CEVA FIRST TO LAUNCH 802.11AX IP

By Mike Demler (April 30, 2018)

The IEEE's next-generation 802.11ax Wi-Fi specifications are more than a year from ratification, but (as usual) several wireless-chip vendors have already announced pre-standard products. To enable them, DSP-intellectual-property (DSP-IP) specialist Ceva is offering 802.11ax additions to its RivieraWaves Wi-Fi family. Its new RW-AX-series comprises three models targeting a range of products that spans IoT/wearables, mobile devices, access points, and gateways. The company plans to release the RW-AX IP for general licensing by the end of this quarter.

The RW-AX packages include synthesizable RTL for the RF automatic gain control (AGC) and the media-access-controller (MAC) layer. A hardware accelerator handles MAC-layer encryption. To minimize area and power, designers can select standard RTL for a hard-wired modem or, for greater flexibility, run a software-defined modem on a Ceva-XC DSP core (see *MPR 12/14/15,* "Ceva Optimizes DSPs for IoT"). The company estimates a die-area ratio of roughly two to one when comparing the largest model (including all options) with the smallest IoT model, but it withheld exact measurements. The IP package comes with C-language software for the lower-MAC and full-MAC protocol stacks. It omits the RF-front-end (RFFE) components, but Ceva works with Catena and other suppliers to ensure compatibility with their RF hard macros.

For IoT and wearable devices, the low-power RW-AX model incudes a hard-wired modem that supports a single (1x1) 20MHz channel, delivering 114Mbps of peak throughput—a 58% boost compared with 1x1 20MHz 802.11n, which currently serves in most low-end devices. The new 802.11ax standard enables greater access-point capacity, however, so it promises higher average speeds for more simultaneous connections. It also has mechanisms that increase spectral efficiency by allowing lower bandwidth, thereby reducing power consumption.

Wireless clients such as media-streaming devices and surveillance cameras will use the higher-performance RW-AX IP, which handles 802.11ax in 1x1 and 2x2 MIMO modes. It employs a hard-wired modem that works with 20MHz, 40MHz, and 80MHz channels in addition to supporting the new standard's QAM-1,024 (see *MPR 12/26/16,* "Draft 802.11ax Up for 2017 Ballot"). A single 80MHz channel delivers 600Mbps of throughput, and the 2x2 mode doubles it to 1,200Mbps, enabling a 36% speedup from 802.11ac. The IP provides a more efficient encryption method—called the Galois Counter Mode Protocol (GCMP), introduced in 802.11ad—that requires only a single pass to encrypt a data block, unlike the dual passes of the previous method. This new method is better suited to the speeds that high-performance clients need.

At the top of the RW-AX lineup is the Multi-Gig product. It supports 4x4 configurations in access points and media gateways. This model runs most modem functions on a high-end Ceva-XC core, but it uses the same hardware MAC accelerator and lower-MAC software stack as the other RW-AX models (see *MPR 4/3/17,* "Ceva Telegraphs 5G Intent With XC12"). Along with the DSP core, the Multi-Gig IP boosts performance thanks to its hardware accelerators for the AGC and bit processing (i.e., low-density parity check and Viterbi coding). Maximum throughput for 4x4 with 80MHz channels is 2.4Gbps.

The RW-AX IP allows the MAC and upper-protocol stack to run on a variety of processor configurations. Standalone IoT processors will typically handle the full MAC, supplicant, TCP/IP layer, and application code on an embedded CPU or DSP core. Application processors can run the stack on the host CPU or offload the lower or full MAC to a smaller embedded core. Ceva has tested its MAC software on Arm, Cortus, and RISC-V CPUs, but customers can substitute controller CPUs from other IP vendors, including Andes and Synopsys.

The company integrates its Wi-Fi IP with the open-source Zero-Riscy core developed by the Integrated Systems Lab at ETH Zurich and the University of Bologna. Zero-Riscy is a simple two-stage design implementing the RV32E/I ISA (see *MPR 3/28/16,* "RISC-V Offers Simple, Modular ISA"). It also supports RV32C compressed instructions as well as RV32M integer-multiplication/division extensions.

By offering its new RV-AX, Ceva has strengthened its considerable lead in licensable Wi-Fi cores. It's the first IP vendor to announce support for the emerging 802.11ax standard. Its closest competition is from Cadence's ConnX baseband DSPs. That company lacks a product to compete with RivieraWaves in high-performance 802.11ac designs, but for small IoT devices, its Tensilica Fusion implements the aging 802.11n standard (see *MPR 5/4/15,* "Cadence Fuses IP for IoT, Wearables"). The RW-AX package is the only licensable IP that enables all of the latest Wi-Fi specifications, and its combination of hardware/software configurability gives designers the flexibility to begin prototyping ahead of 802.11ax ratification in 2019. ♦