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# Revision History

<table>
<thead>
<tr>
<th>Date</th>
<th>Descriptions</th>
<th>Type of modification</th>
</tr>
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<tbody>
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<td>First Draft</td>
<td>New</td>
</tr>
<tr>
<td>23 Aug, 2016</td>
<td>Modified Ch. 2.5</td>
<td>Modification</td>
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<td>Modified Ch. 6.1 with CBS added as backup destination; Ch 1 Overview section modified</td>
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<td>Modified Ch 3.5 with new information on OBM NFS service</td>
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</tr>
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<td>New / Modified</td>
</tr>
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</tr>
<tr>
<td>23 Jun 2017</td>
<td>Updated Ch.4, Ch.5, Ch.7, Ch 14, Updated all granular screen shots</td>
<td>Modified</td>
</tr>
<tr>
<td>13 Jul 2017</td>
<td>Updated Ch.5, Ch.10, Ch.14, Updated all granular screen shots</td>
<td>Modified</td>
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Why should I use OBM to back up my VMware vCenter/ESXi?

We are committed to bringing you a comprehensive VMware backup solution with OBM. Below are some key areas we can help making your backup experience a better one.

- **Easy Setup & Professional Services**
  
  *Setup is a few clicks away* - our enhanced OBM v7 can be easily downloaded and installed in just a few clicks. The refined user interface also provides user-friendly instructions to guide you through installation, configuration, backup and restore. The intuitive setup procedures together with instructions in this user guide makes the software installation and operations easy even for layman users.

- **Instant VM Restore with Run Direct**

- **Fast & Efficient**

- **Cloud Destinations Backup**

- **Centralized Management Console**

- **High Level of Security with AES 256-bit encryption**
**Instant VM Restore with Run Direct**

**What is Run Direct?**

Run Direct is a feature introduced since OBM version 7.5.0.0, that helps reduce disruption and downtime of your production VMs.

Unlike normal VM restore procedure where a VM is extracted from backup files and copy to the production storage, which can take hours to complete. Restore with Run Direct can instantly restore a VM by running it directly from the backup files in the backup destination. Administrator can troubleshoot on the failed virtual machine, while users are back in production with minimal disruption.

**How does Run Direct work?**

When a Run Direct restore is performed, the backup destination is mounted as a NFS datastore from the VMware host, where the VM is run directly from the backup files.

The restored virtual machine, at this stage (e.g. before the restore is finalized) is in a read-only state to preserve its integrity. All changes made to the virtual disks (e.g. operation within the guest virtual machine) are stored separately in transaction logs stored on the NFS datastore or the original datastore, depending on the setting selected. These changes are discarded when Run Direct is stopped, where the restored VM will be removed and all changes will be discarded, or the changes will be consolidated with the original virtual machine data when the restore is finalized.

**Settings Differences between Run Direct and Non-Run Direct Backup Set on VMware**

<table>
<thead>
<tr>
<th></th>
<th>Run Direct Backup Set</th>
<th>Non-Run Direct Backup Set</th>
</tr>
</thead>
<tbody>
<tr>
<td>Encryption</td>
<td>NO</td>
<td>YES</td>
</tr>
<tr>
<td>Compression</td>
<td>NO</td>
<td>YES</td>
</tr>
<tr>
<td>VDDK (CBT)</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>CBS</td>
<td>NO</td>
<td>YES</td>
</tr>
<tr>
<td>Local Destination</td>
<td>YES</td>
<td>YES</td>
</tr>
</tbody>
</table>

**Finalizing a VM Recovery (Migrating VM to permanent location)**

To finalize recovery of a VM, you will still need to migrate it to a permanent location on the VMware host. The following steps are taken when you finalize a Run Direct restore:
For vCenter VM backup set, provided that the vMotion feature of the vCenter set is working properly, the VM will not be suspended during the data consolidation.

Beside disaster recovery scenario, the Run Direct restore feature is also useful for recovery test or quick recovery of data on archived VM. Instead of restoring a VM on the production storage, run a VM directly from the backup files, to confirm on the backup, or quickly recover a file within an archived virtual machine that no longer exists on the VMware host.

For more details on how to setup a VMware VM backup set with Run Direct, refer to the chapter on Configuring a VMware VM Backup Set.
Fast and Efficient

We understand that backup could be a time and resources consuming process, which is why OBM is designed with advanced technologies to make backup a fast and efficient process.

We also understand that you may wish to run backup at a specified time interval of your choice, that’s why we also allow you to set your own backup schedules so that you can take full control of the time when to perform backup.

- **Multi-threading** – this technology utilizes the computing power of multiple CPU cores for creating multiple backup and restore threads to produce fast backup and restore performance.

- **Block Level Incremental Backup** – this technology breaks down the backup files into multiple blocks and only the changed blocks will be backed up each time.

Flexible Backup Destinations

- **Multi-destination Backup for Extra Protection** – you can now back up your VM to both local drive and cloud destination. While local drive backup gives you the convenience of faster backup and restore as a result of the locally resided infrastructure, you can take a further step to utilize the cloud backup to give you an extra layer of protection in the event of a local drive corruption, where you will still be able to retrieve data from the cloud destination.

High Level of Security

We understand your VM may contain sensitive information that requires protection, which is why your backup data will be encrypted with the highest level of security measure.

- **Un-hackable Encryption Key** – to provide the best protection to your backup data, you can turn on the encryption feature which will by default encrypt the backup data locally with AES 256-bit truly randomized encryption key.
What is the purpose of this document?
This document aims at providing all necessary information for you to get started with setting up your system for VMware VM backup and restore, followed by step-by-step instructions on creating backup set, running backup job and restoring backed up data.

The document can be divided into 3 main parts.

Part 1: Preparing for VMware VM Backup & Restore

Understanding Backup Mode
Introduce the differences between Non-VDDK and VDDK backup modes

Requirements
Requirements on hardware, software, VMware server, Client Backup Computer, Run Direct, and Non-VDDK/VDDK backup modes

Best Practices and Recommendations
Items recommended to pay attention to before backup and restore

Part 2: Performing VMware VM Backup

Creating a Backup Set
Log in to OBM and create backup set

Running a Backup Set
Run and backup set & configure backup schedule for automated backup

Part 3: Performing VMware VM Restore

Restoring VM with Run Direct
Steps on performing a VM restore with Run Direct

Restoring VM without Run Direct
Steps on performing a VM restore without Run Direct

What should I expect from this document?
After reading through this documentation, you can expect to have sufficient knowledge to set up your system to backup VMware VM on OBM, as well as to carry out an end-to-end backup and restore process.
1 Understanding Backup Mode

Backup Mode
There are two backup modes available for VM backup:

- **Non-VDDK backup mode**
- **VDDK backup mode**

**Note**
For VDDK backup mode, OBM must be installed on a supported Windows operating system platform.

The backup mode is chosen by OBM at the start of a backup, according on the license level of the VMware host, as well as other requirements outlined in Preparing for Backup and Restore.

**Non-VDDK Backup Mode**
For VM on free version of VMware hosts, backup is performed in non-VDDK mode. Backup in non-VDDK mode produces a backup chain that consists of a full file and a set of delta files:

- During the first backup, full files (e.g. virtual disk file (*.vmdk)) are created in the backup destination.
- During subsequent backup, In-file delta - an OBM feature is employed, to track only data blocks that have change since the last backup. All changed data blocks are saved as incremental / differential delta files in the backup chain.

During a subsequent backup in non-VDDK mode, VM files are streamed to the Backup Client Computer, for delta generation:

<table>
<thead>
<tr>
<th>Pros</th>
<th>Free version of ESXi is supported.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cons</td>
<td>Slower backup speed for subsequent backup compared to VDDK backup, as a result of having the entire VM backed up every time regardless of the actual used size.</td>
</tr>
</tbody>
</table>

**VDDK Backup Mode**
For VM on VMware host on Enterprise Standard, Enterprise and Enterprise Plus Edition, backup is performed in VDDK mode. Backup in VDDK mode produces a backup chain that consists of a full VDDK file and a set of VDDK incremental files.

- During the first backup, full files (*.F.vdk) are created in the backup destination.
During subsequent backup, Changed Block Tracking (CBT) - a VMware native feature (https://kb.vmware.com/kb/1020128) is employed, to identify disk sectors altered since the last backup. Altered blocks are saved as incremental VDDK file (*.I.vddk) in the backup chain.

During a subsequent backup in VDDK mode, OBM queries CBT through VADP (vSphere APIs for Data Protection) to request for transmission of all altered blocks since the last backup.

As there is no need to stream the VM files to the Backup Client Computer for delta generation, backup in VDDK mode will greatly enhance the speed of subsequent backup.

<table>
<thead>
<tr>
<th>Pros</th>
<th>Faster backup speed for subsequent backups compared to non-VDDK backup, as a result of backing up only the used size of your VM instead of the entire machine to enhance backup efficiency. This also helps with minimizing the storage size requirement and saving storage cost.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cons</td>
<td>VMware license requirement for usage of vSphere API</td>
</tr>
</tbody>
</table>

Further to the VMware license requirement described above, there are other requirements for VMware VM backup in VDDK backup mode. Refer to the chapter on Preparing for Backup and Restore for details.

Features Comparison between VDDK and Non-VDDK Modes

<table>
<thead>
<tr>
<th></th>
<th>VDDK (CBT)</th>
<th>Non-VDDK</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full Backup</td>
<td>Used data size of guest</td>
<td>Provisioned data size of guest</td>
</tr>
<tr>
<td>Incremental / Differential</td>
<td>Generated by VMware Host using CBT</td>
<td>Generated by OBM on the staging machine using in-file delta</td>
</tr>
<tr>
<td>Storage Size</td>
<td>Uses less storage quota</td>
<td>Uses more storage quota</td>
</tr>
<tr>
<td>Storage Cost</td>
<td>Lower storage cost</td>
<td>Higher storage cost</td>
</tr>
<tr>
<td>Backup Speed</td>
<td>Faster backup speed due to smaller data size</td>
<td>Slower backup speed due to larger data size</td>
</tr>
<tr>
<td>Run Direct Support</td>
<td>YES</td>
<td>NO</td>
</tr>
<tr>
<td>Restore from VDDK to VMDK format</td>
<td>YES</td>
<td>NO</td>
</tr>
</tbody>
</table>
2 Requirements

Hardware Requirement
Refer to the following article for the list of hardware requirements for OBM: FAQ: Hardware Requirement List (HRL) for version 7.3 or above.

Software Requirement
Refer to the following article for the list of compatible operating systems and VMware platforms: FAQ: Software Compatibility List (SCL) for version 7.3 or above.

VMware vCenter / ESXi Server Requirements
For backup of virtual machines on vCenter / ESXi servers, make sure the following requirements are met.

ESXi / vCenter Patch Release
Make sure that the latest supported patch release is installed on the vCenter / ESXi hosts to prevent critical issue, such as corruption to change tracking data in certain situation (https://kb.vmware.com/kb/2090639)

ESXi Shell Access
- ESXi Shell access must be enabled on the ESXi servers. Refer to the following VMware KB article for instruction: https://kb.vmware.com/kb/2004746
- Consult with VMware support representatives if you are unsure on the process.

Root Account
OBM requires root account access to the ESXi server to perform backup and restore.

Port Requirement
- For environment with firewall, the vCenter, ESXi servers and Backup Client Computer must be able to communicate with each other.
- Ensure that ports 22, 80, 111, 443 and 902 allow outbound communication on the vCenter and ESXi servers.

Note
Ports 443 and 902 are default ports for VMware.
If these have been changed from the default in your VMware environment, the firewall requirements will change accordingly.

Disk Space Available on Datastore
Sufficient disk space must be allocated on the datastore (e.g. 1.2 x size of the largest virtual machine selected for backup), where the virtual machine(s) to be backup are located.

**Maximum Virtual Disk Size**
- For VMware ESXi version 5.1 and earlier, the maximum size of a virtual disk to be backup cannot exceed 1.98 TB (or less, depending the block size setting of the datastore).
- Details - [http://kb.vmware.com/kb/1003565](http://kb.vmware.com/kb/1003565)

**VMware Tools**
VMware Tools are used to quiesce VMs prior to backing them up. To create consistent backup for your VMs on Windows platforms, ensure that VMware Tools are installed, and up-to-date on all VMs to be backup.

### Note
Quiescing is a process that ensures that the disk data is in a state suitable for backups to reduce the possibility of data corruption upon restore. This is especially important for transactional-based applications running on VMs like MS SQL Server.

There are different types of quiescing mechanisms, according to the guest operating systems (e.g. Crash-consistent, File-system-consistent and Application-consist quiescing).

For more details, refer to the following VMware vSphere document: [http://pubs.vmware.com/vsphere-60/index.jsp#com.vmware.vddk.pg.doc/vddkBkupVadp.9.6.html](http://pubs.vmware.com/vsphere-60/index.jsp#com.vmware.vddk.pg.doc/vddkBkupVadp.9.6.html)

**ESXi/ESX Hosts and Virtual Machine Hardware Versions Compatibility**
Refer to the link below for information on the supported and compatible virtual machine hardware versions in VMware vSphere.
[ESXi/ESX hosts and compatible virtual machine hardware versions list (2007240)]

**Backup Client Computer Requirements**
For backup of virtual machines on ESXi server (with no vCenter setup), a separate Backup Client Computer must be prepared for OBM to be installed on.

### Important
OBM cannot be installed on an ESXi server directly.
For environment with vCenter setup, OBM should be installed on the vCenter computer for best performance.

Ensure that the following requirements are met by the Backup Client Computer or the vCenter computer:

**Hardware and Software Requirement**
Ensure that the hardware and software requirements are met by the Backup Client Computer or the vCenter computer.

**Add-on Module Requirement**

Make sure that the VMware VM backup add-on module is enabled for your OBM user account, and that sufficient number of guest / socket is assigned. Contact your backup service provider for more details.

**Backup Quota Requirement**

Make sure that your OBM user account has sufficient quota assigned to accommodate the storage for the guest virtual machines. Contact your backup service provider for details.

**Port Requirement**

- For environment with firewall, the vCenter, ESXi hosts and Backup Client Computer must be able to communicate with each other.
- Make sure that ports 22, 80, 111, 443 and 902 allow outbound communication on the Backup Client Computer. Refer to the link below for details on port usage.
  

  **Note**

  Ports 443 and 902 are default ports for VMware.
  If these have been changed from the default in your VMware environment, the firewall requirements will change accordingly.

**Backup Client Computer on Linux**

For Backup Client Computer running on Linux operating system platform, Graphical User Interface (GUI) environment (e.g. GOME or KDE) must be installed.

  **Important**

  Run Direct restore and VDDK backup mode is not supported for Backup Client Computer on Linux / Mac OS X platforms.

**Disk Space Available on Backup Client Computer (or the vCenter computer)**

Sufficient disk space must be allocated on the Backup Client Computer (or the vCenter computer) for the temporary directory configured for the backup set (e.g. 120% x provisioned size of the largest virtual machine selected for backup).

**Windows OS Requirement for VDDK and Non-VDDK Modes Backup**

Make sure OBM is installed on:
64-bit Windows OS if you will back up VM data to VMware vCenter/ESXi 6.5 or above in VDDK mode.

Either 32-bit or 64-bit Windows OS if you will back up VM data to VMware vCenter/ESXi 6.5 or above in Non-VDDK mode (Free VMware version).

Run Direct Requirements
Run Direct is a feature introduced since OBM version 7.5.0.0, that helps reduce disruption and downtime of your production VMs.

For more details on Run Direct, refer to the chapter on Instant VM Restore with Run Direct.

To utilize the Run Direct feature, ensure that the following requirements are met:

VDDK Backup Mode
Run Direct restore is only supported for virtual machine that is backed up in VDDK mode. Make sure that the VDDK backup mode requirements are met.

Backup Destination Requirement

- When a Run Direct restore is performed, the backup destination containing the guest VM files is mounted on the ESXi host as NFS datastore.
- Ensure that the following requirements are met by the backup destination of the VMware VM backup set:
  - **Destination Type** of the backup destination must be set to a **Single storage destination**.
  - Destination must be accessible to the ESXi host.
  - Destination must have sufficient disk space available for the backup operation. There should be 1.5 x total provisioned size of all VMs selected for backup.
  - For backup of 1 VM with provisioned size of 100GB, there should be 150GB (e.g. 1.5 x 100GB) of free space available in the Destination.
**No Compression and Encryption**

Data backed up to a Run Direct enabled destination is not compressed or encrypted.

**Operation System of the Backup Client Computer**

- Run Direct restore is only supported by OBM installation on Windows.
- To utilize the Run Direct feature, make sure that OBM is installed on a supported Windows platform.

**Restore to Alternate Location**

- When performing a Run Direct restore to **Alternate Location**, only one VM can be selected per restore session.

![Restore virtual machines to](image)

- In alternate restoration, you can only select one virtual machine at a time. Do you want to modify the selected virtual machines?

![Yes No](image)

- Consider to create separate VMware VM backup set for each VM that you intend perform Run Direct restore (e.g. VMs that you may restore to alternate location).
**Dedicated NFS Service**

Starting from OBM version 7.9.0.0, a dedicated OBM NFS Windows service is introduced to allow Run Direct session to continue even if the OBM user interface is closed.

By default, the OBM NFS service is started as Local System, which does not have sufficient permission to access any network resources (e.g. the OBM NFS service does not have sufficient permission to access the VM backup files on network drive).

Make sure that the **Log on** setting of the **Online Backup Manager NFS Service** is configured with an account with sufficient permission to access the network backup destination where the backed up VM data are stored.

1. Under Control Panel, open Administrative Tools then Services.
2. Right click on Online Backup Manager NFS Service, select the Log on tab.
3. Select the **This Account** option.
4. Enter the login credentials of an account with sufficient permission.
5. Restart the service afterward.

**VDDK Backup Mode Requirements**

For VDDK backup mode, OBM must be installed on a supported Windows operating system platform.

**License Requirement**

- The VMware vSphere Storage APIs, which are essential for VDDK backup mode, are included with the VMware vSphere Enterprise Standard, Enterprise and Enterprise Plus Edition: [http://www.vmware.com/products/vsphere/features-storage-api](http://www.vmware.com/products/vsphere/features-storage-api)

- Ensure that the license requirement is met.

**Notes**

- For VM on free version of ESXi without a Run Direct backup destination, backup will be performed in non-VDDK mode.
- For VM on free version of ESXi with a Run Direct backup destination, the following error message would be returned during a backup: "Skip backing up Virtual Machine "name". Reason = "Run Direct is only support to VDDK backup mode"."

**Changed Block Tracking (CBT) on VMs**

CBT must be enabled for the VM to be backed up in VDDK mode. Make sure that the following requirements are met:
- The VM must be hardware version 7 or later.
- The VM must have zero (0) snapshots when CBT is enabled.
- The virtual disk must be located on a VMFS volume backed by SAN, iSCSI, local disk, or a NFS volume.

**Note**
For virtual disk on VMFS, the initial backup (e.g. full file backup) will be of size similar to used size; while for virtual disk on NFS, the initial backup will be of the provisioned size.

- RDM (Raw Device Mapping) in physical compatibility mode is not supported.
- The virtual disk must not be in Independent Mode (Persistent or Nonpersistent).

**VMware Snapshot**
VDDK backup mode does not support backup of virtual machine snapshot.

**Virtual Machine State**
VDDK backup mode does not support backup of virtual machine state (e.g. power on state / suspend state).

**Non-VDDK Backup Mode Requirements**
For VM that cannot be backed up in VDDK mode, non-VDDK backup mode will be used instead.
- Independent Disk (Persistent or Non-persistent)

- Independent disk can only be backed up if the VM is shutdown during a backup. If the VM is started up during the backup, all independent disks selected for backup cannot be backed up.
3 Best Practices and Recommendations

Please consider the following recommendations:

- Use the latest version of OBM.
  The latest version of OBM should be installed on the staging machine or Backup Client Computer for VMware ESX/ESXi, or on the vCenter server.

- Install OBM on a physical staging machine
  For best backup and restore performance, it is highly recommended that OBM is installed on a server grade staging machine or backup client computer with sufficient memory and processing power. As guest VM can be very large, during backups and restore this may involve the compression & encryption of large amounts of data, which can be very resource intensive.

- VMware Tools
  Make sure the latest version of VMware Tools is installed on each guest VM selected for backup. VMware Tools is used by OBM to quiesce the guest VMs prior to backing them up to create consistent backup for your VMs.
  Quiescing is a process that ensures that the disk data is in a state suitable for backups to reduce the possibility of data corruption upon restore. This is especially important for transaction-based applications running on VMs like MS SQL Server, MS Exchange etc. There are different types of quiescing mechanisms, according to the guest operating systems (e.g. Crash-consistent, File-system-consistent and Application-consist quiescing).

- Don’t use a guest VM as a staging machine.
  Although installing OBM on a guest VM as a staging machine is possible, the backup and restore will work as on a physical staging machine. This setup is actually inefficient and can lead to possible performance bottlenecks on the VMware host server, as in a VMware host the virtualization layer separates guest VM OS layer and the VMware host physical hardware layer.
  As the guest VM operating system does not have direct access to physical hardware where the data resides, a backup agent installed inside the guest VM must go through the virtualization layer to access the guest virtual machine data.

- Use the VDDK mode / CBT feature.
  The VDDK or CBT (Change Block Tracking) feature is supported on VMware ESXi/vCenter hosts with VMware Essentials License or above. The job of the CBT feature is keeping track of any data blocks which have changed since the last backup job. As the OBM via the vStorage API can quickly obtain this
information it does not need to calculate it which requires time and resources, therefore the performance of incremental backups is much faster with CBT feature enabled.

The use VDDK mode or CBT feature has another advantage, the amount of data backed up is relatively smaller. The used data size of the guest VM is backed instead of the provisioned size, so the storage cost of these backups will be less.

The temporary directory of a VMware VM backup set is set to a local volume, and not to a network volume (e.g. to improve I/O performance).

However, the temporary directory should not be set to the system volume (e.g. where the operating system is installed).

Plan your backup schedules carefully to minimize any performance impact on the VMware host.

To avoid concentrated disk I/O on the VMware host datastores which will have a negative performance impact on the guest VMs residing on these datastores, you should schedule your backups to limit the number of concurrent VM backups on a host and shared datastores. Hosts typically share the same datastores in virtual environments, and bottlenecks caused by too many simultaneous VM backups on a single datastore will affect all hosts that have VMs running on that datastore.

Backup the guest VMs to more than one destination

To provide maximum data protection and recovery flexibility you should consider storing your guest VM backups in multiple backup destinations, ideally both onsite and offsite locations. Onsite locations on local or network drives will enable very quick recovery even for large guest VMs. While offsite locations will ensure that if there is a site outage, the guest can be restored from another location.

Consider to increasing the Java memory allocation setting for OBM (Java heap space) if you are using non-VDDK mode backup.

If you are using non-VDDK mode, it is recommended to increase the Java heap size space to at least 2GB or above for optimal performance.

Refer to the following KB article for further instruction:

4 Starting OBM

Login to OBM

1. Login to the OBM application user interface.

For Backup Client Computer on Windows / Mac OS X, double click the OBM desktop icon to launch the application.

For Backup Client Computer on Linux, enter the following command to launch the application user interface:

```
# sh /usr/local/obm/bin/RunOBC.sh &
```

2. Enter the **Login name** and **Password** of your OBM account.

3. Click **OK** afterward to login to OBM.
5 Creating a VMware VM Backup Set

1. In the OBM main interface, click **Backup Sets**.

2. Create a VMware VM backup set by clicking the “+” icon next to **Add new backup set**.

3. Enter a **Name** for your backup set and select **VMware Backup** as the **Backup set type**.
4. Select the **Version** of the corresponding host:

   - **➢ Select VMware ESXi 4 / 5 / 5.5 / 6 / 6.5** for a VMware ESXi backup set
   - **➢ Select VMware vCenter 4 / 5 / 5.5 / 6 / 6.5** for a VMware vCenter backup set

5. Enter the VMware host and access information. For a VMware ESXi backup set, enter the **Password** of the root account, **Host**, **Port** and **SSH Port** information of the ESXi host.
For a VMware vCenter backup set, enter the **Password** of the administrator account, **Host**, and **Port** information of the vCenter server.

![Create Backup Set](image)

Click **Next** to proceed when you have finished entering all necessary information.

6. For VMware ESXi backup set, select the virtual machines or individual virtual disks that you would like to backup.

![Backup Source](image)
For VMware vCenter backup set, select the settings, virtual machines or individual virtual disks that you would like to backup.

7. In the Schedule menu, configure a backup schedule for backup job to run automatically at your specified time interval. By default, this feature is turned on with a predefined scheduled backup to run at 20:00 daily. Click Add to add a new schedule if necessary.
If you will configure a scheduled backup, define the backup schedule details in the New Backup Schedule section as shown below. Click OK when you have finished configuring a backup schedule.

![New Backup Schedule](image)

Click Next to proceed when you are done with the settings.

**Note:** For details about the options from the dropdown menus, please refer to Configure Backup Schedule for Automated Backup.

8. In the Destination menu, select a backup destination where the backup data will be stored. Click the “+” icon next to Add new storage destination / destination pool.

![Destination](image)

Select the appropriate option from the Backup mode dropdown menu.

- **Sequential** (default value) – run backup jobs to each backup destination one by one
- **Concurrent** – run backup jobs to all backup destinations at the same time

To select a backup destination for the backup data storage, click the “+” icon next to Add new storage destination / destination pool.
9. In the New Storage Destination / Destination Pool menu, select the storage type.

- **Single storage destination** – the entire backup will be uploaded to one single destination you selected under the **Destination storage** drop-down list. By default, the destination storage is selected as **CBS**.

![New Storage Destination / Destination Pool](image)

**Run Direct**

1. To utilize the Run Direct feature for your VMs recovery, enable the **Run Direct** option. The Run Direct option is only available for single storage destination, and is enabled by default.
2. Further to the above settings, there are also other requirements for the Run Direct feature, refer to the chapter on **Run Direct Requirement** for more details.

- **Destination pool** – the backup will be spread over on the destinations you have selected. Enter a **Name** for the destination pool and then click the + icon next to **Add new storage destination to the pool** to select the desired destinations.

![New Storage Destination / Destination Pool](image)

You can choose a storage combination of the Local/Mapped drive/Removable Drive, Cloud storage or FTP.
➢ If you have chosen the Local/Mapped Drive/Removable Drive option, click Change to browse to a directory path where backup data will be stored. The path must be accessible to the ESXi host.

![New Storage Destination For The Pool](image)

10. You can add multiple storage destination if you wish. The backup data will be uploaded to all the destinations you have selected in this menu in the order you added them. Press the ▲ ▼ icon to alter the order. Click Next to proceed when you are done with the selection.

![Destination](image)

**Note**

Multiple backup destinations can be configured for a single backup set (e.g. one destination with Run Direct enabled, and another with Run Direct disabled).

Click Next to proceed.

11. In the Encryption window, the default Encrypt Backup Data option is enabled with an encryption key preset by the system which provides the
most secure protection.

WARNING: If a note of the encryption key is NOT taken, and the key is LOST, the data will be irretrievable. We recommend changing the DEFAULT encryption key to something memorable.

You can choose from one of the following three Encryption Type options:

- **Default** – an encryption key with 44 alpha numeric characters will be randomly generated by the system
- **User password** – the encryption key will be the same as the login password of your OBM at the time when this backup set is created. Please be reminded that if you change the OBM login password later, the encryption keys of the backup sets previously created with this encryption type will remain unchanged.
- **Custom** – you can customize your encryption key, where you can set your own algorithm, encryption key, method and key length.

Click **Next** when you are done setting.
12. If you have enabled the Encryption Key feature in the previous step, the following pop-up window shows, no matter which encryption type you have selected.

![Encryption Window]

The pop-up window has the following three options to choose from:

- **Unmask encryption key** – The encryption key is masked by default. Click this option to show the encryption key.

![Unmask Key]

- **Copy to clipboard** – Click to copy the encryption key, then you can paste it in another location of your choice.

![Copy to Clipboard]

- **Confirm** – Click to exit this pop-up window and proceed to the next step.

**WARNING:** If a note of the encryption key is NOT taken, and the key is LOST, the data will be irretrievable. We recommend changing the DEFAULT encryption key to something memorable.
13. Enter the Windows login credentials used by OBM to authenticate the scheduled or continuous backup.

![Windows User Authentication]

Click **Next** to proceed when you are done with the settings.

**Note**

If the backup schedule is turned off for the backup set the Windows User Authentication screen will be automatically skipped. The Windows User Authentication login credentials can be added or updated post backup set creation.

14. The following screen is displayed when the new VMware VM backup set is created successfully.

![Congratulations!]

"VMware Run Direct Backup Set" is successfully created.

15. Click the **Backup now** button if you wish to run a backup for this backup set now.
6 Overview on Backup Process

The following steps are performed during a VMware VM backup job.

1. Establish connection
   - Connection from the backup client to the backup server is established.

2. Pre-backup command
   - Pre-backup command is run (if configured).

3. Remote file list
   - Remote file list and checksum files are downloaded from the backup destination.

4. VMware snapshot
   - OBM triggers a VMware snapshot to be created for VMs selected for backup.

5. Files comparison
   - Remote and local file lists are compared to identify new / updated / deleted VM files.

6. Change block tracking
   - In-file delta files are generated (for non-VDDK mode) or VDDK files are generated (for VDDK mode) (if required).

7. Uploading files
   - New, updated, in-file delta / VDDK files are compressed and encrypted (for non-VDDK backup only), then saved to the backup destination.

8. Removing VMware snapshot
   - VMware snapshot is deleted for VMs selected for backup.

9. Saving files
   - Latest local index files are saved to the backup destination.

10. Post-backup command
    - Post-backup command is run (if configured).

11. Remove temporary files
    - Temporary files are removed from the temporary directory of the backup set.

Backup completed successfully
7 Running a Backup

Start a Manual Backup

1. Click the Backup icon on the main interface of OBM.

2. Select the backup set which you would like to start a backup for.

3. If you would like to modify the In-File Delta type, Destinations and Retention Policy Settings, click Show advanced option.

4. When advanced options are shown, it is recommended that you tick the checkbox next to Run Retention Policy after backup in the Retention Policy section at the bottom. This will help you save hard disk quota in the long run. In the In-File Delta type section, the following three options are...
available:

Full – A full backup captures all the data that you want to protect. When you run a backup job for the first time, OBM will run a full backup regardless of the in-file delta setting.

Differential – A differential backup captures only the changes made as compared with the last uploaded full file only (i.e. changes since the last full backup, not since the last differential backup).

Incremental – An incremental backup captures only the changes made as compared with the last uploaded full or delta file (i.e. changes since the last incremental backup).

Click Backup to start the backup.

5. Click Backup to start the backup job. The status will be shown.

6. When the backup is completed, the progress bar will be green in color and the message “Backup Completed Successfully will appear.
7. You can click the View icon on the right hand side to check the log. A window will pop up to show the log. Click Close to exit the pop-up window.
Configure Backup Schedule for Automated Backup

1. Click the Backup Sets icon on the OBM main interface.

2. All backup sets will be listed. Select the backup set that you would like to create a backup schedule for.

3. Go to the Backup Schedule tab. If the Run scheduled backup for this backup set option is off, switch it On. Existing schedules will be listed if any.
4. Click **Add** to add a backup schedule. The New Backup Schedule window will appear.

![New Backup Schedule](image)

5. In the New Backup Schedule window, you can configure your backup schedule settings. To save hard disk quota in the long run, it is recommended that you tick the checkbox next to **Run Retention Policy after backup** at the bottom. The rest of the setting options will vary by which option you choose from the **Type** dropdown menu:

- **Daily** – when to start the backup job

![Daily backup schedule](image)
- **Weekly** – which day of the week and what time that day to start the backup job

```
Weekly Backup Schedule
Name: Weekend
Type: Weekly
Backup on these days of the week:
- Sun
- Mon
- Tue
- Wed
- Thu
- Fri
- Sat
Start backup at: 23:00
Stop: until full backup completed
Run Retention Policy after backup
```

- **Monthly** – which day of the month and what time that day to start the backup job

```
Monthly Backup Schedule
Name: Monthly Closing
Type: Monthly
Backup on the following day every month:
- Day: Last
- First: Sunday
Start backup at: 23:59 on the selected days
Stop: until full backup completed
Run Retention Policy after backup
```

- **Custom** – which particular date to start a one-off backup job

```
Custom Backup Schedule
Name: New Year Eve
Type: Custom
Backup on the following day since:
- Year: 2016
- Month: December
- Day: 31
Start backup at: 23:59
Stop: until full backup completed
Run Retention Policy after backup
```
The **Stop** dropdown menu offers two options:

- **until full backup completed** – in case you prefer a complete backup

  ![](image)

- **after [how many] hr** – in case you prefer the backup job to stop after a certain number of hours regardless of whether or not the backup job is complete

  ![](image)

As an example, the four types of backup schedules may look like the following.

![](image)

6. Click **Save** to confirm your settings when you are done with the settings.
## 8 Restore Methods

There are three methods to restore your backed up virtual machine.

### Method 1 - Restoring a Virtual Machine with Run Direct

**Introduction**

This restore method can instantly restore a VM by running it directly from the backup files in the backup destination. Administrator can troubleshoot on the failed virtual machine, while users are back in production with minimal disruption.

**Pros**

- Fast Recovery
- Minimize VM server down time so as minimizing impact on your business

**Cons**

- Changes made during Run-Direct restore is not committed to the VM until it is migrated completely.

### Method 2 - Restoring a Virtual Machine without Run Direct

**Introduction**

This is the conventional restore method where VM data is restored from the backup destination to either the original VM location or an alternate location of your choice.

**Pros**

- Complete VM restore can be done in one take; no data migration needed afterwards

**Cons**

- Recovery time could be long if the VM size is larger
- Long VM server down time may cause greater impact on your business

### Method 3 - Restoring a Virtual Machine in Raw File (VMDK Format)

**Introduction**

If you wish to restore the VM to another ESXi server directly without using OBM

**Pros**

- You can manually restore the VM to another ESXi server off-site without having to use OBM as the restore channel
<table>
<thead>
<tr>
<th>Cons</th>
</tr>
</thead>
<tbody>
<tr>
<td>➢ Restore procedures are relatively complicated</td>
</tr>
</tbody>
</table>
9 Method 1 - Restoring a Virtual Machine with Run Direct

Login to OBM
Log in to the OBM application according to the instructions provided in the chapter on Starting OBM.

Running Direct Restore via OBM
1. Click the Restore icon on the main interface of.

![Restore Icon]

2. Select the backup set that you would like to restore the VM from.

![Select The Backup Set To Restore]

3. Select the backup destination that contains the VM that you would like to restore.

![Select The Destination From Which To Restore...]

4. Select to restore VM from a specific backup job, or the latest job available from the Select what to restore drop down menu.

5. Select the virtual machine that you would like to restore.

Important
When performing a Run Direct restore to Alternate Location, only one VM can be selected.
If you wish to restore the VM to another Esxi server, you can restore the VM in raw file format, where the .vmdk disk format file will be included, by clicking the **Restore raw file** button at the bottom left corner. Refer to the steps in Appendix Restoring VM in VMDK format.

6. Select to restore the VM to its **Original location** (to the original ESXi host and datastore), or to an **Alternate location** (to a different VMware host or to another datastore).

7. Enable the **Run Direct** option to run the VM directly from the backup files in the backup destination. Configure the following options according to your restore requirement:

- **Auto migrate after Run Direct is running**
Enable this option to auto migrate the virtual machine to a permanent location on the original VMware host \ another VMware host \ another datastore, according to the **Restore virtual machines to** option.

<table>
<thead>
<tr>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>This will finalize the recovery of the VM; the migration will be performed right after Run Direct is running for the VM.</td>
</tr>
</tbody>
</table>

- **Auto power on after Run Direct is running**
  Enable this option to power up the virtual machine automatically, after Run Direct is running for the VM.

- **Use existing storage as VM working directory to improve performance**
  Enable this option to enhance performance of the restored VM. Click **Next** to proceed when you are done with the settings.

8. This step applies only for restoring to **Alternate location**. For restoring to **Original location**, skip to step 10.

Enter the VMware host and access information of where you would like the VM to be restored to.

i. For restoration to another VMware ESXi host, select **Version VMware ESXi 4 / 5 / 5.5 / 6 / 6.5**, then enter the **Password** of the root account, **Host**, **Port** and **SSH Port** of the new / original host.

![Alternate location](image)

ii. For restoration to another VMware vCenter setup, enter the **Password** of the administrator account, **Host**, and **Port** information.
of the new / original vCenter server.

iii. Press **Next** to proceed when you are done with the settings.

iv. Enter a new **Name** for the VM, then **Browse** to modify the **Inventory Location, Host/Cluster, Resource Pool** and **Storage** settings, according to where you would like the VM to be restored to.
v. Click **Next** to proceed when you are done with the settings.

9. Select the temporary directory for storing temporary files, then click **Restore** to start the restoration.

10. When restoring your guest VM to another VMware host, the following message will be prompted. Since each virtual machine is automatically assigned a universally unique identifier (UUID), a new UUID must be created when you restore the guest VM to another host because it is not possible to have two identical UUID running at the same time. Therefore, make sure you click **Yes** when you see the prompt below.
11. The following screen shows when the VM has been restored successfully.
Verifying Run Direct Restore Connection

When a run direct restore is initiated, the following steps are taken at the backend.

- **Create NAS datastore**
  The backup destination is turned into a NFS (also known as NAS) datastore

- **Mount VM on Esxi Server**
  The NFS datastore is mounted on the Esxi Server

- **Create Virtual Machine Snapshot**
  A snapshot of the virtual machine is created. All changes made during Run Direct is taken place will be stored temporarily in this snapshot, and the changes will not be committed to the virtual machine until a migration is done.

- **Power on Virtual Machine**
  The virtual machine is being powered on so it can be run directly from the backup files.

Check the following items to verify if the run direct restore connection has been established between the backup destination and the VMware host.

- The following screen with the text **Restore Completed Successfully** displayed in your OBM.
You should also be able to see the restored VM being run directly from the backup files in the backup destination.

---

**Notes**

- Do not exit from the OBM application when a Run Direct restored VM is still running. Run Direct must be stopped (e.g. by finalizing recovery of the VM or stopping the VM) before exiting OBM.
- When the restored VM is starting up, there may be an error screen prompted to alert you that Windows was not shut down properly. This message shows as a result of the VM’s runtime status not being backed up. You may simply select to start up Windows as normal to proceed with the startup.
Manage Run Direct VM

Manage a Run Direct restored virtual machine, by finalizing the VM recovery (e.g. migrating it to a permanent location on the VMware host), or stop the virtual machine when it is no longer needed.

1. Click the **Restore** icon on the main interface of OBM.

2. Click **Manage Run Direct virtual machines** to manage all Run Direct virtual machines.
Finalize VM Restore

To finalize recovery of a VM, migrate it to a permanent location on the VMware host:

1. Select the backup set which contains the Run Direct VM that you would like to finalize.

2. Click Browse to select the datastore where you would like to migrate the VM to.

3. Click Migrate Virtual Machine to start the migration process.

Note

For VM on ESXi host, the VM may be suspended temporarily during the migration process. The downtime of the VM should be minimal.

Stop Run Direct VM

To stop all virtual machines, or individual virtual machine that is running with the Run Direct feature:
1. Click **Stop all Run Direct virtual machines** to stop all VMs that are currently running with the Run Direct option.

   Alternatively, select the backup set which contains the VM that you would like to stop.

2. Click **Stop Run Direct** to the VM.
10 Method 2 - Restoring a Virtual Machine without Run Direct

Login to OBM
Login to the OBM application according to the instruction provided in the chapter on Starting OBM.

VM Restore without Run Direct

1. Click the Restore icon on the main interface of OBM.

2. Select the backup set that you would like to restore the VM from.

3. Select the backup destination that contains the VM that you would like to restore.

4. Select to restore VM from a specific backup job, or the latest job available from the **Select what to restore** drop down menu.
5. Select the virtual machine that you would like to restore.

6. Select to restore the VM to its **Original location** (to the original ESXi host and datastore), or to an **Alternate location** (to a different VMware host or to another datastore).

7. Disable **Run Direct**.

8. Click **Next** to proceed.
9. This step applies only for restoring to **Alternate location**. For restoring to **Original location**, skip to step 10.

   i. Enter the VMware host and access information of where you would like the VM to be restored to.

   ➢ For restoration to another VMware ESXi host, select **Version VMware ESXi 4 / 5 / 5.5 / 6, 6.5**, then enter the **Password** of the root account, **Host**, **Port** and **SSH Port** of the new / original host.

   ![Alternate location](image1.png)

   ➢ For restoration to another VMware vCenter setup, enter the **Password** of the administrator account, **Host**, and **Port** information of the new / original vCenter server.

   ![Alternate location](image2.png)

   ii. Click **Next** to proceed when you are done with the settings.
iii. Enter a new Name for the VM, then Browse to modify the Inventory Location, Host/Cluster, Resource Pool and Storage settings, according to where you would like the VM to be restored to.

iv. Click Next to proceed when you are done with the settings.

10. Select the temporary directory for storing temporary files.

1. Enter a new Name for the VM, then Browse to modify the Inventory Location, Host/Cluster, Resource Pool and Storage settings, according to where you would like the VM to be restored to.

2. Click Next to proceed when you are done with the settings.

3. Select the temporary directory for storing temporary files.
11. When restoring your guest VM to another VMware host, the following message will be prompted. Since each virtual machine is automatically assigned a universally unique identifier (UUID), a new UUID must be created when you restore the guest VM to another host because it is not possible to have two identical UUID running at the same time. Therefore, make sure you click **Yes** when you see the prompt below.

![Restore](image)

12. The following screen shows when the VM has been restored successfully.

![Restore](image)

**Note**

When the restored VM is starting up, there may be an error screen prompted to alert you that Windows was not shut down properly. This message shows as a result of the VM’s runtime status not being backed up. You may simply select to start up Windows as normal to proceed with the startup.
11 Method 3 - Restoring a Virtual Machine in Raw File (VMDK Format)

Restoring a VM in VMDK format

Since OBM v7.11.0.0, we have introduced a new feature to enable guest VMs that are backed up in VDDK mode to be restored in VMDK raw file format. This feature is useful if you wish to restore the backed up VM to another ESXi server even without using the OBM.

**IMPORTANT**

Restoring guest VMs from VDDK to VMDK format only supports backup sets that are created in OBM v7.9.0.0 or later version. Backup sets created with OBM before v7.9.0.0, or VMware VDDK backup sets migrated from v6 are **NOT** supported.

Follow the steps below for details.

1. Click the **Restore** icon on the main interface of OBM.

2. Select the backup set that you would like to restore the VM from.
3. Select the backup destination that contains the VM that you would like to restore.

4. Select to restore VM from a specific backup job, or the latest job available from the Select what to restore drop down menu.

5. Select the virtual machine that you would like to restore in .vmdk format, then click the Restore raw file checkbox at the bottom left corner. It is possible to select multiple VM to restore in .vmdk format.
6. Select a location where you wish to restore the VM to. Click **Browse** to select a location and the click **Next** to confirm.

![Choose Where The Virtual Machines To Be Restored](image1.png)

7. Select a temporary directory for storing restore files.

![Temporary Directory](image2.png)

8. Click **Restore** to start the VM restore.

9. Open the folder where you have the VM restored. Check whether the .vmdk file has been successfully restored.

![Folder with VM files](image3.png)
10. Open the VMware vSphere agent and log in to the Esxi server you wish to restore the VM to.

11. Click on the VM machine’s name at the top, then look for the **Summary** tab on the right.
12. Right click on the Datastore where you wish to deploy the restored VM to, then click Browse Datastore…

13. Right click on the right panel to open a new folder for uploading the VM you are going to import.
14. Open the newly created folder then click the Upload Folder option at the top menu bar to select the VM you wish to restore.

15. Open the folder you have just uploaded, then right click on the .vmx file and click on **Add to Inventory**.

16. Follow the screen prompts and name the imported VM and confirm the resource pool. You should see the imported VM display on the left on the main page of vSphere if the VM has been successfully imported to the ESXi server.
17. Right click on the newly imported VM and then click Power On to turn it on.

18. Select I Copied It and then click OK to confirm if you see this screen.