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# Next-Generation Vertical Cable Management for the Digital Era

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As enterprises digitally transform to remain competitive and meet customer and employee expectations, they demand high-performance, reliable, scalable and available networks that deliver the bandwidth and latency needed to support emerging technologies and an ever-increasing number of devices. With the average hourly cost of network downtime exceeding $300K for more than 90% of enterprises, according to ITIC's 2022 Hourly Cost of Downtime Survey, cabling infrastructure that serves as the foundation of the network is the lifeline of business today.

In the information and communications technology (ICT) industry, proper cable management has long been a best practice. Cable management can enable—or inhibit—everything from the signal integrity of a single cable, to the overall performance of a data center or local area network (LAN). Cable management is also closely tied to aesthetics, as well as form and function. A lack of cable management doesn't just risk network performance, reliability and availability—it conveys a sense that the network is out of control and unmanageable. Neat, well-organized cabling allows technicians to easily locate and troubleshoot issues and encourages proper network care during routine maintenance or moves, adds and changes (MACs).

As cabling infrastructure evolves, expands and becomes more complex to support emerging technologies, next-generation vertical cable managers do more than just ensure performance, reliability and availability. They play a critical role in providing the durability, scalability, flexibility and ease of installation for enterprises to quickly and efficiently embark on digital transformation, allowing them to remain competitive while looking their best.

# Fundamentals remain, trends bring new challenges

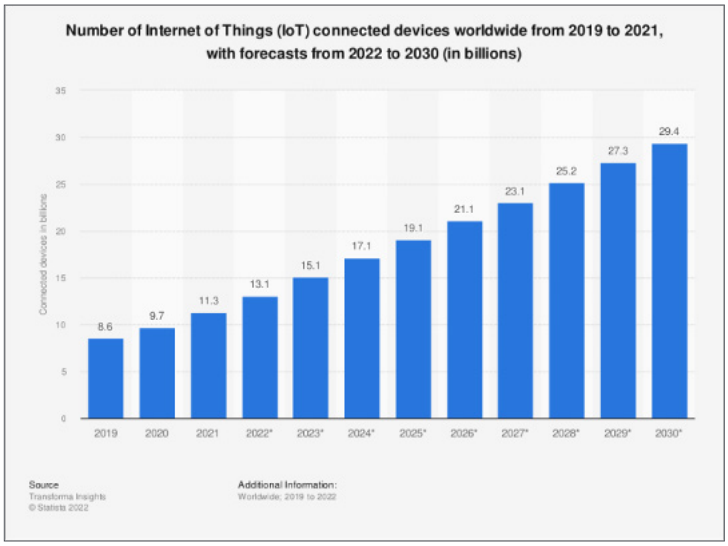
The fundamentals of cable management are key to maintaining the signal integrity of cables and the overall performance, reliability and availability of a network. One vital aspect is maintaining the specified minimum bend radius of copper and fiber optic cables routed within racks and cabinets. The minimum bend radius refers to the smallest radius the cable is allowed to be bent without degrading performance and is specified as follows:

- The minimum bend radius for Category 6A, 5, and 5e cable is four times the cable diameter, or approximately 1 inch.
- The minimum bend radius for fiber optic cable is 20 times the cable diameter under tension (i.e., while pulling) and 10 times the cable diameter under no tension.
- The minimum bend radius under tension for bend-insensitive fiber optic cables is typically 15 times the cable diameter to ease routing of cables in tight spaces within racks and cabinets.

Bending cables tighter than their specified minimum radius can alter the cable geometry, which degrades network performance. For example, bending a Category 6A too tightly can disturb the precision with which the individual pairs of conductors are twisted together to reduce crosstalk and support high-speed transmission. For fiber cable, it can create microbends that can cause imperfections or cracks in the glass, leading to signal loss or completely non-functioning links.

Another key fundamental is maintaining proper cable strain relief to protect cables and connectors from any strain that can occur during cable routing or from hanging cable weight in vertical managers and at connection and cable entry/exit points. Vertical cable managers also keep cables neat and organized within racks and cabinets where substantial numbers of cables converge and terminate at network equipment and patch panels. This improves overall aesthetics and prevents spaghetti cabling that can impede proper airflow in and around equipment. It also facilitates access to individual components and makes it easier to trace, identify and reconfigure cables during MACs.

While the fundamentals of cable management haven't changed, technology certainly has Emerging technologies like the Internet of Things (IoT)/Industrial Internet of Things (IIoT), 5G wireless, artificial intelligence (AI), virtual and augmented reality (VR/AR), smart buildings and edge computing all mean that cabling infrastructure needs to handle more data and connect more systems, equipment, devices and users than ever before. The number of connected devices is now expected to reach nearly 30 billion by 2030. To support increasing bandwidth demand, twisted-pair copper cabling has advanced over the past 30 years, with the latest Category 6A cabling now supporting up to 10 Gigabits per second (Gbps). At the same time, optical transceiver technology has advanced to enable much higher transmission speeds of 400 Gbps and beyond over fiber optic cabling.




In the data center, transmission speeds are now migrating to 25 and 50 Gbps in horizontal switch-to-server links and to 100 to 400 Gbps in backbone switch-to-switch links. With twisted-pair copper cabling effectively only supporting up to 10 Gbps, data centers are increasingly relying on fiber optic cabling.

With space at a premium, data centers also strive to accommodate more fiber connections in less space with high-density switches and patch panels. Fiber applications that support speeds of 100 Gbps and beyond are often also based on parallel optics, meaning they transmit and receive over multiple fibers. Data centers can leverage these applications to cost-effectively break out a high-speed switch port to multiple lower-speed switches or servers (e.g., 4 X 25 Gbps or 8 X 50 Gbps). The increased use of parallel optics and breakout configurations is adding to the density of fiber cabling in the data center, while the need to support highly virtualized, low-latency and ever-changing networks further increases complexity.

In the LAN environment, Category 6A is the industry-standard recommended cable type for new deployments, with its ability to transmit data and power for high-throughput Wi-Fi 6/6E, high-definition audio-visual, LED lighting, security systems and a growing number of IP-based building systems and devices. To support 10 Gbps speeds, Category 6A cable features enhanced characteristics such as extra internal airspace or splines separating twisted pairs that make it bulkier with a larger outer diameter compared to earlier generations of twisted-pair copper cables. The larger diameter of Category 6A increases the minimum bend radius and overall cable weight.

With more Category 6A cables to connect more devices and systems, vertical cable managers need to support and manage large bundles of heavy cables. At the same time, the rise of Power over Ethernet (PoE) technology that can transmit up to 100 Watts of power over these same cables creates heat rise within cable bundles that can impact performance, which requires limiting the number of cables installed in bundles and ensuring adequate spacing between bundles.

As digitization and bandwidth demand continues to increase to support more emerging technologies, vertical cable managers must provide the durability, scalability and flexibility to accommodate ever-increasing densities and more complex, volatile network environments. With today's limited workforce and the need to reduce labor and speed deployments, vertical cable managers also need to be fast and easy to install while still ensuring network performance, reliability, availability and aesthetics.

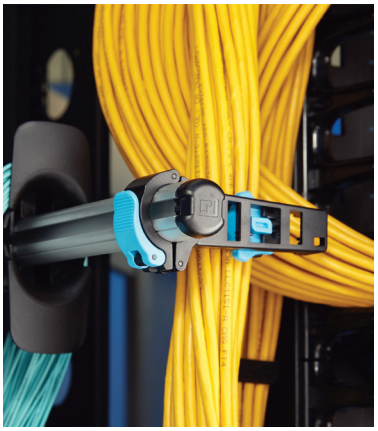
# What makes a next-generation vertical cable manager?

Many legacy vertical cable management solutions do not provide the durability, capacity, scalability and flexibility needed for today's networks. Often they are not fiber-friendly enough to handle the increasing amount of fiber in the data center space, or they don't offer the strength and capacity for large numbers of bulkier Category 6A cables in the LAN. Many solutions on the market are also lower quality, lack aesthetics, have a limited offering and are difficult to assemble with several parts and pieces requiring more time and labor.

Next-generation vertical cable management solutions are designed specifically to sustain high performance, reliability and availability in today's high-density, complex and volatile networks. The following enhanced design elements support current and future cabling needs while saving time and labor:

### Engineered for standards-based best practices

Next-generation vertical cable managers take the fundamentals of cable management to a new level to ensure maximum signal quality, transmission and availability. They support larger bend radii for bulkier cables in the LAN, while eliminating the potential for kinks, twists and sharp bends in high-density fiber environments. With signal integrity in mind, next-generation vertical cable managers offer bend radius protection at critical entry/exit points, as well as the ability to add bend radius protection and strain relief wherever needed in the vertical rack and cabinet space.



### Designed for today's technology

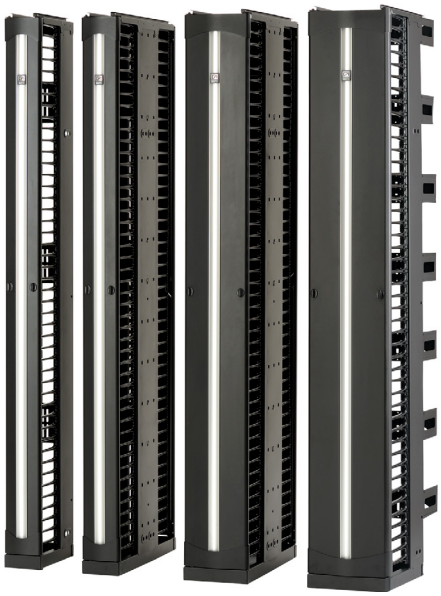
Next-generation vertical cable managers are designed to support the latest cable designs and applications. In the data center, that means maximizing utilization of space to properly manage high-density fiber while enabling optimal airflow and accessibility to components. For LAN environments, vertical cable managers need to be durable enough with a proper load rating to accommodate large numbers of heavier Category 6A cables, while adequately spacing cable bundles as required for PoE applications.

### Flexible to seamlessly scale and adapt

To support ever-changing network environments, next-generation vertical cable managers come in a wide variety of heights and widths, with high configurability and adjustable designs. For example, accessories like cable spools, cable management fingers and cable bundle supports that can be installed at various depths and easily adjusted horizontally or vertically to support both fiber and copper allow for increased capacity as the network grows. One example is a vertical cable manager with a toolless central track system for attaching accessories at any vertical point versus typical cable managers that have limited accessory attachment points.

**Intuitive to save time, cost and labor**
Next-generation vertical cable managers feature intuitive, toolless designs that speed deployment and reduce labor costs. This includes toolless accessories that can be quickly attached and reconfigured, with highly visible touch points for easy identification. Vertical cable managers that can be set up and installed with a one-person operation and standalone solutions that can be simply pushed into place are ideal for reducing labor cost and dealing with workforce constraints in data centers and LANs.

**Developed for form and function**
Next-generation vertical cable management solutions don't just consider the latest trends—they also deliver form and function. Matching sleek and modern designs across product lines offer seamless aesthetics for enterprises to showcase their technology, while unique details like dual-hinged doors with push-to-close convenience and hooks for hanging a test meter facilitate day-to-day tasks.



# Now is not the time to overlook vertical cable management

Cabling infrastructure is the lifeline of today's enterprise business—from the data center that processes, stores and transmits information, to the LAN that connects a myriad of systems, devices and users. Proper cable management has long played a vital role in ensuring high-performance, reliable and available networks to avoid costly downtime.

While the fundamentals of maintaining proper bend radius and strain relief and keeping cables neat and organized haven't changed, we now live in a digital era with ever-advancing technology that demands high-density fiber in complex data center environments to deliver high-bandwidth, low-latency data transmission and high-density bulkier Category 6A copper cables in the LAN to connect and power more devices.

As enterprises digitally transform and adopt emerging applications to remain competitive, the amount of fiber in the data center and copper in the LAN will only increase. Vertical cable management can no longer be overlooked as playing a critical role in today's digital era.

While legacy vertical cable managers may support the fundamentals, the time is now for next-generation vertical cable management solutions that are specifically designed and engineered to support the cabling needs of today's and tomorrow's technology. Not only do next-generation vertical cable managers help ensure network performance, reliability and availability in increasingly dense, complex and volatile data center and LAN environments, but they do so while saving time, cost and labor and maintaining the aesthetics that enterprises need to look and function their best.

Click **HERE** to explore the latest next-generation cable management solutions for your data center and LAN.

# Contributors

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Michael Moore has more than 25 years of experience within the telecommunications industry. He has held various Product Management roles where he was responsible for developing, launching, and managing new innovative products within the Data Center, Airflow Management, and Information Technology market segments.

When Michael was with CPI prior, he held various roles from Technical Support Specialist, Applications Engineer, Associate Product Manager and Product Manager. As a Senior Product Manager for Open Architecture, he will be responsible for managing CPI's Cable Management, Cable Runway & Tray, Grounding & Bonding, Rack Systems, Wall-Mount Systems, Zone Cabling & Wireless Enclosures and Seismic Protection Systems product lines.

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