Symantec NetBackup Blueprints
Blueprint for Accelerator for VMware

Symantec Backup and Recovery Technical Services

Notice

This NetBackup Blueprint presentation includes example diagrams that contain objects that represent applications and platforms from other companies such as Microsoft and VMware. These diagrams may or may not match or resemble actual implementations found in end user environments. Any likeness or similarity to actual end user environments is completely by coincidence.

The goal of the diagrams included in this blueprint presentation is not to recommend specific ways in which to implement applications and platforms from other companies such as Microsoft and VMware; the purpose of these diagrams is to illustrate NetBackup best practices only.

For guidelines and best practices on installing and configuring applications and platforms from other companies, please refer to best practice documentation and other resources provided by those companies.

Symantec NetBackup Blueprints
How to use ?

These **Blueprints** are designed to show customer challenges and how NetBackup solves those.

- Each Blueprint consists of:
  - **Pain Points**: Explain the current challenges a customer faces.
  - **Whiteboards & Example Diagrams**: Describe the implementation of NetBackup solution.
  - **Best Practices**: Present NetBackup best practices to avoid common pitfalls
- Use these **Blueprints** to present the NetBackup best practice implementation example

Pain Points

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- Volume of data to be backed up from VMware environments is generally high and backup windows are small

- Traditional full backups of virtual machines on VMware platform are slow as all data blocks need to be processed and backed up over the network

- High network bandwidth utilization during backups

- High I/O activity and CPU overhead within the virtual machine

- Accelerator could be used in NetBackup 7.5 to back up VMware virtual machine file system data using MS-Windows or standard policy type _provided_ that the NetBackup client software was installed on the virtual machine. vStorage API or VADP based backup could not use the accelerator feature.

NetBackup Advantages

- Accelerator for VMware introduced in NetBackup 7.6 uses VMware Changed Block Tracking (CBT) and sends only changed data blocks for backup.

- The NetBackup media server then synthesizes a full virtual machine image using data from previous backups plus data from changed blocks

- A full backup image of the VM is completed in approximately the time it takes to run an incremental backup.

- Reduces storage requirements for backup with content-aware deduplication

- Reduces the I/O activity and CPU load within the virtual machine.

- Uses less network bandwidth for backup data transfer
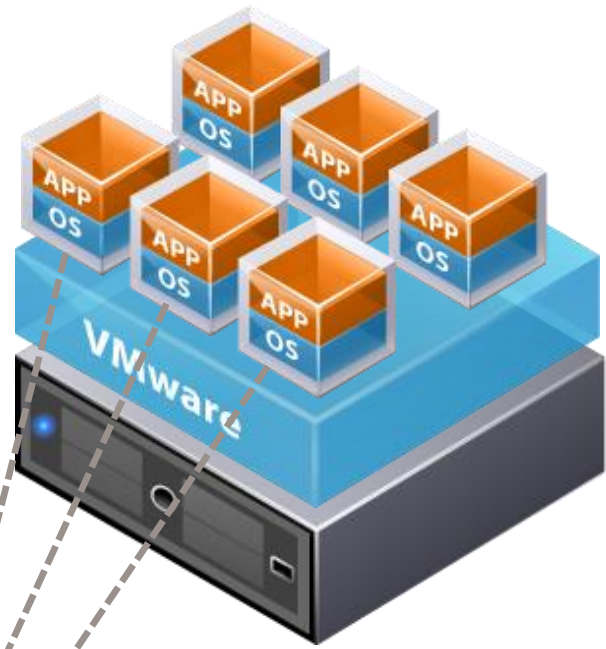
- Supports GRT for MSExchange, MSSQL and MS SharePoint

Restore

- Entire virtual machine

- Files and folders

- Exchange, SharePoint and SQL databases

- Exchange Email, SharePoint items

Optimized Synthetic

vSphere **Changed** Block Tracking
aka Block-level Incremental

Unchanged Blocks reside in Dedupe storage

Whiteboards and Example Diagrams

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- NetBackup 7.6 is required on NetBackup master server, media server, and client (proxy host) systems.
- SuSe Linux (SLES), RHEL, Windows and even a NetBackup 5230 appliance can be used as a VM proxy backup host.
- VMware ESX server version 4.0.3 or greater is required.
- Requires the **NetBackup Data Protection Optimization Option** license.
- MSExchange, MS SQL Server and SharePoint instances must be in a virtual machine residing on VMDK files. A NetBackup client must be installed in the VM to protect these instances.
- Applications must be in VMDK volumes; RDM volumes are not supported.
- Requires that the backup storage has the **OptimizedImage** attribute enabled

- Virtual machines running on ESX/ESXi hosts can track disk sectors that have changed using a feature called Changed Block Tracking (CBT).

- VMware CBT stores information about changed blocks in **ctk** file under each VM folder which are associated with each vmdk and snapshot file. CBT has to be enabled on each VM protected using Accelerator for VMware.

- When Accelerator performs a backup, it requests transmission of only changed blocks since the last backup by calling vSphere APIs for Data Protection (VADP).

- Accelerator combines those changed blocks with the list of already backed up extents, which are obtained from a state file, stored on the VM proxy host (backup host) and on the master server.

- Accelerator then transfers this data and information to a Symantec dedupe engine and generates the optimized synthetic full backup

- The state file is updated by the media server and transferred to the master server after each virtual disk backup completes.

- Accelerator generates only catalog data for the changes, however, when the media server generates the synthetic full backup, it transfers catalog information for a full backup to the master.

- Accelerator full backup consumes as much catalog space as a traditional full backup.
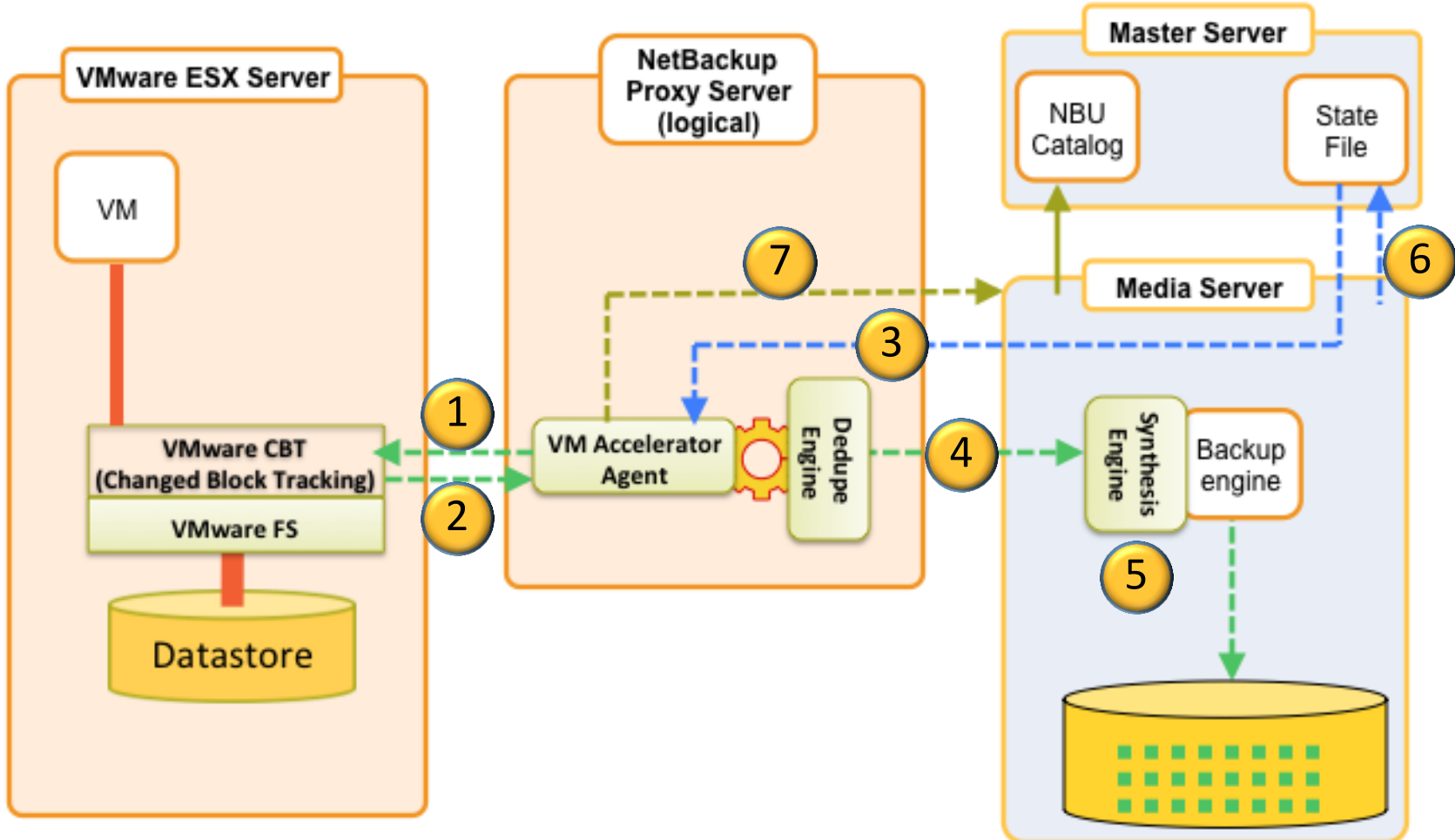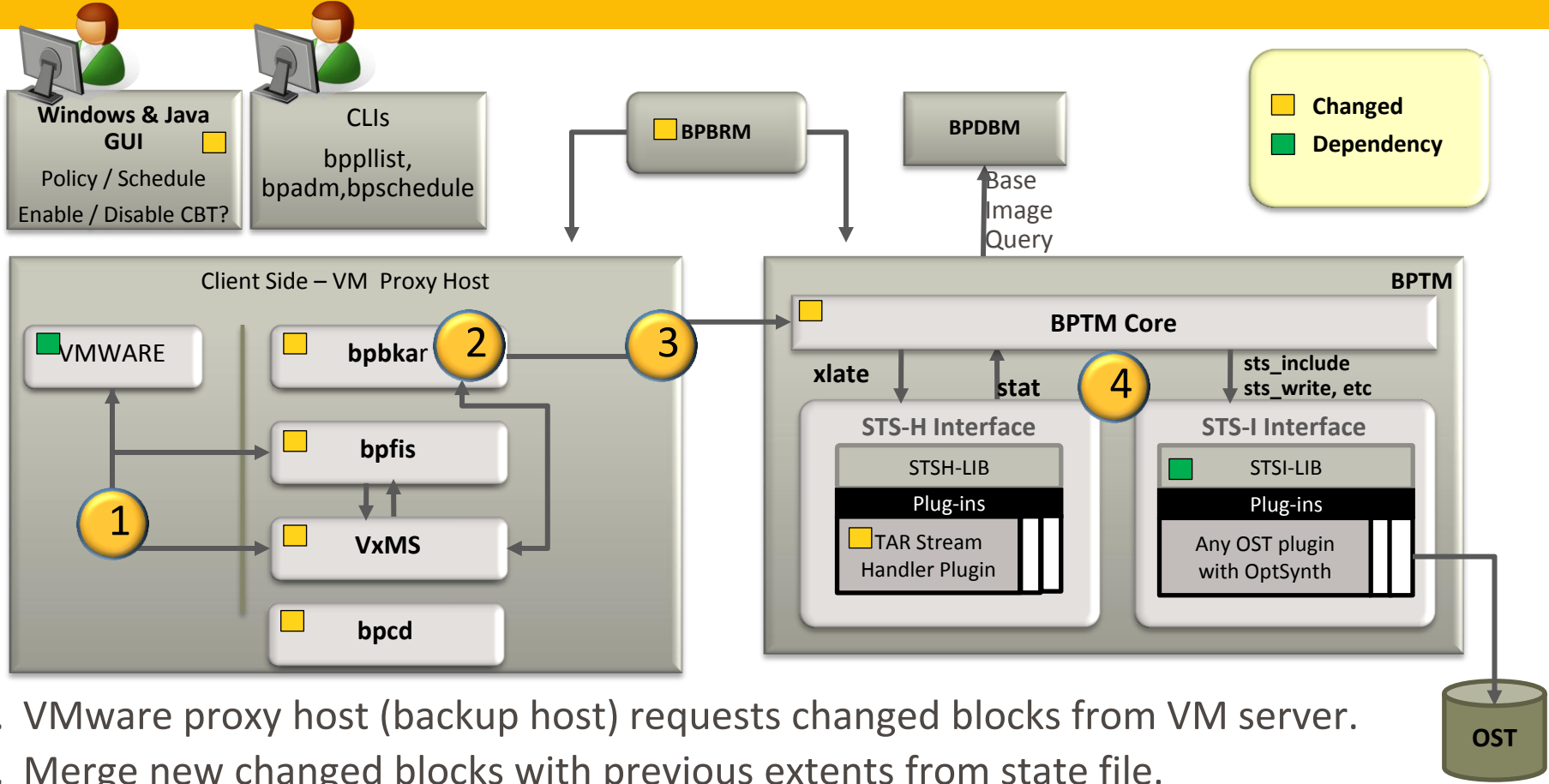
NetBackup Blueprints: Accelerator for VMware
NetBackup Process Flow and Log details

1. VMware proxy host (backup host) requests changed blocks from VM server.
2. Merge new changed blocks with previous extents from state file.
3. Generate Accelerator tar stream, send to **bptm**.
4. Generate a full image on the storage server, using blocks from previous image and the inline data received from the client (proxy host).

1. **bpbrm** starts **bpfis** on client (proxy host).

2. **bpfis** verifies that VMware server version greater than 4.0.3.

   If VMware version *is less than* 4.0.3:

   – This message is logged in the job entry visible in the Activity Monitor:

     Accelerator works with VMware Server version 4.0.3 or higher, and current version of 4.0.0 is not supported

   – The snapshot job fails.

3. **bpfis** takes snapshot, creates entries in the **NBU_DATA.xml** file

   – **NBU_DATA.xml** file is pre-existing file used during all VMware backups.

   – New information was added to the **NBU_DATA.xml** file to identify the state file from the previous backup.

   – More information on virtualization state files on an upcoming slide.

4a. bpbrm checks with bpcd on client (proxy host) for last backup id.

– For the first Accelerator backup, a previous state file *will not exist*:

```
16:50:03.567 [1879] <4> nb_accl_get_last_backup_byname: get backup ids from
client failed.
16:50:03.567 [1879] <4> nb_accl_get_last_backup_byname: END: client_param
egyptvm8%20-%20w2k3,client_hostname_param egyptvm8%20-%20w2k3 ,
last_backup_ids .
16:50:03.567 [1879] <4> nb_accl_get_last_backup: last_backup_ids is empty
16:50:03.567 [1879] <2> bpbrm main: last_backup_ids = ''
16:50:03.567 [1879] <2> set_job_details: Tfile (27): LOG 1343685003 4 bpbrm
1879 There is no complete backup image match with track journal, a regular
full backup will be performed.
```

– In subsequent Accelerator backups the previous state file is found:

```
12:13:50.253 [21953] <4> nb_accl_get_last_backup_byname: END: client_param
egyptvm8%20-%20w2k3,client_hostname_param egyptvm8%20-%20w2k3 ,
last_backup_ids egyptvm8%20-%20w2k3_1343684998,.
12:13:50.253 [21953] <4> nb_accl_get_last_backup:  client=egyptvm8%20-
%20w2k3, last_backup_ids is  'egyptvm8%20-%20w2k3_1343684998'
12:13:50.253 [21953] <2> bpbrm main: last_backup_ids = 'egyptvm8%20-
%20w2k3_1343684998'
```

4b. **bpcd** replies to BACKUP_ID_RQST.

– For first Accelerator backup, a previous state file *will not* exist:

```
16:50:03.570 [19344] <2> process_requests:
BPCD_GET_VM_CLIENT_ACCL_BACKUP_ID_RQST
16:50:03.570 [19344] <16> read_vm_header_by_name: could not open statefile
/usr/openv/netbackup/online_util/fi_cntl/bpfis.fim.egyptvm8@20-
@20w2k3_0.1.0_egyptvm11.extent (2)
16:50:03.570 [19344] <16> get_vm_backupid_by_backup_time: could not read
header of file
/usr/openv/netbackup/online_util/fi_cntl/bpfis.fim.egyptvm8@20-
@20w2k3_0.1.0_egyptvm11.extent
16:50:03.570 [19344] <2> process_requests: could not get any backup id from
extent file
```

– If subsequent Accelerator backup, backupid is read from the state file:

```
12:13:43.799 [15979] <2> process_requests:
BPCD_GET_VM_CLIENT_ACCL_BACKUP_ID_RQST
12:13:43.799 [15979] <2> process_requests: last_vm_backup_id=(egyptvm8%20-
%20w2k3_1343684998)(egyptvm8%20-%20w2k3_1343684998)
```

5. bpbrm starts **bpbkar** on proxy host and **bptm** on media server.

6. bpbkar looks for previous state file.

– For first Accelerator backup, a previous state file *will not* exist, and the backup continues down the normal Flashbackup VMware code path and will look like a normal full backup:

```
16:50:04.348 [19352] <2> stage_one_virtual: could not find previous extent
file (../flashmap.cpp:3753)
```

– Subsequent Accelerator backups will find the state file:

```
12:13:51.576 [15988] <2> stage_one_virtual: previous extent file =
/usr/openv/netbackup/online_util/fi_cntl/bpfis.fim.egyptvm8@20-
@20w2k3_1343684973.1.0_egyptvm11.extent (../flashmap.cpp:3751)
```

The state file is found in the following path:
[*install_path*]/netbackup/online_util/fi_cntl/bpfis.fim.[*client_name*]_[*backup_time*].1.0_[*storage_server*].extent

7. During subsequent Accelerator backups, **bpbkar** reads data from state file (reads a list of extents that composed the last backup).

```
12:13:51.725 [15988] <2> stage_one_virtual: Read accl extent state file
pathname /usr/openv/netbackup/online_util/fi_cntl/bpfis.fim.egyptvm8@20-
@20w2k3_1343684973.1.0_egyptvm11.extent (../flashmap.cpp:3976)
12:13:51.725 [15988] <2> read_state_extent_file: read State Extent File
backupid egyptvm8%20-%20w2k3_1343684998 (../flashmap.cpp:5052)
```

- **fiml_set_fvv_table** reads list of all extents and only changed blocked extents from VxMS representing the VM as it exists currently, and merges extents with changed data into a full list of extents that shows the entire VMDK, highlighting those extents that have been changed.

- **fiml_set_fvv_table** uses the previous image's extents (read from the state file) to update the extents that haven't been changed – and identifies where the extents can be found in the previous image.

8. As the Accelerator backup continues…

- **write_vm_files_extents_ACCL** writes a **tar** stream to **bptm** using the extents formed during **fiml_set_fvv_table**.

- Previous image extents:

```
12:14:38.028 [15988] <2> write_vm_files_extents_ACCL: Fast Backup
processing extent 0 VMDK (../flashmap.cpp:4756)
12:14:38.079 [15988] <2> write_accl_hdr_ex: PREVIOUS_IMAGE_DATA without
include checksum (../flashmap.cpp:1207)
12:14:38.079 [15988] <2> put_acclhdr: PREVIOUS_IMAGE_DATA header offset:
36928000, num bytes: 524288, vmdk_off: 0, verify_len:131072
(../flashmap.cpp:1268)
```

- New (inline) data:

```
12:14:38.079 [15988] <2> write_vm_files_extents_ACCL: Fast Backup
processing extent 1 VMDK (../flashmap.cpp:4756)
12:14:38.079 [15988] <2> put_acclhdr: Fast Backup put IN LINE DATA header
num bytes: 327680 (../flashmap.cpp:1291)
12:14:38.079 [15988] <2> write_vm_files_extents_ACCL: Accelerator writing
inline data (../flashmap.cpp:4779)
12:14:38.079 [15988] <2> write_extent_data: Accelerator write_incr_data,
offset = 524288 length = 327680 (../flashmap.cpp:5344
```

9. For all Accelerator backups (first and subsequent):

– **bpbkar** writes the state file for the backup.

```
16:56:31.088 [19352] <2> write_state_extent_file: write State Extent File
create file name =
/usr/openv/netbackup/online_util/fi_cntl/bpfis.fim.egyptvm8@20-
@20w2k3_1343684973.1.0_egyptvm11.extent (../flashmap.cpp:4988)
```

10. **bptm** writes inline data to storage server.

Uses Accelerator technology to create a traditional full NetBackup image.

11. **bpbkar** reports optimization percentage to **Job Details**.

```
12:16:46.983 [15988] <4> bpbkar main: JBD - accelerator sent 581953536
bytes out of 7567738880 bytes to server, optimization 92.3%
```

- Used to speed up cataloging of changed files.

- Previously VxMS would go through every file on a file system.

  Using random index mapping, VxMS only analyzes files from blocks that have been reported as changed, thereby reducing the time required to traverse file systems to identify changed files.

- Random Index Mapping…

  – Applies only when protecting a Windows-based virtual machine.

  – Affects both Accelerator and non-Accelerator backups.

  – For non-Accelerator backups the impact is seen for both Differential and Cumulative Incremental schedules.

  – With Accelerator enabled, Random Index Mapping applies only when using a Differential Incremental schedules – it is disabled for Cumulative Incremental schedules. Cumulative Incremental backups using Accelerator may be slower than Differential Incremental backups.

- The state file stores information about each extent of data on a virtual disk.

  – 24 bytes is needed per extent.

  – The number of extents per virtual disk depends upon disk fragmentation, allocation type, and other factors.

  – In practice, there is 1-3 KB of state file for every GB of virtual disk.

- State files are cleaned up when image is expired.

- State files are transferred to and from master server by **bpfis**.

- The Accelerator state file is one of many used by the virtualization code:

  bpfis.fim.[*client_name*]_[*backup_time*].1.0_[*storage_server*].extent

- Other state files used during backups:

  – bpfis.fim.[*client_name*]_[*backup_timestamp*].1.0

  – bpfis.fim.[*client_name*]_[*backup_timestamp*].1.0.changeid.xml

  – bpfis.fim.[*client_name*]_[*backup_timestamp*].1.0.NBU_DATA.xml

  – bpfis.fim.[*client_name*]_[*backup_timestamp*].1.0.NBU_DATA.xml.BID

- State file used during restores:

  – bpfis.fim.[*client_name*]_[*backup_timestamp*].VM_ObjInfoXML.xml

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- Set the **Policy type** to VMware.

- The Accelerator for VMware feature is configured using the **Use Accelerator** checkbox in the policy **Attributes** tab.

The storage unit must support **optimized synthetics**, limiting the storage unit options to MSDP, PDDO, and certain 3rd-party OST devices. If **Use Accelerator** check-box is selected, NetBackup automatically verifies that the selected storage unit is supported for Accelerator backups.

If the **Use Accelerator** check-box is greyed out and un-selectable, verify that the **NetBackup Data Protection Optimization Option** license is installed.

When Accelerator is enabled, the **Enable block-level incremental backup** parameter setting is automatically selected.

Add New Policy - VMware-ACCEL

Attributes | Schedules | Clients | Backup Selections | VMware

VMware backup host: Backup Media Server

Optimizations
- ☑ Enable file recovery from VM backup
- ☑ Enable block-level incremental backup
- ☑ Exclude deleted blocks
- ☑ Exclude swap and paging files

Primary VM identifier:
VM hostname

Orphaned snapshot handling:
Remove NetBackup

Application Protection
- ☐ Enable Exchange Recovery
  - ☐ Truncate logs
- ☐ Enable SQL Server Recovery
  - ☐ Truncate logs
- ☐ Enable SharePoint Recovery

Transport modes
NetBackup tries each selected transport in order from top to bottom
- ☑ san : Use san to move virtual disk data
- ☑ hotadd : Use virtual disk files from NetBackup server
- ☑ nbd : Do not encrypt the virtual disk data for over-the-network transfers
- ☑ nbdssl : Encrypt the virtual disk data for over-the-network transfers

Move Down

> Automatically selected when **Use Accelerator** is selected. Cannot be de-selected.

NetBackup Blueprints: Accelerator for VMware
Additional Configuration

- When creating the policy, if **Use Accelerator** is selected, NetBackup verifies that the selected storage unit is supported for Accelerator backups.

  Storage Unit must support optimized synthetics (MSDP, PDDO, and certain third-party OST devices).
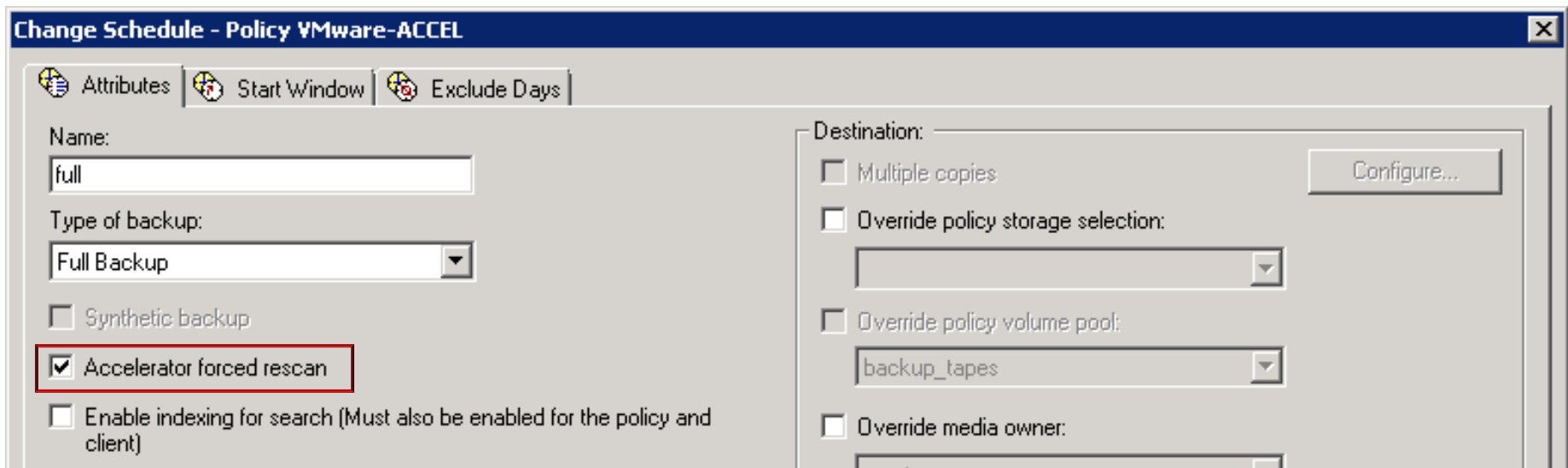
- SharePoint, MS-Exchange, and MS-SQL support FULL schedule types only.

- **Accelerator forced rescan** option enables creating a new baseline and helps protect against any potential omissions by underlying VMware CBT. Run **Accelerator forced rescan** option enabled backups from time to time to establish a new baseline.This option can be enabled on a per-schedule basis. See next slide for details.

NetBackup Blueprints: Accelerator for VMware
Accelerator Forced Rescan

- Causes the entire virtual machine to be backed up, resulting in 0% optimization and longer backup times.

- Provided as a safety net to prevent errors in VMware Changed Block Tracking (CBT) from permanently affecting Accelerator images.

- Should not be selected on every schedule. For example, could be optionally enabled on a schedule that runs every six months.

- **Accelerator Optimization** reported in Activity Monitor column (hidden by default).

- In **Job Details** – **Status** pane.

> **Accelerator Optimization** reported in column of Activity Monitor and in **Job Details -> Status** pane.

Best Practices

- Symantec recommends not to enable **Expire after copy** retention for any storage units that are used with storage lifecycle policies (SLP) in combination with Accelerator

- Update the NetBackup device mapping files if needed

- Storage unit groups are supported only if the storage unit selection in the group is Failover.

- Accelerator requires the storage to have the **OptimizedImage** attribute enabled.

- If a backup of the virtual machine does not exist, NetBackup performs a full backup (non accelerator) for the first time and accelerator enabled backups subsequently.

- To protect against any potential omissions by underlying VMware CBT, run **Accelerator forced rescan** option enabled backups from time to time to establish a new baseline

Issue: "Use Accelerator" checkbox not selectable

- If "Use Accelerator" policy checkbox is grayed out, and not selectable…

  – This is caused by lack of a proper license.

  – Add the **NetBackup Data Protection Optimization Option**.

  – You can obtain a list of the currently active features using the command:

    bpminlicense -list_keys -verbose > "output file name"

    (This command reads a verbose list of NetBackup licensed features and writes the output to a specified file name.)

Issue: Policy creation failure

- Creation of a policy with "Use Accelerator" may fail due to the selection of an invalid storage unit..
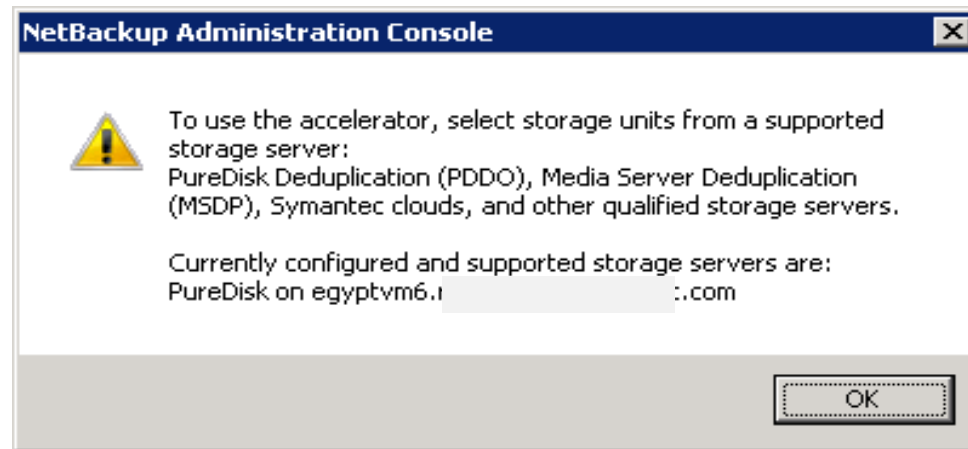
- NetBackup validates the selected storage unit, and posts the message (above) if an invalid storage unit is selected.

- Valid types are MSDP, PureDisk, Symantec cloud, and various third party OST storage servers.

- If using a third-party storage server that has been validated for use with Accelerator, verify device mappings are up-to-date.

Issue: Low or no optimization for Accelerator backups

- Possible causes for 0% optimization

  - First backup of VM using Accelerator.

    From Job Details:

    08/03/2012 09:26:29 - Info bpbrm (pid=17147) There is no complete backup image match with track journal, a regular full backup will be performed.

  - **Accelerator forced rescan** is enabled in the policy schedule.

    From Job Details:

    08/03/2012 09:41:30 - Info bpbrm (pid=18875) Accelerator enabled backup with "Accelerator forced rescan", each file will be read in order to validate checksums. Backup time will be longer than a normal Accelerator enabled backup.

  - Storage server was changed after previous backup.

    This situation looks the same as a first backup in the Job Details.

- Possible cause for low optimization

  High rate of change on the virtual machine.

Issue: Snapshot or backup failures

- Accelerator snapshot failures

  – Unsupported VM server.

    In Job Details look for:
    13:51:11.973 [30188] <2> onlfi_vfms_logf: INF - VMware_freeze: Accelerator works with VMware Server version 4.0.3 or higher, and current version of 4.0.0 is not supported.

  – The VMware server must be upgraded to version 4.0.3, or higher.

  – For other snapshot errors, look in **bpfis** log.

- Accelerator backup errors.

  Look in **bpbrm**, **bpcd**, **bpbkar**, **bptm** and **VxMS** logs.

- More information on configuring **VxMS** logging for NetBackup 7.6 is available in the following technote: http://www.symantec.com/docs/HOWTO70905

Accelerator does not require its own log directory. For log messages about Accelerator, see the following standard NetBackup log directories.

LOG Directory	Location
UNIX: /usr/openv/netbackup/logs/bpbrm Windows: *install_path*\NetBackup\logs\bpbrm	NetBackup master or media server
UNIX: /usr/openv/netbackup/logs/bptm Windows: *install_path*\NetBackup\logs\bptm	NetBackup media server
UNIX: /usr/openv/netbackup/logs/bpbkar Windows: *install_path*\NetBackup\logs\bpbkar	VMware Backup host
UNIX: usr/openv/netbackup/logs/bpfis Windows: *install_path*\NetBackup\logs\bpfis	VMware Backup host
Linux: /usr/openv/netbackup/logs/vxms Windows: *install_path*\NetBackup\logs\vxms	VMware Backup host

- Symantec NetBackup 7.6 for VMware Administrator's Guide
  http://www.symantec.com/docs/DOC6461
- Accelerator notes and requirements for virtual machines
  http://www.symantec.com/docs/HOWTO92075
- About the NetBackup Accelerator for virtual machines
  http://www.symantec.com/docs/HOWTO92076
- Accelerator messages in the backup job details log
  http://www.symantec.com/docs/HOWTO92077
- Accelerator forced rescan for virtual machines
  http://www.symantec.com/docs/HOWTO92079
- Support for NetBackup 7.x in virtual environments
  http://www.symantec.com/docs/TECH127089

Thank You!

Symantec Backup and Recovery Technical Services