AdvancedTCA and Advanced Mezzanine Cards provide standard foundation for next-generation telecom systems

By Todd Wynia

AdvancedTCA carrier boards equipped with Advanced Mezzanine Cards (AMCs) are poised to become the dominant platform for high-availability telecom applications. AdvancedTCA boards' high throughput, multi-protocol support, high power capability, hot-swap ability, and integrated system management form an ideal baseline telecom fabric. AMCs enhance the flexibility of that fabric by enabling designers to customize, scale, upgrade, and service their AdvancedTCA-based telecom systems with a finer degree of granularity. AdvancedTCA and AMC come together in an optimal telecom platform that addresses major bandwidth, availability, field upgradeability, cost, scalability, management, and interoperability issues.

AdvancedTCA isn't the first open architecture platform to target the telecom industry, but unlike predecessors such as CompactPCI Packet Switching Backplane (PICMG 2.16), a retrofit of general-purpose platforms, AdvancedTCA is the first platform designed from the ground up for telecom. Whereas PICMG 2.16 is an adaptation of the general-purpose CompactPCI bus, adding telecom-friendly features such as Ethernet backplane transfers and system management, AdvancedTCA makes integrated system management and multi-protocol support part of the baseline spec. In addition, AdvancedTCA provides much higher throughput (10 Gbits/sec versus 1 Gbit/sec per link), supports a Full Mesh interconnect (in addition to 2.16's Dual Star), accommodates higher power (up to 200W versus 50W), and has a larger form factor (8U versus 6U), all of which are invaluable for telecom applications.

Similarly, AMC isn't the first mezzanine architecture to target telecom, although it is the first one designers built from the ground up for telecom. PMC, for example, is the expansion module of choice for VMEbus, CompactPCI 2.16, and many custom designs. It even has an offshoot for telecom applications called PTMC (PCI Telecom Mezzanine Card) that brings an H.110 TDM bus up to the module along with other optional interfaces such as RMII or UTOPIA. Even with these enhancements however, PMC is less than ideal for telecom. For one thing, PMC use of PCI as the control plane bus consumes extra management resources. Equally important, PMC modules aren't hot swappable, and can only handle 7.5W per module.

On the other hand, AMC designers optimized it for high-performance packet-based telecom environments. Employing a packet-based serial interface to communicate with the carrier, AMC modules achieve an aggregate bandwidth of 250 Gbits/sec and support multiple protocols (e.g., Ethernet, PCI Express, RapidIO, and InfiniBand). Equally important, AMC modules are hot swappable, enabling them to be replaced individually in the field. In addition, an IPMI-based interface makes remote monitoring and maintenance possible.

Seamless extension drives AdvancedTCA/AMC flexibility

The AMC interface extends the performance and serviceability of the baseline AdvancedTCA fabric to the module level, supplying the key to AdvancedTCA/AMC flexibility. AMC modules, for example, gives designers full access to AdvancedTCA's 10 Gbits/sec fabric providing 21 lanes of high-speed I/O, all of which can run at up to 12.5 Gbits/sec. AMC modules are also hot swappable, so both the AdvancedTCA baseboard and individual AMC modules can be replaced in the field without disrupting overall service. By extending AdvancedTCA's IPMI based system management interface, AMC modules make remote monitoring and maintenance of the AdvancedTCA carrier and individual modules possible. The modules' 60W maximum power capacity also makes it easy for module designers to take full advantage of AdvancedTCA's high power budget. Figure 1 illustrates an AMC on an AdvancedTCA carrier board.

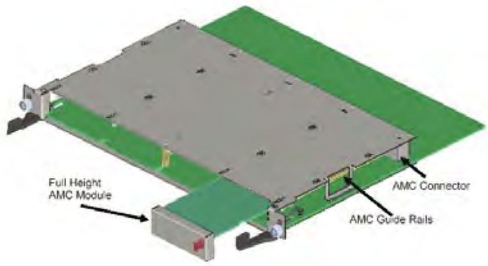

Figure 1

Support for multiple mechanical form factors and configurations contribute significantly to overall AdvancedTCA/AMC flexibility. Designers can choose from a variety of module sizes and carrier configurations, partitioning their systems to maximize scalability, upgradeability, and field serviceability. For example, designers can equip a generic AdvancedTCA card with a large number of small AMC modules to upgrade, scale, and service their systems at a very fine grain level. Figure 2 shows double-width and single-width AMCs plugged into a carrier board.

Figure 2

By mixing and matching short, long, and hybrid carriers with various modules, designers can readily configure their AdvancedTCA system with the desired degree of granularity. An AdvancedTCA shelf holding up to 16 AdvancedTCA carriers and populated with short carriers can hold up to 128 AMC modules, providing a degree of granularity not possible with other baseboard/mezzanine fabrics.

Fine-grain fabric reduces cost, increases flexibility

System architects typically view long carriers as baseboards that provide primary functionality and treat AMCs as functional onboard circuitry extensions. 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 AdvancedTCA fabric. Here the carrier performs generic functions such as distributing power, managing system infrastructure, and providing fabric interconnectivity, while field replaceable AMC modules deliver primary functionality with varying degrees of granularity.

The short carrier architecture offers a number of advantages relative to conventional baseboard/mezzanine approaches. A key advantage is reduced product cost. Many of the modules that system developers will create for AdvancedTCA carriers will be reusable across a broad range of applications. This commonality and functional interchangeability will make volume production possible, driving costs down and enhancing reliability. Carrier commonality will also speed time to market by facilitating module reuse and spurring third-party production of off-the-shelf modules, thereby decreasing the number of functional elements vendors must design and test from scratch. This also reduces a customer's spare parts pool.

Upgrading modular systems costs less and is easier than upgrading monolithic systems. Consider, for example, a deployed system that requires additional processing power or an upgraded WAN interface. Substituting a new AMC processor or WAN module, rather than redesigning or replacing the entire baseboard, takes less time and money. The finer the module granularity, the smaller the impact on the rest of the carrier.

Fine-grain modular systems also enhance availability by reducing the impact of component failures. Let's take the example of an AdvancedTCA 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. However, failure on a monolithic card with 32 channels mounted directly to the baseboard would wipe out all 32 T1 channels.

The fine-grain modularity of short carrier implementations also cuts costs by enabling manufacturers to scale and provision systems according to actual demand. For example, designers could add and provision the 32 T1 channels mentioned in the example above in blocks of four rather than 32. This fine granularity also reduces sparing costs. Regardless of the number of active channels used in the system, spare replacements (online and on the shelf) usually require only one or two modules, not an entire 32-channel carrier board.

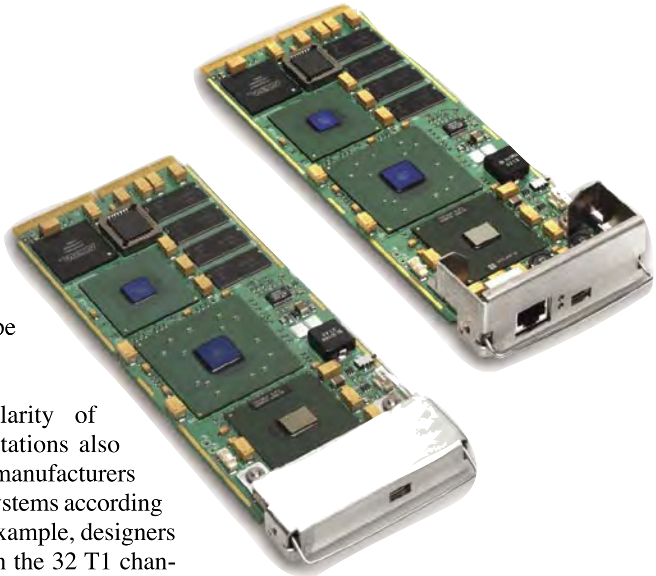

Figure 3

As standardized functional modules emerge, so too will standardized online functional testing, paving the way for a new generation of continuous background testing that consumes a small portion of channel capacity and assures far more extensive coverage (due to serial fabric topology's nature). Ongoing test strategy refinements will rely on and leverage the limited number of standardized modules required to implement any system, a byproduct of the Lego-block-like approach. The modules' consistent functionality will also make these tests easier to propagate to other modules providing similar functionality.

Designers gain tremendous system-partitioning flexibility thanks to the modularity of AdvancedTCA/AMC fabrics. Using AMC modules, designers are free to create scalable, 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 to maximize scalability, upgradeability, availability, and serviceability. Figure 3 shows examples of Pentium 4 based AMCs.

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. AdvancedTCA and AMC are the *real McCoy*. AdvancedTCA carriers equipped with application-specific AMC modules form the consummate foundation for building the telecom systems needed to power next-generation packet networks. Ultimately, AdvancedTCA and AMC will lower the lifetime cost of ownership by leveraging efficiencies and reducing time to market, allowing TEMs to outsource enabling technology, lower maintenance costs, and create a roadmap to future technologies.

***Todd Wynia** has been with Artesyn since February 1987. An industry expert with extensive knowledge of trends, technology, and companies driving the telecommunication-data communications convergence, Todd is an active participant in many industry standards associations and trade associations including the ATM Forum, VME Industry Trade Association (VITA), and the PCI Industrial Computer Manufacturers Group (PICMG). Todd graduated from the University of Wisconsin with a BS in Economics.*

For further information, contact Todd Wynia at:

Artesyn Communications Products
8310 Excelsior Drive
Madison, WI 53717
Tel: 800-356-9602
Fax: 608-831-4249
E-mail: info@artesyncp.com
Web site: www.artesyncp.com