

The logo for vmworld 2011 features the text "vmworld 2011" in a small, white, sans-serif font at the top. Below it, the words "Own It." are written in a large, white, bold, sans-serif font, with "Own" on the top line and "It." on the bottom line. To the right of "Own It.", the words "Your Cloud." are written in a large, white, sans-serif font, with "Your" on the top line and "Cloud." on the bottom line. The entire logo is set against a dark blue circular background. The background of the slide is a colorful, abstract, watercolor-like pattern in shades of blue, green, and purple.

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BCA1709

Successfully Running Active Directory in a Virtualized Environment

**Chris Skinner, Senior Program Manager, VMware Worldwide
Education, VMware, Inc.**

Disclaimer

- **This session may contain product features that are currently under development.**
- **This session/overview of the new technology represents no commitment from VMware to deliver these features in any generally available product.**
- **Features are subject to change, and must not be included in contracts, purchase orders, or sales agreements of any kind.**
- **Technical feasibility and market demand will affect final delivery.**
- **Pricing and packaging for any new technologies or features discussed or presented have not been determined.**

Objectives and Goals

- You can virtualize Active Directory successfully
- It's not difficult, mystical or magical
- Many companies have successfully deployed AD through virtualization

Agenda

- Why virtualize Active Directory on vSphere?
- What are the challenges virtualizing Active Directory?
- How to successfully migrate?



Why Virtualize Active Directory?

Why Virtualize Active Directory on vSphere?

Support

Microsoft SVVP Support and Licensing

Performance

Active Directory Performs extremely well in vSphere

- vSphere can drive 500,000+ IOPS
 - 32 vCPU support and 1 TB memory per virtual machine
-

Cost

Reduce infrastructure costs

- Combine Active Directory servers with other server roles
 - Eliminate need for additional dedicated servers
 - Standardize domain controller images
-

Management

Dynamic Management

- Streamline testing & troubleshooting with snapshots and clones
- Provision servers in minutes
- Scale dynamically and right-size infrastructure
- Achieve high availability without complexity of clustering

Microsoft Server Virtualization Validation Program (SVVP)

Welcome to the Windows Server Virtualization Validation Program

To improve customers' support experiences when running Windows Server on virtualization technologies other than Hyper-V™ and Virtual Server, Microsoft has launched the Server Virtualization Validation Program (SVVP).

<http://www.windowsservercatalog.com/svvp.aspx>

Licensing Allows VMotion

- > Reassign licenses between servers as frequently as needed
- > Covers many server apps including:
 - > Active Directory
 - > Exchange 2007/2010
 - > SQL Server 2000/2005/2008
 - > SharePoint Server 2010
 - > Dynamics CRM 4.0

Support for Applications

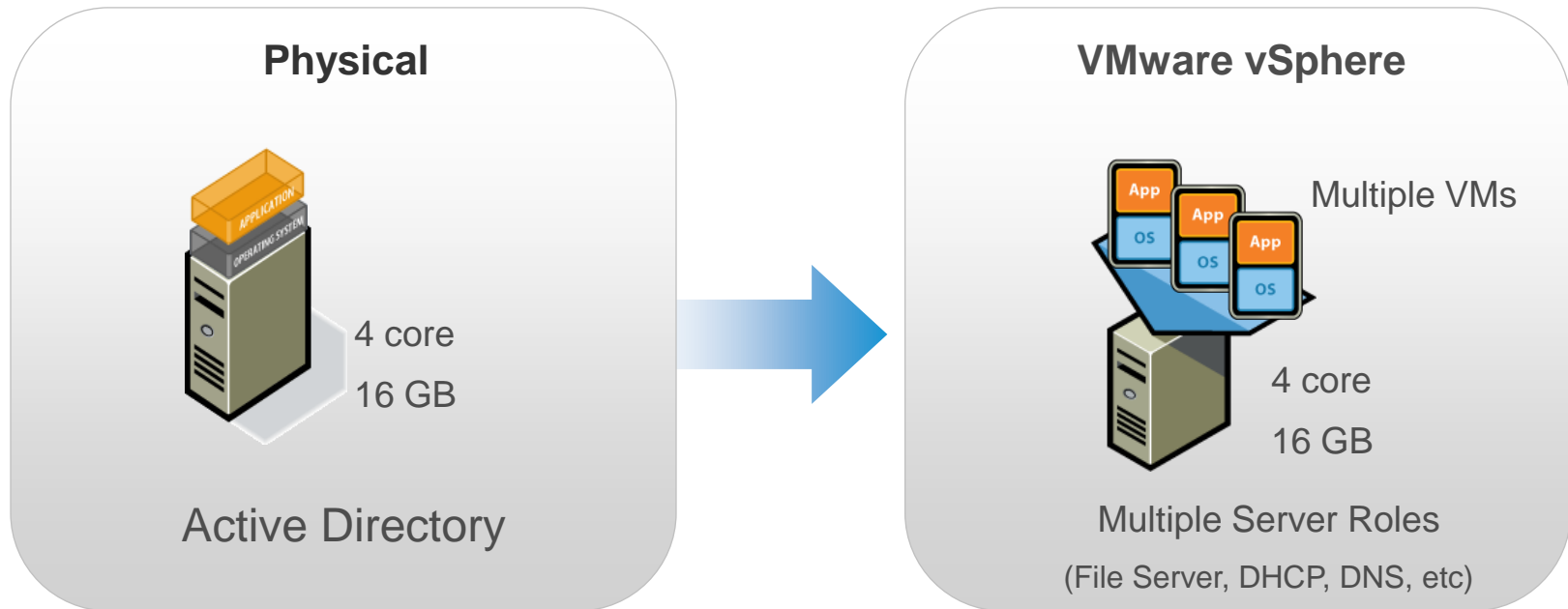
- > Microsoft SVVP Program to validate virtualization products
- > Technical support for Windows and apps on SVVP validated software:
 - > Active Directory
 - > Exchange 2007/2010
 - > SQL Server 2000/2005/2008
 - > SharePoint Server 2010
 - > Dynamics CRM 4.0

VMware Validated in SVVP

- > 9/3/09 announcement
- > VMware Products include:
 - > ESX/ESXi 3.5 Update 3-5
 - > ESX/ESXi 4.0 thru Update 2
 - > ESX/ESXi 4.1 thru Update 2

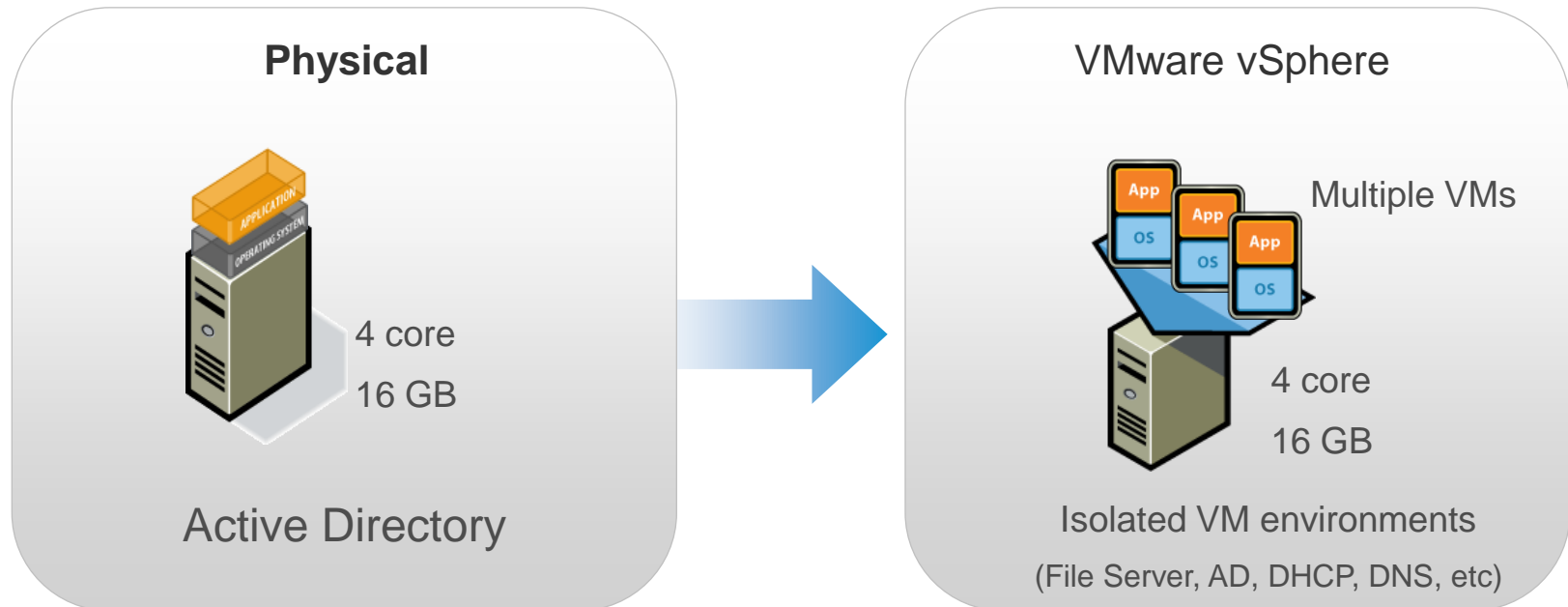
Cost - Hardware Consolidation

- Standardization – Eliminate imaging problems and reduce activation issues
- Repurpose multiple single-use server hardware
- Combine multiple physical server roles into separate VMs
- Great for creating Remote/Branch office servers (provides local authentication)

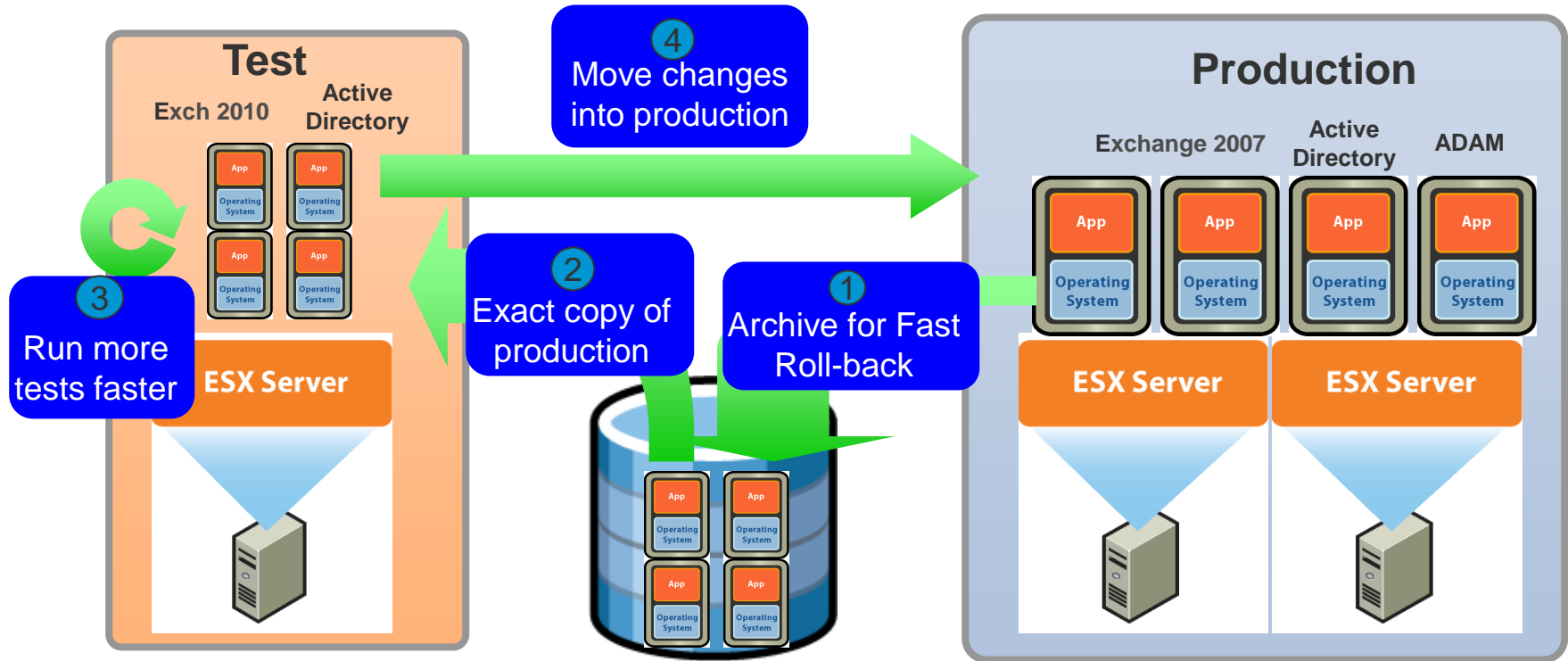


Greater Security Control

- vCenter Role-Based access provides even more granular permissions than VI3
- Address Space Layout Randomization (ASLR) in vSphere reduces attack surface and eliminates security breaches
- Isolated VM environments
- Better change control management



Improve Testing Efficiency with Snapshots and Clones



- > Faster testing of Schema changes without affecting production
- > More accurate testing on exact production copies
- > Lower cost testing infrastructure

Agenda

- Why virtualize Active Directory on vSphere?
- What are the challenges virtualizing Active Directory?
- How to successfully migrate?

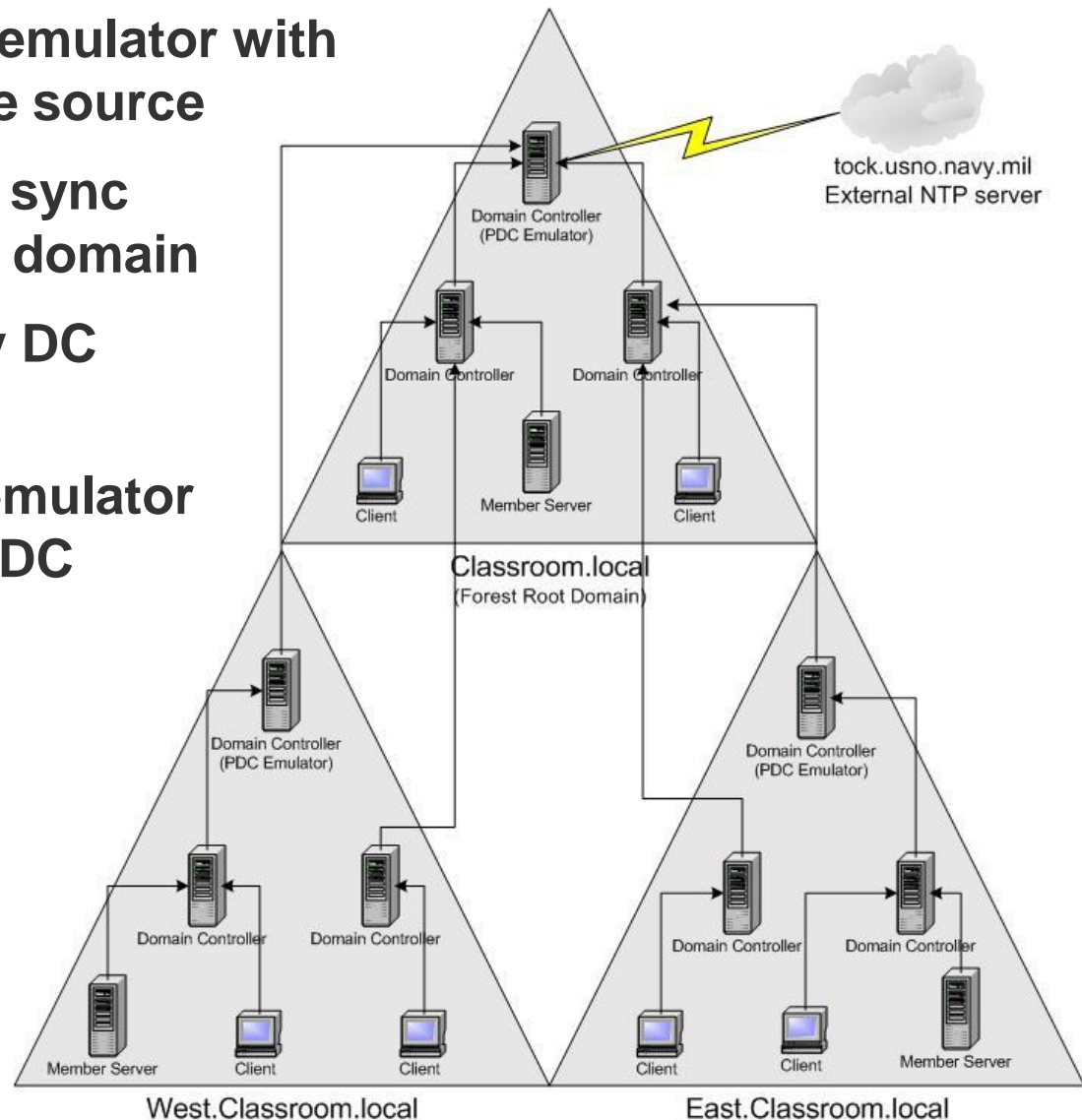
What are the challenges virtualizing Active Directory?

- **Time Synchronization**
- **Performance**
- **Replication**
- **Availability**
- **Disaster Recovery**

Time Synchronization

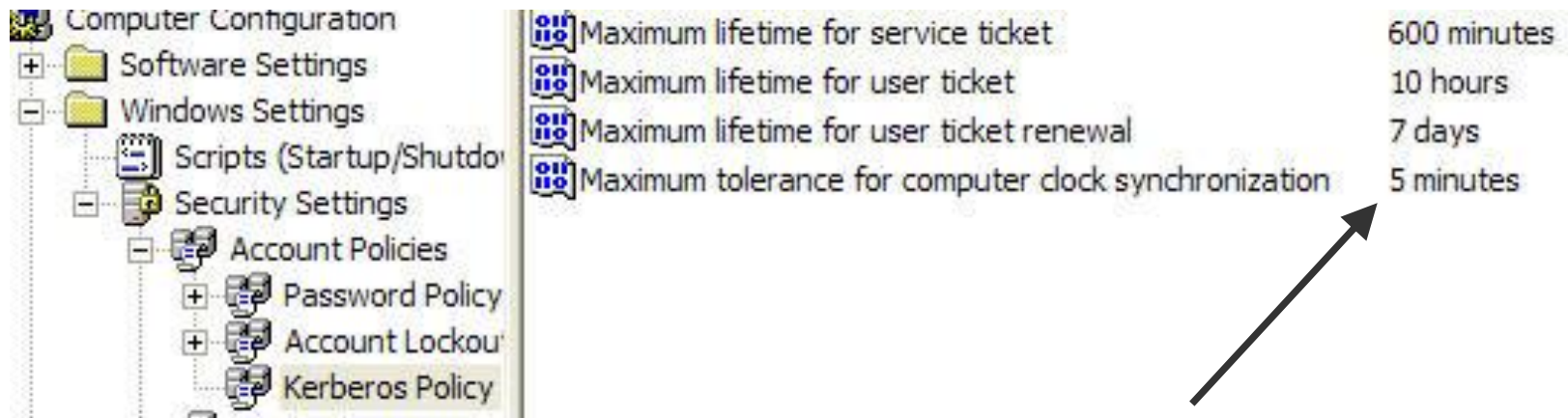
Windows Server Time Server Hierarchies

- Synchronize Forest PDC emulator with an external stratum 1 time source
- Child PDC emulators can sync with any DC in the parent domain
- Clients can sync with any DC in its own domain
- DCs can sync with PDC emulator in its own domain or any DC in parent



Why is time synchronization so important?

- Active Directory implements Kerberos for authentication
- MS Kerberos implementation allows for a 5 minute tolerance
- Active Directory operations are critically time dependent
 - Password changes
 - Terminated user accounts
 - Urgent replication (group membership change, account additions and modifications, group policy changes)
- File Replication Services (FRS) synchronizes scripts, database changes/updates, policies based, in part, on time-stamping



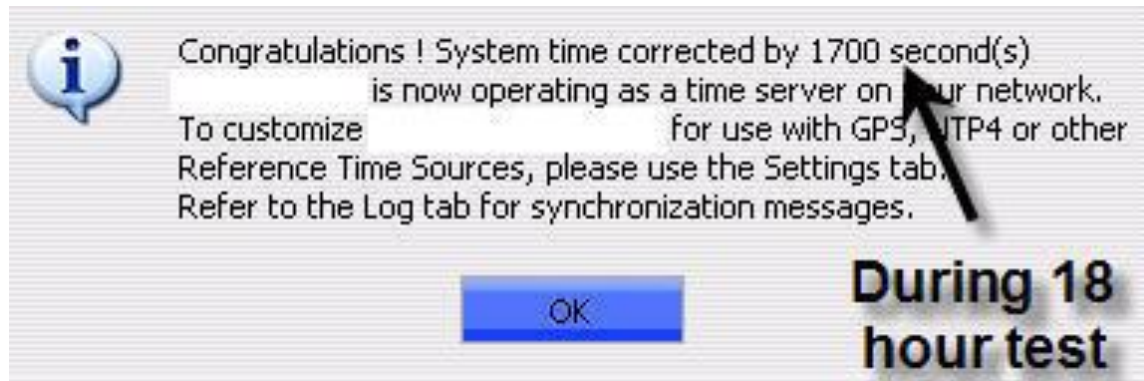
The image shows a screenshot of the Windows Security Settings console. On the left, the tree view is expanded to 'Security Settings' > 'Kerberos Policy'. On the right, a list of four Kerberos policy settings is displayed with their respective values:

Maximum lifetime for service ticket	600 minutes
Maximum lifetime for user ticket	10 hours
Maximum lifetime for user ticket renewal	7 days
Maximum tolerance for computer clock synchronization	5 minutes

An arrow points from the bottom right towards the 'Maximum tolerance for computer clock synchronization' setting.

Virtualization Issues with Clock Synchronization

- If no CPU cycles are needed – none will be given to virtual machine
- Clock drift can be significant in a relatively short period
- Idle cycles in a virtual machine can and will be detrimental to Active Directory
- How can you ensure that your Active Directory does not experience time synchronization issues?



**More than a 28
minute drift!**

Group Policy using WMI filtering to detect PDC Emulator

■ Define group policy object using Windows Time settings

- Modify global Windows Time Settings in:

```
Computer configuration\Windows Settings\Administrative  
Templates\Windows Time Service
```

- Create policy under Domain Controllers container

■ Create a WMI filter to detect the PDC emulator

- Group Policy Management Console (GPMC)

- Select “New WMI Filter”

- Choose a name for the filter

- Add namespace root\CIMv2

- Add query (Select * from Win32_ComputerSystem where DomainRole = 5)

- Roles are 0 = standalone, 1 = Member workstation, 2 = Standalone Server, 3 = Member Server, 4 = Backup domain controller, 5 = Primary domain controller

- Link your created WMI filter to your configured group policy object (GPO)

- Will only apply to Domain controller holding the PDC emulator FSMO role

- Will automatically move to wherever the PDC emulator role resides

Option A – Using the Windows Time Services

■ Use Windows Time Service

■ Define an external stratum time source

- Modify Registry settings on the PDC emulator for the forest root domain:

HKLM\System\CurrentControlSet\Services\W32Time\Parameters

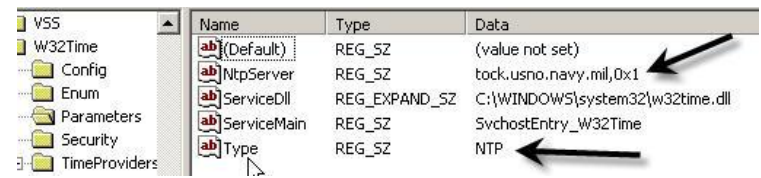
- Change **Type** value from **NT5DS** to **NTP**
- Change NtpServer value from (time.windows.com,0x1) to an external stratum 1 time source, (EX: timekeeper.isi.edu,0x1)

HKLM\System\CurrentControlSet\Services\W32Time\Config

- Change AnnounceFlags REG_DWORD from 10 to 5
- Change SpecialPollInterval to 900 decimal = every 15 minutes
- Stop and restart Time Service – net stop w32time & net start w32time
- Manually force update → w32tm /resync /rediscover



Name	Type	Data
(Default)	REG_SZ	(value not set)
AnnounceFlags	REG_DWORD	0x00000005 (5)
EventLogFlags	REG_DWORD	0x00000002 (2)

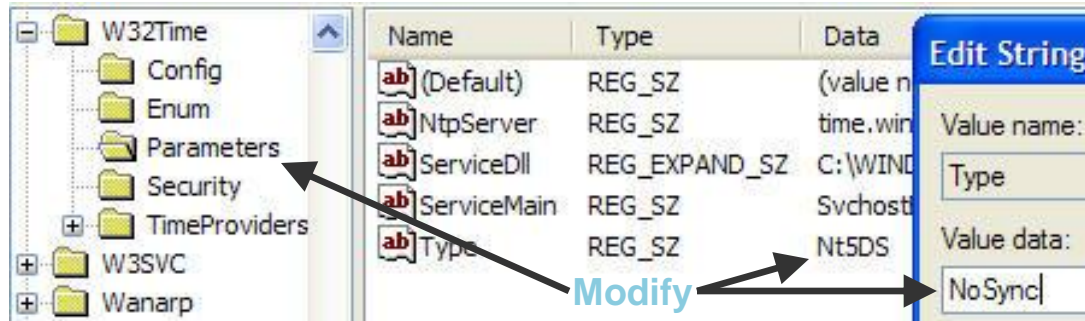


Name	Type	Data
(Default)	REG_SZ	(value not set)
NtpServer	REG_SZ	tock.usno.navy.mil,0x1
ServiceDll	REG_EXPAND_SZ	C:\WINDOWS\system32\w32time.dll
ServiceMain	REG_SZ	SvchostEntry_W32Time
Type	REG_SZ	NTP

Option B – Using VMware Tools

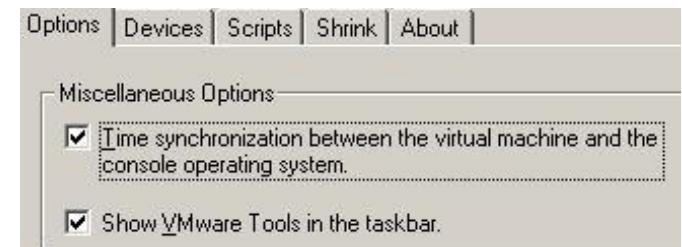
■ Modify Windows Time Service – Use VMware Tools

- Implement Domain Controllers Group Policy to modify registry:



- **Enable ESX server NTP daemon to sync with external stratum 1 NTP source**
 - VMware Knowledge Base ID# 1339
- **Use VMware Tools Time Synchronization within the virtual machine**

NOTE: VMware Tools time sync is designed to play “catch-up”, not slow down!



Time Synchronization - Summary

- Use one method or the other
- Do NOT use both!!!
- Decisions should be based on current time management infrastructure or organization's policies

Performance



Performance for Virtualized Domain Controllers

- **Virtualized AD domain controllers can run at 85-90% of native system's performance**
 - Active Directory deployments in most datacenters utilize less than 10% of today's computing power
- **Requires significantly less hardware to achieve greater number of virtualized domain controllers**
- **Greater number of domain controllers provides better logon results, less points of failure**

vSphere Performance Improvements

- **Windows Server 2008 x64 bit architecture allows you to trade I/O for memory.**
- **32 vCPU and 1 GB of RAM support for the most demanding virtual machines**
- **Enhanced networking stack can accommodate ~20Gb/s bandwidth**
- **Enhancements to vSphere storage layer ensures that the I/O subsystem is not an inhibitor to application performance (>500,000 IOPS per ESX server)**

Performance Summary

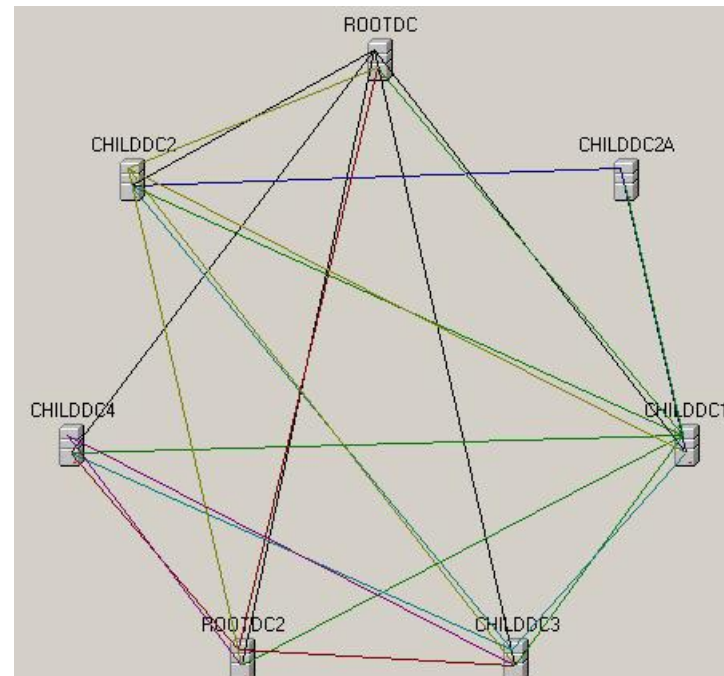
- **Virtualization does not necessarily increase performance**
- **Proper planning of resource allocation is still important**
- **Important to follow Microsoft's best practices for the strategic placement of FSMO role servers, catalog servers, etc.**

Replication



Examining Replication Topology

- Checking Replication Topology
 - All partitions should be replicated and free of replication errors
 - Use Replmon for Windows 2003
 - Use Repadmin for Windows 2008
-
- Look for replication errors

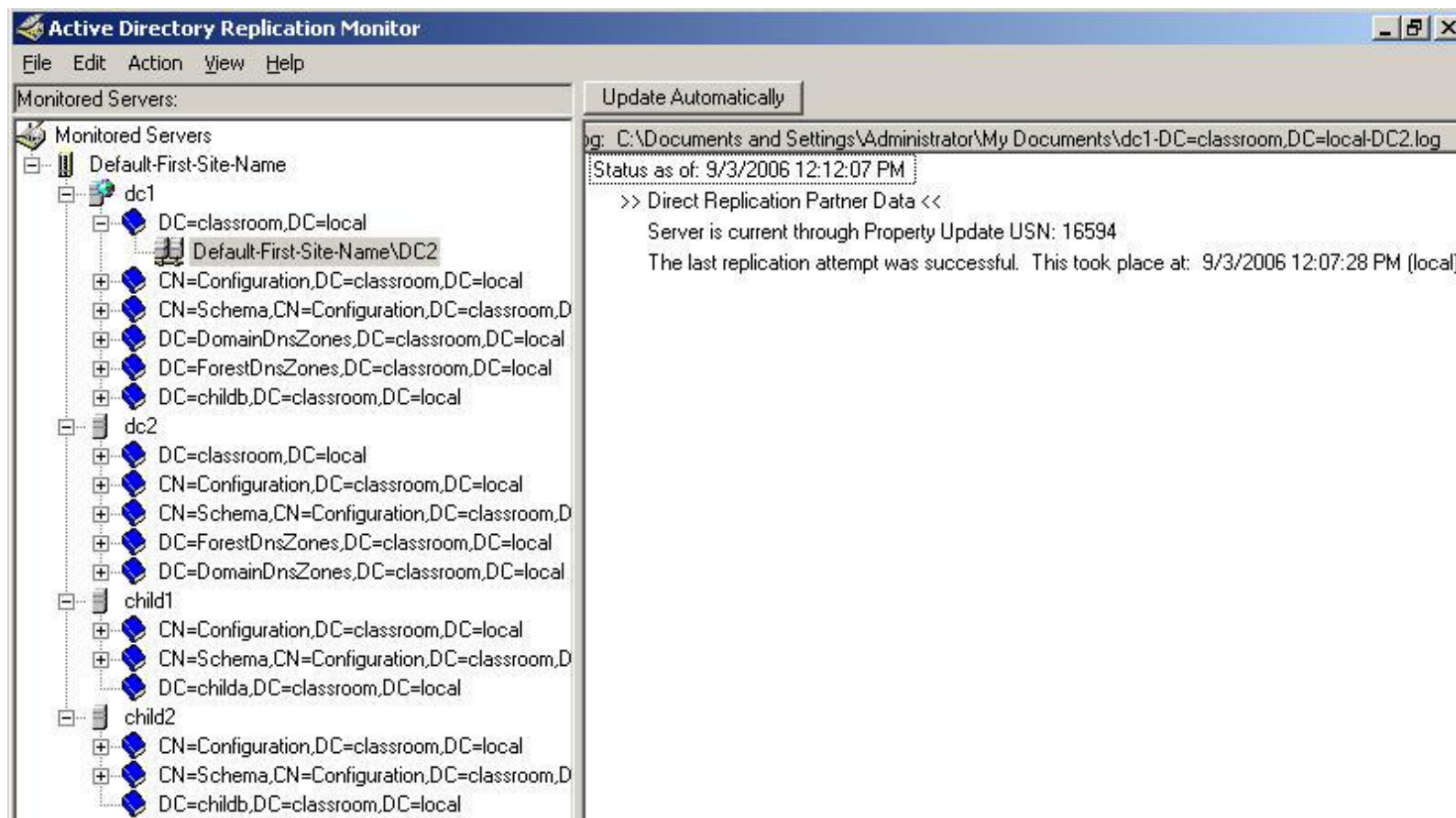


g: C:\Documents and Settings\Administrator\My Documents\dc1-CN=Schema,CN=Configuration,DC=
Status as of: 9/3/2006 12:12:07 PM

>> Direct Replication Partner Data <<
Server is current through Property Update USN: 5545
Replication Failure: Changes have not been successfully replicated from DC2 for 1 attempt(s).
Replication Failure: The reason is: There are no more endpoints available from the endpoint map
Replication Failure: The last replication attempt was: 9/3/2006 11:48:42 AM (local)

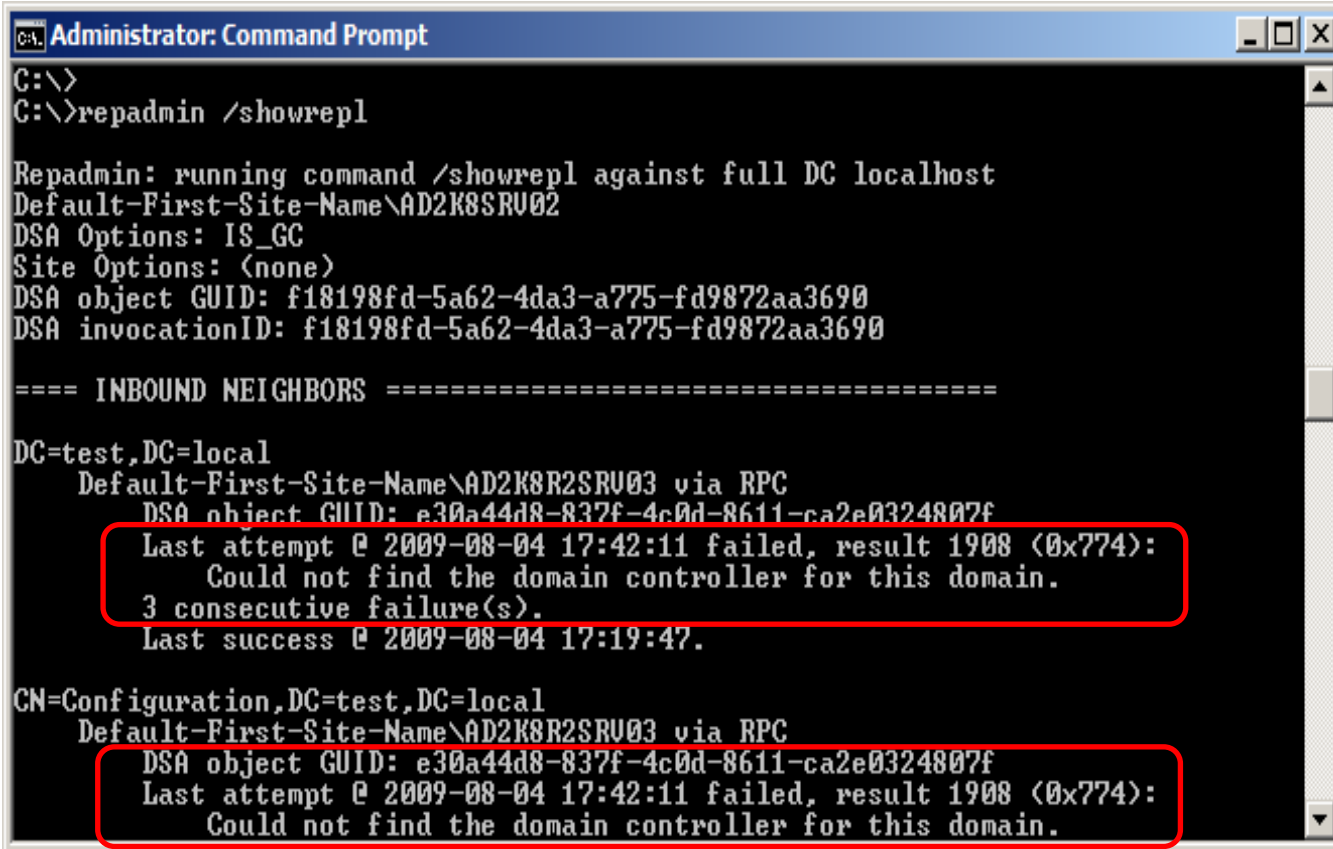
Using Replication Monitor (Replmon)

- Validating Active Directory replication inbound connections



Using Replication Admin (Repadmin)

- Validating Inbound Connections
- Replication is not occurring to other domain controllers in this forest



```
Administrator: Command Prompt
C:\>
C:\>repadmin /showrepl

Repadmin: running command /showrepl against full DC localhost
Default-First-Site-Name\AD2K8SRV02
DSA Options: IS_GC
Site Options: (none)
DSA object GUID: f18198fd-5a62-4da3-a775-fd9872aa3690
DSA invocationID: f18198fd-5a62-4da3-a775-fd9872aa3690

==== INBOUND NEIGHBORS =====

DC=test,DC=local
  Default-First-Site-Name\AD2K8R2SRV03 via RPC
    DSA object GUID: e30a44d8-837f-4c0d-8611-ca2e0324807f
    Last attempt @ 2009-08-04 17:42:11 failed, result 1908 (0x774):
      Could not find the domain controller for this domain.
    3 consecutive failure(s).
    Last success @ 2009-08-04 17:19:47.

CN=Configuration,DC=test,DC=local
  Default-First-Site-Name\AD2K8R2SRV03 via RPC
    DSA object GUID: e30a44d8-837f-4c0d-8611-ca2e0324807f
    Last attempt @ 2009-08-04 17:42:11 failed, result 1908 (0x774):
      Could not find the domain controller for this domain.
```

Using Replication Admin (Repadmin)

■ Successful Active Directory Replication

- All Active Directory partitions have replicated successfully to all inbound partners or neighbors
- Repadmin displays no errors
- Other tools for checking Active Directory health:
 - Nltest
 - DCdiag
 - Active Directory Best Practice Analyzer
 - New for Win2008 R2
 - Microsoft IT Environment Health Scanner
 - New from Microsoft

```
Administrator: Command Prompt
C:\>repadmin /showrepl

Repadmin: running command /showrepl against full DC localhost
Default-First-Site-Name\AD2K8SRU02
DSA Options: IS_GC
Site Options: (none)
DSA object GUID: f18198fd-5a62-4da3-a775-fd9872aa3690
DSA invocationID: f18198fd-5a62-4da3-a775-fd9872aa3690

==== INBOUND NEIGHBORS =====

DC=test,DC=local
  Default-First-Site-Name\AD2K8R2SRU03 via RPC
  DSA object GUID: e30a44d8-837f-4c0d-8611-ca2e0324807f
  Last attempt @ 2009-08-04 18:14:59 was successful.

CN=Configuration,DC=test,DC=local
  Default-First-Site-Name\AD2K8R2SRU03 via RPC
  DSA object GUID: e30a44d8-837f-4c0d-8611-ca2e0324807f
  Last attempt @ 2009-08-04 17:56:41 was successful.

CN=Schema,CN=Configuration,DC=test,DC=local
  Default-First-Site-Name\AD2K8R2SRU03 via RPC
  DSA object GUID: e30a44d8-837f-4c0d-8611-ca2e0324807f
  Last attempt @ 2009-08-04 17:56:41 was successful.

DC=DomainDnsZones,DC=test,DC=local
  Default-First-Site-Name\AD2K8R2SRU03 via RPC
  DSA object GUID: e30a44d8-837f-4c0d-8611-ca2e0324807f
  Last attempt @ 2009-08-04 18:25:26 was successful.

DC=ForestDnsZones,DC=test,DC=local
  Default-First-Site-Name\AD2K8R2SRU03 via RPC
  DSA object GUID: e30a44d8-837f-4c0d-8611-ca2e0324807f
  Last attempt @ 2009-08-04 18:34:16 was successful.
```

Using Directory Server Diagnostics (DCdiag)

- Use DCdiag to monitor the health of your Active Directory domain controllers
- Checking Active Directory domain controller health using Dcdiag
- Partial printout of a DCdiag run
- Diagnostics show that active directory partition tests passed successfully
- DCdiag can provide insight into how your Active Directory domain controllers are performing
- Available on Windows Server 2003 and Windows Server 2008 and R2

Running partition tests on : ForestDnsZones

Starting test: CheckSDRefDom ... ForestDnsZones passed test CheckSDRefDom

Starting test: CrossRefValidation ... ForestDnsZones passed test CrossRefValidation

Running partition tests on : DomainDnsZones

Starting test: CheckSDRefDom ... DomainDnsZones passed test CheckSDRefDom

Starting test: CrossRefValidation ... DomainDnsZones passed test CrossRefValidation

Running partition tests on : Schema

Starting test: CheckSDRefDom ... Schema passed test CheckSDRefDom

Starting test: CrossRefValidation ... Schema passed test CrossRefValidation

Running partition tests on : Configuration

Starting test: CheckSDRefDom ... Configuration passed test CheckSDRefDom

Starting test: CrossRefValidation ... Configuration passed test CrossRefValidation

Running partition tests on : test

Starting test: CheckSDRefDom ... test passed test CheckSDRefDom

Starting test: CrossRefValidation ... test passed test CrossRefValidation

Running enterprise tests on : test.local

Starting test: LocatorCheck ... test.local passed test LocatorCheck

Starting test: Intersite ... test.local passed test Intersite

High Availability and Disaster Recovery

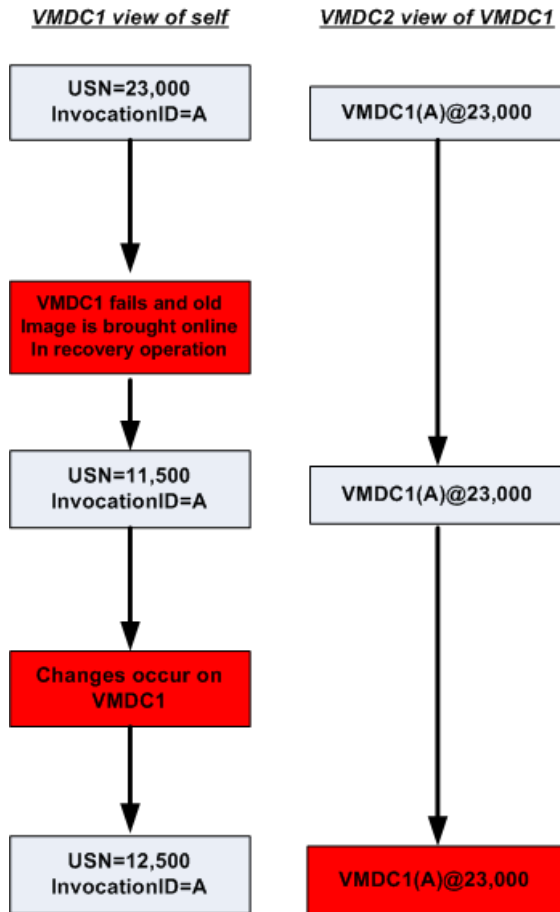


Active Directory Backups

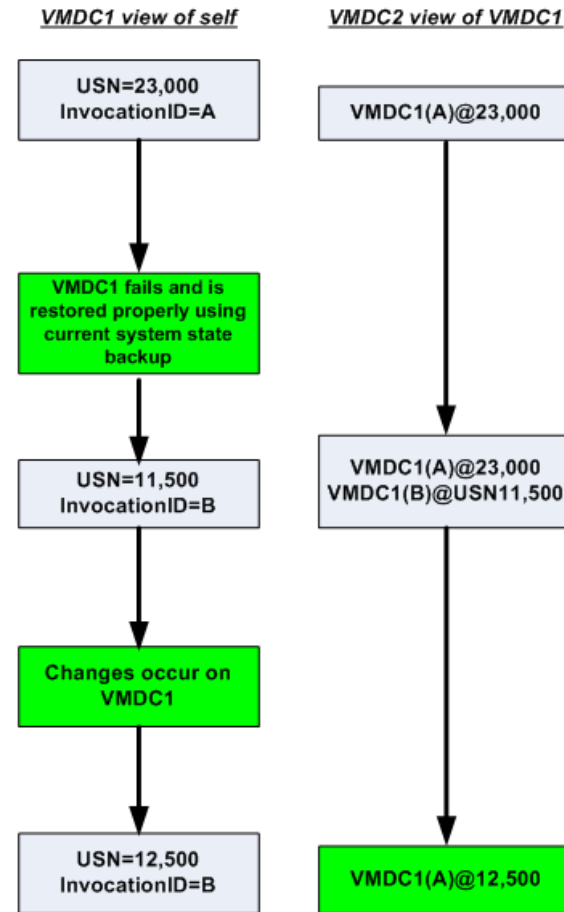
- **Perform consistent system state backups**
 - Eliminates hardware incapability when performing restore
- **Follow Microsoft recommendations on FSMO role placement:**
 - <http://support.microsoft.com/kb/223346>
- **All Active Directory restorations should be performed in accordance with Microsoft domain controller backup and restoration procedures**
- **Do not recover an Active Directory domain controller from a backup copy of an old virtual disk**
- **Do not use snapshots (differencing) disks as this could cause corruption and performance degradation within Active Directory**
- **Do not pause or suspend virtual domain controllers for extended periods of time.**

Disaster Recovery Scenarios

Improper Restore of VM

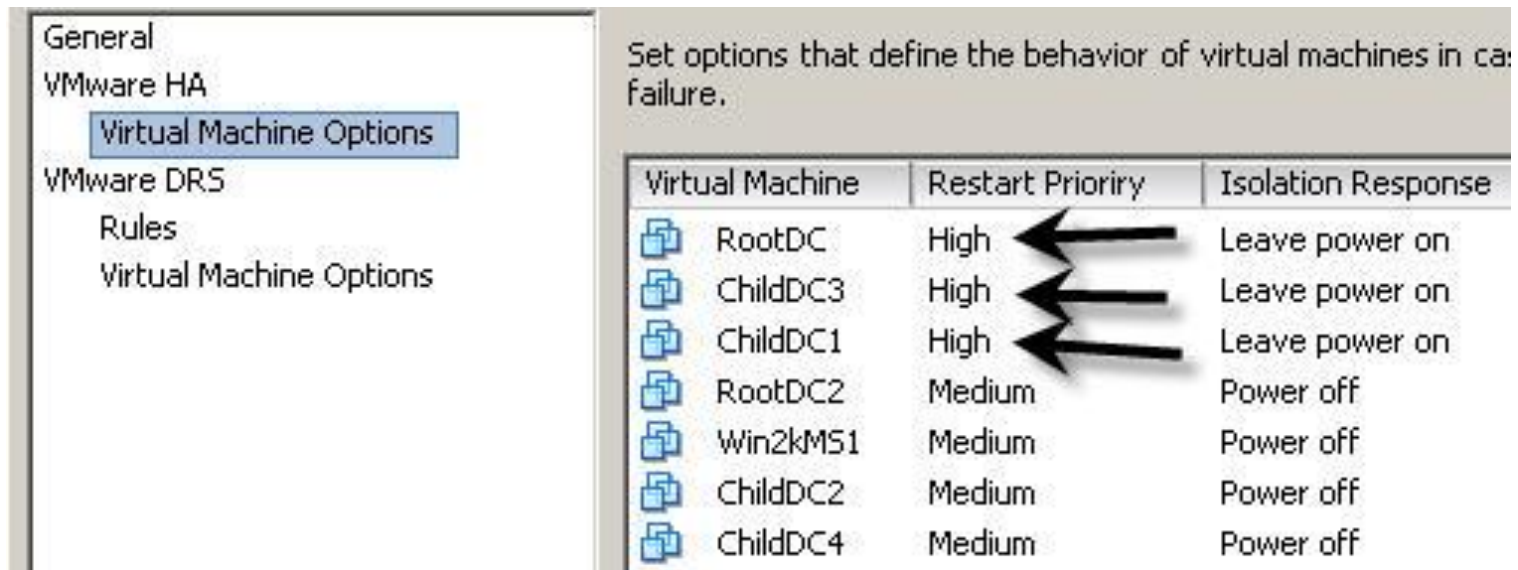


Proper Restore of Active Directory VM



Preparing for Disaster using vSphere Features

- VMware provides solutions for automatically restarting virtual machines
 - Restart Priorities
 - vApp Containers
- Implement VMware HA as a high availability to ensure virtual machine domain controllers restart in the event an ESX server fails



General
VMware HA
Virtual Machine Options
VMware DRS
Rules
Virtual Machine Options

Set options that define the behavior of virtual machines in case of failure.

Virtual Machine	Restart Priority	Isolation Response
RootDC	High	Leave power on
ChildDC3	High	Leave power on
ChildDC1	High	Leave power on
RootDC2	Medium	Power off
Win2kMS1	Medium	Power off
ChildDC2	Medium	Power off
ChildDC4	Medium	Power off

Using DRS Anti-Affinity Rules

- Combined with VMware DRS Anti-affinity rules can ensure domain controller VMs are segregated

The screenshot displays the VMware vSphere configuration interface for creating a DRS Anti-Affinity Rule. The interface is divided into three main sections:

- General:** Shows the navigation menu with "Rules" selected under "VMware DRS".
- Configuration:** A tree view shows the rule is applied to the "Root DCs" folder. The rule is named "Root DCs" and is of type "Separate Virtual Machines". The "Virtual Machines" list includes "RootDC" and "RootDC2".
- Object Selection:** A list of objects with checkboxes and expand/collapse icons. The objects are "East DCs", "Root DCs", "RootDC", "RootDC2", and "West DCs". The "Root DCs" folder and its sub-objects are selected.

High Availability, Disaster Recovery Summary

- **Utilize DRS and HA to implement a successful recoverability solution**
- **Always to continue to use Microsoft's System State data best practices to backup Active Directory database**
 - Default useful life of System State data → 60-180 days
 - Controlled by Tombstone lifetime attribute (depends on OS, SP, etc.)
 - Microsoft does not support snapshots of DCs → KB888794
- **Continue to follow best practices around the placement of key, critical roles**
- **VMware Fault Tolerance**
 - Can protect critical domain controllers (PDC Emulators)

Agenda

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How to Successfully Migrate?

Transitioning from Physical to Virtual

- **Start with a fresh system state backup for recovery**
- **Consider creating a dedicated virtual switch or virtual machine port group to isolate replication traffic**
- **Generally single processor virtual machines are adequate for domain controllers**
- **Validate inbound/outbound connections between physical and virtual machines**
- **Allow 24-48 hours for replication to complete**
- **Change the weight and/or priority of the DNS SRV records for virtual machines**
- **Monitor the logon requests to ensure virtual machines are successfully responding**
- **Decommission physical domain controllers**

DNS Modifications – Transitioning to VMs

- **Modify the weight and/or priority of the DNS SRV records**
- **Specifically offload the authentication requests from the PDC emulator when possible**
- **DNS weight is the proportional distribution of requests among DNS servers**
- **DNS priority is the likelihood a server will receive a request**
- **PDC emulators should have one or both adjusted accordingly by adding:**
 - `HKLM\System\CurrentControlSet\Services\Netlogon\Parameters`
 - `LdapSrvWeight` DWORD decimal value of 25 or 50
 - `HKLM\System\CurrentControlSet\Services\Netlogon\Parameters`
 - `LdapSrvPriority` DWORD decimal value to 100 or 200
- **Physical domain controllers should be adjusted similarly to decrease dependencies on PDC emulator**

DNS Modifications

- Can also be changed within DNS manager
- Registry changes do not require a reboot

The screenshot displays the DNS Manager interface. On the left, a tree view shows the hierarchy: gc, pdc, classroom.local, _msdcs, sites, Default-First-Site, and _tcp. The main pane shows a list of Service Location (SRV) records. An arrow points to the first record in the list, which is expanded in a detail pane on the right.

Name	Type	Data
_kerberos	Service Location (SRV)	[200][50][88] rootdc.classroom.local.
_ldap	Service Location (SRV)	[200][50][389] rootdc.classroom.local.
_gc	Service Location (SRV)	[200][50][3268] rootdc.classroom.local.
_kerberos	Service Location (SRV)	[0][100][88] rootdc2.classroom.local.
_ldap	Service Location (SRV)	[0][100][389] rootdc2.classroom.local.

Service Location (SRV) | Security

Domain: Default-First-Site-Name. s

Service: _ldap

Protocol: _tcp

Priority: 200

Weight: 50

Port number: 389

Host offering this service: rootdc.classroom.local.

Virtual Machine Considerations

- **Add, modify, search, delete and update operations will benefit significantly from caching**
- **Slight penalty incurred for write operations – Physical or Virtual**
- **Microsoft's AD Sizer can help you plan the size**
- **Use Microsoft's best practices and separate boot, database, log virtual disks on individual SCSI controllers to optimize write performance**

Typical VM Sizing: Active Directory

Active Directory Domain Controller	
Hardware (Virtual)	VMware ESX/ESXi 4.x (vSphere)
Processor	1 vCPU (for smaller directories) 2 vCPU (larger directories start with 2vCPU and increase as required)
Memory	4GB (smaller directories start with ~1 – 2 GB) 100,000 users can require up to 2.75GB of memory to cache directory (x86) ~16GB or greater (larger directories start with 16GB) 3 Million users can require up to 32GB of memory to cache entire directory (x64)
Network Adapter	Enhanced VMXNet3 Physical NICs should be teamed and plugged into separate physical switches in your network infrastructure
Storage Configuration	
vSCSI Controller 0 vSCSI Controller 1	Disk1 (C:) OS ~16GB or greater (depending on OS version) Disk2 (D:) Database ~16GB or greater for larger directories Disk3 (L:) Log files ~4GB or 25% of the database LUN size

Lead Practices

- **Synchronize the forest PDC emulator to an external stratum 1 time source**
- **Avoid snapshots or REDOs for domain controller virtual machines**
- **Regularly monitor Active Directory replication**
- **Do not suspend domain controller virtual machines for long periods**
- **Perform regular system state backups as these are still very important to your recovery plan**
- **Utilize the Active Directory recycle bin (Win2008 R2)**
- **Protect OU's from accidental deletion (Win2008 R2)**

VMware's Active Directory Environment

■ Internal Active Directory Deployment

- 9000 + users (not including groups and objects)
- 33 Active Directory Sites
- 48 Domain Controllers (Including Global Catalogs)
- 47 Virtualized – Windows Server 2003 x86 & x64
- 1 Physical Domain Controller (Forest PDC emulator)
- Stratum 1 Time Synchronization
- Continuous uninterrupted service for 5+ years

Summary

- **Perform and test your System State backups**
- **Ensure time synchronization from reliable stratum 1 time source**
- **Create and test your disaster recovery plan and procedures**
- **Implement VMware HA to provide high availability**
- **Monitor replication traffic using Replmon, Repadmin tools**
- **Utilize safeguards in Windows Server 2008 (Recycle Bin, ADBPA, Repadmin, MS IT Environment Health Scanner, protect OU's from accidental deletion)**
- **Analyze, Design, Deploy, Re-analyze**

Additional Resources

Additional Information

- **VMware Time Sync and Windows Time Service**
 - VMware Knowledge Base ID# 1318
- **Installing and Configuring NTP on VMware ESX Server**
 - VMware Knowledge Base ID# 1339
- **VMware Descheduled Time Accounting (VMware Infrastructure 3)**
 - http://www.vmware.com/pdf/vi3_esx_vmdesched.pdf
- **How to detect and recover from a USN rollback in Windows Server 2003**
 - <http://support.microsoft.com/kb/875495>
- **How to detect and recover from a USN rollback in Windows 2000 Server**
 - <http://support.microsoft.com/kb/885875>
- **Support policy for Microsoft software running in non-Microsoft hardware virtualization software**
 - <http://support.microsoft.com/kb/897615>
- **How to configure an authoritative time server in Windows Server 2003**
 - <http://support.microsoft.com/kb/816042>

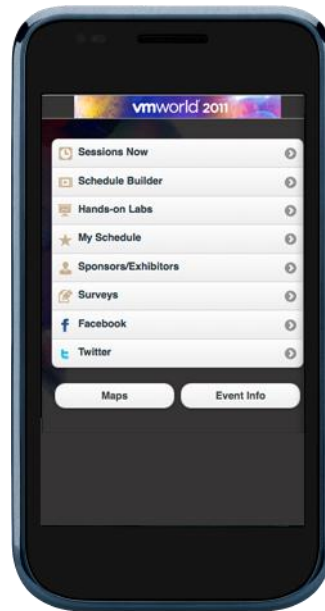
Additional Information (2)

- **For more information & customer case studies visit us at the following websites:**
 - VMware Website
 - <http://www.vmware.com>
 - Critical Business Applications Solutions and Performance Studies
 - <http://www.vmware.com/solutions/business-critical-apps/>
 - Virtualizing a Windows Active Directory Infrastructure on VMware
 - <http://www.vmware.com/resources/techresources/10029>
 - Customer Case Studies
 - http://www.vmware.com/technology/virtual-infrastructure-apps/microsoft/active_directory.html

Thank You !!

Questions?

Fill out a survey on your mobile device for this session.



Visit www.vmworld.com for a link to the mobile application.

The logo for vmworld 2011 features a dark blue circle containing the text "Own It." in white. To the right of the circle, the words "Your Cloud." are written in a white, sans-serif font. The background of the slide is a vibrant, abstract image of a coral reef with various colors like blue, green, and purple.

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Successfully Running Active Directory in a Virtualized Environment