

# Systems designers' dreams become reality with AdvancedMCs

By *George Kontopidis*



*Advanced Mezzanine Cards (AdvancedMCs) appear to be on the way to creating a market bigger than all PCI Mezzanine Cards (PMCs) and other daughterboards combined. There are two main reasons this is likely to occur – AdvancedMCs have the right scale for a hot-pluggable Field Replaceable Unit (FRU) and they leverage AdvancedTCA standardization work. AdvancedMCs will most likely replace proprietary functional modules at a high enough volume so that the economies of scale and their ubiquitous use in the telecom sector will drive costs to commodity levels. Just think what will happen if a good fraction of the 1.7 billion mobile subscribers start using a chain of AdvancedMCs in Node Bs, RNCs, and gateways, extending to multimedia transcoding processing elements.*

## A philosophical shift

Traditional board designers included expansion options to accommodate unplanned functionality and future needs. The terms piggyback and daughterboard are indicative of this concept – both imply that they supplement a base board with more functionality. AdvancedMCs, however, have caused a shift in the I/O expansion philosophy. The new concept is that the mezzanines are the main functional units. The minimal functionality provided by the “big” base board is simply the interconnectivity of these new, more powerful cards. Instead of CPUs with piggyback I/Os, now the concept is I/Os with processing capability on AdvancedMCs. Components evolving quickly with more functionality can now be located on replaceable units, not on large, hard-to-replace base boards. Generic backplanes with carrier blades managed by generic frameworks can outlive multiple generations of silicon when implemented on AdvancedMCs. Whether using Advanced Telecom Computing Architecture (AdvancedTCA), MicroTCA, or blade server shelves, you can now bring a new level of functionality to your system without the expensive forklift upgrades of the traditional telco industry.

## The right scale

Silicon functionality has been increasing according to Moore's Law. At the same time, the physical size of chips remains small, due in part to advances in the packaging of small ball grid arrays. These forces combine to make it possible to design highly functional modules in an AdvancedMC footprint. It's possible to fit just the right number of communication elements on an AdvancedMC, either for the access plane or the edge plane of the network. If too many elements are packaged in an FRU, the point of failure becomes a concern. However, if too few elements are packaged together, the cost of interconnects becomes a concern. For these reasons, a typical AdvancedTCA blade is too big to serve as an FRU, while AdvancedMCs are just the right size.

Manufacturing organizations also prefer multiple, smaller, printed circuit boards versus larger boards such as AdvancedTCA. Using high volumes of smaller boards:

- Reduces assembly prices
- Simplifies inventory management
- Improves manufacturing yields
- Makes assembly corrections simpler
- Reduces packaging and shipping costs

## Minimal premium for high availability

One of the significant advantages to building systems using AdvancedMCs rather than full AdvancedTCA blades is the ability to create inexpensive, highly available systems. To illustrate the cost advantage, consider building a redundant 1,536-port video gateway system using full-size AdvancedTCA blades. Rough calculations indicate the need for 2:1 redundancy for AdvancedTCA blades and 6:2 redundancies for AdvancedMCs. Under reasonable assumptions you can derive that the AdvancedTCA system implementation is more than 50 percent more expensive than the equivalent AdvancedMC implementation, as illustrated in Figure 1. Of course,

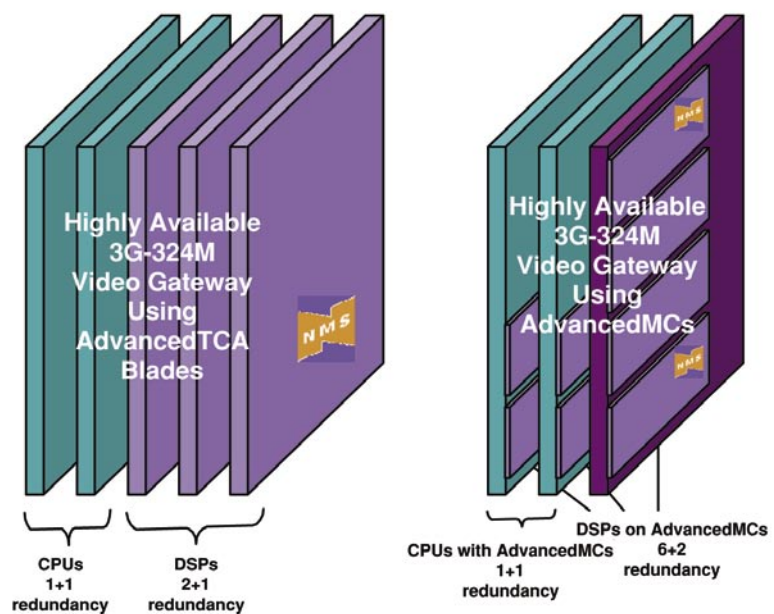


Figure 1

such a cost difference becomes smaller if the desired port size is a multiple of the ports that can fit on an AdvancedTCA blade, and that cost difference eventually diminishes as the size of the system becomes very large.

### Packaging flexibility

The cost of common equipment is often a factor in choosing the best packaging solution for a telecom system. Given that shelves require a processing unit – and most likely two for high availability, the minimum system requires at least two AdvancedTCA slots for CPUs. For an entry-level system supporting market trials of a new service, an AdvancedMC with I/O trunks can be added on the same CPUs without occupying another slot. Alternatively, system designers can consider replacing full-blade CPUs with their AdvancedMC counterparts, located on one or two carrier blades. Additional AdvancedMC slots can be used for peripheral I/O elements for early-stage capacity expansion. The four standardized sizes of AdvancedMCs (half- or full-height and single- or double-width) provide further flexibility for expansion to CPUs and carrier blades.

Just liberate your thinking for a moment to other application spaces, such as IT blade servers or remote access servers, where the cost of entry is important and graceful scalability is critical, and you'll find even more examples for which using AdvancedMCs provides a packaging advantage.

### Panels for access

As AdvancedMCs become the main functional unit, they require onboard I/O as well as external connectivity to minimize system-level connector transitions. This, plus the need for mechanical handling of FRU insertion and extraction,

led to a nice AdvancedMC front-panel design. And for the hardcore 23-inch rack designers in North America, the option remains to connect T1 lines to the back of the shelf using Rear Transition Modules, feeding the carrier blades and the hosted AdvancedMCs.

### Management inheritance

The PICMG group spent significant time on the Intelligent Platform Management Interface (IPMI) subsystem used in AdvancedTCA shelves. It represents a well designed physical and logical management layer including:

- Dual interconnects for high availability
- Payload power management to control safe amperage consumption
- Payload watch-dog and reset features for reliable operation
- Temperature monitoring to avoid thermal runaways

AdvancedMCs leverage the previous design by extending IPMI's benefits to mezzanine components. The same framework used for an AdvancedTCA chassis is used to provide negotiated power and thermal management to the granularity of AdvancedMCs.

### Natural interconnects

The base and fabric switching of the AdvancedTCA backplanes have been extended naturally to the AdvancedMCs. You can now access a large bandwidth of streaming data without physical conversion to parallel buses. There is no need to slow down data rates due to skew concerns of buses and their respective latches. The new advanced silicon of CPUs, NPUs, and DSPs can now be packed on mezzanine cards with minimal glue logic. Switching of data streams is now much

easier and is typically embedded in the same glue logic.

### Clock is ticking

Most of us remember the MVIP, SCSA, and H.100 days in which designers needed special help with sensitive clock circuits and PLLs. This accumulated experience lead to the inclusion of TDM clocking in AdvancedTCA, which is naturally inherited in AdvancedMC designs. No more complex clock extractions or clock edge alignments every time a clock has to travel from one module to another.

According to a Crystal Cube Consulting report last year, the AdvancedMC market is estimated to become around \$8 billion by 2008. Marketers say, "Interesting times we live in." Engineers say, "The good designs are just around the corner." At the end of the day, good designs, put to use in major markets, are likely to cause industry disruptions. AdvancedMCs are conceived thoughtfully and will lead to cost-efficient system designs and target large and growing markets.

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