Private Clouds and AMD Processors: A Match Made in IT Heaven

More than a decade after the first Internet-based business applications and development platforms made their halting debuts, cloud computing has emerged as a mainstream IT phenomenon. Along the way—through various iterations of software as a service (SaaS), infrastructure as a service (IaaS), platform as a service (PaaS) and development as a service (DaaS)—corporate IT managers have grown to appreciate the compelling architecture and on-demand delivery model of public cloud computing. This appreciation, in turn, has now sparked the adoption of cloud computing technologies and processes behind the corporate firewall in the form of "private cloud" IT infrastructure.

Internal IT deployments that qualify as private clouds are still more the exception than the rule, and what exactly constitutes a private cloud remains open to some debate. Almost all industry trackers agree, however, that private clouds are poised for rapid growth. And most also agree that any private cloud worthy of the name will start with an underlying IT infrastructure that makes extensive use of virtualization.

Viewed from a 10,000-foot level, private clouds promise many of the same technical and business benefits of their public cloud counterparts, everything from greater IT efficiency and lower costs to increased business agility. Besides doing top-down assessment, however, smart IT managers are also taking a bottom-up approach to private clouds. They have come to realize that the physical IT infrastructure on which private clouds are built—down even to the microprocessors powering application servers—can greatly affect a cloud's overall capabilities and potential.

Indeed, there is growing recognition that high-core-count microprocessors that also offer other advanced architectural features can be a critical building block for private clouds based on virtualized infrastructures. Also growing is the conviction that AMD Opteron™ Series processors provide many "cloud-friendly" characteristics, which helps explain why several major public cloud service providers have standardized on AMD Opteron processor–based servers. As private clouds billow farther across the IT landscape, corporate IT managers would be wise to do their own assessment of the microprocessors at the core of their private clouds.

DEFINING AND DEPLOYING PRIVATE CLOUDS

Before examining the attractions of private cloud computing, let's first define what a private cloud is. As noted, definitions vary, but research firm Nemertes Research offers a useful characterization: "A private cloud is a common pool of dynamically allocated resources—compute, network and storage—delivered to customers (internal and external to IT) via a self-service portal with metered services."

Beneath this broad definition resides a collection of cloud-relevant technologies and business processes. Ted Ritter, principal research analyst at Nemertes Research, says the journey to private cloud computing typically entails five steps:

1. **VIRTUALIZE.** The foundational step for cloud computing involves creating a virtual machine layer above the physical server infrastructure.
2. **REORGANIZE.** Once the virtualization layer is in place, companies need to reorganize their application workloads to make the most-efficient use of the virtualized infrastructure.
3. **OPTIMIZE.** Next, organizations must optimize their business processes and procedures so they can most effectively capitalize on the virtualized IT infrastructure and workloads.
4. **ORCHESTRATE.** IT managers use tools to automate and orchestrate key processes such as provisioning/deprovisioning virtual machines, deploying upgrades and patches, and migrating workloads based on fluctuating demands.
5. **MANAGE.** Although listed as the final step, private cloud management really begins alongside the initial virtualization effort and continues throughout the private cloud's evolution. In the later stages, management comes into play to support some of the more advanced capabilities of private clouds, such as the ability to support self-service provisioning of compute resources for specific tasks and the tracking and metering of usage to support the internal bill-back of charges.

Virtualization, the seminal step in any private cloud deployment, is already widely accepted and adopted. Based on detailed interviews conducted from January through April 2011 with more than 240 IT professionals at 228 companies, Nemertes determined that 53 percent of the application workloads at these firms now run on virtual machines. "There are now more virtual instances of applications than physical implementations in the firms we interviewed," notes Ritter, who expects virtual workloads to approach 80 percent of the total application load over the next three to six years.

Beyond the virtualized foundation, other elements of private clouds are materializing at varying rates within different corporations. Some components of the "ideal" private cloud—including self-service provisioning and usage metering and billing—require technical or business-model changes that have slowed the adoption of these elements in some firms. Such challenges notwithstanding, Nemertes Research expects the number of private clouds to increase dramatically in the near term as IT managers and corporate executives buy into the many business benefits this computing model can confer.

Additional independent research substantiates the growth of private and hybrid cloud computing adoption as well. A survey of enterprise CIOs and CFOs (100 IT managers and 106 finance managers) released in January 2012 and conducted by IDG Research Services shows that 35 percent of the surveyed organizations are using private or hybrid clouds enterprise-wide or department-wide. (See chart below).

THE ALLURE OF PRIVATE CLOUDS

Not all, but many, of the benefits private clouds deliver spring directly from their exploitation of a virtualized infrastructure. Traditional corporate data centers rely on dedicated servers and application silos, in which specific applications run only on designated servers. With this computing model, each server must have enough extra capacity to accommodate peaks in application usage, meaning that a significant percentage of the server's capacity—often more than 50 percent—is idle much of the time. As demands grow, companies must purchase and deploy new physical servers and allocate more floor space, increasing capital costs. Having a growing number of underutilized servers also drives up administrative complexity, power usage and other operational costs.

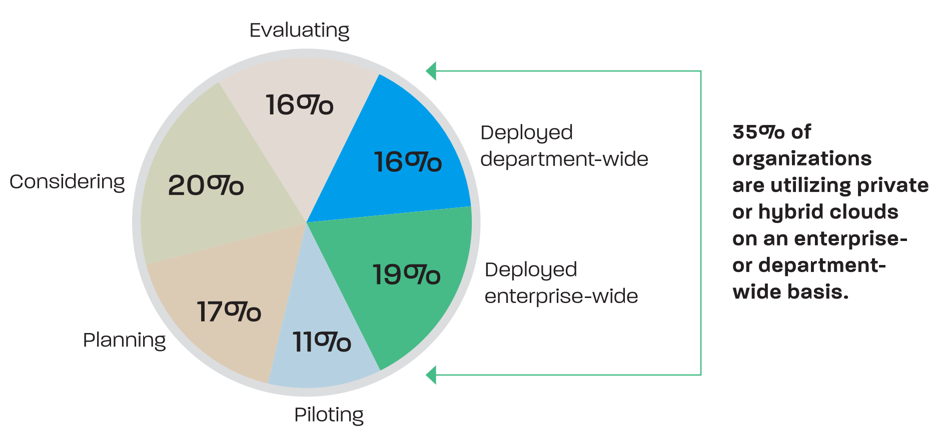
By contrast, servers that use virtualization hypervisors to create many logical virtual machines (VMs) within each physical server can cut both capex and opex outlays. With the proper management and monitoring software, IT managers can build shared pools of virtualized resources that are much more flexible and adaptable than dedicated, hardwired application silos. Individual physical servers in these resource pools can support different operating system instances and applications in each VM they contain. With the ability to provision and deprovision VM workloads relatively easily, and even automatically, IT managers can wring the maximum amount of power and utilization out of their server infrastructure.

Servers running at high utilization can translate into fewer servers, less floor space, fewer IT administrators and lower power consumption. At the same time, the workload fluidity made possible through the combination of a virtualized infrastructure and sophisticated management software produces an IT operation—and, by extension, a company—that can adapt more rapidly to changing demand loads, new business requirements and ongoing business growth.

Private/Hybrid Cloud Adoption

Proliferation of private and/or hybrid cloud models

Source: IDG Research, January 2012



Growth, in fact, is one of the main drivers behind the migration to private clouds. Mimicking their public cloud counterparts, private clouds aim to be “elastic,” stretching to accommodate new computing demands or, conversely, shrinking in response to the lessening of demands. Private clouds, for example, can often accommodate increasing user demands for one application by temporarily requisitioning idle VMs from some other workload, rather than forcing the purchase of entirely new servers and incurring the overcapacity and deployment costs that come with them.

As for workloads, virtualized private clouds can happily accommodate the full range of applications—messaging and collaboration, database, back-office enterprise resource planning (ERP) and business intelligence (BI) and front-office customer relationship management (CRM)—typical in most corporations. Some companies are even starting to leverage the combined resources of private clouds to tackle high-performance computing tasks that would formerly have required dedicated supercomputers or other expensive high-end servers. And, countering a common management concern about placing sensitive corporate data and applications in public clouds, private-cloud-based corporate resources sit safely behind the corporation’s own security wall.

MICROPROCESSORS INFLUENCE THE CLOUD’S PERFORMANCE

Not surprisingly, IT managers have often focused on the high-end functionality and management of private clouds while paying less attention to the physical infrastructure on which they run. Increasingly, however, IT professionals are coming to understand how the underlying infrastructure can influence a public or private cloud’s performance and potential. One indication of this growing awareness: In a March 2011 survey AMD conducted of companies with at least 100 employees, 92 percent of the respondents said that infrastructure was an important consideration in their cloud computing decisions.

Of particular importance—to private clouds overall and, especially, to their virtualization foundation—are the microprocessors running at the heart of the cloud’s application servers. Many companies, for instance, choose to deploy one VM per processor core, meaning that higher-core-count processors can support more VMs per physical server. To help support VMs that operate at speeds close to native performance, processors also require large memory capacity and bandwidth to accommodate memory-intensive virtualized environments. Similarly, processors with high-capacity I/O throughput can provide the means for numerous VMs to communicate rapidly and efficiently with various system peripherals.

The AMD Opteron™ 6200 Series processor, the newest in a proven line of high-core-count devices, provides unparalleled capabilities across all these variables. Compared to Intel Xeon 5600 Series processors, the AMD Opteron 6200 Series processor offers more cores (as many as 16 versus as many as 6), more memory channels (4 versus 3) and more memory bandwidth (73 GB/s versus 42 GB/s)[1], among other advantages. At one VM per core, the AMD Opteron 6200 Series processor can host up to 672 VMs in a standard 42U rack, whereas the same load would require 2.6 racks of Intel-based systems and three times the floor space[2]. Customers can get up to 160 percent more VMs in 2P configurations and 60 percent more in 4P configurations with AMD Opteron 6200 Series processor–based servers.[3]

To further bolster the advantages provided by its high-core-count processors, AMD builds a range of virtualization functionality directly into its silicon. AMD Virtualization™ (AMD-V™) technology speeds virtual machine operations to the point where they nearly match dedicated physical machine performance. Among the AMD-V functions are Rapid Virtualization Indexing, which provides hardware-assisted memory management of complex virtual machine environments, and Address Space IDs, which decreases context switching overhead and improves VM performance.

Another AMD Opteron 6200 Series processor feature, AMD Turbo CORE technology, gives applications a shot of computational adrenaline by turning unused power headroom into higher clock speed above base frequency (up to 500 MHz with all the cores active and up to 1 GHz+ with half the cores active) .[4]

AMD PROCESSOR–BASED SERVERS POWER THE PRIVATE CLOUD

The virtualization, scalability and power characteristics of the AMD Opteron 6000 Series platform have convinced several public cloud services to use servers based on these processors as the foundation for their cloud infrastructures. Among others, for example, Microsoft Windows Azure has standardized on AMD Opteron 6000 Series processor–based servers for its clouds.

Now, as indicated by the Nemertes Research benchmark, the many benefits achievable via private cloud deployments are catalyzing the rapid growth of this form of corporate computing. The flexibility, adaptability, power and cost-effectiveness of private clouds, compared to legacy IT infrastructure models, can be stunning. But these benefits won't fully materialize if the processor building blocks powering the cloud don't excel at supporting a virtualization layer of fast and efficient VMs, provide high performance at low-power levels and deliver the range of additional functions private clouds require.

The AMD Opteron 6000 Series platform, led by the new AMD Opteron 6200 Series processors, delivers performance and pricing characteristics that make it ideally suited to the many demands of private cloud computing. IT managers moving to deploy private clouds of their own would do well to explore the reasons many commercial cloud providers have decided to go with an AMD processor–powered infrastructure.

[1] AM STREAM : 73 GB/s, 2 x AMD Opteron processors Model 6276 in Supermicro H8DGT, 64 GB (8 x 8 GB DDR3-1600) memory, SuSE Linux® Enterprise Server 11 SP1 64-bit, x86 Open64 4.2.5-1 Compiler Suite 42 GB/s, 2 x Intel Xeon processors Model X5670 in Supermicro X8DTT server, 24 GB (6 x 4 GB DDR3-1333) memory, SuSE Linux Enterprise Server 11 SP1 64-bit, Intel Compiler v11.1.064 **SVR-83**

[2] AMD Opteron 6200 Series processor–based 2P servers can support as many as 32 VMs each, assuming 1 VM per core. A rack can hold 21 servers x 32 VMs = 672 VMs per rack. Intel Xeon 5600 Series processor–based 2P servers can support as many as 12 VMs each, based on core counts listed at www.intc.com/pricelist.cfm as of 10/24/11, for 21 servers x 12 VMs = 252 VMs. **SVR-90**

[3] Assumes 1 VM/core. AMD Opteron 6200 Series processor–based server has as many as 32 cores in 2P and 64 cores in 4P. An Intel Xeon 5600 Series processor-based server has as many as 12 cores in 2P and an Intel E7-4800 Series processor–based server has as many as 40 cores in 4P. Intel specs as of November 2011 at www.intc.com/pricelist.cfm. **SVR-89**

[4] AMD Opteron Series 16-core processors experience all-core boost of up to 500 MHz (P2 base to P1 boost state) and up to 1.3 GHz max turbo boost (half or fewer cores boost from P2 to P0 boost state). **SVR-27**

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