

# THE GIGABIT UPGRADE

NBASE-T technology lets organizations meet rapidly growing network bandwidth demands without migrating to fiber.

## Executive Summary

Mobile devices, social collaboration, cloud computing and Big Data analytics are reshaping network traffic, placing ever greater bandwidth demands on networks already struggling to keep pace with existing data traffic. The situation is about to grow even more dire with the imminent arrival of 802.11ac Wave 2. The new wireless networking standard, delivering multigigabit Wi-Fi, will place additional strain on the backbone, including the cable plant infrastructure, outstripping the ability of nonfiber networks to serve users smoothly and reliably.

Replacing existing copper cabling with fiber to meet growing bandwidth demands is typically expensive, time consuming and disruptive. Organizations can deal intelligently with the upcoming network bandwidth squeeze by implementing NBASE-T hardware, which boosts the speed of twisted-pair copper cabling well beyond the designed limits of 1 gigabit per second – up to 5Gbps over 100 meters of Category 5e cable.

## Table of Contents

- 2 **Bandwidth Strain  
Creates Network Pain**
- 3 **Introducing NBASE-T**
- 3 **What Can NBASE-T Do?**
- 4 **CDW: A Network Partner That Gets IT**

## Bandwidth Strain Creates Network Pain

Emerging technologies and new user activities are placing an immense burden on existing networks that were primarily designed to transport predictable flows of web, email and other types of routine traffic. Networks are now struggling to cope with services that have huge (and increasing) appetites for bandwidth and are also changing the shape of network traffic.

Networks installed in the days before anyone had ever used the acronym BYOD to describe a bring-your-own-device program are now expected to handle demands imposed by employees and guests who use an array of different smartphones, tablets, notebook computers and other mobile devices. A growing number of business technologies, including cloud computing, web conferencing and Big Data analytics, are also increasingly burdening networks with bandwidth-hungry services that they were never designed to handle.

The current trend toward ever-greater bandwidth demands shows no sign of slowing down. Waiting in the wings is the Internet of Things (IoT), which aims to connect a vast array of business and consumer devices — ranging from vehicles to door locks to refrigerators — to the Internet. A growing user preference for ultra-high-definition 4K video also promises to send data traffic into the stratosphere.

### What Is the NBASE-T Alliance?

The NBASE-T Alliance is a nonprofit consortium focused on the development and deployment of products that support NBASE-T technology and the NBASE-T specification, which defines 2.5 gigabit per second and 5Gbps speeds at up to 100 meters using the large, installed base of copper cabling in enterprise networks.

In addition to founders Aquantia, Cisco, Freescale and Xilinx, some 30 companies have joined the alliance since its 2014 founding, representing all major facets of enterprise networking infrastructure, including access points, Ethernet switching and computing, as well as the necessary semiconductor components required to deliver these applications, such as physical layer integrated circuits (ICs), processors, connectors, controllers, switches, field-programmable gate arrays and Power over Ethernet ICs.

The NBASE-T Alliance does not release standards. As a collaborative forum, the organization encourages companies to join together and reach an informed consensus on how to implement the technologies needed to boost network performance. Company representatives then participate and contribute to the discussions that occur at IEEE standards evaluation meetings. The NBASE-T Alliance also releases specifications that allow members to start work on real-world solutions and then deploy them in real-world applications, an important first step toward standardization.



# 74%

The percentage of organizations that either already allow or plan to allow bring-your-own-device programs

**SOURCE:** Tech Pro Research, [Wearables, BYOD and IoT: Current and Future Plans in the Enterprise](#), January 2015

Perhaps the biggest challenge to existing networks comes from 802.11ac Wave 2, the latest Wi-Fi standard. Wave 1 products, which have been on the market for some time, can deliver speeds up to 1.3Gbps. Wave 2 products will have a theoretical speed of 6.9Gbps and throughput of around 5Gbps. With the potential of such a significant increase in throughput, 802.11ac Wave 2 will necessitate changes to access points and switches, creating the need for multigigabit copper.

To keep pace with emerging technologies and user demands, networks must be resilient and future-ready. In an era of rapid technological change, it's not enough to just keep pace with existing traffic; enterprises must find ways to get ahead. Unfortunately, the vast majority of Ethernet cables deployed between access switches and access points (APs) are Category 5e (CAT 5e), which currently supports a maximum speed of 1Gbps. Thus, organizations cannot take full advantage of 802.11ac Wave 2 and subsequent technologies without upgrading the cabling infrastructure.

While it's possible to achieve faster data rates by using link aggregation techniques that combine two or more Gigabit Ethernet connections into a virtual multigigabit stream, this approach requires specialized — and potentially costly — hardware and comes with a variety of implementation and maintenance challenges. Migrating from copper to fiber is another way of ensuring sufficient network throughput and performance for many years to come. But making the switch from copper to fiber is neither cheap nor easy.

While the price differential between fiber and copper cabling has narrowed in recent years, ripping out one type of network and replacing it with another is never a decision to be taken lightly. For many organizations, it isn't cost-effective or even feasible to rip out and replace cabling that has been installed. The cost of a cable upgrade has been estimated at [\\$300 per cable pull](#), meaning that a campuswide upgrade could easily run into hundreds of thousands of dollars. Organizations thinking about installing a new network infrastructure also need to consider other drawbacks, such as workplace disruption caused by construction and network downtime as the installation work proceeds.

Fortunately, enterprises have a simpler, more convenient and far less expensive way of giving existing copper-based networks fiber-class bandwidth. The NBASE-T standard, announced in

October 2014 by Cisco, Aquantia, Freescale and Xilinx, boosts the speed of twisted-pair copper cabling, ranging up to 100 meters in length, well beyond the 1Gbps design limit. With NBASE-T, existing CAT 5e- and CAT 6-based networks are immediately able to handle growing bandwidth demands and accommodate traffic growth well into the future.

## Introducing NBASE-T

The NBASE-T standard uses physical layer integrated circuit capabilities to extend the data throughput available in CAT 5e and CAT 6 cables, allowing them to accommodate speeds of up to 5Gbps within a 100-meter distance. NBASE-T solutions, including next-generation wiring closet/campus LAN switches and 802.11ac Wave 2 wireless LAN access points, allow organizations to boost the performance of enterprise networks in a highly cost-effective way with only minimal disruption to network services and enterprise activities. With 802.11ac Wave 2 wireless access points aggregating up to 5Gbps of throughput, organizations can use NBASE-T hardware to deliver the performance required to connect these new wireless access points to campus switches. NBASE-T technology gives them the ability to do so without replacing a single cable.

NBASE-T solutions utilize a new type of signaling over twisted-pair copper cables. The NBASE-T Alliance, the industry organization behind the new standard, has already released the first version of the physical layer interface specification, NBASE-T 1.0. This specification supports both 2.5Gbps and 5Gbps rates over 100 m of Category 5e or better cabling, with a bit error rate of less than 10e-12.

Both rates preserve the IEEE 802.3 Ethernet frame structure and sizes. The actual speed a compliant device selects is determined by the signal-to-noise ratio and status reported by error-protection algorithms. Compliant devices can also support the existing standard 802.3 data rates of 100Mbps, 1Gbps and 10Gbps. The

### The 802.11ac Wave 2 Challenge

Wave 1 of the IEEE 802.11ac standard has already delivered 1Gbps wireless speeds to enterprise networks. Now, vendors are introducing 802.11ac Wave 2 products that can potentially deliver wireless speeds up to 5Gbps to smartphones, tablets, notebook computers and other compatible mobile devices.

As Wave 2 takes hold, organizations will encounter situations where Wave 2 clients and access points can combine to exceed a single 1 Gigabit Ethernet uplink from the access point, and even more likely, network traffic forwarded by multiple radios in the AP will exceed this same single 1Gig-E uplink.

By supporting network speeds of up to 5Gbps over 100 meters of existing Category 5e or CAT 6 cables, the NBASE-T standard allows organizations to accommodate Wave 2 bandwidth demands quickly and cost-effectively.



# 24.3 Exabytes

The monthly total of mobile data traffic forecast for 2019. An estimated 52 percent of that traffic will be offloaded from cellular networks to the fixed network through Wi-Fi.

**SOURCE:** Cisco Systems, [Cisco Visual Networking Index: Global Mobile Data Traffic Forecast Update 2014–2019 White Paper](#), February 2015

NBASE-T specification adapts the standard 802.3an 10GBASE-T, adjusting key parameters such as frame duration and baud rates.

NBASE-T solutions can be designed to include an auto-negotiation capability that enables the selection of the best speed for a given network at a particular time, including 100 Megabit Ethernet, 1 Gigabit Ethernet, 2.5 Gigabit Ethernet and 5 Gigabit Ethernet. NBASE-T solutions can also switch to the IEEE standard 10GBASE-T mode when given sufficient bandwidth, such as the presence of data center-class CAT 6a cables.

Another important NBASE-T attribute is its full compatibility with Power over Ethernet. PoE will not work over fiber, forcing organizations that replace legacy copper cabling solutions to find an alternative power option. NBASE-T avoids this problem, allowing engineers to deploy power as needed, out to remote access points. The capability to deliver PoE along with multigigabit speeds is a huge benefit that will simplify the deployment of hardware such as wireless access points and compact switches.

Physical-layer products compatible with the NBASE-T 1.0 specification are already shipping; system-level products have also begun to arrive. Cisco, for instance, has already announced NBASE-T support on select models of its Catalyst 3850 Series and Catalyst 3560-CX Series switches and new line cards for the Catalyst 4500 modular switch.

## What Can NBASE-T Do?

All NBASE-T adopters receive the benefits associated with greater network bandwidth without the need to switch to fiber or to run multiple cables between switches and access points, extending the life of the installed cable plant well into the future.

NBASE-T opens the way for faster deployment of 802.11ac Wave 2 APs, connecting the latest generation of 802.11ac Wi-Fi APs to wiring closet switches in indoor and outdoor deployments. NBASE-T technology also supports PoE for the integration of next-generation 802.11ac Wave 2 access points into existing cabling

layouts. The standard supports PoE up to 60 watts.

The proliferation of sensor technologies in the Internet of Everything (IoE) creates a need for the capability to deliver PoE. NBASE-T's 60 watts of PoE can efficiently and effectively power not only wireless access points, but also the sensory modules in the APs, enabling many IoE deployments.

Organizations that can benefit from NBASE-T technology include nonprofits, businesses, schools, hospitals and other medical facilities, conference centers, airports and any public area where Wi-Fi is a must-have service. Thanks to NBASE-T's ability to work with IEEE's Precision Time Protocol for remote timing, the technology is also destined to play a key role in the upgrade and build-out of Ethernet-based backhaul links used in small-cell networks.

Technologies and services that will run faster or more efficiently on an NBASE-T network include security cameras, web conferencing and collaboration platforms, digital signage, medical imaging, industrial/compact switches and virtually any other activity that consumes large amounts of bandwidth. The standard is expected to promote the adoption and use of video cameras running sensor applications and ruggedized/industrial/compact switches, as well as access points with more diverse sensor modules.

Further, network users will benefit from the improved quality of service enabled by NBASE-T technology. After NBASE-T

deployment, slow response times, lags and other symptoms of an over-burdened network will significantly diminish, boosting user satisfaction and encouraging increased productivity.

## CDW: A Network Partner That Gets IT

CDW has years of experience working with the latest network technologies and helping bandwidth-starved organizations accommodate increasing user demands and relentless traffic growth. CDW understands the technical, cost, productivity and transition challenges organizations face as they plan a network upgrade.

Keeping pace with technology isn't a luxury — it's critical. CDW offers network solutions designed to fit nearly any organization. CDW also provides a dedicated team of experts to help deploy new technologies, including solution architects with deep expertise in designing custom network solutions. CDW's advanced technology engineers are also ready to address your immediate and long-term needs with proven implementation and management solutions.

**For more information about how CDW can help modernize your network infrastructure, contact your account manager, call 800.800.4239 or visit [CDW.com/network](http://CDW.com/network).**



Cisco® Catalyst® 3850 and 3560-CX Series Switches offer Cisco Catalyst Multigigabit Technology to take advantage of 802.11ac Wave 2 capacity increases and start delivering even better user experiences.

[CDW.com/cisco](http://CDW.com/cisco)



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[CDW.com](http://CDW.com)



The Brocade® VDX® 6740 offers 48 10 Gigabit Ethernet (GbE) SFP+ ports and four 40GbE QSFP+ ports. Each 40GbE port can be broken out into four independent 10GbE SFP+ ports, providing an additional 16 10 GbE SFP+ ports. In addition, the switch features low power consumption, consuming 2 watts per 10GbE port.

[CDW.com/brocade](http://CDW.com/brocade)

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