

FUELING THE REAL-TIME ENTERPRISE

The ever-increasing need to respond instantly to changes in customer demand or competitive conditions requires enterprise applications that can fulfill complex supply chain and operational requirements. These applications, in turn, demand advanced database capabilities. Providing these databases with the performance and memory capacity they need to access large amounts of data rapidly is an imperative most effectively met by 64-bit computing solutions. With 64-bit-only processing technology, that would be a harsh change demanded of enterprises with substantial investments in 32-bit applications and infrastructure.

Change may be a business constant, but it's not the only one that today's competitive organization faces. Another—data growth—may present even greater challenges. According to the University of California, Berkeley, between 1 exabyte (one million million million bytes) and 2 exabytes of unique data are created annually—from e-mail and point-of-sale systems to multimedia and enterprise systems such as enterprise resource planning and customer resource management.

But even today's rate of annual data growth will seem small in the near future, when interconnected sensor networks measure and monitor production, sales, and other business environments in second-by-second detail.

No matter how much data is generated, data is only useful if databases can effectively channel, track, analyze, and distribute relevant information. Without advanced database capabilities to transform data into information, companies cannot meet customer, operational, and financial demands.

Recognizing the importance of business intelligence, supply chain, and other applications, corporations have deployed applications whose strength derives from the ability to rapidly access and manipulate information in data warehouses and very large databases. These data workhorses share three characteristics:

- Processing power that lets them control, apply, and leverage the vast amount of information feeding into businesses.
- Data analysis speed by handling large data sets directly in memory instead of via disk.
- Sophisticated algorithms that take advantage of advances in software and hardware technology.

Most production databases today run on 32-bit processing platforms. Leveraging the capabilities of bigger, more advanced databases to enable better and faster business decision-making requires the next generation of processing power. Moving to 64-bit-capable servers does much more than simply



eliminate the constraints of 32-bit platforms; it also delivers benefits to corporations requiring high transaction-processing throughput and reliant on compute-intensive applications implementing extensive searches.

Companies anticipating growth are moving toward 64-bit computing for a number of reasons. 64-bit computing offers advanced computational capabilities and greater

AMD OPTERON™ PROCESSOR BENEFITS

Adding AMD Opteron™ processor capabilities to computing infrastructures produces numerous benefits, including:

- Faster decision-making
- Smooth migration and lower costs when moving to 64-bit computing
- Infrastructure investment protection

The combination of the AMD Opteron processor's Direct Connect Architecture and the ability to run 32- and 64-bit applications underlie many of the real-world benefits. As a result, successful companies are leveraging AMD Opteron processor-based systems into their operations.

scalability. It can also offer an improved platform on which to run all existing enterprise applications, including databases—whether they are 32-bit or 64-bit.

Advantages of the New Generation

64-bit computing has a profound affect on the speed with which companies develop the business intelligence they need to gain and maintain a competitive edge. It provides the foundation for real-time enterprises—organizations that leverage technology to reduce the gap between when data is collected and analyzed, and when the right decision is made.

64-bit computing has capabilities specifically suited for the computational demands of today's companies—large file support, for example. With its extensive addressability, allowing large chunks of data to be contained and handled in memory, 64-bit computing eliminates a common performance bottleneck in large data-bases. Although a 32-bit system may have up to 4GB of virtual address space to use for its own instructions and data, a 64-bit system can reserve up to 18 exabytes of data for its own use. Application performance improves when very large amounts of data are kept in memory, avoiding the need to access much slower disk drives and eliminating performance-sapping swapping.

What may have the greatest business impact is that 64-bit applications—now emerging from IBM, Microsoft Corp., Oracle Corp., SAP, and other software vendors—can take

full advantage of 64-bit processors. It is these advanced applications in CRM, ERP, finance, manufacturing, and other areas that can distill millions of trade-offs into one or two optimal business decisions, enabling companies to keep up the pace demanded by today's accelerating competitive environment and fulfill time-sensitive customer, regulatory, and supply chain requirements.

Companies turn to 64-bit computing to leverage 64-bit power, enjoy an increased ability to manipulate data in memory, or to lay the foundation for the next generation of computing. They may also find 64-bit processing advantageous to cope with additional capabilities that major vendors are adding to their applications.

But despite the advantages they gain, some businesses are reluctant to embrace advances if it means abandoning investments in software and applications. Prudent IT resource management dictates that 32-bit applications will be around into the foreseeable future. An understanding of such business realities is precisely why AMD's 64-bit technology offers compatibility with 32-bit applications based on the industry-standard x86 architecture. AMD64 technology doesn't sacrifice 32-bit performance in favor of compatibility. In fact, the 64-bit AMD Opteron™ processor currently holds many 32-bit performance benchmarks.

Making 64-Bit Work

While providing excellent performance for many 32-bit applications, the AMD Opteron processor offers all the advantages of 64-bit processing along with multiple microarchitectural advances.

These microarchitectural features include Direct Connect Architecture with an integrated memory controller that reduces memory bottlenecks, and HyperTransport™ technology, which increases overall performance. The result is a substantial advance in compatibility, performance, investment protection, and reduced total cost of ownership (TCO). Together, these capabilities make the AMD Opteron processor a superb 32-bit processor that simultaneously delivers all the benefits of 64-bit computing.

The x86 processor has remained the backbone of computing infrastructures because successive processor generations have maintained software compatibility with previous versions. This lets companies maintain existing software investments and upgrade to the next generation at their own pace. Rather than create a new instruction set, AMD extended the x86 architecture with the AMD64 Instruction Set Architecture (ISA), which supports 64-bit addressing. This enables seamless compatibility with 32-bit applications and environments. In business terms, that lets



companies punch up their 32-bit applications without significant infrastructure overhauls.

Enterprise data has grown so much that databases of 1 terabyte (TB) and larger are common. To process so much data efficiently, systems need more memory than 32-bit systems provide. The AMD Opteron processor is capable of addressing up to 1TB of physical memory and 256TB of virtual address space. This means that data-intensive applications designed to use large memory addressing enjoy a dramatic boost in performance. Because it is roughly 100 times faster to

REAL-TIME MISSION-CRITICAL PROCESSING

One online Standard & Poor's 500 company provides travel suppliers, travel agencies, and travelers with access to real-time information about price and availability of airline seats. Not long ago, its system was processing more than 48 million transactions daily. A dramatic increase in processing demands on its core mainframe application was straining capacity.

After comparing features, performance, and reliability, the company selected AMD Opteron™ processor-based servers to handle production traffic for searches for lowest fares. The AMD Opteron processor-based server farm has replaced the mainframe for over half of these transactions already, with further off-loading of the mainframe planned.

access information in memory over even the fastest disk drives, data-base applications in 64-bit environments can see a substantial increase in speed.

As processor performance has advanced, overall system performance has been limited by the use of a front-side bus with its limited bandwidth. To clear this bottleneck, the AMD Opteron processor integrates a memory controller, speeding the way that x86-based processors access main memory. Eliminating the front-side-bus memory controller allows AMD's processor to directly connect to memory, giving the processor up to 6.4GB/sec of available memory bandwidth. Latency is reduced, and memory scales with the number of processors.

IT executives appreciate the added efficiency and flexibility of AMD64 technology while business executives appreciate the ability it gives their organizations to deploy better online systems based on symmetric multi-processing (SMP). Direct Connect Architecture makes SMP systems based on AMD Opteron processors ideal for online systems with many users accessing the same database.

Another bottleneck has been chip-to-chip communications. To eliminate this chokepoint, the AMD Opteron processor includes HyperTransport

interconnect technology, based on the HyperTransport Consortium standard. HyperTransport technology provides a flexible, scalable interconnect. Because it supports high-performance, high-bandwidth communications between links to deliver the lowest possible latency, it offers an aggregate bandwidth of 22.4GB/sec, which is about 70 times the throughput of legacy PCI buses.

Optimized for Databases

The lifeblood of real-time enterprise applications is the facts and figures flowing through the database, feeding decision-makers and other employees the information they need. Yet often this lifeblood is slowed by system constraints, many stemming from technological hold-overs when databases were smaller and accessed less often, when queries were less complex, and online access was limited.

Although those constraints may have been acceptable previously, today they are affecting business capabilities to meet e-commerce and other online demands, respond to supply chain disruptions, and seize competitive opportunities. As a result, companies are looking closely at improving technological infrastructures and taking advantage of next-generation database offerings from IBM, Microsoft, and Oracle. Yet companies are hesitant to abandon their investments in older architectures.

What is needed is technology that spans the dual worlds of 32- and 64-bit computing. The 32-bit compatibility of the AMD Opteron processor lets companies incorporate the latest in processor innovation to facilitate an inevitable move to 64-bit environments, while maintaining excellent compatibility and performance with 32-bit applications and operating systems. The robust 32-bit capabilities that the AMD Opteron processor delivers lets companies plan for their future computing needs while they continue to run the 32-bit computing applications that continue to be the backbone of many enterprises for the foreseeable future.

No changes, re-compiles or re-links are needed, and 64-bit extensions normally require only minimal coding. The result is not only more choices for companies, but choices that remain open, to be exercised today or in the future.

The databases that are the backbone of today's enterprise applications and Web operations require two elements. The first is clean and current data based on data integrity functions during collection and ETL (extract, transform, load) activities. The second is processing power. The AMD Opteron processor handles twice as much data per clock cycle as do 32-bit processors. The other



technical improvements in the processor add to the throughput and increase database processing speed. In business terms, that means the AMD Opteron processor delivers not only faster processing for complex database queries but also more system resources for applications. The system can support more users and much larger files, which is especially critical for data-intensive applications.

LOWERING TCO & DISRUPTION COSTS

Operating cost reduction is a key benefit of AMD Opteron™ processor-based systems. Not only is TCO lower in an AMD 64-bit environment, but migration costs are reduced as well. Migration costs result from the IT labor, time and trouble, training, and write-down of existing infrastructure when incorporating new technologies into an existing environment.

Because the AMD Opteron processor implements the x86 instruction set, software engineers can take advantage of all the tools and techniques they have learned through years of programming for the x86 architecture, eliminating many migration costs. One organization moved its 32-bit data warehouse to AMD Opteron processor-based servers running 64-bit Linux, protecting its data warehouse investment.

The Next Generation of Enterprise Computing

Recognizing the cost, performance, and other business advantages of 64-bit computing, major platform, operating system, and database vendors are making a commitment to the AMD Opteron processor. Computer Associates International Inc., Hewlett-Packard Co., IBM, OpenSource, Oracle, Sun Microsystems Inc., and the Linux community are all examples of organizations that have committed to 64-bit computing.

Businesses are more dependent than ever on enterprise applications to fulfill complex supply chain, customer, and operational requirements. Additionally, companies looking over the horizon are seeing an inevitable move toward real-time enterprises, when they will have to respond almost instantly to changes in demand or competitive conditions. E-commerce and other capabilities are becoming increasingly reliant on the integration of information from multiple sources.

Those trends have one underlying need in common: advanced database capabilities. Unless databases have the performance and memory capabilities to rapidly access and process large amounts of data, they are handicapped. Businesses have long recognized this imperative, advancing from 8- to 16- to 32-bit computing. Now it is time for companies to leverage the speed, performance and memory advantages of 64-bit computing.

It is no longer “if” companies will move to a 64-bit environment. It is only a matter of “when.” The AMD Opteron processor gives companies the ability to shift to the 64-bit computing architecture, without disruption, while continuing to maximize existing 32-bit investments. The AMD Opteron processor also provides numerous memory and throughput benefits for companies seeking to maximize existing 32-bit environments. If databases are at the heart of your operations, the AMD Opteron processor should be at the heart of your IT infrastructure.

AMD OPTERON™ PROCESSOR HELPS ONLINE INFORMATION WEB SITE

When a leading provider of online information migrated its 32-bit database to AMD Opteron processor-based servers, it experienced both a performance boost and a seamless transition from the previous server platform.

The new 64-bit solution handles peak loads of more than 50 million Web accesses a day, with each page containing a variety of current information from multiple databases that change hourly. The information provider estimated that hundreds of thousands of dollars in savings derived from the shift.

