CompactPCI -- The Nuts and Bolts of Next-Gen CT

Richard "Zippy" Grigonis - June 14, 2000

The latest results are in. "In terms of recent design wins in the telecom arena, most fault resilient computer business is going to CompactPCI," says Jim Medeiros, chairman of the CompactPCI Core Spec Committee and product marketing manager at Ziatech (San Luis Obispo, CA - 805-541-0488, www.ziatech.com) the company that got the cPCI ball rolling back in the 1990s.

"In terms of shipments, we're seeing an increase happen," says Medeiros. "We grew quite significantly in 1999, over 50%, and that was almost exclusively our CompactPCI business. So we're certainly seeing cPCI start to take off, but it's been taking a while for it to happen."

We at CT Magazine have been extolling the wonders of CompactPCI (cPCI) for several years now. cPCI takes the best features of VME (the ruggedized Eurocard/Eurorack packaging) and marries it with a very popular technology, the Peripheral Component Interconnect (PCI), an inexpensive, mass-produced bus and board standard for which a zillion suppliers compete at low margins.

The formulators of cPCI then added a bunch of other things to sweeten the pot, such as the ability to hot-swap boards, and to have the boards interoperate thanks to the ECTF's H.110 version of the H.100 CT Bus. Since cPCI is electrically similar to regular PCI, there will always be a preponderance of Intel-based solutions for cPCI vs. PowerPC and SPARC platform solutions.

Of course, cPCI's development was not all sweetness and light. VME engineers love to trash cPCI for various reasons (see this month's Nitty Gritty column). And it's taken a while to get the cPCI specs nailed down. One of the challenges faced was taking the PCI bus architecture, which wasn't designed for hot-swap or high availability, and making it ruggedized.

Adding value to a known architecture such as PCI is a different approach than just herding a bunch of engineers into a room and getting them to design a "perfect bus" from the ground up, which is what happened in the case of the failed architecture called FutureBus. FutureBus was a fun utopian vision of what a computer bus should be, and it even held a lot of promise. But in reality, FutureBus never convinced a critical mass of suppliers, probably because such totally new concepts always start out as merely concepts. There's just too much time between the initial announcement of a new concept and the actual deployment of systems based on it.
This is why, in the case of cPCI, the engineers tried to bypass that problem by taking a popular architecture (PCI) already in existence and morphing it over time into a solution (cPCI) with the characteristics needed to succeed in its intended higher-end market. This ultimately involves taking a large existing PCI supplier base and converting it over, gradually, to cPCI - using slow, steady persuasion rather than trying to convince folks to take a single huge step into brand new technology, something that's very difficult to do.

Why, it's even easy to design a board using PCI circuitry since there are scads of tools, many custom Application Specific Integrated Chips (ASICs) for the PCI environment, and other such readily available items that make it easier to design and build a PCI based board than, say, a VME bus board.

"The other thing to keep in mind is that PCI has become a near-universal standard at the local bus level," says Ziatech's Medeiros. "At Ziatech, we had the same problem when designing boards for our older STD 32 architecture. We were almost forced to use PCI because of all the chipsets that are PCI-compliant, and in order to be able to use them we had to create a layer of logic circuitry to convert signals from PCI to our STD 32 architecture. The same thing is true with VME. If you're going to build a VME CPU board you're going to have PCI lurking somewhere in your solution. It's just hard to avoid. And to hook up a VME bus and a local PCI bus, VME engineers need to devise bridges and generic chips. You may be able to eliminate PCI from your design, but these days it's pretty hard to build something that doesn't have PCI in it at all."

Adding a layer of logic to convert back to an older bus such as SDT 32 or VME is not all bad, since such a scheme allows a system to be backward compatible to the earlier, legacy technology. But it's rough to expect consumers of such a product to pay a higher purchase price for additional pieces of silicon (such as VME to PCI bridging chips) that they may not even know are running in the background anyway. It's difficult for VME CPU board vendors to offer a cheaper solution than cPCI, because they have to burden their solution with PCI/VME translation logic. CompactPCI has less cost and complexity. And any time you have fewer transistors in the design, it's going to improve your overall reliability.

VME COSTS MAY DROP

At this point in the argument, the VME camp counters by saying that VME component pricing was greater, at one time, only because VME vendors were used to higher margins - having the military as a customer, for example, can be quite lucrative. After all, VME and CompactPCI look very much alike and can be built on similar assembly lines. Given changing markets and new opportunities, could the price of VME come down enough to give cPCI a run for its money? Are cPCI cost advantages as great as claimed?

It's true that you can go to your friendly local computer store and buy a PCI parallel port card for $30, while a VME bus version can cost you $300 or more. Therefore, everybody thought cPCI was going to be really cheap because it has inexpensive PCI bus interface parts, but the reality is that board prices aren't as closely linked to parts-cost as they are to economies of scale. Anybody can make a $30 PCI board if they send it to China and have 100,000 units a month made, which actually happens. But by the same token, if you build 100,000 VME cards a month they'll come down in price too.
What it all boils down to is that, given similar production volumes, CompactPCI and VME cards can be sold at pretty much the same price, with a slight advantage in cPCI's favor. To get the kind of savings from economy of scale that you'd expect from a derivative of mass-market PCI such as cPCI, you need real high volume production.

This is why cPCI makers targeted telecom right from the beginning. Telecom companies are capable of acquiring a particular chassis or board in tremendous volumes, tens or hundreds of thousands or more pieces per year, while a "large" sale of a particular VME board for industry or the military can be 1,000 or fewer pieces per year. It thus may come as a surprise that most non-telecom companies (and even some smaller telecom companies) that buy VME or cPCI systems are buying fewer than 1,000 systems a year. In fact, the vast majority are buying much less than that, just a few hundred systems or fewer. Of course, when you add up all of these little guys, you get "the big market."

In any case, it was felt that the large-volume production of cPCI boards and chassis needed to satify telecom's insatiable appetite would keep cPCI components far less expensive than VME boards.

In this respect, CompactPCI came along at exactly the right time, and cPCI promoters were very lucky in many ways. CompactPCI was introduced at the moment when telecom was being deregulated and all sorts of new and exciting pieces of computer equipment were being evaluated in terms of reworking the world's telecom infrastructure. Many people were using comparatively unreliable cheap PCs and lackluster rackmounts for telephony applications, and suffering because of it. CompactPCI garnered a fair amount of business from those guys, becoming an alternative solution, not only to the PC, but to VME and even conventional PCI-bus rackmount machines.

VME has been around for a long time - since 1981. But people looked at it in "Internet time" and squawked that "it's more than three years old so it must be obsolete!" In fact, VME works just fine.

"If things start happening to your bus, if you're trying to defend why your architecture is better than the new upstart, then once you're in that position, you're toast," says Medeiros. "You can't easily undo a perception like that."

However, some VME aficionados ironically point out that although cPCI is indeed gaining popularity with large telecom companies, these companies tend to build much of their own equipment. Did you know that the largest user of power supplies in the U.S. is Lucent Technologies? And guess who builds many of the power supplies for them? Lucent, that's who. Various divisions of companies like Motorola and Siemens are big buyers of their own company's products. They want to keep their factories busy and they actually make more money that way.

"As many operations and manufacturing specialists will tell you, the breakpoint, or the point at which it makes sense to bring a board's manufacture in-house, is somewhere between 700 and 1,000 pieces a year," says Wade Peterson, author of The VME Handbook and president of Silicore Corp. (Corcoran, MN - 612-478-3567, www.silicore.net), a company that builds very high density RISC microcontroller cores and "system-on-a-chip" devices.

Peterson says that when the real heavyweights in the industry (the Lucents, Ericssons, etc.) need a
small number of a certain type of board ("stray dog and cat boards," as he calls them) they just go out and buy them. "But if these companies need half a million boards, they'll build the boards themselves or farm out the manufacture to companies in places like China," says Peterson.

So if you're buying more than 1,000 boards a year you can afford to develop your own product and bring it to market by just building it yourself. You may even contract it out - you just go out and find a contract manufacturer. It’s done all the time and it's still cheaper than a commercial product. This is because when you buy a commercial board level product you're also paying for warranty costs, documentation costs, the board manufacturer's overhead, their sales costs, etc.

"Typically, when a manufacturer is building small quantities of a board, the rule of thumb is to take the parts cost and multiply it by five and that's the board's end selling cost," says Peterson.

If a system is needed in a couple of months, of course, you've got to pick up a catalog and order what you need. But even here, a company will develop their initial product, get it going, and then value engineer it.

"I have a client who's a major copy machine company and they're putting board-level products in their copy machines," says Peterson. "Their volumes are so high that they'll get the first units out and try them, but then they're also busy developing their own components to build the product. Maybe they ship their first 500 systems with commercial boards until they get their own product into production. Then they switch over to their own boards. That's always been the way the board level industry has been and perhaps always will be."

So the decision to build your own product should strictly be the cut-and-dried results of an engineering economy equation. However, things are not quite that simple.

"Companies have greater time-to-market pressures than ever before, and thanks to the newest technology and production techniques, commercial board makers have become nearly as flexible as contract manufacturers when establishing close working relationships with volume purchasers," says Peter H. Zackin, vice president of sales for Cyclone Microsystems (New Haven, CT - 203-78-5536, www.cyclone.com).

"We're also stealing a lot of market from what might otherwise have been designed and built in a proprietary way," says Ziatech's Medeiros. "People used to build their own equipment from the ground up. CompactPCI has allowed an easier way of doing things. We see a lot of our customers whose initial architectures were proprietary and they got tired of having to rip things out and start from scratch every few years, and they needed to go to a more modular architecture primarily because of time-to-market pressures. They couldn't afford to take 18 months to design a piece of equipment anymore, they needed it in six to eight or maybe twelve months max. Severe time-to-market pressure favors a standard, well-known architecture such as CompactPCI. To use a playing card analogy, it's a Full House vs. a couple of pairs."

Even Wade Peterson agrees that "compactPCI does have a future. What it comes down to is this: There will always be the need for a front-loading PC architecture. Front loading boards are strictly a
mechanical issue. If you want to fix a PC that's running a large telecom application or a robotic assembly line in an automobile plant and nothing is working, you've got to fix things as soon as possible, since you're losing thousands of dollars a minute. You don't want to be pulling rackmounts (or entire racks) out and fiddling around with conventional PCs, you want a front-loadable card that can be swapped out immediately. At Control Data they used to call that 'Easter egging' since you'd have to find the Easter egg, or faulty board. Live insertion or 'hot swap' is another feature of interest to telcos. Ironically, many real-time systems don't rely on hot swap. People just want a convenient way to fix things."

Medeiros concludes with: "Simpler solutions, higher performance, hot-swappability, the huge number of programmers familiar with the Intel architecture, and give the engineers what they want - which is access to PCI technology directly in a raw form without bridges and extra logic layers - that's what CompactPCI is all about."

Here's a look at the increasingly large harvest of compactPCI products.

ACULAB

Acub's (Panama City, FL - 850-763-9281, www.aculab.com) CompactPCI Prosody board is the impressive cPCI embodiment of their universal-port Prosody technology. It's powered by four Analog Devices' SHARC floating-point DSPs. These let Prosody play a range of third-party (not to mention Acub's own) speech-recognition and text-to-speech algorithms, as well as call processing, conferencing, record and playback, and fax. Amazingly, 17 of Prosody's most popular and useful algorithms can be downloaded free from Aculab's website.

The CompactPCI version of Prosody is a one-card, one-slot solution with 240 channels of speech and 120 T-1/E-1 channels (five T-spans) in a "hot-swap" package. A single, generic API reduces the learning curve of developers looking to integrate a range of Aculab products.

ADVANTECH

Advantech Technologies' (San Diego, CA - 858-623-0838, www.advantech.com/ic) new Computer Telephony Division develops and markets products for IT managers such as efficient, "five-nines" computers for PC-PBXs, data centers, ISP backbones, clustered configurations, and server farms. Initial offerings include a Server and RAID all-in-one product line (the SPC series); a CompactPCI modular PC server product line (the cPCI series); and a Slim network server (the e-Server series). A variety of CPU cards are also available for these, powered by Pentium III/II, Celeron, and Pentium MMX processors.

Focusing now on their cPCI offerings, Advantech's MIC-3033/5 five-slot 19" rackmount cPCI chassis can pack five, 6U high, horizontally-inserted CompactPCI boards in a 32-bit (optional 64-bit) hot-swap compliant passive backplane in a space only 4U high (7"). Fault resilient capabilities include redundant 300W power supplies, a hot-swap compliant passive backplane, and an automatic integrated intelligent fault detection and alarm notification system. The MIC-3033/5 includes a roomy device bay for up to four devices, including CD/DVD-ROM, two 3.5" HDDs, and one 3.5" FDD
The enclosure is fully compliant with the PICMG 2.5 computer telephony (CT), H.110 CT bus and front/rear panel I/O, and PICMG 2.1 hot-swap specifications. The 6U-sized five-slot backplane dedicates one slot to the system’s CPU leaving four others for any application specific cPCI boards. All drives are front accessible behind a lockable panel. The rear mounted P3 and P5 connectors on the backplane let you route all I/Os from the back, so boards can be accessed from the front without disconnecting wires.

A hot-swappable 86 CFM fan pulls cool air across all cards and drives from front to back while a 15 CFM fan at the rear maintains even airflow by pushing the air out the back, ensuring uninterrupted operation from 32 to 112 degrees F (0 to 50 degrees C). The fans' tachometer output enables the alarm module to monitor the speed of the fans, while an ingenious protective circuit in the fan backplane suppresses spikes and noise during fan hot-swapping.

The MIC-3033/5 is priced as low as $2,600 with OEM volume discounts. The chassis can be delivered within 48 hours from the company's Fremont, CA production facility. Custom configurations, cPCI CPU boards, and software pre-loads are also available.

Advantech offers a heftier unit, the new MIC-3032/8 cPCI chassis, a 9U tall (15.75 inches), 19-inch wide rackmount that can contain up to eight 6U-high cPCI boards, four front mounted drives including one 3.5” floppy and three 5.25” or 3.5” devices, and redundant 300W, hot-swappable power supplies. The pull out fan drawer, with three 86CFM individually hot-swappable fans, allows even airflow across all cards and drives from front to back, or bottom to back. There’s also built-in fault detection, intelligent alarms, and status monitoring that can be used for real-time remote monitoring. MIC-3032/8 is priced from $2,350.

If you need some really massive processing power to drive a chassis full of cPCI telephony resource boards, take a look at Advantech’s new MIC-3376 cPCI single board computer, a 6U high, dual processor, two-slot wide package that's available with the latest Pentium III processors - including 500 MHz and 600 MHz versions holding up to 512 MB of SDRAM. The Intel 440BX chipset enhances performance along with a 100 MHz frontside bus and 66/100 MHz bus speeds. The SBC also provides a single/dual PCI-to-PCI bridge option, letting the system control up to 14 PCI master devices.

The built-in, high speed PCI IDE controller has two separate channels for Ultra DMA/33 support of up to four hard drives. The floppy disk controller supports two drives whether floppy, CD, or CD-R drives. An optional Ultra2 SCSI interface and dual 10/100 Ethernet ports provide optional RAID support.

No CPU fan is needed, thanks to the MIC-3376's unique heat sink. All of the board's I/O connections including two Ethernet, two serial, two USB, one VGA, one SCSI, one parallel, and one PS/2 keyboard /mouse connection are on the front panel. An optional rear transition board can be used for a rear connection of the keyboard, mouse, and serial port. This option also supports on-board connections for a floppy drive, two on-board hard drives, and one CompactFlash card.
The MIC-3376 is priced from $1,500 for the SBC with dual Ethernet controllers and a video controller.

**AMTELCO**

The **XDS MVIP/SCSA High Density BRI CompactPCI Board** from Amtelco (McFarland, WI - 608-838-4194, [www.amtelco.com](http://www.amtelco.com)) takes the well-known Amtelco XDS boards to a new level of density and reliability, supporting both the central office and digital phones.

The XDS Basic Rate Interface ISDN board provides twelve BRI ISDN ports. Each of these ports supports both two "B" channels and a "D" channel, and can be configured as a Terminal Equipment (TE) or Network Termination (NT) port. The connection is an S interface. The board is 8/16 bit ISA compliant, and is both MVIP-90 and SCSA compliant, so the B channels can connect to either the MVIP bus or the SCbus through switching on the board, or they may be connected to each other.

A 25 MHz 80386 local processor provides support for OSI Layers one, two and three, and includes Terminal Endpoint Identifier (TEI) management (so that up to eight devices can be connected to one ISDN BRI line), as well as message buffering and LAPD protocol support.

Flexible clocking is included with BRI span to PCM bus, or PCM bus to BRI span. The XDS BRI board provides the clock master and clock fallback. Three DSPs supply call progress tone and DTMF generation and detection.

The firmware for both the processor and the DSPs is stored in Flash memory and can be quickly upgraded, even in the field. The board includes NI-1 and AT&T custom support. DOS, OS/2, UNIXWARE, Windows NT, and Solaris drivers are available. The XDS BRI board is designed to be compatible with other XDS boards, and shares a common interface structure with these boards, which should make all of you developers happy.

**ANATEL**

Anatel Communications Corporation (Peabody, MA - 978-977-6817, [www.anatel.net](http://www.anatel.net)) is a spin-off subsidiary of parent company Analogic and has inherited many of Analogic's cPCI-based voice-over-IP (VoIP) DSP resource boards, such as their TAP-800 family.

Anatel now offers a **Linux version of its TAP-800 Software Developer's Kit (SDK)** that works with CompactPCI-based TAP-810 cards as well as the conventional PCI-based TAP-804 and 806 cards.

Anatel's **Network Access Card (NAC)** family for cPCI platforms includes DS-3 and quad and octal T-1/E-1 cards. All three cards are 6U high, hot-swap compliant and support the H.110 CT Bus.

The quad **NAC-120** (120 port) and the octal **NAC-240** (240 port) cards sport a software-selectable
T-1/E-1 interface, Primary Rate ISDN, and a passive back card. For data networking apps, they also feature a 10 MBps Ethernet interface, a Motorola MPC860 processor with VxWorks, and either 128 or 256 channels of HDLC. These boards are designed for large apps involving voice-over-IP trunking, voice-over-IP gateway, remote access server, call center, and ISDN router applications.

The NAC-120 costs $4,495, the NAC-240 costs $6,995. OEM quantity discounts are available. The powerful, high density NAC-600 DS-3 card gives you 672 channels to incorporate into your system, and all of these ports can be switched to any of the 4,096 time slots on the H.110 interface. The NAC-600 is designed for the largest of call center and VoIP applications.

When used with Analogic's TAP-810 CompactPCI telephony application processor, high-availability DS-3 scale gateways and servers can be built. The NAC-600 card with the DS-3 interface is not cheap - it's priced at $17,995. But according to Anatel's calculations, savings can be realized in only months, since the break-even point for a business switching to DS-3 is said to be between seven and twelve T-1 lines.

**APW ELECTRONICS SOLUTIONS**

The new **Titan cPCI Chassis** from APW Electronics Solutions (Poway, CA - 858-679-4550, [www.apw-elsol.com](http://www.apw-elsol.com)) can house a 6U, eight slot cPCI backplane along with 300W plug-in power supplies. Suited for telco apps, it's NEBS compliant.

Reverse impeller style fan modules in the top of the unit provide a new approach to cooling. Two pluggable fan modules are accessible from the front and can be removed for repair or maintenance. This allows removal of one fan while not interfering with the performance of the other.

Finally, a microcontroller-based Ultra-Smart Module option monitors voltage, temperature and controls fan speed.

**ARIEL**

Ariel Corporation (Cranbury, NJ - 609-860-2900, www.ariel.com), masters of both PCI- and CompactPCI-based 56K/ISDN access products, has enhanced its **PowerPOP architecture** and **56K/ISDN access family** so they can use SS7 signaling technology.

Most smaller ISPs provide dial-up access by leasing subscriber-side T-1 or T-1/PRI lines from the local telco at a cost of $500 to $1,000 per month. ISPs can reduce this cost by replacing expensive T-1 and PRI lines with the same Inter Machine Trunk (IMT) lines used by ILECs and CLECs, which typically cost less than half as much.

To obtain these IMT lines, however, ISPs must use the SS7 signaling network, which, until now, meant you had to buy a multi-million dollar Class 5 telephone switch. Ariel's approach to incorporating SS7 technology will make it cost effective for ISPs to take advantage of the SS7 network, enabling them to employ IMT lines without the Class 5 switch.
Deploying ISP networks using Ariel's SS7-enabled access technology will also permit ISPs to reduce POP infrastructure and management costs. Today, ISPs must deploy multiple POPs within each LATA (local access and transport area, roughly equivalent to an area code) so their customers can log on without paying long distance charges. With Ariel's technology, ISPs/CLECs will be able to service an entire LATA with as little as a single POP.

Products based on the new Ariel SS7 gateway technology will be announced later this summer and sold together with Ariel's PCI and CompactPCI-based 56K/ISDN access products to ISPs, CLECs, ILECs, and co-location service providers.

"When we created the PowerPOP architecture," said Dennis Schneider, senior vice president of worldwide marketing at Ariel, "we did so with the idea of reducing remote access cost and providing an open, intelligent platform that could be used to reduce cost and boost performance throughout an ISP's network. Our RS4200 platform was an important step in that direction, cutting the capital cost of remote access by about $100 per port. Now, we are developing an SS7 technology that, together with the RS4200, will enable ISPs to reduce their dial-up access and POP costs in a way currently not possible with most remote access concentrators."

**ARTESYN**

Artesyn Communication Products (Madison, WI - 608-831-5500, www.artesyn.com/cp) has a legion of new cPCI products as well as modules that can be plugged into cPCI boards, enhancing them.

For example, the Artesyn PM/T-1x and PM/E-1x are PCI Mezzanine Card (PMC) modules that provide dual T-1/J-1 (J-1 is a Japanese version of T-1) or E-1 interfaces on a variety of carrier boards, including CompactPCI and VME. The open PMC form factor is a convenient, flexible way of providing T-1/J-1 or E-1 functionality to standards-based boards, and allows for faster system development and lower overall costs.

The T-1/J-1 or E-1 interfaces can be used to carry up to 24 (T-1/J-1) or 30 (E-1) voice channels. In many telecom applications, such as cellular and PCS services, there's also a need to transport voice, data, and signaling from one system to another. Hence, the PM/T-1x and PM/E-1x module interfaces can also be used to carry SS7 signaling information between STPs and SCPs, or a combination of voice, data, and signaling over a single, time-division multiplexed (TDM) interface. The interfaces can even be used to carry ATM over T-1/J-1 or E-1.

The PM/T-1x and PM/E-1x modules feature an 80MHz Motorola MPC860p (PowerQUICC Plus) microprocessor configured with 16 or 32 MB of SDRAM and 0, eight, or 16 MB of Flash memory. The modules include an optional bank of SDRAM that will allow fast access to non-cacheable buffer descriptions, and segmentation and re-assembly (SAR) functionality provides support for ATM.

The PowerPC-based communications controller provides the T-1/J-1 or E-1 interfaces as well as protocol support for HDLC, LAPB, and LAPD, as well as SS7 MTP1, MTP2, and frame relay (frame relay support comes by running the SpiderFRAME-RELAY software package from an Artesyn subsidiary, Spider Software of Edinburgh, Scotland).
The modules offer low-profile RJ45 connectors, eliminating the requirement for an adapter cable or custom cabling. A multi-function nano DB-9 connector provides a console port for development and differential external clock input.

The modules support Wind River's VxWorks real-time operating system with advanced development tools to speed time to market. The PM/T-1x and PM E-1x each costs $1,300 per unit in quantities of 1,000.

As we went to press, Artesyn announced enhancements to its Octal-T-1/E-1 BajaSpan CompactPCI board that provides up to eight T-1 or E-1 spans and up to four PowerQUICC 860 processors for processing voice and protocol data. One enhancement is an upgraded H.110 interface based on the Lucent T8105 Ambassador chip. One of the chip's interchangers now enables twice the previous local-to-H.110 capacity - from 256 to 512 programmable connections between any of the 4,096 time slots on the H.110 bus and any of the 1,024 time slots in the local switching domain.

A second interchanger on the T8105 chip is used to switch between any of the local time slots. With the Lucent T8105, BajaSpan also offers an interesting subrate-switching feature that allows the kind of switching of compressed voice streams commonly found in wireless base-station applications. Subrate switching allows increased channel capacity in increments of two, four, or eight times.

The BajaSpan includes a transition module that provides rear-panel access to the T-1/E-1 spans, ensuring a low MTTR.

BajaSpans with the Lucent T8105 enhancement are priced starting at $3,384.

Finally, a collaborative effort among Artesyn, Blue Wave Systems, GNP Computers and Sun Microsystems has resulted in the Alpha4, a system that combines cPCI T-1/E-1 interfaces, SPARC processors and DSP boards supported by the Sun Solaris operating system. The Alpha4 acts as a processing subsystem for VoIP or FoIP. For example, it can be configured as a high-density transcoder engine. A voice transcoder performs signal processing that translates digitized speech from one data rate to another in full duplex communication. As a subsystem, Alpha4 can provide and manage a pool of voice transcoder resources for many different kinds of applications.

Alpha4 uses the Artesyn BajaSpan, their flagship protocol-processing CompactPCI board providing eight T-1 or E-1 spans in a single slot. The Alpha4 also includes GNP's own compact horizontal design and an AC- or DC-powered four-slot backplane with front or rear I/O capability. Sun Microsystems' rugged single-slot SPARCengine CP1500 single board computer, with 333-, 360-, or 440-MHz UltraSPARC IIi processors running under Solaris, power the system. The Alpha4 also incorporates Blue Wave Systems' CPCI/C6400 high performance CompactPCI board featuring four TMS320C6201 fixed-point or four TMS320C6701 floating-point DSPs.

All products comprising Alpha4 support CompactPCI hot-swap, including one or two 9.1- and 18.2-GB formatted fixed internal drives. And Alpha4 is designed to meet the stringent Telcordia NEBS Level 3 standard, so it'll survive fires, earthquakes, and maybe even spilled coffee.
Alpha4 will be co-marketed by all four companies, with the final sales and support being offered by GNP Computers. **CompactPCI -- The Nuts and Bolts of Next-Gen CT**

**AUDICODES**

AudioCodes' (San Jose, CA - 408-577-0488, [www.audiocodes.com](http://www.audiocodes.com)) **TPM-800** is the newest addition to their Voice over Packet Media Gateway modules that "tile" (plug in) as PCI Mezzanine Card (PMC) daughter cards on OEM-designed carrier cards. Audiocodes' modules accept PCM voice on one end, perform all signal processing, packetization, signaling and control functions, and send out packetized voice-over-IP or ATM.

The TPM-800 supports 240 voice/fax /data ports, capable of accepting uncompressed 64Kbps DS0 voice, fax, or data traffic over 12 PCM highways at 8MHz, RTP packetized VoIP, T.38 packetized FoIP, or voice over AAL2/ATM through 100 Base-T or UTOPIA level 2 interfaces. Designed for high end carrier grade and fault resilient platforms, each TPM-800 is a complete VoIP or voice and telephony over ATM (VTOA) media gateway, controlled through the media gateway control protocol (MGCP) or else using AudioCodes' proprietary API. The TPM-800 is backwards compatible with the TPM-200. Full T-3 support can be created with three TPM-800s running G.723.1 or G.729A. A PCI based development kit is available to use while your OEM carrier card is being developed.

**BLUE WAVE**

Blue Wave Systems (Carrollton, TX - 972-277-4600, [www.bluews.com](http://www.bluews.com)), a supplier of DSP-based subsystems to wireless and wireline markets, is also a new entrant in the VoIP marketplace. CompactPCI, PCI, and VME are their favored form factors. Their ComStruct line of DSP boards was launched in January 1999. At the heart of the ComStruct line is the company's FACT software (Framework Architecture for Communication Technologies), a high level software application interface and resource management system that enables a board's DSP subsystem to be rapidly reprogrammed and deployed in various carrier class telecom applications.

In November 1999, Blue Wave and Texas Instruments announced a co-marketing agreement to provide complete voice/fax/data-over-IP solutions for CompactPCI platforms. A product of this alliance is the **ComStruct CPCI/C5421**, which is also optimized to run Telogy’s embedded VoIP software.

The hot-swappabe 6U high CPCI/C5421 board provides media gateway DSP resources (20 Texas Instruments C5421 DSPs per board) and can operate as a single board media gateway processing engine. The CPCI/C5421 uses its DSP power to process circuit switched voice channels for transcoding on the DSPs and then formats the data in packets for routing over an IP data network.

The board's processors and other chips are split into four processing blocks for optimum performance, with each block consisting of Motorola PowerQUICC, five T-I C5421 DSPs, an optional StrongARM SA-110 processor, up to 64 MB of SDRAM and a 10/100 Base-TX Ethernet interface.

The optional StrongARM SA-110 processors are architected for use with **Tely's GoldenPort software**, which enables carrier-class equipment to off-load voice, fax, and V.90 modem calls from
the PSTN to data networks (IP, frame relay, and ATM). The StrongARM processors provide the additional processing power needed for modem applications, and when fitted with them the cPCI/C5421 is able to support over 120 channels of Universal Port - voice, fax, or even V.90 modem calls (making the single slot board a 120-channel V.90 modem bank).

Depending on the system, the CPCI/5421 can also either directly terminate up to four T-1/E-1 trunks through an on-board standard PMC site or rear transition module, or it can work with a separate H.110 compliant line interface card (the bi-directional ECTF H.110 bus connection is provided via the cPCI J4 connector). The PMC connection site can also be used to add other interfaces such as ATM.

A complete Blue Wave/Telogy communications solution includes hardware, software, and patent indemnification. A whole integrated package would consist of the CPCI/C5421 single board gateway using Telogy's Golden Gate software for voice and fax processing, running under a Sun Solaris high availability operating system and powered by Sun's SPARCengine CP 1500 microprocessor-based single board computer.

This combination of technology lets developers scale from as few as 120 ports to hundreds of ports per shelf and thousands of ports per rack - all through an open architecture systems integration model.

Pricing is dependent on volume commitments and interface choice.

The latest member of the ComStruct family is the PMC/C5421 - a single slot DSP powered PCM module that can bring from up to 192 channels of voice/fax over packet capability to a cPCI single board computer having PMC expansion capability, yielding a powerful single slot solution.

The PMC/C5421 holds up to 16 Texas Instruments TMS320C5421 DSPs and a Motorola 8240 integrated PowerPC microprocessor. Running at up to 250 MHz, the chip can be used for packet and data processing. A 10/100 Base-T Ethernet plus a SCSA compatible timeslot bus are available on the module's user P4 connector.

A 16-processor PMC module is priced from $3,995 in volume.

Developers should also check out Blue Wave's CPCI/C6400 DSP resource board for general voice and data stream processing applications. It holds up to four 200 MHz TMS320C6201 fixed point DSPs, a single Motorola MPC860 Power QUICC control processor for real-time control and data management, and a Lucent Ambassador T8100 TDM switch that provides an ECTF H.110 compliant off-board interface.

There's also Blue Wave's customary PMC site for modular expansion plus a 10/100 Base T Ethernet connection to the LAN.

If you need even more processing power, take a look at the hot-swappable CPCI/C6402 DSP
resource board, with its eight T-I TMS320C6202 DSPs and two Motorola MPC860T control processors (an architecture equivalent to two C6400 boards), a Lucent Ambassador T8105 TDM switch providing a full H.110 bus interface, a single PMC site, and a dual 10/100 Base-T Ethernet connection.

**BROOKTROUT**

Brooktrout Technology (Needham, MA - 781-449-4100, [www.brooktrout.com](http://www.brooktrout.com)) has moved heavily into the voice-over-net marketplace, and CompactPCI is increasingly their form factor of choice.

For example, Brooktrout is now shipping cPCI versions of its **TRxStream Series** of media processing platforms that provide DSP resources for "New Network" communication systems such as Intelligent Peripheral/Service Nodes, web-based messaging servers, and voice-over-packet gateways.

Products in the TRxStream Series include the **TR1000** voice/fax messaging platform and the **TR2001** real-time IP gateway platform. These high-density platforms currently support up to two DS-3 spans (1,344 channels) in a single shelf. TRxStream carrier-grade features include high-availability/hot-swap, 100% passive rear I/O, and NEBS Level 3 compliance.

The TR1000 is more of a store-and-forward, high-density voice, fax, and unified messaging board that supports up to 96 channels, and includes optional on-board T-1/E-1/ISDN network interfaces. It's designed for rapid development of advanced messaging applications with its slick API and support for standards-based protocols and interfaces. The TR1000 supports programmable noise and silence compression, volume and pitch correction, DTMF detection during playback, and support for popular third-party ASR and TTS products. Drivers are available for Linux, Solaris, UnixWare, and Windows operating systems.

Meanwhile, the TR2001 IP telephony resource board supports up to 60 channels of real-time voice/fax processing for VoIP and FoIP gateways and application servers. The TR2001 supports standard VoIP protocols including H.323 V2, as well as G.711, G.723.1, G.729, and SX vocoders. The SpeechPac API layer allows developers to write to alternate protocols such as MGCP, SIP, and Megaco/H.248. On-board T-1/E-1/ISDN interfaces eliminate the cost, slot requirements, and complexity of using separate WAN interface boards. Drivers are available for Linux, UnixWare, and Windows operating systems. Like the TR1000, the cPCI TR2001 consumes just 12.4 Watts per board for cool operation, low system cost and high reliability.

Brooktrout's **Netaccess CompactPCI WAN access cards**, part of the Netaccess Series, offer an incredibly high density platform with eight software-selectable T-1/E-1 ports, an H.110 telephony bus, and an Ethernet interface in a single cPCI slot. The NEBS Level 3-compliant design meets the building and environmental requirements of LECs, CLECs and IXCs. The board's PSTN connectivity is flexible, offering a variety of signaling standards at the central office, including ISDN, ISDN NFAS, GR-303, and SS7.

**CARLO GAVAZZI**
Carlo Gavazzi Mupac (Brockton, MA - 508-588-6110, www.carlogavazzi.com) has introduced a new, Intel based dual-slot CompactPCI single board computer and a rackmountable/benchtop industrial chassis.

Gavazzi Computer Systems Group's interesting new cPCI SBC is a PICMG-compliant, 6U high board powered by either an Intel Celeron (Model CSBCP2BX370 - a PPGA370 Celeron with 128KB on-die L2 cache and 66MHz system bus) or a Pentium III (Model CSBCP3BX370 - a "Flip-Chip" Pentium III FC PGA with 256KB L2 cache and 100 MHz system bus). Both versions of the board are identical except for the processor socket and what kind of processor is mounted, and both use Intel's 440 BX AGP set and provide up to 768 MB of PC100 ECC memory on DIMMs.

With processor speeds from 300 MHz to 800 MHz, buffered by a 128 KB or 256 KB L2 cache, it's obvious that this board can power some big applications. The board has a high performance PCI Ultra DMA/33 dual-channel EIDE interface that can move data at 33 MBps, an Ultra2 SCSI (LVD or SE) interface that can move data at 80 MBps, a 10-BaseT/100-BaseTX Ethernet connector, and a 64-bit AGP graphic controller with 2 MB of SDRAM.

Besides the standard PC I/O - floppy disk, USB, serial, and bi-directional parallel ports - the SBC supports a PMC mezzanine card (CM-CBXBR01) with a PCI bridge, an ultra-slim floppy and/or 2.5" EIDE disk. The optional PMC card expands cPCI slot support from seven (through the SBC) to 14 slots. Also available is an 80mm rear I/O transition module (CTM80-CBX01) for routing I/O from the front to the rear of a system.

The enhanced Award Elite BIOS (housed in Boot Block Flash memory) supports software enable/disable of Ethernet and SCSI, hardware enable/disable of video, serial/parallel port remapping/disable, ACPI 1.0, APM 1.2, and advanced thermal/voltage management. A system monitor (board voltages, temperature, and fan) and watchdog timer are included; multi-level PCI-t-PCI bridging and full hot-swap is fully supported.

Quantity pricing of the CSBCP2BX370 with a 300 MHz Intel Celeron processor (but without SDRAM) is $1,495; $1,945 with a 500 MHz Pentium III processor.

Moving on to their 586 Series chassis, it's a 4U (7" high), 21" deep, 19-inch wide industrial-strength rackmount/benchtop chassis that can house 13/14-slot ISA or PCI/ISA PICMG-compliant passive backplanes. It provides two 3.5" x 1" and two 5.25" x 1.63" vertical front accessible peripheral bays and three 3.5" x 1.63" horizontal internal drive bays behind a latchable (optional lock for higher security) transparent Lexan door.

The chassis comes with either a 320 or 400 Watt PS/2 auto select 90-132/180-264 VAC power supply. A positive pressure cooling subsystem (with two 90CFM quiet 12V DC fans, coupled with a removable, washable, foam filter and power supply exhaust fan) ensures optimal, clean airflow through the chassis to remove heat from critical components.

Standard front panel controls and indicators include illuminated power ON/OFF, a reset switch, a PS/2 keyboard connector, and five peripheral activity LEDs. The rear I/O panel includes one five-pin
DIN (AT), two DB9, one DB25, two USB, and one 68-pin SCSI ports.

Quantity pricing of the Series 586 ranges from $1,295 to $1,545 depending on backplane and power supply selections.

CONTINUOUS COMPUTING

Continuous Computing Corporation (San Diego, CA - 858-547-8804, www.ccpu.com) recently debuted what's described as the world's first Ethernet switch on a 6U cPCI form factor board. Called the **24+2 Ethernet Switch**, it's a 26-port non-blocking, fully-managed Ethernet switch with 24 10/100 MBps autosensing, Fast Ethernet ports, and two Gigabit interface converter (GBIC) ports. The switch provides full-wire speed Layer 2 switching supporting up to 16k MAC addresses, 256 IEEE 802.1Q Virtual LANs, IP multicasting, full and half duplex flow control, and IEEE 802.1p/Q standard quality of service (QoS).

The board's compact size enables high-speed communications between elements in CCPU's own highly available systems - avoiding the use of external hubs that often block airflow. Its vertical, low-power design allows for increased system density and saves expensive CO rack space - sometimes used otherwise to spread out components, in order to compensate for airflow blockage. The board can operate in a cPCI slot or in an isolated backplane, simplifying the error-prone process of cabling from a standard Ethernet switch to other modules in a rack. It also supports TCP/IP and serial management interfaces.

CYCLONE SYSTEMS

The **CPCI-945 RAID Controller** from Cyclone Microsystems (New Haven, CT - 203-786-5536, www.cyclone.com) is a 6U board that uses an Intel i960RN I/O processor and 64-bit PCI host interface (capable of delivering 266 MBps across the PCI bus) to control four 80 MBps Ultra2 LVD SCSI channels, with each channel supporting up to 15 wide and 7 non-wide devices.

The CPCI-945 holds up to 128 MB SDRAM for disk caching. An on-board cache battery backup module will retain data for up to 72 hours. There's also 2 MB of Flash ROM. When the system is started, the firmware residing in the Flash ROM is copied into and executed from RAM. The firmware supports RAID levels 0, 1, 3, 5, 10, 30, and 50.

The system can also do remote configuration and array management via the MegaRAID subsystem WebBIOS Server.

The board's RAID utilities manage and configure the RAID system while the MegaRAID subsystem controller creates and manages multiple disk arrays, controls and monitors multiple RAID servers (Microsoft Cluster Server for Windows NT is also supported) and does error statistics logging and online maintenance.

The MegaRAID Self Monitoring Analysis and Recovery Technology (SMART) detects up to 70% of all
predictable drive failures. SMART monitors the internal performance of all motors, heads, and drive electronics. Drive failures can be recovered through RAID remapping and online physical drive migration, and automatic and transparent rebuild of Hot Spare drives.

An interesting Configuration on Disk (drive roaming) feature saves configuration information both in non-volatile RAM (NVRAM) on MegaRAID and on the disk drives connected to MegaRAID. If the hot-swappable board is replaced, the new MegaRAID controller can detect the actual RAID configuration, maintaining the integrity of the data on each drive, even if the drives have changed channel and/or target ID.

Operating Systems supported: Windows NT, Novell Netware, SCO Unix Open Server, SCO UnixWare, IBM OS/2, Sun Solaris, Red Hat Linux.

The CPCI-945 RAID Controller loaded with 64 MB SDRAM costs $1,627 in quantities of 1,000.

DAWN

Dawn VME Products (Fremont, CA - 800-258-DAWN, www.dawnvme.com) offers a lightweight, portable CompactPCI Development Chassis for the testing, debugging, and software development around the cPCI architecture. Dawn offers two models: one with a 3U backplane and one with a 6U backplane. The switchable input voltage for the power supply is 115/230 VAC. The lower part of the chassis directly supports multiple-format peripherals. The cPCI Development Chassis is priced from $1,250.

DIALOGIC

The DM3 IPLink cPCI board from Dialogic, an Intel company (Parsippany, NJ - 973-993-3000, www.dialogic.com), is a complete single-slot IP telephony CompactPCI gateway with onboard DSPs, onboard Ethernet, and supports for up to two T-1 or two E-1 interfaces per board.

The DM3 IPLink supports the H.323 IP interoperability standard (including H.245 and H.225 protocols) and a plethora of vocoders such as G.723.1, G.711, G.729a, MS-GSM, and ETSI-GSM. T.30 real-time fax-over -IP is also supported. Fax lines can be kept open for up to four seconds, if network problems occur during transmission.

You can plug up to 14 DM3 IPLink cards in a single chassis to yield an 840-channel gateway. The rackmount cPCI chassis can be accessed from the front or rear. The board is also hot-swappable. The board's adherence to the DM3 API allows for compatibility with existing DM3 IPLink applications, as well as the DM3 IPLink SNMP management tools. These include support for Dialogic's BoardWatch, a runtime monitor. The DM3 IPLink cPCI board runs under Windows NT 4 and SPARC Solaris 2.6.

Dialogic has also released its DM3 QuadSpan Series of network interface cards in both CompactPCI and PCI versions. Above this density, as noted above, Dialogic will package network
interface and media processing separately.

**DIVERSIFIED**

Diversified Technology (Ridgeland, MS - 601-856-4121, [www.dtims.com](http://www.dtims.com)) recently unveiled the new **CPC8629 CompactPCI Single Board Computer**. It's a single or dual CPU PICMG compliant board based on Intel's Pentium III processor and 840 chipset running at 100 MHz and with 133 MHz front side bus support. This provides support for processor speeds up to 800MHz.

The CPC8629 supports up to 2GB of memory using RAMBus. Dual PCI 10/100 Base-T Ethernet, PCI Ultra 2 SCSI, PCI EIDE, and USB interfaces are provided along with a AGP video with flat panel support. Other features include floppy, parallel, and serial ports as well as DTI's renowned System Monitor.

**ELMA ELECTRONIC**

Elma Electronic (Fremont, CA - 510-656-3400, [www.elma.com](http://www.elma.com)) is also brimming with new CompactPCI products such their new generation of cPCI enclosures, the first example of which is **The Elite**, a 4U chassis that addresses electromagnetic containment, cooling, and ease of manufacturing, all at a new low price.

The Elite easily converts from a rackmount to a tower or desktop configuration. The chassis is fully compliant to IEEE 1101.10/.11 specifications, with horizontal mounting for 6U x 160mm CompactPCI cards from the front and 6U x 80mm I/O cards from the rear. The new, inexpensive Elite enclosure is specially designed to provide basic features in an optimal way.

The unit is designed to hold one 3.5" and one 5.25" half-height devices, mounted vertically. The airflow is front to rear. Standard four- and six-slot 6U cPCI or H.110 backplanes can be mounted. A 350W ATX power supply is standard.

Elma has also designed some neat Hot-swap handles for cPCI that allow easy insertion and extraction of boards. The carefully thought-out insertion geometry and ergonomic design provides maximum lateral force with minimum vertical force. The two-step extraction process prevents premature board removal and a self-locking mechanism gives you added security. The special window design lets users conveniently view panel LEDs.

**FORCE**

Force Computers (San Jose, CA - 408-369-6000, [www.forcecomputers.com](http://www.forcecomputers.com)) just introduced an ultra-high performance, two-slot, single board computer, the **CPCI-780**. The CPCI-780 was launched with two 733MHz Pentium III processors (FC-PGA370 socket) and uses the Intel 840 chipset, which was specifically designed to meet the high-bandwidth needs of multi-processor servers. The CPCI-780 is also the first CompactPCI SBC to use fast RAMBus memory technology. A 32/64 Bit interface at 33/66 MHz doubles the cPCI bus bandwidth as well.
The board's use of Intel's new flip-chip PGA (socketed) packaging technology enables Force Computers to scale processing power by quickly and easily upgrading the CPCI-780 with new processor chips, as faster clock-speed models become available from Intel.

The CPCI-780 will also support a full 16-slot CompactPCI bus based system when paired with Force's optional IO-720 companion board. Two on-board 10/100 Base TX Ethernet controllers provide flexible networking capabilities.

Support for the PICMG 2.1 hot-swap specification enables I/O boards controlled by the CPCI-780 to be hot-swapped without interrupting system operations. Also, an advanced heat dissipation design, using a heat sink with integrated heat pipes, ensures safe and reliable operation. The Force CPCI-780 is shipping under Force's Early Access Unit (EAU) program and volume shipments are scheduled for August 2000. List prices start at $5,900 with dual 733 MHz Pentium III Processors and 512 MB RDRAM.

You may also recall that Force's SENTINEL, the company's single chip PCI-to-PCI bridge (PPB), received a "Best of Show" award at CT Expo Spring 2000. SENTINEL allows you to plug a CPU board into any cPCI slot via a "universal mode" single board computer solution, MSI (Message Signaled Interrupt) for advanced interrupt support, and hardware support for Intelligent I/O (I20) communication. SENTINEL is optimized for CompactPCI hot-swap and asymmetrical multiprocessing applications. SENTINEL is only available on Force products.

Following on the heels of SENTINEL's debut at CT Expo, Force has announced the CPCI-540, the first SPARC-based single board computer using the SENTINEL bridge chip. By integrating the SENTINEL technology with SPARC processors, the CPCI-540 is now the first solution on the market that makes the advantages of the "Universal Mode" technology available to embedded Solaris applications. The CPCI-540 can run in any slot of a CompactPCI system, allowing the system to be populated with clusters of CPCI-540 boards that will be able to talk to each other through the backplane. The CPCI-540 is also hot-swappable.

The CPCI-540 family comes in one-, two-, and three-slot configurations with up to three Ultra SCSI controllers, seven 100 BaseT Ethernet controllers and 1,024 MB of DRAM. The processor on these boards is a second generation UltraSPARC-IIi running at 440 MHz. The boards support full I/O slot hot-swap capability, as per PICMG 2.1 specifications.

Force sees SENTINEL is the key technology to create CompactPCI systems with many CPUs in a single chassis. This technology supports today's demands of the Internet telecom industry to build systems with scalable performance in a confined space. Large buffers allow data transfers across the cPCI bus without disturbing interruptions that can slow down the system performance.

The CPCI-540 product family list price starts at $4,000 for single units with volume discounts available. The CPCI-540 is now available under Force's Early Access Unit (EAU) program, and volume shipments are scheduled for Q4 of 2000.

GENERAL MICRO SYSTEMS
General Micro Systems (Rancho Cucamonga, CA - 909-980-4863, www.gms4vme.com) has announced **Atlas-C**, a multiprocessor CompactPCI board based on the new Intel Coppermine-256 Processors. With scaleable clock speeds of up to 733 MHz, the Atlas-C provides built-in support for symmetric and real-time asymmetric multiprocessing, which enable its two Coppermine processors to work together in parallel on the same program, transparent to the programmer and the application.

The baseline Coppermine processor is faster than the fastest mobile module, and it consumes a fraction of power and does multi processing. With Atlas-C, OEMs get a rugged, CompactPCI board with a pair of Coppermine processors and versatile multiprocessor, I/O, graphics and networking options. The first version of the Atlas-C featured a pair of low-power (15W), 550 MHz Coppermine processors. Each processor is equipped with 256 kbytes of no-wait-state on-die L2 Cache. The two processors also share up to 1 Gbyte of 100 MHz synchronous DRAM main memory. The processors, cache, and memory are linked via a 100 MHz local bus, which is an extension of Intel's Front Side Bus (FSB).

Atlas-C provides versatile I/O and networking options. Included are dual 10/100 Mbps Ethernet interfaces (twisted pair), a 40 Mbps UltraWide SCSI interface, and a 64 bit AGP graphics engine with four Mbytes of video RAM optimized for 3D rendering. Also available are two Ultra-DMA 33 IDE interfaces, a pair of USB ports, dual serial I/O with optional RS422 drivers, and a parallel port. For applications requiring high performance at a reduced cost, Atlas-C is also available with a single 466 MHz Celeron PPG370 processor, scaleable to 500 MHz. The Celeron processor includes 128 Kb of on-die cache with a one-to-one clocking, which dramatically improves cache performance.

Atlas-C I/O is available via a 80 mm rear panel I/O, which can also accommodate a 2.5 " 9 GB IDE drive. For applications that must be deployed without a rotating hard disk, the board also provides up to 340 MB SanDisk 1.5" Flash IDE on the rear panel. All the system I/O including video may be accessed via front panel or rear panel through a series of 'Quick Switch" devices which routes the I/O signals to front or rear panel I/O.

Atlas-C runs many popular desktop and real-time operating systems, including Windows NT, Solaris x86, QNX, and VxWorks. Additional software support includes multiprocessing drivers for the CompactPCI backplane, which treat the bus as a TCP/IP network. Atlas also comes equipped with AMI's BIOS and on-board diagnostics software and status LED's.

Pricing for Atlas-C starts at $2,299 less processor and memory.

At the Applied Computing Developers Conference in May, GMS was showing off the new **Atlas C2P4**, which unchained the power of single/dual 750 MHz Pentium Coppermine processors with 256 KB of on-Die L2 cache for each processor. Additional performance derives from the fact that with the cache on the Coppermine, unlike the regular Pentium III, Slot One is clocked at the CPU speed for maximum performance.

All major operating systems such as Windows NT, VxWorks, QNX, Solaris x86, and Linux are fully supported on the C2P4. The VxWorks Board Support Package, igBSPls, contains the drivers for all of the I/O devices; and, it is available in Source or Binary versions. The Atlas C2P4 is now ready for
General Micro Systems also offers what is said to be the industry's first CompactPCI board based on the Embedded Roadmap version of Intel's Pentium III Coppermine processor. Dubbed the **Mariner C157**, the new board occupies a single cPCI slot and provides more than double the performance of CPU boards based on the Pentium II Mobile module. The Mariner can also be equipped with a Celeron processor for applications requiring high performance at a reduced cost.

The Embedded Roadmap is an Intel initiative intended to make select Pentium processors and I/O support devices more attractive to embedded developers by providing friendlier packaging and extended (five-year) product life cycles. Current Embedded Roadmap members include the 166-MHz Pentium Classic, 233-MHz Pentium with MMX, Celeron (in PPG370 Socket), Pentium II Low-Power Processor (Dixon), and Pentium II Low Power module (EMCII).

**GNP COMPUTERS**

GNP Computers (Monrovia, CA - 626-305-8484, [www.gnp.com](http://www.gnp.com)) has announced two new CompactPCI solutions, **cServer** and **cNode**, central office servers designed to meet the Telcordia NEBS Level 3 standard.

The cServer is a completely customizable high-performance product, leveraging off-the-shelf technology to meet a customer's specific requirements. There's DC or AC power available, and an eight-slot backplane (also available with an optional dual four-slot configuration) and is capable of automatic failover. The cServer can contain from one to four internal 9.1 and 18.2 GB formatted hot-swappable drives and fixed internal CD-ROM and DAT drives.

The cNode, with its interesting horizontal design, is a less expensive, compact product that nevertheless can still be used for mission-critical applications such as those found in the CO. Like the cServer, it features DC or AC power in a four-slot backplane, and one to two 9.1 and 18.2 GB formatted hot-swappable drives.

Both solutions are capable of hot-swappability and provide a 10/100 BaseT Ethernet network interface and an ultra-wide SCSI-2, 40 MBps interface, accessible via the rear panel, and two rear outputs with I/O serial interfaces. Using Sun Microsystems' rugged single slot SPARCengineT CP1500, the cServer and cNode run 333, 360, and 440 MHz UltraSPARC IIi processors running under the Solaris operating system.

Pricing for the cServer starts around $20,000 and a basic cNode system starts around $12,000.

**HYBRICON**

Just out is Hybricon Corporation's (Ayer, MA - 877-HYBRICON, [www.hybricon.com](http://www.hybricon.com)) 14-slot CompactPCI backplane with bridge, the **Model B024-6314**. The backplane is designed with a primary cPCI bus segment in slots eight to 14, with a right hand system slot in slot 14 and a secondary cPCI bus segment in slots one to seven with a right hand bridged system slot (via a rear
pallet bridge) in slot 7. The 64 bit rear pallet bridge (Kaparel type PS1130) mates in the rear with backplane rear connectors RP1 and RP2 in geographic slots 7 and 11.

Hybricon's cPCI backplanes are in accordance with the newly released R3.0 of the PICMG CompactPCI Specification as well as the PICMG 2.1 R1.0 hot-swap specification. Hybricon's CompactPCI backplanes have been computer simulated in Hybricon's signal integrity laboratory to ensure low signal cross-talk and trouble-free system operation. The H.110 version is compliant with the ECTF H.110 R1.0 CT bus specification as well as the PICMG 2.5 R1.0 CompactPCI computer telephony specification and has all telecom buses implemented on P4 and Telephony P5 rear I/O connectors implemented on all peripheral slots.

The backplane can accept up to three 6U cPCI pluggable power supplies using the 38-pin Positronic Compact Power Connector. Type AB rear shrouds on rear connectors RP3 and RP5 prevent rear transition module alignment problems. The backplane can deal with 5V or 3.3V switchable V(I/O) operating voltages.

Pricing starts at $1,968.00 (quantity of one to four).

I-BUS/PHOENIX

The new **G8 Sparc CompactPCI** system from I-Bus/Phoenix (San Diego, CA - 858-974-8400, [www.ibus.com](http://www.ibus.com)) joins the rest of the G line (formerly called the Galaxy line) of CompactPCI products.

I-Bus/Phoenix appears to be joining in the "cPCI/SPARC movement" in the industry. The G8 system includes a cPCI CPU board powered by a Sun Microsystems SPARC 1500 processor (starting at 360 MHz and 128 MB RAM), an I/O transition board, a 4 MB video card, 8-slot cPCI backplane, 4 drive bays, 110/220 VAC redundant power supplies, a CD-ROM drive, a floppy drive, hard drive, and a hot-swap, sliding fan tray loaded with three 85 CFM fans. The system supports the H.110 telephony bus. It can ship with Solaris 7 or 8.

Options include an 8-drive bay RAID configuration, a -36 to -72 VDC power supply and redundant 85 CFM fans. I-Bus/Phoenix has third party relationships with cPCI board manufacturers such as Dialogic, Natural Microsystems, and Brooktrout.

The price of a G8 Sparc fully integrated system starts at $11,896.

INNOMEDIAPLOGIC

The **HYPER T-3/STS-1 card** from InnoMediaLogic (St-Hubert, QC, Canada - 450-676-2977, [www.iml-cti.com](http://www.iml-cti.com)) is built on IML’s exclusive ASIC technology. It got a Best of Show Award at CT Expo 2000. IML’s extraordinary new high-density access adapter switches the 672 incoming time slots of DS-3 or STS-1 streams onto any of the 2,048 full duplex H.110 channels of a single cPCI chassis. With 672 TDM ports per adapter, IML’s HYPER-T3 satisfies the most stringent capacity requirements of high-traffic volume and large-scale voice and data applications.
To prevent exhaustion of time slot capabilities at such high levels of port density, the HYPER-T3 also includes a secondary TDM bus to effectively double the TDM capacity within the cPCI chassis. This optional TDM bus allows the addition of various companion resource adapters available from IML, which provides voice processing services such as compression and echo cancellation, without consuming any time slots on the H.110 bus.

Used in conjunction with IML's ArTeMux family of TDM/ATM Networking Server Adapters, the HYPER-T3 DS-3 and STS-1 access adapters allow for provisioning and switching of the kind of very large channelized TDM voice traffic volume expected in telco environments. Voice processing such as compression and echo cancellation can be serviced with IML's new family of plug-in resource modules.

With IML's HYPER-T3 access adapter, typical applications and devices such as access gateways, distributed switching, intelligent networking service nodes, intelligent peripherals, remote access servers, and multimedia gateways reach new levels of telephony port density without exceeding the time slot limitations of cPCI industrial chassis.

Designed for the CO environment, IML's HYPER-T3 adapter includes support for cPCI hot-swappability, high capacity TDM buses, and rear I/O access and cabling. Its rear I/O card has a serial port for local access and a 10 MBps Ethernet port for remote access. It is equipped with a mezzanine bus connector to allow for on-board digital signal processing such as tone detection or generation, echo cancellation or compression.

The HYPER-T3 broadband access adapter can be used in applications where either in-band or out-of-band signaling is required. It has on-board support for ISDN PRI, robbed-bit signaling, GR-303 for out-of-band signaling, and APIs for applications using SS7 signaling. The HYPER-T3 adapter includes a local Motorola MPC860 processor running at 66 MHz that manages peripheral initialization, signaling (CAS, PRI, and GR-303), and time slot assignments. The local processor also serves as the host application interface.

Host-level APIs provide a simple means of initialization, configuration, call setup, call termination, and diagnostics. Drivers are available for Windows NT, Linux, Solaris (SPARC), and Tru64 (Digital Unix) operating systems.

IML's HYPER-T3 broadband access adapter costs $16,995.

**CompactPCI -- The Nuts and Bolts of Next-Gen CT**

**IXTHOS**

Ixthos (Leesburg, VA - 703-779-7800, [www.ixthos.com](http://www.ixthos.com)) is a wholly-owned subsidiary of DY 4 Systems of Kanata, Ontario. Ixthos designs high-performance CompactPCI DSP boards based on the Motorola PowerPC, Texas Instruments 'C6x and ADI SHARC DSP processors, as well as PCI Mezzanine cards and analog/digital input/output mezzanine modules.

Ixthos now has a cPCI Linux-based DSP board for telecom voice processing called the **CompactPCI CHAMP-AV telecom DSP board**. It delivers more than 26,000 MIPS of available DSP performance
and 81.3 SPECint95 of available RISC performance. Ixthos' CHAMP (Common Heterogeneous Architecture for Multi-Processing) architecture further helps this board process high voice/data throughput channels for apps ranging from DTMF and Vocoder to speech rec and generation.

Thanks to the "lean and mean" Linux operating system, this latest CHAMP-AV board can process over 1,000 broadband-integrated voice/data channels in a single 6U CompactPCI slot. This is done via the Motorola PowerPC AltiVec RISC microprocessor and SMP real-time extensions from the Linux OS. The new high performance board provides support for two PMC expansion modules that allow flexible and adaptable I/O modifications. These PMC I/O expansion sites and Ixthos' strategic I/O partnerships can create solutions for T-1/E-1, ATM, frame relay, OC3 / OC48 (Sonet), 10/100 BaseT and Gigabit Ethernet-based applications.

Ixthos' CHAMP architecture provides for the creation of systems based on two scalable, redundant Signal Processing elements (SPEs) where each SPE contains two MPC7400 PowerPC processors running at 450 to 600 MHz. Each SPE has a dedicated 10/100 BaseT Ethernet interface and all the needed resources to send, receive, and process voice/data channels with additional I/O data fed through the dedicated industry standard PMC sites. This facilitates a flexible, low cost configuration while meeting specific I/O requirements for a variety of telco apps.

The four signal processing PowerPCs are supported by a core processing element (CPE) made up of another PowerPC controller (a 250MHz MPC8240), global memory, semaphores, interrupt multiplexers, a dedicated Ethernet interface, and the H.110 bus. The core processor can process data from any of its I/O sources independent of the SPEs, or seamlessly serve as an I/O manager to DMA data to the four 7400s for concurrent processing.

Independent PCI-PCI data bridges separate the new board's core and signal processors, providing up to 0.5 GBps of simultaneous I/O data movement, enabling concurrent I/O, H.110, Ethernet, and cPCI bus transfers. The H.110 bus data is thus efficiently distributed to all SPE and CPE processors on the board.

Global CPE memory for the CompactPCI CHAMP-AV is 32 or 64 MB of high speed SDRAM, 64 bits wide. Local memory is 64 to 128 MB of 64-bit-wide SDRAM per SPE PowerPC pair. Level 2 (L2) cache is up to 2 MB of SBSRAM (Synchronous Burst SRAM) per processor and FLASH memory is up to 16 MB.

CompactPCI CHAMP-AV software support includes Ixthos' IXATools, used to configure and control the DSPs and all the board level resources and provide a common suite of DSP math libraries. This software suite includes Host/Target support libraries, Smart DMA firmware that presents a command interface to the backplane, and PowerPCs and operating system-specific board support packages. Additional DSP libraries are provided by comprehensive IXLibs-AV Third-party software. Supported operating systems include VxWorks and Linux.

Pricing for the new Ixthos CompactPCI CHAMP-AV telecom DSP board starts at $18,900.

Also, Ixthos' new line of CHAMP Digital Radio Boards, called the CHAMP-DR, provide four channel
receivers or dual channel transceivers, tightly coupled with up to four DSP processors in a single 6U VME or cPCI slot. Sub-system solutions include several third-party PMC products integrated from Ixthos' Embedded Business Partners program.

The versatile CHAMP-DR can implement multi-channel, very low noise, wide and narrow band receivers and transmitters which allow virtually any demodulation scheme, including AM, FM, PM, FSK, PSK, QPSK, CDMA, and others. The boards incorporate (SPEs) tightly coupled 14 bit A/D front end tuners for high speed data transfers and high data throughput (>200 MBps).

Because the CHAMP architecture is processor-independent, users can specify the popular TI320C6xDSP, the traditional choice of digital radio designers, or the new Motorola PowerPC 750/7400 with AltiVec. Up to two PMC mezzanine sites are provided to enhance the versatility of the CHAMP architecture.

The board can run OSes such as VxWorks and SMP Linux. Also, full function optimized math libraries, PMC drivers, software development tools (for developing filter coefficients, board configuration parameters, programming, and algorithms, etc.), and multiple host board support packages are available.

Extended temperature and conduction-cooled versions of the CHAMP-DR are available from DY 4 Systems, Ixthos' parent company.

Pricing for the VMEbus CHAMP-DR with the TI320C6701 DSP starts at $21,000.

MAPLETREE NETWORKS

Mapletree Networks' (Norwood, MA - 781-51-2400, www.mapletree.com) MTN-5000 is said to be the first CompactPCI remote access card for service provider and carrier class OEMs to offer true universal port functionality.

Based on Mapletree's UniPorte architecture, the MTN5000 features from 96 to 168 56K/ISDN remote access ports, more than twice that of its nearest competitor. Equally important, each port can be dynamically configured to handle a wide variety of incoming subscriber calls, including V.90 56K, Basic Rate ISDN, and both fax-- and voice-over-IP.

The MTN5000 supports both T-1/PRI and E-1/PRI WAN interfaces. A single MTN5000 card provides enough ports to accommodate seven T-1 lines, and a cPCI chassis equipped with four MTN5000s provides enough ports for a full T3 line.

Mapletree's UniPorte is a universal port solution that lets any port dynamically handle voice, fax, and data calls. This capability is essential for building scaleable network access servers and gateways that can cost effectively handle constantly changing call patterns and diverse subscriber bases.
The MTN5000 supports ITU-T V.90, V.34bis, and lower data modulations, complete with MNP5 and V.42bis compression, and MNP 2-4 and ITU-T V.42 error correction. The MTN5000 also supports ITU-T V.17, V.29, V.27ter, T-30, Class 2, and Class 2.0 fax modulations. Voice data support includes ITU G.711, G.723.1, G.729A, and G.729B voice coders, G.165 and G.168 echo cancellation, voice activity detection, comfort noise generation, DTMF relay, and jitter buffer management and playback, complete with call status/progress monitoring, statistics/error collection, and system diagnostics. Packetization support includes PPP and SLIP data, RTP packets for VoIP, T.38 IFP packets for FoIP, and Rate-Adaptation with buffering, spooling, and stalling.

The MTN5000 is hot-swappable and complies fully with the PICMG Hot Plug specification. It's also H.110 compliant.

MARATHON TECHNOLOGIES

Marathon Technologies (Boxborough, MA - 978-266-9999, www.marathontechnologies.com) has announced it will introduce a line of Endurance products specifically for the communications industry. The new product line will provide continuous call handling and database availability in standard based-platforms or NEBS-compliant carrier-grade systems.

Based on Windows server OSes and an Intel-based architecture, Marathon will deliver 99.999% availability for IP call processing, IP conferencing and video, inbound and outbound call processing, pre-paid calling, unified messaging, enterprise UnPBX, LAN PBX, 800 number lookup, SS7, and 3G wireless systems.

Marathon will deliver Endurance platforms for use in NEBS or non-NEBS compliant CompactPCI servers for all telephony and telecom applications. These scalable platforms provide nonstop carrier-grade service for shrink-wrapped applications using wireless application protocol (WAP), voice-over-IP (H.323), LDAP, COM, and other protocols and services. As with its enterprise Endurance products, the underlying software applications need not be altered or scripted in any way to achieve true 99.999% availability.

Marathon will begin shipping the first CO cPCI and standard PCI models this summer. Pricing is not yet available.

MOTOROLA

The Motorola Computer Group (Tempe, AZ - 602-438-3000, www.mcg.mot.com) one of the pioneers of CompactPCI, has introduced the single-slot CPV5400 Pentium III processor card, the first in a line of MCG cPCI products supporting a single socket 370 and the latest high-speed 840 chipset capable of 133-400 MHz front side bus performance. The CPV5400 can be configured using different SDRAM from 128 MB to 1 GB and dual Rambus memory (from 1 GB to 4 GB) mezzanines to help enable superior performance and flexibility. These speed and memory enhancements will serve as a starting place for next-generation embedded boards, offering a minimum five-year lifecycle, compared to the typical 9-12 month product lifecycle for desktop applications.
The CPV5400 is designed for operating systems and Real-Time Operating Systems (RTOS) such as Windows NT, VxWorks and Linux. The CPV5400 lists starting at $2,195.

And we shouldn't overlook Motorola's MCPN765, a CompactPCI single board computer with dual PCI Mezzanine Card (PMC) capabilities that can hold up to 1 GB of memory, is hot-swappable and has dual Ethernet ports. Available in two models, the MCPN765 is based on Motorola's MPC7400 PowerPC microprocessor with AltiVec technology or the PowerPC 750 microprocessor with speeds of 466 MHz and beyond.

Real-time database applications such as wireless infrastructure location registers require large memories and high speeds like those provided by the MCPN765. The single-slot, 1 GB configuration improves performance for HLR/VLR (home location register/visitor location register) look-up algorithms.

Based on Motorola's PowerPlus II architecture, the MCPN765 operates in non-system slots, allowing configuration of loosely coupled multiprocessor systems. Also, it occupies a single slot, even when fully configured with 1 GB of memory and two PMC cards. This enables systems to be deployed with the maximum number of processor boards. For example, a standard eight-slot CompactPCI system can be configured with a system slot processor and up to seven MCPN765 boards, allowing the maximum amount of CPU horsepower in a CompactPCI system. The board also complies with the latest revisions of PICMG hot-swap specifications, reducing the downtime needed for system repair or upgrade.

In addition to providing front I/O, the MCPN765 processor board is designed to work with the proposed PMC Interface Module (PIM) architecture for modular rear I/O. This enables Motorola to provide its OEM customers with faster time to market and a cost-effective, simplified rear I/O configuration with standard, off-the-shelf products.

Motorola's MPC7400 PowerPC microprocessor is a swift member of the PowerPC family. When combined with Motorola's MCPN765, the floating point capabilities offered by AltiVec technology can enhance wireless functions such as rate adaptation or transcoding that are used in applications like GSM's Generalized Packet Radio Service (GPRS) when converting data between wireline and wireless encoding formats. Motorola's Semiconductor Products Sector is rapidly increasing production of the MPC7400 PowerPC microprocessor for both embedded and computing applications.

The single-unit U.S. list price for the MCPN765 with the 233 MHz PowerPC 750 is about $1,995; the MCPN765 with the 400 MHz MPC7400 and 2 MB of L2 cache starts at $2,595.

NATURAL MICROSYSTEMS

Natural Microsystems' (Framingham, MA - 508-620-9300, www.nmss.com) has unveiled the CG6000C - a new carrier-class, CompactPCI-based platform supporting "in-the-network" deployments for IP enhanced services. The CG6000C offers 240 VoIP ports per cPCI slot, a mature and comprehensive software development environment, worldwide trunking certifications, and high
availability features.

The CG 6000C is the first of the Convergence Generation (CG) family, a new carrier-class, cPCI-based platform supporting "in-the-network" deployments.

The CG 6000C hosts Fusion 4.0, Natural MicroSystems' VoIP software platform for the development of advanced real-time media streaming applications.

IP Media Server technology is a cornerstone for next-generation enhanced service offerings. The CG 6000C, a key component of Natural MicroSystems' IP Media Server architecture, was built to support low-latency media streaming of IP-based multimedia traffic.

The CG 6000C also includes: Universal port for IVR/Fax/ Vocode/ Play/Record, configurable signal processing configuration, by port, by call T.38 IP Fax, software-selectable T-1/E-1 interface, and MGCP v1.0 integrated with their CT Access API.

**PENTAIR**

The Pentair Electronic Packaging Group (Anoka, MN - 800-328-9626, [www.pentair-ep.com](http://www.pentair-ep.com)) manufactures the complete range of Schroff products and provides a wide array of custom and off-the-shelf enclosure packaging solutions for customers in the fast-growing datacom and telecom markets.

Like Rittal and Elma, Pentair has also developed a new cPCI Insertion/Ejection Handle that incorporates several advanced design features to solve industry-wide handle problems. The handle has been introduced by Pentair as part of its Schroff product range.

In CompactPCI hot-swap/live insertion applications, handles are critical components because they actuate the microswitch and also control the insertion/ejection process. Unlike other handle designs, however, the live insertion microswitch is operated by a pushbutton in the Schroff handle and functions independently of the handle ejection process, preventing accidental triggering of the hot-swap microswitch during insertion/ejection.

As added safety measures, the push button is recessed in the handle, and guard walls on both sides of the pushbutton provide a barrier to further prevent accidental contact with the microswitch.

The new Schroff handle is designed to overcome premature failure associated with earlier cPCI handle designs. It has been tested to 200 cycles of insertion/ejection. This matches the life expectancy of the 2mm connector, which is an integral part of the CompactPCI form factor.

The handle provides ease-of-use because it prevents users' fingers from getting caught between the ejection teeth and the subrack front rails during operation. Pentair also offers a Schroff VME64X variation of the handle.
Pricing starts at $2.75 per handle.

PERFORMANCE TECHNOLOGIES

Performance Technologies' (Rochester, NY - 716-256-0200, www.pt.com) **6U high CPC380 Quad T-1/E-1 WAN Controller** for CompactPCI systems provides OEMs, integrators, and end users with a 128-channel serial communications interface for any channelized protocol connection to telco switches, AIN nodes, CT systems, or remote access multiplexers. Optional protocols include Frame Relay, SS7, HDLC, X.25, or the ProtoKit Development Environment, enabling the integration of customer specific WAN protocols. The CPC380 can also operate with SunLink protocols using ChanneLink, PTI's fully channelized Solaris driver.

The CPC380's dual 50MHz Motorola MPC860MH PowerQUICC datacomm processors perform onboard protocol execution without burdening the host CPU. CompactPCI H.110 CT Bus support is achieved using the OKI H.100/H.110 interface chip. PTI has also adopted the OpenTelecom.org H.110 API.

Memory consists of 32 MB DRAM (one dedicated 16 MB array per PowerQUICC processor), 64KB of high speed shared SRAM to provide ample space for accepting and queuing of PCIbus data, and 1 MB of Flash PROM that simplifies field firmware upgrades.

Integrated CSU/DSUs and an onboard Layer 1 interface eliminates the need for costly external CSU/DSUs.

The board complies with the PICMG 2.5 computer telephony specification for hot-swap on cPCI and H.110. and incorporates the PLX PCI9054 Bus Master Interface and a passive transition module to facilitate hot-swap and eliminate failure points.

OS support includes Solaris, Windows NT, VxWorks, and QNX.

RADISYS

Radisys Corp. (Hillsboro, OR - 503-615-1100) announced as we went to press the **ARTIC 1000** cPCI I/O Platform for telecom OEMs.

Radisys' new platform is a board that uses an amalgam of the latest technology: Motorola Corp's PowerQUICC II; Tundra Semiconductor Corp.'s PowerSpan PCI to PowerQUICC II Bus Switch; and Texas Instruments' TMS320 C6202 (C6X) Digital Signal Processors (DSPs). This combination of processing, connectivity, and expandability enhances performance to the ARTIC family for carrier-class apps such as SS7, ATM, SONET/SDH, and voice/data convergence protocols, as well as connectivity including traditional serial interfaces, T-1/E-1/J-1, OC-3, and other optical interfaces.

The ARTIC 1000 cPCI I/O Platform includes expandable processing and connectivity via two PCI
mezzanine card (PMC) connectors, dual 10/100 Ethernet connectivity and an H.110 interface. Follow-on products will include integrated intelligent platform management interface (IPMI) capability, the option to populate with four Texas Instruments DSPs for increased processing power, and, later this year, a PCI-bus-compatible version.

As you may recall, a Best of Show Award went to Radisys at CT Expo Spring 2000 for its outstanding new cPCI-based single board computer - the **EPC-3306 System Controller**. The EPC-3306 is designed to interface and manage one or more of RadiSys' latest cPCI peripheral processors - the **EPC-3305** and **EPC-3208** - or peripheral processors from other manufacturers.

**RITTAL**

The new **CompactPCI Developer Subrack** from Rittal Corporation (Springfield, OH - 937-39-0500, [www.rittal-corp.com](http://www.rittal-corp.com)) is designed to be a quick and inexpensive solution to test and debug cPCI front-loaded and rear-loaded I/O boards. When developing cPCI boards, access to the components may be necessary. This can be done with a cPCI extender card, a solution that tends to be expensive and might cause signal distortion. Rittal's Developer subrack, however, has specially designed side plates that allow easy access to a prototype Printed Circuit Board (PCB) and its components.

Power for the backplane can come from an existing benchtop supply. Alternatively, you can use a pluggable power supply in place of PCB slots, or an inexpensive ATX power supply can be plugged directly into the backplane.

The cPCI subrack is 8U (14") high, has a 42HP (10.5 slot) usable width, and is 292 mm. (11.5") deep. The upper 6U is for 6U cPCI front- and rear-loaded PCBs and the lower 2U is for fan tray and table (cable) clearance. You have a choice of cPCI or H.110 telephony backplanes.

**SBS TECHNOLOGIES**

SBS Technologies, Inc., Industrial Computers (Carlsbad, CA - 888-598-8111, www.sbs.com) recently announced their **Models CP3508** and **CP6808**, rackmount CompactPCI enclosures for 3U and 6U cards, respectively.

The 5U high CP3508 enclosure provides for a standard eight--slot CompactPCI backplane for 3U cards. The many plug-in cPCI CPU cards relying on the PowerPC or the Intel processor are easily integrated into the enclosure.

The standard enclosure comes with dual 150W redundant hot-swappable pluggable power supplies. The working power supply assumes the full system's load while the faulty supply is being replaced. The 8U high CP6808 enclosure provides for a standard eight-slot cPCI backplane or a telephony H.110 backplane for 6U cards. Standard transition modules are available for all slots.

The standard enclosure comes with dual 300W redundant hot-swappable power supplies. Power
supply options include pluggable cPCI power supplies. Up to three 5.25" or 3.5" front-accessible, vertical shock-mounted drive bays are located on the front panel.

Both Models CP3508 and CP6808 provide positive pressure, push and pull cooling with six high-efficiency ball bearing fans located above (the "push") and below (the "pull") the card cage. This failsafe cooling system is critical for telecom applications where downtime is not an option. Washable air filters are an integral part of the bottom fan assembly's front panel and are easily removed for maintenance.

The control panel consists of a recessed power and reset switch with power-on and hard drive LEDs. There is room for additional system controls or special switches to meet specific application requirements. An optional "health" monitoring system is available to monitor the system's internal environment. Both models are constructed of steel to provide EMI/RFI shielding and line transient protection. The electronics are modular in design for easy integration, service and customization.

The Model CP3508 is priced from $2,495 (list) while the Model CP6808 is priced from $2,995 (list).

The 9U high enclosure provides for a standard eight-slot CompactPCI backplane or a telephony H.110 backplane for 6U cards.

Also, SBS Technologies' 9U high, eight-slot Model CP6908 got a Best of Show at CT Expo Spring 2000. It's an improved and enhanced version of their Model CP8000 rackmount CompactPCI system. The CP6908 was specifically designed for telecom applications and can easily be customized for specific telecom OEMs.

The Model CP6908 is priced from $2,995 (list).

The standard enclosure comes with dual 350W redundant hot-swappable power supplies. Up to five 5.25" or 3.5" front accessible, horizontal shock-mounted drive bays are located behind the front panel door.

Positive pressure, push and pull cooling is provided by six 4.7" high efficiency ball bearing fans located above and below the card cage. This fail safe cooling system is critical for telecom applications where downtime is not an option. Washable air filters are an integral part of the bottom fan assembly front panel door and are easily removed for maintenance.

Yet another division, SBS Technologies, Inc. Modular I/O (Newark, CA - 510-742-2500, www.sbs.com), has now made available two new mezzanine carrier boards for 6U CompactPCI. Both carriers provide a range of solutions for systems that require front or real-panel I/O in a single 6U cPCI slot. The new CP-613 "combo" carrier is the first one to hold up to three modules: two PMC modules and one PC*MIP module. The CP-620 holds two PMC modules. The CP-613 and CP-620 join the SBS family of Modular I/O solutions for CompactPCI which include carrier boards, PMC modules, and PC*MIP modules.
The CP-613 overcomes a significant barrier for I/O expansion in CompactPCI systems, providing more on-board PCI functionality to allow extra I/O expansion in a single slot.

Using the industry standard Intel 21152 PCI to PCI Bridge, the CP-613 supports a 32-bit data path at 33 MHz for 132 MBps operation. The "PC*MIP" site and the PMC sites on the CP-613 support bus mastering. The three expansion sites support front-panel and rear-panel I/O. A rear-panel transition board, the **TM-680**, is also available. The CP-613 and CP-620 carrier boards comply with the PICMG 2.0, version 3.0 cPCI specification. Also, the CP-613 carrier provides complete compatibility with the PC*MIP draft specification (ANSI/VITA-29).

The CP-613 carrier, which holds two PMC modules and one PC*MIP module is priced at $550 (list). The CP-620 carrier, which holds two PMC modules, is priced at $495 (list).

And don't miss their CP-3101, a new 3U CompactPCI board with two independent, high-performance Fast Ethernet controller ports. Based on the Intel 82559ER Fast Ethernet PCI Controller, back-to-back transmissions with minimum interface latency are realized through two large transmit and receive FIFOs. The CP-3101 provides IEEE 802.3 auto-negotiation support and includes a number of sophisticated features such as Manchester encoding/decoding (10 BaseTx), 4B/5B encoding/decoding (100 BaseTx) and scrambling/descrambling (100 BaseTx). LAN connectivity is through two front panel RJ45 connectors. The CP-3101 complies with the IEEE 802.3 standard for 10 BaseT and 100BaseTx. Both full- and half-duplex modes are supported.

The CP-3101 is priced at $395 (list). Driver support is available for the VxWorks and Windows NT operating systems.

**TEKNOR APPLICOM**

Teknor Applicom's (Boisbriand, QC, Canada - 450-437-5682, [www.teknor.com](http://www.teknor.com)) **cPCI-DXS64**, is a 6U high availability cPCI dual-slot single board computer. It's built upon two Pentium III 600 MHz SMP processors, up to 2 GB of Direct RAMBus memory and 64-bit bus support.

Serving as a fine complement to Teknor's family of 6U system and peripheral processors, the cPCI-DXS64 takes full advantage of one 733 MHz Pentium III or two 600 MHz Pentium III SMP processors, a 133 MHz front side bus, and the Intel 840 chipset, to thoroughly satisfy the highest bandwidth requirements. Another performance boost comes from its use of Direct RAMBus technology with up to 2 GB of PC800 Direct RDRAM on four 168-pin latching RIMM sockets, and a 64-bit CompactPCI bus clocking at 66 MHz.

The hot-swappable cPCI-DXS64 is pin-out compatible with Teknor's 6U CompactPCI family of system and peripheral processors, including the **cPCI-MXS**, **cPCI-MXP**, and **cPCI-CXS**. It includes a permanent mezzanine with a secondary bridge that extends the cPCI-DXS64 interface capabilities to 14 CPCI I/O slots. An optional high density (min. 10 GB) 2.5" HD can also be fitted on the permanent mezzanine.

Teknor's cPCI-DXS64 has a list price of $3,700.
Teknor's **cPCI-MXP64** multiprocessing peripheral processor is based on a low power, high performance Pentium III processor and up to 768 MB of SDRAM in a 4HP form factor. This little cPCI-MXP64 can deliver cutting-edge CompactPCI clustered multiprocessing for mission-critical telecom applications.

Hot-swappable, the cPCI-MXP64 offers speeds of up to 500 MHz with the 440BX AGPset, and features high availability support for dual Ethernet, a 64-bit PCI bus, and an Intelligent Platform Management Interface (IPMI) through FPGA logic. This comprehensive, high-density CPCI package enables communications gateway solution providers - who integrate telephony services with data communications - to implement scalable multiprocessing for NT, VxWorks, pSOS, and Linux-based applications.

**TEMIC**

The **StarRec KXL board** from Telefunken Microelectronic GmbH (Ulm, Germany - +49-7-31-3-94-106, [www.temic.com](http://www.temic.com)) is a 32-channel speech processing board that comes in PCI and cPCI form factors. The board holds four T-I TMS320C6701 DSPs and one Motorola MPC860 PowerQUICC. 32 channels are handled per board, and each port can be switched between isolated speech recognition, continuous recognition, and word spotting by invoking the appropriate instruction in the API. The recognition probability is indicated for each recognized word. If the probabilities are too low then the application can use alternative worlds and check them against a given database.

Up to 32 context-related sub-vocabularies can be activated through the API. Large active vocabularies with up to 4,000 words are possible.

Available channels drop from 32 to 16 when continuous recognition is done using the Barge-In mode, a speech recognition module that determines when the user voluntarily interrupts a prompt and is able to recognize the voice of the user despite an active voice output from the IVR system.

The two versions of the board are H.100 and H.110 compatible, though they are adaptable to SCbus and MVIP.

The board runs under SCO Unix and Windows NT 4.0 (the NT version also has an ECTF S.100 API available).

**TRACEWELL SYSTEMS**

Tracewell Systems (Westerville, OH - 614-846-6175, [www.tracewellsystems.com](http://www.tracewellsystems.com)) now offers two cPCI backplane series, the **cPCI and H.110 Telecom Backplanes** for 6U boards.

The cPCI backplanes have a PICMG 2.0-R2.1 compliant 64-bit cPCI bus, including hot-swap and slot geographic addressing (a 5-bit "geographic address" allows a telephony card read its slot number and "know" what phone lines it’s connected to). The eight-layer design is optimized for signal and power distribution with uniform impedance. A right-justified system slot is available allowing use of
all slots, even with multi-slot CPU boards. Left-justified versions also are available. Power terminals are positioned adjacent to the system slot to provide more efficient power distribution and wiring, an orientation that allows a 6U overall board height while providing full access for rear plugging boards. Power connections use a combination of ATX and high current power taps to support a wide range of power harness configurations. To eliminate the problem of bent pins during installation of rear plugging I/O boards, "AB" type connector shrouds are installed on both P3 and P5 in all slots.

The H.110 Telecom Backplane is similar to the cPCI model, but it combines a 32/64 bit compatible cPCI bus with an embedded TDM bus. Also the H.110 uses a 10-layer board design instead of eight. The P4 H.110 TDM bus extends to all slots except the system slot, allowing CPU feed-through I/O and segment bridging. The TDM bus also meets all hazardous voltage requirements for IEC950 / UL1950. In single quantities, Tracewell cPCI/H.110 backplane prices start at $660.

TRENTON TECHNOLOGY

The CPBI Single Board Computer from Trenton Technology (Gainesville, GA - 770-287-3100, www.trentonprocessors.com) marks Trenton's entry into the CompactPCI marketplace. It can hold either Intel’s Pentium III "flip chip" or Celeron Plastic Pin Grid Array (PPGA) processors. It also features the 440BX AGPset, on-board Intel video and Ethernet interfaces that's supported by Intel's Applied Computing Product Division. The 440BX AGPset supports the system/memory bus at 66 MHz and 100 MHz speeds. The Pentium III supports high bandwidth with Intel's new 256K level 2 Advanced Transfer Cache technology running at full CPU core frequencies. The Celeron PPGA processor, Intel's Socket 370 low-profile solution, comes in speeds up to 533MHz.

The CPBI has dual PCI EIDE Ultra ATA/33 interfaces which allow synchronous DMA mode transfers up to 33 MBps. Two DIMM sockets will hold up to 512 MB of SDRAM. An Ultra2 SCSI interface has an 80 MBps data transfer rate. There's also dual Intel 82559 10/100 Base-T Ethernet interfaces and the usual serial, floppy, parallel, mouse, and dual USB ports.

The Pentium III CPBI comes in six models up to 850MHz with prices starting at $2,793. The Celeron version is available in six models up to 600MHz with prices starting $2,466. Volume and OEM discounts are available.

VMIC

The VMICPCI-7699 from VMIC (Huntsville, AL - 256-880-0444, www.vmic.com) is a single-slot Pentium II/III processor-based cPCI single-board computer, offering processor speeds of up to 500 MHz and up to 512 MB of SDRAM. As a peripheral-slot CPU, an embedded PCI bridge allows the on-board Pentium II/III processor to operate independently of the cPCI bus.

VMIC has teamed with Artesyn Communication Products on this product to provide up to eight T-1/E-1 channels via rear panel I/O using two PMC boards that can be plugged into the dual PMC expansion sites.

The VMICPCI-7699 allows three instructions to be executed per clock cycle. A dynamic branch
prediction unit, separate instruction and data caches, and MMX technology also increase the Pentium II/III processor's performance.

The VMICPCI-7699 complies with the high-availability provisions of PICMG 2.1 revision 1.0 standard for CompactPCI hot-swap. This means, besides being able to remove and replace the board with the system operating, processing can automatically be switched to a second backup board already installed in the system in the event of failure in the primary processor.

There's 32 KB of battery-backed SRAM on board and options include 96 MB of IDE Compact Flash memory.

Also included is a 64-bit AGP SVGA controller with 4 MB SGRAM, a software-selectable watchdog timer with reset, a Fast Ethernet controller supporting 10 BaseT and 100 BaseTX interfaces, UltraDMA-33 hard drive and floppy drive controllers with CompactPCI J3 I/O, two 16550-compatible serial ports, a PS/2-style keyboard and mouse port on front panel, a real-time clock and miniature speaker, and a passive heat sink. Operating systems supported include: Windows NT, VxWorks, QNX, Solaris, and Linux.

The VMICPCI-7699 costs $2,360.

ZIATECH

Ziatech's (San Luis Obispo, CA - 805-541-0488, www.ziatech.com) new cPCI development systems are based on a new chassis with enhancements such as increased power supply capacity to 425 watts, and a new more serviceable fan tray design. The first of these systems, the **Sapphire 1008 Development System**, is a pre-configured, ready-to-run, H.110 compliant cPCI computer. It's a 10U-high, 19" rackmount that can be configured with a choice of eight-slot backplanes. After you choose from among Ziatech's many cPCI CPU boards, you can select your operating system (Linux, Windows NT, VxWorks), and then you're up and running.

Core peripherals include Super VGA, CD-ROM, floppy disk drive, and IDE hard drive.

The system is compliant with the PICMG CompactPCI specification 2.0, Rev 2.1, the hot-swap specification (PICMG 2.1 Rev 1.0) and the telephony bus spec (PICMG 2.5, Rev 1.0).

The Sapphire 1008 Development System has a single quantity price of $5,495.

When you're ready to run your finished product on a more hefty platform, take a look at Ziatech's 12-slot, 15U high, **ZT 5083 NEBS High Availability (HA) System**, which supports redundant CPUs (switchover time of less than 10 ms.) and the VxWorks operating system.

The ZT 5083 in single quantities starts at $19,695. A VxWorks Board Support Package (BSP) goes for $2,450.
Finally, Ziatech won a Best of Show Award at CT Expo Spring 2000 for their 6U high **ZT 5550 Redundant System Slot SBC** for custom system application developers working in carrier-grade environments. Developers of high-end, fault tolerant systems can now buy an off-the-shelf product for what was previously only serviced by proprietary board designs.

The ZT 5550's standard configuration includes a 500 MHz Intel Pentium III and up to 256 MB of ECC SDRAM and dual CompactPCI buses. The ZT 5550 supports up to 12 cPCI peripheral boards (as can be found in Ziatech's ZT 5083 NEBS system) and, when used with another ZT 5550, can provide 99.999% availability. Switchover time from the active master to the standby master CPU is less than 20 milliseconds. The board has expansion options such as dual PMC sites, floppy drive, IDE hard drive and video.

The ZT 5550 has a single quantity price of $5,695.