Published in Internet Telephony, October 2000

CompactPCI the Foundation:

An Introduction to Open High-Availability Solutions for Telecom Applications

By Jon Kenton – Telecom Marketing Manager Motorola Computer Group

Why High Availability?

"Who cares?" you ask. Ultimately, YOU DO.

With the incredible pace of change in the telecom industry, new technologies are being added to our vocabulary every day. WAP, VoIP and a host of others. It seems a far cry from the days when the telephone was our only interface to the telecom network. We all expect there to be a dial tone when we lift up the handset. The older switched-telephone networks were designed to provide service 24 hours a day, 365 days a year … high availability has been there from the start.

Yet, the Internet's explosive growth brought a revolution that surprised many, including the planners and designers for the network operators. Many years were spent shoe horning data on to the network's circuit-switched fabric. But what started as a revolution has become an evolution into a packet switched network that is designed to move Internet traffic as efficiently as possible.

Having piggybacked data onto the voice network for so long, it didn't take a big leap to look at how to piggyback voice onto the data networks. This has lead to many opportunities in which new companies have set up operations as voice providers when they own only a packet-switched data infrastructure and build interconnections into the conventional phone networks. Service revenues from VoIP have been small by comparison to existing services but are forecast to exceed the $5 billion mark by 2003. VoIP gateways, which are responsible for the interconnect of the old and new networks, have a CAGR approaching 40% according to the MMTA (MultiMedia Telecommunications Association).

As we begin to rely on these new networks in our business and personal lives, we won't tolerate unavailability or outages. We have come to expect infinite dial tone and now infinite data tone.

CompactPCI = Open Systems
Today's service providers and operators demand a flexibility that requires a different approach. Distributed, open-standard, IP digital networks that provide new feature-rich, affordable, easy-to-access and value-added services require underlying technologies that provide unprecedented connectivity, reliability, availability, scalability and serviceability.

For equipment providers, time to market is now a major facet in staying competitive and open standards hold the key to being able to respond quickly to market demands. Features and functions of the overall solution are the basis for decisions made by operators and while hardware design is still a factor, the bus or processor that powers a switch or gateway matters much less than the speed at which they can bring services online and start billing customers.

CompactPCI is now the open standard of choice for new infrastructure designs. Resources previously deployed on hardware designs are now being focused on software value-add. As an open standard, CompactPCI brings many benefits.

- Standard processor, chassis and communications hardware are readily available "off-the-shelf". This, along with industry-standard operating environments and software, help to dramatically cut development times.
- Without the need to train on proprietary architectures, staffing becomes easier due to an increased knowledge pool.
- Vendor competition is promoted by open standards, ultimately speeding innovation & reducing prices.
- Competition also ensures upgrade paths to the latest chipsets and technologies.
- Single sourcing issues are made easier, as products may be purchased from a range of suppliers.

The attributes of CompactPCI from a technology perspective reflect the needs of the telecom community. The PCI bus was well established and the associated wealth of slot cards prevalent with PCs was attractive. However, there were limitations that made it difficult to safely include them within designs requiring high levels of availability and reliability. PCI's physical shortfalls were addressed by combining IEEE 1101 mechanical standards with the PCI electrical specification creating CompactPCI, with the robustness required for carrier-grade infrastructure deployment. CompactPCI had high availability in mind from the get go, as evidenced by a key feature -- the hot swap specification -- that defines three models: basic, full and high availability.

Hot Swap and High Availability
The ability to add and remove components from a live system, reducing system downtime is a fundamental for high availability. Shutting down and powering off a system prior to the addition, removal or replacement of system boards and components causes unacceptable levels of unavailability. Systems with hot

swap capabilities range in their ability to reduce this downtime from hours of system unavailability per year to less than five minutes per year. Predictably, as the availability of a system increases, so too, does the complexity of the hardware and software of that system.

The three levels of hot swap capabilities defined by PICMG build upon each other, increasing system availability at each step.

Basic hot swap establishes the fundamental capability to add and remove boards from an active system. Staged power pins and control circuitry ensure that the physical insertion and removal of a board will not cause bus glitches or damage the component itself. At the basic level, operator intervention is required to control the software ensuring it is in the correct state for insertion or removal.

Full hot swap extends the basic model with the addition of hardware and software enabling the system to be notified automatically of a board's removal or insertion. The operating system controls the configuration without operator direction, reducing opportunities for error and the time required to perform hot swap activity. A microswitch is added to the ejector handle of the CompactPCI® board. Activation of the microswitch upon removal generates an interrupt (ENUM). The operating system identifies the board that is about to be removed and gracefully un-configures it. The operator is notified that it is safe to complete the removal of the board when an LED is illuminated on the face of the board. The microswitch activates the reverse process when a new board is inserted, ultimately the LED turns off to indicate the completion of configuration and that the board has been accepted into the system.

High availability systems significantly increase the levels of control the operating environment has over the total chassis. APIs and middleware (user level software outside the O/S) are added, allowing a greater granularity of management and an interface for the user applications themselves. In a high-availability system, the state of chassis components can be further controlled via the addition of the hot swap controller (HSC). Motorola has developed such an HSC providing bus and slot control, as well as chassis alarm and status registers and is itself hot swappable. Individual slots can literally be turned on and off through software control providing significant benefits in fault isolation.

Software and Hardware Working Together

Hardware architectures such as CompactPCI can create the foundation for high availability, but to build a truly highly available solution requires further hardware considerations such as redundancy schemes and a broader, holistic approach. Three major building blocks working in cooperation are needed to build such a solution - the hardware, the operating environment and ultimately the application itself. Details of these components will be explored further in future articles.

High availability is a real requirement and we all want it, whether we know it or not. The speed at which we -- as end users -- are devouring network bandwidth and subscribing to new services continues to increase, as does our dependency on them. CompactPCI offers developers a step-up, providing the platform for their applications needing to offer high-availability attributes, as well as meeting time to market goals.

Optional Product Example:
There a number of CompactPCI-based offerings on the market today that have pieces of this puzzle. Integrating these separate elements is the key to creating the all-important time-to-market advantage. At this time, we believe Motorola Computer Group's configurable high-availability platforms are possibly the only CompactPCI solution proving capable of delivering these levels of availability. The CPX8000 family of CompactPCI® systems, when combined with our advanced HA software environments such as HA-Linux, offer designers of critical telecom infrastructure the integrated base on which they can build their end applications.