Virtual Infrastructure Backup Engine (VIBE) User Guide

Version 1.0.11

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Introduction

NetApp is the premier storage provider for virtualization environments today, allowing customers the ability to store and manage their virtual information in an efficient, organized manner. With the explosive adoption of virtualization solutions from companies such as VMware, the need for creating consistent backups of these data sets is crucial to a customer's business continuity strategy.

VIBE provides the ability to take consistent snapshot-based backups of virtual machines in a VMware Datastore. This type of solution can be integrated with a task scheduler to allow for regularly scheduled backups intervals based on a customer's overall backup strategy. The combination of consistent virtual machine (VM) snapshots with NetApp snapshot functionality provides a solid business continuity solution for VMware environments.

This document is intended to show you how to appropriately test and use VIBE in combination with a properly configured NetApp storage system implementation.

NOTE: VIBE is not intended as a replacement for SnapManager for Virtual Infrastructure (SMVI), NetApp's premier backup and restore solution for VMware environments. Customers looking for a fully supported solution should look to SMVI for their backup and restore needs.

VIBE Limitations

This section describes the implementation limitations of VIBE as well as configuration requirements. Note that VIBE is not intended as a replacement for any similar SnapManager products from NetApp. In addition, VIBE is not supported through the traditional NetApp support process -- please engage NetApp Professional Services for enhancements and updates as needed.

Operating System Limitations

VIBE in executable form is intended for all versions of Microsoft Windows XP and Windows Server 2003. No claim is made as to proper functionality on any non-Windows platforms. Although VIBE was originally built as a Perl script, it was converted into an executable to allow for easier use in Windows environments. Any use of the VIBE executable outside of Windows XP or Windows Server 2003 is not supported.

VIBE in script form is supported on platforms that have the following Perl configurations:

- Perl version 5.6.1 or higher;
- Perl modules for compatibility;
    - Crypt::CBC
    - Net::Ping
    - Getopt::Long
    - File::Path
    - Term::ReadKey
    - Socket
    - Net::hostent
    - File::Basename
    - FileHandle
    - Mail::Sendmail
    - XML::LibXML
- VI Perl Toolkit 1.6, available through VMware (older or newer versions may not be supported);
    - VMware::VIM25Runtime
    - VMware::VILib
- NetApp ONTAP ZAPI Perl modules (optional; if not available, `--protocol rsh` or `--protocol ssh` must be used)
    - NaServer
    - NaErrno
- Windows systems require additional logging modules:
    - Win32::EventLog
    - Win32::EventLog::Message
    - Win32::TieRegistry
- UNIX systems require additional logging modules:
    - Log::Dispatch
    - Log::Dispatch::Syslog

Any and all updates to VIBE in executable or script form will be available through NetApp Professional Services. Please contact your local NetApp professional services contacts for more details on the latest version of VIBE, or for a fully supported solution, contact your NetApp sales representatives for more information on SnapManager for Virtual Infrastructure (SMVI).

VMware Configuration Limitations

VIBE is supported for use with ESX Server versions 3.0.2 and 3.5. Earlier or newer versions of ESX server are not tested or supported at this time. Additionally, a Virtual Center must be installed and configured properly with the Datastores and VMs for VIBE to work properly, since all VMware API calls are made to the Virtual Center directly. It

is strongly recommended to run with the most recent patch levels of ESX to properly work with datastores on NetApp storage.

NetApp Limitations

VIBE is supported with Data ONTAP versions 7.2 and higher. Earlier versions of Data ONTAP are not tested and may not work properly. In addition, it is recommended that VIBE users follow the VMware ESX on NetApp storage best practice standards provided in TR3428 (http://www.netapp.com/us/library/technical-reports/tr-3428.html) when creating their configurations.

VIBE is **not** supported through NetApp's Technical Support Center (TSC). Support is only provided through NetApp Professional Services on a services engagement basis. Customers looking for a fully supported solution should look to SnapManager for Virtual Infrastructure (SMVI) for their backup and restore needs.

Installation

VIBE in script form can be installed in any location on a server where other system applications are stored. VIBE in executable form can also be installed in any location on a Windows operating system, although it is recommended to use the VIBE MSI installer package and install VIBE and associated files into your `Program Files\NetApp\VIBE` directory, which is the traditional installation location for the VIBE installation package.

To properly enable the use of the `--restore` option or the `--protocol ssh` option, you must install a valid SSH client application on the server you are running VIBE. Most modern UNIX operating systems have SSH built-in, but Windows does not. One possible package to use is OpenSSH for Windows, available from SourceForge on the Internet. OpenSSH for Windows provides the ability to generate SSH keys (`ssh-keygen`) as well as a command-line version of SSH similar to that found on newer UNIX systems. Other SSH tools such as `plink.exe` can provide similar functionality.

Runtime Operation

Running VIBE can be run from a command line or configured as a scheduled job. Some options require interactive prompts depending on the configuration, so be sure to test each command line before creating a scheduled job.

To see default values available, run VIBE with the `--help` option.

General Options

VIBE is run with either the `--backup` or `--restore` option. Additional required arguments include:

- The name of the Datastore (`--ds`) or Datastores (`--dsset`). If a single Datastore is being backed up (which includes all VMs on that Datastore), the hostname or IP address must be entered with the `--saip` option as well as the username to authenticate as with the `--sauser` option.
- The hostname/IP address and username on the Virtual Center (`--vcip`, `--vcuser`). Since Virtual Center is a requirement, these are mandatory options.
- The hostname/IP address and username of the NetApp storage system (`--saip`, `--sauser`).
- If multiple clusters are being managed by the same Virtual Center, it is highly advisable to use the `--cluster` option to specify the specific cluster you are testing against. If you do not use the cluster option to specify the appropriate Cluster Compute Resource, backups and restores may not find the correct Datastore location.

Note that if the `--dsset` option is used, the `--ds` and `--saip` options cannot be used, as they are part of the Datastore and storage appliance set pairs.

Configuration Files

VIBE has the ability to circumvent using command line options with the `--config` option. The `--config` option takes a filename as an argument. The file holds all the values traditionally used on the command line, but allows for better batch processing.

Command line values can still be used, but any matching configuration file option will override the command line option. In addition, values in the configuration file do not use the `--` prefix.

One possible configuration file for a backup job would look like the following:

```
# VIBE Backup Configuration File
# ------------------------------
# These are the configuration options needed for a backup job.
# Configure these based on your custom needs.

# GENERAL OPTIONS
# You have to define either 'backup' or 'restore' for any job.
#
# Examples:
# restore
#
# Or:
# backup
backup

# VIRTUAL CENTER INFORMATION
# Virtual Center values include the hostname/IP address, the
```

```
# username and password (if you want it in plain text).
#
# Examples:
# vcpasswd=mypasswd
# vcip=10.1.4.30
# vcuser=administrator
vcip=10.1.4.30
vcuser=administrator

# STORAGE APPLIANCE INFORMATION
# Storage appliance variables include the username and password.
# Entering IP addresses is part of specifying the Datastores
# below.
#
# Examples:
# sapasswd=mypasswd
sauser=root

# DATASTORE/STORAGE APPLIANCE INFORMATION
# Here you need to place your set of Datastore and IP address
# pairs depending on your backup (or restore) set.  If you are
# running VMs across multiple Datastores, you must specify
# all the Datastores necessary.  The IP address must be the
# interface that the server running VIBE will use to contact
# the storage appliance (even if the Datastore is connected
# through a different IP subnet).
#
# Examples:
# saip=10.1.2.3
# ds=myds
#
# Or:
# dsset=vol_mydsnfs:192.168.3.1.,vol_mydsvmfs:10.1.4.5
#
dsset=vol_nfs:10.1.4.20

# VIRTUAL MACHINE INFORMATION
# Virtual machines can be listed as a subset of the Datastores
# listed (so that you can specify multiple Datastores but only
# a single VM).  This lets you narrow down the VMs you want to
# back up.  In general, all VMs on the Datastores will be backed
# up.  To set a VM or set of VMs, use either 'vm' or 'vmset'.
#
# Examples:
# vm=myvm1
#
# Or:
# vmset=myvm1,myvm2,myvm3
#
vmset=test_nfs_1,test_vmfs_2

# ADDITIONAL OPTIONS:
# Put all extra options here.  You can enter verbose, debug,
# noreport, reportdir, etc., etc.  Please read the VIBE User
# Guide for more information on the possible options.
#
verbose
```

```
prevmsnapcreate="./pretest.sh"
postvmsnapdelete="./posttest.sh"
```

Virtual Machine Backup

If users wish to backup a smaller set of virtual machines, it can be accomplished with the `--vm`, `--vmset` or `--novmset` options. The `--vm` option backs up a single virtual machine, whereas the `--vmset` option is a comma-separated list of virtual machines to back up. When using the `--novmset` option, it will exclude all VMs listed from the set of VMs backed up in the Datastore.

The virtual machine list always supercedes the list of Datastores specified. If multiple Datastores are specified when backing up a set of virtual machines, only the VMs on those Datastores specified will be backed up. For example, if Datastores A, B and C are requested for backup but VMs X, Y and Z are also specified, then X, Y and Z will be quiesced with a VMware snapshot before the NetApp snapshots or Datastores A, B and C are taken.

Care should be taken when specifying multiple Datastores and VMs in a single command line to ensure proper consistency of the snapshots. For example, specifying a backup of Datastore DS1 and Datastore DS2 while also specifying a backup of virtual machine VM1 will only ensure that VM1 is consistent. Any other VMs on DS1 or DS2 will not be consistent. It is a valid backup command line but may not provide the intended results.

Restores

Various types of restores can be performed with VIBE to allow VMs or Datastores to a state associated to a given consistent snapshot. In general, users should focus on VM restores, as converting an entire Datastore can be extremely disruptive depending on how the NetApp storage system is configured. Restores use a wide variety of methods:

- VM restores on an NFS Datastore use single-file snap restore (SFSR) on the NetApp storage system, which avoids host copies and speeds restore operations.

- VM restores on a VMFS Datastore involves using FlexClone or LUN clone of the LUN contained in a specific restore snapshot, mapping that to the ESX server where the copy will occur, then using SSH into the ESX server specified with the `--hsip` option and performing a sparse-copy of the target files from the snapshot LUN to the active mounted LUN for the VM(s) specified.

- Datastore restores use volume-based snap restore (VBSR) on the NetApp storage system, which does not take into account ESX server state when the operation takes place. If this option is done, it will be disruptive to the entire volume. **For this reason, it is considered a best practice to for VMFS Datastores to separate LUNs into their own volumes to avoid restoring over other LUNs during the VBSR restore operation.**

The `--restore` option must be specified along with the `--ds` option to specify the target Datastore. Currently VIBE only allows one Datastore to be specified at a time, even if multiple VMs are restored. The restore snapshot is specified with the `--restoresnap` option. VMs are specified with either the `--vm` or `--vmset` options.

Additional options include specifying the time to validate busy snapshots for NFS VM restores (`--restoretime`, `--restoreint`) as well as the ability to run the restore operation without being prompted (`--noprompt`). Note the `--noprompt` operation for Datastore restores (not VM restores) will still prompt the user to be absolutely certain the operation is correct.

Another available option specific to NFS datastores is `--restorendmp`. This will allow NDMP (`ndmpcopy`) to be used instead of SFSR when restoring files. This option can be a much faster command than SFSR, since the copy operation does not require block evaluation between the snapshot and the active file system. This option is not the default, however, because the ONTAPI implementation of NDMP is not complete and the date checks may in some cases take longer than SFSR.

NetApp Storage System Access

Protocol access to the NetApp storage system is accomplished through either NetApp API calls or with RSH/SSH (remote shell/secure shell). The `--protocol` option uses one of the following values:

- ZAPI
  This option uses the ONTAP API and is the default. Standard ONTAP API calls are used to collect information and perform NetApp storage system commands. This option requires the use of the `--sapasswd` option.

- ZAPIAUTH
  This command also uses the ONTAP API but does not require the use of a password. In order to use this option, you must put appropriate IP address and user information into the `/etc/hosts.equiv` file on each NetApp storage system in use (this includes any SnapMirror destinations if the `--updatemir` option is used). In addition, you must also turn on the `httpd.admin.hostsequiv.enable` option on each NetApp storage system. This functionality is very similar to using RSH except the commands will always be ONTAP API based.

- RSH or SSH
  This will use standard remote shell or secure shell operations to collect information and perform NetApp storage system commands. To configure the NetApp storage system for RSH or SSH access, please review the Accessing the Storage System and Using SecureAdmin sections of the System Administration Guide for more information. Once properly configured, commands can be issued to the NetApp storage system without requiring a password, which is the behavior needed by VIBE if `--protocol rsh` or `--protocol ssh` is used.

Encrypted Passwords

Some environments may not want to use clear text passwords for commands to the Virtual Center (`--vcpasswd`) or to each NetApp storage system (`--sapasswd, --mirpasswd`). In these cases each password can be encrypted with CBC encryption so the password is obscured on the command line or configuration files.

When using encrypted passwords, VIBE users must first generate the password with the `--cryptpasswd` option. This command is run independent of a `--backup` or `--restore` command. A single prompt is generated asking for the user to enter a password for use:

```
C:\> vibe.exe --cryptpasswd
Enter password text to encrypt:
Encrypted password string to use is:
53616c7465645f5feb47fea18c437c5644bd79765059b4fcc68154d1bab87447
```

Once an encrypted password is created, it can be used as the value for the `--vccryptpasswd`, `--sacryptpasswd` and `--mircryptpasswd` options. These replace the `--vcpasswd`, `--sapasswd` and `--mirpasswd` options respectively. For example, instead of entering `--sapasswd <cleartextpassword>`, the user can specify `--sacryptpasswd <encryptedpassword>` instead.

NOTE: *As this is a two-way encryption implementation, it should in no way be considered entirely secure. Two-way encryption strategies can help avoid users from directly finding a clear text password, but users who can determine the hash value used to generate the password in the Perl code or disassembling the Windows executable could reverse the encryption process.*

NOTE: *The encryption hash used for the Perl code in the Windows installer is not the same as the one used in the Windows executable. If users are implementing both the Perl code and Windows executable, the encrypted passwords must be regenerated by the version of VIBE being run.*

Reporting

Reports are generated automatically and stored in the default report directory (see the `--reportdir` default setting specified when running VIBE with the `--help` option). The filenames are time stamped according to the local time on the server running VIBE. The report location for Windows is the Report subfolder contained in the folder where VIBE was installed. By default, the path is `C:\Program Files\NetApp\VIBE\Report`. For UNIX, the path is `/NetApp/VIBE/Report`.

There is also the ability to report only to specific locations or at specific levels. With the `--logdest` option, users can send log output to either the Event Viewer or the report log or both. The --loglevel option allows information, warning or error messages to go to the appropriate log location(s). See the Command Line Arguments section for more details on these two options.

Command Line Arguments

Field	Description
`--backup`	Configure VIBE to run a backup operation. This option is required if the `--restore` option is not specified.
`--restore`	Configure VIBE to run a restore operation. This option is required if the `--backup` option is not specified.
`--ds <str>`	The name of the Datastore to backup or restore. This can be an NFS or VMFS Datastore connected to a NetApp storage system with NFS, iSCSI or FCP. If this option is used, the `--dsset` option cannot be used.
`--dsset <ds>:<ip>,<ds>:<ip>,…`	The set of Datastores and storage appliance IP addresses for the Datastores. This allows a user to backup multiple Datastores at once with all affected VMs quiesced before the NetApp snapshots are taken. If this option is used, the `--ds` and `--saip` options cannot be used. **NOTE: The NetApp snapshots are not part of a consistency group -- they are just consistent from a VMware standpoint with all VM activity disabled.**
`--vcip <str>`	The name or IP address of the Virtual Center to run against (or ESX server in a non-Datacenter environment). This will be translated internally to specify the Virtual Center SDK URL as `https://<vcip>/sdk`. This option is required for backups and restores.
`--vcuser <str>`	The user to authenticate as on the Virtual Center. This is typically specified as Administrator or root, depending on the server used, although it can be any user that can authenticate and perform privileged operations through the VMware SDK. This option is required for backups and restores.
`--vcpasswd <str>`	The password for `--vcuser`. This option is required if running as a scheduled task, and optional (but must be entered when prompted by VIBE) when running interactively. This option cannot be used at the same time as the `--vccryptpasswd` option.

--vccryptpasswd <str>	The encrypted password for --vcuser. The password is generated using the --cryptpasswd command. This option is required if running as a scheduled task, and optional (but must be entered when prompted by VIBE) when running interactively. This option cannot be used at the same time as the --vcpasswd option.
--saip <str>	The name or IP address of the NetApp storage system where the Datastore is located. If this option is used, the --dsset option cannot be used.
--sauser <str>	The user to authenticate as on the NetApp storage system as specified by --saip. This is typically specified as root, although it can be any username created on the storage system (or if using ONTAP 7.2 and domain users, the DOMAIN\username with appropriate API and/or CLI permissions. This option is required for backups and restores.
--sapasswd <str>	The password for --sauser. This option is required if running as a scheduled task and also using NetApp API-based protocols. This option cannot be used at the same time as the --sacryptpasswd option.
--sacryptpasswd <str>	The encrypted password for --sauser. The password is generated using the --cryptpasswd command. This option is required if running as a scheduled task and also using NetApp API-based protocols. This option cannot be used at the same time as the --sapasswd option.
--verbose	Print out information as VIBE is executing. By default, VIBE will only print errors and warnings.
--debug	Provide internal VIBE function names when specified. This option should only be used when debugging an internal VIBE execution problem.
--help	Print out usage information and all command line options.
--noreport	Do not create an output report. By default, reports are created and stored in the standard report directory.
--novmsnap	Do not take snapshots of VMs before taking a NetApp snapshot. This will speed up the backup process.
--reportdir <str>	Specify a new location <str> in which to store VIBE backup and restore reports.
--protocol <rsh|zapi>	Run VIBE using either RSH/SSH protocols or with NetApp API calls. When using --protocol rsh or --protocol ssh, the --sapasswd option is not required.
--rshcmd <str>	Use a specific RSH command. By default, the command rsh is used to communicate with the NetApp storage system when the rsh option is used with --protocol. If the RSH application cannot be found, the --rshcmd option can be used to specify the absolute path to the RSH executable.
--sshcmd <str>	Use a specific SSH command. By default, the command ssh is used for communicating with a NetApp storage system, but it is also a required application for running VMFS VM recovery on an ESX Server (see the --hsip option). Changing this option allows for strings such as "C:\Program Files\OpenSSH\bin\ssh.exe -o ConnectTimeout=5" to be used, which is more efficient in cases where rsh would traditionally hang.
--numkeep <#>	Change the number of NetApp snapshots to keep. The default number is 7.
--snapname <str>	Change the name of the default snapshot to <str>. This string will be appended with ".<#>" based on the number of snapshots preserved. By default, the snapshot name is VIBE_ds_snap for Datastore snapshots and VIBE_vm_snap for snapshots where a subset of VMs on the Datastore is consistent when the snapshot is taken.

--updatemir	Run a SnapMirror update operation when the backup is complete. If this option is specified but no SnapMirror relationship exists, VIBE will report a warning and a non-zero return code when completing. For this option to work properly, a correct /etc/snapmirror.conf entry must exist for the SnapMirror relationship or the SnapMirror update will not work properly.
--miruser <str>	The user to authenticate as on the SnapMirror destination. Once the SnapMirror source and destination are determined, VIBE will issue a SnapMirror update request on the SnapMirror destination. The same protocol used for the VIBE backup will be used for the SnapMirror destination. This option is required if the --updatemir option is specified.
--mirpasswd <str>	The password for --miruser. This option cannot be used at the same time as the --mircryptpasswd option.
--mircryptpasswd <str>	The encrypted password for --miruser. The password is generated using the --cryptpasswd command. This option cannot be used at the same time as the --mirpasswd option.
--noprompt	When performing a restore, do not prompt the user before recovery. This option should be used with caution as it will immediately start powering down VMs associated to the Datastore. This option does not apply when attempting a full Datastore restore since full Datastore restores can be extremely disruptive.
--restoresnap <str>	The name of the snapshot on the NetApp storage system volume associated to the Datastore. This option is required when using the --restore option.
--restoretime <str>	The amount of time to allow a NetApp storage system to finish a single-file snap restore (SFSR) operation. This option is used when restoring VMs from an NFS Datastore or VM snapshot. The default value is 3600 seconds. The valid range for <str> is 1200 to 20000 seconds. If a snapshot is still busy after all SFSR restores are complete, VIBE will wait for a specific interval (defined by the --restoreint option) and try the operation again until either an error occurs, time runs out or the snapshot is no longer busy.
--restoreint <str>	The amount of time to wait between checks to determine whether a single-file snap restore (SFSR) operation is busy or not. This option is used when restoring VMs from an NFS Datastore or VM snapshot. The default value is 30 seconds. The valid range for <str> is 5 to 600 seconds. The total time for checking for busy SFSR operations is defined by the --restoretime option.
--vm <str>	The name of the virtual machine to snapshot before backup, or the specific virtual machine to restore. If this option is used, the --vmset option cannot be used.
--vmset <str>,<str>,…	A set of virtual machines to snapshot before backup, or the specific virtual machines to restore. If this option is used, the --vm option cannot be used.
--hsip <str>	The IP address of the ESX server to perform a restore of a VMFS on. For recovery of VMs on VMFS Datastores, copies must be done directly on a ESX host system. While this information is not required for recovery of VMs on NFS Datastores, it is currently an option that must be provided for all --restore operations. In addition, this must operate with password-less authentication, so that ssh <hsip> /usr/bin/vmware -v works without requiring the user to enter a password. This option is required when using the --restore option on a VMFS Datastore.
--hsuser <str>	The username to use when logging into the ESX server with SSH (based on the --hsip option). This option is required when using the --restore option on a VMFS Datastore.

`--deletetempsnap`	Delete the temporary snapshot taken during the restore process. By default, the restore snapshot is not deleted. This option is only valid when the `--restore` option is used.
`--noping`	Do not attempt to ping either the storage appliances or the Virtual Center. By default VIBE will attempt to ping the target devices to ensure they are up and running before any backup or restore operation. This may be needed, however, in some environments where ICMP traffic is not routed.
`--svpri`	The presence of the `--svpri` flag will cause a `snapvault snap create` command or ZAPI equivalent to be issued for the volumes containing Datastores being backed up. The snapshot basename specified in the `--snapname` argument must be the same as the snapshot name configured with the `snapvault snap sched` command on the SnapVault primary storage appliance volumes. When `--svpri` is used, VIBE does not perform any snapshot rotation or deletion since those tasks are controlled by the `snapvault snap sched` settings on the SnapVault primary appliance volumes. In order for this option to function correctly, the `snapvault snap sched` snapshot creation schedule with a correct snapshot basename must be pre-configured on all volume(s) containing Datastores to be backed up by VIBE. In addition, a SnapVault transfer schedule needs to be configured on the SnapVault secondary storage system volumes since VIBE does not trigger any SnapVault updates.
`--prevmsnapcreate <cmd>` `--postvmsnapcreate <cmd>`	These options allow VIBE to run an external shell command before any VM and storage appliance snapshots are taken. There are many uses for this operation -- for example, some users may want to send commands to their guest OS VMs before the snapshots take place. Other possibilities include notification to SNMP servers, log incrementals, or simply running additional guest OS scripts. For consistency purposes, `--prevmsnapcreate` runs the command before the VMware snapshot is taken and `--postvmsnapcreate` runs the command after the VMware snapshot. If a non-zero value is returned from `<cmd>`, VIBE will issue a warning but will not terminate. If a zero value is returned, no message will be displayed.
`--prevmsnapdelete <cmd>` `--postvmsnapdelete <cmd>`	Similar to the `--prevmsnapcreate` and `--postvmsnapcreate` options, these options tell VIBE to run an external shell command after the VM and storage appliance snapshots take place, but before any VM snapshots are deleted. For consistency purposes, `--prevmsnapdelete` runs the command before the VMware snapshot is deleted, and `--postvmsnapdelete` runs the command after the VMware snapshot is deleted. If a non-zero value is returned from `<cmd>`, VIBE will issue a warning but will not terminate. If a zero value is returned, no message will be displayed.
`--config <file>`	Specifies a configuration file to read for the backup or restore job being run. This allows for dynamic additions of batch jobs without directly modifying the scheduled task or cron job specified. Configuration values specified do not use the `--` prefix and will always override any command line options specified.
`--logdest <str>`	The log destination for various commands. The value for this option must be specified as `file`, `eventlog` or `both`. The `file` value sends output only to the log file specified as the default filename stored in the location where `--reportdir` is located. The `eventlog` value only sends logged options to the Event Viewer or syslog output (depending on whether VIBE is run on a Windows or UNIX platform, respectively). The `both` value is the default behavior.

`--loglevel <str>`	The log threshold level to use when sending a message. The value for this option must be specified as `info`, `warning` or `error`. The `error` value only outputs error messages to the location specified by the `--logdest` option. The `warning` value sends both error and warning messages to the location specified by the `--logdest` option. The default value is `info`.
`--novmset <vm>,<vm>,..`	If a user has VMs they do not wish to backup on a datastore with many VMs, the `–novmset` option allows a user to specify the list of VMs not to backup. The advantage is a user can specify an entire datastore and create an exclusion list so that all VMs but those specified with `–novmset` are backed up.
`--cryptpasswd <str>`	Create an encrypted password using the internal CBC hash key. This will print a string to use in place of other required passwords for Virtual Center or a NetApp storage system. The value will be used for the `--vccryptpasswd`, `--sacryptpasswd` and `--mircryptpasswd` options.
`--cluster <str>`	The name of the Cluster Compute Resource to use when there are multiple Clusters managed by a single Virtual Server. This is not a mandatory option but should always be used when multiple Clusters are managed by a single Virtual Center.
`--restorendmp`	On NFS restores, use NDMP instead of SFSR for copying contents from snapshot directories into each VM directory. This option may be much faster for some restore environments but not all. The default is to use SFSR for restores on NFS datastores.

Return Codes

VIBE will return an error code of 0 if the backup or restore operation is successful. VIBE will return a 1 if the backup or restore operation ran to completion but there were warnings or errors along the way, such as conditions where VMs could not be quiesced before taking a NetApp snapshot, or not being able to take a NetApp snapshot due to space or permissions. Please review the report logs for additional information on the success or failure of any given operation.

The following is the set of possible error codes:

Value	Description
0	Operation completed successfully without warning or error.
1	Operation completed successfully but warnings or errors occurred. Please review the VIBE log output for more information.
2	Bad command line options were specified. Review the VIBE User Guide or the output to the `--help` option for command line assistance.
3	Virtual Center SDK view information is not available. Please review the Virtual Center SDK and API configuration for more details, including the report log.
4	No virtual machines were found on the Datastore specified. Check to make sure there is at least one VM on the Datastore.
5	The Datastore specified does not exist on the ESX server. Please check to make sure the name specified with the `--ds` option is correct.
6	A VM snapshot creation process failed for one or more VMs (and the entire process was unrecoverable). Please review the report log for more details.
7	A VM snapshot removal process failed for one or more VMs (and the entire process was unrecoverable). Please review the report log for more details.
8	A ping request to a hostname or IP address did not respond correctly. Please review the report log for more details.
9	A NetApp API call for LUN queries and snapshot operations did not succeed. Please review the report log for more details about which operation did not run properly.
10	The Datastore specified is VMFS-based, and the LUN on the NetApp storage system associated to that Datastore could not be found. Confirm the Datastore specified is correct and the `--saip` option points to the NetApp storage system which has the LUN for that Datastore.

11	A NetApp API initialization call failed. Confirm the `--sauser` and `--sapasswd` options are correct, and that you are running at least version 7.1 of Data ONTAP.
12	The RSH command (either the default or the one specified with the `--rshcmd` option) failed. Confirm that RSH or SSH works properly against the NetApp storage system without requiring a password prompt.
13	The report directory could not be created. Verify the `--reportdir` option is correct and that the directory can be made properly. Also make sure the report directory is writable for the user running VIBE.
14	No command line arguments were specified, or there was a parsing error for the command line arguments. Run VIBE with only the `--help` option for more option information.
15	One or more Perl modules needed for VIBE (when running in script form) does not exist on the server. Please load the modules in order to run properly.
16	Login to the Virtual Center failed. This can be due to a number of reasons -- firewall settings to the Virtual Center, incorrect username and password (`--vcuser` and `--vcpasswd` options, respectively), an improperly configured Virtual Center or the IP address or hostname passed in with the `--vcip` option does not point to a Virtual Center to begin with.
17	The test of the SSH command failed. Verify the SSH command exists on the local server where VIBE is being run, or if not, add the `--sshcmd` option to specify the absolute path to where the SSH command is located.
18	One or more steps of the restore operation failed. Review the log for which portion of the restore failed, paying attention to any errors or warnings with ONTAP API or Virtual Center calls. VIBE cleans up after itself if a warning or error occurs, but if there were problems with clean-up, manual interaction may be required.
19	If this error appears, the user interrupted the script (either manually or through Task Manager or process kills). Determine who terminated the script and under what conditions the interrupt left the state of the backup or restore operation.
20	The host system specified with the `--hsip` option is not listed in the set of ESX servers for the Virtual Center specified (with the `--vcip` option). Confirm the IP address is associated to an ESX server.

Example Operations

The following is a set of example operations that display possible execution options with VIBE in executable form (although the Perl script can be substituted for the executable). Use the version most appropriate to your environment.

- Backup Datastore leopard with SSH, 12 snapshots to keep, print output to the screen:
  - `vibe.exe --backup --ds leopard --vcip 192.168.1.1 --vcuser administrator --vcpasswd root --saip 192.168.1.10 --sauser root --sapasswd root --numkeep 12 --protocol rsh --rshcmd "ssh -o ConnectTimeout=5" --verbose`

- Backup Datastore iguana with NetApp API, update the SnapMirror destination at the end of the backup operation:
  - `vibe.exe --backup --ds iguana --vcip 192.168.1.1 --vcuser administrator --vcpasswd root --saip 192.168.1.10 --sauser root --sapasswd root123 --updatemir --miruser root --mirpasswd root456`

- Backup Datastore rabbit with RSH, change the prefix to myVMsnapshots, add debug information to the report:
  - `vibe.exe --backup --ds rabbit --vcip 192.168.1.1 --vcuser administrator --vcpasswd root --saip 192.168.1.10 --sauser root --sapasswd root --snapname "myVMsnapshots" --debug`

- Backup Datastore hamster with SSH, do not create a report:
  - `vibe.exe --backup --hamster --vcip 192.168.1.1 --vcuser administrator --vcpasswd root --saip 192.168.1.10 --sauser root --sapasswd root --noreport`

- Restore VM kitty on VMFS Datastore cheetah using ZAPI on a Windows server:
  - `vibe.exe --restore --vcip 192.168.1.1 --vcuser administrator --saip 192.168.1.10 --sauser root --ds cheetah --hsip 192.168.1.240 --hsuser root --vm kitty --sshcmd "C:\Program Files\OpenSSH\bin\ssh.exe"`

Troubleshooting

VIBE Script Errors

If there are any VIBE execution errors, save the output and report the information to your NetApp Professional Services Engineer for further analysis. If the problem is reproducible, re-run the operation with the `--debug` option to save function information in the report log. Sample debug output looks similar to the following:

```
runCheckArgs(): WARNING: --miruser not defined on command line.  Defaulting to -
-sauser (root).
runCheckArgs(): Command line arguments successful.
runLogin(): Attempting to ping Storage Appliance 10.58.37.20 ...
runLogin(): ERROR: Cannot ping --saip named 10.58.37.20: No route to host
```

Restore Errors

When performing a restore, VIBE requires that a VM of the same name on the same datastore exists in order to restore the files from the NetApp snapshot. It is important to have a VM created exactly the same as the previous VM, including capitalization. Future versions of VIBE may change the behavior and make a stub VM for restore purposes, but currently a VM of the same name is required to exist.

Additionally, restores on NFS datastores utilize SFSR (single-file snap restore), which means a snapshot restore license must exist on the NetApp controller. VMs are currently restored on a one-by-one basis, so the process can be slower than expected. Multiple VIBE restore jobs can be launched at once to more quickly restore a set of VMs.

For VMFS datastore restore operations, the **LVM.EnableResignature** in the environment **must** be set to **1**. This is to allow the snapshot datastore (in the form of a LUN in a volume on a NetApp controller) to be discovered and so the virtual machine contents in the snapshot datastore can be copied to the active datastore.

Shell (SSH, RSH) Errors

If there are any shell execution errors, confirm that shell access works as expected. If using the `--protocol rsh` option, attempt to use RSH to run commands against the storage system or ESX server directly:

```
C:\> rsh <host> -l <username> version
```

If you are prompted for a password, appropriate authentication rights for RSH have not been enabled. Confirm the `rsh.enable` option is turned on for the NetApp storage system, and also confirm the IP address and username are properly stored in the `/etc/hosts.equiv` file on the NetApp storage system. To confirm which users are attempting to gain access, login to the NetApp storage system via command line and view console messages for failures.

If you are establishing a scheduled task with Windows Scheduled Tasks, cron, etc., then make sure the shell environment for running VIBE matches the user running the task. If you are entering a user to run VIBE into Windows Scheduled Task, for example, then open a Command Prompt and run:

```
C:\> runas /user:<myuser>\<mydomain> cmd
```

From this new Command Prompt window, verify that VIBE works as expected. If not, check the SET output to make sure other variables such as %HOME% or other custom parameters do not conflict with running VIBE. If running

VIBE with RSH works correctly from this Command Prompt window, the user should be able to successfully run VIBE from a scheduled task.

If you are using the `--protocol ssh` option you will need to properly configure SSH on the Windows server as well as on the NetApp storage system. For the Windows server, load OpenSSH (or another SSH command line client) and generate a new SSH key for use:

```
C:\Program Files\OpenSSH\bin> ssh-keygen -b 1024 -t rsa
```

Do not enter a passphrase (simply hit <ENTER>) when creating a new key.

Next, configure SSH on the NetApp storage system with the secureadmin command:

```
    netappstorageserver> secureadmin setup -f ssh
    SSH Setup
    ---------
    Determining if SSH Setup has already been done before...yes
    You have chosen to re-run SSH Setup. The old host keys will be
    backed up to the following files:
        /etc/sshd/ssh_host_key.200711201220
        /etc/sshd/ssh_host_rsa_key.200711201220
        /etc/sshd/ssh_host_dsa_key.200711201220
    Do you want to proceed? [no] yes

    SSH server supports both ssh1.x and ssh2.0 protocols.

    SSH server needs two RSA keys to support ssh1.x protocol. The host key is
    generated and saved to file /etc/sshd/ssh_host_key during setup. The server
    key is re-generated every hour when SSH server is running.

    SSH server needs a RSA host key and a DSA host key to support ssh2.0
protocol.
    The host keys are generated and saved to /etc/sshd/ssh_host_rsa_key and
    /etc/sshd/ssh_host_dsa_key files respectively during setup.

    SSH Setup will now ask you for the sizes of the host and server keys.
        For ssh1.0 protocol, key sizes must be between 384 and 2048 bits.
        For ssh2.0 protocol, key sizes must be between 768 and 2048 bits.
        The size of the host and server keys must differ by at least 128 bits.

    Please enter the size of host key for ssh1.x protocol [768] :1024
    Please enter the size of server key for ssh1.x protocol [512] :768
    Please enter the size of host keys for ssh2.0 protocol [768] :1024

    You have specified these parameters:
        host key size = 1024 bits
        server key size = 768 bits
        host key size for ssh2.0 protocol = 1024 bits
    Is this correct? [yes] yes

    Setup will now generate the host keys. It will take a minute.
    After Setup is finished the SSH server will start automatically.

    Tue Nov 20 12:21:00 EST [truanap0001: secureadmin.ssh.setup.success:info]:
SSH setup
```

```
        is done and ssh2 should be enabled. Host keys are stored in
/etc/sshd/ssh_host_key,
        /etc/sshd/ssh_host_rsa_key, and /etc/sshd/ssh_host_dsa_key.
```

Finally, find the `id_rsa.pub` in the Documents and Settings\<username> folder on the Windows server and copy the contents into the keys file onto the NetApp storage system (`/etc/sshd/root/.ssh/authorized_keys` -- if the file or path does not exist, create it via CIFS or contact NetApp support for more assistance).

When SSH is working properly, you will be able to run without a password:

```
C:\Program Files\OpenSSH\bin> ssh.exe <host> -l <username> version
```

If you are not prompted for a password and see the NetApp storage system ONTAP version, SSH is configured properly.

You will also need to perform the same SSH setup on the ESX server (which involves also opening up SSH client firewall access). To open firewall access run `esxcfg-firewall -e sshClient` to allow SSH client access. In addition, you will need to add the contents of the `id_rsa.pub` file in the Documents and Settings\<username> folder on the Windows server to the end of the `~root/.ssh/authorized_keys` file.

Confirm that SSH is working to the ESX server with the same command as to the NetApp storage system, but instead of version, specify `/usr/bin/vmware -v`. The version of ESX should be displayed without requiring a password prompt.

IP/Hostname Mismatch Errors

There are some VMware environments that use isolated networks to connect to NFS datastores. These NFS datastores are typically connected with an IP address. In some cases, however, VMware administrators use a hostname instead of an IP address. VIBE requires that the hostname specified can resolve to an IP address on the server running VIBE. If not, VIBE will not be able to match the IP address for the NetApp storage system to the hostname being used on the ESX servers.

To fix this, simply add in a hosts entry on each ESX server (or a entry in your DNS forward and reserve lookup maps) to associate the NetApp storage system's IP address to the hostname used on the NFS datastore connection. This will allow VIBE to be able to correlate the hostname given to a valid IP address to the NetApp storage system.

RBAC (Role-Based Access Control) Errors

VIBE can work with RBAC configurations for backup (root/administrator users should be used for restores). First, create a role that provides all the appropriate API interfaces needed for VIBE, followed by a group that uses the newly created role, and finally a user assigned to the newly created group. Remember if you are using SnapMirror, the same RBAC configuration needs to be made on the destination as well as the source:

```
      netappstorageserver> useradmin role add vibe_role -a login-http-admin,api-
snapshot-create,api-snapshot-rename,api-snapshot-delete,api-system-get-info,api-
system-cli,api-lun-list-info,api-snapshot-list-info,cli-ifconfig,api-lun-get-
serial-number
      netappstorageserver> useradmin group add vibe_group -r vibe_role
      netappstorageserver> useradmin user add vibe -g vibe_group
```

If a user already exists for using VIBE, the group for the user can be modified:

```
netappstorageserver> useradmin user modify vibe -g vibe_group
```

If the user is already in Active Directory, assign the user to the local `vibe_group` on the NetApp controllers:

```
netappstorageserver> useradmin domainuser add DOMAIN\vibeuser -g
vibe_group
```

Finally, create a role in VirtualCenter called vibe with rights to Virtual Machine - State - (create, rename, and remove snapshots). In addition, create a local user or use an Active Directory user and assign it the `vibe_role`.

Sample Report

```
[01:58:33] LOG REPORT FOR VIBE
[01:58:33] ----------------------------------------------------
[01:58:33] VIBE Version: 0.5.7
[01:58:33] Log Filename: /NetApp/VIBE/Report/VIBE_20080111_015833.log
[01:58:33] Backup Start Time: Fri Jan 11 01:58:33 2008
[01:58:33] Datastore(s) selected: vol_rmatt_fcp,vol_rmatt_nfs,vol_rmatt_iscsi
[01:58:33] VM(s) selected: rmatt_fcp_1,rmatt_nfs_2,rmatt_iscsi_1
[01:58:33] VM snapshot prefix will be used (VIBE_vm_snap).
[01:58:33] Command line arguments successful.
[01:58:33] Initializing connectivity to Virtual Center and storage appliances.
[01:58:33] Converting Virtual Center hostname to IP address ...
[01:58:33] Attempting to ping Virtual Center 10.58.37.30 ...
[01:58:33] Ping of Virtual Center 10.58.37.30 successful.
[01:58:33] Testing login to Virtual Center 10.58.37.30 ...
[01:58:34] Virtual Center login successful.
[01:58:34] Attempting to ping storage appliance 10.58.37.20 ...
[01:58:34] Ping of storage appliance 10.58.37.20 successful.
[01:58:34] Attempting to ping storage appliance 10.58.37.20 ...
[01:58:34] Ping of storage appliance 10.58.37.20 successful.
[01:58:34] Attempting to ping storage appliance 10.58.37.20 ...
[01:58:34] Ping of storage appliance 10.58.37.20 successful.
[01:58:34] Testing login to storage appliance 10.58.37.20 ...
[01:58:35] Storage appliance login successful.
[01:58:35] Collecting VMware and storage appliance configuration data.
[01:58:35] Collecting LUN information ...
[01:58:35] Attempting to collect LUN serial numbers for storage appliance 10.58.37.20 ...
[01:58:35] Found LUN name /vol/vol_rmatt_fcp/vmware_fcp.1.lun, serial number:
486e57522f6f456e76465a46
[01:58:36] Found LUN name /vol/vol_rmatt_iscsi/vmware_iscsi.1.lun, serial number:
486e57522f6f456e7955746f
[01:58:36] Found LUN name /vol/vol_phil_lun2/one.lun, serial number:
486e57522f6f4547686f4550
[01:58:36] Found LUN name /vol/vol_phil_lun1/one.lun, serial number:
486e57522f6f4547686f4549
[01:58:36] Found LUN name /vol/vol_vm_ubuntu_desk/ubuntu_desk1.lun, serial number:
486e57522f6f4547686f4532
[01:58:37] Found LUN name /vol/vol_vm_lic2/lun_vm_w2k3_1, serial number:
486e57522f6f4547686f444e
[01:58:37] Found LUN name /vol/EDIVMRXRC3_TDPS_mdLog_M/M.lun, serial number:
486e57522f6f4547686f4376
[01:58:37] Found LUN name /vol/clone_vm_fedora/lun_vm_fedora_1, serial number:
486e57522f6f4547686f4439
[01:58:37] Found LUN name /vol/EDIVMRXRC3_TDPS_udLog_L/lun, serial number:
486e57522f6f4547686f436b
[01:58:38] Found LUN name /vol/EDIVMRXRC3_edivmrxrc2_dr_f/edivmrxrc2_dr_f.lun, serial
number: 486e57522f6f4547686f4363
[01:58:38] Found LUN name /vol/EDIVMRXRC3_edivmrxrc2_dr_e/edivmrxrc2_dr_e.lun, serial
number: 486e57522f6f4547686f4355
[01:58:38] Found LUN name /vol/EDIVMRXRC3_edivmrxrc1_dr_f/edivmrxrc1_dr_f.lun, serial
number: 486e57522f6f4547686f4336
[01:58:38] Found LUN name /vol/EDIVMRXRC3_edivmrxrc1_dr_g/edivmrxrc1_g.lun, serial
number: 486e57522f6f4547686f4345
[01:58:39] Found LUN name /vol/EDIVMRXRC3_edivmrxrc1_dr_e/edivmrxrc1_dr_e.lun, serial
number: 486e57522f6f4547686f4276
```

```
[01:58:39] Found LUN name /vol/EDIVMRXRC2_PACS_Image1/e.lun, serial number:
486e57522f6f4547686f4266
[01:58:39] Found LUN name /vol/EDIVMRXRC2_Test/f.lun, serial number:
486e57522f6f4547686f426d
[01:58:39] Found LUN name /vol/EDIVMRXRC1_Test/g.lun, serial number:
486e57522f6f4547686f4261
[01:58:40] Found LUN name /vol/EDIVMRXRC1_PACS_Log1/f.lun, serial number:
486e57522f6f4547686f4255
[01:58:40] Found LUN name /vol/EDIVMRXRC1_PACS_Data1/e.lun, serial number:
486e57522f6f4547686f424c
[01:58:40] Found LUN name /vol/edison_demo_lab_snap6hrs/vmdk1, serial number:
486e57522f6f4547686f4164
[01:58:40] Found LUN name /vol/edison_demo_lab_snap6hrs/vm_w2k3_rdm/c_drive, serial
number: 486e57522f6f4547686f4169
[01:58:41] Found LUN name /vol/clone3_w2k3/lun_vm_w2k3_1, serial number:
486e57522f6f4547686f4155
[01:58:41] Found LUN name /vol/clone_vm_Datastores/dslun1, serial number:
486e57522f6f4547686f4143
[01:58:41] Found LUN name /vol/clone_w2k3_vm/lun_vm_w2k3_1, serial number:
486e57522f6f4547686f4134
[01:58:41] Found LUN name /vol/vol_vm_fedora_1/lun_vm_fedora_1, serial number:
486e57522f6f4547686f2d74
[01:58:42] Found LUN name /vol/vol_vm_w2k3_1/lun_vm_w2k3_1, serial number:
486e57522f6f4547686f2d6f
[01:58:42] Found LUN name /vol/vol_vm_Datastores/dslun1, serial number:
486e57522f6f4547686f2d63
[01:58:42] Found LUN name /vol/vol_vm_Datastores/rdm_maps, serial number:
486e57522f6f4547686f2d6a
[01:58:42] Already collected LUN serial numbers for storage appliance 10.58.37.20 ...
[01:58:42] Already collected LUN serial numbers for storage appliance 10.58.37.20 ...
[01:58:42] Collecting virtual machine information ...
[01:58:48] Virtual machine information collected.
[01:58:48] Collecting datacenter information ...
[01:58:49] Datacenter information collected.
[01:58:49] Collecting host system information ...
[01:58:52] Host system information collected.
[01:58:52] Looking for the requested Datastore(s) ...
[01:59:01] Datastore discovered: ISO (type: NFS).
[01:59:01] Datastore discovered: vol_rmatt_nfs (type: NFS).
[01:59:01] Datastore discovered: ReplicatorX_Datastore (type: NFS).
[01:59:01] Datastore discovered: nfs_gold_image (type: NFS).
[01:59:02] Datastore discovered: nfs_vmdk (type: NFS).
[01:59:02] Datastore discovered: sata_vmware_core (type: NFS).
[01:59:02] Datastore discovered: vmware_vswap (type: NFS).
[01:59:02] Datastore discovered: esx1_internal (type: VMFS).
[01:59:03] Datastore discovered: esx2_internal (type: VMFS).
[01:59:03] Datastore discovered: vol_rmatt_fcp (type: VMFS).
[01:59:03] Requested Datastore (vol_rmatt_fcp) is available.
[01:59:03] Saving virtual machine information for rmatt_fcp_1.
[01:59:04] Saving virtual machine information for rmatt_fcp_2.
[01:59:04] Saving virtual machine information for rmatt_fcp_3.
[01:59:05] Saving virtual machine information for rmatt_fcp_4.
[01:59:05] Searching for matching disk name vmhba1:0:0 on storage appliance 10.58.37.20
...
[01:59:05] Name = vmhba1:0:0, UUID = 486e57522f6f456e76465a46.
[01:59:05] Found LUN with UUID 486e57522f6f456e76465a46, host 10.58.37.20
[01:59:05] Snapshot host: 10.58.37.20
```

```
[01:59:05] Snapshot path: /vol/vol_rmatt_fcp/vmware_fcp.1.lun
[01:59:05] Datastore discovered: ISO (type: NFS).
[01:59:05] Datastore discovered: vol_rmatt_nfs (type: NFS).
[01:59:05] Requested Datastore (vol_rmatt_nfs) is available.
[01:59:06] Saving virtual machine information for syspreped_W2K3.
[01:59:06] Saving virtual machine information for rmatt_nfs_1.
[01:59:06] Saving virtual machine information for rmatt_nfs_2.
[01:59:07] Saving virtual machine information for rmatt_nfs_3.
[01:59:07] Datastore discovered: ISO (type: NFS).
[01:59:07] Datastore discovered: vol_rmatt_nfs (type: NFS).
[01:59:08] Datastore discovered: ReplicatorX_Datastore (type: NFS).
[01:59:08] Datastore discovered: nfs_gold_image (type: NFS).
[01:59:08] Datastore discovered: nfs_vmdk (type: NFS).
[01:59:08] Datastore discovered: sata_vmware_core (type: NFS).
[01:59:09] Datastore discovered: vmware_vswap (type: NFS).
[01:59:09] Datastore discovered: esx1_internal (type: VMFS).
[01:59:09] Datastore discovered: esx2_internal (type: VMFS).
[01:59:09] Datastore discovered: vol_rmatt_fcp (type: VMFS).
[01:59:10] Datastore discovered: vol_rmatt_iscsi (type: VMFS).
[01:59:10] Requested Datastore (vol_rmatt_iscsi) is available.
[01:59:10] Saving virtual machine information for rmatt_iscsi_1.
[01:59:10] Searching for matching disk name vmhba40:0:20 on storage appliance 10.58.37.20
...
[01:59:10] Name = vmhba1:0:0, UUID = 486e57522f6f456e76465a46.
[01:59:10] Name = vmhba40:0:20, UUID = 486e57522f6f456e7955746f.
[01:59:10] Found LUN with UUID 486e57522f6f456e7955746f, host 10.58.37.20
[01:59:10] Snapshot host: 10.58.37.20
[01:59:10] Snapshot path: /vol/vol_rmatt_iscsi/vmware_iscsi.1.lun
[01:59:10] VM rmatt_fcp_1 name found, saving virtual machine ...
[01:59:10] VM rmatt_nfs_2 name found, saving virtual machine ...
[01:59:10] VM rmatt_iscsi_1 name found, saving virtual machine ...
[01:59:10] All VMs validated, reducing set of VMs to backup.
[01:59:10] Starting VIBE backup process.
[01:59:10] Executing VIBE pre-backup operations.
[01:59:10] Removing oldest snapshot with ZAPI ...
[01:59:10] Checking if snapshot VIBE_vm_snap.12 exists on vol_rmatt_fcp on storage
appliance 10.58.37.20 ...
[01:59:10] Snapshot VIBE_vm_snap.12 on vol_rmatt_fcp not found.
[01:59:10] Oldest snapshot VIBE_vm_snap.12 does not exist on vol_rmatt_fcp.
[01:59:10] Checking if snapshot VIBE_vm_snap.12 exists on vol_rmatt_vms on storage
appliance 10.58.37.20 ...
[01:59:11] Snapshot VIBE_vm_snap.12 on vol_rmatt_vms not found.
[01:59:11] Oldest snapshot VIBE_vm_snap.12 does not exist on vol_rmatt_vms.
[01:59:11] Checking if snapshot VIBE_vm_snap.12 exists on vol_rmatt_iscsi on storage
appliance 10.58.37.20 ...
[01:59:11] Snapshot VIBE_vm_snap.12 on vol_rmatt_iscsi not found.
[01:59:11] Oldest snapshot VIBE_vm_snap.12 does not exist on vol_rmatt_iscsi.
[01:59:11] Rotating snapshots with ZAPI ...
[01:59:11] Rotating snapshots named VIBE_vm_snap.# on vol_rmatt_fcp ...
[01:59:11] Checking if snapshot VIBE_vm_snap.11 exists on vol_rmatt_fcp on storage
appliance 10.58.37.20 ...
[01:59:12] Snapshot VIBE_vm_snap.11 on vol_rmatt_fcp not found.
[01:59:12] Checking if snapshot VIBE_vm_snap.10 exists on vol_rmatt_fcp on storage
appliance 10.58.37.20 ...
[01:59:12] Snapshot VIBE_vm_snap.10 on vol_rmatt_fcp found.
[01:59:12] Running ZAPI snapshot-rename 'volume' 'vol_rmatt_fcp' 'current-name'
'VIBE_vm_snap.10' 'new-name' 'VIBE_vm_snap.11' on storage appliance 10.58.37.20 ...
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[01:59:13] Checking if snapshot VIBE_vm_snap.9 exists on vol_rmatt_fcp on storage
appliance 10.58.37.20 ...
[01:59:13] Snapshot VIBE_vm_snap.9 on vol_rmatt_fcp found.
[01:59:13] Running ZAPI snapshot-rename 'volume' 'vol_rmatt_fcp' 'current-name'
'VIBE_vm_snap.9' 'new-name' 'VIBE_vm_snap.10' on storage appliance 10.58.37.20 ...
[01:59:14] Checking if snapshot VIBE_vm_snap.8 exists on vol_rmatt_fcp on storage
appliance 10.58.37.20 ...
[01:59:14] Snapshot VIBE_vm_snap.8 on vol_rmatt_fcp found.
[01:59:14] Running ZAPI snapshot-rename 'volume' 'vol_rmatt_fcp' 'current-name'
'VIBE_vm_snap.8' 'new-name' 'VIBE_vm_snap.9' on storage appliance 10.58.37.20 ...
[01:59:15] Checking if snapshot VIBE_vm_snap.7 exists on vol_rmatt_fcp on storage
appliance 10.58.37.20 ...
[01:59:15] Snapshot VIBE_vm_snap.7 on vol_rmatt_fcp found.
[01:59:15] Running ZAPI snapshot-rename 'volume' 'vol_rmatt_fcp' 'current-name'
'VIBE_vm_snap.7' 'new-name' 'VIBE_vm_snap.8' on storage appliance 10.58.37.20 ...
[01:59:16] Checking if snapshot VIBE_vm_snap.6 exists on vol_rmatt_fcp on storage
appliance 10.58.37.20 ...
[01:59:16] Snapshot VIBE_vm_snap.6 on vol_rmatt_fcp found.
[01:59:16] Running ZAPI snapshot-rename 'volume' 'vol_rmatt_fcp' 'current-name'
'VIBE_vm_snap.6' 'new-name' 'VIBE_vm_snap.7' on storage appliance 10.58.37.20 ...
[01:59:17] Checking if snapshot VIBE_vm_snap.5 exists on vol_rmatt_fcp on storage
appliance 10.58.37.20 ...
[01:59:17] Snapshot VIBE_vm_snap.5 on vol_rmatt_fcp found.
[01:59:17] Running ZAPI snapshot-rename 'volume' 'vol_rmatt_fcp' 'current-name'
'VIBE_vm_snap.5' 'new-name' 'VIBE_vm_snap.6' on storage appliance 10.58.37.20 ...
[01:59:18] Checking if snapshot VIBE_vm_snap.4 exists on vol_rmatt_fcp on storage
appliance 10.58.37.20 ...
[01:59:18] Snapshot VIBE_vm_snap.4 on vol_rmatt_fcp found.
[01:59:18] Running ZAPI snapshot-rename 'volume' 'vol_rmatt_fcp' 'current-name'
'VIBE_vm_snap.4' 'new-name' 'VIBE_vm_snap.5' on storage appliance 10.58.37.20 ...
[01:59:19] Checking if snapshot VIBE_vm_snap.3 exists on vol_rmatt_fcp on storage
appliance 10.58.37.20 ...
[01:59:19] Snapshot VIBE_vm_snap.3 on vol_rmatt_fcp found.
[01:59:19] Running ZAPI snapshot-rename 'volume' 'vol_rmatt_fcp' 'current-name'
'VIBE_vm_snap.3' 'new-name' 'VIBE_vm_snap.4' on storage appliance 10.58.37.20 ...
[01:59:20] Checking if snapshot VIBE_vm_snap.2 exists on vol_rmatt_fcp on storage
appliance 10.58.37.20 ...
[01:59:20] Snapshot VIBE_vm_snap.2 on vol_rmatt_fcp found.
[01:59:20] Running ZAPI snapshot-rename 'volume' 'vol_rmatt_fcp' 'current-name'
'VIBE_vm_snap.2' 'new-name' 'VIBE_vm_snap.3' on storage appliance 10.58.37.20 ...
[01:59:21] Checking if snapshot VIBE_vm_snap.1 exists on vol_rmatt_fcp on storage
appliance 10.58.37.20 ...
[01:59:22] Snapshot VIBE_vm_snap.1 on vol_rmatt_fcp found.
[01:59:22] Running ZAPI snapshot-rename 'volume' 'vol_rmatt_fcp' 'current-name'
'VIBE_vm_snap.1' 'new-name' 'VIBE_vm_snap.2' on storage appliance 10.58.37.20 ...
[01:59:22] Checking if snapshot VIBE_vm_snap.0 exists on vol_rmatt_fcp on storage
appliance 10.58.37.20 ...
[01:59:23] Snapshot VIBE_vm_snap.0 on vol_rmatt_fcp found.
[01:59:23] Running ZAPI snapshot-rename 'volume' 'vol_rmatt_fcp' 'current-name'
'VIBE_vm_snap.0' 'new-name' 'VIBE_vm_snap.1' on storage appliance 10.58.37.20 ...
[01:59:23] Rotating snapshots named VIBE_vm_snap.# on vol_rmatt_vms ...
[01:59:23] Checking if snapshot VIBE_vm_snap.11 exists on vol_rmatt_vms on storage
appliance 10.58.37.20 ...
[01:59:24] Snapshot VIBE_vm_snap.11 on vol_rmatt_vms not found.
[01:59:24] Checking if snapshot VIBE_vm_snap.10 exists on vol_rmatt_vms on storage
appliance 10.58.37.20 ...
[01:59:24] Snapshot VIBE_vm_snap.10 on vol_rmatt_vms found.
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[01:59:24] Running ZAPI snapshot-rename 'volume' 'vol_rmatt_vms' 'current-name'
'VIBE_vm_snap.10' 'new-name' 'VIBE_vm_snap.11' on storage appliance 10.58.37.20 ...
[01:59:25] Checking if snapshot VIBE_vm_snap.9 exists on vol_rmatt_vms on storage
appliance 10.58.37.20 ...
[01:59:25] Snapshot VIBE_vm_snap.9 on vol_rmatt_vms found.
[01:59:25] Running ZAPI snapshot-rename 'volume' 'vol_rmatt_vms' 'current-name'
'VIBE_vm_snap.9' 'new-name' 'VIBE_vm_snap.10' on storage appliance 10.58.37.20 ...
[01:59:26] Checking if snapshot VIBE_vm_snap.8 exists on vol_rmatt_vms on storage
appliance 10.58.37.20 ...
[01:59:27] Snapshot VIBE_vm_snap.8 on vol_rmatt_vms found.
[01:59:27] Running ZAPI snapshot-rename 'volume' 'vol_rmatt_vms' 'current-name'
'VIBE_vm_snap.8' 'new-name' 'VIBE_vm_snap.9' on storage appliance 10.58.37.20 ...
[01:59:27] Checking if snapshot VIBE_vm_snap.7 exists on vol_rmatt_vms on storage
appliance 10.58.37.20 ...
[01:59:28] Snapshot VIBE_vm_snap.7 on vol_rmatt_vms found.
[01:59:28] Running ZAPI snapshot-rename 'volume' 'vol_rmatt_vms' 'current-name'
'VIBE_vm_snap.7' 'new-name' 'VIBE_vm_snap.8' on storage appliance 10.58.37.20 ...
[01:59:28] Checking if snapshot VIBE_vm_snap.6 exists on vol_rmatt_vms on storage
appliance 10.58.37.20 ...
[01:59:29] Snapshot VIBE_vm_snap.6 on vol_rmatt_vms found.
[01:59:29] Running ZAPI snapshot-rename 'volume' 'vol_rmatt_vms' 'current-name'
'VIBE_vm_snap.6' 'new-name' 'VIBE_vm_snap.7' on storage appliance 10.58.37.20 ...
[01:59:29] Checking if snapshot VIBE_vm_snap.5 exists on vol_rmatt_vms on storage
appliance 10.58.37.20 ...
[01:59:30] Snapshot VIBE_vm_snap.5 on vol_rmatt_vms found.
[01:59:30] Running ZAPI snapshot-rename 'volume' 'vol_rmatt_vms' 'current-name'
'VIBE_vm_snap.5' 'new-name' 'VIBE_vm_snap.6' on storage appliance 10.58.37.20 ...
[01:59:30] Checking if snapshot VIBE_vm_snap.4 exists on vol_rmatt_vms on storage
appliance 10.58.37.20 ...
[01:59:31] Snapshot VIBE_vm_snap.4 on vol_rmatt_vms found.
[01:59:31] Running ZAPI snapshot-rename 'volume' 'vol_rmatt_vms' 'current-name'
'VIBE_vm_snap.4' 'new-name' 'VIBE_vm_snap.5' on storage appliance 10.58.37.20 ...
[01:59:31] Checking if snapshot VIBE_vm_snap.3 exists on vol_rmatt_vms on storage
appliance 10.58.37.20 ...
[01:59:32] Snapshot VIBE_vm_snap.3 on vol_rmatt_vms found.
[01:59:32] Running ZAPI snapshot-rename 'volume' 'vol_rmatt_vms' 'current-name'
'VIBE_vm_snap.3' 'new-name' 'VIBE_vm_snap.4' on storage appliance 10.58.37.20 ...
[01:59:32] Checking if snapshot VIBE_vm_snap.2 exists on vol_rmatt_vms on storage
appliance 10.58.37.20 ...
[01:59:33] Snapshot VIBE_vm_snap.2 on vol_rmatt_vms found.
[01:59:33] Running ZAPI snapshot-rename 'volume' 'vol_rmatt_vms' 'current-name'
'VIBE_vm_snap.2' 'new-name' 'VIBE_vm_snap.3' on storage appliance 10.58.37.20 ...
[01:59:33] Checking if snapshot VIBE_vm_snap.1 exists on vol_rmatt_vms on storage
appliance 10.58.37.20 ...
[01:59:34] Snapshot VIBE_vm_snap.1 on vol_rmatt_vms found.
[01:59:34] Running ZAPI snapshot-rename 'volume' 'vol_rmatt_vms' 'current-name'
'VIBE_vm_snap.1' 'new-name' 'VIBE_vm_snap.2' on storage appliance 10.58.37.20 ...
[01:59:34] Checking if snapshot VIBE_vm_snap.0 exists on vol_rmatt_vms on storage
appliance 10.58.37.20 ...
[01:59:35] Snapshot VIBE_vm_snap.0 on vol_rmatt_vms found.
[01:59:35] Running ZAPI snapshot-rename 'volume' 'vol_rmatt_vms' 'current-name'
'VIBE_vm_snap.0' 'new-name' 'VIBE_vm_snap.1' on storage appliance 10.58.37.20 ...
[01:59:35] Rotating snapshots named VIBE_vm_snap.# on vol_rmatt_iscsi ...
[01:59:35] Checking if snapshot VIBE_vm_snap.11 exists on vol_rmatt_iscsi on storage
appliance 10.58.37.20 ...
[01:59:36] Snapshot VIBE_vm_snap.11 on vol_rmatt_iscsi not found.
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[01:59:36] Checking if snapshot VIBE_vm_snap.10 exists on vol_rmatt_iscsi on storage
appliance 10.58.37.20 ...
[01:59:36] Snapshot VIBE_vm_snap.10 on vol_rmatt_iscsi found.
[01:59:36] Running ZAPI snapshot-rename 'volume' 'vol_rmatt_iscsi' 'current-name'
'VIBE_vm_snap.10' 'new-name' 'VIBE_vm_snap.11' on storage appliance 10.58.37.20 ...
[01:59:37] Checking if snapshot VIBE_vm_snap.9 exists on vol_rmatt_iscsi on storage
appliance 10.58.37.20 ...
[01:59:37] Snapshot VIBE_vm_snap.9 on vol_rmatt_iscsi found.
[01:59:37] Running ZAPI snapshot-rename 'volume' 'vol_rmatt_iscsi' 'current-name'
'VIBE_vm_snap.9' 'new-name' 'VIBE_vm_snap.10' on storage appliance 10.58.37.20 ...
[01:59:38] Checking if snapshot VIBE_vm_snap.8 exists on vol_rmatt_iscsi on storage
appliance 10.58.37.20 ...
[01:59:38] Snapshot VIBE_vm_snap.8 on vol_rmatt_iscsi found.
[01:59:38] Running ZAPI snapshot-rename 'volume' 'vol_rmatt_iscsi' 'current-name'
'VIBE_vm_snap.8' 'new-name' 'VIBE_vm_snap.9' on storage appliance 10.58.37.20 ...
[01:59:39] Checking if snapshot VIBE_vm_snap.7 exists on vol_rmatt_iscsi on storage
appliance 10.58.37.20 ...
[01:59:39] Snapshot VIBE_vm_snap.7 on vol_rmatt_iscsi found.
[01:59:39] Running ZAPI snapshot-rename 'volume' 'vol_rmatt_iscsi' 'current-name'
'VIBE_vm_snap.7' 'new-name' 'VIBE_vm_snap.8' on storage appliance 10.58.37.20 ...
[01:59:40] Checking if snapshot VIBE_vm_snap.6 exists on vol_rmatt_iscsi on storage
appliance 10.58.37.20 ...
[01:59:40] Snapshot VIBE_vm_snap.6 on vol_rmatt_iscsi found.
[01:59:40] Running ZAPI snapshot-rename 'volume' 'vol_rmatt_iscsi' 'current-name'
'VIBE_vm_snap.6' 'new-name' 'VIBE_vm_snap.7' on storage appliance 10.58.37.20 ...
[01:59:41] Checking if snapshot VIBE_vm_snap.5 exists on vol_rmatt_iscsi on storage
appliance 10.58.37.20 ...
[01:59:41] Snapshot VIBE_vm_snap.5 on vol_rmatt_iscsi found.
[01:59:41] Running ZAPI snapshot-rename 'volume' 'vol_rmatt_iscsi' 'current-name'
'VIBE_vm_snap.5' 'new-name' 'VIBE_vm_snap.6' on storage appliance 10.58.37.20 ...
[01:59:42] Checking if snapshot VIBE_vm_snap.4 exists on vol_rmatt_iscsi on storage
appliance 10.58.37.20 ...
[01:59:42] Snapshot VIBE_vm_snap.4 on vol_rmatt_iscsi found.
[01:59:42] Running ZAPI snapshot-rename 'volume' 'vol_rmatt_iscsi' 'current-name'
'VIBE_vm_snap.4' 'new-name' 'VIBE_vm_snap.5' on storage appliance 10.58.37.20 ...
[01:59:43] Checking if snapshot VIBE_vm_snap.3 exists on vol_rmatt_iscsi on storage
appliance 10.58.37.20 ...
[01:59:43] Snapshot VIBE_vm_snap.3 on vol_rmatt_iscsi found.
[01:59:43] Running ZAPI snapshot-rename 'volume' 'vol_rmatt_iscsi' 'current-name'
'VIBE_vm_snap.3' 'new-name' 'VIBE_vm_snap.4' on storage appliance 10.58.37.20 ...
[01:59:44] Checking if snapshot VIBE_vm_snap.2 exists on vol_rmatt_iscsi on storage
appliance 10.58.37.20 ...
[01:59:44] Snapshot VIBE_vm_snap.2 on vol_rmatt_iscsi found.
[01:59:44] Running ZAPI snapshot-rename 'volume' 'vol_rmatt_iscsi' 'current-name'
'VIBE_vm_snap.2' 'new-name' 'VIBE_vm_snap.3' on storage appliance 10.58.37.20 ...
[01:59:45] Checking if snapshot VIBE_vm_snap.1 exists on vol_rmatt_iscsi on storage
appliance 10.58.37.20 ...
[01:59:45] Snapshot VIBE_vm_snap.1 on vol_rmatt_iscsi found.
[01:59:45] Running ZAPI snapshot-rename 'volume' 'vol_rmatt_iscsi' 'current-name'
'VIBE_vm_snap.1' 'new-name' 'VIBE_vm_snap.2' on storage appliance 10.58.37.20 ...
[01:59:46] Checking if snapshot VIBE_vm_snap.0 exists on vol_rmatt_iscsi on storage
appliance 10.58.37.20 ...
[01:59:46] Snapshot VIBE_vm_snap.0 on vol_rmatt_iscsi found.
[01:59:46] Running ZAPI snapshot-rename 'volume' 'vol_rmatt_iscsi' 'current-name'
'VIBE_vm_snap.0' 'new-name' 'VIBE_vm_snap.1' on storage appliance 10.58.37.20 ...
[01:59:47] Quiescing and snapshotting all VMs being backed up ...
[01:59:47] Checking power state of VM rmatt_nfs_2 ...
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[01:59:47] Checking snapshot capability of VM rmatt_nfs_2 ...
[01:59:47] Creating snapshot of VM rmatt_nfs_2 ...
[01:59:50] Snapshot of VM rmatt_nfs_2 successful.
[01:59:51] Checking power state of VM rmatt_iscsi_1 ...
[01:59:52] Checking power state of VM rmatt_fcp_1 ...
[01:59:52] Checking snapshot capability of VM rmatt_fcp_1 ...
[01:59:52] Creating snapshot of VM rmatt_fcp_1 ...
[01:59:57] Snapshot of VM rmatt_fcp_1 successful.
[01:59:57] Taking storage system snapshot(s).
[01:59:57] Taking snapshot with ZAPI ...
[01:59:57] Taking snapshot VIBE_vm_snap.0 for vol_rmatt_fcp on storage appliance
10.58.37.20 ...
[01:59:57] Running ZAPI snapshot-create 'volume' 'vol_rmatt_fcp' 'snapshot'
'VIBE_vm_snap.0' ...
[01:59:58] Snapshot created successfully.
[01:59:58] Taking snapshot VIBE_vm_snap.0 for vol_rmatt_vms on storage appliance
10.58.37.20 ...
[01:59:58] Running ZAPI snapshot-create 'volume' 'vol_rmatt_vms' 'snapshot'
'VIBE_vm_snap.0' ...
[01:59:58] Snapshot created successfully.
[01:59:58] Taking snapshot VIBE_vm_snap.0 for vol_rmatt_iscsi on storage appliance
10.58.37.20 ...
[01:59:58] Running ZAPI snapshot-create 'volume' 'vol_rmatt_iscsi' 'snapshot'
'VIBE_vm_snap.0' ...
[01:59:59] Snapshot created successfully.
[01:59:59] Executing VIBE post-backup operations.
[01:59:59] Removing oldest snapshot with ZAPI ...
[01:59:59] Checking if snapshot VIBE_vm_snap.12 exists on vol_rmatt_fcp on storage
appliance 10.58.37.20 ...
[02:00:00] Snapshot VIBE_vm_snap.12 on vol_rmatt_fcp not found.
[02:00:00] Oldest snapshot VIBE_vm_snap.12 does not exist on vol_rmatt_fcp.
[02:00:00] Checking if snapshot VIBE_vm_snap.12 exists on vol_rmatt_vms on storage
appliance 10.58.37.20 ...
[02:00:00] Snapshot VIBE_vm_snap.12 on vol_rmatt_vms not found.
[02:00:00] Oldest snapshot VIBE_vm_snap.12 does not exist on vol_rmatt_vms.
[02:00:00] Checking if snapshot VIBE_vm_snap.12 exists on vol_rmatt_iscsi on storage
appliance 10.58.37.20 ...
[02:00:01] Snapshot VIBE_vm_snap.12 on vol_rmatt_iscsi not found.
[02:00:01] Oldest snapshot VIBE_vm_snap.12 does not exist on vol_rmatt_iscsi.
[02:00:01] Removing snapshots for all VMs being backed up ...
[02:00:02] Checking power state of VM rmatt_nfs_2 ...
[02:00:02] Checking snapshot capability of VM rmatt_nfs_2 ...
[02:00:02] Removing VM snapshot for VM rmatt_nfs_2 ...
[02:00:07] Removal of VM snapshot for VM rmatt_nfs_2 successful.
[02:00:07] Checking power state of VM rmatt_iscsi_1 ...
[02:00:08] Checking power state of VM rmatt_fcp_1 ...
[02:00:08] Checking snapshot capability of VM rmatt_fcp_1 ...
[02:00:08] Removing VM snapshot for VM rmatt_fcp_1 ...
[02:00:13] Removal of VM snapshot for VM rmatt_fcp_1 successful.
[02:00:13] Updating SnapMirror relationships (if any exist).
[02:00:13] Getting SnapMirror status for vol_rmatt_fcp on storage appliance 10.58.37.20
...
[02:00:13] WARNING: No snapmirror exists for volume vol_rmatt_fcp.
[02:00:13] Getting SnapMirror status for vol_rmatt_vms on storage appliance 10.58.37.20
...
[02:00:14] Issuing SnapMirror update for volume vol_rmatt_vms ...
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[02:00:14] SnapMirror source: (njdemo2, vol_rmatt_vms) => SnapMirror destination:
(njdemo2, vol_rmatt_mirr)
[02:00:16] ERROR: Cannot ping SnapMirror destination named njdemo2: Unknown error
[02:00:16] Command completed successfully.
[02:00:16] Backup End Time: Fri Jan 11 02:00:16 2008
[02:00:16]
[02:00:16] VMs Successfully Quiesced
[02:00:16] -------------------------
[02:00:16]  rmatt_nfs_2
[02:00:16]  rmatt_fcp_1
[02:00:16]
[02:00:16] VMs Which Were Not Quiesced (Powered Off or Incompatible)
[02:00:16] ------------------------------------------------------------
[02:00:16]  rmatt_iscsi_1
[02:00:16]
[02:00:16] VMs With Successful Snapshot Removal
[02:00:16] -----------------------------------
[02:00:16]  rmatt_nfs_2
[02:00:16]  rmatt_fcp_1
[02:00:16]
[02:00:16] VMs Which Were Not Issued VM Snapshot Removal Commands
[02:00:16] -------------------------------------------------------
[02:00:16]  rmatt_iscsi_1
[02:00:16]
```

Change Log

Changes 1.0.10 and 1.0.11:

- Changed the behavior of backing up datastores without any VMs. The original behavior was to simply stop if there were no VMs in the datastore. Now we simply print a message. There are some customers that pre-deploy VIBE to backup datastores and fill VMs after the fact. This takes care of that requirement.
- Cleaned up a couple of log messages based on what VIBE actually is doing when the message is printed.

Changes 1.0.9 and 1.0.10:

- Added `--cluster` option to allow users to specify a single cluster instead of an entire datacenter. This required an update to how hosts search for datastores.
- Added `--restorendmp` option to allow NDMP to be used instead of SFSR for restores on NFS datastores.
- Updated snapshot creation process to first delete the recent snapshot entry before attempting to create it. This provides an extra layer of insurance that the recent snapshot is always correct and eliminates some cleanup required when using VIBE.

Changes 1.0.8 and 1.0.9:

- Added ZAPIAUTH protocol option, which allows for RSH-style access to ONTAP API calls. It is the same as ZAPI, except access is defined on `/etc/hosts.equiv` entries.
- Added `--cryptpasswd` option to allow for two-way encryption option on passwords specified on command line.
- Added `--mircryptpasswd`, `--sacryptpasswd`, `--vccryptpasswd` which requires password generated by `--cryptpasswd`. Windows hash key is not the same as Perl version to allow for more security.
- Updated `runInterrupt()` for early interrupt cases which require `print()` instead of `logMsg()`.

Changes 1.0.7 and 1.0.8:

- Changed the behavior of return code checks of ref() details on VI Perl Toolkit SOAP faults so we don't try to validate a code that doesn't make sense and then fail on it. Some large environments will fail out if this condition is seen.

Changes 1.0.6 and 1.0.7:

- Bumped timeout values on restores to default to 60 minutes (20 minutes minimum) and a maximum of 99999 seconds.
- If we detect a timeout on restores, we establish a new VI Perl Toolkit session.

Changes 1.0.5 and 1.0.6:

- Changed VI Perl Toolkit interface to use sessions.
- If we detect a timeout on restores, we establish a new VI Perl Toolkit session.

Changes between 1.0.4 and 1.0.5:

- Modified VMware snapshot creation procedure. This change is somewhat important. We now look for previous snapshots created with VIBE leftover from a failed backup and remove them. After removing them, we create the VMware snapshot. If that fails, we try again (cleaning up first). We try three times before giving up and cleaning up. This is to handle situations where older VMware versions time out for some VMware snapshot deletions. Typical backups will not have the timeout, but for the rare case where it fails due to timeouts, the backup works as expected and the cleanup of older VIBE VMware-based snapshots prevents logs growing out of control.
- Cleaned up information messages for new SFSR delete before restore operation.
- Documentation updated with RBAC/IP address troubleshooting sections and new logo.
- Changed —protocol rsh command to map to handle all Windows configurations.

Changes between 1.0.3 and 1.0.4:

- Modified snapshot path to better reflect some environments that use SFSR but can't query paths not off the root of the volume.
- Removed `--hsuser`, `--hspasswd`, etc., requirement for restores on NFS datastores.
- Updated to use VI Perl Toolkit 1.5 (1.0 is obsolete).
- Slight performance improvements with new toolkit in query times.
- Increased timeouts for restores to allow for slower drives when SFSR is used on NFS datastores.
- Added `--novmset` option for excluding VMs for backup.
- For NFS datastore/VM restores, delete the files before calling SFSR (this is a performance improvement for restore times!)
- Correct NetApp logo included.
- Modified documentation to show Perl updates needed, timeout value changes, all options confirmed.