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ATCA/AMC Set to Provide Flexible Platform for a Variety of High-Performance Applications

PICMG's ATCA form-factor has its own new mezzanine standard that's destined to extend ATCA's benefits to modular daughtercards.

By Michael Franco, Engineering Manager,Artesyn Technologies

AdvancedMC or Advanced Mezzanine Cards (AMCs) are poised to become a significant platform for a variety of high-performance, high-availability applications. They are designed primarily to provide flexibility for ATCA (Advanced Telecommunications Computer Architecture) that has been designed to provide high throughput, multi-protocol support, high power capability, hot swapability and integrated system management as a solid baseline telecom fabric. While primary applications address the telecom requirements, there are significant other applications for it in the military and aerospace industry ranging from simulation to signal processing.

The AMC mezzanine module extends the benefits of the ATCA fabric to individual modules, enabling designers to customize, scale, upgrade and service their systems with a finer degree of granularity. Together ATCA and AMC greatly reduce the time and cost associated with developing, upgrading and servicing high-performance, high-availability systems.

Not for Telecom Alone

ATCA isn't the first open architecture platform to target the telecom industry that has been (is expected to be) co-opted for military duty. CompactPCI Packet Switching Backplane (cPSB or PICMG 2.16), for example, is an adaptation of the generalpurpose CompactPCI bus that adds telecom-friendly features like Ethernet backplane transfers (PICMG 2.16) and system management (PICMG 2.9). ATCA goes several steps further, providing integrated system management and support for multiple protocols as part of the baseline spec. In addition, ATCA provides much higher throughput (10 Gbit/s vs. 1 Gbit/s per link), supports a full mesh interconnect (in addition to 2.16's dual star), accommodates higher power (up to 200W/board vs. 50W), and provides a larger form-factor (8U vs. 6U), all of which can be invaluable in a broad variety of applications.

The idea of an expansion module isn't new either. PMC, for example, is the expansion module of choice for VMEbus, CompactPCI, cPSB (PIGMG 2.16) and many custom designs. PMC even has an offshoot for telecom applications called PTMC (PCI Telephony Mezzanine Card), which brings a TDM bus up to the module along with other optional interfaces such as RMII or Utopia. Unfortunately, PMC modules are not hot swappable. As such, they cannot be upgraded or serviced in the field. They also lack an integrated system management interface, which makes it difficult to monitor and control individual PMC modules remotely.

AMC, by contrast, is designed specifically for packet-based, high-availability applications. Like ATCA carriers, AMC modules are hot swappable, enabling operators to replace only the malfunctioning portion of an ATCA blade (rather than the entire blade). This reduces spares costs and mean-time-to-repair (MTTR), lowering both CAPEX and OPEX. AMC also provides an IPMI-based system management interface, which enables operators to pinpoint and fix problems at the module level, also lowering MTTR and OPEX.

AMC provides a high-speed, multi-protocol (Ethernet PCI Express, Rapid I/O and InfiniBand) serial packet interface with up to 21 I/O channels (12.5 Gbit/s per channel) that supports module-to-baseboard and module-to-module data rates of up to 200 Mbits/s, five times that of OC-768. This scaleable

Versatile Form-Factor Enhances Architectural Flexibility

One of the biggest contributors to overall ATCA/AMC flexibility is its support for multiple mechanical form-factors and configurations. This mechanical flexibility enables designers to partition their blades in a way that is optimized for their scalability, upgradeability and field serviceability requirements.

AMC supports four module sizes: half-height single width, half-height double width and a full-height version of both of these. The modules have escalating power limits of 20W for the smallest half-height single width to 60W for the largest module, which is doublewide full height.

The AMC spec also provides detailed guidelines for building three types of ATCA carrier boards—short, long and hybrid. The short carrier has bays for up to eight AMC modules with no component height restrictions. The long carriers provide bays for up to four AMC modules, with two thirds of the board reserved for other components that have component height restrictions. The hybrid carrier provides for portions of either long, short or no module bays along the faceplate of the board.

By mixing and matching short, long and hybrid carriers with various modules, designers can readily configure their ATCA system with the desired degree of granularity. An ATCA shelf (holds up to 16 ATCA carriers) populated with short carriers for example, can hold up to 128 AMC modules, enabling designers to upgrade, scale and service their systems at a very fine-grain level.

Fine-Grain Advantages

Architecturally, long carriers are generally perceived as baseboards that provide primary functionality, with AMCs acting as a functional extension of the on-board circuitry. This is the conventional role of mezzanine cards. The short carrier, however, is more aptly viewed as a modularly constructed blade or extension of the ATCA fabric. Here, the carrier performs generic functions such as distributing power, system management infrastructure and fabric interconnectivity, while field replaceable AMC modules provide the primary functionality with varying degrees of granularity.

The fine granularity of modular ATCA/AMC carriers offers significant cost savings for telecom OEMs. Modular blades cost less to produce because they can be configured using generic AMC components such as network interfaces, network processors, DSP farms, mass storage devices and encryption/decryption devices that can be reused across multiple blades, thereby facilitating volume production.

Modular ATCA/AMC blades also reduce cost by reducing the number of unique blades that telecom OEMs have to purchase and stock. With ATCA/AMC, telecom can stock a single generic carrier board vendor that spans several products, along with the AMCs needed to configure that carrier for specific applications. This is not possible with traditional mezzanine architectures like PMC because PMC modules aren't field replaceable. They're typically bolted on at the factory and sold to the telecom OEM as a single unit. Thus, the TEM has to purchase and stock a unique board for each application, regardless of the commonality that exists from one board or application to the next.

Modular,field-replaceable ATCA/AMC systems are also easier and less expensive to scale and upgrade, reducing equipment costs by enabling carriers to deploy the minimal hardware needed to service their subscriber base. Consider for example, an ATCA-based core router equipped with AMC-based network processor modules, or a VoIP gateway equipped with AMC-based transcoding modules . Both systems could be deployed in a minimal configuration and scaled later without replacing the whole blade or taking it off line.

Fine-grain ATCA/AMC blades also reduce provisioning cost by enabling systems to be scaled and provisioned according to actual demand. For example, consider an ATCA WAN card equipped with eight AMC cards, each providing four T1 channels. In this configuration, the T1 channels can be added and provisioned in blocks of four rather than 32. This fine granularity also reduces the cost of sparing. Regardless of the number of active channels used in the system, spare replacements (on line and on the shelf) usually require only one or two modules, not an entire 32-channel carrier board.

In addition to reducing cost, the modular “Lego-like block” approach provides faster time to market. The greater the number of functional elements that are available off the shelf (or from prior projects), the smaller the number of functional elements that must be designed and tested from scratch. This building block approach greatly reduces overall complexity and ground-up design, thereby reducing development time.

Modular systems also enhance availability by reducing the impact of component failures. Consider, again, an ATCA WAN card equipped with eight AMC modules, each providing four T1 channels. A failure in any particular T1 channel might at most take out four T1 channels, versus all 32 for a monolithic card on which the 32 channels are mounted directly to the baseboard.

Sample Applications

The modularity of ATCA/AMC fabrics gives designers tremendous flexibility in the way that they partition their system. Using AMC modules, designers are free to create scaleable, high-density modules dedicated to a specific function, such as control, SIGTRAN signaling, transcoding, interfacing or packet processing. They can also combine multiple functions on a single blade and alter the mix as applications and/or system partitioning changes.

Figure 1 shows how an ATCA card equipped with Advanced Mezzanine Card modules might be used to implement a scaleable signaling blade. The server module runs the upper level signaling stacks such as SS7 MTP3, SCCP, ISUP, TCAP and/or MAP. The signaling modules run the lower level signaling protocol such as SS7 MTP1 and MTP2. Mass storage devices log blade and signaling link activity.

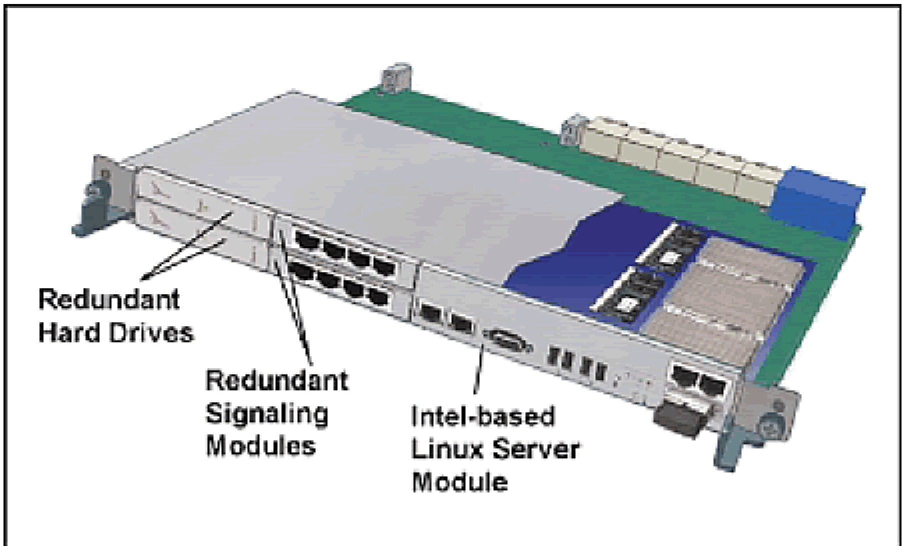

Figure 1. This is a rendering of what could be a typical AMC/ATCA configuration, with typical function cards included.

Figure 2 shows how an ATCA card equipped with AMC modules could be used to implement a single-board media gateway. TDM voice traffic comes onto the board via either optical carrier SONET interfaces or via T1/E1 ports. Using TDM/IP or circuit emulated switching, the voice and clock is moved to DSP farm modules for transcoding and packetization. The packetized voice is then transported off the board via the high-speed IP switch fabric interface. Alternative solutions could be architected using a multi-blade approach, where one blade is dedicated to the DSP transcoding and packetization function and another blade is dedicated to the TDM interfaces. The diagram also shows a mixture of full-height/doublewide modules with half-height/singleside modules on a single blade.

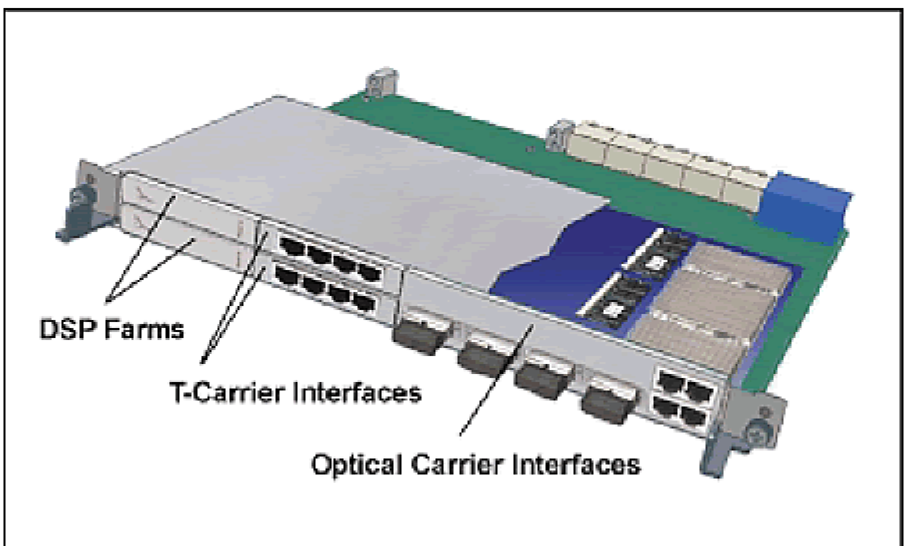

Figure 2 An AMC-equipped ATCA card might be used as a single-board media gateway. Here, slower speed T-carrier plus high-speed optical line card interfaces are aggregated on a single module. The DSP AMC mezzanines can perform voice quality enhancement, signaling/frequency modification and modulation, or any signal processing application such as voice mail or even voice recognition.

Component suppliers have been trying for almost two decades to create an open architecture platform for telecom systems that would entice telecom OEMs to utilize off-the-shelf solutions. At long last, close collaboration between component suppliers and telecom OEMs has produced such a platform.

Unlike many of their predecessors, ATCA and AMC are not buses in search of an application. And they're not a modification and retrofit of general-purpose platforms in hopes of appealing to telecom OEMs. ATCA and AMC are a system platform and expansion architecture designed by telecom for telecom. They're a collaboration of major telecom OEMs and suppliers aimed at developing an optimal telecom platform that addresses major bandwidth, availability, field upgradeability, cost, scalability, management and interoperability issues. Ultimately, ATCA and AMC will lower lifetime cost of ownership by leveraging economies of scale. At the same time, it will reduce time-to-market. This will allow TEMs to outsource enabling technology, lowering maintenance costs, and providing a roadmap to future technologies.

Artesyn Communication Products.
Madison, WI.
(608) 831-5500.
[www.artesyn.com].