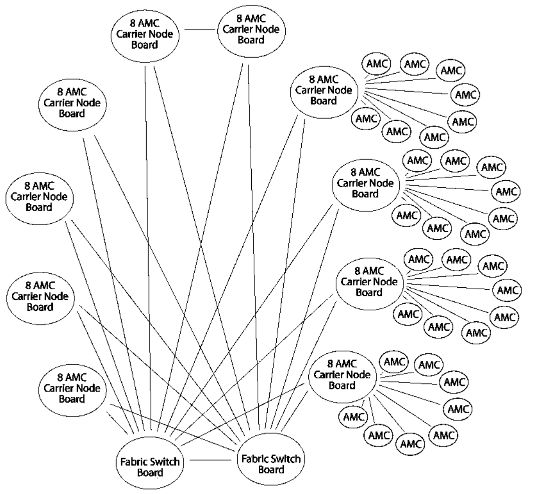
# Advanced Mezzanine Cards provide flexible fine-grain telecom fabric

**by Michael Franco,** Artesyn Technologies (Communication Products Division)

**BY COMBINING GENERAL-PURPOSE ATCA CARRIER CARDS WITH APPLICATION-SPECIFIC ADVANCED MEZZANINE CARDS, DESIGNERS CAN CREATE VERSATILE TELECOM SYSTEMS THAT CAN BE READILY UPGRADED, SCALED, AND SERVICED IN THE FIELD.**




*Full mesh ATCA fabric with maximally fine grain structure.*

AdvancedTCA base boards equipped with AdvancedMC or Advanced Mezzanine Cards (AMCs) are poised to become the dominant platform for high-availability telecom applications. ATCA's high throughput, multi-protocol support, high power capability, hot swapability, and integrated system management provide an ideal baseline telecom fabric. AMC enhances the flexibility of that fabric by enabling designers to customize, scale, upgrade, and service their ATCA-based telecom systems with a finer degree of granularity. The resulting fabric structure offers greater flexibility than ever before possible, reducing the costs of product development and time to market, reducing the cost of repairs, upgrades and spare maintenance, and reducing the impact of individual component failures.

By combining general-purpose ATCA carrier cards with application-specific AMC modules, designers can create versatile telecom systems that can be readily upgraded, scaled, and serviced in the field. In fact, Artesyn expects that blades combining an ATCA carrier with AMC modules will be the best fit (vis-a-vis fixed-function ATCA cards) for up to 80% of telecom applications.

The key to ATCA/AMC flexibility is the ability of the AMC interface to extend the performance and serviceability of the baseline ATCA fabric to the module level. AMC modules for example are hot swappable, enabling not only the ATCA baseboard, but individual AMC modules to be added or replaced in the field without disrupting overall service. Similarly, AMC extends ATCA's IPMI-based system management interface, which enables the ATCA carrier and individual modules to be remotely monitored and maintained, thereby enhancing reliability, availability, serviceability, and manageability (RASM). AMC also makes it easy for module designers to take full advantage of ATCA's high power budget (up to 200W per blade), supporting up to 60W per module.

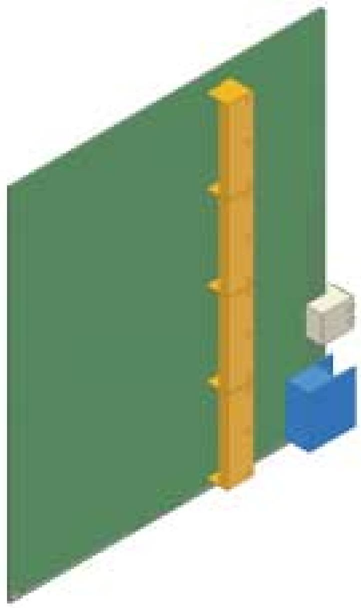
From a performance standpoint, AMC gives designers full access to ATCA's high bandwidth 10 Gbit/sec fabric. AMC modules provide 21 lanes of I/O, all of which can run at up to 12.5 Gbit/sec. The modules communicate with the ATCA baseboard via a packet-based serial interface. Ethernet is the de facto protocol. But like ATCA, AMC can support any number of protocols, including PCI Express, Rapid I/O, and InfiniBand.

Though not loudly trumpeted, one of the biggest contributors to overall ATCA/AMC flexibility is its support for multiple mechanical form factors and configurations. The ability to choose from a variety of module sizes and carrier configurations enables designers to partition their system in a way that maximizes scaleability, upgradeability, and field serviceability. Equipping a generic ATCA card with a large number of small AMC modules, for example, enables designers to upgrade, scale and service their systems at a very fine-grain level.

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 double width full-height. The AMC spec 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, which 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, providing a degree of granularity not possible with other baseboard/mezzanine fabrics.

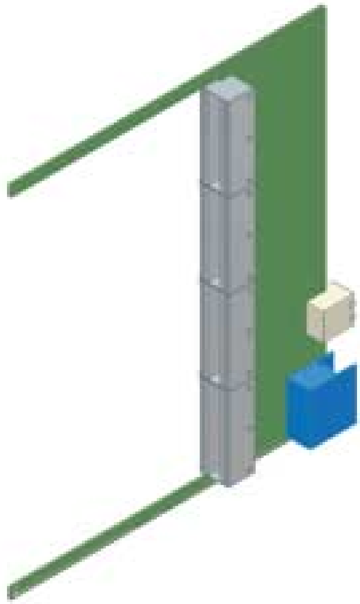
Architecturally, long carriers are generally perceived as base boards that provide primary functionality, with AMCs acting as a functional extension of the on-board circuitry. This is the conventional role of mezzanine cards. The short carrier, however, is more aptly viewed as a modularly constructed 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 long carrier provides bays for up to four AMC modules, with two-thirds of the board reserved for other components.*

The short carrier architecture provides a number of advantages vis-a-vis conventional baseboard/mezzanine approaches. A key advantage is reduced product cost. Many of the modules that will be developed for ATCA carriers will be reusable across a broad range of applications. This commonality and functional interchangeability will facilitate volume production that not only drives costs down, but also enhances reliability. A number of vendors have already announced they will offer AMC modules for a wide variety of functions, including general-purpose processors and DSPs, network processors, line cards (optical and copper), radio cards, programmable gate arrays (for custom functions such as encryption and compression), and both hard drives and removable media.

In addition to reducing cost, the short carrier "Lego-block-like" approach also provides faster time to market. The greater the number of functional elements that are available off the shelf or can be reused 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 are also easier and less expensive to upgrade. Consider, for example, a deployed system that requires additional processing power or an upgraded WAN interface. Both of these upgrades could be performed faster and more inexpensively by substituting a new AMC processor or WAN module than redesigning or replacing the entire baseboard. Modular systems also enhance availability by reducing the impact of component failures. For example, consider an ATCA WAN card equipped with eight AMC cards, 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.



*The short carrier has bays for up to eight AMC modules with no component height restrictions*

The fine-grain modularity of short carrier implementations also reduces provisioning cost by enabling systems to be scaled and provisioned according to actual demand. For example, the T1 channels mentioned previously could 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.

As standardized functional modules emerge, so too will standardized on-line functional testing, paving the way for a new generation of continuous background testing that consumes a small portion of channel capacity and provides far more extensive coverage (due to nature of serial fabric topology). The ability to refine and keep refining this test strategy relies on and will leverage the limited number of standardized modules required to implement any system, a by-product of the Lego-like block approach. The consistent functionality of these modules will also make these tests easier to propagate to other modules providing similar functionality.

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. Either way, they can spread critical functions across multiple field replaceable AMC modules in a way that maximizes scaleability, upgradeability, availability, and serviceability.

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. With an eye toward high performance and availability, integrated system management, and field upgradeability, ATCA carriers equipped with application-specific AMC modules provide the consummate foundation for building the telecom systems needed to power next-generation packet networks. Ultimately, ATCA and AMC will lower the lifetime cost of ownership by leveraging efficiences and reducing time to market, allowing TEMs to outsource enabling technology, lowering maintenance costs, and providing a roadmap to future technologies. ■