Cabling Infrastructure for Next Generation Wireless Access Points, 802.11ac and Beyond

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Cabling for 802.11ac Wireless Access Points

The latest generations of Wireless Access Points (WAP) (IEEE 802.3ac) use more power and run much higher data rates than previous generations. Designing and installing the right cabling infrastructure that can provide the migration path to support these WAPs, not to mention future generations of WAPs (e.g. 802.11ax), will be critical to successful deployment and migration over the life of the installation.

Characteristics of 802.11ac

The full details of the WAP implementation are outside the scope of the cabling discussion, and there are numerous excellent references on the differences and advantages of the various product implementations. This paper focuses on the parameters relevant to cabling infrastructure selection, mainly power and data rate.

The IEEE has divided the implementation of 802.11ac into two “waves”. These waves are nothing more than a two step implementation of the maximum data rates. The differences between 802.11n, 802.11ac Wave 1 and 802.11 Wave 2 include increasing the frequency bandwidth (40MHz to 80MHz and 160MHz), the denser modulation (64QAM to 256QAM) and increases the number of spatial streams (3 to 8) and radios.

This allowed manufacturers to offer products at different price and performance points as they became available, getting product to market faster and providing users with more options to match their needs. Wave 1 devices max out at data rate of 1300Mbps with throughput just under 1Gbps (910Mbps), while Wave 2 devices will run at data rate as high as 3470Mbps with throughputs higher than 2Gbps (2400Mbps).

In terms of power, many Wave 1 devices require PoE+ (IEEE 802.3at) power levels of 26W for full functionality, with reduced data rates at PoE level (802.3af) of 13W. Wave 2 devices will likely require higher power levels, requiring multiple cables or 4-pair PoE+ (4PPoE) configurations. At this point, the IEEE project for 4PPoE (802.3bt) is progressing, but until it is completed, first generations of 802.11ac Wave 2 devices may resort to proprietary implementation of PoE. Wave 1 devices are available now, whereas Wave 2 devices are anticipated to be available by mid 2015.

What about the work at IEEE and the 2.5/5GBASE-T study group?

There are several active equipment manufacturers and PHY vendors that have announced a 2.5Gbps and 5Gbps Ethernet for use with WAPs with the intention for this application to operate over 5e cabling or better. The creation of a study group to explore this topic was approved at the IEEE November 2014 plenary, which Hubbell attended.

These 2.5/5Gbps solutions are intended to allow users with existing 802.11n WAPs to upgrade to 802.11ac WAPs without re-cabling. It is very specific to 802.11ac devices and does not provide a migration path to higher rates.

It is too early to predict what the supported media for the potential 2.5GBASE-T or a 5GBASE-T standard will be. Our expectation is that an IEEE standard will be developed for speeds exceeding 1GBASE-T but lower than 10GBASE-T. However, it is also likely that these applications will require higher bandwidth than C5e performance specification.

As a result, transmission over C5e will be limited at best, and will likely require additional qualification of the installed cabling similar to TSB-155 qualification of Category 6 for use with 10GBASE-T. There is a higher likelihood for these applications to be able to operate over C6, but there are many details still to be determined during the typical two year cycle to complete the standardization of a new Ethernet application.

Specifying a Cabling Infrastructure

Looking at the characteristics of existing products and standards, proposed standards, manufacturers' literature and the IEEE 802.11ac standard provides clear expectations of what the cabling infrastructure should look like. In parallel, the TIA has provided guidance (TSB-162-A) on the specification and deployment of cabling in support of wireless access points today and for the future.

Specifying a Cabling Infrastructure (cont.)

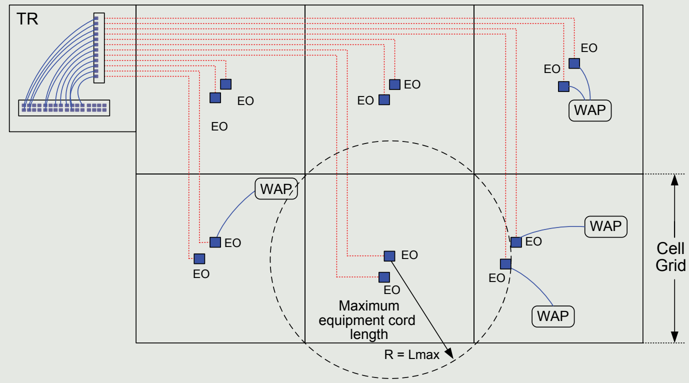
The guidelines are as follows:

- Data rate: the cabling needs to support a minimum of 1Gbps, but should be specified to support 10GBASE-T speeds.
- Current carrying capacity: cabling needs to support PoE+ levels at a minimum, but also needs to be designed to support proposed 4PPoE levels of at least 49W, and possibly up to 100W.
- 10G and PoE: although the IEEE standard explicitly specifies compatibility of 10GBASE-T with PoE+, 10Gbps devices have not required PoE up to this point. As a result, there are currently no available magnetics that can support both in parallel.

  This means that initial implementations of 802.11ac may choose one of two routes for data and power:

  - Multiple 1GBASE-T ports with PoE+ on all, *or*
  - 10GBASE-T port for uplink, with a separate port for PoE+ (or multiples) or 4PPoE.

It is unknown what early, pre-standard, implementations of 2.5/5Gbps rates will be. However, similar guidance is still applicable, with two links of C6A cabling being the best choice for new installations.



TIA Guidance

TSB-162A provides detailed guidance on the design of cabling for the support of wireless access points. The standard contains recommendations for coverage areas, cell size and allocation. It further recommends the use of multiple outlets for each wireless access point to support increased power and bandwidth requirements of MIMO applications.

The minimum recommended cabling in TSB-162A is Category 6A and, in the case of optical fiber, OM3 or higher.

Summary and Recommendations

What does all this mean to cabling infrastructure?

The current recommendation of the TIA (and Hubbell) is to provide *two* Category 6A outlets to each access point location. This will maximize both the power and data delivery potential.

Can lower category cabling be used?

Maybe, but we would not recommend it. Why? Again, the answer is power delivery and data rate.

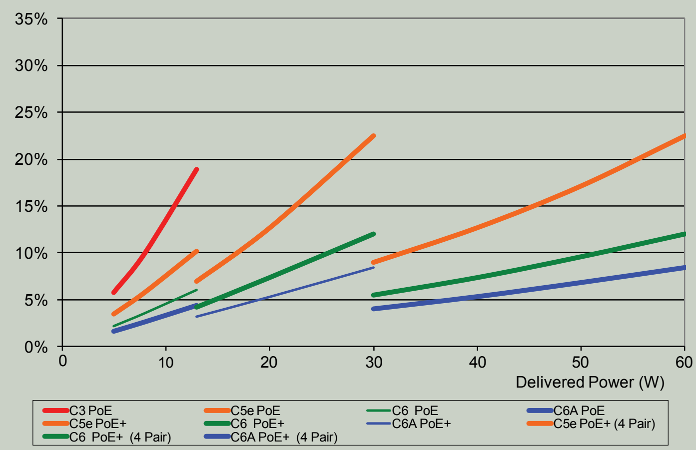
Data Rate

Category 6, for example, may support 10GBASE-T for a limited distance, but that support is limited and required qualification of installed base per TSB-155.

Power Delivery

The ratio of delivered vs. required input power will be lower on C6A channels that on C6. The lower gauge (translation, more copper) of C6A cables results in lower voltage drop and power loss between the power supply and the access point. Why is this important? Other than the general efficiency and operating cost concern, there is a real world concern of exceeding the capacity of the power supplies. The supplies are designed and sized to support the power needs under specific conditions. Forcing the system to operate over lower category cabling will require more input power, and could exceed the power delivery capability of the PoE supplies, or force the use of higher power (more expensive) supply units.

% Power Loss by Cabling Category



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