Virtualizing SAP

An in-depth look on how The City of San Diego utilizes VMware ESX

Breakout Session # EA1562

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This session may contain product features that are currently under development.

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Pricing and packaging for any new technologies or features discussed or presented have not been determined.

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Agenda

- **About your Speaker, San Diego and SDDPC**
- **The City of San Diego and SAP**
  - Their Business Needs and How Could We Accomplish Them
- **Why VMware VI3**
  - Why The City of San Diego & SDDPC choose VMware
- **SAP on VMware – Best Practices**
- **Why NetApp NFS Datastores**
  - Fast Restores, Automated D.R. and Data De-Duplication
- **Some Good Resources**
  - Forums, Knowledge Bases, VMTN, Google
- **QA**

About the Speaker

Has been working in IT for 11 years

Systems Administrator for 9 years

- UNIX Administration (Solaris, AIX, Linux)
- Windows Administration (Windows NT 4.0 +)
- Network Design and Admin. (Cisco Catalyst and Cisco MDS)
- Programming (Perl, Shell, HTML)

Working with State/Local Government for 7 years

Working with VMware products for 5 years

- Workstation 4.0, VMware GSX, ESX 2.0

VMware VCP for 2 years (VCDX coming soon?)

About The City of San Diego

Americas Finest City

- 1.25 Million Residents
- The Best Climate in the United States

Over 10,000 Employees

- 8,500+ Windows XP Desktops (HP)
- 1,000+ Printers

Different Departments, Different Needs

- Water Department
- Environmental Services (Trash Pickup, etc.)
- Public Safety (Police, Fire, Lifeguard, etc.)
- City Administration (City Council, City Attorney, Mayor, etc.)

About San Diego Data Processing Corporation

Founded in 1979 by The City of San Diego

- Wholly Owned and Operated as a Non-Profit Company

250+ Employees

- Fully Independent Company
- Server/Application/Database Administrators, etc.
- Programmers, Project Managers, Executive Management, etc.

7,000 sq. ft. Data Center Facility

- 450+ Windows Servers (HP)
- 100+ UNIX Servers (Sun Microsystems)
- 275+ TB of Storage (NetApp 6040, 6030, 960; Sun StorageTek; HP EVA)
- 22 VMware ESX 3.5 Hosts – VC 2.5 – Mix NFS/FC Storage

The City of San Diego and SAP

The City of San Diego and SAP

What does The City of San Diego need?

- Simplicity
- Consolidation

The City of San Diego chose SAP NetWeaver ECC 6.0 as its choice ERP system. SDDPC provides technical consulting and resources to the implementation project team, as well as hosting the SAP computing infrastructure.

The City of San Diego and SAP

Business Continuance Requirements

- Systems Must Be Fully Redundant
  - Maximum 4 Hour Full Recovery
  - Maximum 30 Minutes Data Loss
- Systems Must Be Impervious To Local Disaster
    - Datacenter Failure
    - Storage Failure
    - Hardware Failure
  - SDDPC Maintains a second regional datacenter within the City
- Systems will be part of Enterprise Disaster Recovery Plan
  - SDDPC maintains a contract with a third-party provider for an out of state Disaster Recovery location

The City of San Diego and SAP

Going to SAP isn't going to simplify everything…

- 10+ SAP NetWeaver Modules
  - Multiple Servers = No Consolidation
  - We've Consolidated into one ERP System,
    but we still need to manage 14+ servers per environment
    (DEV, QA, PROD = 42+ servers)
- The City had chosen Microsoft Windows and SQL as the Operating System and Database for their SAP deployment
- Backup and Recovery are often more complex than initial deployment
- Development Availability must meet the Production systems, developers need fast recovery in case of error
  - Downtime for developers can become extremely costly

The City of San Diego and SAP

Why Don't We Virtualize?!

WE DID!

Why VMware VI3
Why the City of San Diego chose VMware

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Why VMware VI3

VMware Virtual Infrastructure Basics

- Server Consolidation
- Business Continuance
  - VMotion
  - Dynamic Resource Scheduling (DRS)
  - High Availability (HA)
- Disaster Recovery
  - Site Recovery Manager (SRM)
- Consolidated Backups
  - VMware Consolidated Backup (VCB)
- Power Management
  - Distributed Power Management (DPM)

Why VMware VI3

Our Existing VMware Farm

- (14) ESX 3.5 Hosts on HP and Sun Hardware
- (190+) Virtual Machines
  - Mostly Windows 2003, Some Linux and Solaris x86
- Disaster Recovery already in place
- Proven and Trusted

SAP Wasn't Supported

- At the time of our Blueprint SAP did not support VMware (officially)
- We decided to fully Virtualize development regardless of support
- Now that it is supported, we will plan on Virtualizing production after our initial deployment is complete.

Why VMware VI3

Virtualized SAP Development

- Four HP DL580 G5 Servers
  - (4) Quad Core Intel Xeon E7340 Processors 2.4GHz
  - 64GB RAM
  - (10) Gigabit Ethernet Ports
- NetApp 6030c Cluster
  - 10G Private VLAN For Storage Traffic
  - RAID6-DP with two separate Aggregates for O/S and Data
  - SnapManager for VI + SnapMirror + FlexClones
- Full Redundancy
- Fast Recovery

Why VMware VI3

Virtualized SAP Development

- SAP Netweaver
  - BI
  - ECC
  - E-Recruitment
  - GRC
  - Learning Solution
  - NWDI
  - PI
  - Portal
  - SAP Search
- Informatica
  - Data Migration

Virtual Machines typically consist with two vCPUs and 8-16GB RAM.

O/S VMDK are located on one NetApp aggregate and Data VMDKs are located on a separate NetApp aggregate.

Why VMware VI3

Virtualized Production Standby Environment

- Two HP DL580 G5 Servers
  - (4) Quad Core Intel Xeon E7340 Processors 2.4GHz
  - 64GB RAM
  - (6) Gigabit Ethernet Ports
  - 4GB Dual Port Fibre Channel
- NetApp 6040c Cluster
  - 10G Private VLAN For Storage Traffic
  - RAID6-DP with two separate Aggregates for O/S and Data
  - SnapManager for VI + SnapMirror + FlexClones

Physical Production Servers are P2V'd to Standby Environment

- SAP Data Drives (NetApp LUNs) Are SnapMirror'd and Presented to VM Guests as RDM

Why VMware VI3 / SAP on VMware - Benchmarks

Hardware Vendor	IBM	HP	Fujitsu Siemens Computers
Number of SD Users	545	516	490
Average Dialog Response Time (sec.)	1.98	1.92	1.93
SAPS	2730	2600	2470

All machines we're running VMware ESX 3.5 and VM Guests had 2 vCPUs running Windows 2003 Enterprise Edition.

Why VMware VI3 / SAP on VMware – Benchmarks

Benchmark 2008007

- HP Proliant DL580 G5
  - (2) Quad-Core Intel Xeon X7350 @ 2.93GHz
  - 64GB RAM
- Benchmark Users = 516 SD (Sales & Distribution)
  - Average Dialog Response = 1.92 seconds
  - Fully Processed Order Line items/hour = 52,000
  - Dialog Steps/Hour = 156,000
  - Average DB Request Time (dia/upd) = 0.016 sec / 0.012 sec
- CPU Utilization of ESX Host = 13%
- CPU Utilization of VM = 99%
- O/S = Windows 2003 Enterprise on VMware ESX 3.5
- Guest had 2 vCPUs
- SQL 2005
- SAP ECC 6.0

SAP on VMware
Best Practices

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SAP on VMware – Best Practices

Plan just like you would for physical

- Look at your SAPS (SAP Application Performance Standard)

Don't over commit memory

- SAP allocates memory permanently
- Use Memory Reservations to guarantee the full amount needed
- If using SQL server use "Fixed Memory Allocation"
- Multiple datastores for Virtual Disks
- Separate OS VMDK from DB/LOG VMDK
  - Put OS on slow physical disks (SATA)
  - DB on fast physical disks (SAS/FC)

Two is Better than One

- Two VMs with (2) vCPUs is more efficient than One VM with (4) vCPUs

SAP on VMware – Best Practices

VMware Tools

- SQL and SAP are big on time
- Make sure NTP is configured on your servers
- Enable time syncing in VMware Tools

- For **CPU-bound** systems with sufficient memory resources, use the SAP flat memory model with memory protection (mprotect) switched off. For more details on this configuration, see **SAP note 1002587**. This configuration yields the best performance and response times.
- For **memory bound** systems, use the classical SAP view memory model. To improve performance for this configuration, implement **Microsoft hotfix 931308** (see http://support.microsoft.com/kb/931308)

SAP on VMware – Best Practices

Get State of the Art

- Multi-Core CPU Architecture (Intel Dunnington 6-core)
- Hardware Assisted Virtualization (Intel VT & AMD-V)
- More Memory…More Memory…More Memory

Don't Forget About I/O

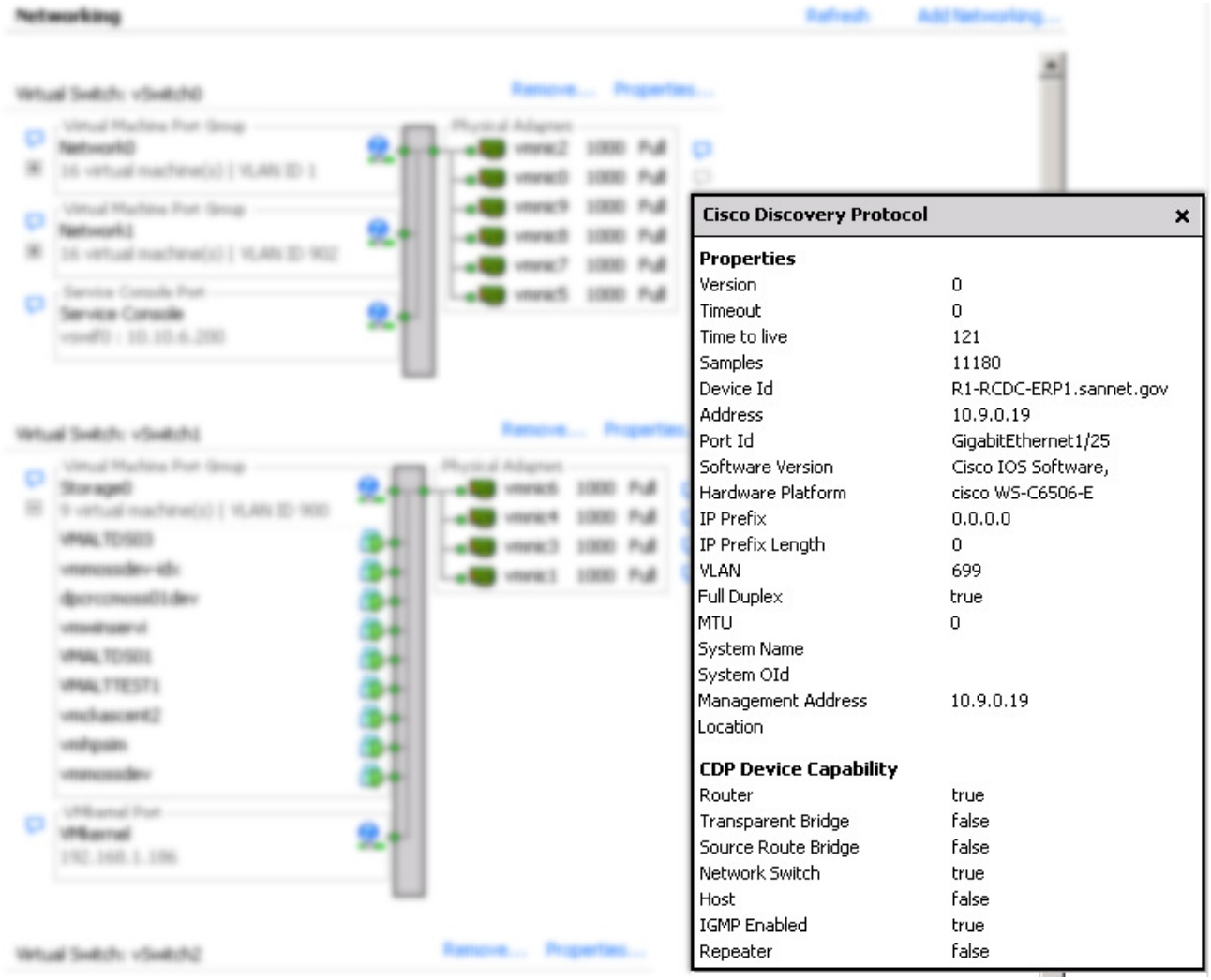
- Capture data should be on faster physical disks (FC/SAS)
- Retention Data can stay on your slower physical disks (SATA)

Verify your Service Console Settings

- Allocate Appropriate RAM to the Service Console – 800mb!
- Enable NTP and make sure its in sync
- Make sure DNS is functioning (forward and reverse lookups)

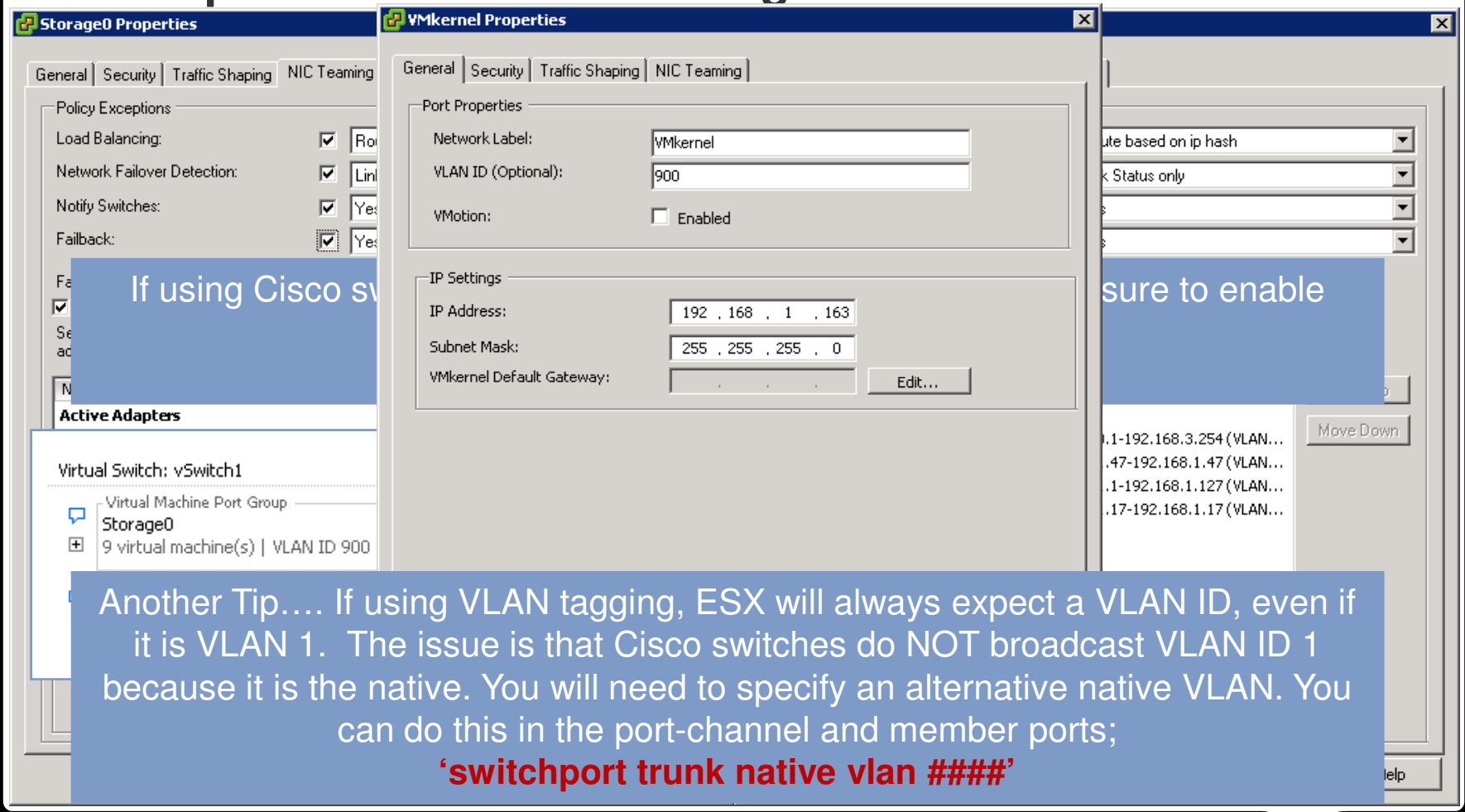
SAP on VMware – Best Practices

- **Network**
  - Conf
  - Use
    - IE
    - Se
  - Utiliz
    - Si
      M
  - 10Gb
- Cisco (
  - esxc
- **ALWA** !



SAP on VMware – Best Practices

Example of our vSwitch Configuration



Why NetApp NFS Datastores

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The Reasons We Chose NetApp NFS Datastores

Thin Provisioning

- Grow and Shrink your Datastore on the fly
- Only use the storage your consuming
  - Thin Provisioning Volume and VMDK (automatic for NFS datastores)

MSCS requires Thick VMDKs, VMDKs created on NFS datastores are Thin by default. Use vmkfstools to create your Thick VMDK.
'vmkfstools -c [size] -d thick [full path to vmdk]
(ex: vmkfstools -c 20G -d thick /vmfs/volumes/nfsdatastore/vmtest/vmtest.vmdk)

Better Performance

- Bandwidth matters little, IOPs and Response Time matter a lot
- Single Mount across multiple hosts (outside VMware ESX as well!)
- NetApp Filer supports IEEE 802.3ad Link Aggregation

The Reasons We Chose NetApp NFS Datastores

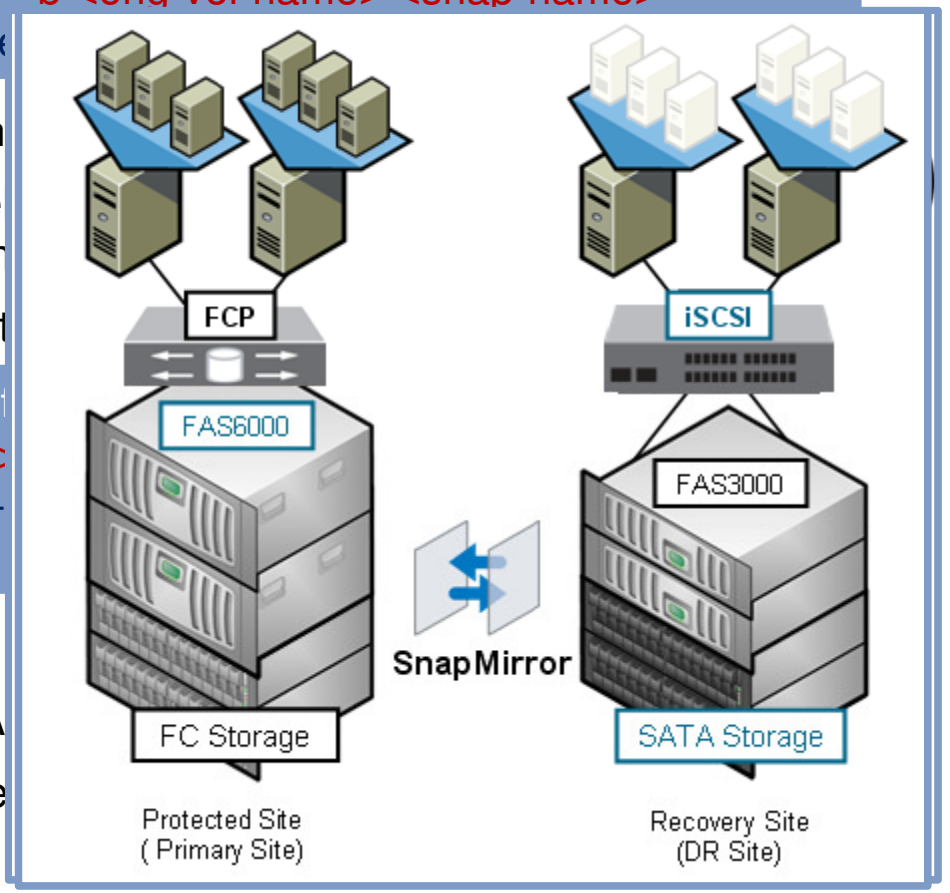
Create a flexclone of your NFS Datastore snapshot;
'vol clone create <vol-name> -b <orig-vol-name> <snap-name>'
(ex: vol clone create

- I can flexclone a volume snapsh
  - Mount the VMDK for file leve
    Use snaprestore to restore th
- Also can use snaprestore to rest

Use snap restore to copy VMDK files
'snap restore –t file –s <snap-name
(ex: snap restore –t file –s vmsnap.1 –
/vmfs/volumes/nfs1/vm1/vmold.vmdk)

Automated DR

- Site Recovery Manager w/ NetA
- Works with SnapMirror for full re
- Scheduled Automated DR tests



The Reason We Chose NetApp NFS Datastores

Data De-Duplication (NetApp A-SIS)

- No additional cost
- Only supported on NetApp XXXX Series Filers (ie: 2050, 3100, 6030)
- Little to no performance degradation
  - None on data writes
  - Roughly 2-5% on reads based on data type
- Virtualization is the perfect candidate for Data De-Duplication!
- Achieve 50-60% Storage Savings!

- A-SIS TIP :: Enable A-SIS on the volume prior to loading data on it.
  - (sis start –s /vol/path)
- Also, be cautious if you have a lot of snapshots on your volume. A-SIS creates a small amount of metadata.

NFS Datastores and VMware – Hints and Tricks

Separate your Storage Network

- Dedicated Ethernet for Storage and/or Private VLANs

Increase your NFS Datastore Limits

- By default VMware ESX allows 8 NFS Datastores, this limit can be increased to 32

If using a NetApp Filer, disable access time updates

- vol options <vol-name> no_atime_update on

NIC Teaming Failback

- Disable this, if your experiencing port faliures you do not want your VMKernel jumping back and forth between vmnic's

NetApp Best Practice Guide

snap restore for deploying many VM's at once is handy since you can script the entire process

'snap restore –t file –s <snap-name> -r <new-vmdk-path> <orig-vmdk-path>'

(ex: snap restore –t file –s vmsnap.1 –r /vmfs/volumes/nfs1/vm1/vmnew.vmdk /vmfs/volumes/nfs1/vm1/vmold.vmdk)

- You do lose the sysprep automation

NFS Datastores and VMware – Hints and Tricks

- I/O Intense Virtual Machines will benefit when their Starting Partition is divisible by 4096.
- Misalignment can result in degraded performance. The recommended starting value is 32768, typical VMs default setting is 32256.
- The best option is to fix your template:
  - Prior to O/S installation boot with a WinPE CD
  - Run diskpart
  - Select Disk 0
  - Create Partition Primary Align=32
  - Reboot and Install your O/S as normal

References and Resources

Some Good Resources

http://www.vmware.com/files/pdf/whitepaper_sap_usecases_Q207.pdf

- VMware Infrastructure for SAP Enterprise Applications: Use Cases

http://communities.vmware.com/blogs/SAPsolutions

- Virtualization for SAP Solutions Blog

http://www.sap.com/benchmark

- SAP Benchmarking (including Virtualization Benchmarking)

http://vmware.com/files/pdf/whitepaper_SAP_bestpractice_jan08.pdf

- Best Practice Guidelines for SAP Solutions on VMware Infrastructure

http://www.vmware.com/vmtn **- VMware Community Forums**

http://www.rtfm-ed.co.uk **– Helpful Blog Site**

http://blog.scottlowe.org **– Another Helpful Blog Site**

http://www.vmwaretips.com **– Tips & Tricks Blog Site (Just released for VMworld)**

Q&A

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