

How to cable 802.11n Wireless Access Points

The 802.11n standard is an important advance in wireless Local Area Networks (LANs).

In 2007, residential consumers began installing 802.11n products and in 2009 enterprises began adopting en masse.

Since 802.11n provides bit rates many times faster than legacy 802.11 technology, the “wired side” of a wireless LAN faces new and stringent demands. This paper discusses the impact 802.11n has on cabling as well as what installers and enterprises should do to address it.

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Background

802.11n wireless technology delivers throughput and coverage that will cause a seismic shift in enterprise use of wireless LANs. Where the “a,” “b” and “g” versions of 802.11 supported casual PC connectivity uses in a few industries, 802.11n will make wireless access to business-critical applications a widespread reality. 802.11n also cracks open the use of Voice over Wireless LANs (VoWLAN) and wireless for streaming media.

The IEEE 802.11n standard specifies data rates as high as 600 Mbps although the Wi-Fi certified data rates will be less. It is reasonable to expect a data rate of 200 Mbps, still four times the maximum speed of 802.11g wireless LANs. This upshift in speed is the crux of the issue: most 802.11a/b/g Wireless Access Points (WAPs) are connected to Ethernet switches with Cat5 or Cat5e cable that was never tested for data rates beyond 100 Mbps. This means that the installed copper infrastructure could choke the speed improvements offered by 802.11n. As 802.11n gains widespread adoption, anyone who installs, tests or troubleshoots a wireless LAN should be aware of the potential limitations imposed by the wired network.

The 802.11n standard

A common perception of 802.11n is that it is simply a turbocharged version of 802.11g—an advanced modulation technique that pumps more data. While this is true, it is also incomplete. 802.11n includes other features that make for a better wireless LAN:

- Greater Layer 2 efficiency
- Multiple Input- Multiple Output (“MIMO”) antennas
- Support for two separate radios and two RF bands: 2.4 GHz and 5 GHz
- Shorter delays between transmissions

Even before the 802.11n standard was ratified, thousands of 802.11n access points and adaptors were shipped. Hardware vendors resisted changes to the final standard that made the installed-base products difficult to upgrade. Right or wrong, it forced 802.11n to stability and diminished the risk of deployment.

The value of 802.11n

Why will enterprises adopt 802.11n? The first reason is speed. At 200 Mbps, 802.11n is about four times the speed of 802.11g wireless. If data rates close to the theoretical maximum are achieved, so much the better.

Another reason to adopt 802.11n is coverage. 802.11n access points offer greater range and promise to reduce the number and size of deadzones. This translates to fewer access points, consistent connections and simpler management.

Finally, 802.11n reinforces two advantages inherent to all wireless LANs: flexibility and cost. If users roam or change work areas frequently then it is easiest to connect them with a wireless LAN. Equally compelling is cost. In a new office there is a simple and direct savings if fewer cables are installed.

The truth on data rates

Hyperbole and technology change created confusion about 802.11n data rates. A clear understanding of the facts is needed.

As mentioned above, the IEEE 802.11n standard stipulates a top data rate of 600 Mbps. No one expects that speed in practice, but some vendors claim data rates up to 300 Mbps. Skeptics opine that 100 Mbps is a reasonable expectation for the maximum data rate and that the “average” rate may be less. Their argument is that enterprises will choose to maintain compatibility with 802.11b/g clients. In this configuration, the 802.11 access point uses the 2.4 GHz band and downshifts to slower data rates overall, punishing 802.11n clients to keep legacy users happy. There is insufficient data to conclude if this is the majority or minority case.

Access point vendors will make 802.11n speed the topic of specmanship for months to come. The cabling installer can, and should, remain detached from this debate and assume 100 Mbps to 200 Mbps is the maximum wireless data rate. The pertinent question for the cabling installer is, “What is the maximum data rate between the access point and the Ethernet switch?”

Wireless LANs are shared media. As such, only one wireless device transmits at a time. The Ethernet link to an access point is a full-duplex media, though, making its maximum data rate two times the maximum wireless data rate. *Example:* If the Wi-Fi 802.11n maximum data rate is 100 Mbps, the aggregate data rate on the cable will be twice that or 200 Mbps. If an 802.11n network has a maximum data rate of 200 Mbps then the aggregate rate on the cable would be twice that or 400 Mbps.

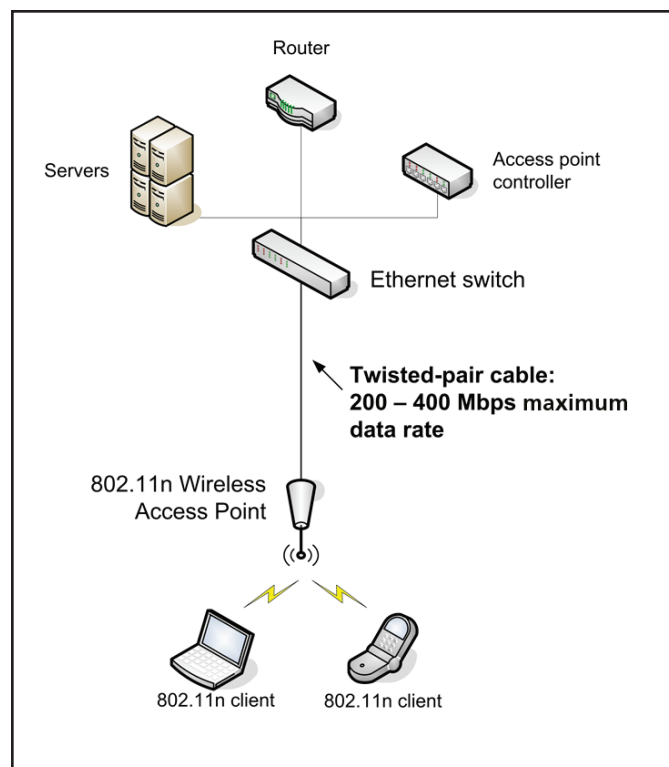


Figure 1

Because an 802.11n access point can have two radios, there is an even more severe case for the cable. If the access point has a 2.4 GHz radio and a 5 GHz radio operating with a maximum data rate of 200 Mbps, the potential aggregate load on the twisted-pair could be 800 Mbps (two radios x 200 Mbps x two for full duplex). This is a good design model for future proofing cable for 802.11n access points. Cat 6 cable certified to 1 Gbps should be the standard for new copper links behind an 802.11n network.

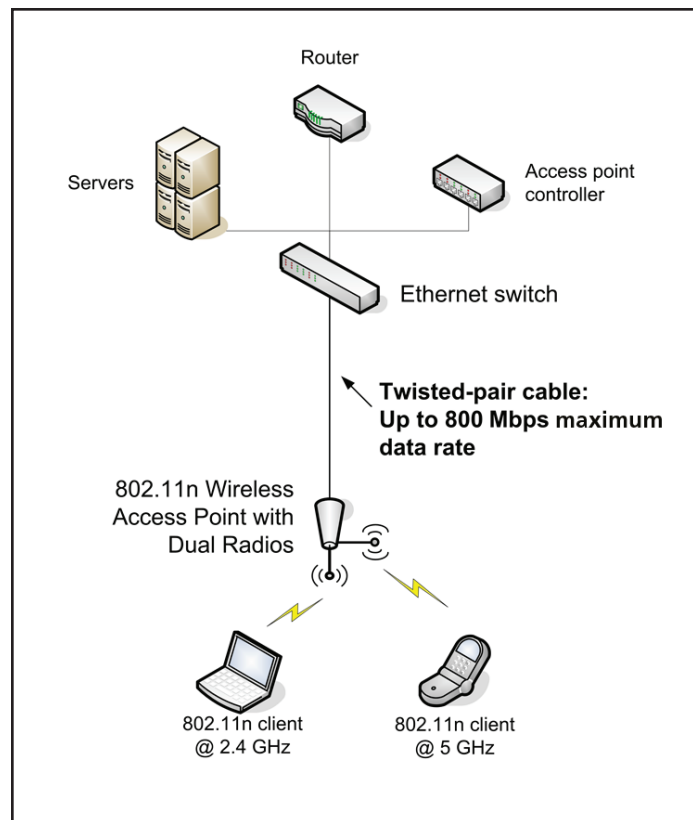


Figure 2

Key takeaway – Twisted-pair copper certified up to 10/100 Mbps may not be suitable for 802.11n access points. Twisted-pair copper that is certified for 1 Gbps will be sufficient.

Options for 802.11n access point cabling

The brute force cabling strategy for 802.11n access points is to install new Category 6 (or better) twisted pair. Proper installation followed by certification to TIA Cat 6 link performance will remove any doubt in support for 802.11n access points. In some cases, though, the cost of new wiring is prohibitive.

There is another alternative to consider. Proper testing may determine that a good deal of installed twisted-pair cabling links may be already suitable for 802.11n access points. A program to re-test installed twisted-pair can save a network owner significant money and raise the confidence in the deployment of 802.11n.

Recommended test steps

All 802.11n links should be able to support 1 Gbps Ethernet (1000BASE-T) traffic.

Cat 5

The Category 5 cabling standard predates the IEEE 1000BASE-T standard, so Cat 5 was not defined to support 1 Gbps Ethernet. But before retiring it and investing in new cabling, a certification test for compliance to the Category 5e standard will indicate if 1 Gbps support is possible. Many high-quality Cat 5 links will pass the certification test to the TIA/EIA-568-B Cat 5e performance level. If they do, you have confidence it is a usable uplink for an 802.11n access point.

Cat 5e

The Category 5e cabling system was designed for 1 Gbps Ethernet. Certifying an installed link to TIA/EIA-568-B Cat 5e performance is definitive proof that it is ready for 802.11n access points.

Cat 6

Category 6 cable is more than sufficient to support 1 Gbps traffic if it was certified upon installation and no changes have been made. If there is any uncertainty about its status, re-certification to TIA/EIA-568-B is wise.

Cable	Testing
Cat 5	Certify to Cat 5e
Cat 5e	Certify or re-certify to Cat 5e
Cat 6	Re-certify to Cat 6, if necessary

Upgrading to 802.11n may encompass upgrading Ethernet switch ports or replacing the entire switch. If the twisted-pair cable and patch cords are already in-place, certification should be done as a Channel test. That is to say, include the installed patch cords in the test configuration and use channel adaptors with the cable certification tool (such as a Fluke Networks' DTX CableAnalyzer™ Series) and select the Channel test. If the patch cords are not in place, the test should be a Permanent Link test.

Summary

802.11n offers many advantages for the wireless portion of enterprise networks. Before those advantages can be realized, the wired infrastructure needs evaluation. 802.11n access points might require new cabling, but some or all of the existing cable could suffice. There is only one way to know for sure: test it.

NETWORK SUPERVISION

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