Wireless
Means
Better Wire

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Wireless Means Better Wire

- The Trend Towards Wireless
- Maximizing Cabling Efficiency
- Cable Selection and Deployment
- Belden Recommendations

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  - User Analysis
  - High Efficiency WiFi
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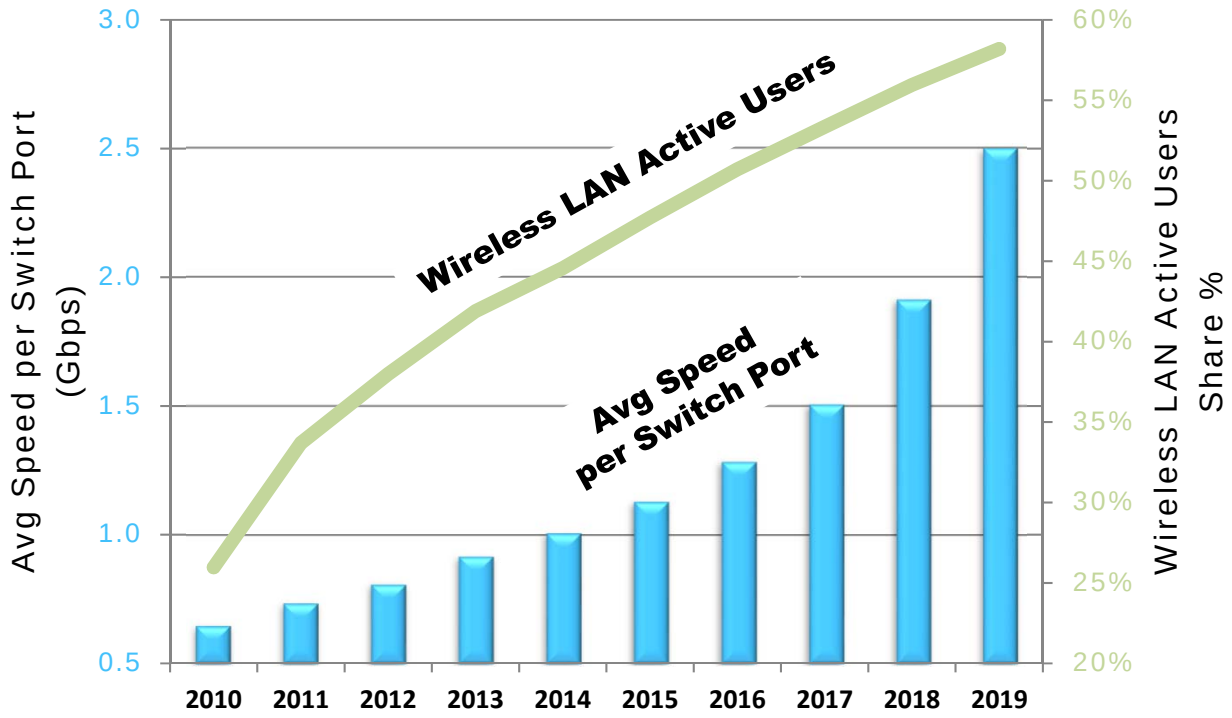
New LAN on the Rise

2000s		2020
Connecting People	→	Connecting Devices
Fixed Connections	→	Wireless Connections
Locally Powered Devices	→	Remotely Powered Devices

LAN Speed Migration



Dell'Oro, 2015

LAN Speed Increase

2.5x **from 2015 to 2019**

Fueled by Multi-Gigabit WiFi

Wireless LAN **Active Users Growth Outpacing Wired LAN**

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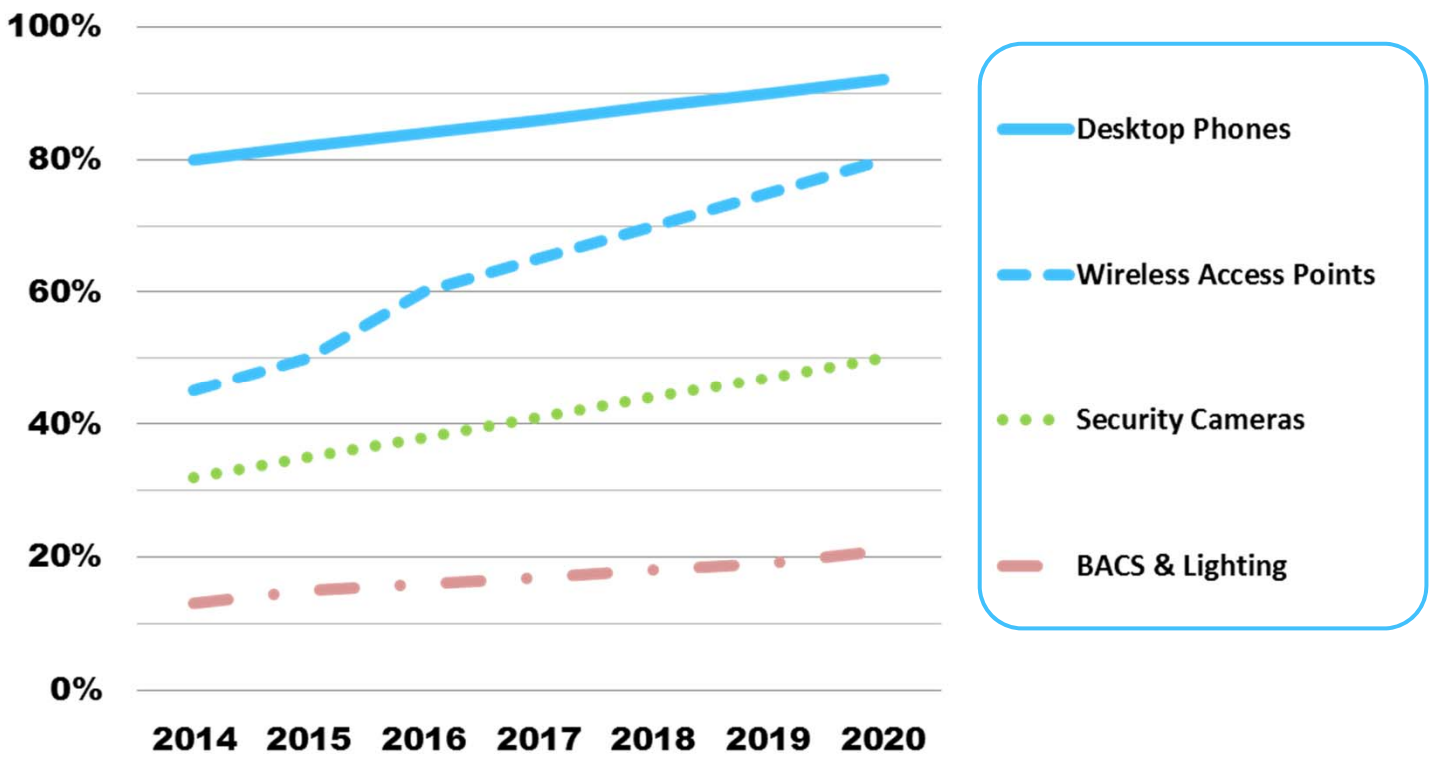
Power-over-Ethernet Adoption

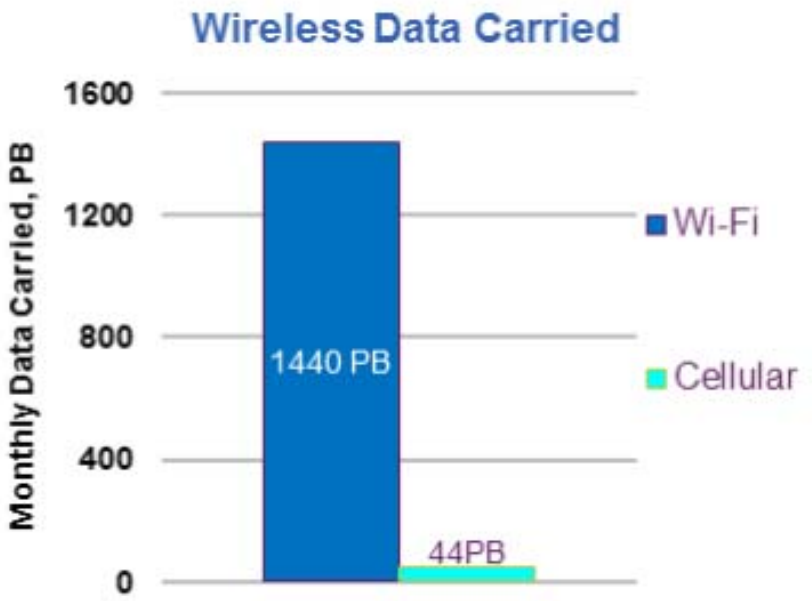


BSRIA, 2015

WiFi Adoption

Why WiFi?

- WiFi speed is rising
- WAPs easily deployed with PoE
- WiFi traffic is 16x cellular



Source: Andy Gowans (UK regulator) presentation: https://mentor.ieee.org/802.18/dcn/16/18-16-0016-01-0000-ofcom-future-spectrum-requirements.pptx

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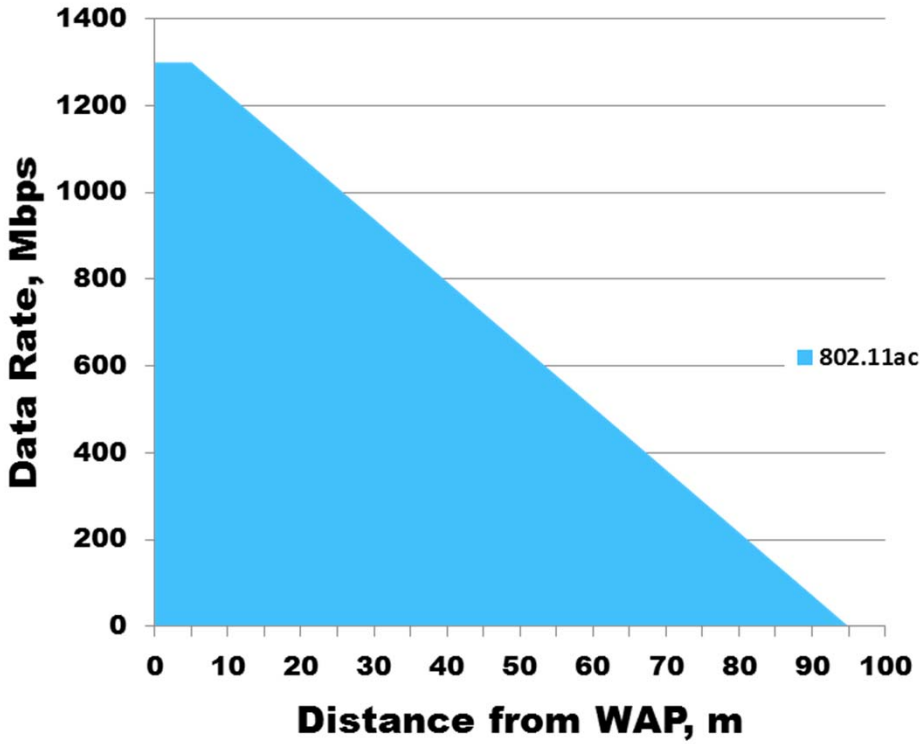
Access Point Specifications

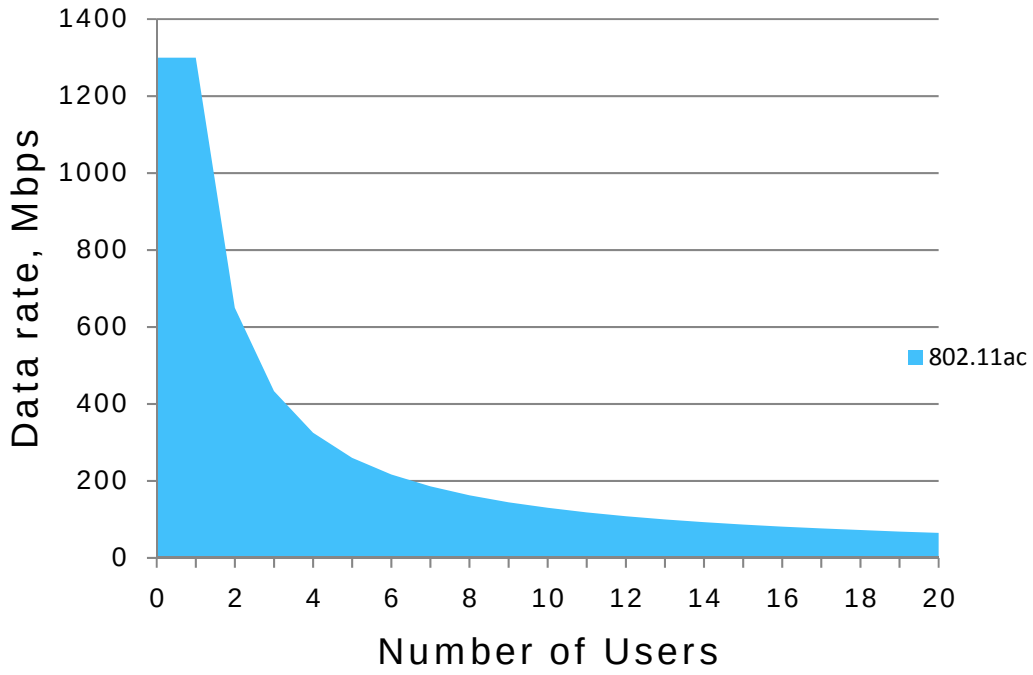
	802.11n	802.11ac Wave 1	802.11ac Wave 2	802.11ax (est. 2018)
WiFi Data Rate	450M	1.3G	3.5-7G	~10G+
Ethernet Uplinks	100M 1G	1G	1G/2.5G/5G	5G/10G
Number of Ethernet Uplinks	1	1	1-2+	1-2
Power Consumption	13W	25W	25W+	25W+

Data Rate Dependence on Distance from WAP

Data Rate and Throughput decrease as client moves away from the WAP



Data Rate per Client



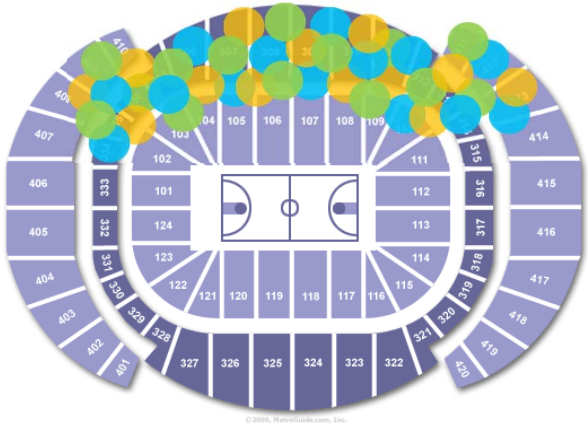
Deploying High Efficiency WiFi

Before

Coverage with “Limited Capacity”

After

Coverage with “High Capacity”



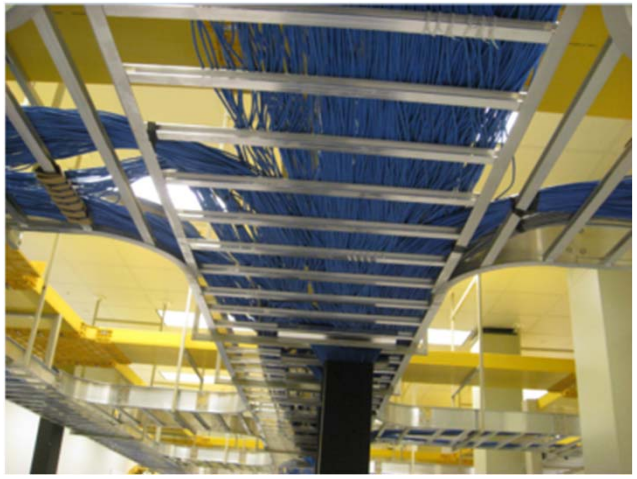
Why More WAPs?

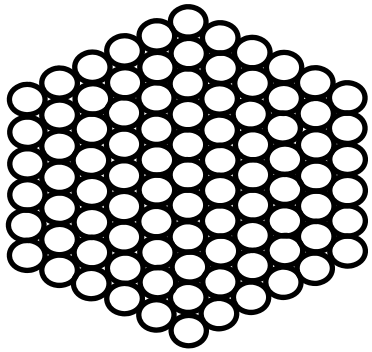
- Higher Modulation requires higher signal quality
- Higher frequency, reduced range

More WAPs = More Cables

Effect of More Cables

- Pathways and Spaces are filled
- Higher Cable Density
- Bundle Effects





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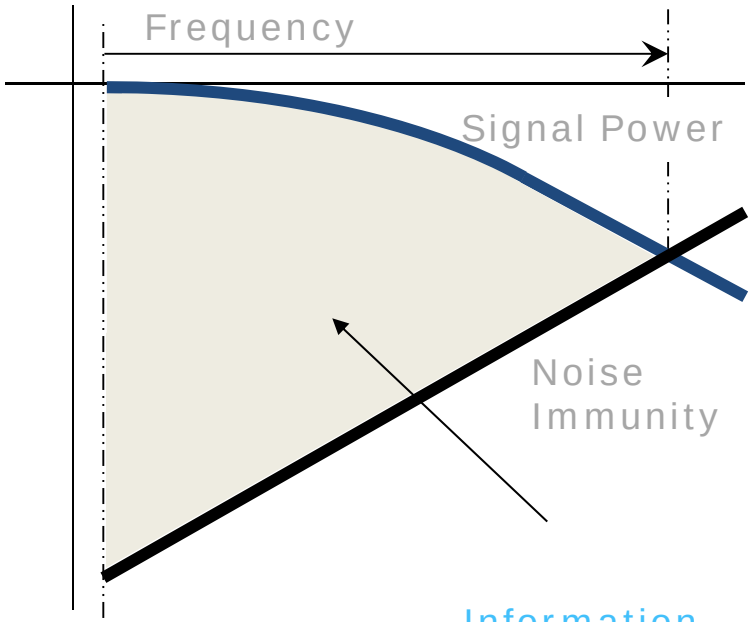
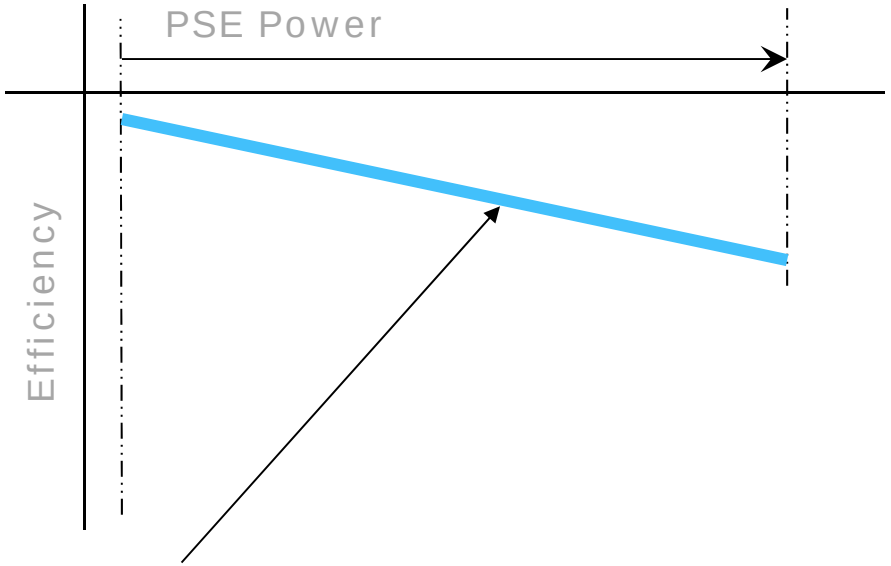
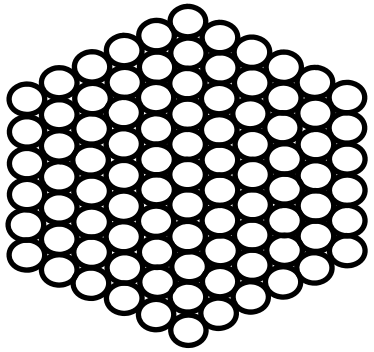
Cabling Performance



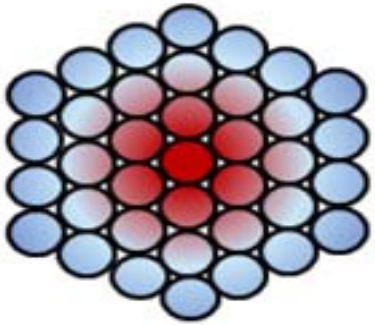


Information Capacity + Power Delivery Efficiency = New Cabling Performance

Bundling Effects Cabling Performance



Alien Effects



Heating Effects

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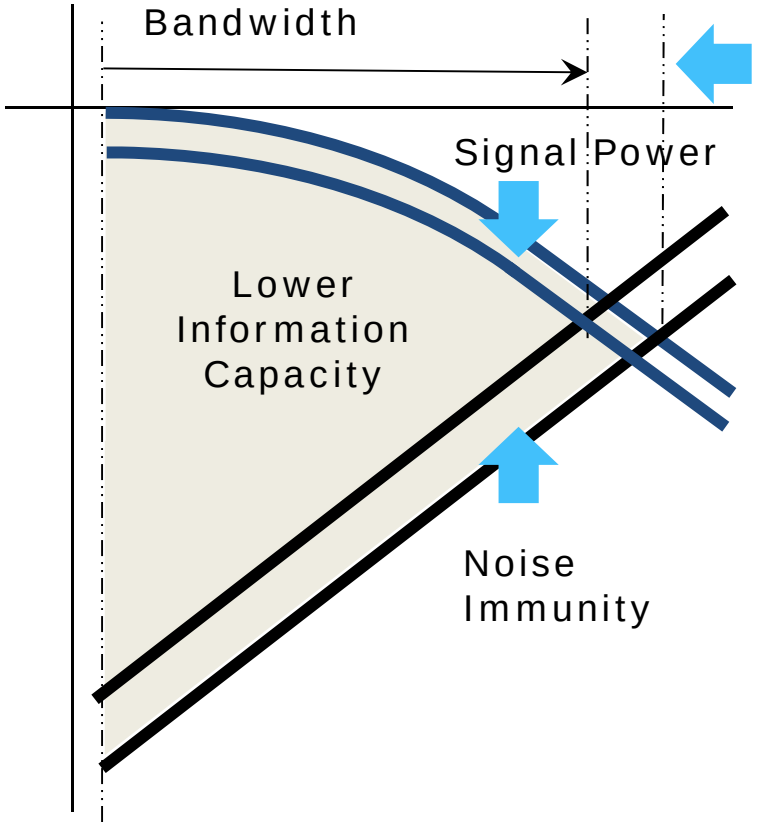
Maximize Performance to Maximize Reliability



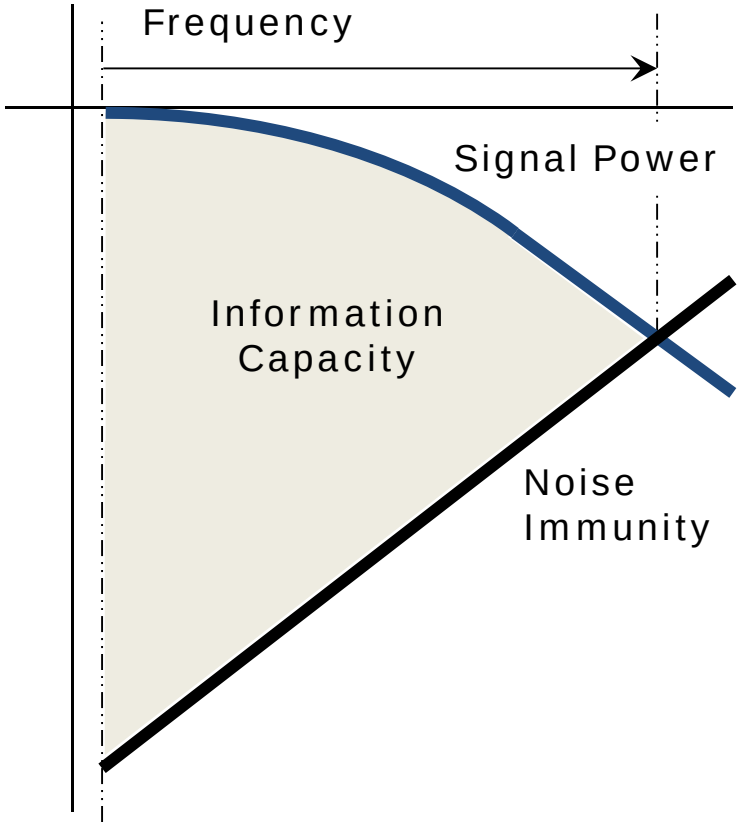
Lower Signal Power

Lower SNR

Lower Noise Immunity leads to decreased information capacity, or Lower SNR

Any combination will reduce bandwidth and reduce information capacity

Maximize Performance to Maximize Reliability



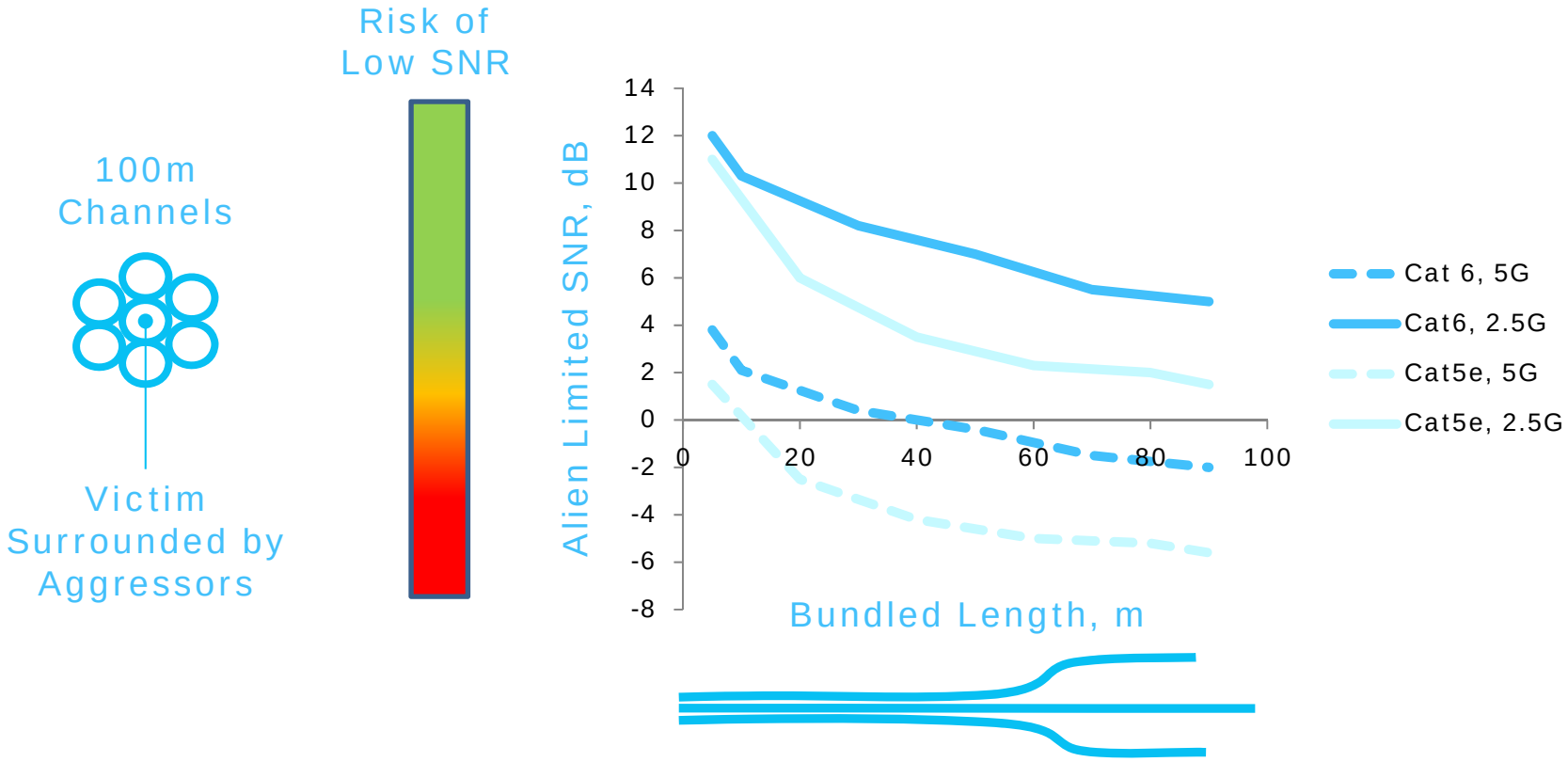
Increased Bandwidth
Higher SNR

Better RL leads to less reliance on the PHY echo cancellation algorithms

Better NEXT leads to less reliance on the PHY digital signal processing

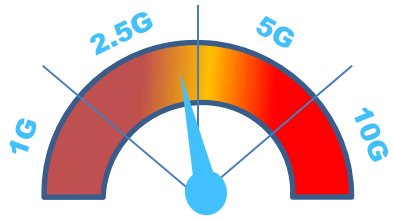
Less reliance on the computational power of the PHY means a more reliable data transmission,
more channel up-time, and even lower power consumption

Bundled Cable Effects on Noise Immunity

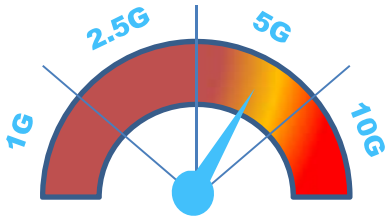


Cabling for Gigabit Wireless

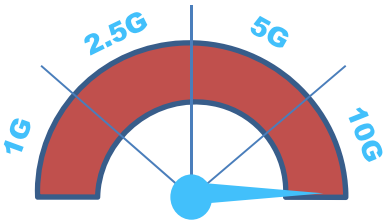
Multigigabit Switches will slow down if SNR too low



Category 5e



Category 6



Category 6A

Multigigabit
Full Implementation

BELDEN
SENDING ALL THE RIGHT SIGNALS

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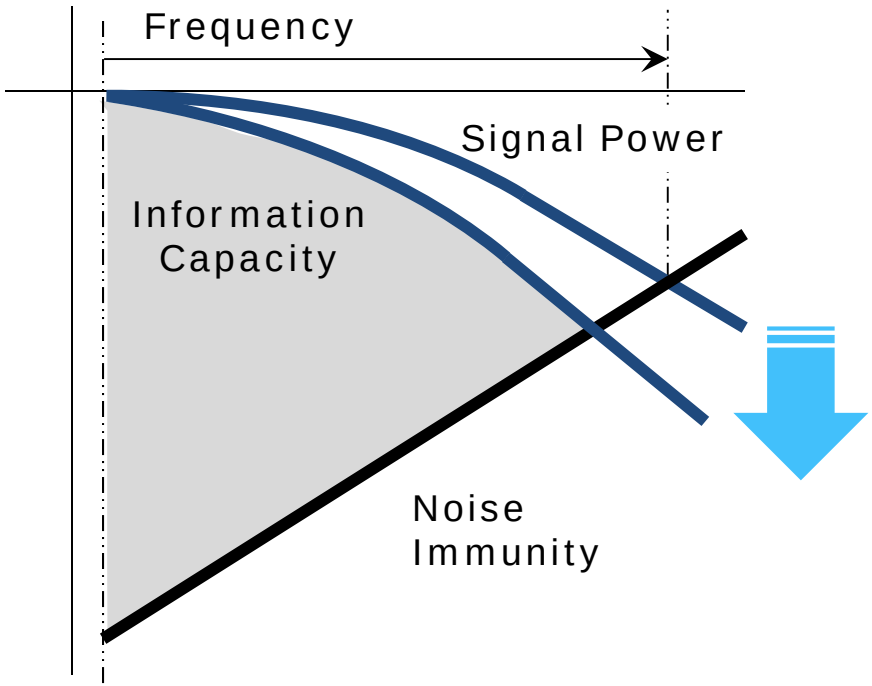
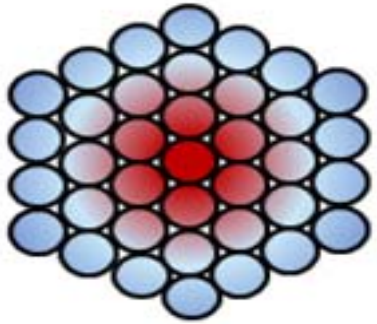
Bundling Conditions & Temperature Rise





Powering over data cables causes heating of cabling

- Possible performance issue due to IL degradation
- Ambient temperature plus heat rise must stay below cable jacket rating

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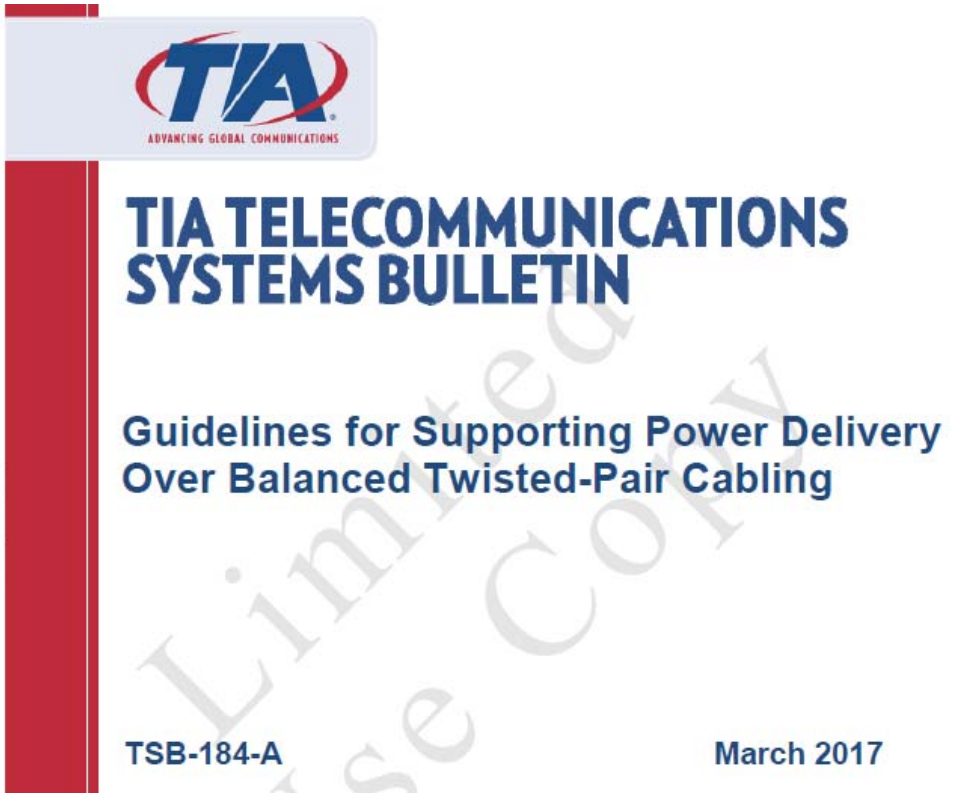
Standards Guidance

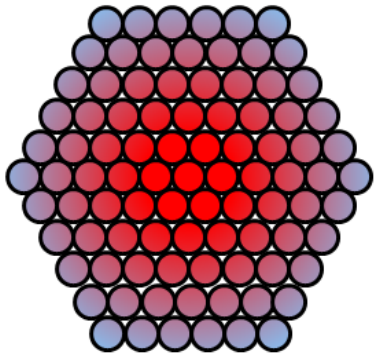
"What happens when cable gets hot?"

- Guidelines to support up to 100W PoE
- Limits Bundle sizes
- 45°C ambient with 15°C rise

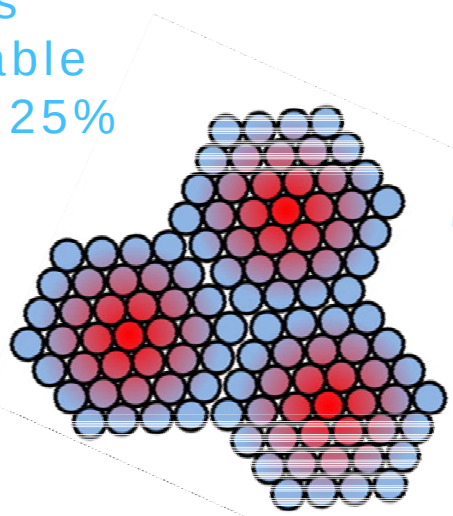


Keep it Cool

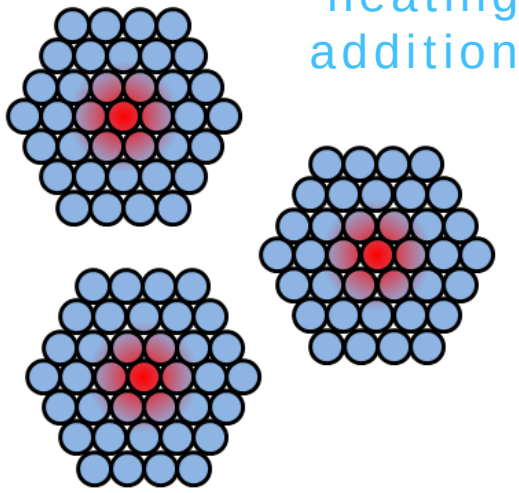
Large bundles trap the heat



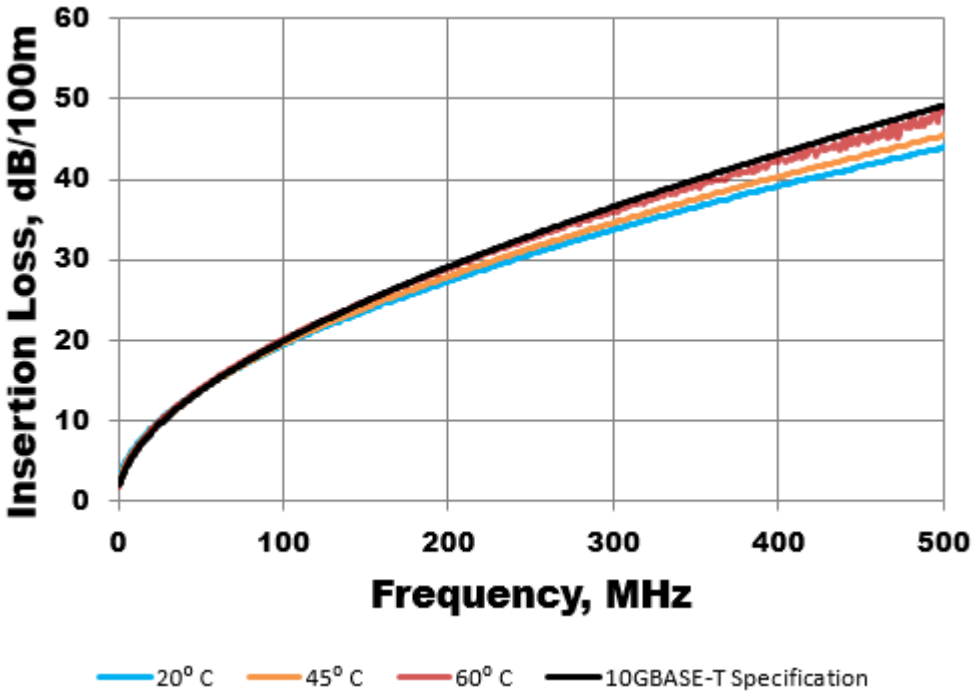
Smaller bundles reduce cable heating by 25%



Separating bundles reduce cable heating by an additional 30%



Cat6A Cabling Insertion Loss at Different Temperatures



IL Margin required to absorb Heating Effects

Cable without Margin cannot reach 100m

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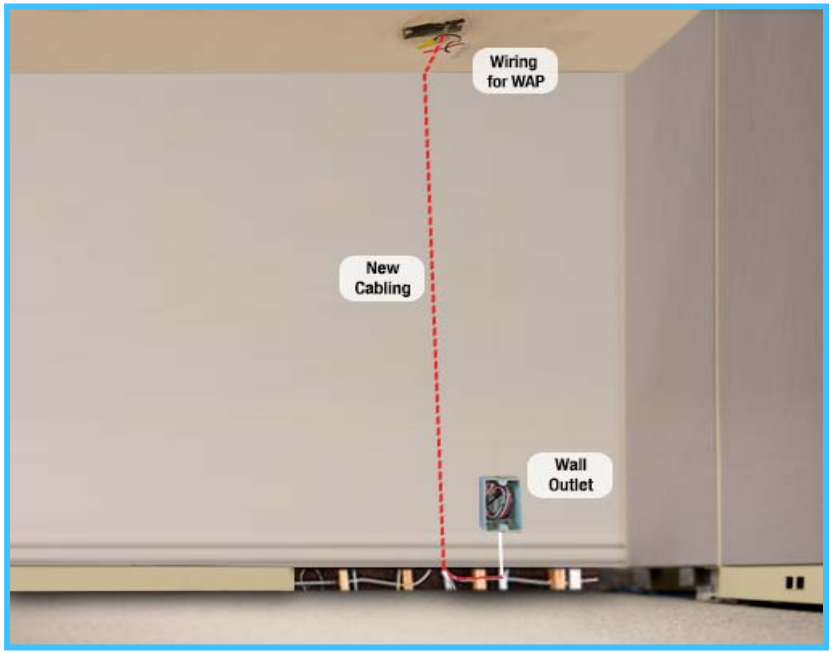
Brownfield Deployment

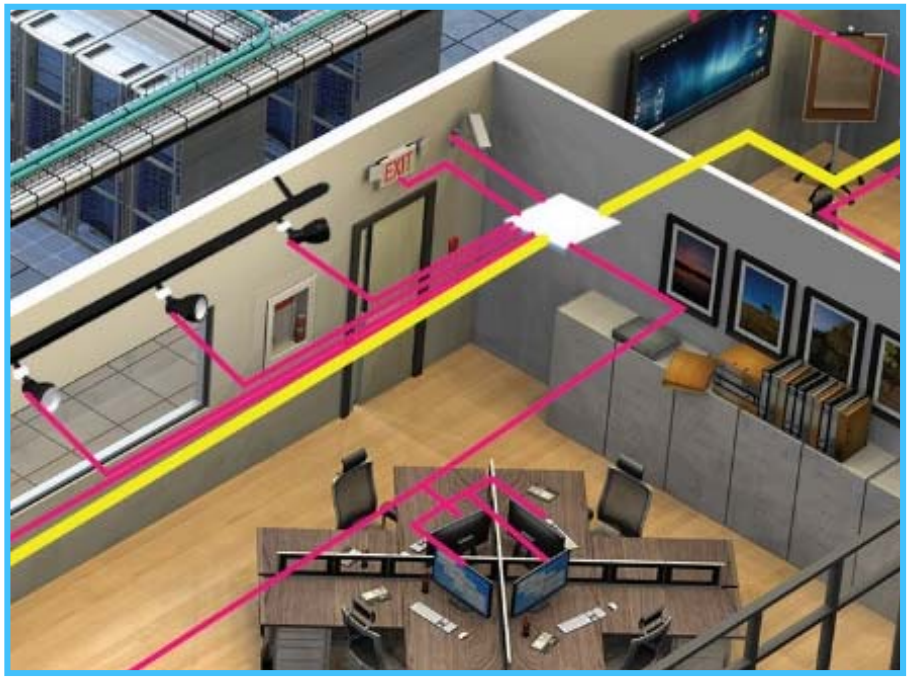
LAN Connections move from the Wall to the Ceiling



Grid Cabling for Ceiling Infrastructure

Future Proofing

Install additional cabling runs into Zone Boxes



Direct Connection to End Devices

Direct Connect Horizontal Cabling to WAP

Maximize Efficiencies

- Wide Bandwidth
- Noise Immunity
- Power Delivery

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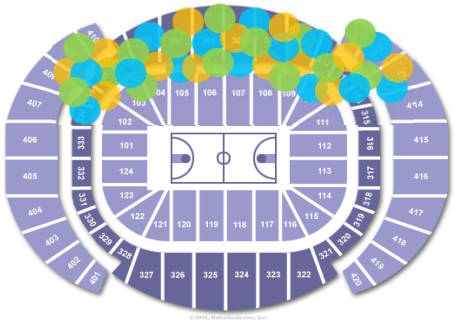
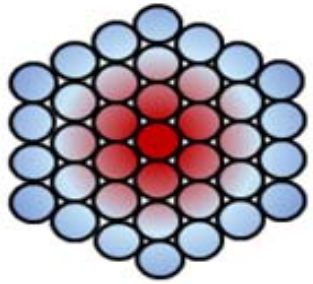
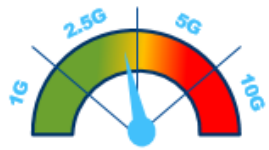
More Demand = More Antennas = More Cabling



High Density

- Bundling Heating Effects
- Bundling Noise Effects





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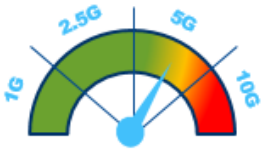
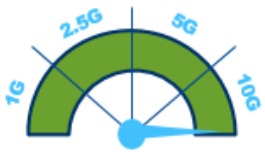


Category 6



Category 6A

Belden Recommendations

Enterprise LAN

- Ensure network reliability by utilizing Category 6A cabling
- Specify cabling with built-in IL margin
- Utilize structured cabling approaches for efficient MACs
- Future-proof by provisioning more drops per WAP
- Apply test methods that supports your solution

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