



NBASE-T Alliance White Paper: Best Practice Cabling for Wireless Access Points

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Since the introduction of WiFi technology over two decades ago, five major WiFi application standards have been published, with another (IEEE 802.11ax) expected to be ratified in 2019. Furthermore, additional work is underway on the next generation WiFi application standards.

This rapid pace of development reflects the clear success that WiFi has enjoyed in the enterprise, enabling mobility and delivering cost-effective connectivity to a broad range of devices.

To ensure that businesses can sustain this pace and avail themselves of the latest WiFi technology, the cabling infrastructure that forms the backhaul between WiFi access point (AP) and switch must be designed to accommodate current and future standards.

To achieve this objective, and support advances in remote powering technology, the recommended cabling design is a minimum of two Category 6A cabling links to each AP.

The rationale for this design recommendation is based on deployments of current WiFi, as well as future WiFi, technology.

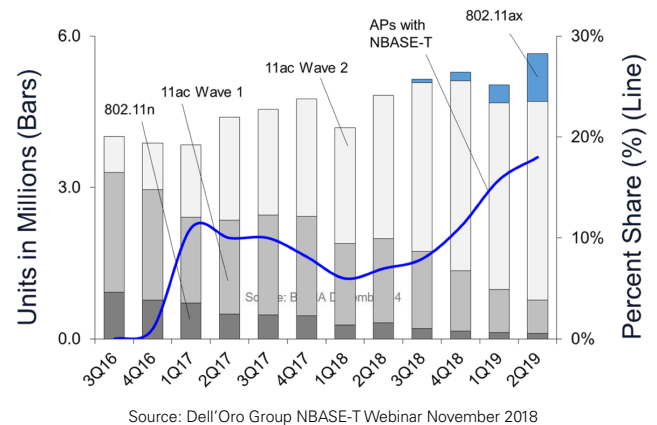
Following the Cabling Standards recommendations, such as the TIA-568 and ISO 11801, has served users well. Future applications that will be developed for structured cabling have kept the existing performance of installed cabling in mind to assure widespread acceptance. NBASE-T, which boosts the Ethernet signal to 2.5 or 5 Gigabits over traditional Category 5e and Category 6 cabling, is an example of this. Knowing the performance of Category 5e cabling, efforts were made to ensure that NBASE-T would work over this existing cabling. With the widespread deployment of Category 6A for APs, future backhaul technology, in order to gain widespread acceptance, will need to run on the installed Category 6A cabling.

Current and Near Term AP Deployments

According to a 2018 study from the Dell’Oro Group, the majority of APs shipping in the first half of 2019 are 802.11ac Wave 2 compliant, with 802.11ax shipments ramping up, as shown in Figure 1.

2019 will also see a sharp increase in the number of APs deployed with NBASE-T interfaces. With their inherent ability to support a range of Ethernet speeds, NBASE-T and Category 6A cabling are ideally suited to support legacy, current, and emerging WiFi technologies.

Figure 1



Source: Dell’Oro Group NBASE-T Webinar November 2018

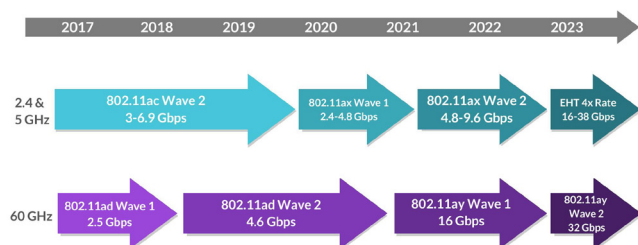
NBASE-T and two Category 6A cables satisfy these needs through:

- **Support for high speed and power:** Category 6A supports both NBASE-T and 10GBASE-T, as well as remote powering up to 71W in compliance with the recently published 4-Pair PoE standard IEEE 802.3bt. Typical Category 6A cabling provides superior PoE performance compared to typical Category 5e and 6 due to its construction allowing better thermal performance.
- **Design freedom:** Using guidelines from cabling standards listed in the Appendix, placement of dedicated outlets or field terminated plug terminals in advance provides flexibility for the exact physical location of the AP pending a later site survey. Cable testing for the fixed link can be done in advance. Having a second cable can also allow deployment of a second AP if needed.
- **Compatibility with embedded base:** Access Points and switching products that incorporate NBASE-T Downshift capability can provide speed flexibility ranging from 100M to 10G.
- **Simplified upgrade and operations:** Deploying a minimum of two Category 6A cables per AP allows for an easy upgrade to newer technology. The legacy APs will run on Category 6A cable, while future APs may utilize both cables through link aggregation when requirements exceed 10 Gigabits. Additionally, provisioning two Category 6A cables allows for easy swap over in case of failure, to get networks back up and running quickly.

Future AP Deployments

Looking beyond IEEE 802.11ax, there is a wireless technology currently referred to as EHT (Extremely High Throughput). EHT utilizes improvements in performance based on more spatial streams, higher throughput, and a broader spectrum. This means that backhaul speeds may exceed 10G, which is the upper limit of speeds supported by Category 6A cabling.

Figure 2: WLAN Future Evolution



Source: <https://mentor.ieee.org/802.11/dcn/18/11-18-1124-03-0000-ecr-ad-hoc-output-report.pptx>

As shown in Figure 2, WiFi APs running 802.11ay and EHT will be capable of generating more than 10Gb/s of traffic. It is expected that deployment of these APs requiring more than a 10G backhaul will begin in the 2022-2023 timeframe.

Based on these and other considerations, it is widely anticipated that higher speeds will be achieved through 10GBASE-T link aggregation (using two or more 10GBASE-T links with two Category 6A cables). Therefore, the recommendation for a minimum of two Category 6A links per AP is still valid for supporting the future generation 802.11ay and EHT access points.

In addition to satisfying wireless AP needs today, installing two Category 6A cables will also:

- **Provide additional design freedom:** Pay as you grow with up to 20G capacity (2x 10G) and ample power utilizing two Category 6A channels. This capacity and power could be used on a single AP or 2 APs located within 5 to 10 meters of each other.
- **Future proof:** 20G capacity available with link aggregation and up to 142 W of remote power based on 802.3bt PoE.
- **Allow additional flexibility and support for multiple speeds and generations of APs:** NBASE-T Downshift optimizes link speed and power needs for different classes of APs.

What's so special about Category 6A cabling?

- Category 6A is a type of twisted-pair copper cabling designed to support data rates of up to 10GBASE-T. Category 6A cables are characterized to a bandwidth of 500 MHz, designed to mitigate alien crosstalk (signal coupling between cables), and function at channel lengths of up to 100 meters.

TIA ISO	Cat 6 Class E	Cat 6A Class E _A
Target Market	Enterprise / Data Center	Enterprise / Data Center
Construction	UTP or STP	UTP or STP
Specified Bandwidth	250 MHz	500 MHz
PoE Performance	Good	Excellent
Gigabit Ethernet	100 meters	100 meters
NBASE-T Support	100 meters	100 meters
10GBASE-T Ethernet	Limited Distances	100 meters
25/40GBASE-T	No	No

- Category 6A sales have seen tremendous growth in recent years due to their ability to support 10GBASE-T and their improved PoE performance. The chart below highlights the differences between Category 6 and 6A. Category 6A has become more popular due to its ability to support 10GBASE-T at lengths up to 100 meters.

Case Studies

Purdue University Case Study with Panduit

When Purdue University embarked on a wireless project in the early 2000s, one of their goals was to expand their wireless capacity. The existing wireless infrastructure within Purdue's academic buildings delivered adequate coverage within the buildings, but lacked the capacity for students to connect multiple devices, which had become the norm (an average of 2.5 devices per student). Purdue adopted Panduit's Category 6A cabling system with MaTriX technology to support 10GBASE-T data and PoE for their wireless networks. Two Category 6A horizontal cables connect each access point, as a permanent link from the telecommunications room. With an eye on future demands, Purdue has set Category 6A as the standard for all new buildings and major renovations, with wireless speeds driving that decision. They have found that the upgrade has given them enough capacity, and their students and faculty have been happy with the performance. For additional information, please visit <https://www.panduit.com/content/dam/panduit/en/landing-page-pdf2/space-optimization/Purdue-University-Case-Study.pdf>.

The Star, Dallas Cowboys New World Headquarters with CommScope

Funded by a unique public/private partnership between the team and the city of Frisco, Texas, The Star is a 25-acre multi-use campus that includes the new world headquarters for the Dallas Cowboys, as well as practice fields and an indoor arena, retail and hospitality spaces. Designing a network with the flexibility to adapt to wide network traffic swings, and building scalability and redundancy into all systems, were key challenges they had to address. The population of the campus swings dramatically from day to day and hour to hour, putting significant surges of demand on the wireless network. For their Wi-Fi network they utilized CommScope’s GigaSPEED X10D® Category 6a cabling, because it provides up to 10GB Ethernet performance with PoE support to enable the facility’s evolving needs and dynamic environment. For additional information, please visit <https://www.commscope.com/Resources/Case-Studies/Dallas-Cowboys/>.

Summary

The recommendation is to install two Category 6A cables per AP to support both current and future wireless technologies. Installing two Category 6A cables per AP provides optimal PoE performance, future proofing, design flexibility, and the potential through link aggregation to have up to 20 Gigabits of data for that AP.

Appendix

Cabling Standards and Guidelines for Wireless Access Point Deployments

Standards Organization	Document Number	Title
ISO/IEC	11801-6	Generic cabling for customer premises – Part 6: Distributed building services
TIA	TSB-162-A	Telecommunications Cabling Guidelines for Wireless Access Points
	862-B	Structured Cabling Infrastructure Standard for Intelligent Building Systems
CENELEC	EN 50173-6	Information technology – Generic cabling systems – Part 6: Distributed building services



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The NBASE-T Alliance is an industry-wide cooperative effort of more than 45 companies focused on enabling the development and deployment of products that support 2.5G and 5GBASE-T Ethernet. To support early product development, the alliance developed and released the NBASE-T specification, which is compatible with the IEEE 802.3bz standard, and includes an added Downshift feature. The alliance focuses on publishing optimizations to the specification, facilitating interoperability and educating the market about the multiple applications of the NBASE-T technology.

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