



Wi-Fi 802.11n standardization REMAINS ELUSIVE

Broadcom's Stephen Palm discusses Wi-Fi and alternative networking technologies.

WORK ON IEEE 802.11N WIRELESS-LAN TECHNOLOGY began in 2004, but a finalized standard continues to elude the industry. However, the lack of formal approval has not held back adoption of this next-generation, higher-speed follow-on to the wildly successful 11-Mbps 802.11b and 54-Mbps 802.11g approaches, according to Stephen Palm, PhD, the technical director for Broadcom's broadband-communications group. "The availability of Wi-Fi-certified products is what matters most in today's marketplace," he says, "and the Wi-Fi Alliance program has succeeded in driving consumer 802.11n purchases before the final standard. However, we expect that IEEE ratification will spur a wave of 802.11n deployments in enterprises, which are typically more cautious in their purchases than consumers."

Palm's academic and industry background bolsters his somewhat-controversial opinion. He earned a bachelor's degree in electrical engineering from the University of California—Irvine, a master's degree in electrical and computer engineering from Carnegie Mellon University (Pittsburgh), and a doctorate from the University of Tokyo. Before joining Broadcom in 1999, Palm was a senior staff engineer at Panasonic, and

The reason that 802.11n standardization has taken so long is the sheer complexity of the specification, Palm suggests. "[It] offers an immense variety of optional modes and technologies for specific applications," he says. The standard's developers included several of these options for political reasons, and deployed systems will likely never implement them. "Given the stability of the baseline draft 2.0 specification,"

time period consistent with the IEEE process."

Wi-Fi isn't the only LAN-connectivity option available to businesses and consumers, of course. Broadcom's stance on alternatives, such as powerline, HomePNA (Phoneline Networking Alliance), MOCA, and traditional Category 5 cable, ranges from enthusiasm to skepticism. "Broadcom continues to keep an eye on powerline networking," Palm says, "but, to date, we have not found a compelling enough advantage that will give it any significant momentum in the marketplace. Two significant detriments that the powerline industry must address are the multiplicity of incompatible standards and poor throughput coverage. A single HD-video stream is likely to be available in only about 60 to 80% of homes with the current powerline technologies. Moreover, there is little that can be done to easily remediate a home. Another issue is that powerline basically can use only a single portion of spectrum, unlike other technologies that



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he also held several engineering and technical-planning roles at Rockwell International Semiconductor Systems. In 2005, he became technical director at Broadcom, with a focus on home-networking technologies, including Wi-Fi and MOCA (Multimedia Over Cable Alliance). He is chairman of the Wi-Fi Alliance.

Palm explains, "we do not expect any substantial changes that would lead to further delays in the standards process or affect already-certified products. All of the major technical items in the specification have been resolved, and only relatively minor wording issues remain. We expect the final 802.11n standard to be ratified in the second half of 2009—a

can use multiple noninterfering channels of spectra."

In contrast, Palm says, "MOCA adds real value as a backbone technology, and, considering its strong support among telephone, digital-cable, and satellite-service operators, it will have a very strong position in the digital-home-networking

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landscape. MOCA technology supports more than four HD streams in 97% of homes without remediation, and installing a simple filter provides full coverage. MOCA offers multiple channels that allow multiple noninterfering networks in an area and relocation to avoid existing services on the coax. With the integration of MOCA into telephone, cable, and satellite SOCs [systems on chips], MOCA technology hits the price point for wide deployment. Similarly, 802.11n has tremendous momentum as a backbone technology. As vendors continue to optimize 802.11n for video over Wi-Fi, it will likely emerge as a convenient and cost-effective way to network the entertainment portion of the digital home and remains the choice for mobile devices.

“There are geographical considerations involving differences in construction materials and home size,” Palm says. “[These differences] create some variability in which backbone is most practical. But, between Wi-Fi, MOCA, and, occasionally, Category 5 cable, we

feel that the majority of homes throughout the world can be accommodated for a compelling digital-media experience. As far as corporate deployments, we do not see any wavering from Category 5 and Wi-Fi. With multiple cubicles and workstations on the same circuit, existing powerline technology would take us back to the days of shared 10-Mbps Ethernet of the 1980s. The main benefit of MOCA, reusing the existing coax cable found in a high percentage of homes, is not exploitable in the corporate environment since coax cabling is just not there.”

And what does the future hold for Wi-Fi and its derivatives? “The next big evolution will be integration of multiple technologies, including Wi-Fi, Bluetooth, GPS [global positioning system], cellular, and mobile TV, onto a single die,” says Palm. “If done right, these combinations enable manufacturers to differentiate the capabilities of mobile-phone handsets, gaming devices, and portable music players without a significant impact on cost, size, or power consumption. Success with combina-

tions will not only hinge upon a silicon vendor’s existing technology portfolio, but also will require a leap to lower process geometries.”

Regarding point-to-point and mesh topologies, Palm suggests, “One area that seems compelling is the point-to-point transmission of uncompressed video signals. Current wireless technologies provide data rates that are appropriate for networking MPEG-2 or AVC [advanced video coding] (MPEG-4) compressed-video streams. There has been increased interest to provide a wireless means to transmit the final link from a set-top box or home-theater receiver to a wall-mounted HD display to ease installation issues. There is consideration for the usage of the 60-GHz spectrum for this application, but cost-effective technology is still years away. [I hope] the concept will not have too much hype as what happened with 802.11n.”

—*Brian Dipert*



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