

As a kid growing up, I have vivid memories of watching Tarzan movies after the Saturday morning cartoons were over. We only had three channels, so we didn't waste a lot of time channel surfing. You watched what was on and you liked it. In about half of those Tarzan movies, you had the bumbling man wearing a French pith helmet or topi. This poor soul would be hacking his way through the jungle with an oversized, extremely sharp machete. Unknowingly, he was facing almost certain death via a lion or some other jungle-induced demise. A couple of badly sequenced movie cuts later and topi man would be dead. A required extermination, so a vine-swinging Tarzan could rescue the completely bewildered people who had been following the recently dispatched soul. As a kid, I remember feeling sorry for this man. He did all that work, and the people following him did nothing, yet his reward was death.

The AdvancedTCA specification is a jungle filled with the words shall, should, and may. It is also a morass of things that I like to call gotchas. These gotchas are certainly not problems with the AdvancedTCA specification, but they are areas where mistakes are easily made and problems are often underestimated. Therefore, I will now don my helmet, raise my machete, and attempt to cut through some of the more obvious gotchas that are ahead in the AdvancedTCA jungle on our path to the prosperous Land of Revenue.

Welcome to the jungle (of AdvancedTCA gotchas)

By Joe McDevitt

As we near the edge of the jungle, a great thorny thicket called electronic keying exists. Since AdvancedTCA (Figure 1) is a fabric-agnostic architecture, an interesting set of design requirements arises. A major one is the relative ease in which dissimilar fabric technologies could be inadvertently connected. In the non-AdvancedTCA world, differing cables and connectors help to alleviate the issues of putting dissimilar fabrics on to the same physical interface. In AdvancedTCA, those cables are replaced with a backplane featuring common connectors; therefore, a new method for preventing accidental fabric interconnection is needed.

The AdvancedTCA specification relies on electronic keying, or E-keying, to prevent these issues. The Shelf Manager knows which slot each board is in, each board's fabric, and the backplane connectivity, so it is an arbiter among the boards and determines which boards' fabric ports can be turned on. The Shelf Manager tells a board to turn off its fabric ports when dissimilarity is found, and that board must disable transmit functionality on its fabric ports.

The *gotcha* lies in how this disabling is accomplished. On some AdvancedTCA boards that ship with a software application, E-keying support can be easily assured. On generic AdvancedTCA boards where no such application exists, who has the ultimate responsibility to disable transmit on the fabric? If chip vendors do not provide a way to disable the transmit SERDES on their chips, then how can handcuffed engineers meet the requirements of E-keying while maintaining the eye pattern requirements of the fabric? E-keying issues are not insurmountable, but like going through a thorny thicket, even armed with a machete, getting through the issues will involve torturous tasks.

PEM solutions

Passing through the thicket, we spot a well-worn path. A little farther down the



Figure 1

path, we notice a tree with a large hole dug into the side. The edges around the hole make it clear this is the spider hole for the venomous hold-up capacitor spider. The hold-up capacitor spider will attack anything passing by the hole and bite it, leaving a pain that will last until the next board revision. But if the hole is seen, the bite is easily avoidable. The hold-up capacitor requirement is likely an old *gotcha*. Many Power Entry Module (PEM) solutions exist today that address specific needs for AdvancedTCA and all of them recognize the need for a hold-up capacitor.

In the early days of AdvancedTCA, these targeted solutions didn't exist, and a few words buried deeply in the specification, almost hidden, drove the hold-up requirement. Years ago, some prototype boards at early AIW conferences could be seen without the required capacitance. Today, the *gotcha* has likely been reduced to the physical size of the capacitance needed. The application schematics for targeted PEM solutions certainly show the hold-up cap, but the size of the schematic symbol almost never does justice to its physical size.

Engineers who are accustomed to specifying components for digital circuits can lose sight of the fact that this is a huge capacitor. This capacitor can be measured easily in square inches of board space, and the layout engineer is sure to feel some of the bite anyway. Dividing it up helps, but it is still lost board real estate. Carefully

look for the hold-up capacitor spider hole and beware its venomous bite; once seen, it is easy to avoid.

Our jungle path comes to an intersection and diverges into many roads. Each road is different, and all seem to promise dangerous obstacles, both seen and unseen. A granite obelisk in the middle of the intersection has these words engraved:

“Choose a handle solution.”

Like the hold-up capacitor, this may also be a *gotcha* that has passed its time. However, Diversified Technology, Inc. (DTI) has used no less than 11 different handle solutions, covering the almost four years and 10 unique AdvancedTCA products that have been developed since DTI's first AdvancedTCA prototype. Many of those changes obviously occurred because of the newness of AdvancedTCA, and the industry dealt with problems no one foresaw along the way. But the *gotcha* of market consolidation may remain. With the breadth of handle solutions available today, which ones will last throughout the planned length of a company's AdvancedTCA deployment is unclear. With no electrical switch locations or switch types defined in the specification, this seemingly adds a requirement of signed contracts from sole source handle vendors for assurance of five-year availability.

AdvancedMC sites may or may not be another dangerous obstacle that could force us all the way back to the granite obelisk, where we must choose our path again.

The labyrinth

After we clear the handle obstacle course, our path leads to a small grassy knoll. Here before us lies an old stone walled labyrinth, thick with growing vegetation and creepy things inside. From this vantage point, it is not clear which path is the correct one through the labyrinth, but obvious wrong ones can be seen. As we approach the massive stone walls, a simple sign above the entrance says “Testing.” All testing in AdvancedTCA will be different. From the first simple stress tests on a prototype to final production line testing, AdvancedTCA testing represents a set of obstacles and decisions that require some preplanning. Consider



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a simple Ethernet traffic generator and exerciser. Nearly all these test devices assume a BASE-T or RJ-45 type of Ethernet connection. With AdvancedTCA base fabric, this is a simple conversion matter. However, the problem is much more difficult on the expansion fabric of AdvancedTCA 3.1, because it uses BASE-BX; this means that an Ethernet PHY is required to interface to existing network equipment. The testing problem doesn't end with prototypes, either: Production line testing may need specialized backplanes with nontrivial development. No company is immune, and they all will have to plot their own course through the testing labyrinth. As with a maze, the more times one goes through the testing problem, the easier it becomes, but some cautious planning from the grassy knoll before entering the labyrinth can always save a few wrong turns.

Upon exiting the testing labyrinth, we spot the indigenous Marketing tribe dancing around a fire, seeking supreme guidance from their requirements idol. With CompactPCI and PICMG 1.0, space was always the deciding factor on which marketing requirements would make it onto a board. The AdvancedTCA specification limits a board to 200 W at the entry point. With modern digital silicon, -48 V at the

entry point must be converted to a more usable voltage. If the front-end conversion of this entry voltage is 90 percent efficient, then only 180 W of power remains. That is not much power with today's digital silicon. While this is sufficient power to handle processors and certain memory sizes, the number of AdvancedMCs and other devices on boards can become an issue. Usable power, not historical space issues, can quickly limit the final feature set of a board. Ultimately, this specification requirement alone will reduce the differentiation of some higher-level boards. Power limitations will simply not allow any differentiation. The market will be driven even closer to *form follows function* design. For the AdvancedTCA customer, beware of boards that are functionally the same but have apparent radical differences; for example, the number of AdvancedMC sites. For my hardware brethren, beware of those marketing natives. They will be restless when they see large amounts of green PCB apparently going unused, as this offends their requirements idol.

We will rest now and set up camp next to the indigenous Marketing tribe. A few guards will be posted because I'm not sure if this Marketing tribe is cannibalistic or not. I think we have appeased them with a

time to market trinket, so it should be safe. We are closer to our final destination, the Land of Revenue. After our guided tour through a portion of the AdvancedTCA specification's jungle of *gotchas*, maybe now your path to production is slightly clearer for your design. Perhaps you've concluded that the author of this article is really just that bumbling man in the helmet. In closing, I leave you with a few words of caution. If you are one of those unprepared, bewildered people following me, Tarzan was a fictitious hero, and there aren't any swinging vines in the AdvancedTCA specification. Hey, look! On the edge of our campsite is the rare NEBS Compliance lion. Man, he looks mad. 🌐



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