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- The increasing demands for bandwidth that networks face
- How NBASE-T can boost the speed of copper cabling
- The importance of Power over Ethernet for campus networks
- Why some organizations need 10 Gigabit Ethernet speeds and beyond

GIGABIT ETHERNET: PUSHING COPPER PAST ITS LIMITS WITH NBASE-T

New technology can help organizations meet increasing network demands without a cabling upgrade.

IT administrators face a common problem: No matter how much capacity they create to accommodate existing applications, developers and vendors always seem to come up with new products and services that demand even more speed. That's why, as connection speeds have increased over time, the Internet has morphed from a series of mostly text-based websites into a place where complex graphics and high-definition videos are expected to load instantly. It's why mobile phone users, who once marveled at 3G connectivity, now largely find the standard interminably slow. And it's the reason why many organizations are looking at the increasing traffic on their networks — due to mobile connections, bring-your-own-device (BYOD) programs and other bandwidth-intensive operations — and seeing a problem they'll soon need to solve.

Installing fiber cable to replace existing copper wire is one option for increasing connection speeds, but this move is expensive and often requires a time-consuming rip-and-replace process. For many enterprises, leveraging existing copper wire infrastructure to increase speeds will be a more attractive option. The NBASE-T standard allows just that.

NBASE-T technology, promoted by a nonprofit group of IT industry leaders called the NBASE-T Alliance, gives network administrators the ability to boost the speed of twisted-pair copper cabling beyond the designed limits of 1 gigabit per second. With the capability of reaching 2.5Gbps or 5Gbps over 100 meters of CAT 5e cable (the "N" in NBASE-T refers collectively to the 2.5GBase-T and 5.0GBase-T standards), NBASE-T technology allows enterprises to dramatically increase their network speed without requiring a large investment in (or complete overhaul of) their network infrastructure.

INCREASING DEMANDS

Numerous factors are creating the increasing traffic demands that networks must accommodate, with even more devices and faster standards set for release into the market. These factors include traffic from mobile and wearable devices, social collaboration tools, cloud computing and Big Data efforts, among others. In the future, traffic from connected devices commonly referred to as the Internet of Things (IoT) or the Internet of Everything, as well as traffic from 802.11ac Wave 2 hardware and devices, will further strain network capacity in many enterprises.

Most networks currently in place were installed before technology solutions such as BYOD programs, video conferencing and Voice over IP (VoIP) phone systems were widely used, meaning that the networks weren't designed to accommodate the number of connections and the amount of data that must be supported today. The cloud is also a driver of this traffic. Programs that were formerly hosted on individual machines (such as Microsoft Office) are increasingly being delivered from the cloud via a Software as a Service (SaaS) model, which requires the network to handle more data than before.

Just as such an explosion in mobile traffic would have once been unthinkable, today new technologies are looming on the horizon, poised to have a similar effect. In the near term, two of the technologies likely to drive substantial traffic spikes are IoT and 802.11ac Wave 2. The coming growth of IoT will mean that many more devices (often in remote locations) will need to communicate with data centers. Additionally, sophisticated analytics programs (some of which will be delivered via the cloud) will be needed to gain an understanding of and extract value from all of this new data.

MobileMonster in the Making

Cisco Systems' "Cisco Visual Networking Index: Global Mobile Data Traffic Forecast Update 2014–2019," illustrates the recent and continued growth of network demands attributable to mobile alone:

- 69% — Global mobile data traffic grew 69 percent in 2014, hitting 2.5 exabytes per month by the end of the year (an exabyte equals a billion gigabytes).
- 24.3 — Monthly global mobile data traffic will surpass 24.3 exabytes by 2019.
- In 2014, 497 million mobile devices and connections were added, increasing the total number of mobile devices and connections to 7.4 billion.
- Although 4G connections account for only 6 percent of mobile connections, they are responsible for 40 percent of mobile data traffic.
- An average smartphone will generate 4GB of traffic per month by 2019, a fivefold increase over the 2014 average of 819 megabytes per month.

The advent of 802.11ac Wave 2 technology will also push some organizations to look for ways to upgrade their networks. The AC standard supports speeds of up to almost 7Gbps. That's obviously much faster than the 1Gbps connections supported by many wired networks that connect to wireless hardware, such as access points. Thus, network administrators will need to find a way to get more capacity out of their wired networks if they want to take advantage of this new speed.

NBASE-T: WHAT, WHY AND HOW?

NBASE-T refers to technology that utilizes a new standard that can boost the speed of twisted-pair copper cabling up to 100 meters in length, well beyond the designed limits of 1Gbps. The standard arose to address the fact that CAT 5e and CAT 6 twisted-pair copper cables (the most commonly deployed connections in enterprise campus networks around the world) do not support 10 Gigabit Ethernet (10 Gig-E) up to 100 meters, creating a need for intermediate rates between 1Gbps and 10Gbps.

This is a significant development because it allows organizations to continue leveraging the substantial investments they have made in copper wire connections, rather than requiring them to replace their copper with fiber, or to run multiple cables between switches and access points. By deploying switches that utilize NBASE-T technology, IT managers can upgrade the speed of their networks without making huge changes to the infrastructure that supports those networks.

In fall 2014, a number of networking industry leaders announced the formation of the NBASE-T Alliance. This group, which includes Cisco Systems, Freescale Semiconductor and other major technology vendors, was set up to be an industrywide cooperative effort to promote the development of 2.5 Gig-E and 5 Gig-E technology for enterprise network infrastructure. The object of the group is "to advance multigigabit Ethernet technology that enables faster data rates on existing enterprise cabling originally designed for 1 Gigabit Ethernet technology."

4.5 billion

Number of people worldwide without Internet access, leaving far more room for growth in network traffic in the coming years

Source: World Economic Forum, "The Global IT Report 2015"

NBASE-T solutions implement a new type of signaling over twisted-pair copper wire and use auto-negotiation to select the best speed: 100 Megabit Ethernet, Gigabit Ethernet, 2.5 Gig-E or 5 Gig-E. Additionally, NBASE-T solutions can switch to the IEEE standard 10GBASE-T mode if the proper connection — for example, data center–class CAT 6a cables — is present.

Of course, enterprises can also improve the connection speeds of their networks simply by replacing their twisted-pair copper infrastructure with fiber-optic cable. Indeed, fiber has several other advantages, in addition to increased speed. Fiber is immune to electromagnetic interference, to which copper cabling can be susceptible. It is also lightweight, thin and more durable than copper, and can be used at greater distances than copper cabling can. So, for some organizations, upgrading to fiber-optic cable, rather than enhancing existing twisted-pair copper connections, may make sense.

However, for enterprises that have already invested in copper cabling, copper still has two chief advantages over fiber. First, it is expensive and time consuming to replace cable infrastructure. According to the NBASE-T Alliance, the cost of a cable upgrade is estimated to be $300 per cable pull, meaning that a campuswide upgrade could cost hundreds of thousands of dollars. With CAT 5e or CAT 6 copper cables comprising nearly all of the cable infrastructure in enterprises around the world, the alliance notes, replacing this infrastructure throughout the world would cost billions of dollars in installation costs, time and disruption to the physical infrastructure of enterprise buildings.

The second chief advantage of copper cabling is that it supports Power over Ethernet (PoE). Many organizations rely on the ability to transmit electrical power over the same connection they use to transmit data. They utilize this setup to power devices such as VoIP phones, wireless access points, network routers, industrial devices and physical security devices.

Power over Ethernet gives enterprises the flexibility to install devices in places where it would otherwise be difficult to get electricity, and it allows IT shops to easily move devices to any location that is connected by cable. It also simplifies setup by minimizing cable clutter and reduces costs by eliminating the need to install new power outlets. Fiber-optic cable does not support Power over Ethernet, eliminating these advantages for organizations that migrate from twisted-pair copper wire.

WHAT IS THE NBASE-T ALLIANCE?

The NBASE-T Alliance, a nonprofit group of industry leaders formed in 2014, seeks to provide a platform to facilitate widespread deployment of NBASE-T technology and products. Member companies include the following:

Promoters: Aquantia; Cisco Systems; Freescale Semiconductor; Intel; Marvell; Qualcomm; Xilinx

Contributors: BEL Network Integration & Support; Cavium; CME Consulting; CommScope; Fluke Networks; KinnexA; Microsemi; Molex; UDE

Adopters: Altera; Amphenol; AppliedMicro; Aruba Networks; Brocade; Centec Networks; CoMIRA Solutions; Hon Hai/Foxconn Technology Group; Shenzhen GLGNET; MorethanIP; Panduit; Pulse Electronics; Realtek; Ruckus Wireless; SpeedTech; Spirent; Synopsys; Tehuti Networks; Zebra Technologies

MOVING THE CORE TO 10/40/100

Just as network administrators are using NBASE-T solutions to boost speed throughout their networks, many IT managers are finding that they need to increase connection speeds within the core of their networks. IT observers are currently seeing a trend of 10 Gigabit Ethernet uplinks into the core and 40 Gig-E connections within the data center (with 100 Gig-E connections set to become equally popular in the near future). These upgrades are becoming necessary (as networks add more and more edge connection) to help prevent bottlenecks within local area networks.

So, when should network administrators make the jump to 10/40/100 Gigabit Ethernet? For some, the time has already arrived. For example, organizations that are extensively utilizing server virtualization to consolidate their data centers and promote efficiency and cost savings may experience bottlenecks because of the workloads that result from multiple virtual machines running on the same physical hardware. Increasing bandwidth in the pipe (for example, from 1Gbps to 10Gbps) can alleviate such bottlenecks. Increasing Ethernet speed can also solve problems if the links connecting a database server to a high-performance storage-area network become overwhelmed with traffic.

Increasingly, wireless network managers are looking to solutions that provide a "single pane of glass" dashboard — delivered either on the organization's premises or via the cloud — that combines a number of tools into one. These network management systems, which include platforms such as Aerohive's HiveManager, Meraki Dashboard from Cisco Systems and AirWave Network Management from Aruba Networks, give administrators real-time, granular visibility into their wireless networks, including details on who is connected, where they're connected, what devices they're using and how much bandwidth they're consuming. These systems also often simplify deployment, configuration and maintenance of wireless hardware.

NETWORK OPTIMIZATION

With more devices coming onto networks and using more data-intensive applications, network administrators are searching for ways to manage this traffic and optimize their wide area networks (WANs) to avoid performance problems. Some are turning to a set of software-based solutions known collectively as intelligent WAN, or iWAN.

As with software-defined networking, definitions of iWAN vary somewhat from one IT observer to the next. However, Cisco, the vendor currently most closely associated with intelligent WAN solutions, identifies four components of iWAN: transport independence, intelligent path control, application optimization and highly secure connectivity.

Intelligent WAN includes WAN optimization techniques, but also incorporates technologies such as performance routing, application visibility and control (AVC) tools, firewalls and web security solutions, and tools that allow traffic to switch between multiprotocol label switching and Internet connections.

To learn more about NBASE-T technology, read CDW's white paper "The Gigabit Upgrade."

QUOTEWORTHY

Some industry leaders have made interesting remarks about NBASE-T technology.

"The 2.5Gbps and 5Gbps modes that the NBASE-T Alliance promotes could prove especially important for applications such as 802.11ac wireless LANs, as they allow enterprises to preserve legacy UTP [unshielded twisted pair] wiring. In the early transition phases from Gigabit Ethernet to 10 Gigabit Ethernet, network managers assumed enterprises would upgrade to CAT 6a or possibly CAT 7 structured wiring, but the associated costs led many enterprises to retain their CAT 5e or CAT 6 UTP wiring."

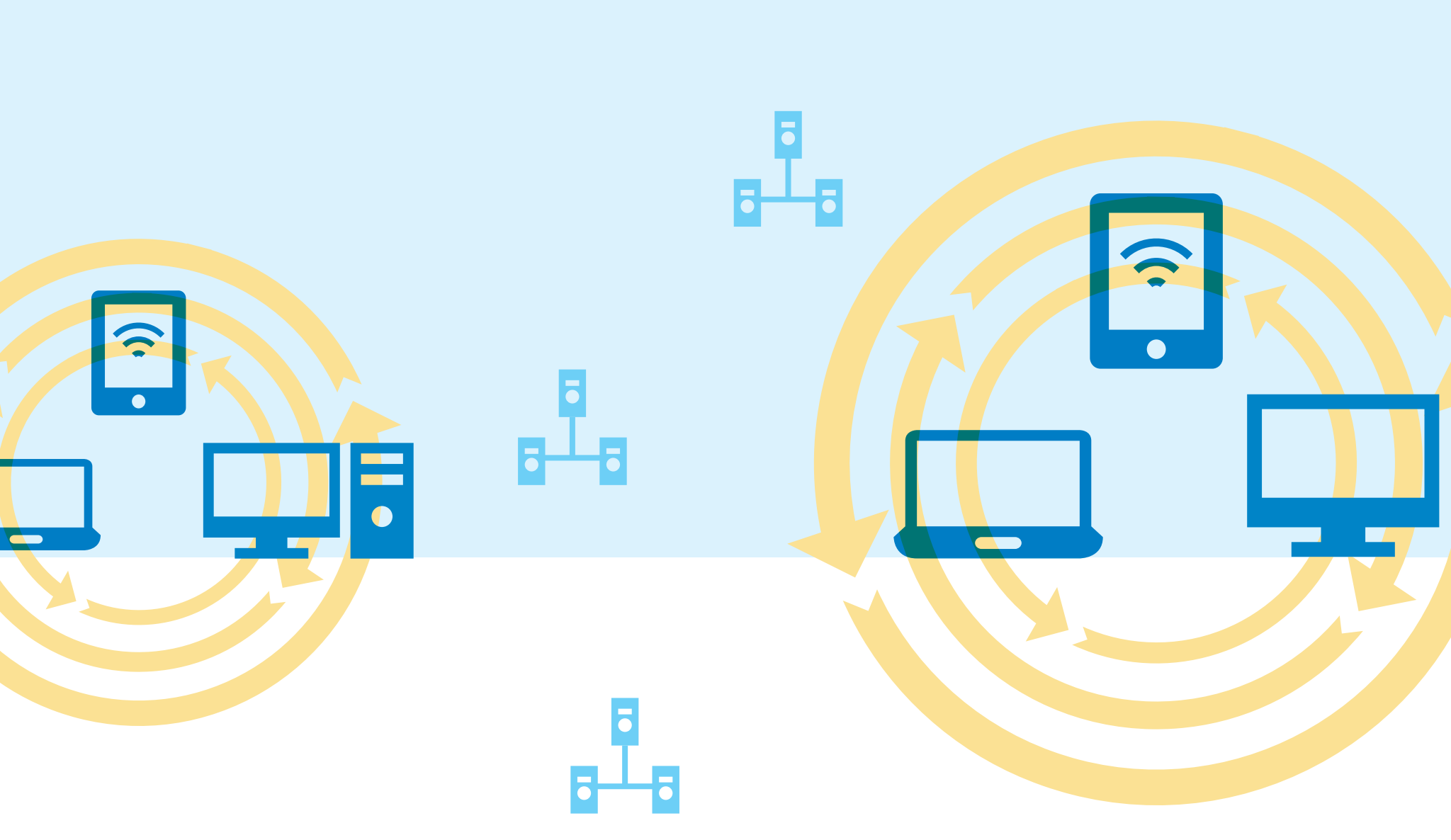
— Loring Wirbel, Senior Analyst, The Linley Group

"A 1Gbps link between the access point and switch is not sufficient. Our mission in working with the Alliance members is to provide customers with innovative technology to increase network speed without the need to upgrade the cabling infrastructure."

— Chris Spain, vice president of product management, Cisco Systems

"Xilinx is excited to be a founding member of the NBASE-T Alliance and to be working with fellow industry leaders to enable 2.5 Gigabit Ethernet and 5 Gigabit Ethernet solutions across the networking and data center industries. Being part of this organization gives us an opportunity to further enable innovative products and expand the capabilities this growing alliance has to offer."

— Hemant Dhulla, vice president of wired communications and data center business, Xilinx



IoT: THE FUTURE OF NETWORKING

The growth in the number and diversity of devices coming onto networks in recent years due to bring-your-own-device programs, wireless initiatives and other technology trends has dramatically increased traffic. The emergence of the Internet of Things (IoT) — in which processor-enabled devices ranging from industrial controllers to smart toasters are connected via the Internet — promises to accelerate this increase in traffic.

This influx of new connected devices will be handled in several ways, including solutions that move some of the processing away from central servers and closer to the endpoints themselves. Software will play a role in determining which data gets handled near the source, and which data must be sent to a central data center for further processing.

Software solutions will also play a tremendous role in powering IoT applications. The utility of the technology depends not on the ability to collect and store data from objects in the world (which, after all, is simple enough), but on the ability to process, synthesize and analyze this data in ways that create value for consumers and enterprises. Software will be central to this effort.

Already, small startups and large enterprises are tapping into the power of IoT with solutions such as smart thermostats that can automatically adjust the temperature in a home, smart pill bottles that ensure patients take their medications and even smart doorbells that rely on facial recognition technology to help identify visitors. The potential applications of IoT will be limited only by the imagination of developers — and by the software solutions that make the applications work.

To learn more about SDN, check out CDW's article "The Promise of Software-Defined Networks."

END OF ARTICLE. NAVIGATE RIGHT FOR IoT MYTH BUSTERS