Smart Enterprise Infrastructure Cabling Trends 2019 and Beyond

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Broadband services and higher bandwidth are in greater demand than ever with the burgeoning Internet of Things (IoT) and pervasive, high-speed mobile connectivity. As new technologies shaping Smart Factories, Smart Buildings and Smart Cities emerge, ICT infrastructure teams will be required to provide networks that are faster and carry larger capacities than they are traditionally capable of delivering – keeping data processing close to the endpoint or network's edge rather than on a centralized server.

By 2022, 28.5 billion fixed and mobile personal devices and connections will help drive global IP traffic to reach 4.7 zettabytes annually. Over the next five years, the expanding edge computing environment featuring greater processing power, storage and other advanced capabilities will establish robust communications back to centralized services.

These trends are intensely reliant on broadband fiber, copper and wireless as well as powered connectivity. Specifically, the following eight trends will significantly impact enterprise infrastructure cabling strategies in 2019 and beyond.

Trend #1

Edge, fog and serverless computing redefines cloud computing and increases the criticality of always-on connectivity.

The always-on lifestyle of Generation Z consumers is poised to intensify the proliferation of streaming music, video and social media over the coming years. These users check their smartphones more than 30 times an hour; are prolific content creators; and share that content freely via their networked devices. Coupled with the demands of the always-on digital business, this confluence of connections, data and devices necessitate an enterprise edge computing strategy to achieve the low latency demanded for stakeholder productivity and better customer experience.

The network that connects billions of sensors, machines and computers forming the IoT will evolve into a 'fog' – immersing users in data with resources all around in close proximity – that will have scale, speed and cost impacts on enterprise infrastructure. The pay-as-you-use utility model of the cloud will be further refined with 'serverless computing' that allows customers to pay only for actual code execution time.

As more compute services and data are moved to the edge of the network, businesses will expand via cloud and co-location services, even more so with escalating real estate cost in urban hubs. Efficient structured cabling with high-performance copper and fiber connectivity is required to accommodate the huge data flows that will be generated at the edge.

Even the traffic from a myriad of IoT sensors that connect wirelessly will reach a wired network at the wireless access point (WAP) or IoT gateway. Future migration options such as a gigabit last mile for SD-WAN linking edge and corporate networks will be critically important to businesses.

Trend #2

High-density fiber connectivity supports continuing trend toward 200/400G backbone.

Early implementations of 400G uplinks and backbones may happen by 2020 even as migration to 100/200G from 40G ramps up. Current requirements may call for 10G, 40G, 100G and 200G links, while the next upgrade might require 25G, 50G, 200G and 400G links.

Meanwhile, server densities and processor capabilities are increasing by approximately 20% every year. As such, enterprises will pursue 400GbE-ready network densification strategies to pack more capacity into less space. Technologies enabling smaller, more flexible cabling designs and centralizing cross-connections provide better access to cable terminations in dense environments, boost pathway efficiency, and address installation and testing challenges.

Advances in technology now allow the specification of 400 Gbps physical layer types that will operate over fewer multimode pairs than required by current 400GBASE-SR16. The IEEE 802.3cm task force's 400GBASE-SR4.2 4-pair solution, for example, uses two short wavelengths to double the multimode fiber capacity from 50 Gbps to 100 Gbps per fiber. Not stopping there, using two more wavelengths opens possibilities for single-pair operation at 200 Gbps and for four-pair operation at 800 Gbps, all without requiring an increase in lane rate or a reduction in reach. OM5 cabling continues to improve support for such wavelength multiplexed solutions while retaining compatibility with legacy applications. An ultra-low-loss fiber infrastructure will reduce optical signal losses associated with cabling and apparatus.

Trend #3

Power over Ethernet becoming powering strategy for wider array of higher-wattage devices and IoT applications. IEEE 802.3bt – the 4-pair Power over Ethernet (PoE) standard also known as 4PPoE – increases the highest average power at the Power Sourcing Equipment output to about 90 W without compromising data bandwidth.

It can power more types of devices beyond lighting, Wi-Fi routers, IP cameras and industrial sensors, including even cellular small-cell base stations, retail point-of-sale terminals and digital signage systems. Grand View Research predicts that the global PoE market will reach US$3.77 billion by 2025 as more applications and devices utilizing 4PPoE technology, which is compatible with data rates of up to 10GBASE-T, are introduced.

However, supporting devices that deliver faster network speeds or more power require the right cabling and network design. Given the higher wattage of 4PPoE technology, potential overheating issues affecting transmission performance and safety of structured cabling systems are important considerations to support next-generation PoE applications in different real-world installation conditions and sustainable green initiatives.

4PPoE also allows the ability to regulate and remotely power down inactive devices for increased efficiency. Industry standards groups like TIA recommend Category 6A cabling for 4PPoE because it offers lower direct current resistance than Category 5e cabling and improved heat dissipation. Since more current generates more heat, the number of cable runs allowed in a single bundle is another key consideration.

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Trend #4

Network convergence leverages data from IT, facility and operational technology (OT) systems to provide unprecedented infrastructural visibility. For all the benefits of IoT devices, they are only as good as the network infrastructure on which they run. With the always-on demands of individuals and businesses, constant access to real-time information is a major driver for investment in IoT.

Convergence of IT and OT networks will ultimately increase network quality with support for reliable real-time access to insights on energy usage, heat emissions, performance and other metrics to boost infrastructure efficiency. Network convergence also spans the smart building-to-smart city continuum, extending seamlessly across in-building, data center and metro networks. It affords users the advantages of seamlessly navigating between all access technologies – Wi-Fi, cellular, satellite, fixed, wireline, and more – with tremendous scale and zero latency.

High consumerization of videos, social media, apps and e-commerce demands low-latency transfer of and access to huge amounts of data. Already, a glimpse of an internet minute in 2016 showed that the world downloads more than 38,000 hours of music on Spotify, streams nearly 70,000 hours of Netflix video, and sends 150 million emails, among other content flowing to and from connected devices. At the same time, the fabric of IoT will unleash billions of sensor-based networks powering everything from personal health/safety to efficient transportation to business transformation.

One converged network to manage all traffic in the enterprise reduces installation costs and operational expenses over the long term and increases flexibility to adapt to changing business needs. Continued improvements in cabling technology with Category 6A copper and OM5 fiber-optic cabling have facilitated convergence of Wi-Fi and in-building wireless solutions. Further, software-defined networking and network functions virtualization extend greater agility and cost efficiencies to edge and access networks.

Trend #5

In-building wireless (IBW) systems to fulfill connectivity needs of smart building applications. Cellular coverage indoors augments Wi-Fi connectivity and plays a vital role in enhancing both employee productivity and customer experience. An IBW solution (i.e. cellular) provides seamless extension of macro wireless networks into indoor space where signals would otherwise struggle to reach. Unlike Wi-Fi, IBW operates on licensed frequency bands used by wireless operators so building operators must ensure that wireless operators that occupants use, as well as virtually any frequency bands, including vital public safety bands, are supported.

IBW technologies, including distributed antenna systems (DAS) and small cell solutions, enhance cellular coverage and capacity in challenging network conditions such as commercial buildings, urban areas, stadiums and transportation systems. For example, C-RAN small cells have been enhanced to define new levels of performance for 5G. The high-performance, high-capacity features of small cells play an integral role in many 5G target use cases, such as ultra-high definition video, industrial automation and smart building applications. Four functional principles governing in-building wireless in the 5G era are user experience, edge intelligence, enterprise-friendly deployments and support for multiple air-interface technologies (i.e. 5G, LTE and other cellular services).

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Trend #6

Wi-Fi 6 or 802.11ax making its way into new installations in 2019. Carrying a new naming convention, Wi-Fi 6 is due for release in 2019 and will begin to make its way into new installations. It is designed to allow for wireless data rates up to 10 Gbps and to operate in today's increasingly congested radio environments, such as airports, stadiums, hotels, apartment and commercial buildings and entertainment venues.

Wi-Fi networks have been useful in alleviating the stress on a LTE/5G network in high-density areas to enhance customer experience. Wi-Fi 6's support of multi-user, multiple-input, multiple-output (MU-MIMO) technology enables any compatible access point to handle traffic from up to eight users simultaneously at the same speed.

Still, enterprises can only realize Wi-Fi 6's true benefits with the right cabling infrastructure out to the WAP. The data rates of WAPs are increasing quickly. To deliver the bandwidth needed for current and future applications, the TSB-162-A standard recommends running two Category 6A cabling to each service outlet supporting a WAP.

Further, the ISO/IEC 11801-6 standard lists typical indoor ranges of a WAP that should be used based on the frequency band and data rate of Wi-Fi services. The list helps to determine the coverage of an average grid and placement of cabling and service outlets.

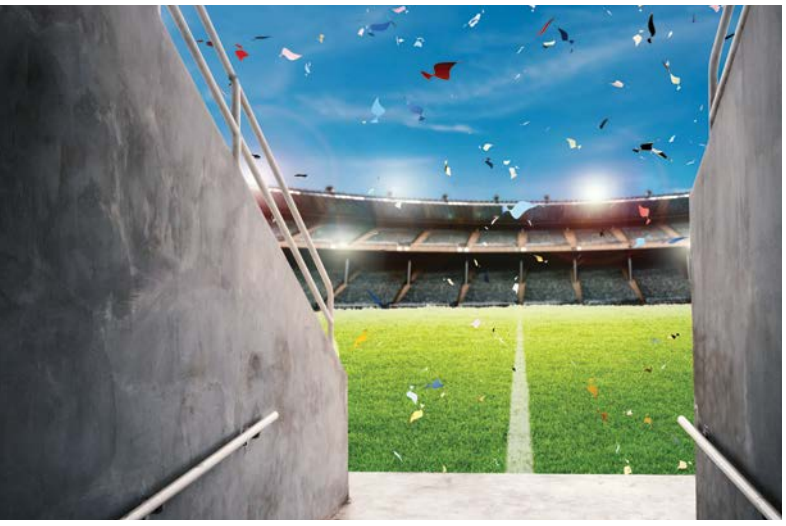
Trend #7

Business use cases for single-pair Ethernet emerging. Single Pair Ethernet technology has been standardized with the IEEE 802.3cg 10 Mbps Single Twisted Pair Ethernet expected to be approved in 2019.

Extending beyond use cases in the automotive industry and in several industrial applications, Single Pair Ethernet offers a cost-effective transport for power, connectivity and security to the billions of IoT edge devices that will be deployed over the next decade. Because the bulk of IoT devices being deployed do not require as much bandwidth and power as a typical application using traditional 4-pair cabling, single-pair Ethernet promises to provide a more compact and economical solution.

The standards development committee – ISO/IEC JTC 1/SC 25 Interconnection of Information Technology Equipment – has selected a single-pair connector design from CommScope, for use in mechanical, ingress, climatic, and electromagnetic 1 (MICE 1) environments, which is commercial office space. While it is not meant to replace traditional four-pair Ethernet cabling, business use cases for single-pair Ethernet are emerging.

Additionally, the ANSI/TIA-568.5 standard is set to provide specifications for cables, connectors, cords, links and channels using one-pair connectivity in non-industrial networks. An addendum to the ANSI/TIA-568.0-D standard will include single balanced twisted-pair use cases, topology and architecture, covering installation requirements and additional guidelines for transitioning from 4-pair to 1-pair cabling. It will also provide guidelines for emerging IoT and machine-to-machine applications that will require higher density, reduced size, and greater flexibility than can be provided by existing technology.



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Trend #8

Automated infrastructure management (AIM) to beef up support for IoT-PoE network. An AIM-empowered PoE network essentially creates a smart grid for smart building applications. With the convergence of IT and OT systems, smart building networks can tightly integrate enterprise business drivers and goals with the day-to-day load demand, usage and potential effects on the IoT-PoE infrastructure.

The capability to keep track of the location of PoE-powered devices while providing more visibility into where PoE services are and can be deployed aligns with the convergence and running of multiple smart building management and control systems on the same PoE-IoT network. CommScope's imVision AIM system, for example, provides a holistic view of a building's network and PoE links in real time, eliminating the need for overlay power and management networks.

Additionally, imVision is the first AIM solution to implement cabling standards in TIA, CENELEC and ISO/IEC that establish recommended bundle sizes based on environment and cable categories. It facilitates accurate record keeping of PoE installation configurations by tracking and documenting cable bundle sizes and total power carried by each bundle to optimize assignment of circuits for remote power delivery.

This supports the tracking of heat generation within a cable bundle to prevent over-heating of any cable in the bundle, reduce heat generation and improve heat dissipation. An AIM solution that tracks and traces which ports and outlets are PoE-enabled and enforces policies like how many cables in a bundle are powered can help to reduce operational costs and ensure optimal PoE performance.

Q&A

Infrastructure cabling provides the critical connectivity on which always-on digital enterprises innovate, transform and conduct business. These enterprises depend on efficient connectivity to fulfill users' expectations of on-demand access to data from the cloud and data residing on connected devices.

Gavin Milton-White, Vice President of Enterprise Sales for APAC at CommScope, provides further insights on the trends impacting enterprise cabling needs and requirements in 2019 and beyond.

From a cabling perspective, how do you see the unrelenting growth in demand for broadband services and higher bandwidth impact enterprise network deployments in 2019?

A: Mobility throughout all networks is driving user expectations higher. The same can be said for the enterprise. Cable for wireless both in Wi-Fi and DAS networks will continue to expand in-building to allow users to seamlessly transition between devices and from tethered connectivity to mobility.

From CommScope's perspective, what should be the top considerations or priorities for enterprises in ensuring that their building and data center networks are future-proofed to support IoT applications as well as bandwidth-intensive enterprise applications (i.e. the most cost-effective way to transport large data sets for the long term)?

A: It's important to follow progressions in technology, driven by transceiver developments and supported by cabling innovations. To allow for maximum flexibility in speed and for future proofing we need to install the "Glass of Tomorrow" for speeds that are already running at 400G and poised to hit 800G and 1.6T in future. These higher speeds are supported by Parallel Optics when we need it and by Serial Optics because we want it.

Network convergence has been a hot topic for Smart Buildings tying into the metro network convergence for Smart Cities. Within that framework, connectivity is now touted as the fourth utility following delivery and consumption models for electricity, gas and water. How do you see this trend developing further in the coming years?

A: The interesting thing about the "4th Utility" is it will impact the other three. While water, electricity and gas are separately delivered, the ability to secure, monitor and bill going forward for all three will be within the realm of converging networks. Smart Buildings and the Smart Cities they are a part of will create the ability to add smarter utilities quickly and accurately.

What impact will cloud-driven computing models – i.e. edge, fog and serverless computing shaping modern enterprise networks – have on enterprise cabling strategies?

A: When we talk about cloud, edge, fog and serverless, it's really a contraction back to centralized storage and processing where smartphones can really act as dumb terminals so to speak. There is only so much data required to create an interactive video experience on any given device.

To drive this ability in both private (enterprise) and public networks, two things become very important. One, fast backhaul and two, low latency. The only way to achieve both of these at the same time is to have the fastest transceivers connected to the cabling infrastructure that allows for error-free transmission.

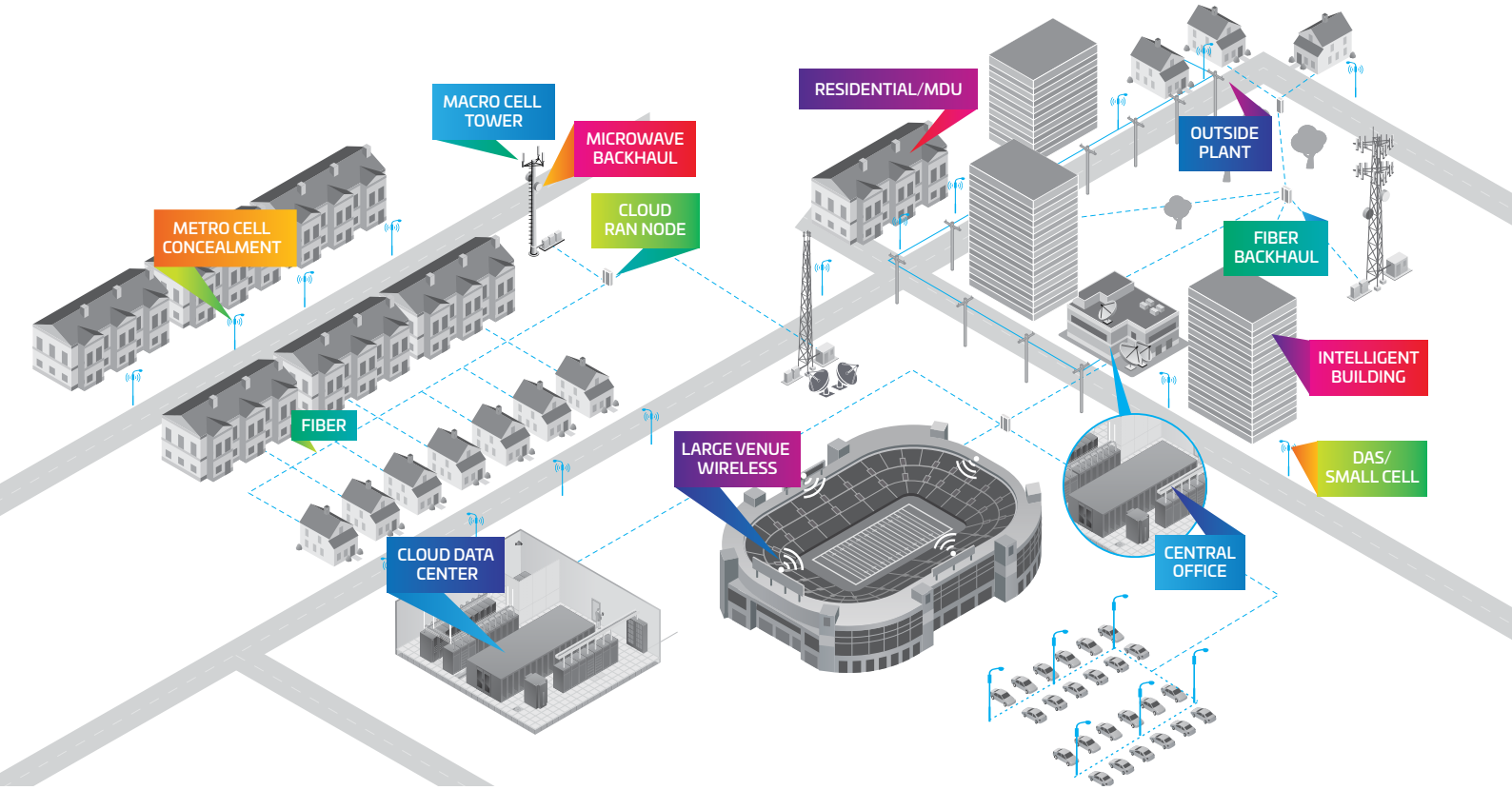
There also has to be so many more points to backhaul to allow for mobility; the wired infrastructure back to the centralized network; and the cumulative number of devices competing for bandwidth on the same network segment.

What advice would you give to data center and network infrastructure managers on how they should build up skillsets and prepare teams to fully harness the benefits of evolving automated infrastructure management systems?

A: Stay relevant! Things change quickly and the best networks are served by people who understand the changes coming, coupled with what is required to support them.

What other trends or perspectives that have not been covered above will significantly impact enterprise infrastructure/ cabling strategies in 2019 and beyond?

A: Power. As we move towards the ability to deliver 90 W of power over twisted pair extra-low voltage cables, we start to move into an area with a lot of heat and safety considerations. We will also see more hybrid fiber cabling solutions to handle longer distances for the delivery of power and data going forward.



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