Every generation of the venerable IEEE 802.11 specification significantly expands wireless networks’ capabilities. And, according to one industry veteran, things have gotten so good that we might be at a point where the physical layer of wireless networks is about to receive a lot less emphasis.

“It’s amazing what we’ve been able to do,” says Craig Mathias, principal with the Farpoint Group, a wireless advisory firm based in Ashland, Mass. “The major trend we are going to see is, we are going to begin to deemphasize the lower three layers of the protocol stack, and the top layer will become the focus — and that’s a good thing. The fact that there are millions of applications out there is a good thing. That’s what gets people to buy the technology and use it to begin with.”

The latest generation of 802.11, 802.11ac, is slated to be officially approved by the IEEE by December 2013; the similarly crucial certification of 802.11ac from the Wi-Fi Alliance is slated to begin in the first part of 2013, according to WFA technical director Greg Ennis.

“Wireless has become the default access,” Mathias says. “The initial problem was throughput, and we solved that. Then security, and we solved that. Then cost and management, and we solved them. I think we’re at the point now where we can talk about sufficiency. People are not going to upgrade a gigabit WLAN to a 10-gigabit WLAN any time soon.”

Of course, Mathias says, a 10 Gbit-per-second WLAN might emerge on standards agendas in the next five to seven years, but the point is that with 802.11ac, the wireless industry has supplied those who develop and deliver whatever type of data they need to get into users’ hands with an unprecedented amount of speed, capacity, and flexibility. The questions Farpoint used to answer when putting together requests for proposals from clients centered on how a WLAN satisfied fundamental physical- and data-layer requirements.

“That’s a given these days,” he says. “Today we focus on the management issues: do you need compliance reporting, are you subject to HIPAA [US federally mandated health privacy legislation] or Sarbanes-Oxley [which mandates stronger financial reporting]? Is there something in the management console related to them? What kind of reporting, alerts, alarms, and what have you do you need? Do you want to run your network from your handset, or do you have a dedicated network operations center or something in between?”

This new emphasis on the upper layers of the stack could mean that those who administer the next-generation WLANs will need enhanced knowledge of application-layer issues, Mathias says.

“We’re still talking about technically sophisticated individuals here — you need people who understand a little about radio and a lot about networking, because the productivity of the users depends upon their ability to provision the network to begin with and resolve problems as they come up.”

**Capacity Trumps Throughput**

The greatest advance 802.11ac is expected to bring to commercial deployments is a further diminution of wired infrastructure within areas such as manufacturing floors and campus uses.

“With 802.11n [the current state-of-the-art Wi-Fi technology], there was a significant jump in minimizing the number of applications you had to keep a wired infrastructure for, and 802.11ac further minimizes that list,” says Dorothy Stanley, head of standards strategy for Aruba Networks.

In terms of raw performance improvement, 802.11ac actually made less of a leap over...
802.11n than n did over its predecessor, 802.11g — ac sports a 288 percent advance over n’s speed, while n increased over g’s capability by 833 percent, according to Mathias. But 802.11ac also includes a flexible channel-configuration capability that can customize a given WLAN’s architecture for the use at hand.

Yet Ennis says that, when necessary, the 802.11ac technology’s wider channels can also deliver more data to each individual end device; this could be especially important as mobile devices such as tablets and smartphones assume ever more commercial duties, such as medical imaging and telemedical video conferencing.

“It will be possible with 802.11ac to get very high data rates for video applications into the handsets, and won’t require two or three antennas in the handset anymore,” Ennis says. “You’ll be able to build a single antenna handset and still get data rates in the many hundreds of megabits. That’s going to introduce a whole bunch of opportunities for high-bandwidth applications for handsets people have shied away from thus far.”

Another new feature of 802.11ac is called multi-user, multiple input, multiple output. MU-MIMO advances the single-user MIMO found in 802.11n by enabling a single access point to send multiple spatial streams, via multiple antennas, to more than one client simultaneously. It essentially dynamically maximizes and minimizes beam energy meant for each client by measuring channel state information between itself and each client. This adds overhead, and while Ennis believes MU-MIMO could “dramatically” increase WLAN capacity, Mathias thinks MU-MIMO’s greatest utility will remain in residential settings.

A corporate white paper from Cisco, however, suggests that MU-MIMO might also play a role in enterprise settings (www.cisco.com/en/US/prod/collateral/wireless/ps5678/ps11983/white_paper_c11-713103.html#wp900361).

“MU-MIMO,” the paper states, “allows an AP to deliver appreciably more data to its associated clients, especially for small form-factor clients (often BYOD clients) that...
are limited to a single antenna. If the AP is transmitting to two or three clients, the effective speed increase varies from a factor of no speed increase up to a factor of two or three times, according to wireless channel conditions.”

**Complementary Technology Adds Potential**
802.11ac isn’t debuting alone. The Wi-Fi Alliance is also promoting a new certification program, Passpoint, which could affect WLAN configurations and usage patterns. Passpoint might be pertinent for platform developers and is almost certainly pertinent for network carriers, especially given that it coexists with new 802.11ac deployments that replace 802.11n networks. It will enable networks to offer users seamless and dynamic provisioning at any hotspot that uses Passpoint-certified equipment.

“For most users, Passpoint means that there will be no need for manual intervention when entering a hotspot running on Passpoint equipment with a Passport mobile device,” the Alliance said in announcing the program. “Automatic detection and secured connection will occur, provided the user is a subscriber of the entity running the hotspot or is a subscriber of an entity that has a roaming relationship with the entity running the hotspot.”

For Mathias, 802.11ac and Passpoint will be complementary and crucial to handling ever-increasing demands for data via mobile devices.

“If you’re a cellular carrier, and you’re looking at the promises you’ve made to your constituencies, you’re not going to be able to satisfy their needs, even with LTE [Long Term Evolution],” he says. “You’re going to need to offer some kind of Wi-Fi service. For years, handsets have had Wi-Fi built in, at least the handsets anybody would want to buy. The carriers haven’t done much with it, but that will become another transparent outlet for services carriers to sell you — whether they will charge for bits carried over a Wi-Fi link and build their own networks or establish partnerships with, say, a hotel network or a consolidator like Boingo. I think almost every conceivable business model will be applied there. But it’s critical for them to adopt Wi-Fi, and I think 802.11ac again helps them to a very large degree. And Passpoint will be one of the critical developments they’re going to need to do this offload, to make sure the authentication is done in a transparent way. Passpoint will solve the problem of having to associate with a particular network; roaming will be done transparently and securely. I’m expecting it will go quite well.”

Mathias says he’s dumbstruck by how Wi-Fi has become the default wireless technology when he thinks of its origins.

“No one, in the early days of 802.11, conceived of where we were going over time,” he says. “They really looked at it as a short range, peer-to-peer, no-access-point technology, and for it to do what it does today is utterly astonishing. I’ve been working in wireless longer than almost anybody in the field, and the handwriting is on the wall. We have done our job. We have built something that is truly remarkable. Now let’s use it.”

**News in Brief**

**cont. from p. 8**

**improve information and communication technologies and is open to all stakeholders, including private sector, government, and nonprofit organizations. The submission deadline for project descriptions is 16 December 2012. More information is available at www.wsis.org/stocktaking/prizes.**

As part of its **African Internet Exchange System (AXIS) project**, the **African Union** has selected **ISOC** to organize 60 workshops on community mobilization and the technical aspects of developing Internet exchange points (IXPs) in AU member states. The AXIS project’s goal is to **keep Internet traffic local** by building capacity and offering technical assistance to help develop national and regional IXPs in Africa. **Moctar Yedaly, head of the AU’s Information Society Division**, said that independent analysis shows that Africa currently pays carriers in developed countries more than US$600 million to exchange its continental Internet traffic; he called the status quo “costly as well as inefficient.”


The **IETF** has standardized the freely available **Opus for online audio** as **RFC 6716**, facilitating use of the sound-compression technology for applications such as videoconferencing and online voice chats. Opus, which evolved out of **Skype** development efforts, defines how to **encode and decode data streams** for more efficient transmission and storage, improving sound quality and covering a wide range of network conditions and audio needs. Opus uses two codecs (one lower and one higher quality), is geared toward low latency, and has a bit rates range of 6 to 510 Kbytes per second.

More information is available at www.opus-codec.org.