New Chips Move Networking onto Silicon

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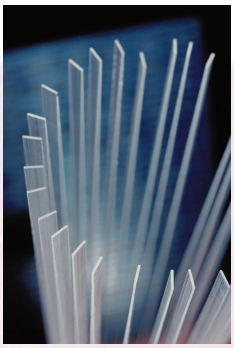
Wherever you look in networking technology, the trend is toward faster, less expensive, and more functional networks. An important part of this tendency is the growing trend of providing many networking functions via a single internetworking chip, rather than via previous approaches that used either multiple ASICs or software on general-purpose RISC processors.

Internetworking processors are integrated, specialized chipsets optimized to perform high-level networking functions, such as traffic and policy management, Layer 3 switching (in which routing is handled at higher speeds by switches), and quality of service (QoS). These chips are intended to be the building blocks for networking components, such as routers and switches. Typically, the processors' functionality is customizable to offer specific features that networking vendors may want to include in their products.

Proponents say this approach to providing networking functionality is better than using flexible but slow software running on general-purpose processors that must also perform other tasks, or using proprietary, single-purpose ASICs that are fast but inflexible and costly.



Internetworking chips are customizable like software but are also fast like ASICs.

Indeed, internetworking processors can be viewed as the middle road between the two extremes: their features can be customized, as in the software approach; but they also hardwire functionality into silicon optimized to perform network operations and thus have the speed offered by ASICs.

In addition to speed and flexibility, proponents say, moving previously proprietary technologies onto commoditized hardware products will generate more competition, a standardized approach to providing networking capabilities, lower prices, and more innovation.

Proponents also say internetworking chips' performance and functionality will permit more intelligence on the network. Many industry observers say fast, intelligent networks will be necessary to handle heavy volumes of traffic while providing such enhanced services as security and data prioritization.

David Passmore, founder and research director of Net Reference, a network analysis and consulting firm, said one of the most important new benefits of internetworking processors is that chipmakers can get their products to networking vendors quickly.

Melinda LeBaron, vice president of marketing for Softcom Microsystems, an internetworking-chip vendor, said networking vendors need to keep offering products with new capabilities. She said chipmakers with expertise in networking technologies could supply vendors with internetworking processors that offer such capabilities more quickly than vendors could develop their own software or ASICs.

Of course, vendors may not want to use internetworking chips because they already have big investments in ASIC design and development. In addition, commoditized internetworking chips may not be able to provide all the new features that vendors want.

Nonetheless, said Bob Merritt, a senior analyst with Semico Research, a market research firm, "Networking products have now reached the volume level necessary to support silicon designs of very high complexity."

THE MOVE TO SILICON

The growth in bandwidth-hungry applications and the mushrooming traffic in today's networks demand sizable gains in networking equipment performance.

For example, as bandwidth increases, routing and switching delays become less tolerable, said Semico Research's Merritt.

Also, said LeBaron, networking equipment must offer high performance and reliability to deliver latency-sensitive traffic, such as live audio and video.

The traditional approach of implementing high-level networking functionality (such as traffic management and

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Internetworking Chips

WHAT THEY ARE:

Integrated, specialized chipsets optimized to perform high-level networking functions

HOW THEY WORK:

They take advantage of improvements in processor technology that permit lower chip prices, as well as more sophisticated decision making in hardware

POTENTIAL ADVANTAGES:

Proponents say commoditized internetworking chips help meet the demand for faster, less expensive, and more functional networks by offering

- better performance than the traditional approach of using software that runs on a general-purpose processor
- lower prices, faster time-to-market, and more flexibility than building multiple proprietary ASICs to perform various networking functions
- a standardized approach that could permit more interoperability

POTENTIAL DISADVANTAGES:

Networking vendors may not want to put aside big investments in in-house ASIC design teams in favor of buying off-the-shelf internetworking.

Generic functions hardwired into commoditized chipsets may not be sufficient to add some of the specialized features that vendors want to incorporate in their products.

routing) with software cannot keep pace. A general-purpose processor, which must handle many types of operations, is not optimized to run such software and thus cannot handle networking functions as efficiently as a processor built specifically for networking.

In response, networking vendors initially implemented specialized networking functionality into proprietary ASICs. However, this approach suffers from two critical drawbacks. First, vendors must spend a lot of time and money developing ASICs themselves. Second, if standards change and demand new chip configurations, vendors must spend more time and money to design and develop new ASICs for incorporation into products.

Standardized, commoditized, and customizable internetworking processors help to solve these problems. Companies with expertise in chip manufacturing can design and mass-produce the processors faster and at lower cost than networking vendors can design and make ASICs.

Kurt Busch, vice president of SwitchCore, an internetworking-chip vendor, said that when vendors develop their own ASICs, time-to-market for new products can stretch from 18 to 24 months, but when they use internetworking chips, time-to-market can fall to six months.

Moreover, said Bob Hafner, an analyst with the Gartner Group, a market research firm, volume production will drive prices even lower. The Gartner Group predicts that the price of internetworking chips will drop by up to 60 percent by 2001.

Meanwhile, the ability of new and small networking companies to buy commoditized chips for their products, instead of having to spend considerable time and money to build their own ASICs, could permit more firms to enter the networking industry. This increased competition could decrease prices and introduce new features faster.

And the standardization necessary to commoditize internetworking chips could improve the interoperability of networking equipment.

Finally, faster and more functional internetworking chips would permit more intelligence on the network, a capability that many organizations want, Hafner said.

This intelligence could be used to handle a variety of increasingly important networking tasks, such as traffic management, QoS, and security, he explained.

Intelligent networks would accelerate a growing move toward policy-based networks, which automatically implement an organization's networking policies. Such networks require considerable intelligence to recognize situations where policies are required, determine which policies are appropriate and how best to implement them, and execute them correctly.

HOW THE CHIPS WORK

Internetworking processors take advantage of many improvements in technology that permit the development of faster chips that use less power.

For example, said Semico's Merritt, one important factor has been the technological improvements that have reduced the prices of making chips and customizing designs.

In addition, the processors' functionality benefits from the ability to put a growing number of transistors and logic gates on silicon. This permits more and increasingly sophisticated hardware-based decision making, such as that necessary to route packets and provide QoS.

Manufacturers are taking various approaches to internetworking chips.

As shown in Figure 1, SwitchCore's CXe-16 is a 16-port Gigabit Ethernet routing chip, designed to perform wire-speed Layer 3 switching, as well as all

basic packet-handling operations, from lookup to buffering to transport.

According to SwitchCore's Busch, distributed networking architectures with multiple ASICs use many chips to process data, which can lead to bottlenecks in interchip transmissions, particularly in designs that use multiple data buffers. In SwitchCore's integrated internetworking chip, he said, all data links share buffer memory, which reduces bottlenecks and improves performance.

Softcom Microsystems' Gigablade Network Accelerator uses the Softcom Engine, a networking CPU, to perform a variety of traffic- and protocol-processing functions. The Gigablade is designed to ease bottlenecks at the important LAN/WAN interface, where Ethernet packets must be converted to ATM cells for delivery into the Internet backbone.

The Softcom Engine handles all buffering control, network-policy management, and traffic-shaping functions. In addition, said Softcom's LeBaron, the chip can add considerable intelligence to the networking by parsing data all the way to the session layer (Layer 5, in which sessions between applications are established, coordinated, and terminated) in the seven-layer OSI communications-system model.

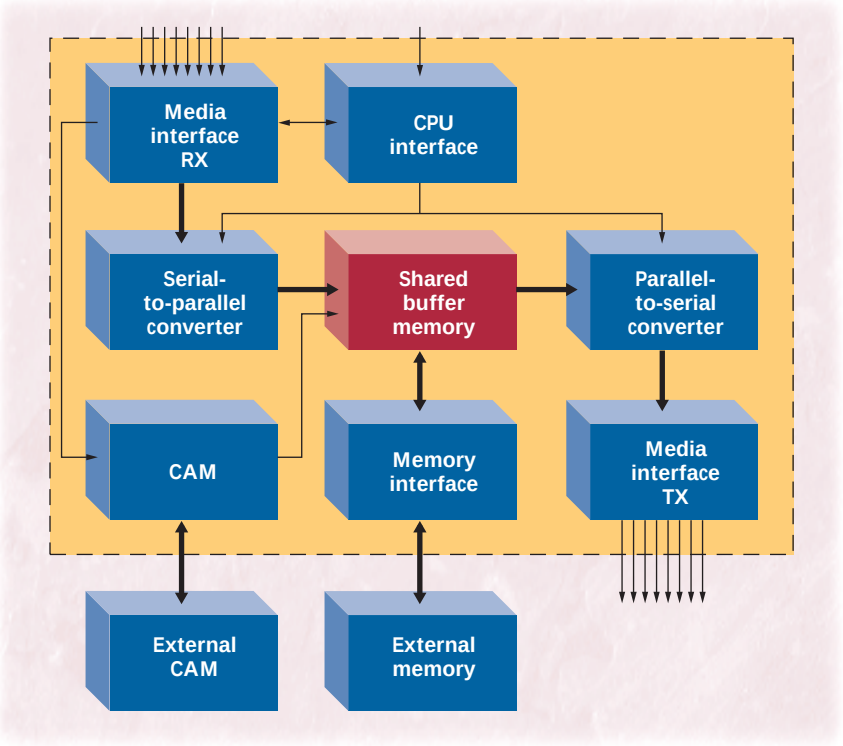

Figure 1. SwitchCore's CXe-16 Gigabit Ethernet routing chip performs Layer 3 switching, in which routing is handled at high speeds by switches. The chips also perform basic packet-handling functions, including lookup and transport. The media interfaces receive (RX) and transmit (TX) data. The internal and external CAM (content-addressable memory) units store addresses for Layer 2 and Layer 3 switching. External memory is used for overflow.

OBSTACLES

It is by no means a sure thing that networking vendors will simply toss aside their sizable investments in in-house ASIC design teams to begin buying off-the-shelf silicon. Vendors will have to determine the relative value of the two approaches, and this could help determine whether and how quickly they adopt internetworking chips.

For example, said Nortel Networks spokesperson Erin Curtis, her company would not want to buy an off-the-shelf internetworking chip if it provided one of the firm's own core competencies, such as packet processing.

In fact, said LeBaron, Softcom believes the biggest threat to its success is the internal development of networking technology by potential purchasers of the company's internetworking chips.

Meanwhile, said Net Reference's Passmore, it may turn out that generic functions hardwired into commoditized chipsets may not be sufficient to provide some of the sophisticated and/or custom features that vendors may want to incorporate in their products.

The most likely users of internetworking chips will be companies that either don't have a sizable investment in in-house ASIC production or those that decide to discontinue such investments because they believe buying commoditized processors would be more cost-effective and time-efficient than making ASICs. Networking companies that continue to make their own ASICs may feel more pressure to switch to commoditized processors if internetworking-chip vendors can improve their time-to-market even more.

In fact, predicted the Gartner Group's Hafner, the functionality achieved with internetworking chips should begin to appear across enterprises by late 2000 as network managers roll over equipment and perform upgrades.

As the networking industry moves into the future, it is clear that the demand for more bandwidth with better performance and greater reliability is not going to abate.

According to SwitchCore's Busch, internetworking chips represent a trend toward specialization in the networking industry that may be the only way vendors can develop products that will meet this ongoing demand. ❖

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