Virtualization for Consolidation and Optimization of System Resources

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OVERVIEW

Organizations have many goals in mind when selecting virtualization technology. Depending upon the organization's goal, different layers of virtualization technology present the best solution. Here's a quick review of goals some organizations have for creating a virtualized environment:

- Agility — Optimize use of systems, deal with a rapidly changing environment, reduce time and complexity of installation
- Availability or reliability — keeping applications and services online and available in order to avoid the costs of downtime
- Consolidation — Merging applications or services onto a small number of systems to avoid the costs due to hardware and maintenance of hardware.
- Performance — Complete tasks more quickly by applying more systems
- Scalability — Get more work done by applying more systems allowing more work to be done, revenues to be increased and more FreeCell games to be completed in a given unit of time
- Unified management environment — Manage a number of systems as a single entity to simply management and reduce the costs due to administration and operations

How organizations came to need a consolidation strategy, what virtualization tools are available to address this need and which of those tools might be best will be considered in this paper.

HOW DID ORGANIZATIONS END UP WITH SO MANY IDLE RESOURCES?

Many organizations allowed their IT infrastructure to grow and evolve based upon the needs of individual business units or departments. Each of these business units or departments was allowed to create its own IT strategy and select IT-based solutions. While this appeared a reasonable approach at one time, it is now largely seen as a flawed concept.

IF YOU DON'T KNOW WHERE YOU'RE GOING, YOU'RE GOING TO END UP SOMEWHERE ELSE

When given that freedom, what would a business unit manager do? That's right, a manager would consider the ebb and flow of his/her ***own*** business and what the business unit's own staff IT expertise. Then that manager would select a solution. The needs of other business units or the organization as a whole would seldom be part of that person's decision-making process. Some would choose a mainframe solution. Others would select a midrange solution. In the late 1980s and early 1990s, these managers would have been very likely to select an industry standard system running Windows, Linux or, possibly, NetWare.

As with other IT architectural decisions, there were important ramifications to what appeared to be “business unit specific” decisions.

DATACENTER IMPACT

As these independent selections were made, the organization’s datacenter increasingly become a museum of computing technology. Each computing solution resided in its own silo. Each silo was purchased to handle peak periods and maximum workloads that one business unit experienced. It was often the case that these business units also purchased redundant resources so that their computing solutions were always available.

While this approach met the requirements of the business units making the decisions, it had a costly side effect. Systems purchased for peak workloads sat largely idle the rest of the time. Backup systems may also have been allowed to sit idle until needed. If all of the organization’s idle resources are considered, a great deal of the organization’s IT investment is not being utilized most of the time. Furthermore, these idle resources were not easily redeployed to support the workload of another department or business unit. This, among other factors, precluded business agility.

It is clear that this approach, an approach that seemed so reasonable only a few years ago, is no longer the best way for organizations to make the best use of their limited funds and resources.

Now organizations are seeking ways to turn those silos into pools of usable resources that can be optimized and orchestrated for today’s requirements.

WHAT VIRTUALIZATION TOOLS ARE BEST FOR BUILDING A CONSOLIDATED, HIGHLY UTILIZED DATACENTER?

Making the transition from a silo-based datacenter to an agile, cost effective pool of available resources requires careful planning and a prudent approach. The needs of all of the organization’s business units as well as powerful virtual processing, management and orchestration/automation tools must be taken into account.

The virtual processing tools most organizations use to create this pool of resources usually fall into one of two categories of virtual processing software — virtual machine software and operating system virtualization/partitioning software.

- Operating system virtualization/partitioning — this technology segments the resources managed by a single operating system and makes it possible for individual applications or workloads to be isolated from all others hosted by the same physical system.

  Each workload runs in its own "virtual server." Since there is really only one copy of the operating system running, this approach is very fast and efficient. It typically is possible to run many times the number of independent workloads on a single physical machine than would be possible using virtual machine technology. This approach also offers significant reduction in the cost of the physical machine as it simply isn’t necessary for business to purchase or deploy the memory and storage required to support multiple operating systems at the same time.

  Another important benefit is reducing the amount and type of staff expertise necessary to support any physical system. Only Windows expertise would be needed to administer a Windows-based server running many independent and isolated Windows environments. Only Linux expertise would be necessary to support a physical system running Linux-based applications.

It is also possible to further reduce the amount of memory required in an operating system virtualization/partitioning environment. Templates of applications can be created. When multiple copies of one of these templates are created, much of the code and data can be shared rather than copied.

This approach works well if the organization has no need to mix operating systems on a single machine. Although HP, IBM and Sun offer extensions to their Unix operating systems that do this, SWsoft's Virtuozzo and the related open source project, OpenVZ, are the best examples of this technology. Virtuozzo supports Windows and Linux on industry standard systems.

Customer Profile

A large multinational company was looking for another option for virtualization technology. It has already deployed a very well known solution for its test and development environment. This solution wasn't translating very well for its production environments.

This company constantly found itself deploying applications into virtual machines only to have to redeploy them again on standalone servers due to performance issues.

This company initially deployed SWsoft Virtuozzo on some of its less critical homogeneous applications such as file/print servers or domain controllers. Performance benchmarks were done. Once the results of these tests were approved, the company standardized on an implementation plan to deploy all "like-OS" production applications on Virtuozzo rather than in virtual machines.

This company got an unexpected benefit, a reduction in time to create and deploy a virtual environment. The company is now spending at least 30% less time with operating system management.

- Virtual Machine Software — this technology encapsulates an entire stack of software, including an operating system, a database manager, an application framework and the application itself, into a "capsule" or virtual machine. One or more of these capsules can be hosted on a single physical system. There are two ways to achieve this: kernel-based and paravirtualization.
  - The kernel-based approach allows one operating system to support others as "guest operating systems." The guest operating systems can be another copy of the first operating system or copy of a different operating system. Many times, this approach requires special hardware support, such as that found in either Intel's VT or AMD's AMD-V technology.
  - Para virtualization – this approach relies on a special purpose hypervisor, or small, dedicated operating system to host these "capsules" or virtual machines. This hypervisor manages the underlying physical system and allows Linux, Solaris, NetWare, FreeBSD, OpenBSD, NetBSD and/or Windows guest operating systems to run. In this approach the general purpose operating systems are ***all*** guests. Hypervisors are very small, highly optimized operating systems that are designed from the ground up to host other operating systems rather than being general purpose.

Each of these approaches has benefits and challenges. Which is best depends upon the organizations need for flexibility and requirements for optimal use of their staff's expertise and their physical systems.

OPERATING SYSTEM VIRTUALIZATION — A SUPERIOR TOOL FOR CONSOLIDATION

If an organization needs the flexibility to run applications requiring different operating systems on the same machine simultaneously then virtual machine technology could make sense. This approach however requires that the underlying system be configured with enough processing power, enough memory and enough storage to handle such a heavy load. Furthermore, the organization will need enough staff expertise to manage the virtual machine software as well as all of the operating systems, their related tools and applications near each system.

Organizations in the business of hosting systems for others often chose operating system virtualization/partitioning because it makes more optimal use of systems, software and staff resources. When this approach is used, all Windows-based applications are assigned to run on a Windows system and Linux applications run on a Linux-based machine. The organization doesn't need to invest so heavily in system hardware, memory and storage. It is also very likely that staff expertise requirements will be minimized using this approach.

Depending upon the organization's requirement, operating system virtualization/partitioning is likely to be the best choice.

ORCHESTRATION OF RESOURCES — ANOTHER CONSIDERATION

Moving from an inflexible physical server environment to an inflexible virtual environment makes no sense. Regardless of the approach chosen, it's important to remember that agility, reliability and performance are key criteria when the choice to either encapsulate applications as partitions under a single operating system image or to encapsulate an entire virtual sever environment.

It is also wise to know if tools allowing these virtual environments to be migrated to a physical environment (called V2P) or a physical environment to be migrated to a virtual environment (call P2V) are available.

SUMMARY

As with all virtualization technology, decision-makers face the imperative to develop a clear understanding of the organization's needs as well as an understanding of the virtualization technology currently available. With this knowledge, a sound architecture for adoption of this technology can be deployed. Without these things, an organization is very likely to waste time and money on a patchwork quilt of incompatible point solutions.

More information about Operating System virtualization/partitioning can be found here http://www.swsoft.com/consolidation.