Virtually Yours – The Sequel

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Session 408

Agenda

- Introduction
- Virtual Advantages
- A Virtual Primer
- The Cost of Going Virtual
- Other Considerations
- Case Study
- Conclusion
- Questions

Introduction

- 2008 - The Silver Bullet Theory

Agenda

- 2008 - Virtual Religion

Virtualize Everything!

Introduction

- 2008 - The "No Free Lunch" Principle

Introduction

- 2010?

Introduction

- Our goals
  - Understand the basics behind virtualization
  - See the benefits behind virtual technology
  - Weigh benefits against the cost of going virtual
  - Analyze those costs in Business Objects terms
  - Look at the future of virtualization

Introduction

- VMware will be used for our case study
  - Most prolific virtualization solution
  - Business Objects uses it internally
  - Clear leader in technology and vision
- Closest competitors
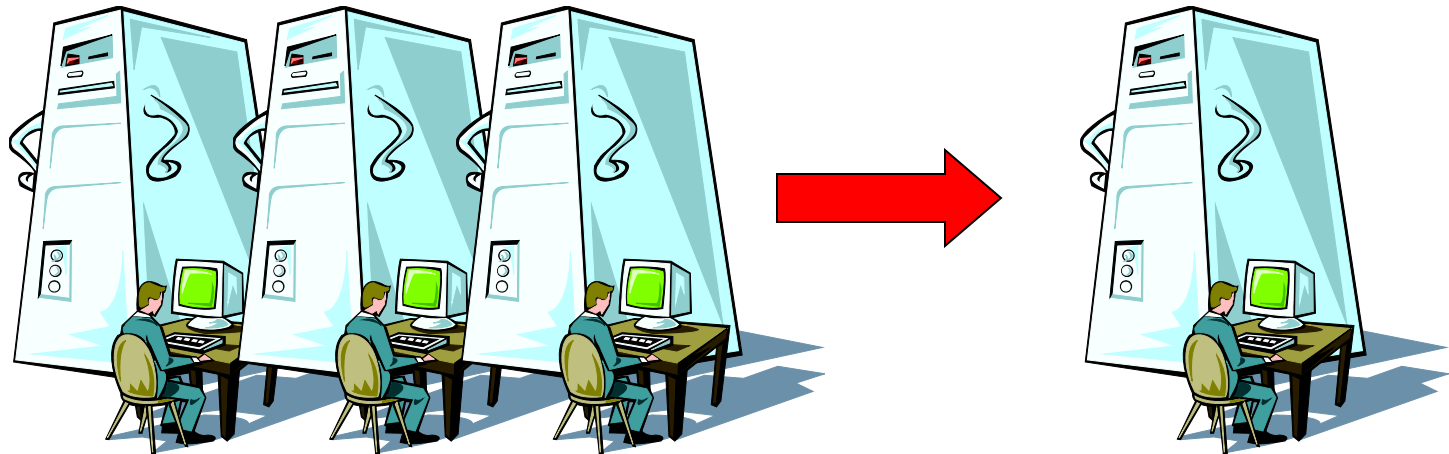 - Microsoft Hyper-V R2
  - Citrix XenServer

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- Qualifying Good Candidates
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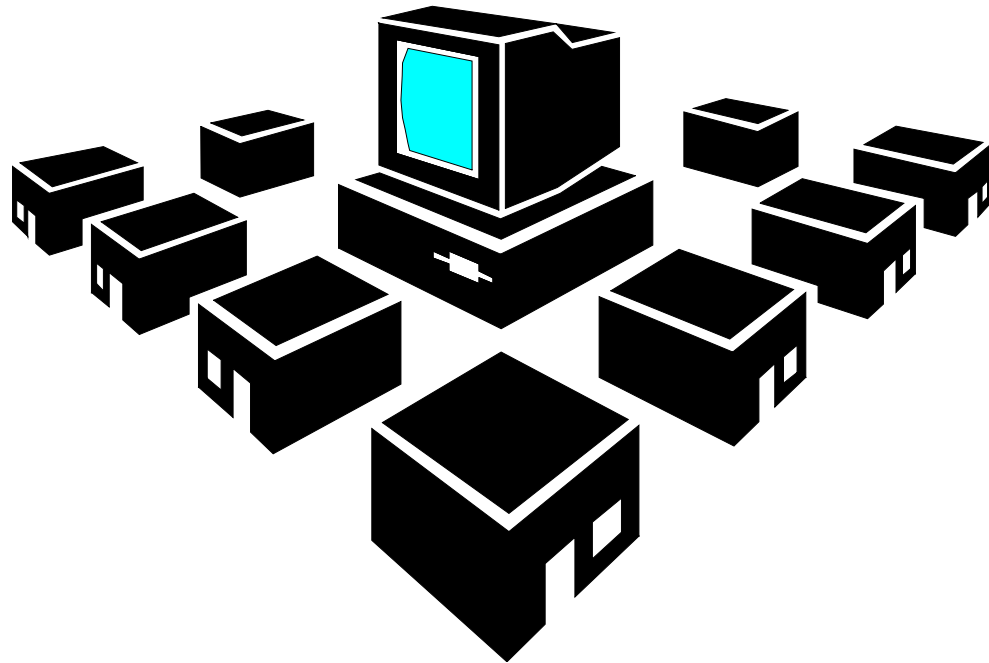- Questions

Virtual Advantages

- Server Consolidation
  - Run multiple operating systems on one physical server
  - Share available resources (CPU, memory, disk, network)
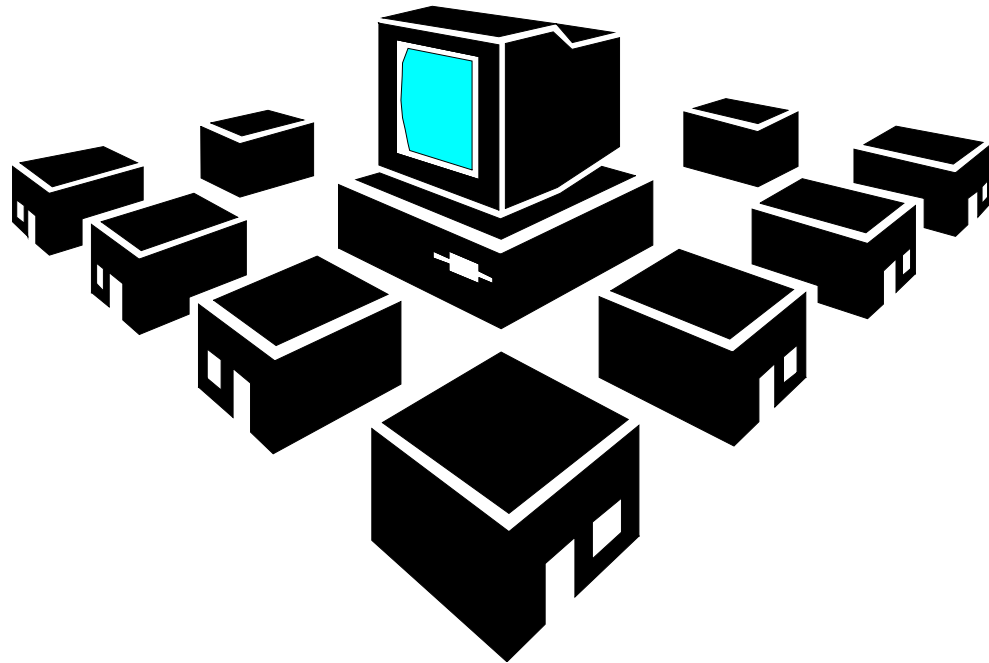 - Also known as **Partitioning**

Virtual Advantages

- Temporary Environments
    - Software testing
    - Training
    - Migration

Virtual Advantages

- Production Environments
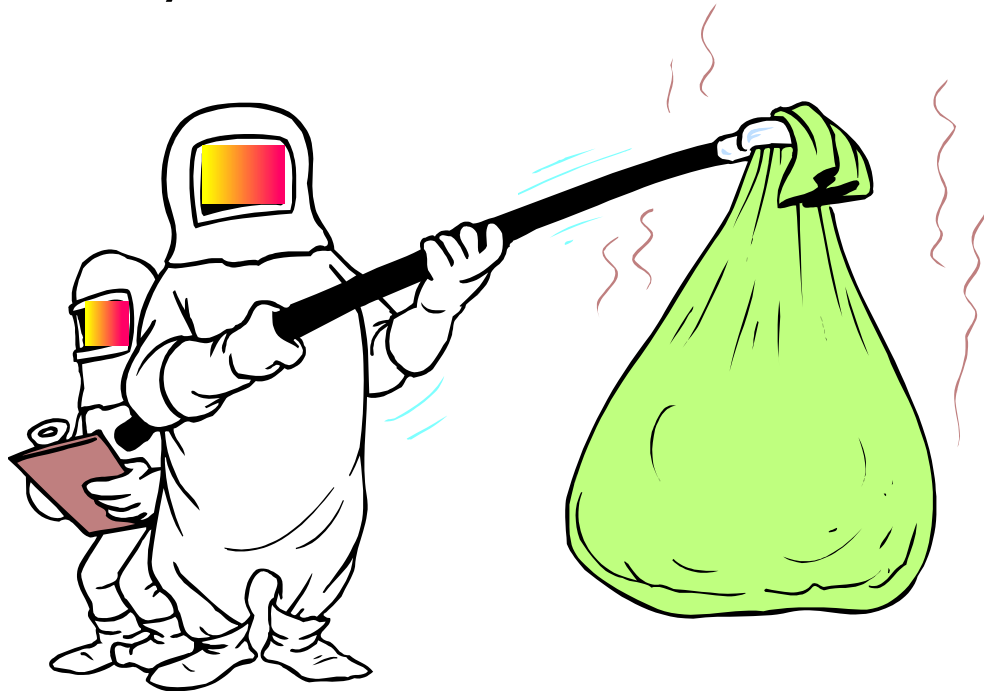 - New advances
    making this possible …

Virtual Advantages

- Lifecycle
    - Create snapshots of environments prior to modification
    - Child snapshots can be built from parents
    - Rollback by choosing a snapshot
    - Once validated, snapshots can be re-assembled into one image

Virtual Advantages

- Business Continuity
  - High Availability
 - Disaster Recovery

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A Virtual Primer

- Virtualization

- Separating a resource like CPU, memory, disk, and network from its physical form

- The resulting resources form a infrastructure that can power one or more virtual machines (VMs)

A Virtual Primer

- Hosted Solution
  - Virtual server software runs as an application
  - Guest operating system runs within this application as a virtual machine
  - A host operating system is **required!**
  - Examples:
    - VMware GSX Server
    - Parallels Desktop
   - MS Virtual Server 2005 R2

Application

Guest Operating System

Virtualization Layer

Host Operating System
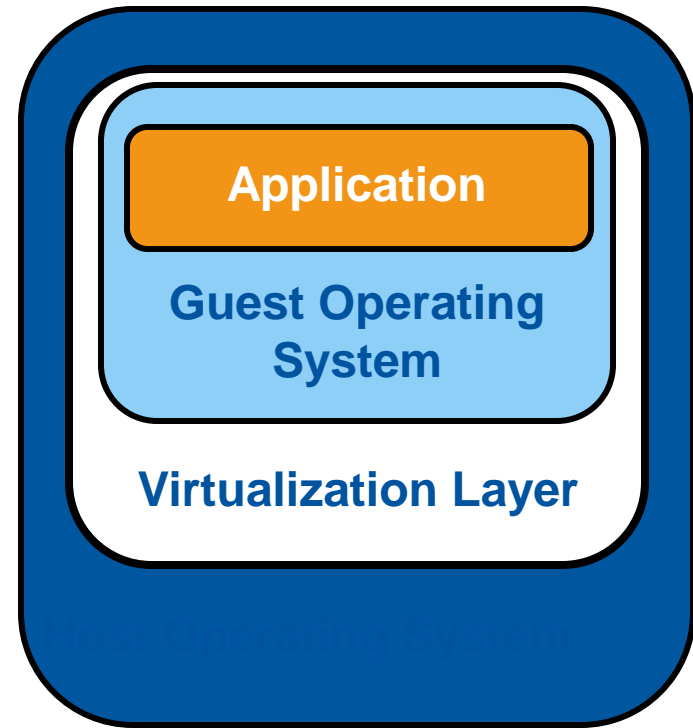
Physical Server

A Virtual Primer

- Hypervisor Solution
  - Also called "bare metal" install
  - **No** host operating system required
  - Hypervisor = thin layer installed on clean server
  - Really a custom kernel
  - Has access to all hardware resources
 - Examples:
    - VMware ESX

Application

Guest Operating System

Hypervisor
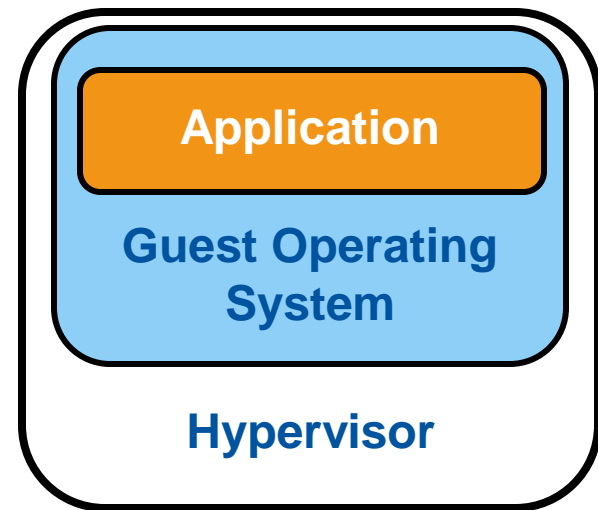
Physical Server

A Virtual Primer

- Paravirtualization
  - $ Ten dollar word $
  - Operating system knows that it runs in a virtual environment
  - Modified to take advantage of this fact
  - Performance improvements traded for custom coding
  - Examples:
    - Xen
    - Windows Server 2008

Application

Guest Operating System

Hypervisor

Physical Server
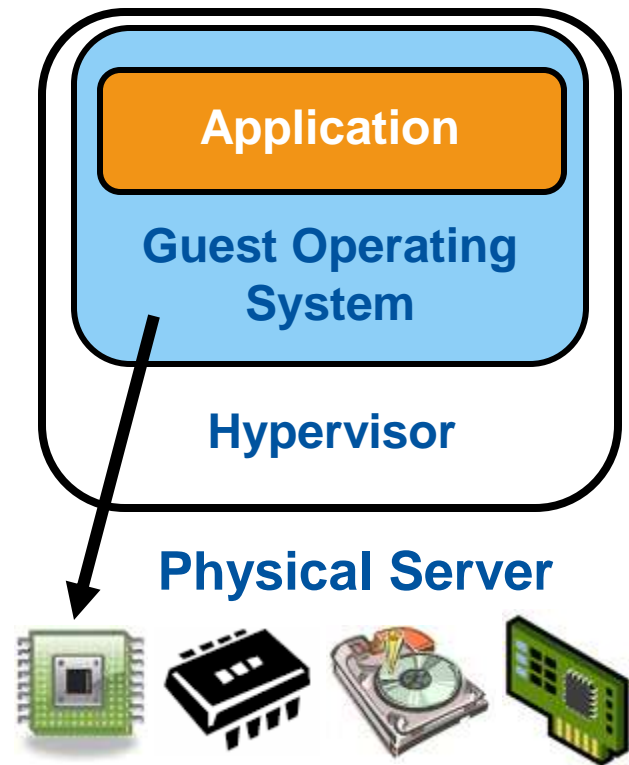
A Virtual Primer

- Hardware Virtualization
  - Virtualization at the processor/chip level
  - Intel and AMD producing chips that allow direct access to platform resources
  - In the past, this included virtual CPU
  - Newer advances allow hardware-assisted memory and I/O
  - Hardware assist is the game changer!
  - We'll see how much in a few slides …

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The Cost of Going Virtual

VMware (ESX Server) –Statement of Support

SAP

Statement of Support updated April 21st, 2009

The Cost of Going Virtual

" Many of our clients are running applications and operating systems under VMware. Business Objects also makes extensive use of VMware** within the Business Objects development, IT and support organizations to create various Windows and Linux environments. **Business Objects is not aware of ANY specific issues with Business Objects software products* and VMware at this time.**"

\- Your Statement of Support

The Cost of Going Virtual

Really?

SAP 1284713 - "The property SI_GUID of info object with ID number x is not unique" message on a VMWare Linux server with multiple virtual CPUs

Version 5   Validity: 06/07/2010 - active   Language English

Cause

This is a Linux timekeeping issue that only occurs in a VMWare environment with multiple virtual CPUs.

The virtual CPUs occasionally fall out of synch, and time-sensitive applications such as the CMS are affected.

Resolution

For Business Objects Enterprise XI 3.1, a code change will be introduced to the CMS which will insulate it from the Linux timekeeping issue.
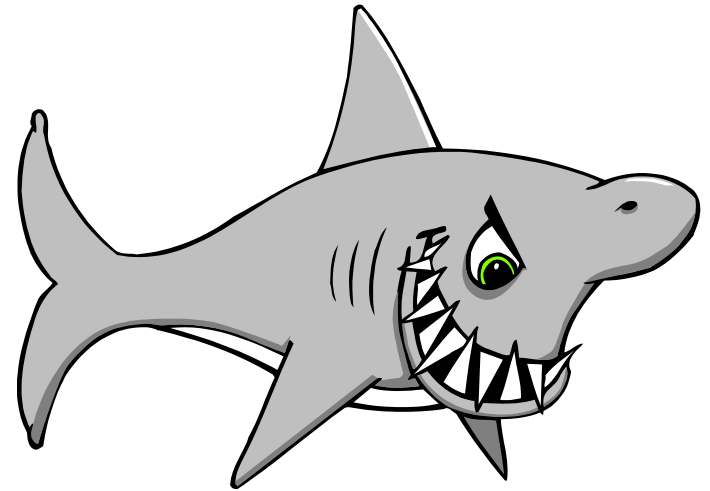
The Cost of Going Virtual

" While Business Objects products are expected to function properly in virtual environments, **there may be performance implications,** which can **invalidate Business Objects' typical sizing and recommended setting guidelines** … **can have significant impact on performance and scalability, particularly under peak load**. "

- Your Statement of Support

The Cost of Going Virtual

- Virtualization comes at a cost …
- System resources will be affected
  - CPU
  - Memory
  - Input/Output (I/O)
  - Network
- Supporting virtualization will require some amount of each
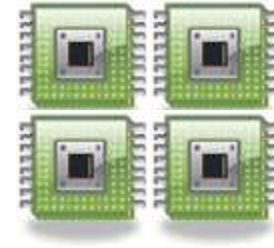- How much?
- Let's see!

# The Cost of Going Virtual

- CPU
    - Cost could be 10 – 15% of running natively
    - A virtual CPU is known as a **VCPU**
    - Depends on workload – CPU intensive applications suffer more
    - What qualifies as CPU-intensive?
    - 80 - 90% or better continuous activity

The Cost of Going Virtual

- SMP (Symmetric Multi-Processing)
  - Most virtual solutions support virtual machines with multiple virtual CPUs
    - VMWare supports up to 8 VCPUs
  - Each virtual CPU maps to a portion of overall processing power
    - Could be a processing core
    - Could create more VCPUs than cores
    - This is a common practice called **Over-Commitment**
  - Virtual machines with multiple VCPUs require more resources than a single VCPU
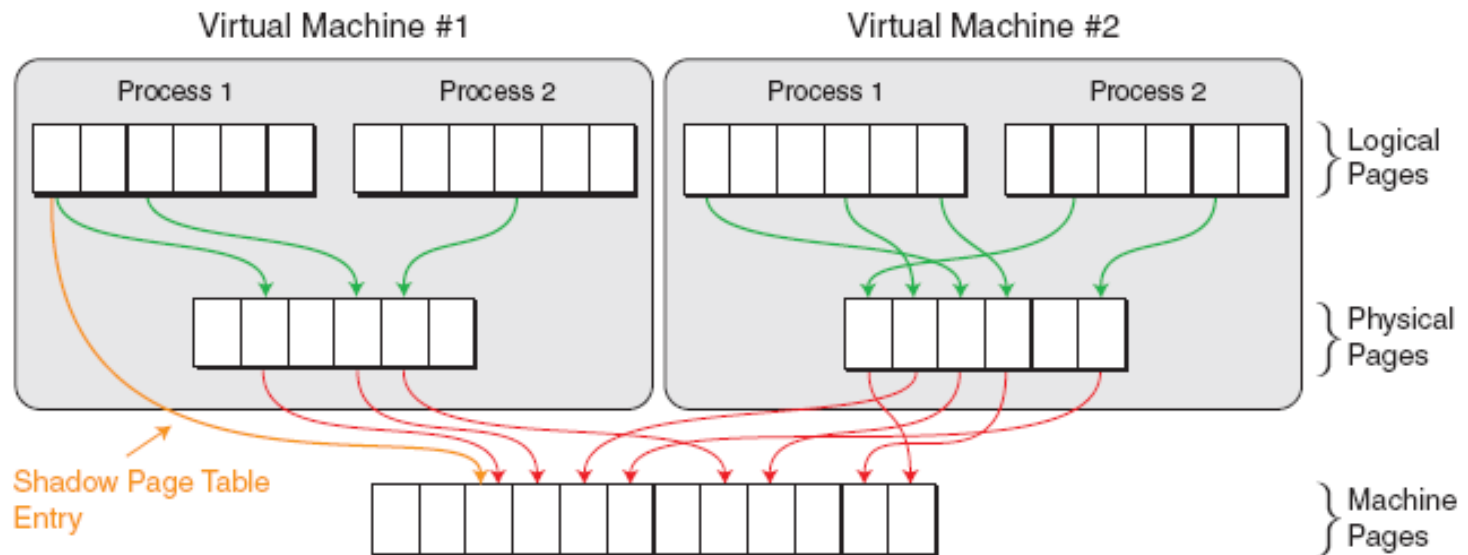
The Cost of Going Virtual
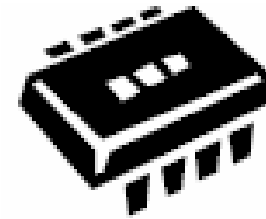
- Memory
  - Each hypervisor / visualization layer requires takes some memory to run
    - Amount depends on number of CPUs and memory allocated
    - Example: 2GB 1 CPU VM = 137 MB

                4GB 2 CPU VM = 242 MB
  - Each virtual machine running over that layer also requires memory
    - 4 GB per VM for Business Objects is not uncommon
  - Many virtual machines with 1 CPU running in parallel may require more memory than a multi-CPU virtual machine
  - 64-bit operating system dramatically increases the max memory per virtual machine
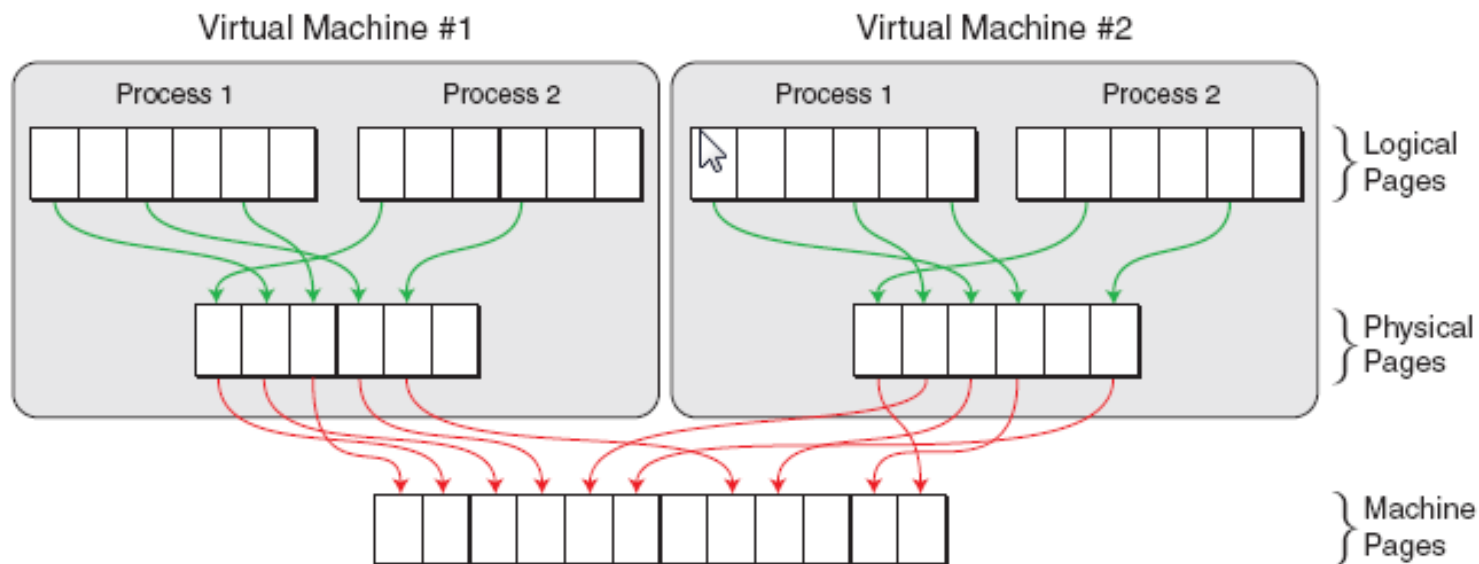
The Cost of Going Virtual

- Old: Keeping track of your memories
  - Old solution forced virtual software to keep up with memory
  - Shadow pages ties physical memory to a virtual machine
 - One shadow per page of memory used

The Cost of Going Virtual

- Hardware Assist for Memory
  - Newer processing chips can manage this task
  - No more middleman!

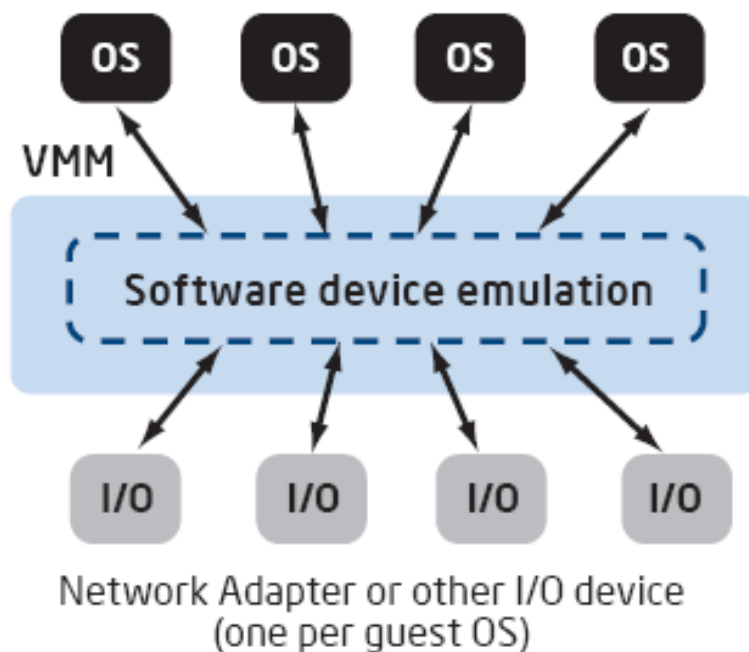# The Cost of Going Virtual

- Input/Output
    - The hardest resource of all to virtualize
    - The guest driver talks to a virtual device
    - The I/O stack translates guest storage requests to physical addresses
    - The physical driver passes these translated requests to real storage devices
    - Sound complicated?

Guest OS

Guest Device Driver

Virtual Device

I/O Stack

Physical Device Driver
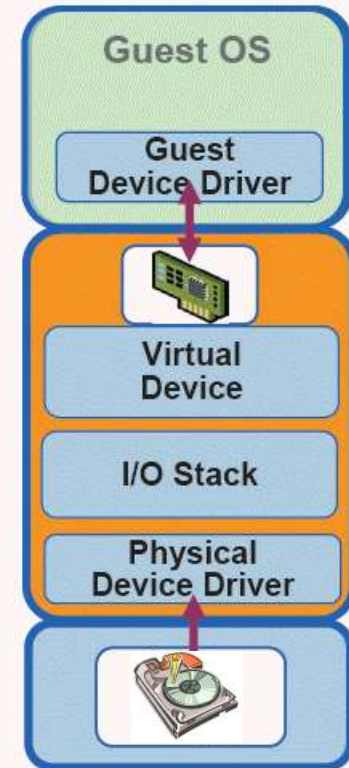
The Cost of Going Virtual

- Old: The Virtual Bottleneck
  - Previously, all input or output was managed by the Virtual Machine Monitor (VMM)

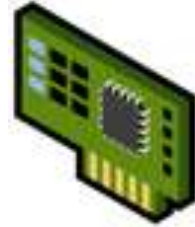Network Adapter or other I/O device
(one per guest OS)

A Virtual Primer

- New: Hardware Assist for I/O
  - Today, devices can be directly assigned to a guest operating system (OS)
  - Result – VM and device communicate directly!

Network Adapter or other I/O device
(one per guest OS)
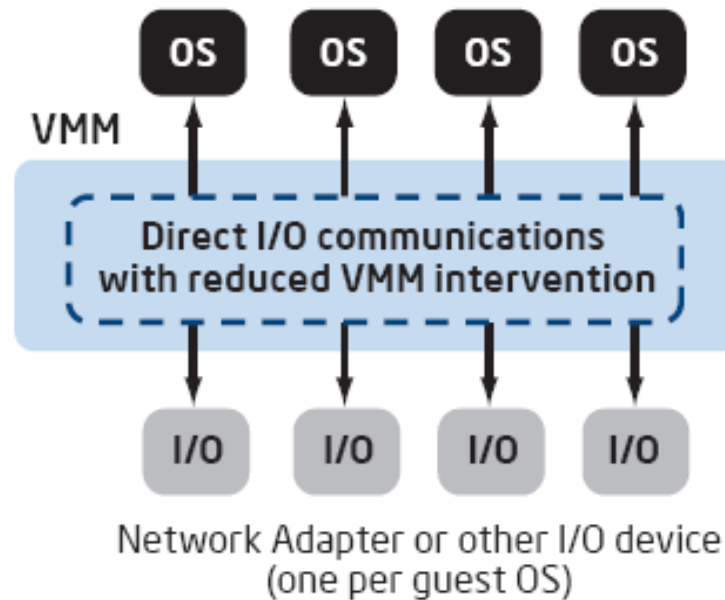
The Cost of Going Virtual

- Network
    - Past VMWare hypervisors used a single core to process all network traffic
    - That was fine for NIC speeds up to 1GB, but could not handle 10GB
    - Ideally, network traffic should pass through to the appropriate virtual machine

The Cost of Going Virtual

- Old: The Virtual Postmaster General
  - Previously, a network card was shared by multiple virtual machines
  - The Virtual Machine Monitor (VMM) had to route incoming data to the right virtual machine
  - This sorting/routing was performed by software and was expensive

The Cost of Going Virtual

- New: Hardware Assist for Network Adapters
  - Now, queues can be created in the network card itself
  - Information coming through the adapter for a particular VM is sorted and grouped together by the card
  - This allows a network card to service multiple VMs much more efficiently

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Other Considerations

- Virtual Machine Sprawl
  - Many virtual machines may depend on the same set of resources
  - What if one machine demands more?
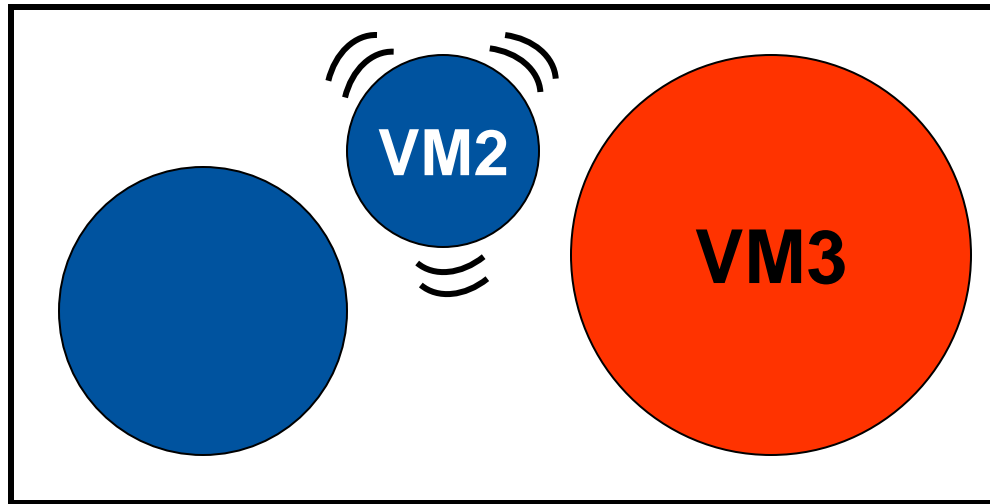
Other Considerations

- Old: Certain utilities helped, but at a cost …
  - VMware's VMotion can relocate VMs based on activity
  - Cost: Twice the memory temporarily,increased,
    I/O to create second image
  - Equivalent of a "hot backup"

Other Considerations

- New: Not that much different
    - Hardware advances have made live migration easier
    - Still not the optimal solution
    - Better: Dynamically allocate resources with VM in place
    - Not ready for prime time …

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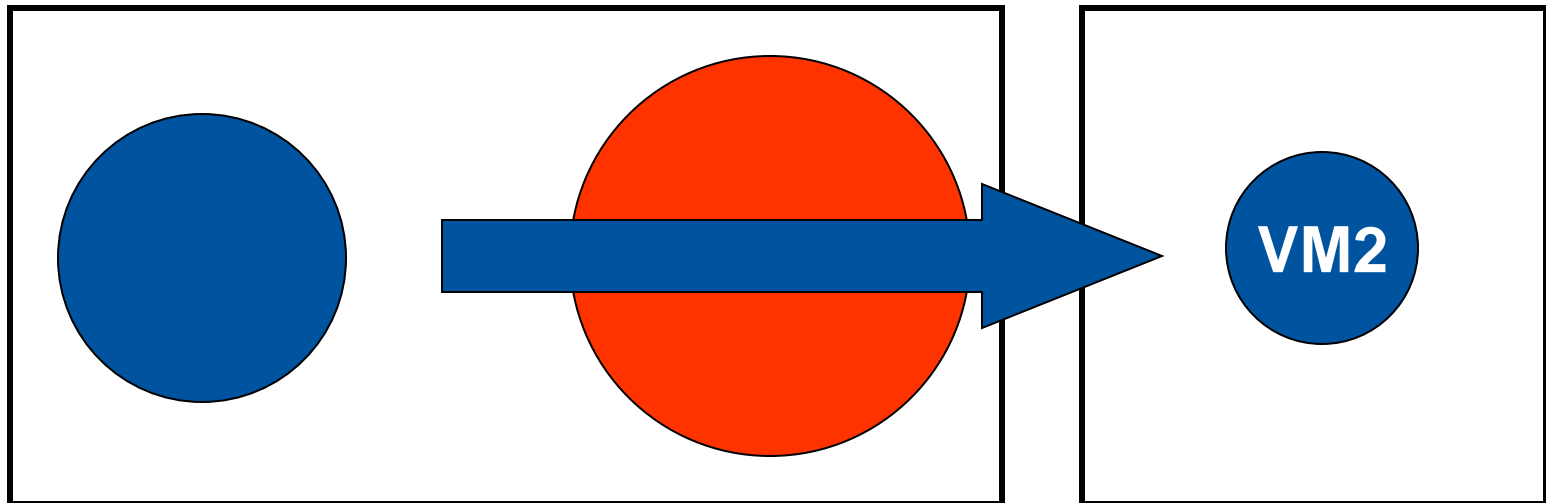- Case Study
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Case Study

Case Study - Virtualization Drivers

- Limited Data Center Resources
  - Power Available - - Limited
  - VMware Testing/POC Phase
  - Teradata & Oracle Database Server needs growing
  - Ab Initio environment growth
  - Southwest.com Expansion Project
  - Older hardware retiring
  - Out of maintenance hardware
  - Power hungry systems
  - Server Refresh Project
  - Continuous expansion – 600 Physical Servers + & growing

Case Study - Virtualization the SWA Way

- Original Virtual Environment
  - VMware Testing/POC Phase I
    - VMware ESX 3.5
    - HP DL580 G5s
    - Four Quad-core Itanium
    - Local Storage - Initially
    - No VMotion – Initially
  - VMware Testing/POC Phase II
    - VMware ESX 4.0
    - VMotion PDC
  - VMware Testing/POC Phase III
    - VMware ESXi 4 Update 2.0 – soon to be 4.1
    - Two Loaner Dell PowerEdge M605 Blade Server
    - VMotion PDC & SDC

Case Study - Virtualization the SWA Way

- VMware Live In Production Now
  - VMware ESXi 4 Update 2.0 – soon to be 4.1
  - Dell PowerEdge M605 Blade Server
  - Dual Quad-core AMD 2372 Opteron HE 2.1 GHz
  - 64 GB per Blade
  - 4 GigE NICs per blade
  - 2 Cisco 3130X switches per blade enclosure
  - Core Router connections via 10 GigE NICs
  - NetApp FAS6040 NAS Filer
  - Prod Data Center Now - ~200 Physical Servers

  - Number of Host:
    - 8 in DEV
    - 8 in QA
    - 8 in SDC
    - 6 in PDC – soon to be 8
  - VMs per Host:
    - 13 in DEV
    - 10 in QA
    - 2 in SDC
    - 8 in PDC
  - No Hardware Accelerators – Yet – none needed
  - VMotion in Place inside each Data Center (DC) and between

Case Study - Production Success - BODS

- SAP Enterprise Resource Planning (ERP) Rollout
  - Data storage Requirements for ERP Reporting
    - New Data Warehouse ??
      - $$$$$$$$$$
      - Two Data Warehouses = two truths ??
    - New ETL (Extract, Transform, Load) Platform ??
      - Related to existing supported internal BI platform
      - Two ETL Platforms
        - Easy to use & control usage
        - Lower Cost
        - $$$$$$$$$$$
      - Oracle Rapid Marts required

Case Study - Production Success - BODS

- BusinessObjects Data Services (BODS)
  - First Production Virtual Environment at Southwest
  - SAP ERP Environment pulls from over 300 sources at Southwest
  - Highly tuned Hosted SAP ERP Environment
  - Four BODS Virtual Server
    - Initial Load
      - One Virtual Server in DEV
      - ~70 Million Records processed
      - Under 7 hours
      - Loads data to Oracle Rapid Marts
    - Rapid Marts handle all financials, employee information, & several new features for the upcoming Management Self Service

Case Study - Production Success - BODS

- BODS: New Virtual Platform
  - Three Development BODS Virtual Server
  - Three Quality Assurance (QA) BODS Virtual Server
  - Four Production BODS Virtual Server
    - Dual Processor
    - 4 Gigabits of RAM
    - Windows 2003 Server – 32 Bit OS
    - One Gigabit Ethernet connection internal
    - One Gigabit Ethernet NLB

Case Study - Production Success - BODS

- Production Today
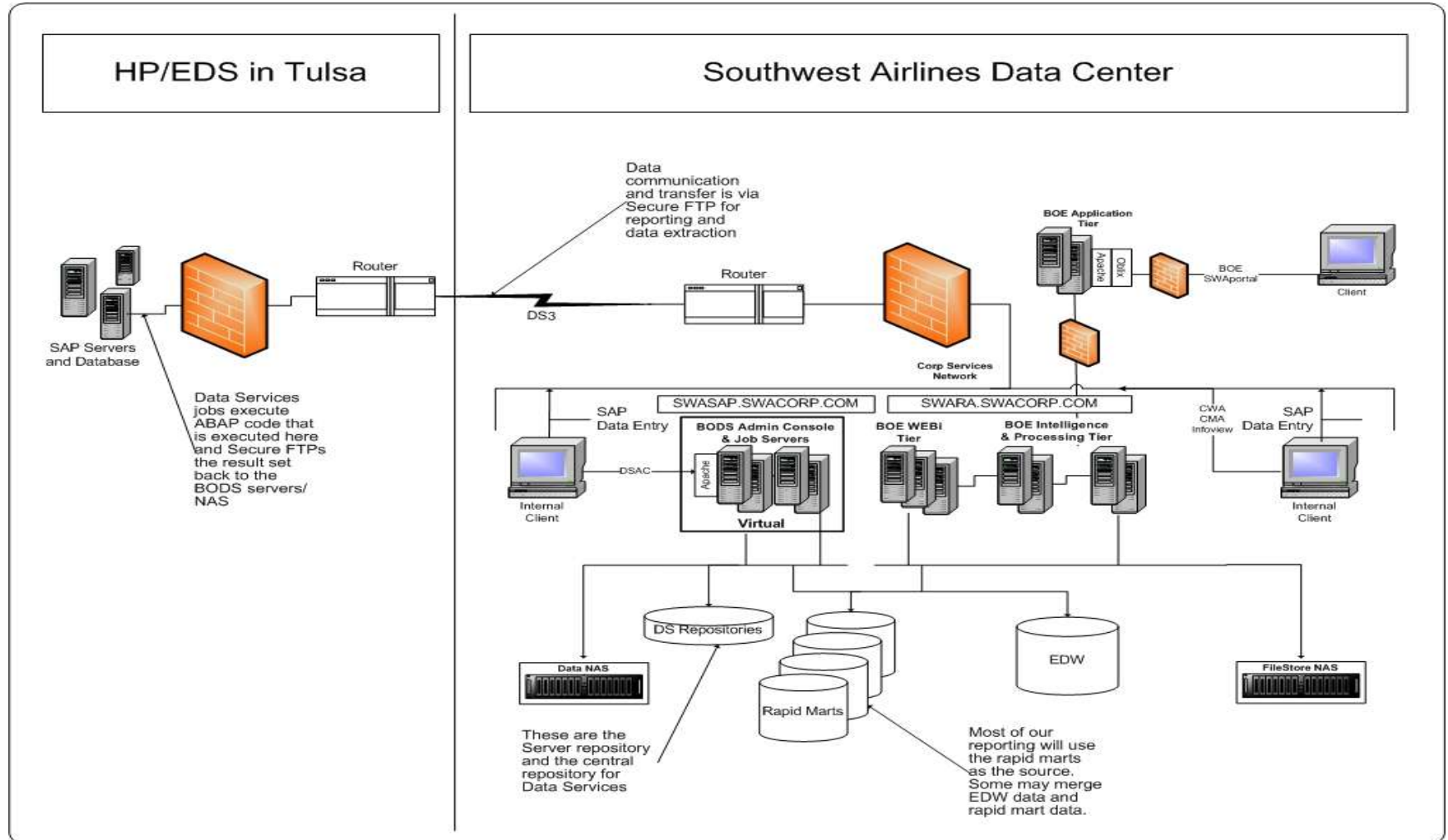
Case Study – BOE, Now & On the Horizon

- Since Last We Met (ASUG 2008)
  - Business Objects Enterprise XI R3.1)(BOE XI R3.1) Development Environment
    - Rolled out two virtual servers - April 2009
    - Over 300 Developers access and utilize 5+ days a week
  - BOE XI R3.1 QA Environment
    - Started out fully physical – 'like' Production (scaled back version)
    - Added two virtual web front ends – June 2009
      - Closer Production emulation
      - For troubleshooting Web Sphere Portlet issues
      - Testing IIS to Apache conversion
      - Future virtualization of Production

Case Study – Now & On the Horizon

- BOE XI R3.1 Current Configuration
  - Nine Physical Servers
    - 4 DL 580 G4s – Dual Hyper-threaded CPUs – Application & Intelligence Tiers
    - 2 DL 580 G5s – Dual Dual-core CPUs – Crystal Processing Tier
    - 3 DL 580 G5s – Dual Quad-core CPUs – WEBi Tier
      - 18 CPUs
      - 44 Cores
      - 35 Gigs RAM
  - Plus a Single Standalone R2 Environment Physical Server

Case Study – Now & On the Horizon

- BOE XI R3.1 Future Configuration
  - Standalone Virtual R2 Environment for SharePoint 2003
  - Six Virtual Servers
    - 6 VMs with 2 CPUs and 4 Gigs of Ram each
      - 2 for Application Tier
      - 2 for Intelligence Tier
      - 2 for Crystal Processing Tier
      - 12 Allocated CPUs
      - 24 Gigs RAM
  - Three Physical Servers
    - 3 DL 580 G5s – Dual Quad-core CPUs
      - 6 CPUs
      - 24 Cores
      - 24 Gigs RAM

Case Study – BOE, Now & On the Horizon

- Production 2011
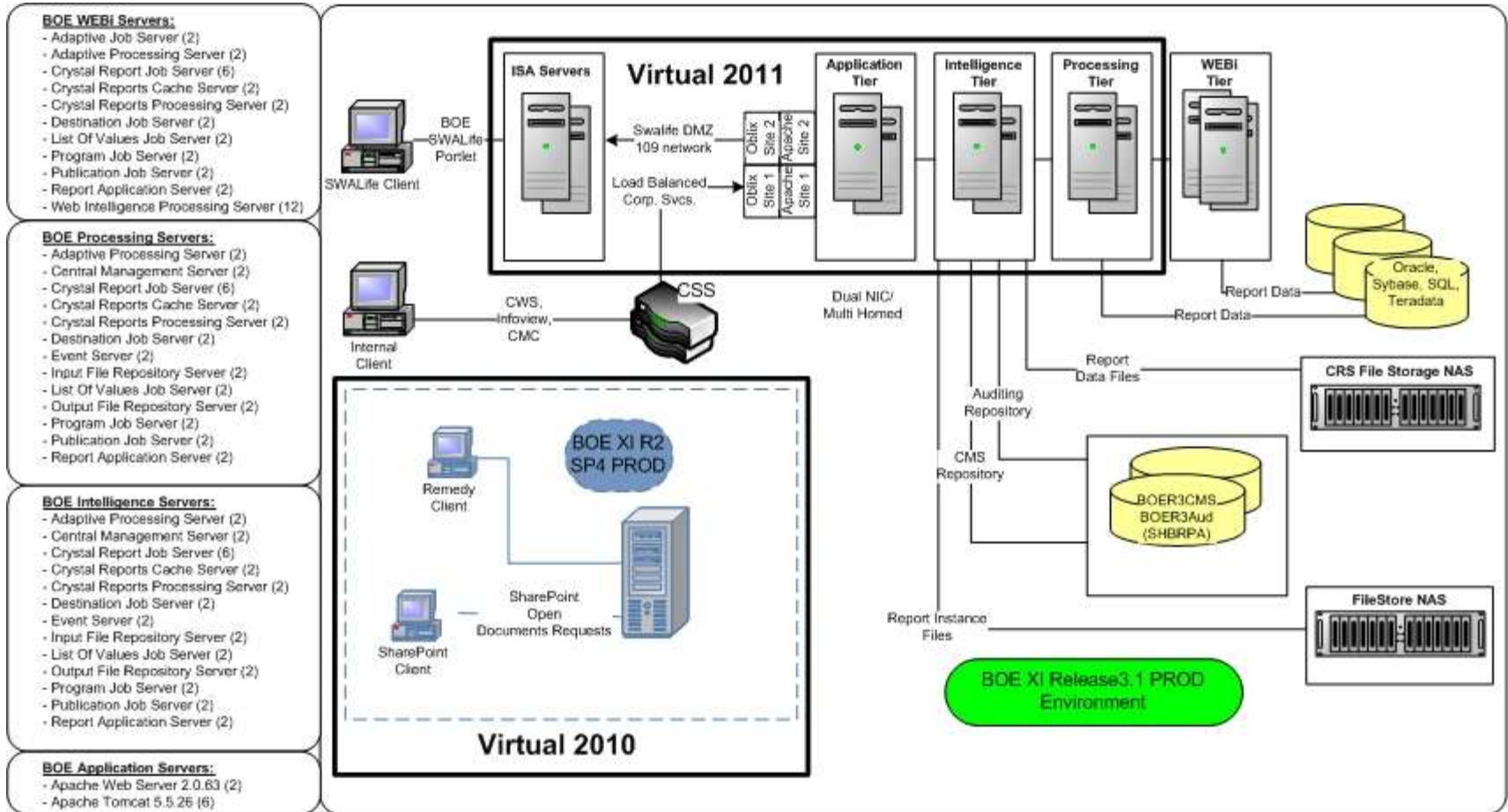
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Conclusion

- Virtualizing is a WHEN, not IF proposition
- Know the real-world benefits to virtualizing
- Balance those against the real costs
- Stress-test a virtualized solution before releasing
- In this way, you may reach harmony with your virtualized self.

Questions?

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Thank you for participating.

Please remember to complete and return your evaluation form following this session.

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