IBM

IBM Netfinity 8-Way SMP Directions

Preparing your business for 8-way SMP technology

Executive Summary

IBM Netfinity® servers are bringing IBM's large-system technology, high-availability and support expertise to the industry-standard server marketplace. IBM Netfinity 8-way systems are being developed recognizing the importance of balanced system design, including processor power, performance and the ability to support increasing numbers of users per server. Working with Intel®, IBM will deliver an 8-way Deschutes processor-based server that provides the power, performance, and scalability your business-critical applications require.

IBM understands your need for industry-standard server solutions. We also know that you can't afford to sacrifice the performance and scalability that your business-critical applications demand. Whether you're launching a business from the Web or extending your current IT investment, you have the same demands for keeping your business up and running 24 hours a day, 7 days a week, 365 days a year. At IBM, we're adapting our high-end server experience to the IBM Netfinity servers, providing performance, reliability and capabilities unavailable in today's industry-standard server marketplace.

Over the years, IBM has earned its reputation as a leader in:

  Designing powerful and scalable systems for business-critical, data-intensive environments
  Creating solutions that help ensure application availability
  Building technical support infrastructures that include skills, tools and procedures for service and support worldwide
Built on experience gained from decades of large and midrange system leadership, IBM's Netfinity servers allow businesses of all sizes to build a reliable foundation for their networks without sacrificing availability and reliability.
IBM is committed to continued enhancements of Netfinity servers by delivering outstanding **power**, **scalability**, **control** and **service**. Focusing on all aspects of computing enables IBM to help you drive reduced total cost of ownership.

This paper discusses what customers should consider in evaluating 8-way symmetric multiprocessor (SMP) technology, IBM Netfinity directions for 8-way SMP technology, and how IBM SystemXtra can help you protect your IT investment.

Reasons for Considering 8-Way SMP Server Technology

Today's server buyers find that they need more processing power, increased perform-ance, higher availability and the ability to support increasing numbers of users per server. These needs are driven by:

New robust software applications for networking that are becoming available

Growing businesses **adding new employees** to networked workgroups

Expanding computerization of key business processes, such as e-commerce

Increased dependence on continuously available solutions and the need to **minimize system downtime**

Server consolidation for **easier network management** and **reduced costs**

Increased demands for **investment protection** should unexpected business condi-tions demand increased server performance and processing power

Viewed another way, 8-way SMP technology is one of multiple solutions to increase power and performance.

Power scales in two dimensions: *vertically,* increasing the number of processors within a multiprocessor node, and *horizontally,* increasing the number of nodes in a cluster. This paper focuses on vertical growth.

The key to vertical growth is a system design that balances the operating system, middleware, applications, processors, memory and I/O subsystems. IBM understands that all of these aspects are critical to effective system throughput and we're applying our experience in these areas to IBM Netfinity systems. IBM has chosen Intel's Deschutes processor to provide vertical growth into the 8-way IA-32 SMP server technol-ogy and beyond.

Getting the Most from 8-Way SMP Technology

A total systems approach is necessary to fully realize the benefit of 8-way SMP technol-ogy. Some of the several industry perceptions surrounding 8-way SMP implementation include:

Perception: *Current* **software—***operating systems like Microsoft Windows NT Enterprise Edition and SCO Unixware, and middleware such as Oracle7 DBMS, Microsoft SQL Server, Lotus Notes, and IBM's DB/2—will install on my 8-way SMP server and utilize all eight processors.*

Fact: New releases of server software will incorporate enhancements for scaling to greater than 4-way SMP servers, and large memory support necessary to run complex applications. Operating system enhancements only account for a portion of performance. Applications and middleware that are optimized for 8-way are key to achieving scalability. Because the benefits of 8-way SMP technology will not be fully realized until applications and middleware are enhanced, IBM is working with key ISVs to ensure the technology for 8-way SMP is there for Deschutes processor-based 8-way servers. Strong links between applications and operating systems require critical focus on issues such as handling CPU thread affinity (CPU favored by a thread or a process), thread resolution, and improved shared resource locking strategies. For example, Microsoft SQL Server 6.5 SP 4 has recently added the Affinity_Mask Configuration parameter, which is used to identify which CPU an SQL thread runs on, thereby improving performance.

Middleware has already been enhanced to take advantage of multiprocessors, large memory and a scalable I/O environment. IBM currently has a large collection of middleware running under Windows NT to leverage the enhanced capabilities of the current and future generations of powerful SMP servers.

Perception: *SMP* **processor hardware** *is a key variable in 8-way performance*.

Fact: 8-way processor hardware alone does not guarantee scalability. In addition to the importance of software, overall balanced hardware design is critical. For example, caches, memory, I/O and bus speeds must all scale to take full advantage of 8-way processors.

Perception: *Today the* **most efficient, low-cost approach** *to an 8-way SMP system is through upgrading a 4-way system by adding 4 processors.*

Fact: Retrofitting a 4-way system sounds good, but to get optimized performance, it may require replacing most of the critical components. For example, the migration to an 8-way Deschutes processor-based solution requires plugging a new processor module in a slot rather than plugging new chips in a socket, thereby changing the volumetric layout and necessitating CPU board replacement. Memory controller chip sets will need to increase from 4GB to 8GB (or more) and the DIMM memory interface changes from Fast Page Mode (FPM) to either Extended Data Out (EDO) or Synchronous Dynamic Random Access Memory (SDRAM). More I/O slots are needed to assure an adequate data stream, and some of these slots will need to be 64-bit PCI for additional bandwidth.

Perception: *Upgrading a Pentium Pro*® *processor-based machine with Deschutes processors gives you Deschutes-processor performance at a nominal cost*.

Fact: Combined with the initial system purchase price, the Deschutes upgrade kit (which includes new boards and processors) can often approach the net purchase price of a new Deschutes processor-based machine.

In summary, to gain the full benefit of 8-way you need to consider the total system. The benefits of upgrades increasingly depend on upgrading multiple major subsystems, including I/O, CPU boards, SMP processors, cooling fans, power supplies and memory. Upgrading today's Pentium Pro system with tomorrow's 8-way Deschutes processor-based technology is not likely to be a cost-effective solution for most customers.

IBM Netfinity Directions

IBM seeks to offer the best solutions to our customers. IBM Netfinity servers provide a reliable foundation for networked business solutions exploiting the leading-edge technology offered by Intel's server-class processors.

Rather than implementing the Pentium Pro processor for greater than 4-way systems, IBM has teamed with Intel to focus and optimize our next generation server products (including a greater than 4-way, high-end enterprise server) with Intel's Deschutes Slot 2 processor. The new Deschutes processor will make significant improvements in three critical areas for scalability beyond 4-way: processor speed, internal cache speed/size, and front-bus speed. IBM believes that the Pentium Pro processor has neared its limits in these critical areas for scalability beyond today's 4-way configurations. A 4-way Deschutes processor based system will outperform an 8-way Pentium Pro processor-based system by a significant margin. An 8-way Deschutes processor-based system will be even more powerful.

IBM has done extensive simulation and analysis in an effort to identify SMP optimization criteria. Each 8-way SMP architecture has distinct advantages and disadvantages, however the **multiport crossbar switch-memory controller** architecture is quickly becoming the low-cost, high-performance industry-standard architecture of choice. Several vendors offer multiport crossbar switch-memory controller architecture. This architecture enables independent, high-bandwidth bus interconnections between the processors, memory subsystems, and I/O subsystems. The following diagram illustrates these interconnections.

Multiport Crossbar Switch-Memory Controller Architecture
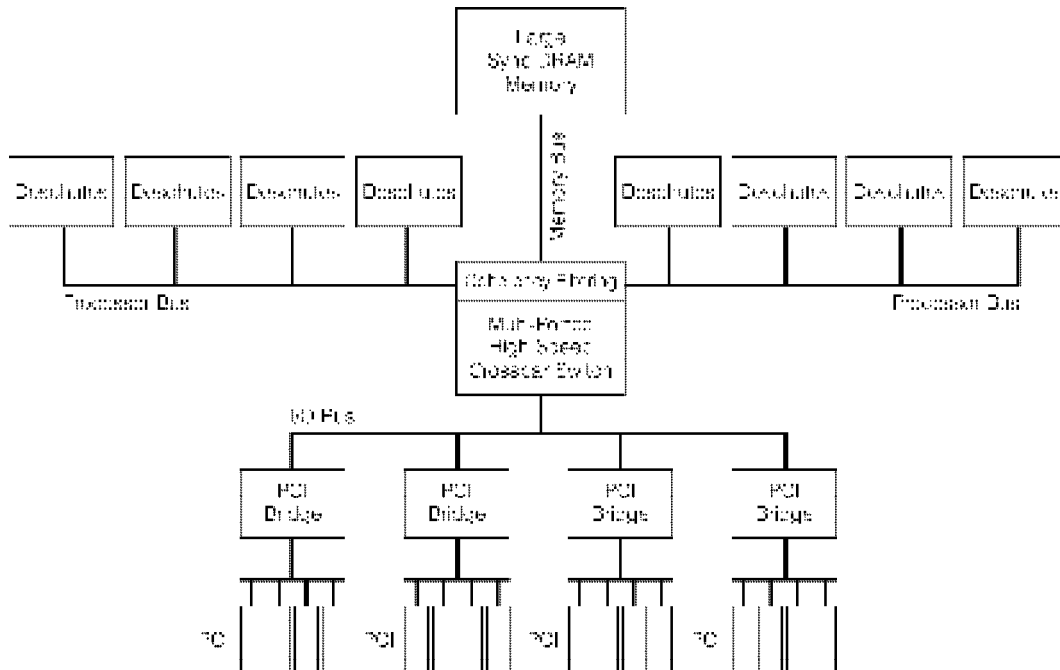
Key attributes of this architecture include:

Two Intel Deschutes processor buses running independently at 100MHz
Independent memory and I/0 bus interconnections
Concurrent bus traffic between the multiple independent buses
A memory coherency filter between the processor buses and the memory and I/O buses

Along with industry-standard solutions, performance and investment protection are critical requirements in the enterprise server marketplace. IBM Netfinity servers offer today an industry-standard solution that has proven scalability. Some vendors are entering the enterprise server market for the first time with an 8-way Pentium Pro server. However, IBM plans to offer 4-way servers with Deschutes processors that we expect will outperform the 8-way Pentium Pro server at a lower price. If you're looking for the best price performance solution today with the ability to upgrade to the larger Deschutes processor-based system in the future, IBM also offers the Technology Exchange Option through SystemXtra®.

Other options currently in the marketplace include retrofitting existing hardware. This option results in a solution that can suboptimize both performance and your investment. The following illustration shows the relative cost of retrofitting your existing Pentium Pro server versus migrating to Deschutes processing with an IBM Netfinity server.

Approximate Cost of Migrating from Pentium Pro to Deschutes
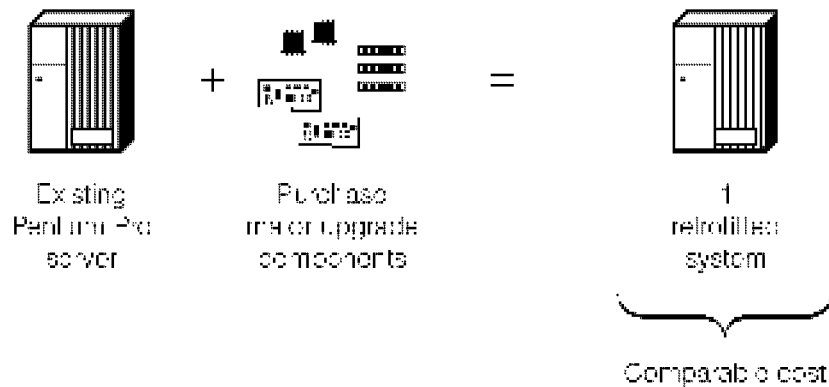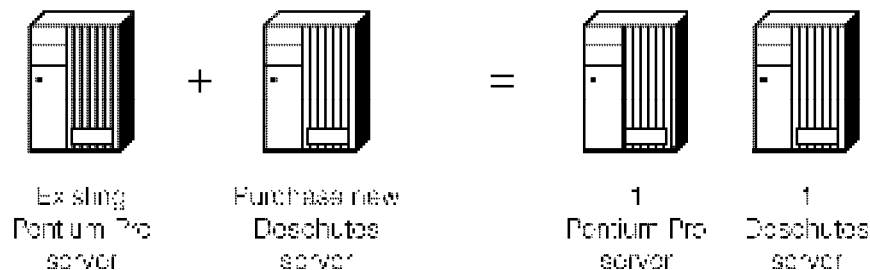
The IBM Netfinity Advantage

The major objective for adopting 8-way SMP technology is to improve productivity through increased system performance. Because of the newness of the technology and the limited number of 8-way optimized applications, many customers are trying to protect investment decisions by adopting an upgradability strategy. However, as seen above, simple upgrades are often not sufficient, and full upgrades may be not be cost-effective.

IBM Netfinity servers have adopted a 4-part investment protection strategy to best serve our customers: (1) an 8-way optimized systems design, (2) alternatives for true investment protection, (3) relationships with key industry leaders, and (4) worldwide support and service.

Our optimized systems design involves balancing the operating system, middleware, applications, processors, memory and I/O subsystems—elements that are critical to scalability and effective system throughput. The optimized design will incorporate the specifications discussed above.

True investment protection involves more than simply upgrading your hardware. If you upgrade your hardware but not your software, then your investment may not result in productivity gains. And if you upgrade your software but improve only some subsets of your hardware, you may still be limiting productivity. You optimize productivity when your server hardware is aligned with your server software investments.

Working with key industry leaders, IBM will provide industry-standard solutions optimized for 8-way SMP technology. We have an ongoing commitment to our relationship with Intel and, as a result, we will develop solutions that are on Intel's technology road map. In addition, we'll be leveraging our relationship with Microsoft at the IBM Kirkland Programming NT Center to optimize our 8-way systems. At the Kirkland Center, we're testing 8-way systems so that they run well with Microsoft software and operating systems, including Windows NT.

Because service and support is critical to high-performance application serving, **our worldwide service and support team** has the expertise to keep your system up and running. Included in our extensive service and support offerings are Remote Connect, a remote support capability for determining hardware problems and launching onsite resources, and MoSTConnect, a direct communication link between the IBM field service specialist and your location and the experts at the IBM HelpCenter.

To fully protect your investment, IBM also provides a comprehensive package, including hardware aligned to software, and SystemXtra. SystemXtra provides real business value for your IT investment, including remote manageability, monitoring, security and investment protection technologies that are on many IBM systems. It also includes:

Network management and support services
Clustering Solution Planning services
Financing that can deliver both hardware and services at an attractive monthly fee
Technology Exchange, a flexible and affordable option for updating your Intel processor-based hardware with newer technology after only two years

Conclusion

8-way SMP architecture is a quantum leap in technology. If you're planning to move your business-critical applications to an 8-way SMP system, you need a business partner you can trust—someone with experience and someone who offers the service and support to keep your business running smoothly.

IBM Netfinity servers bring proven large-system expertise and experience—including over 20 years of experience in SMP technology—to the industry-standard server marketplace. IBM Netfinity servers will deliver an industry-standard 8-way optimized server with Deschutes processors. We will continue to enhance Netfinity servers using the skills, experience and technology that only IBM can offer to help you build a reliable foundation and protect your investments in your networked business systems.

Additional Information

For more information on IBM Netfinity directions, products and services, refer to the following papers and briefs, available from our Web site at **www.us.pc.ibm.com/server**.
IBM Netfinity Cluster Directions
Clustering Solutions for IBM Netfinity and IBM PC Server
IBM Netfinity Technology Directions
IBM Netfinity Fibre Channel Directions
System Management for Servers
At Your Service...Differentiation beyond technology

Note: Because of the dynamic nature of this industry, changes may occur in IBM's actual implementations and, of course, specific requirements/needs may dictate alternate configurations.