The converged network: A building blocks approach

By Steven A. Roldan

For years, the convergence of voice and data over a single network has been spoken of as an event that will revolutionize the telecommunications landscape. As the previously separate industries meld into one, two separate groups of vendors, including embedded systems suppliers, stand to benefit from the larger market for their products. This convergence into a single telecommunications landscape presents solid opportunities for suppliers to offer standards-based platforms that deliver reliability, scalability, and interoperability to network equipment manufacturers.

The converged network strategy is simple – one network running everything. Achieving it, however, can be a daunting task. Today's IP infrastructure is essentially an extensive router-based network, encompassing a vast number of inexpensive resources and interconnecting an immense number of IP addresses.

Because the IP network was built originally for data and not voice, the quality of service requirements are quite different from those of the reliable public switched telephone network (PSTN). Data traffic, for example, is not nearly as time-sensitive as voice traffic. When speaking on a phone, if you don't have an eight millisecond sample rate, voice quality degrades noticeably. But when sending an e-mail, it doesn't much matter whether the message gets there in eight milliseconds, eight seconds or even eight minutes, as long as it arrives.

The telecommunications industry in general has given much thought about how to internetwork IP and PSTN infrastructures. All involved realize that the result will be a foundation for next-generation services. Consideration has been given to issues such as:

- How will a VoIP user access 911 services without having to physically dial 911?
- Where are the convergence points?
- What are the infrastructure devices?
- How can the converged network be built combining features of intelligent network-type reliability and dial tone-like QoS?

Enter the PCI Industrial Computer Manufacturers Group (PICMG). A consortium of more than 650 companies, including industry leaders like Compaq, DEC, Force Computers, HP, and IBM. The group establishes common specifications for embedded computers such as those utilized in VoIP applications. The group's latest objective is to establish a common, open systems standard for a redundant, switched 10/100/1000 Ethernet network within a CompactPCI chassis. The proposed Compact Packet Switching Backplane standard is intended to complement, not replace, CompactPCI. It has evolved from the confluence of new IP-based telephony applications, the growing popularity of CompactPCI, and the fact that Ethernet switching has become the dominant LAN topology in the enterprise marketplace. It blends the robustness, reliability, and hot-swap capabilities inherent in CompactPCI architecture with the ubiquity of Ethernet – yielding an architecture better suited for high availability and next-generation IP network applications.

For the end-user, this translates into a real time telephony solution that runs on an existing physical switch, requiring only software for implementation. As currently proposed, CompactPCI/PSB provides for scalability in density, reliability, cost, and performance. Specifically, the draft standard provides support for:

- 21 slot backplanes
- Multiple enclosures forming large "virtual" backplanes
- Full backplane redundancy down to the slot level
- Scalable bit rate (10/100/1000/2000 Mbits) per slot
- Selectable chassis bandwidths of between 200 Mbits and 40 Gigabits
- Link layer flow control
- QoS/CoS support

Essentially, this would create an Embedded System Area Network (ESAN) in which a packet-based Ethernet switching architecture is layered on top of CompactPCI. The resulting system would leverage the pervasiveness of Ethernet/IP and push network technology down into the chassis.

Force Computers, an active PICMG participant since 1995, has leveraged its experience in working with premier telecom and datacom customers to develop a *Building Block* concept to deliver standards-based products for the emerging converged network. This approach enables greater scalability and flexibility while improving time-to-market of the network equipment manufacturer's solutions.

The off-the-shelf, board and system level building block solutions from Force include NEBS-tested, HA cluster, CompactPCI, and multimode Packet Switching Backplane (PSB) configurations. Central to these solutions is Force's Centellis product line, which is

optimized for carrier-grade Central Office operations as well as telecomm applications such as Customer Premise Equipment.

For merged voice and data on a Compact Packet Switch Backplane, Force's Centellis C021000 family offers redundant Ethernet switch technology that results in highly available communications functionality that developers can quickly and easily implement in systems. And, because they're housed in NEBS Level 3 design chassis, the Centellis CO 21000 Compact PSB family capably delivers 99.999% (five nines) availability for mission critical, central office applications. Figure 1 shows the 12U design.

Figure 1

Among the many applications in which we can expect to see Compact PSB platforms such as these are:

Signaling Gateway

A Signaling Gateway is a Central Office-based NEBS level 3 compliant system that converts SS7 signaling protocol to SigTran signaling protocol, thus translating the control information from the PSTN to the IP network and vice versa. The SS7 interfaces are DS-1 (E1/T1) running MTP-1/-2 lower layers whereas the SigTran interface is an IP interface to the IP data network.

The NEBS Level 3 tested Force Centellis CO 21542 is pre-configured with a SPARC board and Solaris OS, the most widely used operating system for SS7 applications. Multiple SPARC/PMC board configurations can be easily added for more performance, link-set redundancy and high availability.

2.5 and 3G Base Station Controller

The Base Station Controller connects to the Mobile Switching Center via DS-1/SS7 and to the Base Transceiver Station via DS-1/LAPD in 2G and via ATM in 3G environments. Typically, this type of configuration is implemented with a mix of UNIX and RTOS CPUs. Because Force's Centellis CO 21542 uses the PICMG open systems draft specification as a development platform, it can be easily configured with UNIX and RTOS CPU boards in the same system (see Figure 1). Further, the drivers for interboard communication in this system are all IP.

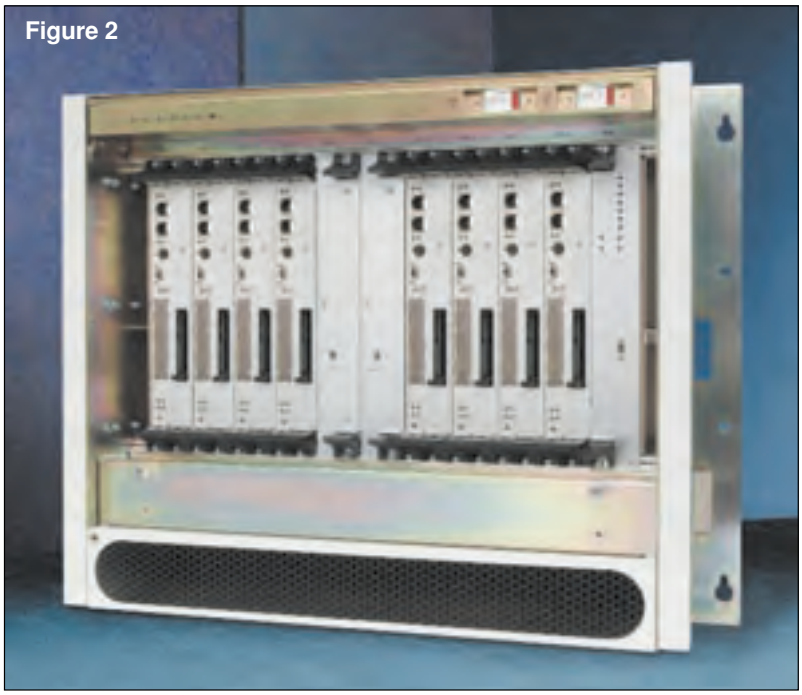
Voice over IP concentrators

Requirements for Media Gateways in general and VoIP in particular are for IP connectivity, PSTN connectivity, VoIP codes, control protocols and especially scalability and upgradability. Force's Centellis CO 21542 meets and exceeds these requirements, providing up to 2 Gbit/sec Ethernet IP connectivity per system, and engineered to support over 1000 VoIP channels per slot. With DSP resource cards being introduced for Compact PSB systems, all the building blocks required for a truly convergent network are present. DSP resource cards typically have Quad E1 (or five T1) interfaces for PSTN connectivity and can access up to 120 uncompressed voice channels. With the combination of PSTN interface and DSP gathered on the same board, the only interface is IP to the backplane, which allows for easy scalability and live upgrade of systems via hot swap and remote management.

"While there are proprietary redundant Ethernet products on the market, Force's platforms are the first – and only – Compact Packet-Switching Backplane solutions that take an open systems approach," said Steve Roldan, Force director of product management, Standard & Telecom Platforms. "Combined with their highly available NEBS Level 3 design, communications equipment developers will find these platforms offer very easy system integration, enabling users to leverage their SPARC/Solaris, Linux, or Windows NT investments."

Companies developing products for the converged network and Compact PSBs view it as a complement to – not a replacement for – CompactPCI. Force, for instance, continues to introduce standard, application ready, building block products for the emerging voice and data network. One recent addition to the company's Centellis CO family is the CO 28000 shown in Figure 2, an

Figure 2



ETSI/NEBS Level 3 system that supports up to eight independent servers in a 10U Footprint. The system runs Windows NT, VxWorks, or Linux operating systems for Network Management Applications. Additionally, the Force Centellis CO 16543 is a SPARC/Solaris based, NEBS Level 3, dual-segment system that can house up to 14 computer telephony cards in a single shelf.

Ultimately, convergence is about simplicity and control. By building common platforms and protocols, the intent is to make communications between people, devices, and applications more fluid and efficient. In the short term, life will be more complicated with the integration of the data and voice ways of life. But by applying a Building Blocks approach–such as the method recommended by Force Computers – to the converged voice and data network, users will benefit from easier, more complete communication.

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