

Growing Network and Data Center Demands: Choose the Right End-to-End System

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Overview

As buildings get smarter, Internet of Things (IoT) expands, wireless flourishes and data generation continues to grow, the demands we put on networks and data centers become more strenuous.

All types of devices are connecting to networks to gain better control, automate processes and improve communication and security. From cameras and wireless access points to nurse call systems and lighting fixtures, the number of wired and wireless devices that rely on the network grows every day:

- Gartner anticipates 25 billion network-connected devices by 2021
- Internet-connected things now outnumber humans 4-to-1
- International Data Corporation (IDC) estimates that 152,200 devices will connect to the internet every minute by 2025
- Ericsson predicts more than 3.5 billion cellular IoT device connections by 2023

The way we designed and installed cabling and connectivity infrastructure in the past – even as recently as 10 years ago – can no longer support these new applications and technologies. Smart buildings, IoT, wireless and big data call for networks and data centers with more speed, more bandwidth and more power. And all these innovative applications and technology rely on cabling infrastructure (layer 0).

It's vital to select the right Ethernet cable and connectivity to support this shift. But deciding what you need isn't always as straightforward as it should be. Even if you can decide between a Category 6 or 6A system, how do you wade through the exhaustive list of choices and pick the right one?



Category 6 or 6A? 10 Questions to Ask Yourself

Before you make any long-term choices about cable and connectivity infrastructure, ask yourself these questions about the application and the type of system performance that will keep it running reliably:

Q: Will your cabling and connectivity system support basic wired workstations or wireless networking applications – or something more complex?

Many wired and wireless networks have Ethernet demands that require at least a Category 6 cable and connectivity system (with speeds up to 2.5 Gb/s and 5 Gb/s).

Higher-speed 10GBASE-T networks and wireless protocols demand Category 6A systems. Otherwise, you risk downtime, spotty connections and unreliable service.

Q: Will your cabling and connectivity system support a mission-critical application? What happens if the systems connected to it go down due to cable or connectivity failure? How long can business run without them?

Applications such as network backbones and data centers are mission critical and can't afford any downtime. If they do go down, then the entire business goes down with them. These situations call for a Category 6A system that supports high density and high bandwidth.

Similarly, most wireless applications can afford very little – if any – downtime. They call for cable and connectivity that ensure 24/7 reliability, such as a Category 6A system that offers excellent noise immunity to eliminate slow network speeds and maximize uptime.

How vital are things like productivity and security to your environment? If even a single workstation goes down, then business productivity quickly declines. If a camera or card reader fails, then security is compromised. These kinds of applications require at least a Category 6 cable and connectivity system that ensures 24/7 reliability.

Q: Will this system support emerging wireless technology and wireless access points?

Many wired and wireless networks have Ethernet demands that require at least a Category 6 cable and connectivity system (with speeds up to 2.5 and 5 Gb/s). Higher-speed 10GBASE-T networks and wireless protocols, such as 802.11ac Wave 2 and Wi-Fi 6 and Wi-Fi 6E access points, demand Category 6A systems.

Q: Is Power over Ethernet (PoE) involved in this application? What wattage is required? Will the system support sophisticated and/or power-hungry devices like thermal cameras with PTZ features, large display screens or LED lighting fixtures?

To reduce resistance and power waste, PoE relies on 4-pair, balanced, twistedpair cabling for efficient power delivery.

In 100W PoE applications, Category 6A is critical to handle these power levels while maintaining cable performance and mitigating effects of high cable temperatures. Less power is dissipated in a high-performance Category 6A cable, so more power is transferred to the device instead of being wasted. Some Category 6A cables also have insertion loss margin to handle the extra heat generated in PoE cable bundles.



Q: Is there "noise" present in your environment (EMI or RFI interference from nearby machinery or equipment)?

This type of noise can impact cable and connectivity performance, data transmission and network traffic. Noise sensitivity increases at higher frequencies, such as 500 MHz. To combat this, select a Category 6 or 6A system that guards against potential outside interference.



Q: Will the cable be installed near fluorescent lighting, ballasts or power cables?

These factors are present in – and can introduce noise into – any type of environment: offices, patient rooms, classrooms, plant floors, etc. The noise given off by lighting, ballasts and power cables can also impact cable and connectivity performance, data transmission and network traffic. To prevent data transmission issues, choose a Category 6 or 6A system that isn't negatively impacted by interference or doesn't require more separation but instead has inherent noise immunity.

Q: Are you facing a difficult installation environment (tight bends, high levels of pulling force, etc.)?

Not all Category 6 or 6A cables can withstand this type of installation. Depending on cable construction, damage may occur (gaps between pairs may be introduced into the cable) if cables are pulled with too much force, bent too far, twisted during installation, deployed in a high-tension run, etc.

Some Category 6 and 6A cables are specifically designed to be handled and manipulated without creating "gaps" between pairs that impact electrical performance. They can withstand pulling, coiling, bending, kinking or tugging without degradation of electrical properties.

Q: Will devices be within 100 m of a switch? Or will channel lengths extend beyond 100 m?

If you have application-specific needs that call for extended reach beyond the 100 m standard, then Category 6A cabling and connectivity are the best choice. They allow reliable PoE distribution and meet insertion loss requirements set forth by IEEE.

Q: Are you deploying in-building small cells (mobile RAN)?

Small cells transmit data to and from wireless devices. They're quickly gaining traction as they improve wireless coverage and add targeted capacity indoors or outdoors. (4G LTE AdvancedPro and 5G licensed protocols require increasing numbers of small cells to provide wireless coverage that connect using PoE.) Applications utilizing small cells require systems that can support high-bandwidth wireless coverage and PoE.

Q: Will there be several direct connect (MPTL) endpoint connections in your environment?

As more devices are installed in areas above the ceiling or on the wall, direct connect – also known as modular plug terminated link (MPTL) topology – allows a horizontal cable to be terminated on one end to an RJ45 plug that connects directly to a device. This supports efficient power delivery with low channel insertion loss while eliminating the need for a jack and cord to connect devices. End-to-end system reliability and simplicity are key to using MPTL topology to connect devices to the network.









Wading Through Your Choices: Seven Important Cable and Connectivity Features

Now that you've determined whether you need a Category 6 or Category 6A solution, there's one final step involved: choosing the right Category 6 or 6A system.

Not all cable and connectivity are created equal, so what constitutes a "high-performance solution"? With everything the market currently offers, how do you pinpoint a system that offers the performance you expect? It all comes down to cable construction and electrical performance.

Keep the following seven features in mind...

Cable and Connectivity Construction



Small Diameter

Look for a Category 6 or 6A cable with a small diameter when possible. This size reduction makes the cable lighter, resulting in a faster, easier installation (especially in tight spaces, plenum spaces and workstations that require a smaller bend radius). A small-diameter cable also takes up less room in conduit and cable trays.



Bonded-Pair Construction

Systems available with Bonded-Pair construction offer enhanced protection

against crosstalk, return loss and other performance issues. It ensures that every mission-critical transmission link – as well as every powered link – is delivered, regardless of environmental conditions or abuse.

By bonding individual dielectrics over the conductors along their longitudinal axis, extremely uniform spacing is guaranteed within each twisted pair to maintain consistent, reliable electrical performance without interference.

Category 6 and 6A Bonded-Pair cables can be handled and manipulated without creating these "gaps" between pairs, maintaining high levels of electrical performance. Even when stress is applied to cabling – pulling, coiling, bending, kinking or tugging – electrical properties won't degrade.



Simplified Connectivity

With more direct connect (MPTL) deployments connecting devices directly to enterprise networks, it pays to look for an end-to-end Category 6 or 6A solution that simplifies connections and infrastructure – even in above-ceiling applications. The more you can streamline the entire installation process from start to finish, the more time and money you'll save.

Electrical Performance



Outstanding Cable Balance

Cable "balance" ensures appropriate electromagnetic compatibility (EMC) performance and reduction of interference (it's directly related to alien crosstalk).

To achieve balance, the voltage and current on each pair's conductor must be equal in magnitude and phase. The two insulated conductors must be physically identical in terms of diameter, concentricity and dielectric material; they must also be uniformly twisted, which requires precise design and manufacturing.

A Category 6 or 6A cable with outstanding balance protects networks from damaging effects of outside noise, which is essential so data signals can reach endpoint devices without slow speeds or downtime.



Excellent Insertion Loss Performance

Insertion loss represents the ratio of received to inserted signal power at the end of a cable, dominated by cable attenuation: Poor insertion loss prevents proper data transmission. Expressed in decibels, insertion loss increases as cable temperature rises.

Look for a Category 6 or 6A cable that has low insertion loss and plenty of headroom (which represents the difference between the cable's measured insertion loss and the maximum insertion loss allowed per standards). Cutting it close doesn't leave room for cable temperatures to rise without experiencing negative impacts, such as reduced reach. Extra "room" between the cable's measured insertion loss and the maximum insertion loss allowed per standards ensures that it will continue to perform throughout the life of the installation. The higher the margin or headroom, the better the cable performance.



Superior Crosstalk Performance

Look for a Category 6A system that offers superior crosstalk performance compared to other options. (Simple crosstalk is caused by the electromagnetic fields of one signal affecting a signal in an adjacent circuit.)

Enhanced crosstalk performance means maximum uptime and ensures less data packet loss due to internal noise. You can identify systems with better crosstalk performance by looking at the system's guaranteed performance for electrical parameters, such as NEXT and ACRF.

NEXT (near-end crosstalk) measures (in dB) the signal from one pair to another within a single link or channel. This measurement is taken at the end where the signal is sourced. The higher the NEXT, the less crosstalk received by the link or channel.



An acronym for attenuation crosstalk ratio far-end, ACRF is a calculation that subtracts insertion loss of the disturbing pair from the far-end crosstalk (FEXT) it induces in an adjacent pair. Look for a system and cable with a higher ACRF; the higher the calculation, the better the system performance.

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Outstanding Alien Crosstalk Performance

Alien crosstalk occurs when one cable is surrounded by many others (in a cable bundle, for example). As bandwidth increases, so does the importance of controlling this interference to ensure proper data transmission.

Alien crosstalk is measured between each pair within the "disturber" cable to each pair within the "disturbed" cable (the one being impacted). To reduce crosstalk and channel noise, choose a system that offers high power sum alien near-end crosstalk (PSANEXT) and power sum alien attenuation crosstalk ratio far-end (PSAACRF) performance.



Superior Signal-to-Noise Ratio

Your Category 6 or 6A system should offer an increased signal-to-noise ratio that can be identified by the previously mentioned parameters. This translates to increased information capacity and ensures that the signal remains intact during transmission without being impacted by noise.

Select a system that maintains signal power (excellent insertion loss performance) and minimizes noise (superior crosstalk performance), which combine to increase information capacity. During transmission, this ensures that the signal remains intact without being impacted by noise: The receiving end receives the same signal sent from the transmitting end.



REVConnect Systems: Simplifying Cable and Connectivity Selection

Belden revolutionized RJ45 connectors a few years ago with REVConnect: a reliable, easy and versatile termination method that applies to all Category 5e, 6 and 6A terminations.

As smart buildings continued to demand more from cabling and connectivity, Belden added innovative products to the REVConnect Connectivity line: the FlexPlug, the 10GX Wall-Mount System, couplers, patch panels and pre-terminated assemblies.

Now Belden is revolutionizing all its structured cabling systems with the introduction of REVConnect Systems. These industry-leading, end-to-end structured cabling and connectivity systems offer best-in-class performance guarantees in all categories to ensure that your network infrastructure investment lasts through the technology and applications of tomorrow – and beyond.

REVConnect Systems combine high-performance cable with REVConnect Connectivity components that feature Belden's innovative, game-changing REVConnect Connectivity. This reduces rework and retesting, is simple for entry-level technicians to learn quickly and makes it simple to adapt to emerging applications and IoT devices.

Meet Belden REVConnect Systems!

REVConnect 10GXS System

Belden's REVConnect 10GXS System supports high-density, high-bandwidth applications and can exceed 100 m channel requirements in certain applications (maximum channel length of up to 185 m).

It features insertion loss performance with 8% headroom, offering industry-leading Category 6A system guaranteed performance across all parameters: insertion loss, NEXT, ACRF and PSAACRF.

To manage cable heat transfer, it incorporates EquiBlock[™] Barrier Technology to achieve uniform heat flow dissipation while still maintaining insertion loss performance.

Common applications include:

- Data centers (end-of-row and middle-of-row deployment)
- Efficient 100W PoE transmission in large bundles
- Campus switching uplinks (network backbones)
- · Manufacturing environments that can't afford downtime
- Noisy environments
- High-end AV applications where performance is vital

REVConnect 10GXW System

Combining the Category 6A performance you need with the Belden quality and reliability you expect, the REVConnect 10GXW System offers best-in-class noise immunity with 4 dB of PSANEXT and 10 dB of PSAACRF headroom. Belden's superior product design and manufacturing capabilities ensure system performance that eliminates slow network speeds and maximizes uptime in wireless environments.







The system also combines the smallest and lightest horizontal Category 6A cable available with REVConnect Connectivity.

It supports high-density, high-bandwidth applications and can exceed 100 m channel requirements in certain applications (maximum channel length of up to 140 m).

Common applications include:

- In-building Wi-Fi
- Indoor small cell deployment
- Network-connected devices for smart building applications
- Multi-gigabit applications of the future (up to 10 Gb/s)

REVConnect 3600 and 2400 Systems

With increased performance guarantees across all electrical parameters, including insertion loss and crosstalk, Belden offers two end-to-end Category 6 systems: the REVConnect 3600 System and the REVConnect 2400 System.

Both offer excellent performance reliability, uptime, headroom and networking speeds of up to 2.5 Gb/s and 5 Gb/s with increased bundle sizes, higher PoE load and additional headroom compared to other Category 6 systems. They're also designed to support PoE device connections at distances of up to 100 m.

Featuring insertion loss performance with 7% and 10% headroom, REVConnect 2400 and 3600 Systems offer best-in-class Category 6 headroom across all parameters: insertion loss, NEXT, ACRF and PSACRF.

Common applications include:

- 1000BASE-T and 2.5G/5GBASE-T networking applications
- PoE and network-connected devices
- Channel lengths of up to 100 m

Want to learn more

about REVConnect Systems and the level of reliability they bring to mission-critical applications, data centers, wireless and PoE environments, and enterprise networks?

Visit www.belden.com/revconnect!









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