

PUTTING SERVER VIRTUALIZATION TO WORK

Enterprises have been using virtualization technology on mainframes and RISC-based systems to enable better utilization of hardware resources. As x86 servers have become a mainstay in the enterprise, more companies are exploring virtualization with these servers to enable more productive, flexible, and scalable data centers while reducing costs and boosting data availability. 64-bit and 32-bit computing technologies from AMD are providing the foundation for today's—and tomorrow's—enterprise virtualization solutions.

In the 21st century, the promise of the Information Age is being fulfilled. Bits and bytes of data, information, and knowledge rocket around the globe in milliseconds. Product cycles have been condensed from years into weeks, and supply chains are interwoven into a complex fabric. Paper is giving way to pixels and e-business is rapidly evolving from an elusive dream into reality.

In this post-industrial environment, an enterprise that has a well-defined data management strategy is indisputably at a tremendous advantage. Such an organization can harness the power of information technology to achieve remarkable results. Conversely, companies that lack the right server and data management strategy risk missing out on the promise and opportunities of the digital age.

Achieving success is no simple task. As organizations have adopted a mélange of hardware and software systems—with servers scattered across an enterprise—the solution has often created a new problem. Today's complex data-server environments have grown exponentially, leaving companies with larger and more rigid data centers.

Not only does it become cost-prohibitive to administer these data centers, it is difficult to achieve optimal value and return on investment (ROI) as well as return on assets (ROA). Hard-to-find data, old and inaccurate data, aging hardware

and software, and sluggish performance can all conspire to drag down service levels and profits. In the end, an organization can find its customers, business partners, and employees dissatisfied.

Enter virtualization—a technology that enables corporations to make more effective use of the computing resources within the data center and move legacy software and data to newer, more efficient hardware platforms. Virtualization partitions a server into several “virtual machines,” each able to run its own separate operating system and application environment. This moves businesses away from a “one server, one application” model in which computing resource use averages less than 25 percent and toward an infrastructure that lets a business far more effectively manage its servers across a heterogeneous environment. The ability to run different operating systems and applications on the same physical server lets organizations consolidate the workload placed on servers. If one virtual system fails, another can take over instantly and perform the same tasks.

Virtualization isn't a new idea. It is a time-tested concept that IT professionals have used for years to manage mainframes and scientific and technical computing environments. Advances in x86 technologies such as AMD64 processors with Direct Connect Architecture have made virtualization ideally suited for today's conventional PC and server-centric



environments—including 32-bit and 64-bit platforms. With computing demands increasing every year, and as much as 80 cents of every IT dollar spent on software and operations maintenance, the need to streamline has become paramount.

For years, enterprises have used virtualization technology on mainframes and RISC systems to enable better utilization of hardware resources. As x86 servers have

With the right software and systems in place, a company can manage and automate an array of complex processes. It can create a “utility” computing environment that serves up data on demand. Armed with greater flexibility in its server and storage infrastructure, an enterprise can attain the flexibility it requires to compete in today’s global economy.

STREAMLINING TESTING & DEVELOPMENT ENVIRONMENTS WITH VIRTUALIZATION

For many enterprises, development and test environments—while a necessary part of doing business—also present challenges when it comes to cost of operation and time to market:

- Capital and space requirements for multiple physical systems, particularly servers, may be prohibitively high, particularly in today’s budget-conscious environments.
- Length of required setup cycles and lack of sufficient hardware reduces workflow efficiencies.
- Actual test and deployment cycles longer than necessary due to frequent system reconfigurations.

The combination of AMD’s Direct Connect Architecture and the ability to run 32-bit and 64-bit applications underlie many of the real-world benefits. As a result, successful companies are integrating AMD Opteron™ processors into their operations.

As any bottom-line-minded business knows, all of these challenges end up costing money in one way or another. With virtualization, corporations can overcome these hurdles.

The benefits of virtualization within a development and test environment include:

- Lower capital and space requirements. Virtualization enables the consolidation of multiple test and development systems into fewer physical machines. These machines may run several different operating systems simultaneously, while still maintaining system independence and integrity.
- Increased efficiencies through shorter test cycles. Corporations can keep centralized libraries of virtual test environments and reuse them when needed, which may drastically reduce configuration times. Further, because these environments are essentially available on demand, server idle time may be reduced. Virtualization also simplifies the process of testing distributed server applications, which can be extremely time-consuming and resource-intensive.
- Faster time-to-market. Virtualization empowers developers to increase efficiencies and effectiveness, so products ultimately may come to market faster.

become a mainstay in the enterprise, increasing numbers of companies are exploring server virtualization to build more productive, flexible, and scalable data centers while reducing costs and boosting data availability. And 32-bit and 64-bit computing technologies from AMD are providing the foundation for today’s—and tomorrow’s—enterprise virtualization solutions.



Business in a Virtual World

Virtualization can provide well-documented benefits to organizations of all sizes and across a wide spectrum of industries. When an enterprise has the right virtualization solutions in place, it can achieve efficient utilization of server resources to more effectively test and deploy new application environments. A well-tuned computing engine can supply an enterprise with the power it needs to ratchet up business goals as well as customer and management expectations. Ultimately, an organization can more effectively utilize all of its assets across the entire enterprise.

Several key business drivers are spurring the adoption of virtualization. Among them are:

- **The need to simplify management of complex hardware devices.** Today, multiple hardware platforms, operating systems and programming environments lead to a jumble of systems, and resources. The proliferation of single-application servers—and resulting data silos—can wreak havoc on data accessibility and network performance. It is not unusual for an organization to overuse some equipment while other devices remain vastly underutilized. The resulting imbalance and cascading inefficiencies typically lead to higher costs, reduced response time, and more complex provisioning.
- **A reduction in costs associated with reduced server management and administration.** At many organizations, network administration is an expensive and unwieldy task. As the number of servers grows, IT staffing and tasks spike as well. However, virtualization can tip the balance back in favor of the enterprise. In some cases, a 5 percent to 15 percent drop in basic IT operating expenses may be achieved. A well-planned virtualization strategy can also reduce the time it takes for IT staff to manage devices. Some companies report gains of 50 percent to 70 percent or more. This leaves hardware specialists, programmers, and other professional staff free to handle more strategic work.
- **The need for greater processing speed and availability of data.** Virtualization technology places a heavy demand on servers. The virtualization software must manage multiple virtual environments while still delivering application and data services to users in a timely fashion. That’s why top server performance within this type of environment is crucial—and it’s being delivered today by AMD64 with Direct Connect Architecture. As a platform for

ROADS TO VIRTUALIZATION

Server virtualization strategies typically revolve around three approaches:

1. **Software-only virtualization.** The virtualization software manages resources and acts as a “translator” between the host operating system and guest operating systems. Using this approach, there is no need to modify the host OS for virtualization. However, applications often suffer decreased performance due to the added overhead.
 - a. **Examples:** VMware Workstation, GSX Server products, Microsoft Virtual PC 2004
2. **OS-enabled virtualization.** Using this approach, the host OS and virtualization software are integrated and/or consist of the same software. This tight integration offers improved software performance.
 - a. **Examples:** Fedora Core 5 and the upcoming release of Red Hat Enterprise Linux (generally available before the end of 2006)
3. **Processor-enabled virtualization.** Under this scenario, processors directly support virtualization. The machines reserve memory locations that only virtualization software can access, thus creating a physical partitioning of resources. By decreasing software overhead, the results are accelerated performance and better security.
 - a. **Example:** AMD processor-enabled virtualization solutions will complement software-based approaches, helping companies to build the strongest virtualization platform possible.

virtualization, AMD64 technology offers low memory latency and high I/O bandwidth, making it easier to integrate with customers and business partners and provide leading-edge solutions.

- **A more flexible and scalable environment.** Many organizations find themselves awash in data—flowing from multiple databases, data marts, and data warehouses, and in addition to the vast array of unstructured data that floods the typical enterprise today. The number of documents in various formats, e-mail messages, photographs, and video files are growing at a rapid clip. The fast pace of business demands a computing environment that allows fast and easy access to this growing mountain of data. Any lag in performance can slam the brakes on a company's overall performance and light up its bottom line in red ink. As the organization's data environment continues to grow, so does the need to ensure that its applications continue to operate at their maximum potential. Virtualization enables legacy applications and data to be run on modern hardware platforms, providing more security and performance benefits.
- **Reduced financial risk.** Loss of data can prove fatal for an organization. According to a 2002 META Group study, 30 percent of businesses suffering a catastrophic event never reopen their doors. Often, the greatest losses aren't the result of the immediate disaster, but of ongoing lapses during the recovery phase. Organizations first lose critical files or information, and loyal customers

follow. Even brief disruptions could result in lost opportunities. But with virtualization, companies that previously weren't able to justify the expense of a disaster-recovery solution (for small applications or smaller IT environments) may now do so. When implemented within the context of virtualization, the ROI for a disaster-recovery solution is high.

- **Governance and regulatory concerns.** Sarbanes-Oxley, Basel II, and the Health Insurance Portability and Accountability Act (HIPAA) all have created an environment that forces organizations to take regulatory issues seriously. Strict reporting rules and tight internal controls translate into a need for better data management. Security and privacy issues have also emerged at the forefront of business. Centralized administration and tighter control of resources provided by virtualization can help an organization avoid problems typically associated with highly fragmented and distributed data and computing resources. Virtualization efforts may also contribute to a more secure and controlled data center, since the IT organization will typically manage fewer servers within this type of environment.

Taking Virtualization to a Higher Level

Virtualization is increasingly attractive to organizations looking to maximize the potential of server-based applications and computing resources. Among its other benefits, virtual servers can help reduce dependency on old, out-of-warranty servers. In many cases, these aging machines, which rely on legacy hardware and operating systems, require a disproportionate amount of attention and support. In contrast, virtualization lets IT managers clear away the deadwood by consolidating servers running line-of-business applications and enable an optimized infrastructure, higher server utilization, and reduced management and infrastructure expenditures.

Virtualization also helps organizations extend the life of their own custom-written applications. In the past, without virtualization, companies couldn't justify keeping these applications intact, because the support and maintenance costs for the accompanying legacy hardware and operating systems were too high. But with virtualization, there's no need to migrate existing custom applications to the latest hardware and OSs. Now, companies may simply create a dedicated virtual machine for their legacy application, and run it alongside other virtual machines running mainstream applications—all on the latest industry-standard server hardware. With virtualization, investments can be protected.

Another advantage of virtualization is its ability to streamline and accelerate deployment of software and systems. An enterprise can run a legacy application on a virtual machine instead of delaying deployment of a new version of an operating system. Using virtual machines to test migration plans, including debugging systems and



TOP 5 BUSINESS BENEFITS OF VIRTUALIZATION

1. Increase server utilization
2. Improve service levels
3. Streamline manageability and security
4. Decrease hardware costs
5. Reduce facility costs

analyzing performance, makes it easier to isolate—and solve problems—before migrating to new environments. It reduces the cost and risk of rewriting, porting, or integrating existing applications with new systems and lets an organization deploy new systems with minimal disruption to users. Consequently, customers, employees, and supply chain partners can work in a familiar way.

In addition, by separating hardware and software management issues, an enterprise can manage and maintain discreet systems far more effectively.

A virtual environment also excels at managing workstations, departmental servers, data center servers, and other devices. The power unleashed by the AMD Opteron™ processor's reduction of latency, combined with virtualization's ability to separate hardware and software management issues and manage discreet virtual systems, escalates network performance to a higher level. In fact, by allocating and reallocating resources on the fly, an organization can gain a level of flexibility unimaginable only a few short years ago.

Laying the Foundation with AMD

AMD64 processors provide a solid foundation for the evolution to 64-bit OS-enabled virtualization. For example, the AMD Opteron processor is a high-performance x86 processor for enterprise servers and workstations. The AMD Opteron processor with Direct Connect Architecture directly connects the CPU to the memory controller, I/O, and other processors. The integrated memory controller provides high-speed, low-latency access to memory, enabling host and guest operating systems to function more efficiently. It also decreases platform power consumption, creates a cooler data center, better leverages the existing power infrastructure, and utilizes space more efficiently. The AMD Opteron processor offers a significant performance improvement in the 32-bit environment, but the gains accelerate in a 64-bit environment where it becomes possible to break through the 4GB memory barrier. By giving companies the ability to run both 32-bit and 64-bit virtual machines on the same physical server—without rewriting code—AMD technology enables them to maximize their IT investments.

HyperTransport™ technology provides improved scalability and I/O capabilities. This translates directly into support for more guest OS sessions and more user access applications. AMD64 extends the x86 instruction set and retains compatibility with x86 software, thus providing necessary support for legacy operating systems and applications. Next-generation technology from AMD will further advance virtualization by emulating multiple independent execution machines on a single computer. This will further improve system performance and boost the return on investment.

Finally, AMD has forged strong relationships with numerous hardware and software firms that have a strong interest in x86 virtualization technology, including EMC Corp.

(VMware), Hewlett-Packard Co., IBM Corp., Red Hat, Inc., Sun Microsystems, Inc., VERITAS Software Corp., and XenSource, Inc. This allows businesses to harness the power of virtualization in far more robust ways. They can act and react to changing business conditions in a more agile manner by reallocating computing resources quickly and efficiently and pooling these resources on specific servers. The combined power and flexibility of the AMD Opteron processor and virtualization will let organizations break the restraints of conventional strategy and take server management to a higher level.

Building a Virtual Success Story

Companies that have taken advantage of virtualization have realized a solid ROI. Today, a wide range of organizations—including those in data-intensive industries such as financial services, health care, aerospace, and retail—already have deployed virtualization successfully. Many other companies are following suit.

In fact, a growing number of businesses are turning to virtualization solutions to help them build highly flexible and scalable solution platforms. As business decision-makers increasingly look to squeeze out additional gains from the x86 architecture, they are taking a closer and more critical look at the servers they purchase. Certainly, it is no longer feasible to buy a server for every application an enterprise plugs in. Managing IT resources efficiently is a necessity. Only then is it possible for an enterprise to ensure that it is maximizing revenues, return on assets, customer and partner loyalty, and shareholder value.

AMD is at the center of this emerging universe. As organizations move beyond the flat earth of CPU cycles and begin to examine I/O and chipset-based virtualization, they are discovering that it is possible to boost productivity and slash costs. Whether the focus is on systemwide performance, e-commerce, storage, or simply maximizing the use of data, tomorrow's solutions exist today. The AMD Opteron processor with Direct Connect Architecture is ushering in a new era of server performance and making architectural-level virtualization a reality. It demonstrates that virtualization can provide a giant leap forward in the evolution of computing and information technology.

