type 4	Ultra PoE, UPoE	100 W	2018	71 W power available for connected device (PD)

Source: Intelligent Network Solutions

Electrical Specifications of PoE Standards OVER UTP

For most users, the "Minimum power for PD" value is the most significant, as that value dictates which PoE standard provides sufficient power for the required application.

PoE Standard	Voltage @ PD	Voltage @ PSE	Minimum power for PD*		Minimum output @ PSE	Supported Modes	Maximum cable length
IEEE 802.3af	37-57 V	44-57 V	12.95 W	16%	15.40 W	Mode A + B	100 m
IEEE 802.3at	42.5-57 V	50-57 V	25.5 W	15%	30 W	Mode A + B	100 m
IEEE 802.3bt Type 3	42.5-57 V	50-57 V	51 W	15%	60 W	Mode A + B, 4-pair mode	100 m
IEEE 802.3bt Type 4	41.1-57 V	52-57 V	71 W	29%	100 W	Mode A + B, 4-pair mode	100 m

* Short distances via high-quality cable result in power values closer to the power output at the PSE.

A high-quality cable may achieve power and data transmission beyond the 100m standard.

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Source: Intelligent Network Solutions

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Common PoE Devices

Access Points

Badge Readers

Biometric Door Locks

Ceiling Fans

Entry Barriers & Turnstiles

Face Recognition Systems

HVAC VAVs

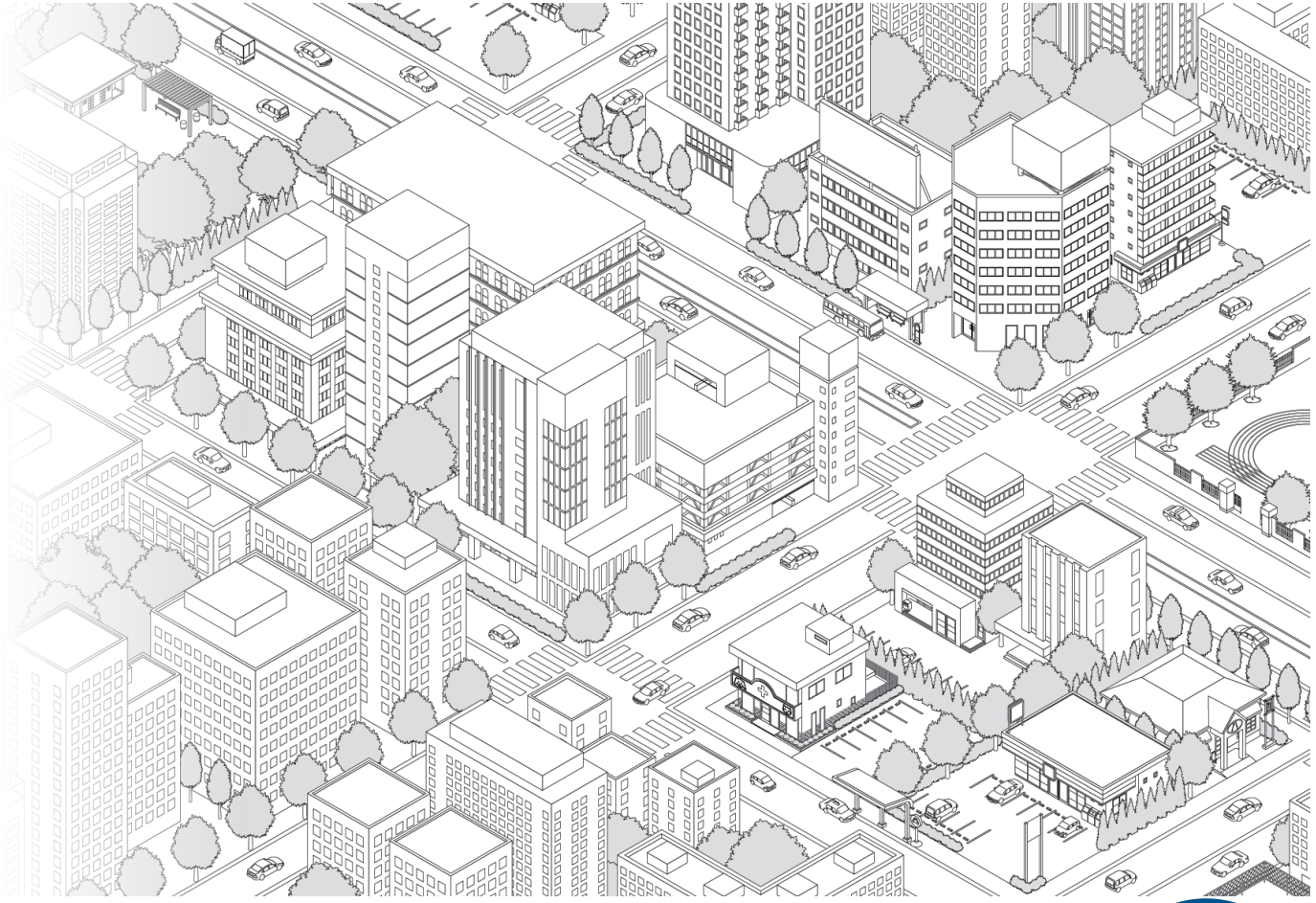
Surveillance Cameras

Horns & Sirens

Smoke Alarms

Temperature Sensors

Touchscreen PCs



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Benefits of PoE:

REDUCE INSTALLATION COSTS UP TO 25%

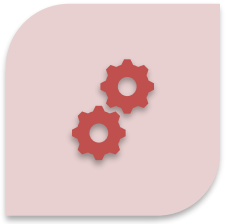
PRE-INTEGRATED LIGHTING CONTROLS

FEEDBACK AND INTELLIGENCE

FLEXIBLE AND ADAPTABLE

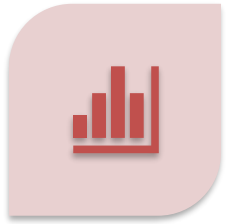
CONTRIBUTES UP TO 20+ LEED CREDITS

INCREASE OCCUPANT COMFORT



ENDLESS INTEGRATIONS

SPACE UTILIZATION



DATA-DRIVEN INSIGHTS

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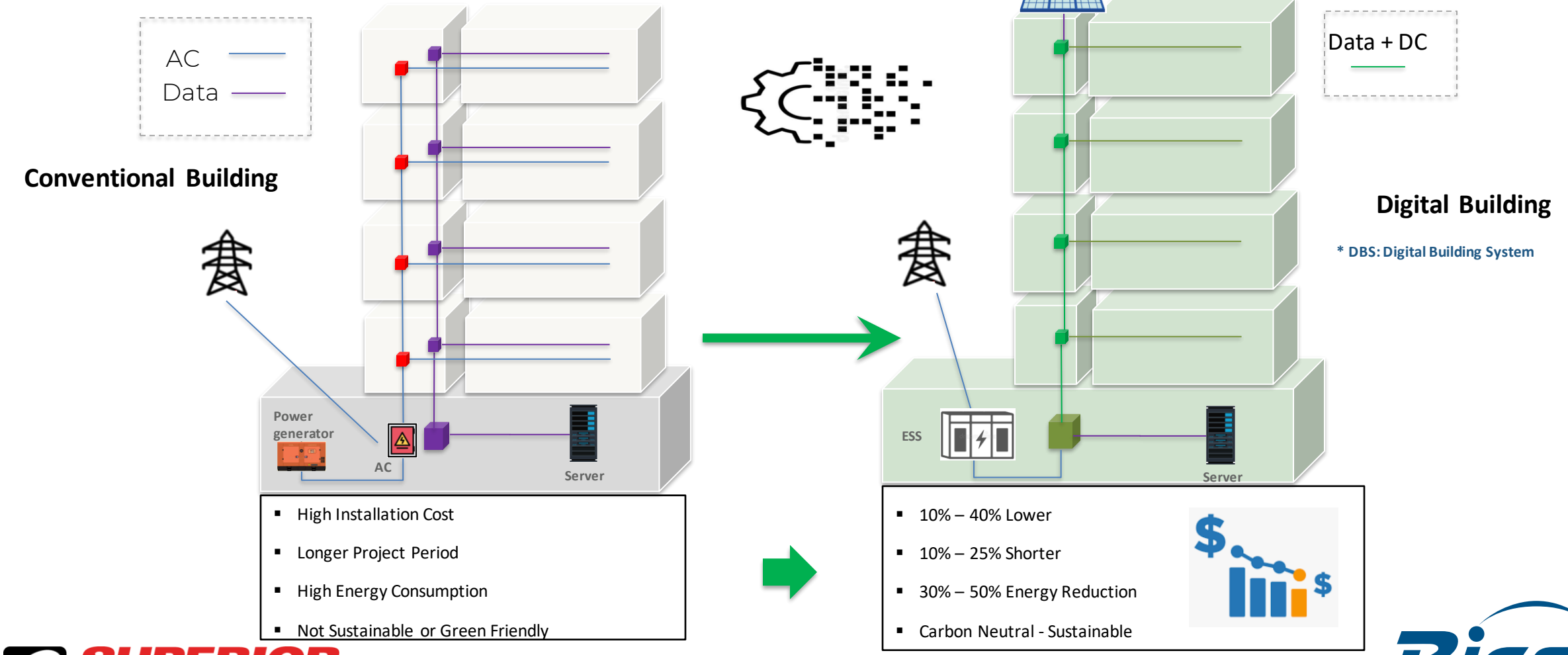
PoE: Enables Digital Transformation of Buildings



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PoE: Enables Greater ROI for IT/OT Convergence

New
802.3bt Type 4
90W
UPOE©+

UPOE©+
(Low Voltage)

Cloud services for control

New Devices

30 - 60 Watt devices

- Sensor (light, motion, CO_2/CO, etc.)
- Wall switch

90 Watt devices

- USB-C dongles
- PTZ UHD Cameras
- Large Video Displays
- Network Powered Light arrays

Silos

Converged

End-to-end solution managed by central IT provides lowered costs, intelligent control, and new experiences.

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EXTENDING ETHERNET REACH BEYOND 100 M

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MANY Copper Cables Hit a Wall at 100 Meters…

Many ethernet devices are more than 100 meters from the data source . . .

Add in PoE Power . . .

- Local Area Network copper cables are historically designed for 100m for industry standards compliance.
- Smart building technologies drive more devices to be connected to and powered by the network.
- Many of these connected devices are beyond 100m.
- Temperature: small copper gauges have higher resistance and allow for more heat to buildup.
- As more current flows through a conductor, the hotter it gets.

Most 4-pair communications cables are manufactured to meet a 100m standard.

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Extending Ethernet Beyond 100m, How?

- Add a TR or Mini TR.
- Use PoE Extenders.
- Use Fiber and Media Converters.
- Use Hybrid Copper-Fiber Cables.
- Use Performance Optimized Cables.

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Adding a TR or Mini TR

Benefits

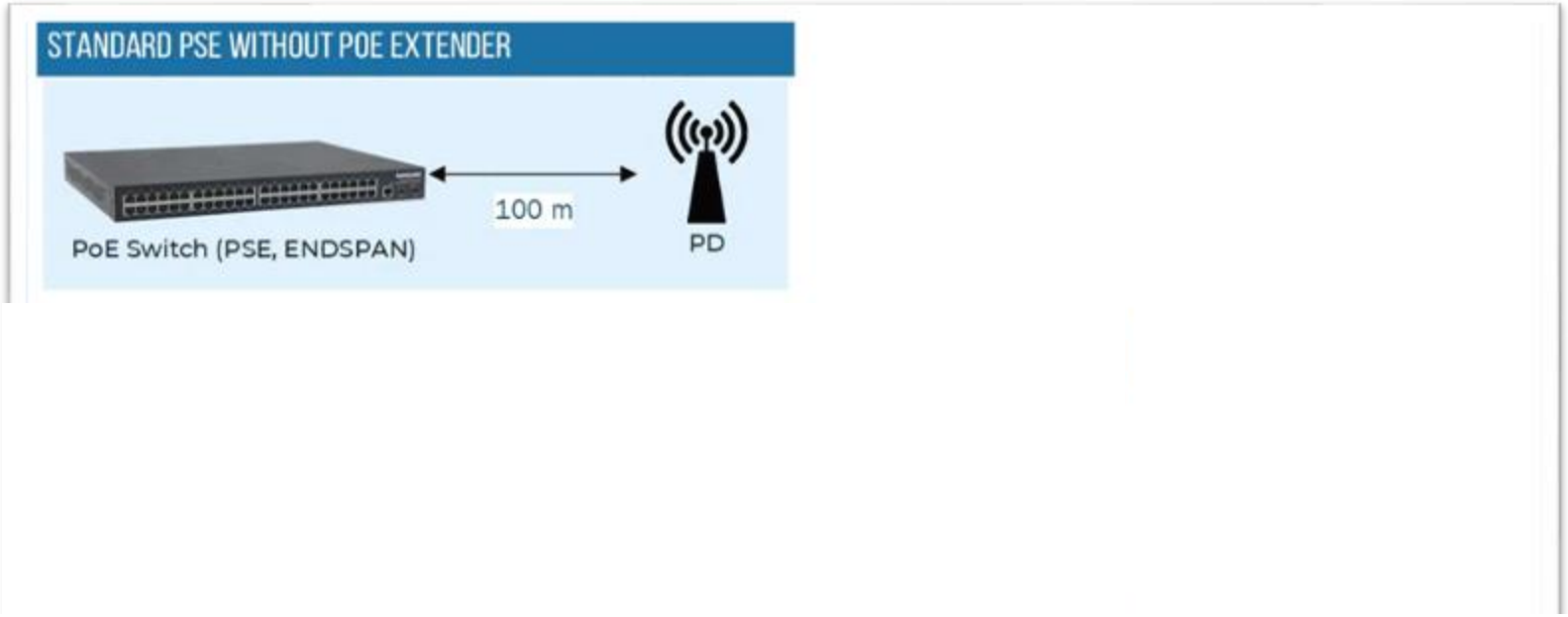
- Standards Compliant.
- Centralized Management.
- Supports up to 10Gb and 90W PoE.

Challenges

- Costly.
- Uses Valuable Real Estate.
- Requires Local Power.
- Adds Point(s) of Failure.

Source: CCCA – Going the Distance

PoE Extenders



Source: Intelligent Network Solutions

PoE Extenders - Limitations

Number of extenders	Distance	Maximum power available from PSE (input)	Maximum power for PD (output)
1	200 m	25 W	20 W
2	300 m	20 W	15 W
3	400 m	15 W	10 W
4	500 m	10 W	5 W

The figures above assume that the PoE extender draws 5 watts for itself. While that is on the high side, to be sure - you may only lose 4 watts per extender - it is good to be conservative about power availability in scenarios like these.

Other things to keep in mind with PoE extenders:

- Some PoE extenders can be used outdoors, but not all.
- Some PoE extenders can be daisy-chained, but not all.
- Not all PoE extenders support Gigabit speeds; some are only Fast-Ethernet.
- Some PoE extenders have two outputs and allow you to connect two PDs to the PSE at a distance of 200 meters.

Source: Intelligent Network Solutions

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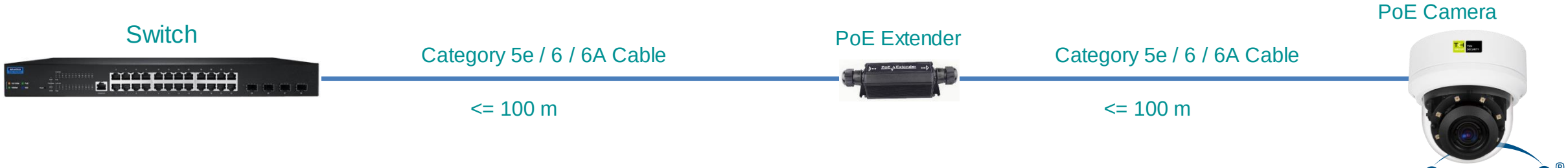
PoE Extenders - Conclusions

Benefits

- Standards Compliant.
- May Leverage Existing Infrastructure and Power.
- May support up to 10Gb and 90W PoE.

Challenges

- Costly (Less than a TR or Mini TR).
- Eliminates Centralized Management.
- May Require Local Power.
- Adds Point(s) of Failure.



Source: CCCA – Going the Distance

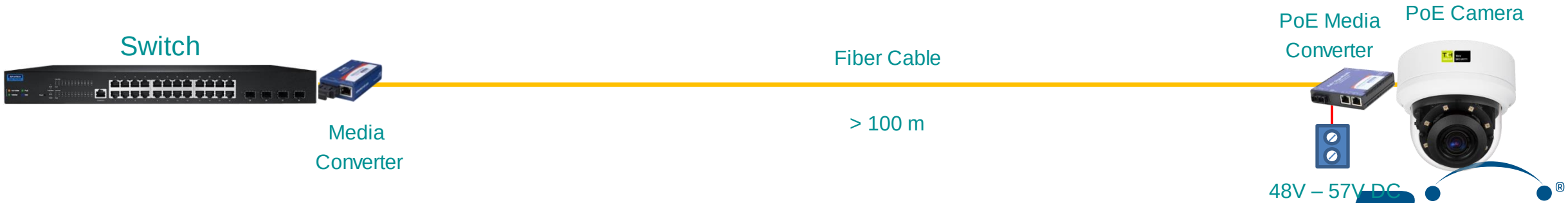
Fiber and Media Converters

Benefits

- OM3 & OM4 Multimode can support 10Gb up to 300m & 550m or 1Gb to 550m & 1,000m.
- Singlemode fiber can support 10Gb to 10km.
- Standards Compliant.

Challenges

- Costly.
- Requires Local Power.
- Adds Point(s) of Failure.



Source: CCCA – Going the Distance

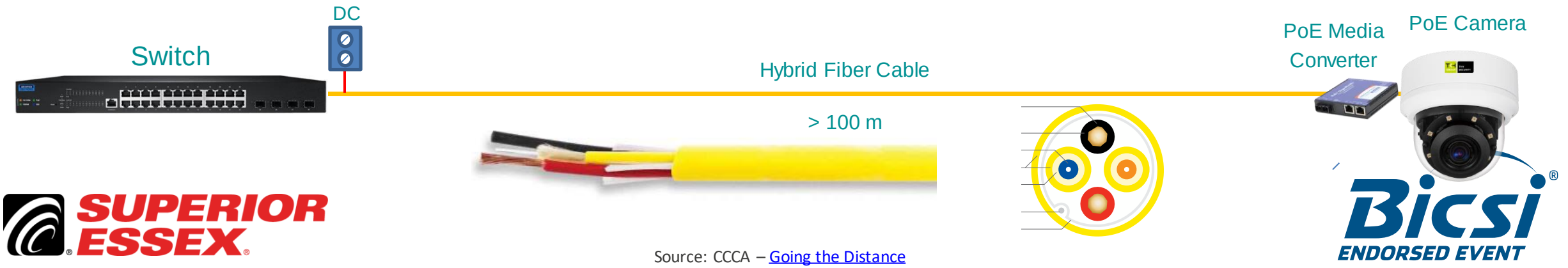
Hybrid Copper-Fiber Cable

Benefits

- Copper & Fiber in a Single Cable.
- Can Support up to 10Gb at Extended Distances.
- Standards Compliant.

Challenges

- Costly - Requires Expensive Fiber Transmission Equipment & Class 2 Power.
- Distance limitations dependent on copper cable size (AWG) and voltage drop.
- Not Moves, Adds, or Changes Friendly.



Source: CCCA – Going the Distance

Performance Optimized Copper Cables

Benefits

- Standards Compliant to 100m and provides 100m performance beyond 100m.
- Cost-Effective Solution.
- No Extra Space or Equipment.
- No Added Point(s) of Failure.
- Centralized Management.
- May be Supported by a Warranty.

Challenges

- Not Supported by Standards Today.
- May be Application Specific.
- Testing Limitations.
- Limitations to how far the distance can be extended.

Source: CCCA – Going the Distance

Comparison of Various Methods of Extending Distance Beyond 100m. . .

Approach	Design	Material	Power	Labor	Maintenance
TR/mini TR	$$$$	$$$$	$$$	$$$$	$$$$
Extender Switch	$$	$$	$$	$$	$$$
Fiber with Media Conversion	$$$	$$$	$$	$$$	$$$
Copper-Fiber Hybrid Cable	$$$	$$	$$	$$	$
Twisted-Pair Copper Cable	$	$	$	$	$

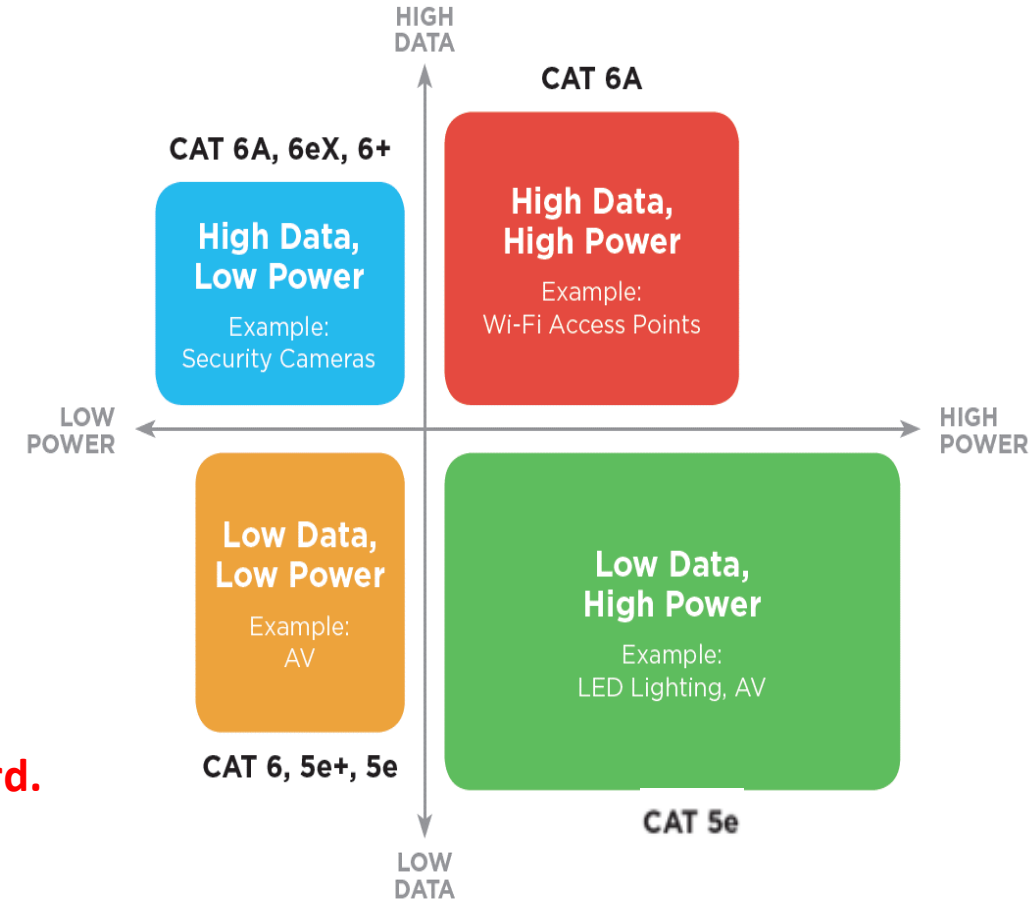
Figure 2: Despite being non-standards compliant, twisted-pair copper cable is the most cost effective option for extending distances beyond 100 m.

Source: CCCA – Going the Distance

Performance Beyond 100m over Copper Cables is . . .

- Not a question of Category.
- Depends on the Application.
- Depends on the Cable Type.
- Depends on the Number of Connections.

Most cables are designed and manufactured to the 100m Standard.



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REAL WORLD USE CASES
POE & BEYOND 100M

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Cisco, 1 Penn - NYC

Source: Cisco on LinkedIn

Warehouse Store – Panama

Project Summary:

- 11,000m² Food & Beverage Storage Warehouse with dynamic inventory.
- Tall metal racks (up to 14m) necessitate comprehensive Wi-Fi for inventory control.

Main Challenges:

- Metal structures cause Wi-Fi signal obstruction.
- High forklift traffic affects maintenance routines.
- Essential for a robust Wi-Fi network covering the entire warehouse.
- Data cabling requires 1Gbps bandwidth, future-ready design, and low upkeep.
- IDF installation complexity due to height and distance considerations.

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Warehouse Store – Panama

Proposed Solution:

- Utilizing twisted pair copper for faster maintenance and better reconnection than fiber.
- Cost-effective copper cables for WAPs' seamless network integration.
- Power over Ethernet (PoE) for device efficiency, reducing power infrastructure needs.
- Extended-distance copper cables reduce IDF numbers, lowering costs for related hardware.
- Avoidance of signal extenders to boost network reliability.
- Facilitates integration with other IP systems like surveillance and environmental controls.

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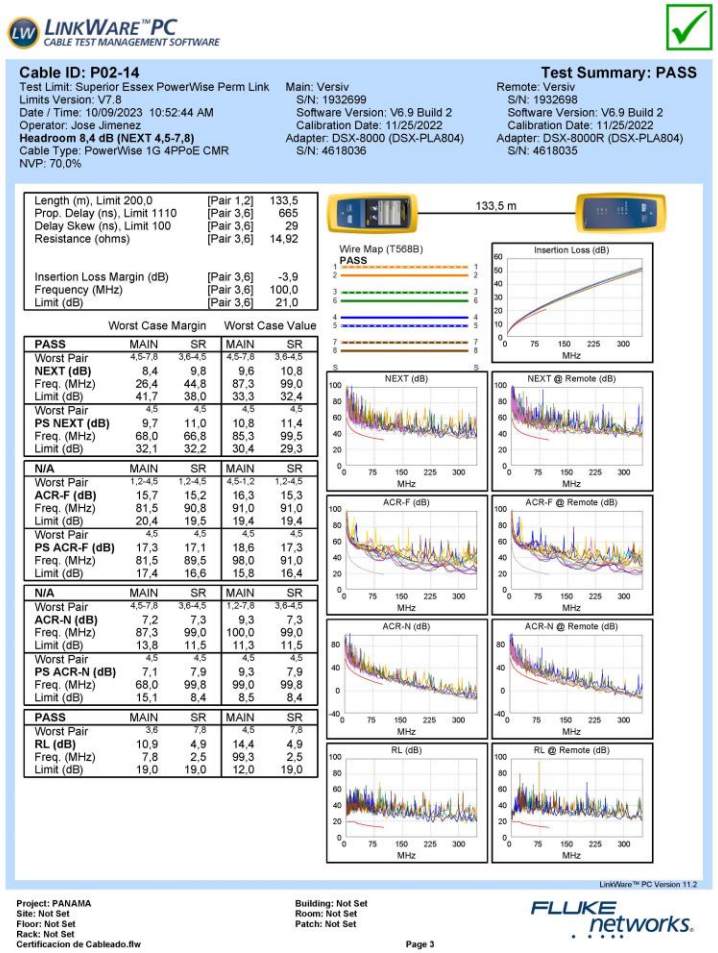
Warehouse Store – Panama



LINKWARE™ PC
CABLE TEST MANAGEMENT SOFTWARE

Cable ID: P02-14
Test Limit: Superior Essex PowerWise Perm Link
Limits Version: V7.8
Date / Time: 10/09/2023 10:52:44 AM
Operator: Jose Jimenez
Headroom 8,4 dB (NEXT 4,5-7,8)
Cable Type: PowerWise 1G 4PPoE CMR
NVP: 70,0%

Main: Versiv
S/N: 1932699
Software Version: V6.9 Build 2
Calibration Date: 11/25/2022
Adapter: DSX-8000 (DSX-PLA804)
S/N: 4618036

Test Summary: PASS
Remote: Versiv
S/N: 1932698
Software Version: V6.9 Build 2
Calibration Date: 11/25/2022
Adapter: DSX-8000R (DSX-PLA804)
S/N: 4618035

Length (m), Limit 200,0	[Pair 1,2]	133,5
Prop. Delay (ns), Limit 1110	[Pair 3,6]	665
Delay Skew (ns), Limit 100	[Pair 3,6]	29
Resistance (ohms)	[Pair 3,6]	14,92
Insertion Loss Margin (dB)	[Pair 3,6]	-3,9
Frequency (MHz)	[Pair 3,6]	100,0
Limit (dB)	[Pair 3,6]	21,0

133,5 m

Wire Map (T568B)
PASS

Insertion Loss (dB)

	Worst Case Margin		Worst Case Value	
PASS	MAIN	SR	MAIN	SR
Worst Pair	4,5-7,8	3,6-4,5	4,5-7,8	3,6-4,5
NEXT (dB)	8,4	9,8	9,6	10,8
Freq. (MHz)	26,4	44,8	87,3	99,0
Limit (dB)	41,7	38,0	33,3	32,4
Worst Pair	4,5	4,5	4,5	4,5
PS NEXT (dB)	9,7	11,0	10,8	11,4
Freq. (MHz)	68,0	66,8	85,3	99,5
Limit (dB)	32,1	32,2	30,4	29,3
N/A	MAIN	SR	MAIN	SR
Worst Pair	1,2-4,5	1,2-4,5	4,5-1,2	1,2-4,5
ACR-F (dB)	15,7	15,2	16,3	15,3
Freq. (MHz)	81,5	90,8	91,0	91,0
Limit (dB)	20,4	19,5	19,4	19,4
Worst Pair	4,5	4,5	4,5	4,5
PS ACR-F (dB)	17,3	17,1	18,6	17,3
Freq. (MHz)	81,5	89,5	98,0	91,0
Limit (dB)	17,4	16,6	15,8	16,4
N/A	MAIN	SR	MAIN	SR
Worst Pair	4,5-7,8	3,6-4,5	1,2-7,8	3,6-4,5
ACR-N (dB)	7,2	7,3	9,3	7,3
Freq. (MHz)	87,3	99,0	100,0	99,0
Limit (dB)	13,8	11,5	11,3	11,5
Worst Pair	4,5	4,5	4,5	4,5
PS ACR-N (dB)	7,1	7,9	9,3	7,9
Freq. (MHz)	68,0	99,8	99,0	99,8
Limit (dB)	15,1	8,4	8,5	8,4
PASS	MAIN	SR	MAIN	SR
Worst Pair	3,6	7,8	4,5	7,8
RL (dB)	10,9	4,9	14,4	4,9
Freq. (MHz)	7,8	2,5	99,3	2,5
Limit (dB)	19,0	19,0	12,0	19,0

NEXT (dB) | NEXT @ Remote (dB)
ACR-F (dB) | ACR-F @ Remote (dB)
ACR-N (dB) | ACR-N @ Remote (dB)
RL (dB) | RL @ Remote (dB)

LinkWare™ PC Version 11.2

Project: PANAMA
Site: Not Set
Floor: Not Set
Rack: Not Set
Certificacion de Cableado.flw

Building: Not Set
Room: Not Set
Patch: Not Set

FLUKE networks

Page 3

Tester Type	Date / Time:	Status	Length(m)	Headroom
DSX-8000	10/09/2023 10:50:24 AM	PASS	132,0 m	3,1 (NEXT)
DSX-8000	10/09/2023 10:52:44 AM	PASS	133,5 m	8,4 (NEXT)
DSX-8000	10/09/2023 10:54:58 AM	PASS	130,1 m	7,8 (NEXT)
DSX-8000	10/09/2023 10:57:08 AM	PASS	128,6 m	4,9 (NEXT)
DSX-8000	10/09/2023 11:01:04 AM	PASS	129,9 m	4,4 (NEXT)
DSX-8000	10/09/2023 11:02:35 AM	PASS	129,9 m	5,0 (NEXT)
DSX-8000	10/09/2023 11:04:18 AM	PASS	130,3 m	4,9 (NEXT)
DSX-8000	10/09/2023 11:06:36 AM	PASS	130,5 m	3,2 (NEXT)
DSX-8000	10/10/2023 07:52:58 PM	PASS	129,5 m	4,5 (NEXT)
DSX-8000	10/10/2023 08:57:04 PM	PASS	104,5 m	3,3 (NEXT)
DSX-8000	10/10/2023 09:48:27 PM	PASS	110,2 m	8,8 (NEXT)

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Community Site – UAE

Project Summary:

- Multi-building community site with an area of 20,000m^2 with many people gathering daily.
- Video surveillance throughout the campus is required.

Main Challenges:

- IP cameras used at the site work use copper connectivity.
- PoE powers all cameras.
- Many cameras are located 130-180m from the network room.

Proposed Solution:

- Extended distance cables connect all cameras located beyond 100m.
- PoE is used to power IP cameras.

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Metro Railway Station – Saudi Arabia

Project Summary:

- Metro rail network has many stations.
- At every station, there are ATMs for the convenience of the passengers.

Main Challenges:

- The ATMs require network connectivity.
- ATMs are located at 150-180 m from the network room.
- The client didn't want to use Ethernet/PoE extenders for the connectivity.

Proposed Solution:

- Extended distance cables connect all the ATMs located beyond 100m from the network room.

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POSSIBILITIES BEYOND 100M

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PoE Networks Require Better Copper Cables

Access Points

Badge Readers

Biometric Door Locks

Ceiling Fans

Entry Barriers & Turnstiles

Face Recognition Systems

HVAC VAVs

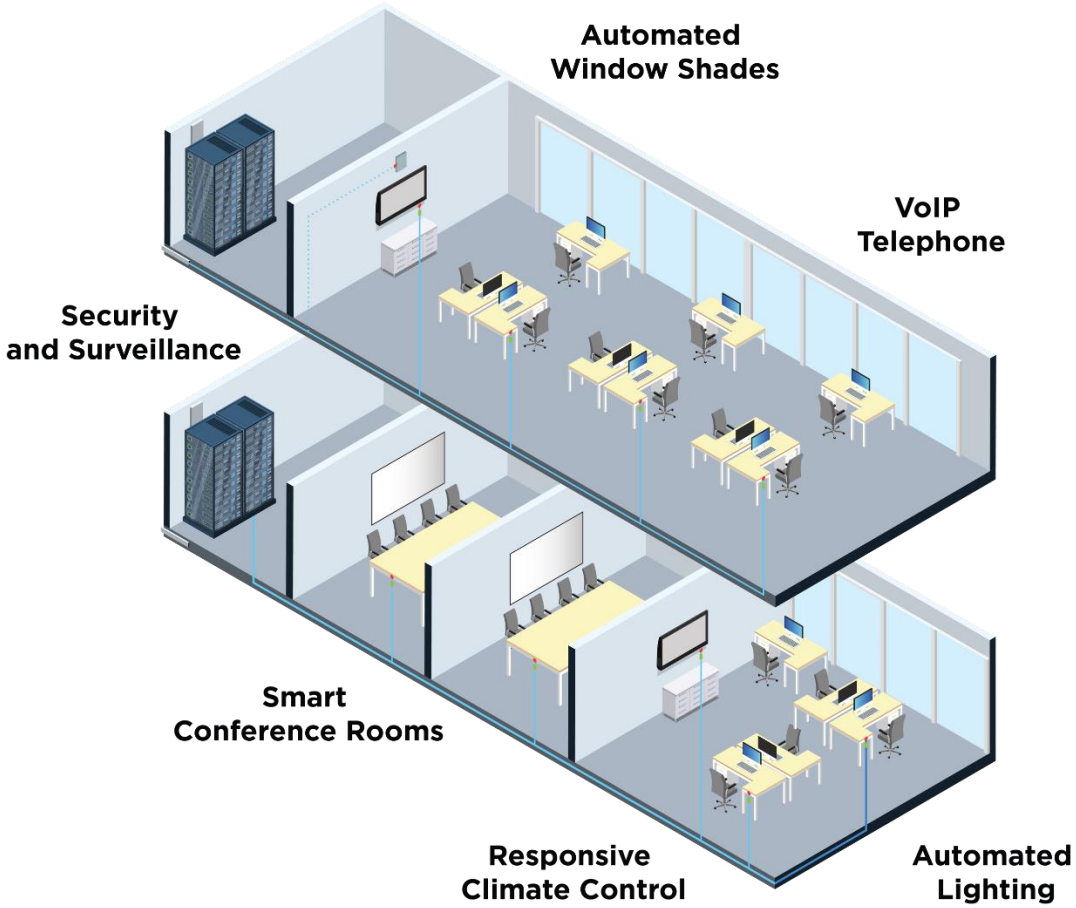
Surveillance Cameras

Horns & Sirens

Smoke Alarms

Temperature Sensors

Touchscreen PCs



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One floor of an office building could have 800+ data and PoE connection points!

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Performance Optimized Cables for Extended Distance Beyond 100m

1G, 2.5G, 5G & 10G Extended Distance Maximum Supported Lengths

Permanent Link 

		22 AWG - 5G Performance		22 AWG - 10G Performance	
PL Application	Transmission/Standard	BER @ Ambient[1] (Type 1 & 2)	BER @ LP[2] (Type 3 & 4)	BER @ Ambient[1] (Type 1 & 2)	BER @ LP[2] (Type 3 & 4)
Data & Power (Bandwidth & Speed)	Max Distance @ 1 Gb/s	160 m	140 m	155 m	145 m
Data & Power (Bandwidth & Speed)	Max Distance @ 2.5 Gb/s	160 m	140 m	155 m	145 m
Data & Power (Bandwidth & Speed)	Max Distance @ 5 Gb/s	160 m	135 m	155 m	145 m
Data & Power (Bandwidth & Speed)	Max Distance @ 10 Gb/s	—	—	110 m	105 m
Power Efficiency		89.30%	88.50%	87.70%	86.80%

Data was generated by UL using test methods UL 4299 and TIA TSB-184A. See https://verify.ul.com/verifications/421 and https://verify.ul.com/verifications/422 for more details.

[1]Simulates cable exposed to Type 1 or Type 2 PoE.

[2]Simulates cable exposed to Type 4 PoE.

BER = Bit Error Rate.

Source: Superior Essex Communications - PowerWise®

SUPERIOR ESSEX®

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Performance Optimized Cables for Extended Distance Beyond 100m

Extended Distance Maximum Supported Lengths

Permanent Link

PL Attached Camera Type	PoE	Bandwidth	Latency	Max Distance
Any IP Security Camera	15 W	2 Mbps	Virtually None	305 m
Any IP Security Camera	30 W	< 10 Mbps	Virtually None	244 m
Any IP Security and Any PTZ Camera	60 W	100 Mbps	Virtually None	200 m

Superior Essex partnered with various camera manufacturers to determine maximum distances supporting IP security and PTZ cameras using PowerWise 1G®. This is a compilation of Bosch, Hanwa, Axis, and Panasonic data.

SUPERIOR ESSEX®

Source: Superior Essex Communications - PowerWise®

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CONCLUSIONS

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Conclusions

- Distances Over 100m with Copper is Achievable:
  - ✓ Dependent on the Application and Installation
  - ✓ Offers Advantages and Provides and ROI

- Select Products Offer Advantages to go Beyond 100m:
  - ✓ Can be part of a Warranty Solution
  - ✓ Performance Considerations

- Smart and Sustainable Technologies:
  - ✓ Reduce TCO and are Environmentally Friendly
  - ✓ Provide a Futureproofing Pathway to New Technologies

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Thank You!

Paul F. Weintraub

RCDD, RTPM, ESS, TECH, CAE

Head of International Business

Superior Essex Communications

APOLAN Chair-Elect

Fiber Connect Council MENA BoD

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