ATCA: It's More Than a Bus

John Titus, Senior Technical Editor

Competitive telecom businesses have realized they can no longer design proprietary hardware. In response to this changed business climate, members of the PICMG, a consortium of industrial-computer vendors, developed PICMG 3.0, or the Advanced Telecom Computing Architecture (ATCA). Marc LeClaire, a product manager in the Advanced Blades and Servers Division at Kontron, stressed that the ATCA standard covers boards, enclosures, interconnections, communications, and other architectural components. "Designers must think of the ATCA as a complete architecture, not simply as a bus."

Today's ATCA vendors let telecom companies buy almost all the communication handling hardware they need as standard off-the-shelf products. According to John Fryer, director of technology marketing at Motorola's Embedded Communications Computing group, to succeed in the telecom market, ATCA equipment must meet 5-9's reliability. That spec -- 99.999 percent uptime -- comes to less than five minutes of downtime a year. "The ATCA community stresses the high reliability of the architecture and of the products built to the PICMG 3.0 spec," noted Fryer. (See note below.)

"We look for common denominators, so that a microprocessor or DSP blade can handle many types of applications." said Venkataraman Prasannan, senior director and Advanced TCA product line manager at RadiSys. "We help engineers understand how the ATCA compares with their present hardware and software to solve a problem." Prasannan explained that a top-down approach to system design helps RadiSys anticipate customers' needs. "We say, 'How would we build the next-generation radio network controller, how would we put these blades together for a specific type of data flow, and how do we achieve the necessary redundancy?' Then, the answers let us show engineers how to design their own network-controller project, for example, with ATCA-based equipment."

People in telecom businesses have their own terminology. In the ATCA realm, "blade" refers to a plug-in card with a processor or communication links. A "shelf" indicates an enclosure that includes a standard backplane and perhaps a power

supply. The backplane provides a built-in management bus that oversees the proper operation of blades, connects power, and determines the compatibility of added blades. A typical shelf includes slots for two hubs, or controllers. Engineers access I/O signals through optional rear transition modules.

Figure. This collection of hardware shows an ATCA shelf populated with blades (background), two ATCA boards (right), a populated Micro TCA shelf (left), and a Micro TCA blade based on an AMC board (center). Courtesy of Motorola.

The ATCA standard specifies several types of links and protocols that connect blades. PICMG 3.1, for example, specifies Ethernet and Fibre Channel, and PICMG 3.5 covers RapidIO. Theoretically, designers can choose the medium they deem best suited for an application. But the majority of vendors and designers have chosen Gigabit Ethernet as the default blade-to-blade standard. "Gigabit Ethernet offers backwards compatibility," explained Fryer. "You can remove a 1 Gb Ethernet switch and replace it with a 10 Gb switch. Your existing 1 Gb Ethernet communications and applications work just as they did before and coexist with 10 Gb Ethernet communications."

"As ATCA applications evolve, designers will naturally move up to 10 Gb Ethernet," said Kontron's LeClaire. "Engineers have started to investigate 40 Gb Ethernet for backplane and fabric communications, so we see a lot of room for ATCA-based products to tackle new applications."

To some extent the PICMG standards complicate the choice of a blade-connection scheme. "You can use a dual-star topology that connects two hub blades to each other and to every other blade on a shelf," noted Motorola's Fryer. "The dual-star configuration builds redundancy into the communication 'fabric' in an ATCA backplane. You also can have a full-mesh topology that connects every blade to every other blade and provides redundancy, too. The backplane can be the same for dual-star or mesh connections; you just select blades that work with one or the other." A full-mesh topology adds cost because every blade must act as a switch and the added switch components take up space, use power, and complicate the software. So, the majority of ATCA telecom systems have adopted the dual-star format.

When engineers need a special function or more processing power, they can place Advanced Mezzanine Cards (AMCs) on ATCA-compatible carrier boards. Many engineers noticed that AMC boards on their own could perform processing and communication functions. As a result, AMC boards on their own formed the basis for the Micro Telecom Computing Architecture, or Micro TCA. Although ATCA and Micro TCA share three letters, do not think of the latter architecture as a subset of ATCA. The Micro TCA can stand alone, and smaller, lower-bandwidth Micro TCA products find use at the access points or edges of telecom systems.

Engineers may see the Micro TCA as a low-cost alternative to other embedded-computer equipment, particularly in applications that require a lot of processing power. Unfortunately, the current cost of MicroTCA boards and related equipment generally limits their use to telecom and military/aerospace applications. Some medical imaging equipment takes advantage of the concentrated computer power in a Micro TCA package to process images.

Today's Micro TCA equipment does not easily adapt to rugged environments, but the PICMG has started to examine ways to ruggedize existing boards and packages. Future rugged equipment might include protective packages and shock mounts. "We want designers to know the same Micro TCA cards they use now will work in ruggedized equipment," explained David Pursley, an application engineer in Kontron's Advanced Blades and Servers Division.

Note: *On September 28th, Emerson agreed to purchase Motorola's Embedded Communications Computing operation, which will operate within Emerson's Network Power division. The purchase should close by year's end.*

Telecom technologies can get complicated. If you would like to know more about ATCA or Micro TCA, send me a short email message. jontitus@comcast.net [1].

For further reading

For answers to "Common Basic Questions" about ATCA and MicroTCA, see: www.asis-pro.com/SiteFiles/1/1108/6478.asp [2]

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