Number 52, Spring 2008

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Virtual Versadex

In the past few years, a new architecture known as “server virtualization” has emerged and is taking the data center by storm. Some may argue that server virtualization is not new, but simply a return to the mainframe architecture of yesteryear when applications shared a single server and the mainframe isolated the applications into regions, so as not to impact other applications running on the same mainframe. This article intends to explain how virtualization works and summarize how it differs from the original mainframe concept.

As the PC and essentially Microsoft Windows grew up and became a viable option in the server room, the conventional wisdom was that each PC-based server would have a specific role to play. For example, a typical server room might be made up of a number of Windows NT servers each fulfilling a single role (e.g. print server, domain server, Directory server, file server, web server and so on). Since the PC-based servers of the 80’s and 90’s had limited processing power, compared to mainframes and mini-computer based servers, large, complex applications were architected so that they were split across many role servers so that processing of one component did not impact the processing of another, also making debugging and performance troubleshooting easier. This isolation could be as simple as splitting the database from the application layer to many servers servicing a component of the application (e.g. GIS validation). I recall seeing one CAD application split across thirty (30) different Windows 2000 servers.

The role server architecture is sound in many ways but also resulted in a hoard of servers (hardware) in the server room and/or data center. All of a sudden, IT managers needed to *manage* more and more “blinking lights” (servers), each with their own version of the operating system and various applications installed. As the Intel and AMD based servers gained processing power, rapidly closing in on the mainframe, and memory prices plummeted, an “out-of-the-box” server (minimal configuration) was overkill for most of the “roles” that a single server might play. New servers were consuming more electrical power but were vastly underutilized when it came to actual computing.

With this problem defined, along came a solution: *Virtualization*.

What is Virtualization?

Virtualization essentially turns any computer into a virtual server where one or more operating systems, and applications, can be running on a single “hardware” server, at one time, each unaware of the existence of the others on that server.

The early virtualization pioneer in the PC (Intel) world is VMware who developed a product that could run “on top” of Windows or Linux and support multiple *guest* operating systems – all running on the server at the same time. This was a significant advancement over the “dual boot” method where a single PC was able to run more than one OS, but you had to select the OS when booting the workstation/PC – you couldn’t run two operating systems at the same time. VMware got its start by offering its product to software developers allowing them to test their products under numerous operating systems without requiring a computer for each or rebooting between tests. For example, a developer needing to test their software under Windows 95, 98, NT and 2000 would require a test workstation per operating system or set up dual boot configurations (very time consuming between boot ups). VMware allowed them to have a single workstation running many operating system versions, all at once – the tester could simply jump back and forth between the operating systems with a click of a mouse.

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VMware recognized there was more to virtual operating systems than testing applications and soon beefed up their products to offer server versions where mixed-mode operating systems could co-exist and run real-world applications, all sharing the same set of hardware resources (computing horsepower including memory, CPUs and disk). At about this time, other major vendors saw the future of computing and began to develop and offer their own commercial grade hardware resource sharing solutions. The IBM LPAR (Logical PARtitioning) solution was intended to provide Unix and Linux configurable environments on the powerful IBM pSeries computer. Microsoft, not to be outdone, began to develop a product known as Microsoft Virtual Server to provide multiple instances of a Windows operating system to run on a single computer. Even an open source solution, known as XenSource, was hatched to provide low level kernel virtualization (it has since been acquired by Citrix).

Benefits of Virtualization

The benefits of virtualization are many:

1) The server role or application can be isolated but without the additional cost associated with separate server hardware. This allows you to fully utilize your server investment while lowering your power consumption (i.e. consolidate servers).

2) Complex applications may require specific versions of the operating system or components of an operating system. When many applications share one operating system, it can be difficult and often time consuming to upgrade the operating system and verify that it did not adversely affect any one of the applications. With virtualization, the operating system can be tuned and patched specifically for each application(s) running within the virtual server. In today's world, operating system manufacturers are providing their installations in packages so that only the required components need to be installed.

3) A virtual server can be *moved* to a new hardware server with ease. If your application requires "more horsepower" or you simply need to replace a server with something more modern, virtualization makes the migration to new hardware much simpler. That is, installing applications into a host operating system takes significant effort whereas, with virtualization, the entire virtual server can be moved and "pinned" to a new hardware platform with ease.

Versaterm recognized the benefits of virtualization early on (~2001) and began using VMware in-house to consolidate server processing and even used VMware in our demo environment where a single Windows laptop could run the Versadex "server" and all of the Versadex client software. In fact, many customers actually began their implementations using a *virtual server* Versadex system provided by Versaterm. Today, we have deployments where the RFServer components (Windows-based) are inside a VMware Linux server (where the VMC message switch lives).

How it Works

Virtualization software, by the simplest terms, is simply a piece of software that runs on top of an operating system. This "piece of software" permits you to install "other" operating systems, as guests, sharing access to the server hardware and run them as virtual servers within the host operating system. The host operating system (i.e. installed on the hardware server) can be a full blown Windows Server, Linux, etc. installation or it can be a pared down version of an operating system tuned to run virtual servers.

Within the VMware environment, VMware offer ESX Server as the optimal *host* operating system. Although a full-blown Linux or Windows operating system could be installed and serve as the *host operating system*, ESX Server is optimized to run, manage and monitor virtual servers with the necessary components to run VMware guest operating systems. It, in effect, becomes the core or base operating system providing an *interface layer* between the guest operating system(s) and the storage (i.e. disks), networking, device drivers and such. The next generation of virtualization, known as *paravirtualization*, is making the guest operating system kernels *virtualization-aware* so they too will run at optimum levels.

As the following diagram illustrates, this provides data center capability where few servers (hardware-wise) are acting like many virtual servers. Applications, running in the virtual server can be "pinned" to any of the available hardware servers. The recommended implementation includes using shared storage so that all servers can connect to the storage and enabling the cluster capabilities

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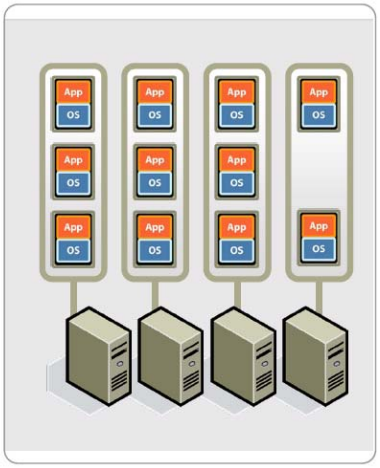
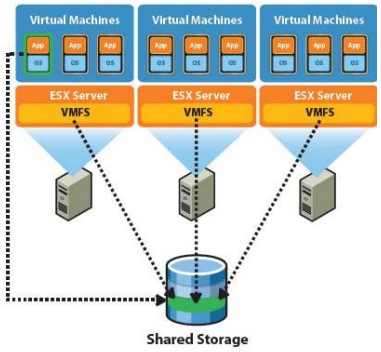


However, the power of virtualization is not just about server consolidation, saving hardware costs and energy consumption. There is an entire framework around virtual server technology providing management capabilities to "patch" the hardware and host operating system (e.g. ESX Server) without taking the applications offline and, in some instances, even patching the guest operating systems providing a snapshot capability to rollback in the event the patch causes problems.

For data center type processing, the virtual environment can provide a very high level of availability as the virtual server can be migrated to another hardware *server* without impacting operations! For example, if the hardware becomes overloaded, the administrator can move the entire virtual server to another hardware host plant without taking the users offline. That is, the virtual server environment can be *moved* to run on another server without impacting the users. This feature might be more applicable in an environment where load could be unpredictable. For example, a store's website is bombarded due to a sale and this increased load is now impacting processing on the hardware plant. The virtual server, running the web server, could be migrated to another, less busy hardware server therefore moving the "load" of the web server. In fact, the virtualization software from VMware, for example, can automate and even schedule the migration.

The following diagram illustrates multiple virtual servers, running on a number of hardware servers connected to a SAN (Storage Area Network). Virtual servers can be migrated across hardware servers to fully utilize the power available in the cluster.



Further, the ability exists to use this technology to manage failover and auto-migration of application servers to other hosts. This could be used in a cluster environment or even for disaster recovery. The following diagram illustrates configuring a VMware clustered environment with off-site disaster recovery. The application server image(s), maintained on the share storage, are copied to the disaster recovery site using SAN replication and/or copy tools. If the production site should fail, the VMware snapshots are loaded from the SAN disk and started automatically.

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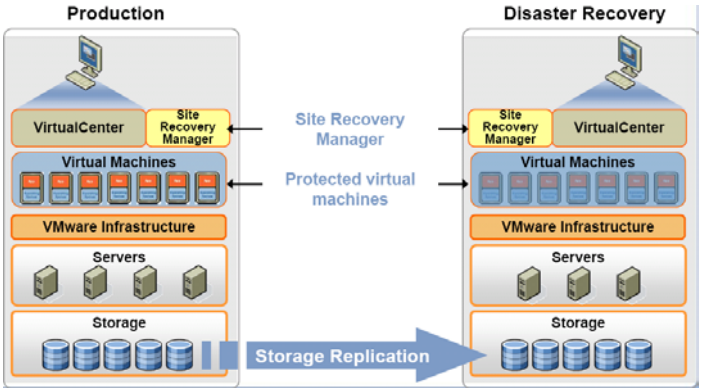

There are many choices, in the Versadex architecture, to provide disaster recovery and even clustering – virtual server technology enhances the choices and capabilities.

Versaterm is actively pursuing this technology and architecture for a number of reasons including, among other things, standardization of application deployments thus reducing costs in upgrading and server replacements. Our experience with VMware, in particular, has taught us that it's a powerful technology and it is reaching (or has reached) a maturity level where it is ready for the prime-time public safety environment. We are currently working on a number of deployments for test/training environments and will have a production environment configured and in production by mid 2008.

Summary

The virtual world of computer processing is an exciting development for the computing industry because it has the potential to simplify system management while providing built-in scalability and availability. In the simplest terms, virtualization can provide easy and less costly migration to new servers. That is, as hardware ages out and needs to be replaced, a virtual server configuration simplifies the installation of the applications on the new hardware. There is no installation but simply a migration of the virtual server from one hardware plant to another (literally minutes vs. days). In the end, Versadex applications will become Versadex appliances where the virtual application server is delivered out-of-the-box and ready to go, connecting to the production database(s).

Many readers of this article or those already familiar with virtualization will see similarities to mainframes and, in many respects; it is very similar to the mainframe technology that dominated in the 70's and 80's. Virtualization is touted as a technology intended to deliver an effective way to manage the IT infrastructure, with mainframe-class reliability and availability while remaining "open" in terms of operating system and hardware. The "openness" where multiple operating systems, of different flavors and/or release levels, *from different suppliers*, can co-exist on the same hardware is a major difference from the mainframe. While mainframes have been able to support many different operating systems under their virtual operating system, all of those different operating systems were provided by the hardware manufacturer.

We plan to give an update on our experience to date of the fully deployed Virtual Versadex at our 2008 Users Conference.

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