Building the
Digital Foundation for the IoT

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Speaker introduction

DAVIDE BADIALI
Field Application Engineering Italy, Greece & Cyprus
CommScope
Based in Milan, Italy

More than 15 years within the ICT Industry

- Degree in telecommunication engineering
- Bicsi member, RCDD certification since 2006
- Member of CEI CT306 – Cabling Systems (*Italian local standard committee linked to CENELEC TC CLC/TC 215 and IEC SC ISO/IEC JTC 1/SC 25*)
- Member of CEI CT46 – Copper cables
- Member of CEI CT48 – Copper connecting hardware
- Participation to CEI SC86A and SC86B - Fibres and cables, fiber interconnecting devices

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Today's presentation agenda

- Industry trends and impact on infrastructure
  - *How these industry trends in the building have impact on the building infrastructure*
- Designing for the future to meet the challenge
  - *Best practices design to ensure these can be accommodated*
- Emerging technologies
  - Emerging technologies specific to the infrastructure that can help enable the digital transformation

1. Industry Trends and Impact on Infrastructure
2. Designing for the future
3. Emerging Technologies

INDUSTRY TRENDS AND IMPACT ON INFRASTRUCTURE

The workspace

Connectivity within the building can determine how well these challenges are met

Indoor **mobility** challenge

Customers don’t care HOW they are connected wirelessly—they just want connectivity

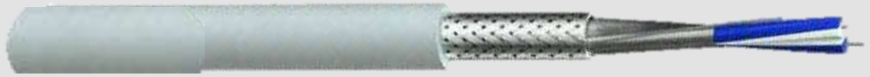
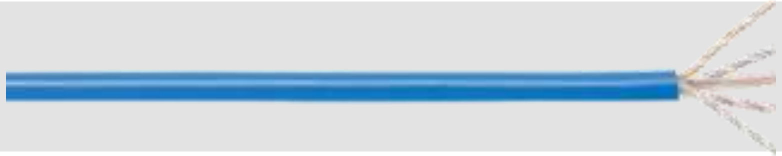
80%

of all mobile sessions are indoors

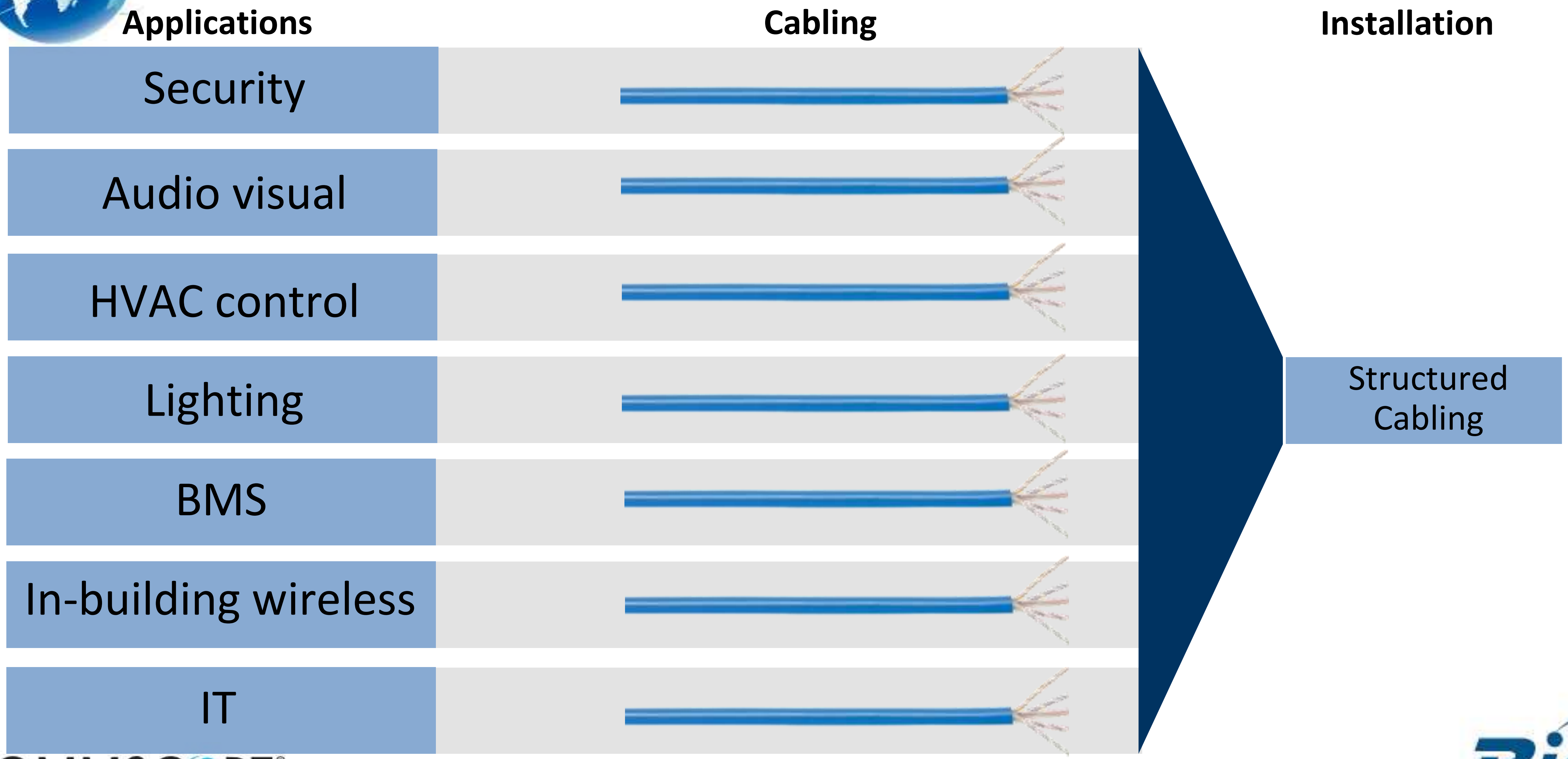
50%

Mobile data growth rate per year

IP **convergence** – the past

Applications	Cabling	Installation
Security		Security
Audio visual		AV
HVAC control		HVAC
Lighting		Lighting
BMS		BMS
In-building wireless		IBW
IT		IT

Cable installation model – now & future

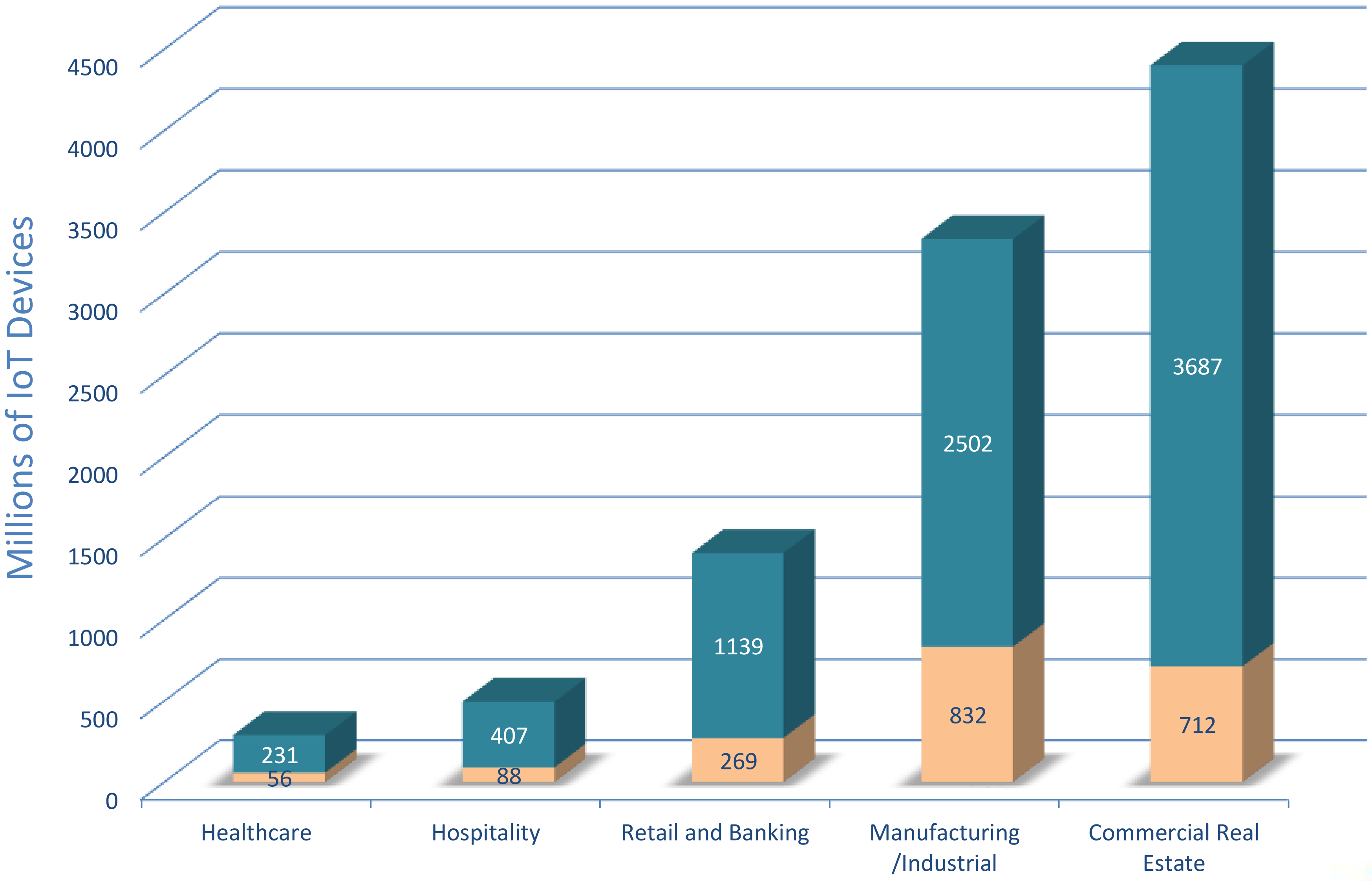


IoT growth in the buildings

30%

IoT growth rate
in commercial buildings

ANNUALLY



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IoT, multiple technology for connectivity

IEEE 802.15 · WiFi · Lte · ethernet alliance · sigfox

ZigBee · Bluetooth 4.0 · Z-WAVE · LoRa · WEIGHTLESS

1. Industry Trends and Impact on Infrastructure
2. Designing for the future
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DESIGNING THE FUTURE

Planning for mobility

- 87 percent said cellular coverage was imperative in all areas of their buildings
- 84% that Optimal in-building coverage improves employee productivity
- 80% of cell phone usage is indoors
- Connectivity requirements changing

86%

market value increase
in commercial buildings
with IBW

Source: Coleman/Parkes Research and CommScope survey of 600 building/facility managers, 2015

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Wireless solutions for the building

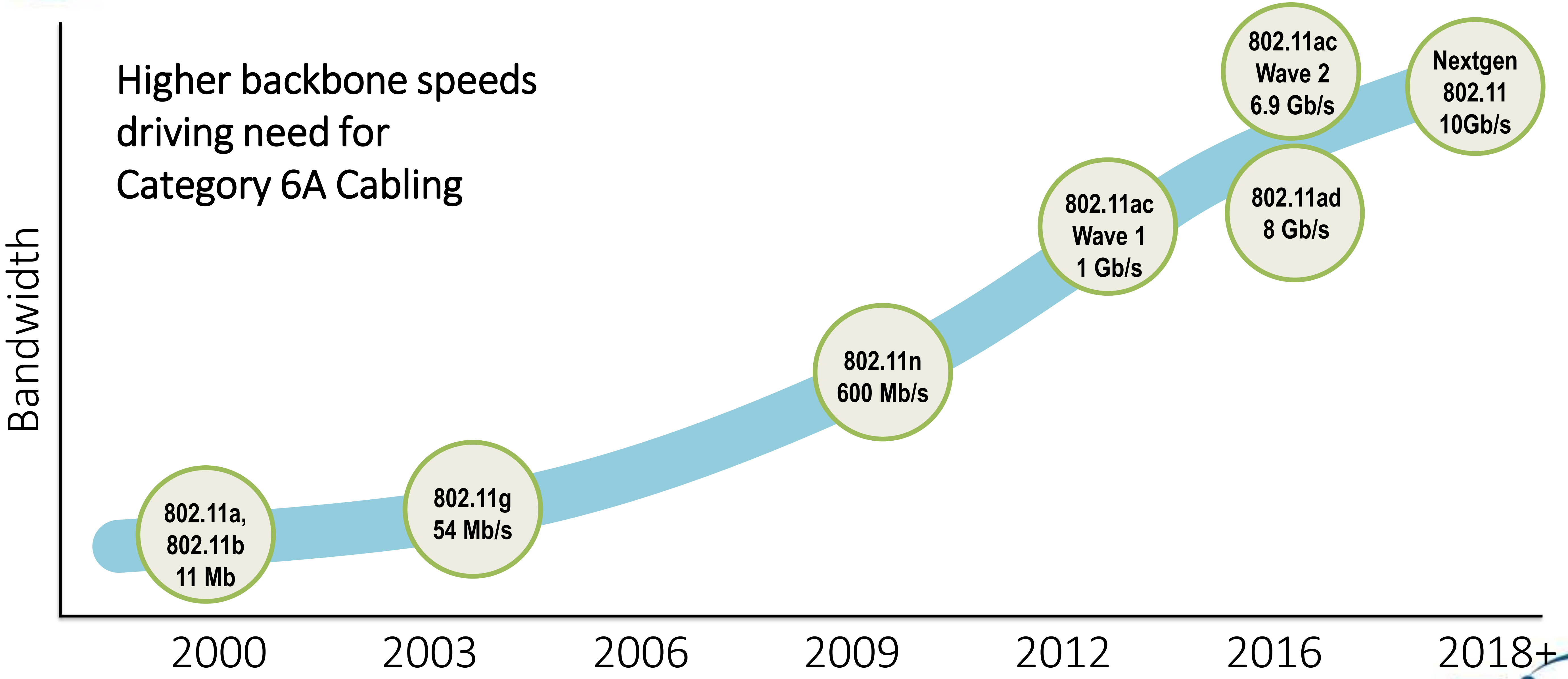
Distributed Antenna System (DAS)

Wi-Fi

Small Cells

Wi-Fi Application Standards

Higher backbone speeds driving need for Category 6A Cabling



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Wi-Fi – Implications for Backhaul

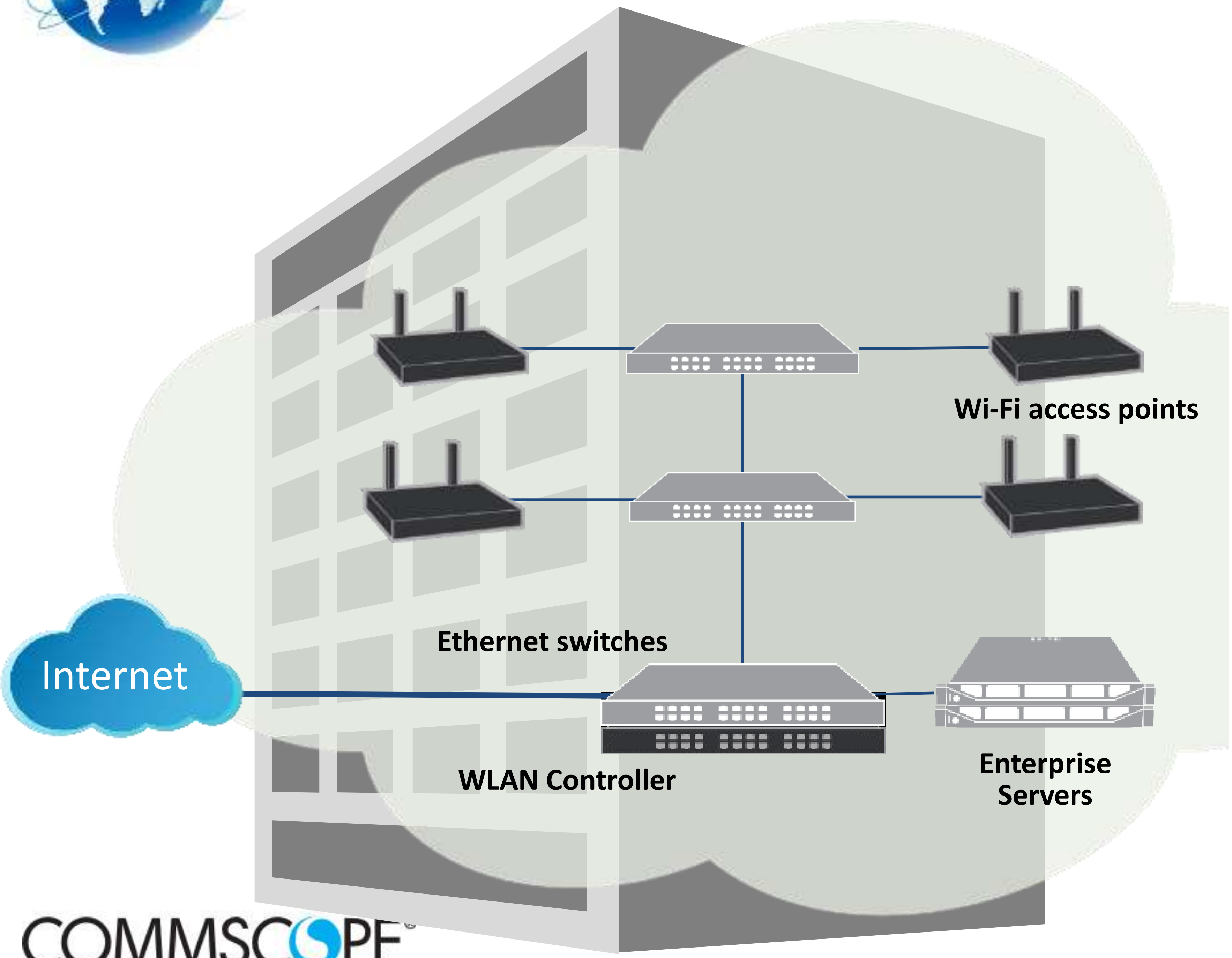

Table 2: ALSNR support risk for 2.5G and 5G applications

Bundled cabling length 0m to 50m	Category 5e	Category 6	Category 6A
2.5GBASE-T			Assured
5GBASE-T Assured			Assured
Bundled cabling length 50m to 75m	**Category 5e**	**Category 6**	**Category 6A**
2.5GBASE-T			Assured
5GBASE-T Assured			Assured
Bundled cabling length 75m to 100m	**Category 5e**	**Category 6**	**Category 6A**
2.5GBASE-T			Assured
5GBASE-T Assured			Assured
ALSNR Risk	High	Medium	Low

Source: NBASE-T Performance and Cabling Guidelines; NBASE-T Alliance

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Challenges for In-Building Wireless (1/4)

COSTS

Mobile operators have other priorities, companies are left to finance these systems on their own unless they can find a neutral host operator to fund the system and lease it. Traditional DAS solutions were designed for large facilities (stadiums, airports) don’t scale down well in enterprises.

Challenges for In-Building Wireless (2/4)

COMPLEXITY

Enterprise IT teams understand Wi-Fi technology, but they have had a steep learning curve in understanding the ins and outs of multi-frequency support, coax cabling, head-ends and remote antenna units.

Challenges for In-Building Wireless (3/4)

CARRIER COORDINATION

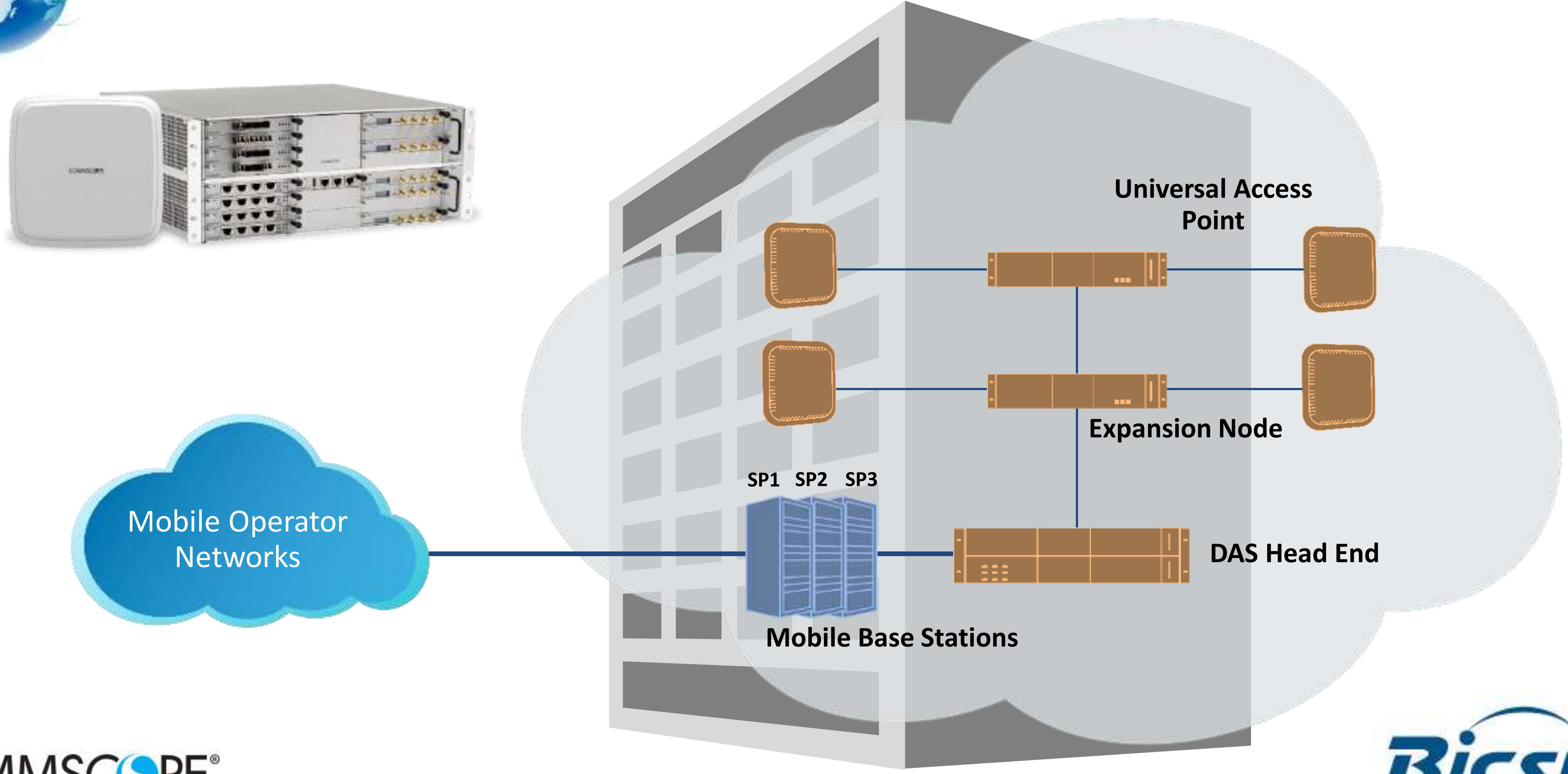
Since a DAS needs to be fed with a carrier base station or signal source, carriers must be involved in its deployment. Enterprises must obtain permission from the carrier, and this can slow deployments considerably.

Challenges for In-Building Wireless (4/4)

LACK OF SKILLS

Enterprise IT teams simply don’t have the skills needed to design, commission and maintain RF equipment, run coax cabling or integrate the other components of a DAS.

Distributed Antenna Systems (DAS)



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DAS is becoming enterprise-friendly

	Advancement	Description	Benefits
	Universal Access Points	Single remote supports all operators and frequencies	Operator flexibility, improved aesthetics
	All-digital	Eliminates signal power loss over long distances	Improved performance, simplified design
	IT cabling	Uses standard fiber and Cat6A cable rather than analog coaxial	Reduced material and installation cost
	Management tools	Software tools for configuration and management	Easier setup and ongoing operations
	Infrastructure sharing	Share cabling infrastructure with Wi-Fi, IP security cameras	Reduced number of cable runs

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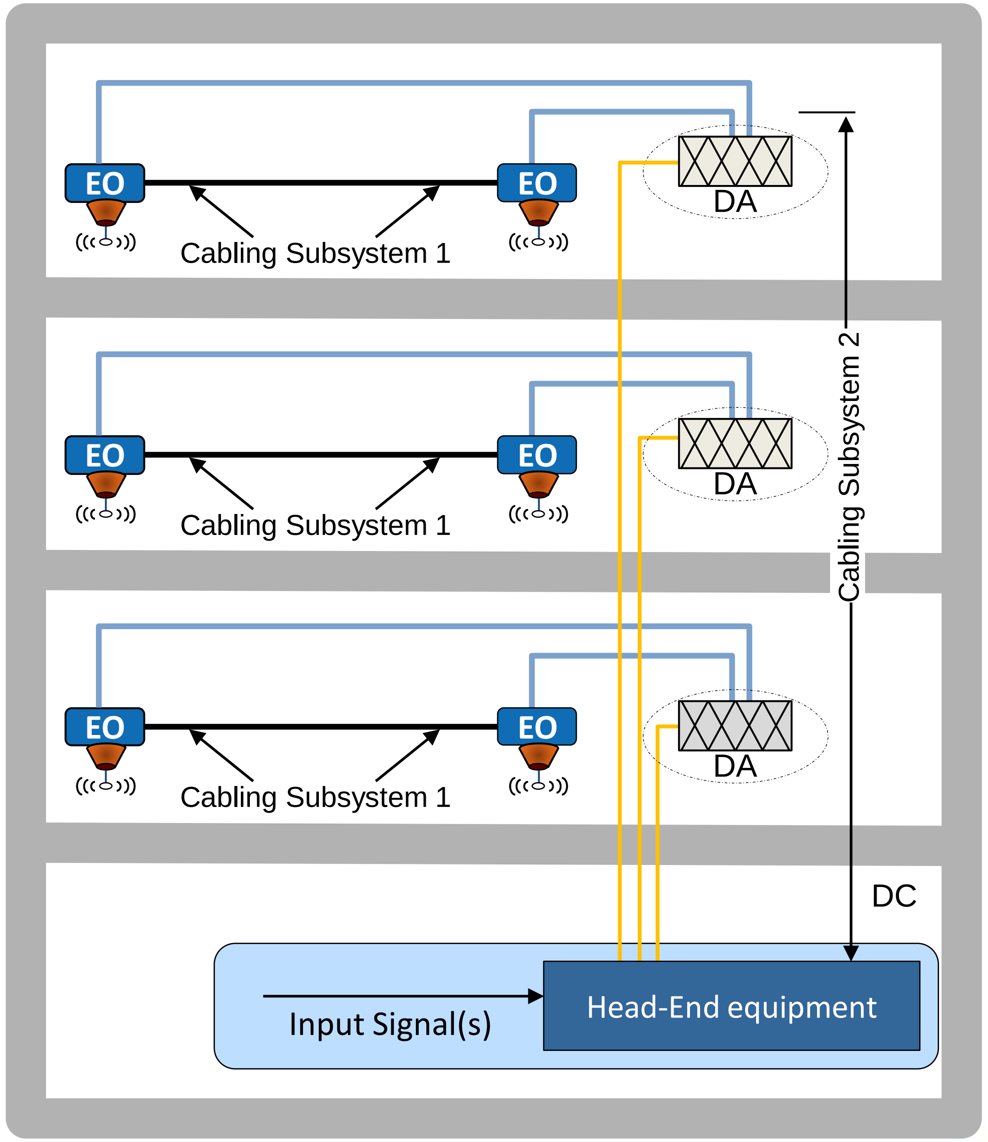
Standard for DAS (TIA TSB-5018)

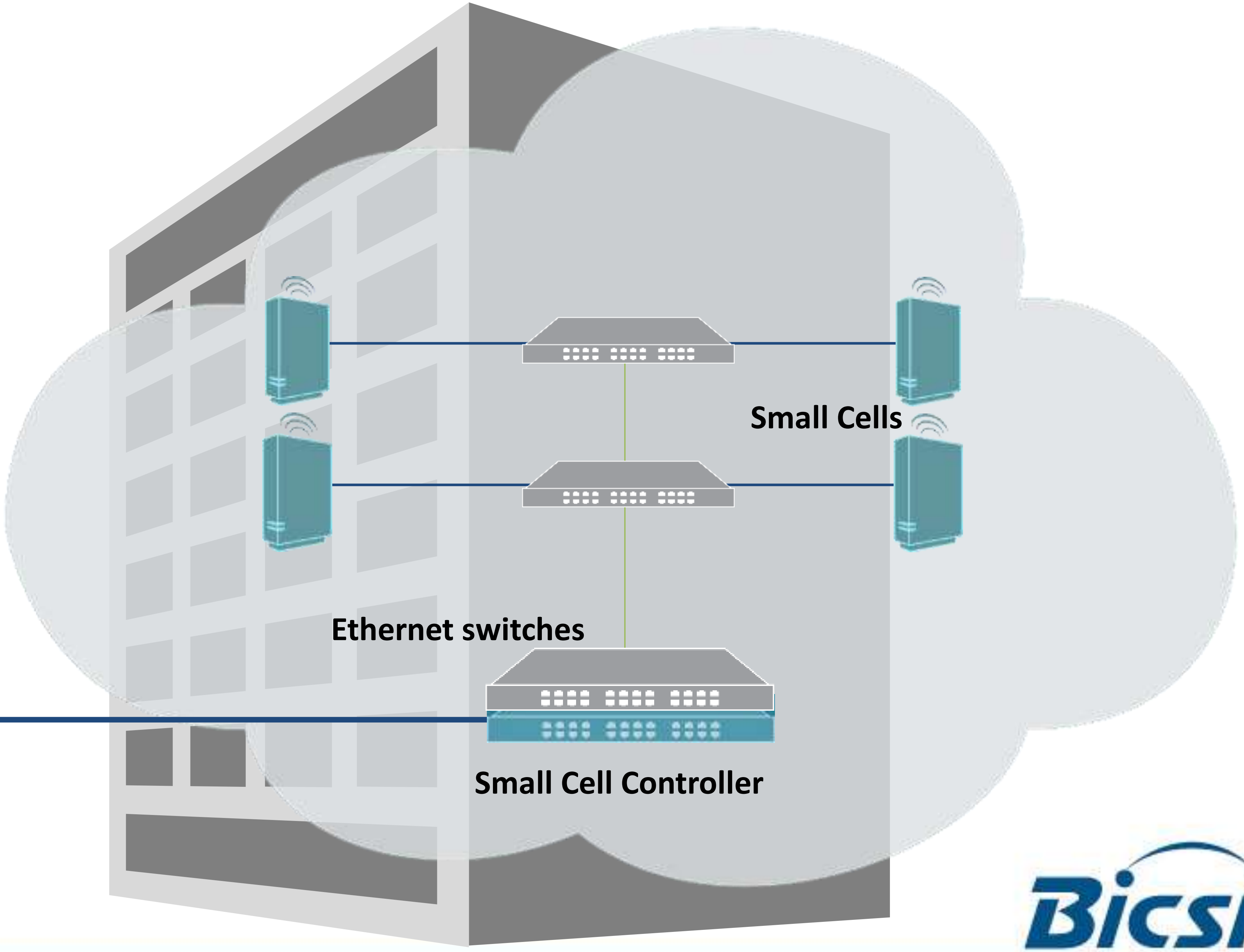
TIA TSB-5018, approved July 2016, defines cabling for DAS more closely matching typical building cabling:

- Cabling Subsystems
  - Backgone: single-mode, OM4 recommended
  - Horizontal: Category 6A recommended
- Coverage area (space containing the antennas)
- TRs or common telecoms room (CTR)
- ERs or common equipment room (CER)
- Entrance facilities (EF)
- Administration



DAS cabling based on generic cabling system structure in ANSI/TIA-568-D.0.

Small Cell



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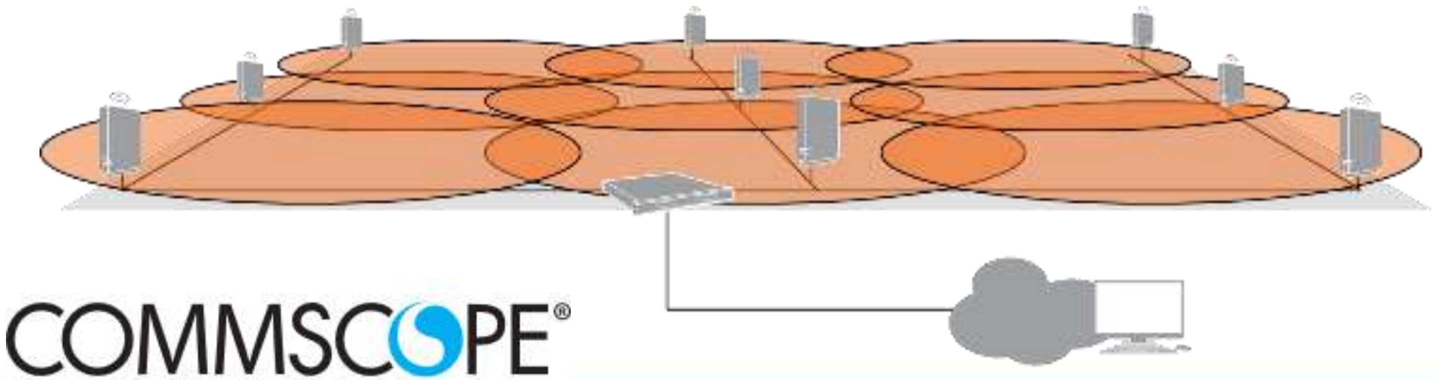
Small cells are becoming more enterprise-ready

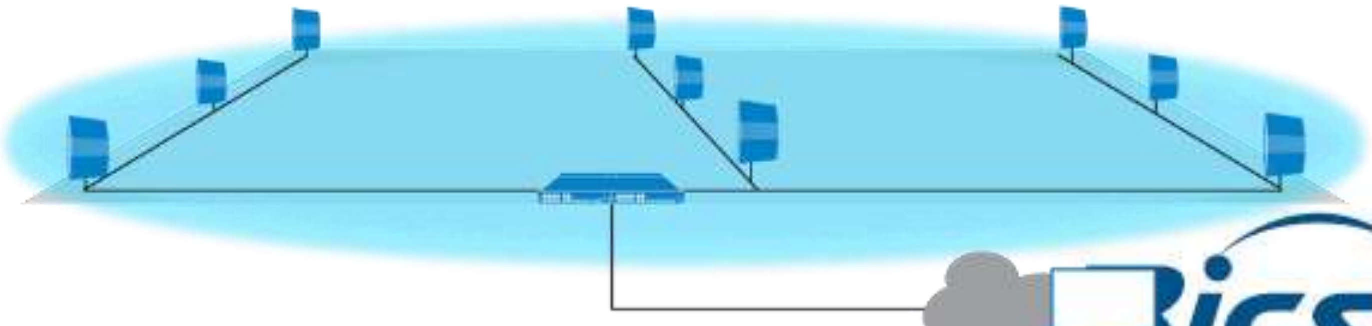
Legacy standalone small cells

- Access points create borders
  Dead zones and handovers
- Capacity fixed to access points
- Complex RF design

Cloud-RadioAccessNetwork (C-RAN) small cells

- Single cell with no borders
  No dead zones, no handovers
- Capacity follows the users
- Simple design and deployment





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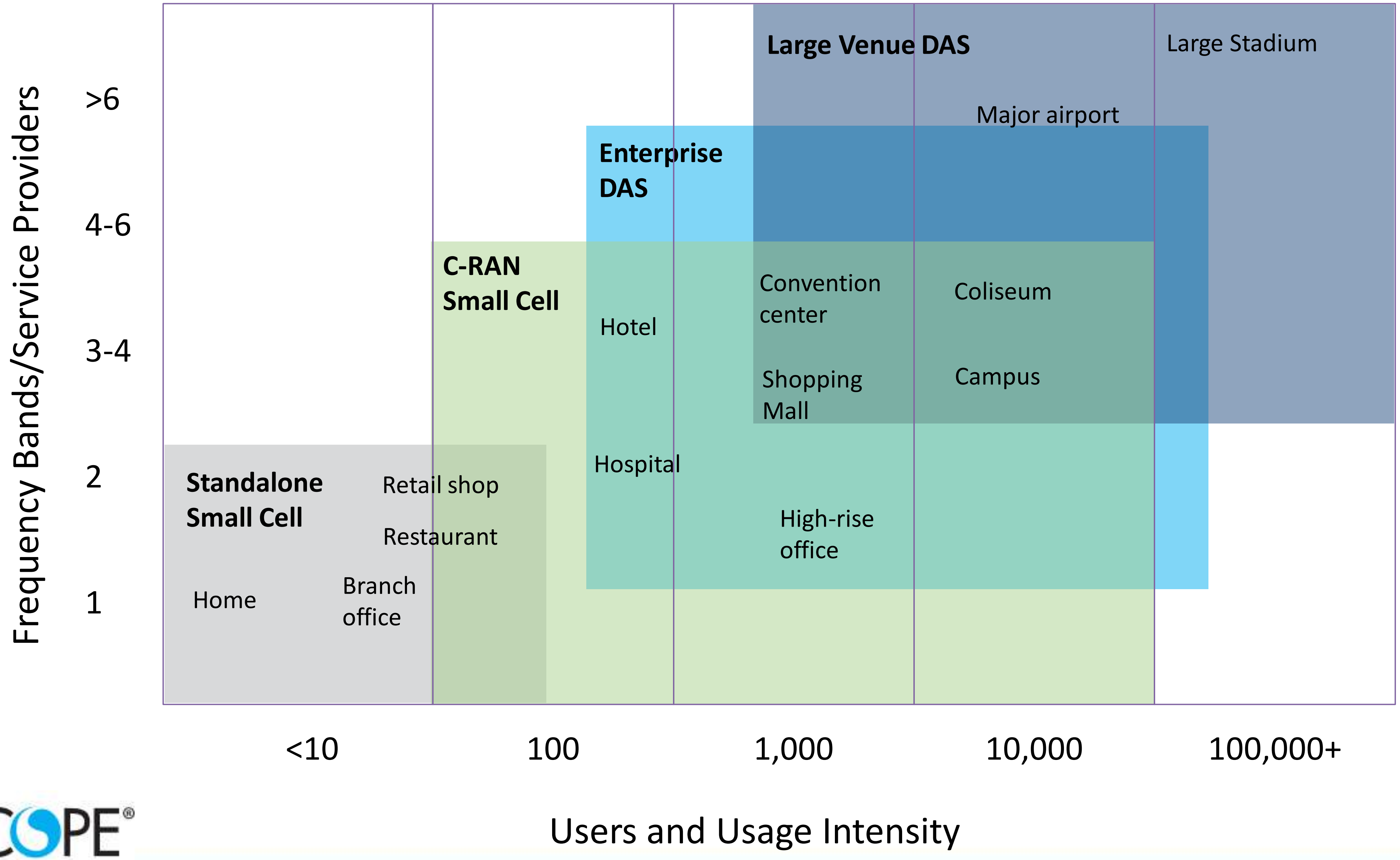
Typical use cases for DAS and Small Cell



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Low Voltage Over TP Revolution

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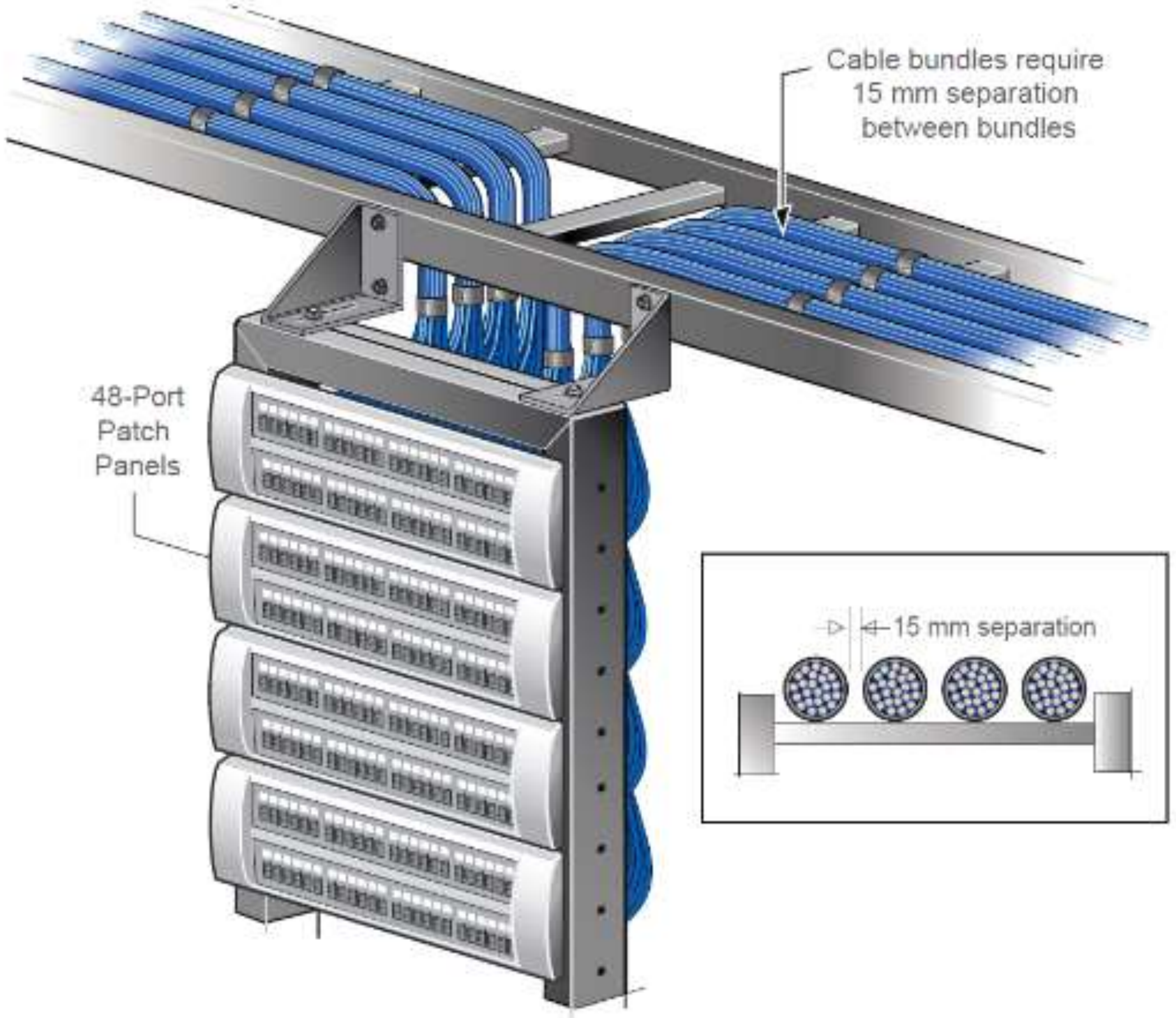
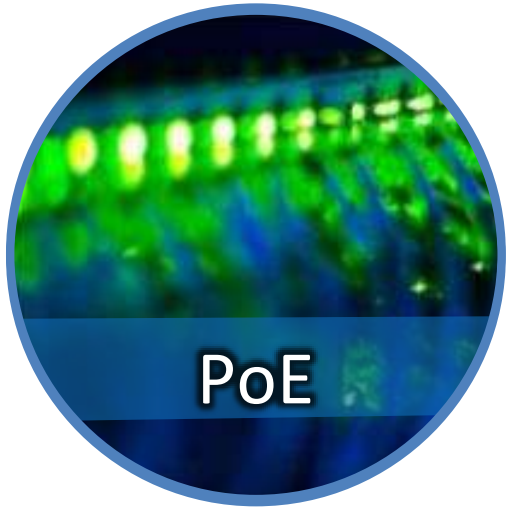
PoE evolution and installation practices

1999	2003	2009	2011	2018 (est)
PoL ≤10 W	IEEE 802.3af PoE (15W)	IEEE 802.3at PoEP (30W)	Cisco UPOE (60W)	Proposed IEEE 802.3bt 4PPoE (90W)



Ever increasing power delivered via PoE is driving need for cable installation guidelines

Category 6A recommendations in standards



TIA TSB-184-A
ISO 14763-2

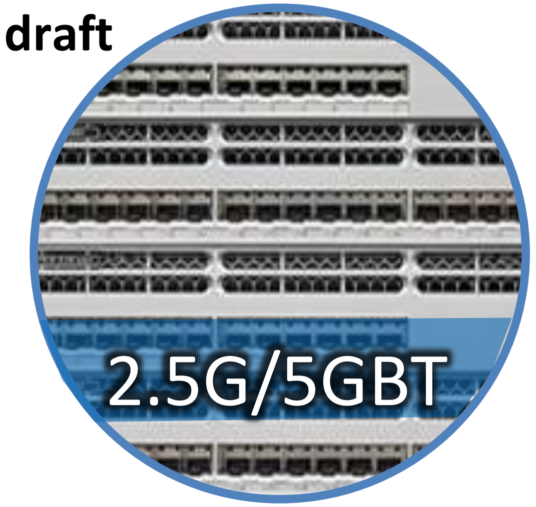
TIA 942-A
ISO 24767

TIA 862-B draft
ISO 11801-6 draft

TIA TSB-162
TIA TSB-5018 (IBW)
ISO TR 24704

TIA 4966

TIA 1179



TIA TSB-5021
ISO TR 11801-9904

Higher bandwidth and power
driving need for Category 6A cabling

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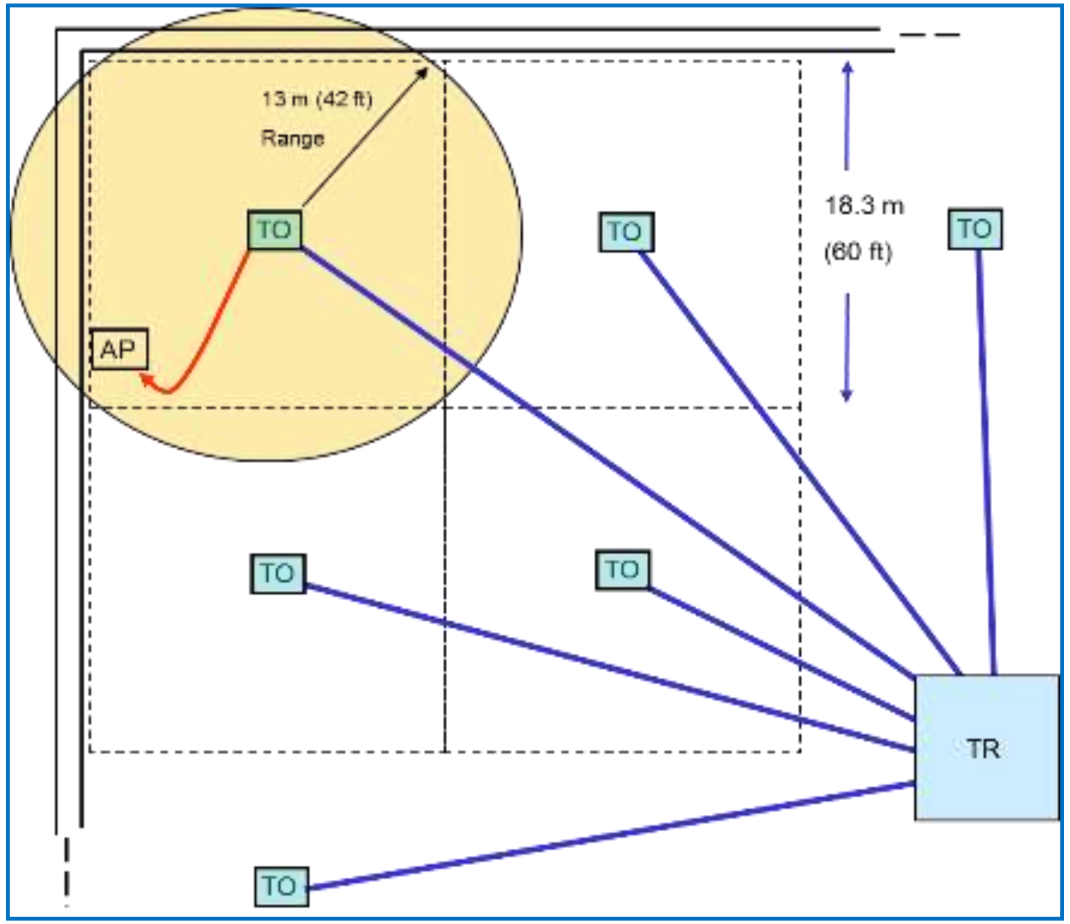
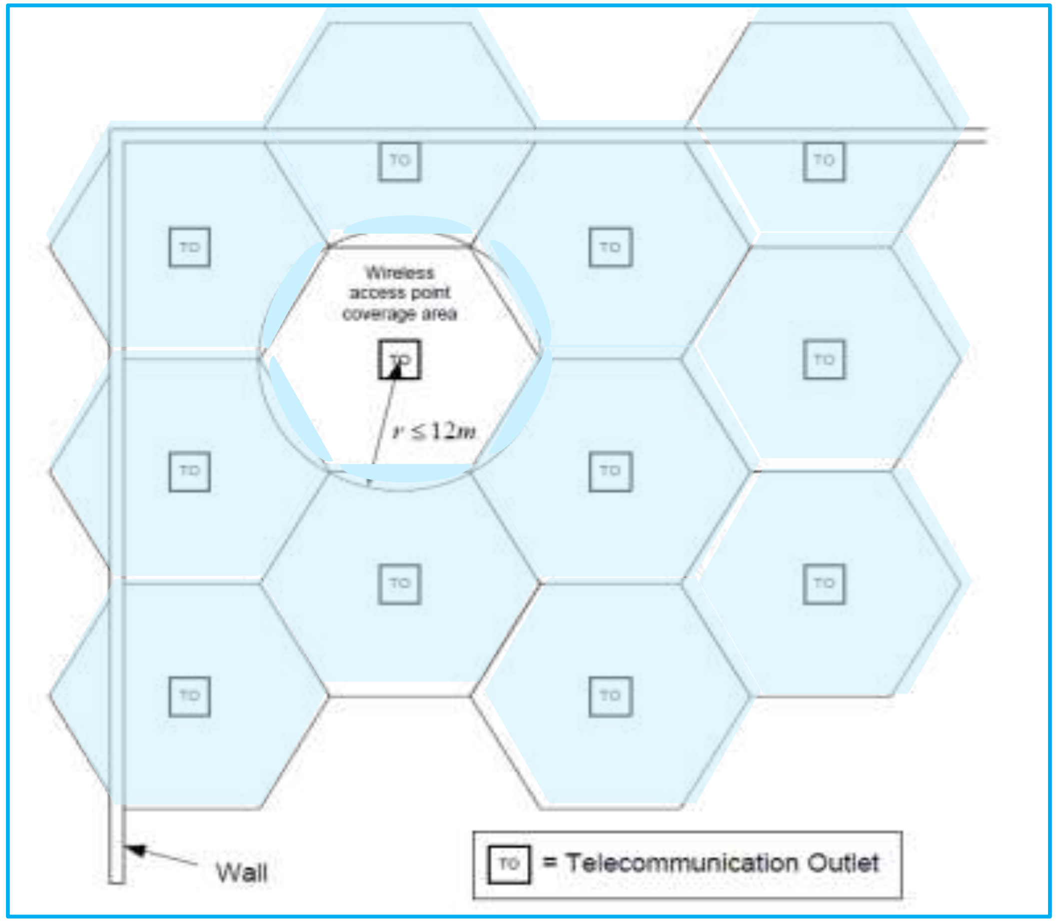
Infrastructure standards for Wi-Fi

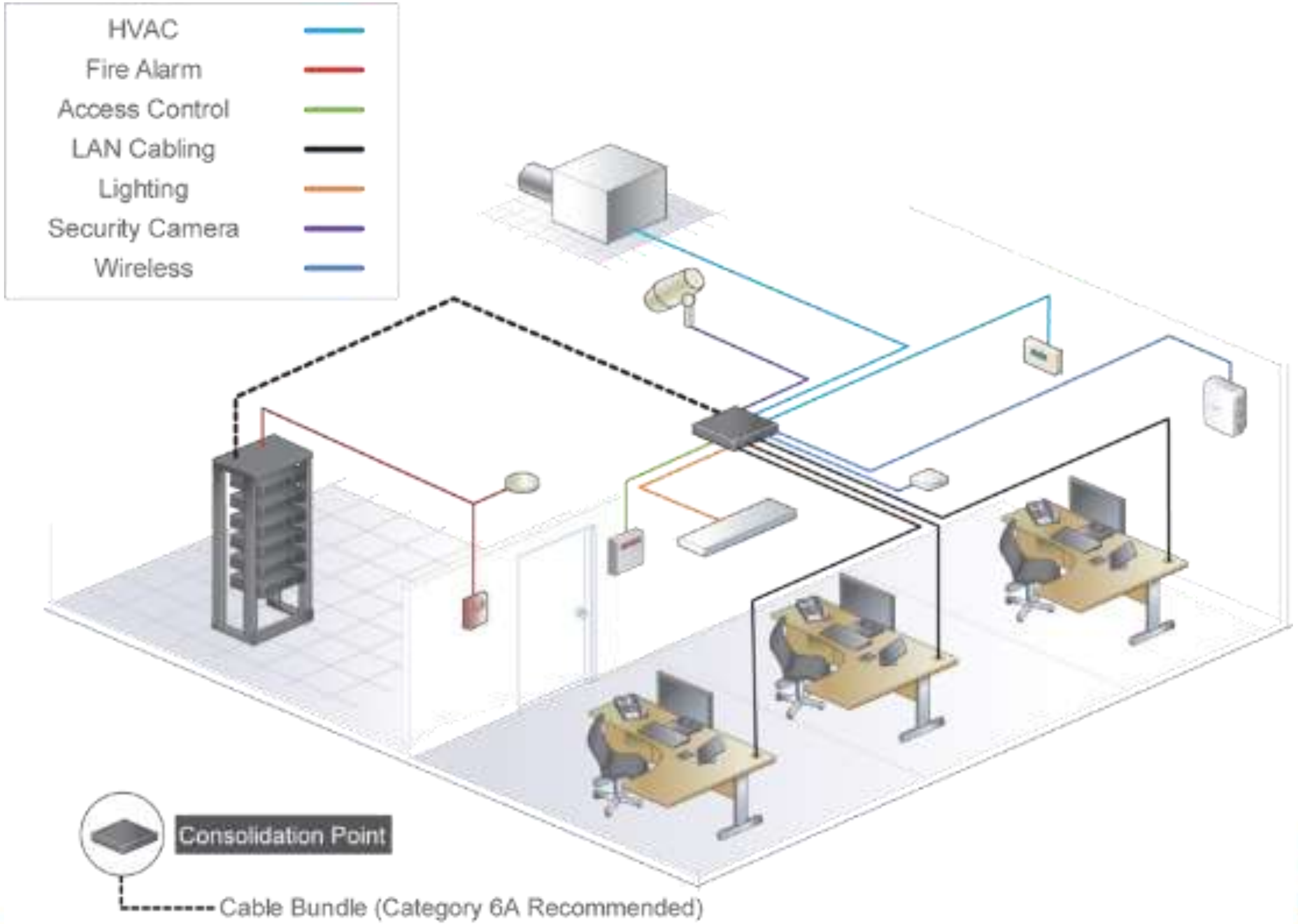


TIA TSB-162-A:
Cabling Guidelines for
Wireless Access Points



ISO/IEC TR 24704:
Customer premises cabling
for wireless access points

A new concept: Universal Connectivity Grid



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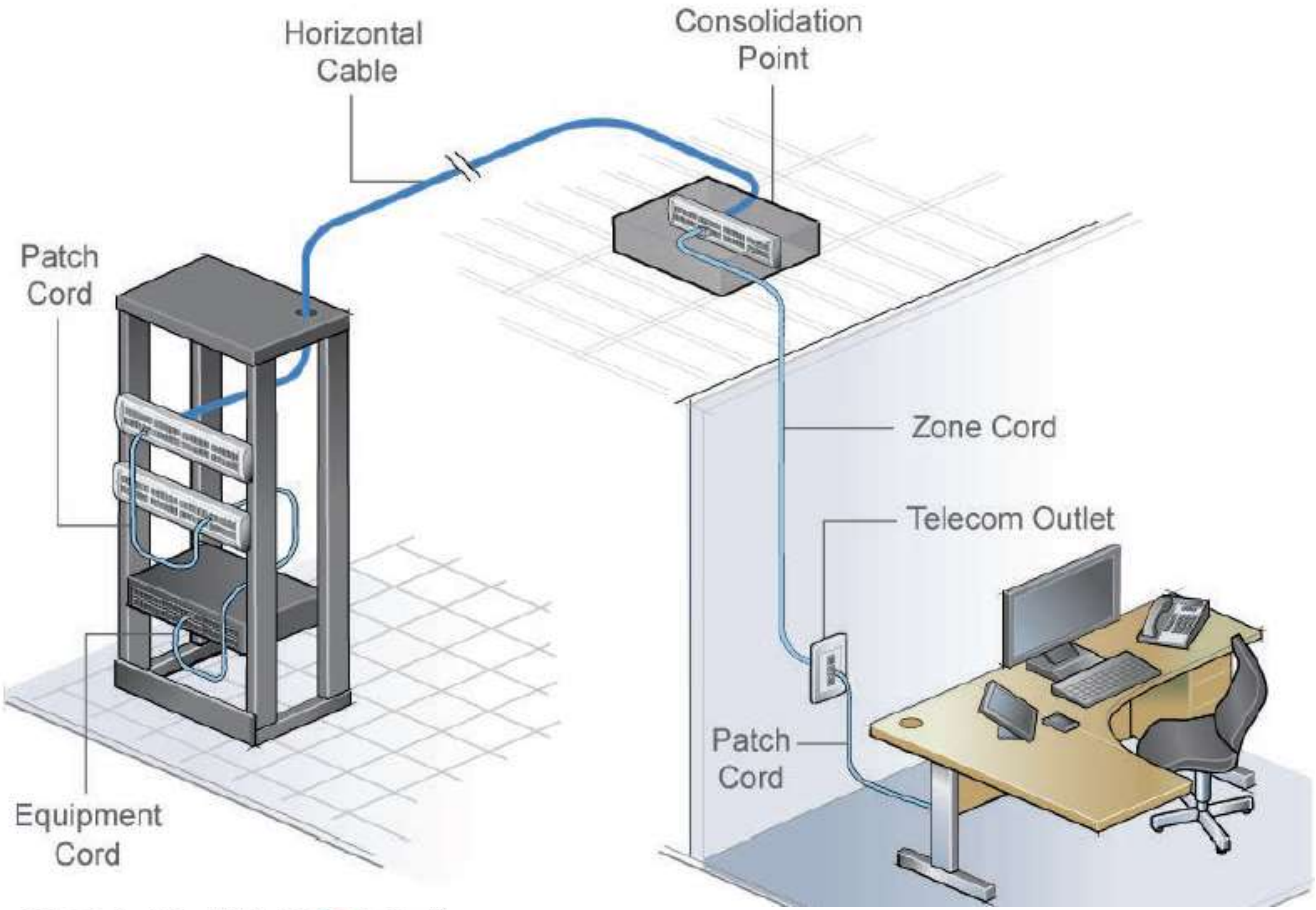
From TR, to CP to TO



Zone cabling
relies on a hierarchy of infrastructure to connect the telecommunications room (TR) to each zone’s consolidation point (CP), which acts as an intermediary between the core network and the telecommunications outlet (TO).

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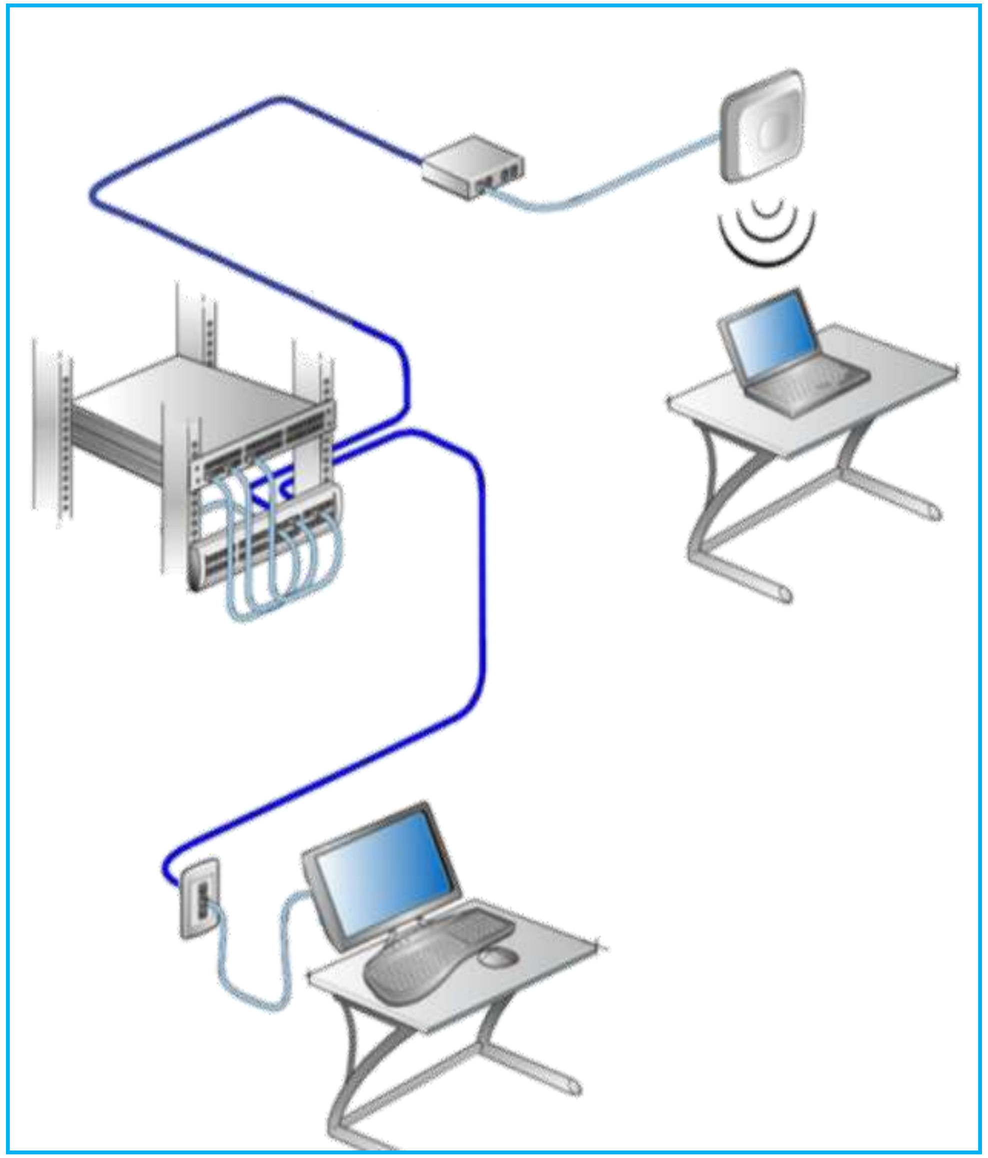
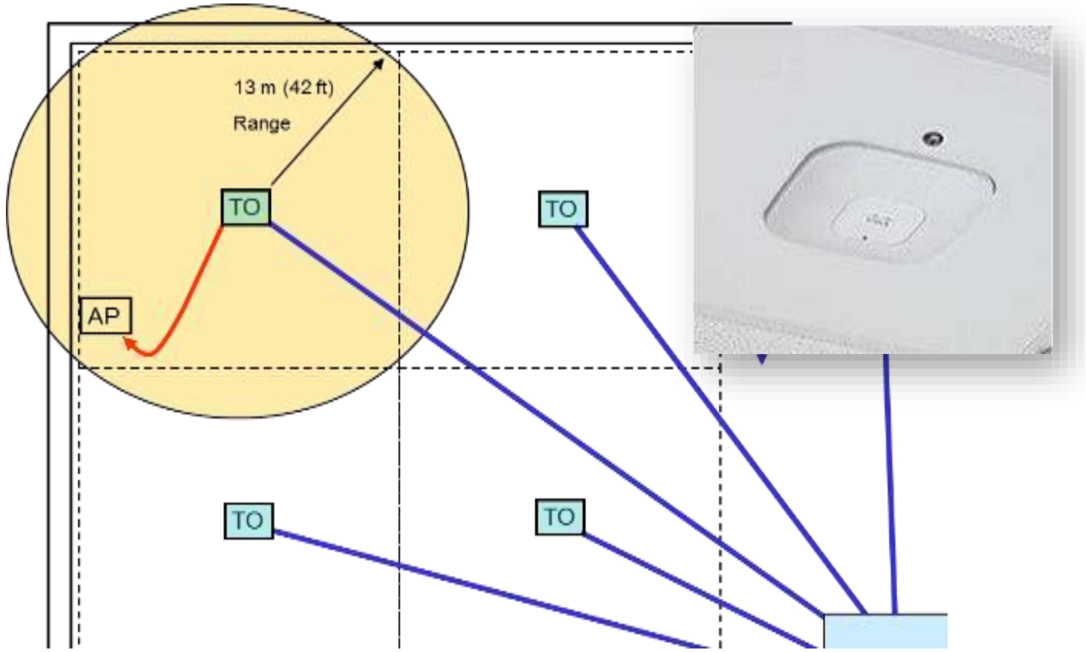
UCG: planning for wireless



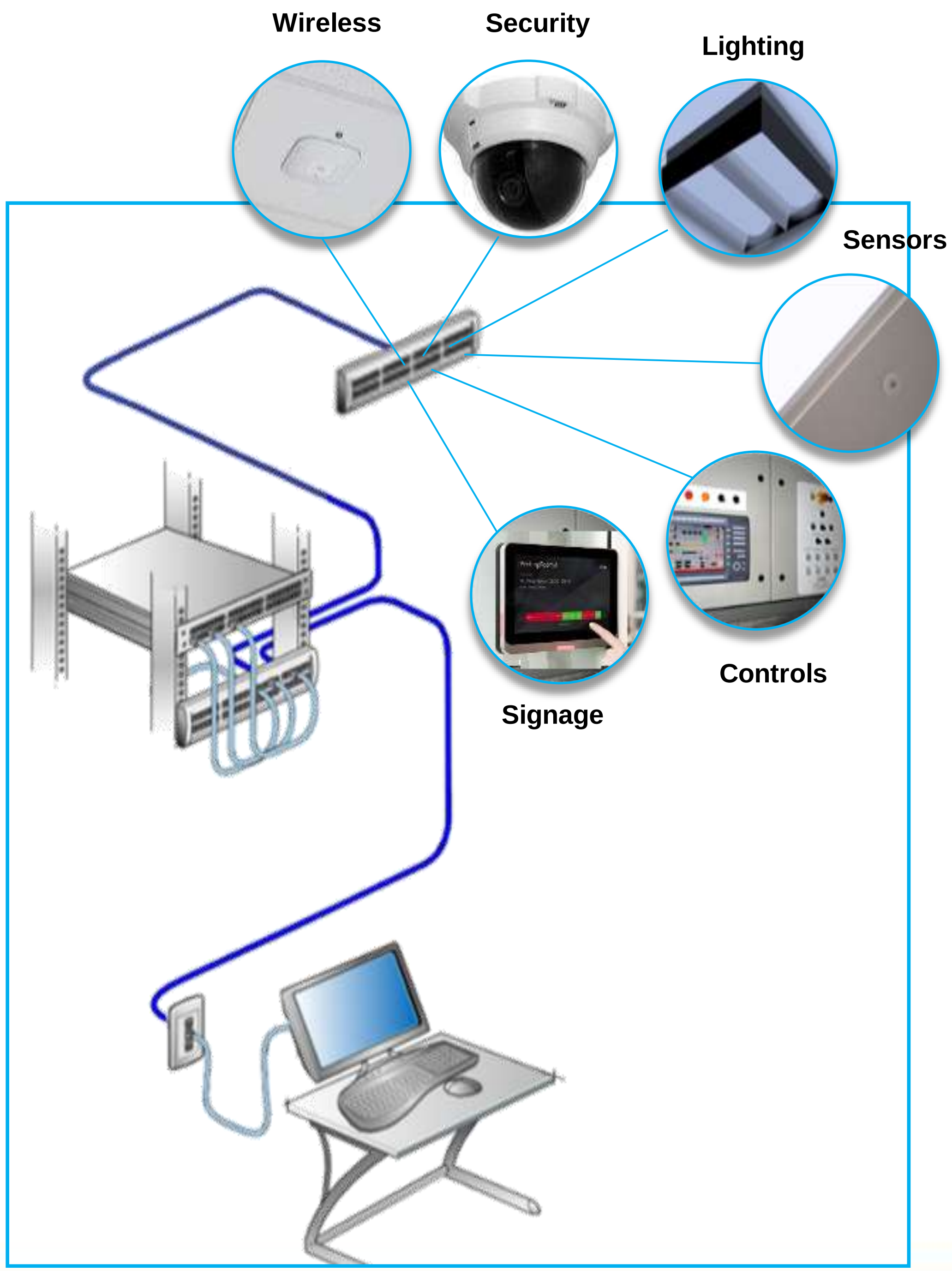


Planning Recommendations

- 2 outlets per cell for Wi-Fi
- 2 additional outlets for IBW + spare
- Maximum cell size per TIA/ISO*
- Category 6A horizontal cabling
- OM3/OM4 riser backbone

* Smaller size should be considered for high density areas

UCG: planning for low voltage applications



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UCG: Spacing and connections counts

Applications	Ports Per Endpoint	Notes/Additional Considerations	Ports Per Cell
Work Station	Two ports per desk	Assumes 36 workstations per 60 foot x 60 foot cell	72 ports
Wi-Fi	Two ports per WAP	Plan for two access points per cell to accommodate future capacity increases	Four ports
In-building wireless	Two ports per AP	Plan one spare port to accommodate future needs	Two ports
Paging and sound masking	One to four ports per system	System architectures vary. Reference manufacturer's requirements	One to four ports
Low-voltage lighting with in-tegrated occupancy sensors	One port per fixture and wall switch	Assumes 9.5 foot ceiling height with connections for wall switches or sensors in common areas	40-48 ports
Occupancy sensors	One port per sensor	Plan one sensor per desk, with additional sensors in hallways and other common areas spaced roughly 10 feet to 15 feet apart	36-48 ports

The number of cable drops in each cell depends on the applications supported and the size of the cell

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EMERGING TECHNOLOGIES

AIM – Automted Infrastructure Management

ISO/IEC 18598 – AIM Standard (October 2016)

Real-time automated documentation of physical layer

AIM is an integrated system consisting of hardware & software components

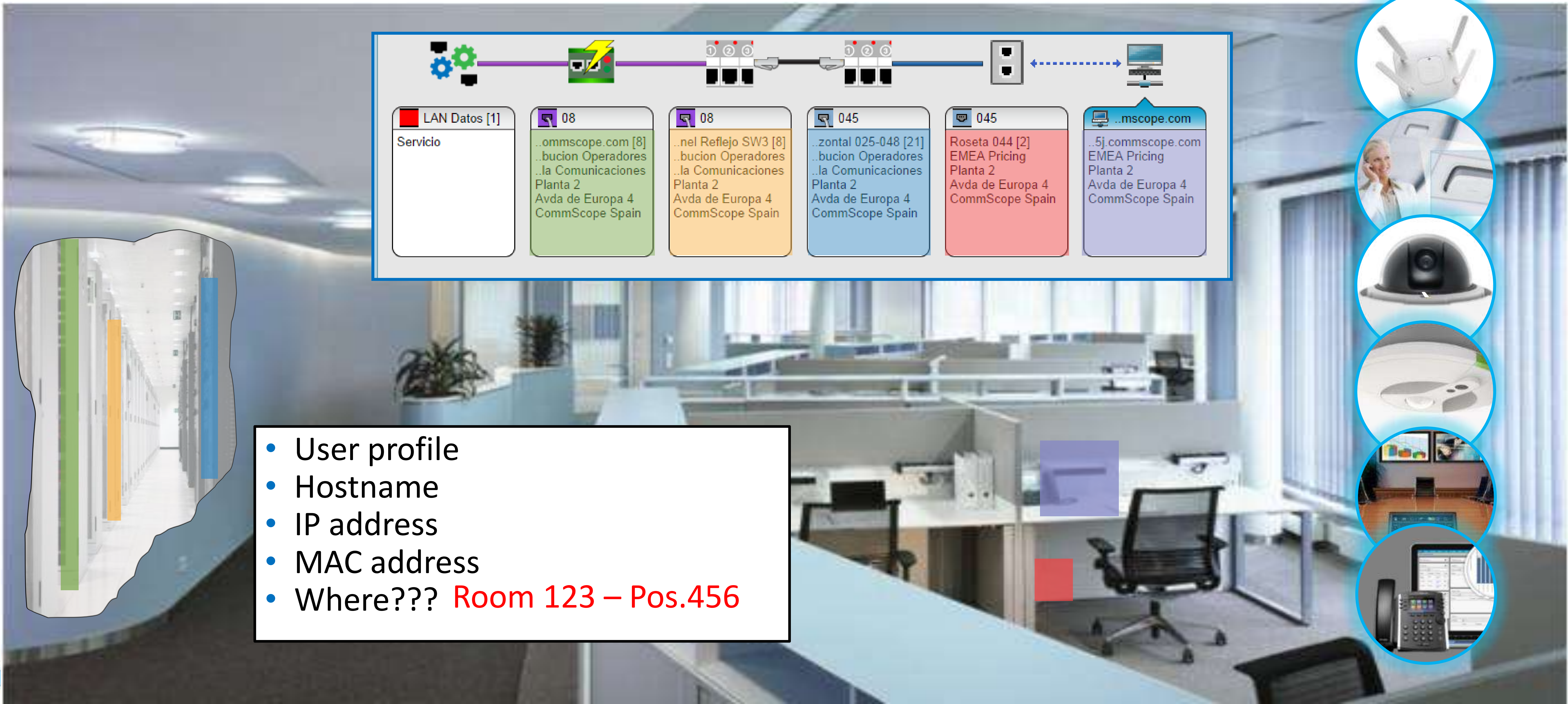
Automatic Detection the insertion and removal of cords

Management and real-time monitoring of connectivity changes

Network Device Discovery and their location information

API for Integrations with other systems

AIM: end-to-end physical layer connectivity



- User profile
- Hostname
- IP address
- MAC address
- Where??? Room 123 – Pos.456

AIM: real-time IP devices detection

AIM: managing PoE

AIM systems ensure
that planning and maintenance of PoE over structured cabling system is done in compliance with TIA TSB-184-A and ISO 14763-2 standards

AIM provides unique capabilities for tracking cable bundle size, number of powered cables and their power level

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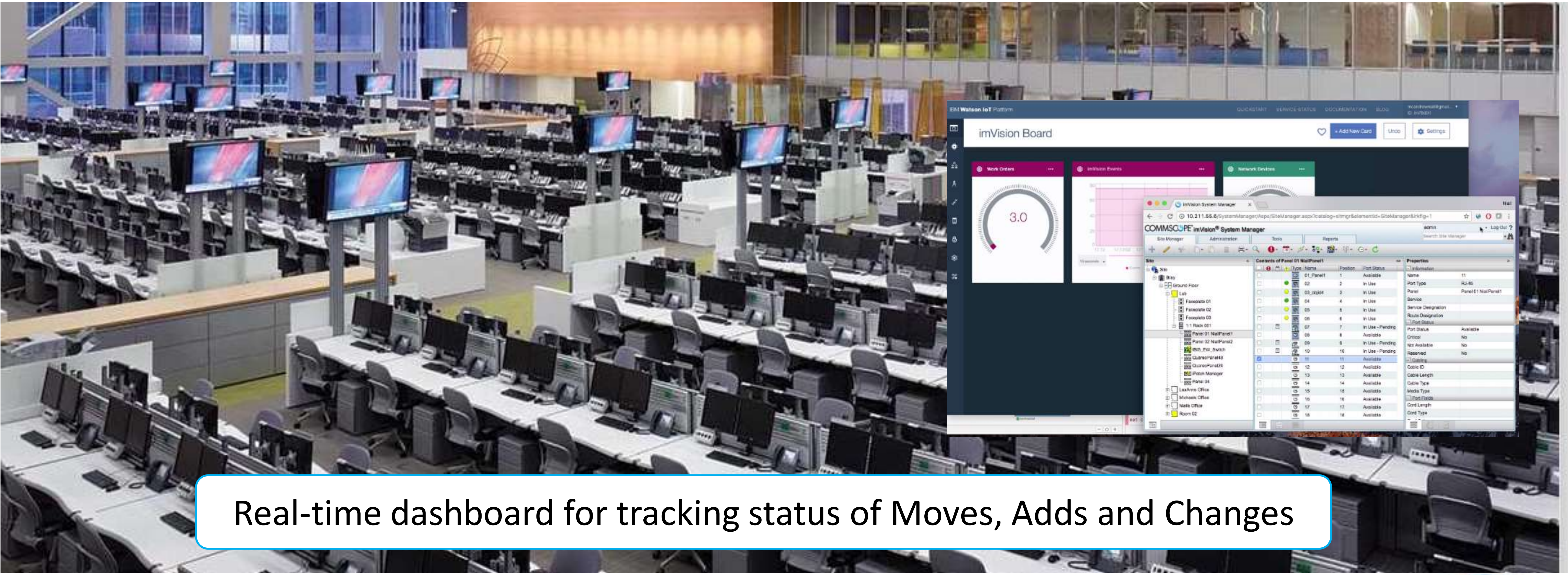
AIM: source for accurate and real time network connectivity data for use by IoT Analytics



Real-time dashboard for tracking status of Moves, Adds and Changes

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Amendment 1 to ISO/IEC 14763-2

Usage Recommendations for customer cabling premises

ISO/IEC JTC 1/SC 25 N 2230
Date: 2013-11-20

Reference number
ISO/IEC 14763-2:2012(E)/DAM 1

Table 11 – Level of operational complexity

No. of administered ports	2 to 100	101 to 5 000	>5 000
Service delivery (see Note 2)	None	None	Automated

AIM is a MUST have!

NOTE 2 Manual records include paper-based systems. Electronic records include spreadsheets, databases etc.

Automated records include the data from automated infrastructure management (AIM) systems that detect connection/disconnection of cords and/or services provided over the cabling. Requirements and recommendations for specifying and operating AIM systems are provided in Annex H.

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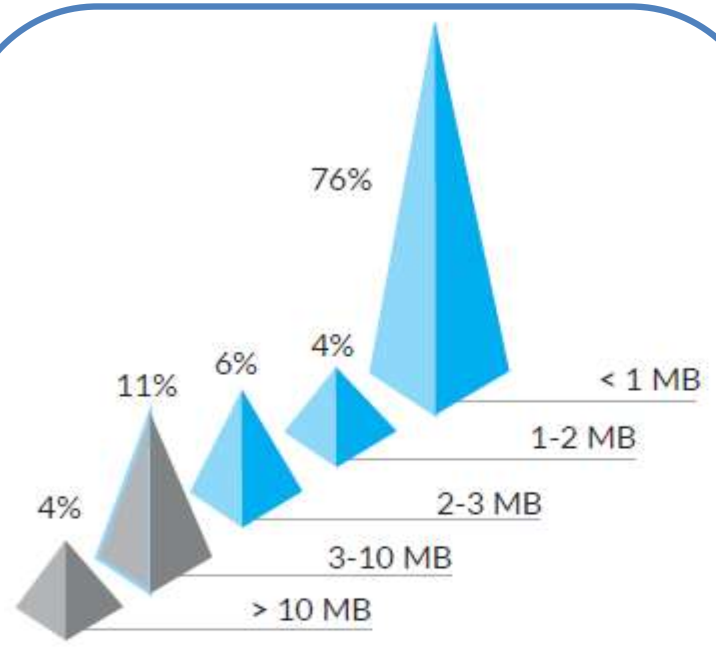
Single Twisted Pair Ethernet

- Demand initiated in automotive and industrial Ethernet applications
- Migrating from legacy multi-drop and analog to point to point digital
- Unified architecture eliminates gateways
- Now under consideration for IoT
- Standard developments:
  - IEEE 802.3cg > 10 Mb/s
  - IEEE 802.3bw > 100 Mb/s
  - IEEE 802.3bp > 1 Gb/s
  - IEEE 802.3bu > Power over Data Lines (0.5 to 50W)



86% of M2M/IoT devices consume less than 3Mb/Month

[Souce: John Brehm & Associates, 2015]

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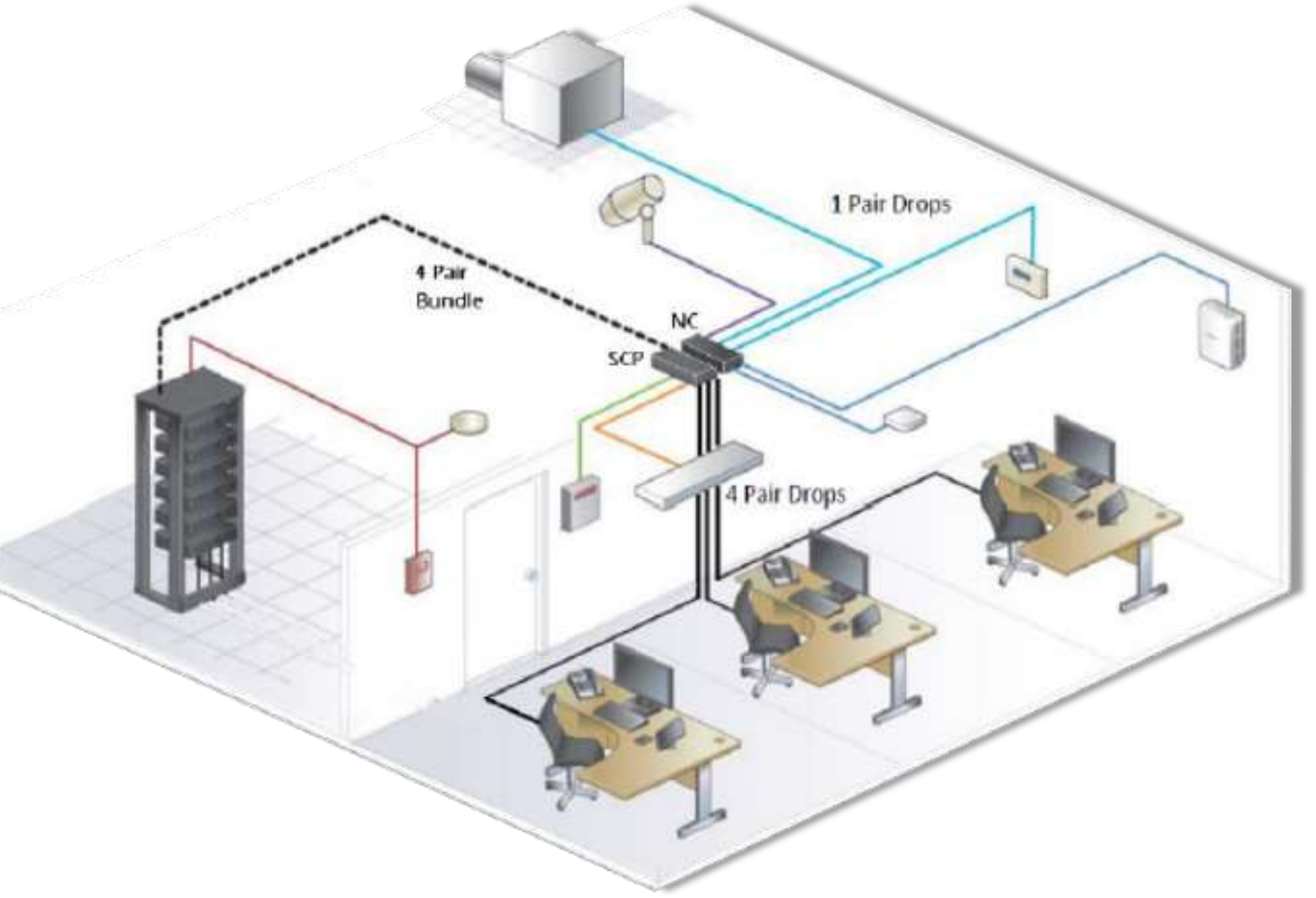
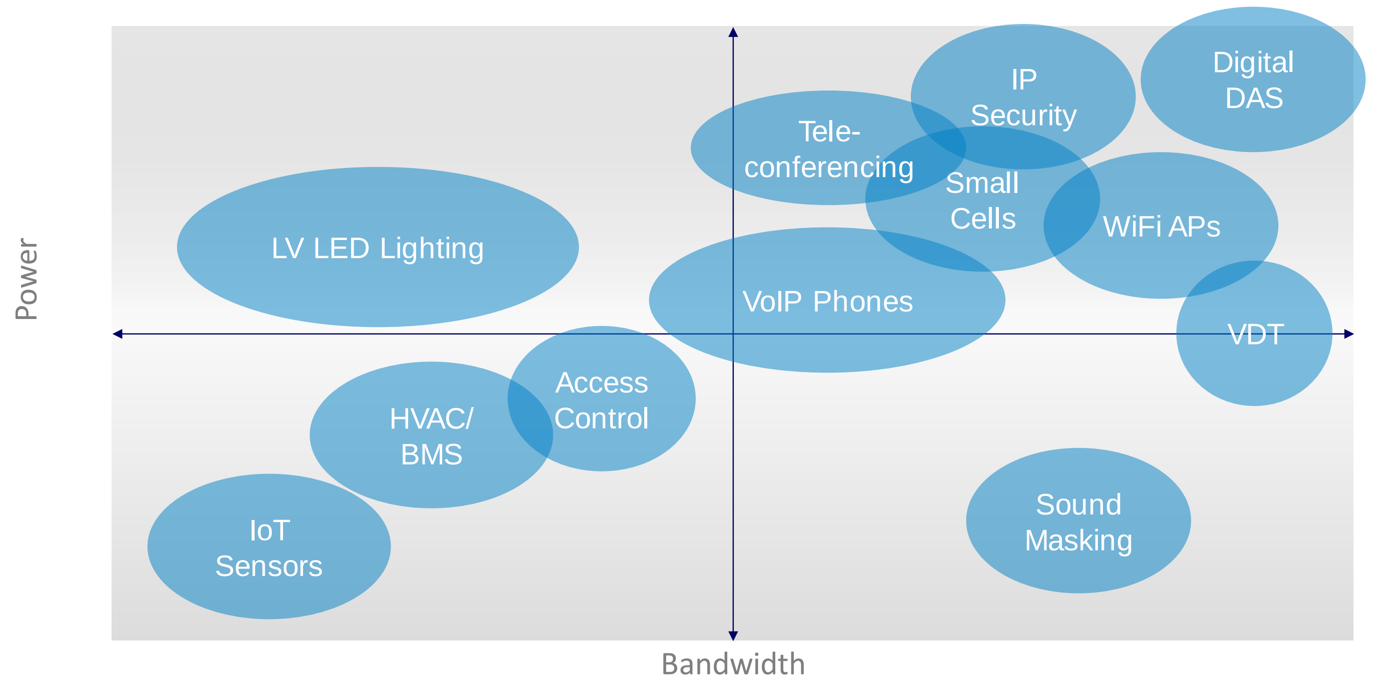
Single-Pair Ethernet - IoT



IoT Applications – Power and Bandwidth



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Summary

- The workplace continues to undergo significant change
- IoT and Mobility will challenge traditional building infrastructure
- New design architecture and technologies simplify installation and management

ThankYou
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Diolch
Kiitos
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Kasih
Todah
Mamnoon
Shnorhakalutiun
Shokriya
Dziękuję
Shokrun
Spaas
Mul
Ači
Xie
Ngiyabonga
Gamsahapnida
Teşekkür
Dekuju/Dekujeme
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