Non-Disruptive Backup of VMware Environments Using Veritas NetBackup

George Winter
Technical Product Manager
Veritas NetBackup
Agenda

- VMware ESX Architecture Overview
- VMware Backup Challenges
- Traditional Backup Concepts
- Non-Disruptive Backup - VMware Consolidated Backup
- Demo – Consolidated Backup with NetBackup
- Planned Future Integration With NetBackup 6.5
- Final Thoughts
- Q & A
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VMWare ESX Architecture – Virtual Machine’s

VMX files contain configuration information

VM's are based on VMDK files

VM1

APP1

APP2

VM2

APP3

APP4

VM3

APP5

APP6

EXT3

VM1.vmdk

VM2.vmdk

VM3.vmdk

VMFS

ESX Service Console (Red Hat)
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Virtual Machine Backup Issues

- All VM's share a single physical host
- System resources are efficiently used but finite
- In VM environments, unused system resources are rare
- Backup activities use significant I/O and network resources

In a nutshell…
- Minimal system resources are available for backups
- Backups need to be designed around these realities
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Traditional Backup Technologies

- Backing up Virtual Machines introduces different set of problems
  - Is it best to backup VM as a client?
  - What are advantages of backing up only the VMDK files?
  - How do I backup a DB hosted on a VM?

- Keep the following in mind:
  - Backup processing is very I/O and resource intensive
  - Backup activities on one VM can impact operations on another
NBU Client is installed inside VM like any other supported NBU client.
Advantages:
> Essentially same backup config as standard (non-VM) backups
> Restore process is unchanged
> Single file restores are possible
> Full and incremental backups are possible
> Translates to DB's as well

Disadvantages
> I/O processing on each VM can significantly impact other VM's
> Entire VM file hierarchy is searched for new or changed files during each backup
> Entire OS restores can be problematic
Technique 1: Backup the VM as a NBU Client

- Recommendations:
  - Backup each VM serially
  - Take advantage of "Synthetic Backup" technology
  - Only allow a single datastream per VM as data in VM's exist on single files
Technique 2: Backup the VMware Disk (VMDK) Files

NBU Client is installed on the Server Console (RHEL)

Running a client on Service Console is supported
Technique 2: Backup the VMware VMDK (and VMX) Files

Three ways of backing these up:

1) Shutdown VM – backup VMDK files – restart VM
   - Most straightforward
   - VMDK files are static during backup window
   - Unfortunately, VM is down for backup duration
   - VMDK files are backed up using NBU RHEL client on Service Console
Technique 2: Backup the VMware VMDK (and VMX) Files

Three ways of backing these up:

2) Shutdown VM – create snapshot – restart VM – backup VMDK files
   - Utilized snapshot + redo capability built into ESX 2.x
   - Requires some scripting
   - VM is unavailable for only a short time
   - Reboot is required with this technique
   - After reboot, all writes are directed to a VMware Redo Log
   - VMDK files are backed up using NBU RHEL client on Service Console
Technique 2: Backup the VMware VMDK (and VMX) Files

Three ways of backing these up:

3) Create snapshot – backup VMDK files
   - Creates a "Crash Consistent" version of VMware image (including apps)
   - "Crash Consistent" does not sound very good…..
   - No guarantee of data integrity
   - Not recommended by NetBackup
   - Raw Device Mapping (RDM) is "Crash Consistent" as well
Technique 2: Backup the VMware VMDK (and VMX) Files

- Advantages:
  - Disaster Recovery is extremely easy
  - Backup everything by backing up a few files

- Disadvantages
  - No single file restore
  - No incremental backup – must backup entire VMDK file each backup run
  - VM must be rebooted
    (assuming you want consistent backups!)
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Before we talk about Consolidated Backups, let's take a quick look at the history of virtualization from a resource consumption perspective.

- 10 Years ago it was not hard to saturate a 20 MHz CPU.
  - No resources available to virtualize.

- Then CPUs started to become *much* more powerful.
  (Moore's law was passed…)
Majority of system resources are typically underutilized

Scheduling backups is easy

Lot's of system resources available for backups
Backups are CPU and I/O intensive.

Peak Loads caused by backup activities.

Not an issue because lots of resources are available.

At night we backup the system.

Windows
**CPU Utilization After Virtualization**

- System resources more efficiently used
- Run higher average utilization
- Where do you fit a backup window?

**Backup Window??**

- **Serv Cnsl**: Red
- **Windows**: Green
- **SUSE**: Orange
- **RHEL**: Blue
- **Sol x86**: Brown

**VMWORLD 2006**
New technology introduced with ESX 3.x:

VMware Consolidated Backup (VCB)

Designed to:
- Improve file system backup – single file restores are possible
- OS is properly quiesced for consistent backups & restores
- OS is 100% available
  - Snapshot & redo creation is quick
  - No reboot is required
- Reduce backup processing load on ESX Server
- Simple implementation
VMware Consolidated Backup Components

- Backup Proxy Server
  - Similar in concept to NBU off-host Media Server backup
  - Image of VMDK file is mounted on this proxy system
  - This image is backed up by NBU
- Sync Driver
  - Installed via VMware Tools
  - Ensures that OS is synched before snapshot of VMDK file
  - Suspending writes to VMDK file and creates REDO
- vLUN Driver
  - Installed on VCB Backup Proxy Server
  - Provides image of VMDK file
  - Translates VMDK blocks into individual files
VMware Consolidated Backup Configuration

- Proxy Server must be W2K3
- VMDK files need to be on storage accessible by both systems

VMware Backup Proxy
NBU Media Server (Windows Server 2003)

SAN

VM1
APP1

ESX
VMware Consolidated Backup Process

NBU instructs Sync Driver to:
- Flush disk buffers
- Quiesce file system
- Suspend writes to VMDK
- Create REDO log

VMware Backup Proxy
NBU Media Server
(Windows Server 2003)
At this point:
- VMDK file is static
- Data in VMDK file is consistent
vLUN driver kicks in:
- Interprets VMDK blocks as individual files
- Backup begins
- Multiple Virtual VMDK files can be mounted simultaneously

VMware Backup Proxy
NBU Media Server
(Windows Server 2003)
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Consolidate Backup Demo Environment

SW Installed on Backup Proxy:
- Consolidated Backup Framework
- NetBackup Media Server
- VMware NBU Integration Module
- Virtual Center Components

SW Installed on Guest OS:
- VMware Tools

VMware Backup Proxy
NBU Media Server
(Windows Server 2003)
DEMO
Some Points To Keep In Mind Regarding VCB

Advantages of VCB include:
- OS is 100% available
- Incremental backups and single file restores are possible
- Snapshot process is very quick

VCB can also run pre and post processing within the VM
- Helpful for DB's or complex data structures
- If this processing fails, entire backup job fails
Some Points To Keep In Mind Regarding VCB

- I/O still occurs against VMDK file on shared storage
  - Plan storage layout and backup scheduling accordingly

- Current VCB OS (sync driver) support is limited
  - Check VMware support site for up-to-date status

- VCB process is currently controlled by NBU pre and post processing scripts
  - Complete integration planned for NBU v6.5 Advanced Client
Not all possible backup configurations are recommended or supported.....
What's Not Supported (And Why!)

- Running a NBU Media Server within a VM
  - Backups are I/O and resource intensive
    - Impact of backups on other VM's would be significant
  - Not recommended by VMware

- Running a NBU Media Server on Service Console (RHEL)
  - Service Console is optimized (non-standard) version of RHEL
  - Never designed to be used as a media server
  - No support for Fibre Tape Drives
  - VMware does not support this
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Future Planned Integration With NetBackup 6.5

**VMware Integration**
- Quiesce for consistency
- Off-host backup processing
- Intelligent host re-mapping
- Volume-level rollback
- File-level snapshot restore

**Snapshot Integration**
- FREE - Veritas Vol Mgr
- Disk Array API integration
- Snapshot cataloging
- Snapshot rotation
- Snapshot expiration
- Wizard-driven setup
Planned Off-host Backup of VMware ESX 3.0

- Snapshot of a virtual machine is mounted on another host at **volume** level
- Full volume is mounted on other host – not an image
- Uses VMware ESX 3.0 native snapshot capability
- Eliminate impact to ESX host including I/O
- File-level restore capability preserved
Additional Planned Integration With NetBackup 6.5

- Configure NetBackup backup Policies instead of writing, maintaining and troubleshooting homegrown scripts
- Intelligent VMware host remapping
  - All backups properly referenced in catalog to Virtual Machine(s)
  - Greatly simplifies restore process especially in larger environments
- Closer integration with DB or Application backup API's
- One click Virtual Machine Bare Metal Restore
- Integration with FREE Veritas Volume Manager
- And more…
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Some Final Thoughts

- Restore requirements tend to influence backup method selection
  - Single file restores not possible with every backup technique
  - Incremental backups not possible with every backup technique
  - DR is straightforward when backing up VMDK files

- Don't forget to backup the ESX Service Console
  - Configuration information is stored there
  - This can be done via NBU client on RHEL
  - Typically does not need to be backed up often
Some Final Thoughts........

For more information:

- Compatibility matrix is available on our support site http://support.veritas.com

- “Implementing VMware Consolidated Backup with NetBackup 6.0”
  http://support.veritas.com

- NetBackup 6.0 Advanced Client SAG
  http://support.veritas.com
Thank You!

george_winter@symantec.com

George Winter
Technical Product Manager
Veritas NetBackup
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