Telephony: The Battle at The Millennium

VME versus CompactPCI at Armageddon

Jerome L. Krasner, Ph.D., Group Manager, Telecom & Embedded Systems, Venture Development Corporation, and Paul Hughes, Senior Analyst, Telecom, Venture Development Corporation

VME board shipments totaled $1.254 billion in 1997, an increase of 3.0% over 1996 revenues. Of this total, 31.7% of VME board shipments ($397.5 million) was for communications applications (see Figure 1).

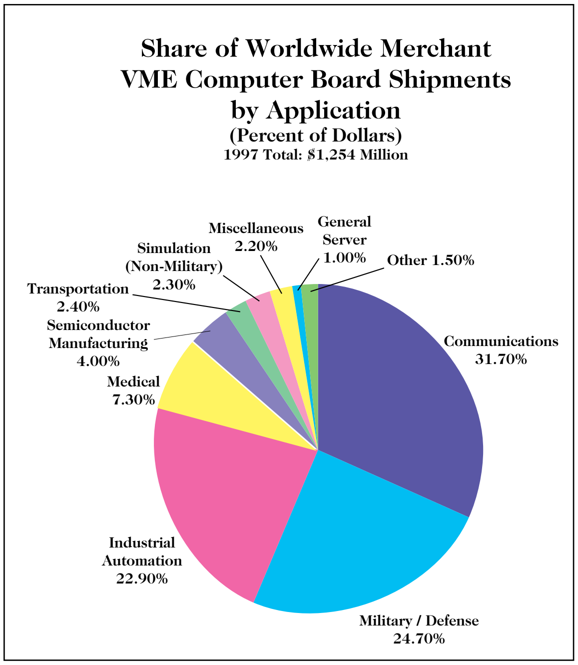

Figure 1.

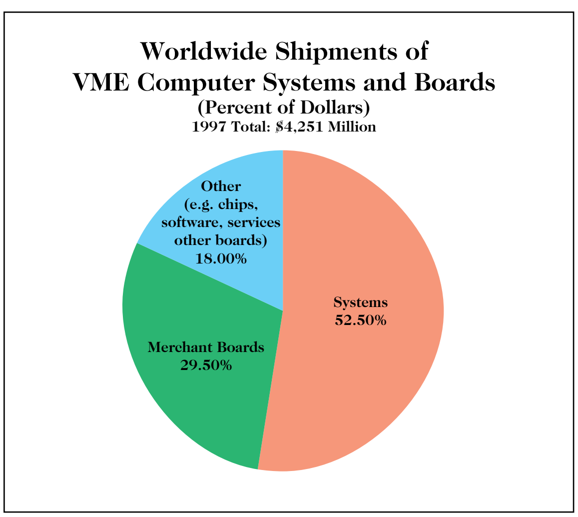

Figure 2.

VME merchant boards, however, constituted only 29.5% of worldwide VME computer systems and board shipments, which totaled $4.251 billion (see Figure 2. It follows that worldwide shipments of VME systems, boards, software and services for communications applications totaled $1.348 billion in 1997.

VDC studies have seen a strong shift towards systems within the VME marketplace, driven by economic factors which are discussed in the VDC study "The 1997-1998 Worldwide Market for Merchant Computer Boards in Real-Time and Embedded Applications".

Communications applications continue to grow at a rapid pace, particularly within the telecommunications marketplace where opportunities abound for the rapid expansion in wireless communications, the demand for enhanced services governed by the Advanced Intelligent Network (AIN), and demands to expand the backbone architecture of the telecom system known as SS7.

The AIN/SS7 telecom market for hardware systems, software, middleware and services totaled $8.65 billion in 1996 and is forecast to grow to $18.6 billion by 2001 (see Fig 3).

Modern Telecommunications: Defining SS& and AIN

Over the last two decades, advances in digital computer and transmission technologies have made significant impacts in telephony. With the introduction of Stored Program Control (SPC) central office switching machines (e.g., AT&T's #1 ESS, in 1965) and PCM digital carrier transmission (e.g. AT&T's T-1 carrier, in 1962), a new approach to network intelligence and inter-office signaling began to evolve. Initially, the prohibitive cost of processors and memories within the SPC switches kept network intelligence centralized. Likewise, trunk signaling in the new digital carriers remained channel associated by stealing bits from the PCM voice channels to derive dedicated, but greatly underutilized, 667 bps data links for each digital voice trunk.

By the mid-1970's, telecommunications engineers felt increasing pressure to conserve expensive switch processor resources (expended while scanning each trunk for signaling data), and to significantly reduce non-revenue trunk usage during the long set-up times required for channel associated signaling. After some intensive study and experimentation, it was decided to borrow some of the more useful data communications techniques from the computer networking industry, which resulted in the initial implementation of common channel signaling, known as the Signaling System No. 6 (CCS6) in 1976. Operating over a permanent virtual circuit network via slow, modem-derived data links at 2400 or 4800 bps, CCS6 was used only to exchange call set-up and routing information for interoffice trunks.

The 1980s saw the implementation of a new generation of intelligent Time Division Multiplexers which combined voice and data circuits into single high-speed aggregate bit streams, resulting in increased reliability, enhanced cost-savings and operational efficiencies. These innovations provided such features as redundancy and automatic circuit rerouting, while supporting a variety of data and voice I/O capabilities.

LAN deployment accelerated allowing widespread data acquisition, bandwidth-on-demand for data transfers, and standardized connectivity. The 1980s also witnessed the migration of computer networks shifting from a central host to a client/server architecture.

By 1980, however, CCS6's capabilities were expanded to allow for queries to centralized databases for use in 800/Freephone Services and third party, collect, or credit card calling services.

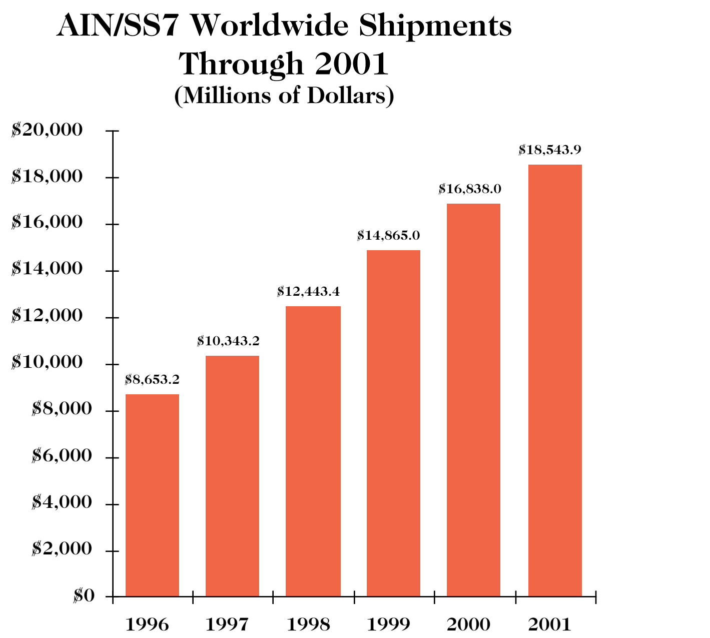

Figure 3.

Although CCS6 offered new revenue potential, it needed improvements in message lengths, data-transmitting speeds, and administrative overhead. These areas were addressed, along with many new enhancements, in the design of the new and current protocol, known as the Signaling System No. 7 (SS7). SS7 has become an international protocol and worldwide standard for modern telecommunications networks. In Europe and Asia, SS7 is known as C7, and the protocol stacks differ from those of the U.S. The U.S. implementation is based on the International Telecommunications Union-Telecommunications Section (ITU-TS) and T1X1 Committee of the Exchange Carriers Standards Association (ECSA).

The 1990s are witnessing the completion of SS7 within the US Public Switched Telephone Network (PSTN), which is enabling the integration of public and business communications. Virtual Private Networks (VPNs) allow flexible dialing and a multitude of voice options for business users. Continued cost reductions in T1 services have resulted in a segregation of voice and data in the Wide Area Network (WAN), thereby enabling the deployment of Frame Relay, which is particularly adept at transporting LAN and X.25 traffic.

New cell-based transmission technologies for integrating voice and data, as well as LAN and WAN networks are under development. These technologies include Switched Multimegabit Data Service (SMDS), Asynchronous Transfer Mode (ATM) and Broadband ISDN (B-ISDN).

Wireless communication systems utilization is growing dramatically for cellular voice and data technologies. Mergers, alliances and acquisitions are providing increased competition within the marketplace. The Cellular Digital Packet Data Standard has emerged as has Code-Division Multiple Access (CDMA) digital cellular technology which competes with Time-Division Multiple Access (TDMA) dual mode analog/digital technology within the wireless communication marketplace.

New frequency allocations for the rapidly expanding Personal Communications Systems (PCS) marketplace have emerged. PCS, through the SS7 network, will bring the enhancements of AIN technology to the individual user as they conduct their daily business.

Some SS7 and AIN Features

In Signaling System 7 (SS7), the linking of the telephone system with computers for switching purposes, has allowed the system to become "intelligent" via the utilization of data bases which can be accessed for general and specific caller related information, and for customized features desired by customers. By utilizing a client/server computer architecture to create a distributed, efficient and easily modified telephone infrastructure, information from common databases controls the switching of calls and allows the transfer of messages within the system.

The Advanced Intelligent Network (AIN) has paved the way for a variety of services, known as custom calling services. For example, calls from pre-determined numbers can be blocked, have a distinctive ring, or be forwarded to another number in compliance with instructions in a computer database accessed through the SS7 network.

A store or company having multiple locations within a city or throughout the world can be assigned a single number. Depending upon where the originating call is placed, the call is directed to the closest office or location. Furthermore, a call to a multinational company's single number can be further delineated with a multi-level messaging system which inquires of a caller the specific services and sub-services desired (directed by pressing a desired number) and, thereby, having the call routed to the appropriate office (which might be located anywhere in the world).

The key to accessing these intelligent capabilities is the client/server architecture that enables the databases, voice recognition systems, and enhanced services offerings that constitute the AIN to be accessed throughout the SS7 network.

Unlike the telephone system of yesterday, where switching fabric and service-delivery mechanisms were tightly coupled, the emerging AIN architecture separates the switch "fabric" from the software-based servers. New enhanced services are now added to open architecture AIN platforms that have industry standard interfaces, are scaleable, and allow rapid deployment and easy customization of these services.

This transformation of the telephone system from a centralized, tightly coupled architecture to a distributed, loosely coupled one is very easy to understand. It is being driven by the market demand for new, customized services, and by progress in hardware and software technology. The idea behind the emerging AIN architecture is to de-couple the new services from switching fabric hardware and software because this allows the development of a whole set of new services to be applied on a call-by-call basis. It will also provide users with advanced services such as movies-on-demand and offer telecom service providers an opportunity to generate revenues based on content that travels over their networks.

Another consequence of this move to a distributed architecture for public telephone networks is that the use of programmable switches in service provider networks will increase manifold over the next five years.

From an architectural standpoint, VDC expects service provider networks to continue to evolve along a client/server model which will require fail-safe, redundant platforms running standard, open operating systems that support multiple telecommunication-centric application software environments.

The Challenge from CPCI

CompactPCI, although currently showing more promise than revenues, is not to be taken lightly. CPCI, by nature, lends itself to the packet switching fabric that characterizes modern telecommunications. Telecom engineers like the CPCI chassis that is designed to accommodate a large number of rear-connect phone lines, allowing unrestricted card insertion and front-end card swapping. They also like the CPCI form factor for a 6U board that leaves an additional 220-pin connector, which they can use for a variety of purposes.

Vendors are drawn to CompactPCI for several distinct reasons. First, service providers, the consumers of telecommunications equipment, are committed to vendors who offer an open architecture (so as not to become enslaved to a single manufacturer). This places a demand on vendors that can offer an architecture that will run a variety of common software. Second, time-to-market considerations are dominated by software development more so that hardware issues. Lastly, the PC architecture possesses the richest software development environment in the world.

Computer designers have embraced PC-based embedded technology because of its extensive software development environment, its software development tools, and the fact that Microsoft-based software and development tools are significantly less expensive than Unix-based software and development tools.

A principal force favoring CPCI for telecommunications applications is its ability to support Windows NT, the favored development platform for AIN software developers. The Intelligent Peripheral (IP) AIN platform requires that enhanced services be customized for each subscriber. Windows NT lends itself nicely to this task. It was assumed that the requirements of the Service Control Point (SCP), the AIN database library, would remain within the Solaris domain, because of its reliability, scalability and robustness.

Surprise! Siemens has committed to using Windows NT and DGM&S software on its SCP. This is a move that might send shock waves across the industry, as others move to NT. There is no secret within the AIN telecom industry. Support NT or be left out.

Major telecom vendors have indicated that they intend to use CPCI on their IP platforms, although no substantial orders have been placed. It's sort of a tease. Alcatel, Nortel, Siemens, Lucent, among many others are evaluating competitive boards to integrate into their own systems. Yet very little money, if any, has changed hands. Certainly, there exists a strong demand by the telcos for open architecture systems, so that certain vendors don't entrap them, as they have in the past.

R. Brough Turner, Chief Technology Officer at Natural Microsystems, Inc., has made clear his company's commitment to addressing the wealth of PC software that is available. He has stated that he will utilize CompactPCI, PCs, or potentially any other platform that will function within the wide range of PC software. In such, a CPCI motherboard driving a PCI interfaced-VME backplane via a Tundra virtual PCI chip (vPCI) would be conceptually acceptable, since it would operate under PC software, including Windows NT.

Accepting that it is the ability to address PC software, rather than the nature of the bus architecture, that is of issue for many telecommunications applications, particularly for AIN, it is conceivable that CPCI may, in some ways, enhance VME opportunities just as PCI has done (e.g., via the PMC and when used as a local bus).

It is reasonable to observe that CPCI is taking a significant market share away from proprietary architectures that VME could not have addressed. Additionally, for applications in which real-time operation is not a requirement, and in which a single microprocessor design is appropriate, CPCI is taking market share from VME.

Limits of CPCI in Telecommunications

CPCI has posed a formidable threat to VME in certain aspects of telephony and the Advanced Intelligent Network. This threat is based upon certain CPCI strengths, but limited to those applications where a single microprocessor and a non real-time environment are appropriate. One won't find CPCI in STP routing applications, sophisticated network management systems or for billing applications, a market where a largely unaddressed need still exists.

CPCI is dependent upon Intel (Motorola's PowerPC family is not supported by Windows NT) and Microsoft software. Uncertainties surround the introduction of the next generation Windows NT 5.0 that will offer real-time operation and port IEEE1394, USB, and ATM for use by telecom developers.

How these other serial technologies will affect CPCI is not known, but the inventiveness of the industry and the receptivity of service providers to new and innovative means of voice/data transmission and control will have an impact of some sort.

Summary

The world market for merchant computer boards and systems for communications applications was $1.348 billion in 1996. The world market for SS7/AIN telecom systems including boards, platforms, systems, software and middleware totaled $8.65 billion in 1996.

The market potential for merchant boards, systems, and software is awesome and opportunities abound for those that choose their marketing strategy accordingly.

VME and CPCI will continue to coexist, each finding their respective markets. Marketing strategies for VME will differ from those for CPCI for factors beyond the scope of this article. The reader is referred to VDC studies regarding the merchant computer board market and the SS7/AIN marketplace.

Venture Development Corporation publishes a number of industry studies, including the ***"1997-1998 Worldwide Market for Merchant Computer Boards in Real-Time and Embedded Applications"***.

VDC is located at One Apple Hill, Natick, MA 01760. Telephone: 508 653 9000.

VDC is on the web at: www.vdc-corp.com