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Virtualizing a Virtual Machine

Azeem Jiva
Shrinivas Joshi
AMD Java Labs

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AMD 
Smarter Choice



Demonstrate best practices for deploying
Java™ Platform, Enterprise Edition (Java EE
platform) in virtualized environment



GOAL

Agenda

- What is Virtualization?
- Types of Virtualization
- Why Virtualize?
- Accelerating Virtualization
- Java EE platform
- Summary
- Q&A

What is Virtualization?

- Platform Virtualization
 - Abstraction of a computer
- Resource Virtualization
 - Abstraction or simplification of a resource
 - Hide physical characteristics of computing resource
- Provides consistent interface, regardless of resource location

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Types of Virtualization

Overview

➤ Native

- VMWare Workstation
- Microsoft® Virtual PC

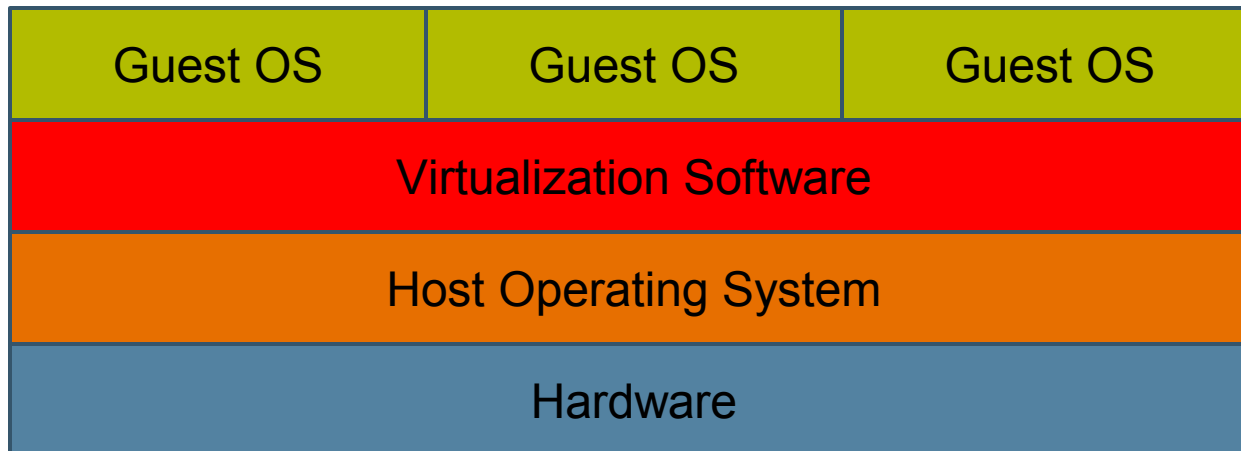
➤ Hypervisor

- VMWare ESX Server
- XEN

Types of Virtualization

Native

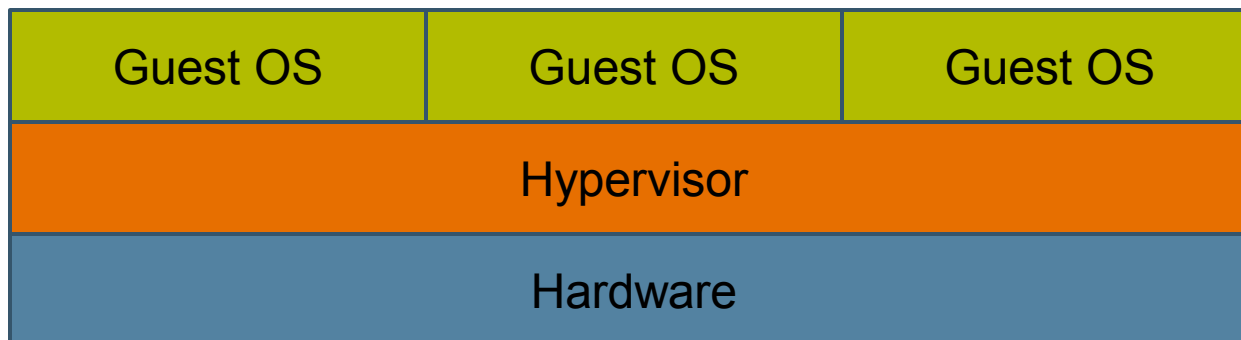
- Virtualize Guest OS on a Host OS
 - Linux® running on Windows®
 - Windows running on Linux
- Host OS not optimized for virtualization (usually)
- Advanced virtualization features not available



Types of Virtualization

Hypervisor

- Virtualize Guest OS on a thin software layer
 - Linux® running on ESX Server
 - Windows® running on ESX Server
- Hypervisor is optimized for virtualization
- Advanced virtualization features are available and well tested



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Why Virtualize?

Advantages

- Not every application needs a full system
- Easier to administer
 - Need to do hardware maintenance?
 - Move the virtualized OS disk to another system
- Lower datacenter costs
- Maintain legacy OSes and applications

Why Virtualize?

Disadvantages

- If Hypervisor crashes, all Guest OSes go with it
- Performance
 - With multiple Guest OSes, performance may suffer
 - Usually 10%, can be higher
- I/O-bound applications suffer
 - Limit the number of I/O-bound applications
 - Disk is the worst offender

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Accelerating Virtualization

AMD-V™ Technology

- Rapid Virtualization Indexing
 - Hardware assist in virtual to physical memory mapping
- Tagged Translation Look-Aside Buffer (TTLB)
 - Assign ID to TLB entries
- Device Exclusion Vector (DEV)
 - Bit to include/exclude devices from accessing memory pages

Accelerating Virtualization

JVM Developers

- Certain instructions are expensive to execute on Guest OSes
 - PAUSE
 - RDTSC
- These instructions require round trip to Hypervisor
 - 125 cycles one way for call to Hypervisor
 - Plus emulation of instruction (600 – 1200 cycles)

Accelerating Virtualization

Replace the OS with a Virtual Machine for the Java platform (JVM™)

- Remove OS layer
 - Hardware -> Hypervisor -> JVM machine
 - Reduce resource utilization by OS
- JRockit Liquid can interact directly with Hypervisor

Accelerating Virtualization

Heap Management

- Page swapping can get complicated
 - Guest OS page swapping + Hypervisor page swapping
- VMWare hypervisor uses “balloon driver” to send requests to OS for reducing memory usage
 - Guest OS has limited knowledge of active Java heap memory
- JVMs have more information about memory usage of the running Java application
 - Liquid VM can take more intelligent decisions to reduce memory footprint

Source – www.bea.com

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Java EE platform

Virtualizing a complete stack

- Application changes not required
- Most changes are at Hypervisor level
- Effects of Virtualization
 - Performance
 - Resource allocation
 - Bottlenecks
 - Consolidation

Java EE platform

Performance

- Use as few virtual CPUs as possible
 - If application utilizes just a single physical CPU, use a single VCPU
- If possible use less than 896 MB of physical memory for Linux® Guest OS
 - Different mapping techniques are used over 896 MB
- SPECjbb2005 performance slows down 10%
- Be prepared for decrease in performance

Java EE platform

Performance

- Virtualization allows you to split up larger systems into smaller execution environments
- Application performance can be impacted by change in available resources
- Java platform tuning should change accordingly

Java EE platform

Performance

- Java platform tuning should change according to change in available resources
 - Configure heap settings as needed: -Xms, -Xmx
 - Configure GC settings as needed: -XX:ParallelGCThreads=n, -Xmn
 - Scale other flags accordingly

Java EE platform

Performance

- Network traffic pattern can have significant impact on network throughput
 - Benchmark your application's network requirements during planning network sizing
- Increased network throughput puts more pressure on CPU resources
 - Evaluate average and peak CPU utilization for the VCPUs to avoid performance bottlenecks
- VMWare ESX tips to improve network performance
 - Enable traffic shaping
 - Configure network drivers according to other network devices such as switches
 - Use Vmxnet network adapters
 - Configure send/receive buffer sizes appropriately

Source – www.vmware.com

Java EE platform

Resource Allocation

- Three-tier testing on single system
- Page sharing
 - Sharing of guest memory pages
 - Decreases host memory usage
- Run the same Guest OS for increased page sharing
- Move Guest OS from system to system
 - Migration of VM Snapshots
 - Running application doesn't know (or care!)

Java EE platform

Bottlenecks

- CPU constraints
 - Guest OS requires all allocated CPUs be available
 - Sum of allocated CPUs == physical CPUs
- Memory constraints
 - Sum of allocated memory < physical memory
 - Leave some free memory for Hypervisor caching

Java EE platform

Bottlenecks

- Disk I/O constraints
 - Apps that have large number of small read/writes severely affected
 - SAN is best, or at least use a separate disk per Guest OS
- Network constraints
 - Lots of small packets affect latency
 - Dedicated NIC per Guest OS

Java EE platform

Consolidation

- Increase CPU core count on the rise
 - Eight cores per system common now
 - Expect sixteen cores per system to be common in two years
- Not all applications can take advantage of that many cores
- Run many Guest OSes on a single system
- Move Guest OS to single system when load is low

Summary

- Virtualization helps lower total cost of ownership
- Slight performance hit, improved maintainability
- Java EE on virtualized environment presents more challenges
- Following best practices guidelines can help improve performance
- Hardware assists and software technologies will continue improving virtualization experience
- Finding the right balance between benefits of virtualization and its trade-offs is the key

For More Information

- AMD Keynote Wednesday, 5:30 pm
- Pavilion Booth #724, North Hall
- Sites
 - <http://www.amd.com/virtualization>
 - <http://developer.amd.com/>
- Azeem.Jiva@amd.com
- Shrinivas.Joshi@amd.com

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