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Applying Thought

APPLICATION OF SERVER VIRTUALIZATION IN PLATFORM TESTING

Application testing remains a complex endeavor as Development and QA managers need to focus on delivering projects on schedule, controlling costs, and ensuring quality. However, meeting these demands is complicated by challenges such as inadequate hardware requirements, lack of time, test coverage limitation and total project cost. Features provided by server virtualization technology can be leveraged in test environments and subsequently reduce the total project cost.

As server virtualization technology emerges as it helps platform testing in many ways, keen attention is needed to make use of it effectively. This paper describes the added advantages of server virtualization in platform testing.

WHITE PAPER

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1 Introduction

Server virtualization helps in effective use of hardware resources. It allows multiple Operating Systems (OSs) run in isolation on the same hardware with each OS associated with its own set of applications. Each instance of this OS is called a virtual machine. We can have multiple virtual machines running on one powerful server.

An application, which needs to be tested across heterogeneous OSs, can be run practically on a single server using server virtualization. This helps in reducing testing cost involved in hardware resources drastically.

This white paper explains the issues involved in platform testing and how it can be resolved using server virtualization in brief.

1.1 Platform Testing

Platform testing includes testing of an application across a wide variety of hardware, OSs, browsers and databases. In this paper, platform testing is considered with respect to heterogeneous OSs or different flavors of the same OS. An application, developed to run on multiple platforms (OSs), needs to be tested on all those supported platforms. It needs a setup consisting of different machines/servers running with different OSs.

1.2 Server Virtualization

Running multiple different OSs or multiple instances of the same OS on a single server is called server virtualization. The two server virtualization architectures are called hosted and hypervisor architecture.

 In case of hosted architecture, the virtualization is accomplished by a layer of software called virtual machine monitor (vmm), which resides between host os and guest os.

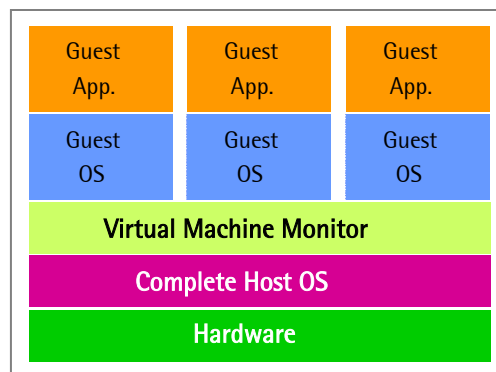| Guest App.	Guest App.	Guest App.
Guest OS	Guest OS	Guest OS
Virtual Machine Monitor		
Complete Host OS		
Hardware		

Fig: Hosted Architecture

Hypervisor is a software that runs directly on a given hardware. It resides between the hardware and the guest OSs.
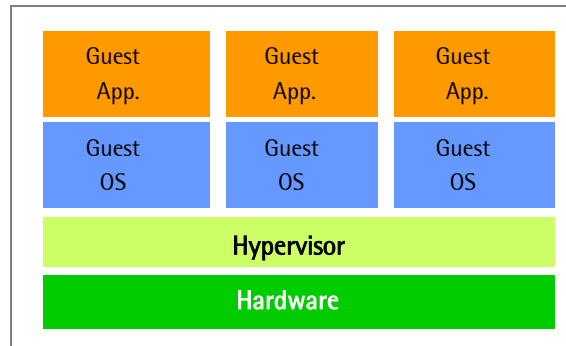
Fig: Hypervisor Architecture

1.3 Significance of Server Virtualization

Virtualization enables new ways for effective usage of both servers and desktops. It helps in consolidating heterogeneous OSs and run untrusted applications on powerful servers providing a simplified data center, better utilization of hardware, reduced cost, and enhanced security for the enterprise.

Using server virtualization, we are no longer limited in running only one OS on a single, underutilized server or workstation. This helps to reduce efforts involved in managing number of systems for the same task, which in turn helps to cut down real time power and cooling cost involved.

2 CURRENT PROBLEMS IN PLATFORM TESTING

Now a days, one of the most important criteria of a world class software product is its independence from its underlying platform (OS). This pushes a need for testing that software product on different supported platforms. Releasing a software product without testing on all platforms is a big risk and can hide many bugs which are platform dependent. Testing of such software product on different platforms involves large investment in test machines running different OSs. Along with this, it requires a lot of effort in configuring and managing these machines.

2.1 Challenges faced in Platform testing

Platform testing is very essential for a quality product to assure its proper behavior on all supported platforms, but this is not an easy endeavor. It involves many challenges in terms of hardware availability, total cost, test bed setup, capturing failure scenario etc., which are explained in more detail below.

Hardware Resources

Platform testing requires sufficient hardware resources to increase efficiency in the team, but it needs good amount of investment in terms of money. Also, management of lab setup having different configurations needs expert staff, thereby increasing administrative cost.

Consider an application containing three modules and this whole application needs to be tested on three different platforms. Test development, automation and execution for each module are handled by one person. For efficient utilization of effort and time of each person, we need three different servers having three different OSs installed for each individual, so for three people we need nine servers, which really adds to the cost of the project. The number of servers can be reduced by time sharing basis but it affects the efficient time utilization of an individual and thus reduces efficiency and productivity.

Cost Involved in Power, Cooling and Commercial Space

If number of hardware is more, it occupies more commercial space which is very expensive today. Also, it increases the cost involved in power, fans and air cooling systems.

License Cost

Licensed copy of OS software can not be reutilized. Thus, each server has license cost involved along with hardware.

OS Installation

Installation of different OSs and configuration needs expert administrative staff and thus it is a very costly and time consuming job.

Creation of Realistic Test Environment

In order to verify compatibility of applications with other elements of the deployment infrastructure, support is needed to create a realistic test environment. For example, there has to be compatibility with clients running on different OSs and connecting to server application via different technologies.

Testing Multi-tier Environment

Multi-tier environment contains different servers running different applications which are dependent on each other and have to be tested all together. Establishing an environment like this is a complex and very expensive job.

Duplication of Test Environment for Geographically Distributed Testing Teams

It is a complex job to duplicate the test environment for geographically distributed teams. It adds to step up administrative costs due to the reconfiguration of testing servers.

Execution of Automated Regression Tests which needs Rebooting of the System

Some tests are purposefully written to test the behavior of an application when the system suddenly goes down or it restarts. Database application is a good example for such scenario especially when it is doing some transaction and in between system goes down or restarts. To simulate such test scenario, rebooting of the system is required, but this impacts and stops other applications running in that system and they too have to be restarted.

Data Collection and Debugging

It is sometimes very difficult to simulate failure conditions occurred during the testing. To analyze such failures, it is required to preserve the state of the system (OS and application). This makes the system engaged for analysis and thus impacts the further testing.

Today, all these above problems can not be overlooked. They all need to be solved to save on hardware and environmental costs, effort and time in management and administration of the server infrastructure.

Server virtualization is a technology which offers many solutions to solve many of the problems and thus plays a very vital role in platform testing. Next section will explain about added advantages of server virtualization and how above challenges can be faced and solved.

3 ADVANTAGES IN PLATFORM TESTING USING SERVER VIRTUALIZATION

Let's see that how server virtualization technology helps in solving some of the difficulties faced in platform testing.

3.1 Multiple OS on a Single Server (Server Consolidation)

Server virtualization allows running multiple different OSs or versions of same OSs (including Microsoft Windows, Linux, Solaris, NetWare, etc.) simultaneously on a single machine -- without partitioning or rebooting. This is called as server consolidation; it consolidates workload of several under-utilized servers to fewer machines, perhaps a single machine.
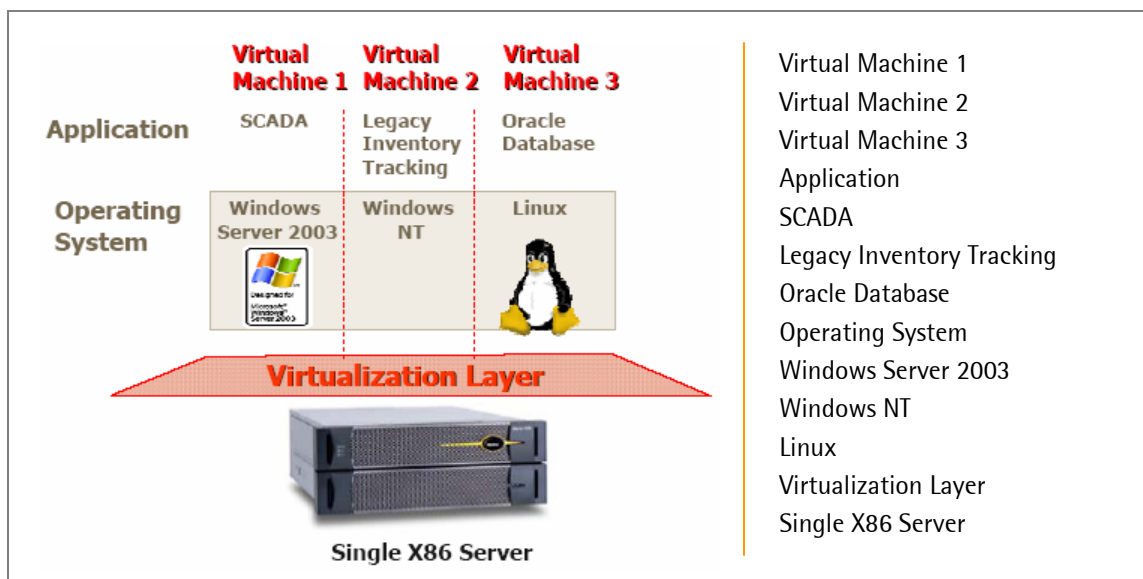

Virtual Machine 1
Virtual Machine 2
Virtual Machine 3
Application
SCADA
Legacy Inventory Tracking
Oracle Database
Operating System
Windows Server 2003
Windows NT
Linux
Virtualization Layer
Single X86 Server

Fig: Server Virtualization

3.2 Complex Multi-tier Environment on a Single Server

Multi-tier environment can be easily simulated and tested on a single system using server virtualization. It also helps demonstrating complex multi-tier applications on a single system without hassles involved in setting of a multi-tier environment. This is achieved by creating different virtual machines on a single system each running its own OS and the application. For example, a Web server, database server and workstation can run on a single machine to build a multi-tier environment.

For instance, VMware Workstation product is used to create, connect virtual machines to simulate and test multi-tier applications.

3.3 Creating and Using a Repository of Test Environments in Virtual Machine

The conventional approach for platform testing is setting up a lab with a pool of systems shared by development and QA and maintained by lab staff. For the required configuration, each developer or tester has to request lab personnel. This is quite frustrating and inefficient because of limited number of machines and to get the required test configuration each time. Inevitably, this results in failure to meet deadlines and poor quality product.

This problem is easily solved by server virtualization by creating libraries of reusable virtual machines that are preconfigured for different test configurations (different OSs, OS versions, patches, test configurations, etc.) and can be rapidly provisioned to any available machine.

For instance, VMware Workstation provides a feature of cloning and multiple snapshots which make it easy to set up a repository of test environments in virtual machines. For example, a user can create a virtual machine, install an OS, load various service packs, set up test configuration, install test application, and save each step as a separate snapshot. Now any tester can open the virtual machine from the repository, go to the appropriate snapshot, and clone it to create a new virtual machine which can be downloaded to local drive in a few minutes and start using it. [3]

3.4 Capture the Scenario with the Current State of the System for Analysis

Inefficiency in analysis or debugging for rarely occurring bugs results in a buggy product. In a software development lifecycle, resolution of some critical bugs requires preserving the state of the system for analysis. Using server virtualization technology, the entire setup containing the bug, including the OS and all applications involved, can be captured in a snapshot, or a series of snapshots and the cloned virtual machine can be stored on the network. Then, any developer with the network access can download the cloned VM in minutes for the debugging purpose.

If the developers do not have any other VMware product installed, then VMware Player is a very useful product in this scenario. It runs virtual machines created by VMware Workstation, VMware Server, or VMware ESX Server and also supports Microsoft virtual machines and Symantec LiveState Recovery disk

formats. Developers can make use of it to just run virtual machine having the failure state captured in a separate window. VMware Player is a free software that enables PC users to easily run any virtual machine on a Windows or Linux PC. It does not allow creating a new virtual machine. [2]

3.5 Accelerate Software Testing with Virtual Lab Manager

It allocates resources on as-needed basis and not maintaining multiple static systems that are only used sporadically. Virtual Lab Manager allows to pool and share resources between test teams for maximum utilization. As a result, productivity increases, teams spend less time on lower-value operational tasks and more time in developing and testing which makes it possible to complete software projects faster.

For example, VMware Lab Manager creates a centralized pool of virtualized servers, storage and networking equipment shared across teams. It also provides the required test environments in minutes and effortlessly moves configurations between development and test facilities.

3.6 Slashing Overall Cost Drastically

Virtualization significantly helps in reducing cost involved in the number of systems that organizations need to acquire for development and testing. Also, it re–duces cost associated with power and cooling, network and storage infrastruc–ture, system administration and commercial space. Most importantly, it reduces extra license cost associated with OS software by creating virtual machines and by provisioning it on a required system.

3.7 Improvement in Software Quality

A team has to spend very less time in setting up the test bed, they can increase testing coverage and be able to test real con–figurations more easily and debug failures more reliably and efficiently. The end result of this is high quality software, customer satisfaction and fewer problems experienced after deployment.

Summary of problems in platform testing and resolution using server virtualization:

Problems in Platform Testing	Solution using Server Virtualization
- Hardware resources - Cost involved in power, cooling and commercial space	Server consolidation
- License cost involved in software - Effort and time spent in OS installation	Create virtual machines, make a repository and reuse it on other systems. VM images can be reused
- Simulation of realistic test environment - Testing multi-tier environment - Duplication of test environment for geographically distributed testing teams	Resolves by creating different virtual machines. For example, a Web server, database server and Workstation can run on a single machine to build a multi-tier environment
- Execution of automated regression tests which needs rebooting of the system	A virtual machine can be rebooted without affecting other virtual machines running its own OS and applications on the same server
- Data collection and debugging for a failure scenario	The state of the system can be captured in case of failure. The current state of the OS and application can be encapsulated in a file and copied to some other system for analysis. VMware Player is very useful in this case. [2]

Note: Server virtualization should not be used for performance testing as it will not give accurate results.

4. Server Virtualization Players in Today's Market

There are several server virtualization vendors available in the market, which have seen tremendous year-over-year growth. But, the selection of it depends on couple of parameters like supported guest OSs, cost of the product, ease in usage, performance, supported features, etc.

Some of the server virtualization vendors are:

VMware

VMware has a very large value add in the server virtualization technology, it has several virtualization solutions available. VMware supports full virtualization meaning running an unmodified OS on a virtual machine. It supports Windows, Linux, Netware, FreeBSD, MS-DOS, Solaris and Mac OS X OSs.

VMware Products:
Data Center Products: VMware Infrastructure 3, VMware ESX Server, VMware VMotion, VMware DRS, etc.
Development and Test Products: VMware Lab Manager and VMware Workstation.
Enterprise Desktop Products: VMware ACE and VMware Virtual Desktop Infrastructure.
Free Virtualization Products: VMware Player, VMware Server, and VMware Virtual Center for VMware Server.
Accelerator Products: VMware P2V Assistant and VMware Virtual Machine Importer.
URL: http://www.vmware.com/

XenSource

Xen is the open source project from XenSource. Xen uses a different approach to virtualization called as paravirtualization. In this type of virtualization, the guest OS has to be modified to work with a software interface to the virtual machine monitor called hypervisor, instead of thinking it is running on the hardware. The thing is that this actually enables better performance of the guest OSs. Xen supports Linux, Windows XP, OpenSolaris and NetWare. Xen 3.0 supports running unmodified OS but for that it is mandatory to have hardware virtualization (Intel VT-x and AMD Pacifica hardware virtualization support).
URL: http://www.xensource.com/

Microsoft Virtual Server

It is a server virtualization technology engineered for the Windows Server System platform. As a key part of any server consolidation strategy, virtual server increases hardware utilization and enables IT staff to rapidly configure and deploy new servers.
URL: http://www.microsoft.com/windowsserversystem/virtualserver/default.mspx

Parallels

It supports the entire Windows family, popular Linux distributions, Mac OS, FreeBSD and Legacy OS as OS/2 and MS-DOS.

URL: http://www.parallels.com/

Virtuozzo

It supports Windows and Linux.

URL: http://www.swsoft.com/en/products/virtuozzo

OpenVZ

The OpenVZ project is an open source community project supported by SWsoft and is intended to provide access to the code and ultimately for the open source community to test, develop and further the OS virtualization effort. OpenVZ is the basis of the Virtuozzo - a commercial virtualization solution offered by SWsoft.

URL: http://openvz.org/

Virtual Iron

It supports Windows and Linux flavors as:

Red Hat Enterprise Linux 4, 32- and 64-Bit

SUSE Linux Enterprise Server 9, 32- and 64-Bit

Windows XP (32-Bit)

Windows 2003 (32-Bit)

URL: http://www.virtualiron.com/

Also, there are couples of companies such as IBM, HP, and Sun which have their own proprietary server virtualization software supported for their servers.

5 CONCLUSION

In today's world of new business demands, platform testing projects need to think about utilization of server virtualization technology to get cost effective complex projects. This will reduce the amount of hardware required, deliver a quality product with reduced bug rate and deliver a software product with fewer compatibility issues. It also helps in effective usage of time and provides customer satisfaction.

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