Recommended Host Settings for Linux Host Utilities 6.2

Recommendations for the host settings

NetApp recommends that you use certain values for host parameters when you run the Linux Host Utilities. These recommendations are based on research, working with Linux providers such as Red Hat and SUSE, and internal testing done at NetApp. The recommended values may differ depending on your system environment and the version of the operating system that you are using.

Before you set up the Linux Host Utilities, it is a good practice to check the following information:

- The *Linux Host Utilities Release Notes*, which are online on the NetApp Support Site, to see if there are any changes to these recommendations.
- The Interoperability Matrix, which is online at support.netapp.com/NOW/products/interoperability, to verify that the Host Utilities support your system setup.
- The *Linux Host Utilities Installation and Administration Guide*, which is online on the NetApp Support Site, for information about setting up and using the Host Utilities.

For detailed information on the DM-Multipath parameters, see the Red Hat documentation on the multipath.conf file. At the time this document was prepared, that information was available at

`http://docs.redhat.com/docs/en-US/Red_Hat_Enterprise_Linux/6/html/DM_Multipath/config_file_defaults.html`

This information on the multipath.conf parameters applies to both Red Hat Enterprise Linux and SUSE Linux.

Examples of multipath.conf files are included in the *Linux Host Utilities Installation and Setup Guide*.

Red Hat Enterprise Linux: Recommended default settings for DM-Multipath

The table that follows lists the recommended settings for the default section of the DM-Multipath multipath.conf file on hosts running Red Hat Enterprise Linux. In most cases, the Red Hat settings also apply to Oracle Linux. If Oracle Linux requires a different value, that value will be listed in this table.

Note

Keep in mind that the parameters and values you supply in the devices section of the multipath.conf file override the values specified in the default section of the file.

Red Hat Enterprise Linux DM-Multipath recommended default parameters		
Parameter	**Value**	**Recommendation**
`flush_on_last_del` **Supported Red Hat versions:** • RHEL 7 series, 6 series, and OL 6 series • RHEL 5 update 3 and later • RHEL 4 update 7 and later	**RHEL:** `yes`	**Red Hat Enterprise Linux:** Set this value to `yes`. The default value is `no`.
`max_fds` **Supported Red Hat versions:** • RHEL 7 series, 6 series, and OL 6 series • RHEL 5.2 and later • RHEL 4 update 7 and later	**RHEL 7 series, 6, 5.2 and later, 4.7 and later:** `max`	**RHEL 6 series, 5.2 and later, 4.7 and later**: Set this value to `max`.
`pg_prio_calc` **Supported Red Hat versions:** • RHEL 5 update 6 and later	`avg`	Set this value to `avg`.
`queue_without_daemon` **Supported Red Hat versions:** • RHEL 7 series, 6 series, and OL 6 series • RHEL 5 update 3 and later	**RHEL:** `no`	**Red Hat Enterprise Linux:** Set this value to `no`. The default value is `yes`.

Red Hat Enterprise Linux DM-Multipath recommended default parameters		
Parameter	**Value**	**Recommendation**
`user_friendly_names` **Supported Red Hat versions:** • RHEL 7 series, 6 series, and OL 6 series • RHEL 5 series and OL 5 series • RHEL 4 series	`no`	Set this value to `no`. Entering `no` forces both the host and the target to use the WWID for naming the DM-Multipath devices, which ensures that the host and the target use a consistent attribute that persists across reboots and does not require a separate mpath bindings file for naming purposes. In addition, by setting this value to `no`, you avoid some of the problems that have been seen when `user_friendly_names` is set to `yes`. There have been several Red Hat Bugzilla reports about these issues. **Note** Red Hat Enterprise Virtualization Hypervisor nodes require that you set this value to `no`.

`dev_loss_tmo`
Supported Red Hat versions:
• RHEL 7 series, 6 update 1 and later, and OL 6 series
	RHEL 6.1:
	`2147483647`
	RHEL 6.2 and later:
	`infinity`
		This parameter is turned on by default and specifies the number of seconds before a link is marked lost. The value you supply depends on your version of Red Hat Enterprise Linux.
		Red Hat Enterprise Linux 6.1: Set this value to `2147483647` seconds.
		Red Hat Enterprise Linux 6.2 and later: Set this value to `infinity`, so that the link is never lost.

`fast_io_fail_tmo` **Supported Red Hat versions:** RHEL 7 series, 6 update 1 and later, and OL 6 series	`5`	Set this value to 5. **Related parameters:** This value works with the value for `dev_loss_tmo`.

Red Hat Enterprise Linux: Recommended device settings for DM-Multipath

The table that follows lists the recommended settings for the devices section of the DM-Multipath multipath.conf file when you are running Red Hat Enterprise Linux. In most cases, the Red Hat settings also apply to Oracle Linux. If Oracle Linux requires a different value, that value will be listed in this table.

Red Hat Enterprise Linux DM-Multipath recommended device parameters

Parameter	Value	Recommendation
`failback` **Supported Red Hat versions:** • RHEL 7 series, 6 series, and OL 6 series • RHEL 5 series and OL 5 series • RHEL 4 series	`immediate`	Set this value to `immediate`. **Related parameters:** `failback` also works with `path_grouping_policy`.

`features`
 	
Supported Red Hat versions:
• RHEL 7 series, 6 series, and OL 6 series
• RHEL 5 series and OL 6 series
• RHEL 4 series
	RHEL 6.1 and later, RHEL 5.7 and later:
	
	`“3 queue if no path pg_init_retries 50"`
	
	RHEL 6.0, 5.1-5.6 and 4 series:
	
	`"1 queue_if_no_path"`
		Red Hat Enterprise Linux 6.1 and later, Red Hat Enterprise Linux 5.7 and later: Set this value to `“3 queue if no path pg_init_retries 50"`. Internal testing has shown that using this value reduces possible path failures that can occur if a delayed controller failover exceeds the default time of 60 seconds.
		
		Red Hat Enterprise Linux 6.0, Red Hat Enterprise Linux prior to 5.7: Set this value to `"1 queue_if_no_path"`.
		
		Related parameters: If you specify `path_no_retry` in the default section of the multipath.conf file, that value overrides the `features` value and could cause an operating system crash during a takeover/giveback procedure.

Red Hat Enterprise Linux DM-Multipath recommended device parameters		
Parameter	**Value**	**Recommendation**

`getuid_callout`
Supported Red Hat versions:
• RHEL 7 series
• RHEL 6 series and OL 6 series
• RHEL 5 series and OL 6 series
• RHEL 4 series
	RHEL 7 series:
	uid_attribute “ID_SERIAL”
	RHEL 6 series:
	`"/lib/udev/scsi_id -g -u -d /dev/%n"`
	RHEL 5 and 4 series:
	`"/sbin/scsi_id -g -u -s /block/%n"`
		RHEL 7 series:
		uid_attribute “ID_SERIAL”
		Red Hat Enterprise Linux 6 series: Set this value to `"/lib/udev/scsi_id -g -u -d /dev/%n"`.
		Red Hat Enterprise Linux 5 series and 4 series: Set this value to `"/sbin/scsi_id -g -u -s /block/%n"`

`hardware_handler`
Supported Red Hat versions:
• RHEL 7 series, 6 series, and OL 6 series
• RHEL 5 series and OL 6 series
• RHEL 4 series
	ALUA environments (RHEL 6 series and 5 series):
	`"1 alua"`
	Non-ALUA environments (RHEL 4 series):
	`"0"`
		Red Hat Enterprise Linux 6 series and 5 series: Set this value to `"1 alua"`.
		Red Hat Enterprise Linux 4 series: Set this value to `"0"`.
		Related parameters: This value works with the value for `prio` or `prio_callout`.

Red Hat Enterprise Linux DM-Multipath recommended device parameters		
Parameter	**Value**	**Recommendation**

`path_checker`
Supported Red Hat versions:
• RHEL 7 series, 6 series, and OL 6 series
• RHEL 5.1 and later
• RHEL 4.7 and later
	RHEL 6.1 and later, RHEL 5.7 and later:
	`tur`
	RHEL 6.0, 5.1-5.6, RHEL 4.7 and later:
	`directio`
		Red Hat Enterprise Linux 6.1 and later, Red Hat Enterprise Linux 5.8 and later: Set this value to `tur`. Internal testing has shown that using `tur` instead of `directio` improves performance. The `tur` parameter uses SG_input/output (I/O) requests that are inserted at the head of the request queue.
		The `directio` parameter uses FS block requests, which are added to the end of the request queue.
		As a result, on a busy device, the `path_checker tur` requests are serviced immediately while the `path_checker directio` must wait for the current I/O load to complete.
		Red Hat Enterprise Linux 6.0, 5.1-5.7 and 4.7 and later: Set this value to `directio`, which is the default.
		Related parameters: If you are using Red Hat Enterprise Linux 5 or 4.6 and earlier, the value for this parameter is `readsector0`.

`path_checker` **Supported Red Hat versions:** • RHEL 5 and OL 5 series • RHEL 4.6 and earlier	`readsector0`	Set this value to `readsector0`. **Related parameters:** If you are using Red Hat Enterprise Linux 5.1 and later, or 4.7 and later, the value for this parameter is `directio`.

Red Hat Enterprise Linux DM-Multipath recommended device parameters		
Parameter	**Value**	**Recommendation**
`path_grouping_policy` **Supported Red Hat versions:** • RHEL 7 series, 6 series, and OL 6 series • RHEL 5 series and OL 5 series • RHEL 4 series	`group_by_prio`	**FC only:** Set this value to `group_by_prio`. **Related parameters:** This value works with `failback`. If you are using the iSCSI protocol, see the next row for information on the value you should use.

`path_selector`
Supported Red Hat versions:
• RHEL 7 series, 6 series, and OL 6 series
• RHEL 5 series and OL 5 series
• RHEL 4 series
	RHEL 7 series, 6 series, 5 series, and 4 series:
	`"round-robin 0"`
	RHEL 7 series and 6 series also support:
	`"queue-length 0"`
	`"service-time 0"`
		RHEL 6 series, 5 series, and 4 series:
		Set this value to `"round-robin 0"`.
		RHEL 7 series:
		Set this value to `"service-time 0"`.
		This is the recommended value for all versions of Red Hat Enterprise Linux that the Host Utilities support.

`prio`
Supported Red Hat versions:
• RHEL 7 series, 6 series, and OL 6 series
	ALUA environments:
	`"alua"`
	Non-ALUA environments:
	`"ontap"`
		The recommended value is `"alua"`, which is the value required when you are using ALUA.
		Related parameters: This value works with `hardware_handler`. If you are using Red Hat Enterprise Linux 5 series or 4 series, see the next row.

Red Hat Enterprise Linux DM-Multipath recommended device parameters		
Parameter	**Value**	**Recommendation**

`prio_callout`
Supported Red Hat versions:
• RHEL 5.1 and later
• RHEL 5 series and OL 5 series
• RHEL 4 series
	ALUA environments:
	`"/sbin/mpath_prio_alua /dev/%n"`
	Non-ALUA environments:
	`"/sbin/mpath_prio_ontap /dev/%n"`
		Red Hat Enterprise Linux 5.1 and later: When ALUA is enabled, set this value to `"/sbin/mpath_prio_alua /dev/%n"`.
		Red Hat Enterprise Linux 5 series and 4 series: When ALUA is not enabled, set this value to `"/sbin/mpath_prio_ontap /dev/%n"`.
		Related parameters: This value works with `hardware_handler`. If you are using Red Hat Enterprise Linux 6 series, see the information about `prio`.

`product`
Supported Red Hat versions:
• All
	`"LUN"`	**RHEL 6.2 and earlier**:
		`"LUN"`
		RHEL 6.3 and later:
		`"LUN.*"`

`rr_min_io`
Supported Red Hat versions:
• RHEL 7 series, 6 series, and OL 6 series
• RHEL 5 series and OL 5 series
• RHEL 4 series
	RHEL 6 series, 5 series, or 4 series:
	`128`
	RHEL 7 series:
	`1000`
		RHEL 6 series, 5 series, or 4 series:
		Set this value to `128`.
		RHEL 7 series:
		Set this value to 1000
		Note
		If you are using Red Hat Enterprise Linux 4 update 7 or earlier, place `rr_min_io` in the default section of the multlipath.conf file.

Red Hat Enterprise Linux DM-Multipath recommended device parameters		
Parameter	**Value**	**Recommendation**
`rr_weight` **Supported Red Hat versions:** • RHEL 7 series, 6 series, and OL 6 series • RHEL 5 series and OL 5 series • RHEL 4 series	`uniform`	Set this value to `uniform`.
`vendor` **Supported Red Hat versions:** • All	`"NETAPP"`	This value is required for the NetApp Host Utilities product.

SUSE Linux Enterprise Server: Recommended default settings for DM-Multipath

The table that follows lists the recommended settings for the default section of the DM-Multipath multipath.conf file on hosts running SUSE Linux Enterprise Server.

Note

Keep in mind that the parameters and values you supply in the devices section of the multipath.conf file override the values specified in the defaults section of the file.

SUSE Linux Enterprise Server DM-Multipath recommended default parameters		
Parameter	**Value**	**Recommendation**
`flush_on_last_del` **Supported SUSE versions:** • SLES 11 SP1 and later	`yes`	Set this value to `yes`. The default value is `no`.
`queue_without_daemon` **Supported SUSE versions:** • SLES 11 SP2 and later	`no`	Set this value to `no`.

SUSE Linux Enterprise Server DM-Multipath recommended default parameters		
Parameter	**Value**	**Recommendation**
`max_fds` **Supported SUSE versions:** • SLES 11 SP1 and later • SLES 10 SP4	`max`	**SUSE Linux Enterprise Server 11 SP1 and later and 10 SP4:** Set this value to `max`. **Related parameters:** If you are using SUSE Linux Enterprise Server 11 or 10 SP3 and earlier, see the next row.
`max_fds` **Supported SUSE versions:** • SLES 11 • SLES 10 SP3 and earlier	`8192`	**SUSE Linux Enterprise Server 11 and 10 SP3 and earlier:** Set this value to `8192`. **Related parameters:** If you are using SUSE Linux Enterprise Server 11 SP1 or 10 SP4, see the previous row.
`user_friendly_names` **Supported SUSE versions:** • SLES 11 series • SLES 10 series	`no`	Set this value to `no`. This is the default.

SUSE Linux Enterprise Server: Recommended device settings for DM-Multipath

The table that follows lists the recommended SUSE Linux Enterprise Server settings for the devices section of the DM-Multipath multipath.conf file.

SUSE Linux Enterprise Server DM-Multipath recommended device parameters		
Parameter	**Value**	**Recommendation**
`failback` **Supported SUSE versions:** • SLES 11 series • SLES 10 series	`immediate`	Set this value to `immediate`. **Related parameters:** The value works with Path Group priorities.

SUSE Linux Enterprise Server DM-Multipath recommended device parameters		
Parameter	**Value**	**Recommendation**

`features`
Supported SUSE versions:
• SLES 11 series
• SLES 10 series
	SUSE Linux Enterprise Server 11 SP2:
	`"3 queue_if_no_path pg_init_retries 50"`
	SUSE Linux Enterprise Server 10 - 11 SP1:
	`"1 queue_if_no_path"`
		SUSE Linux Enterprise Server 11 SP2: Set this value to `"3 queue_if_no_path pg_init_retries 50"`.
		SUSE Linux Enterprise Server 10-11 SP1: Set this value to `"1 queue_if_no_path"`.
		Related parameters: If you specify `path_no_retry` in the default section of the multipath.conf file, that value overrides the `features` value and could cause an operating system crash during a takeover/giveback procedure.

`getuid_callout`
Supported SUSE versions:
• SLES 11 series
• SLES 10 series
	SLES 11 series:
	`"/lib/udev/scsi_id -g -u -d /dev/%n"`
	SLES 10 series:
	`"/sbin/scsi_id -g -u -s /block/%n"`
		SUSE Linux Enterprise Server 11 series: Set this value to `"/lib/udev/scsi_id -g -u -d /dev/%n"`.
		SUSE Linux Enterprise Server 10 series: Set this value to "/sbin/scsi_id -g -u -s /block/`%n`".

`hardware_handler`
Supported SUSE versions:
• SLES 11 series
• SLES 10 with SP4 and later
	ALUA environments:
	`"1 alua"`
	Non-ALUA environments:
	`"0"`
		ALUA environments: If you use ALUA, set this value to `"1 alua"`.
		Non-ALUA environments: If you are not using ALUA, set this value to `"0"`.
		Related parameters: This value works with `prio` or `prio_callout`.

`path_checker` **Supported SUSE versions:** • SLES 11 series • SLES 10 SP2 and later	`tur`	Set this value to `tur`.

SUSE Linux Enterprise Server DM-Multipath recommended device parameters		
Parameter	**Value**	**Recommendation**
`path_grouping_policy` **Supported SUSE versions:** • SLES 11 series • SLES 10 series	`group_by_prio`	**FC only:** Set this value to `group_by_prio`. **Related parameters:** This value works with `failback`. If you are using the iSCSI protocol, see the next row for information on the value you should use.

`path_grouping_policy`
Supported SUSE versions:
• SLES 11 series
• SLES 10 SP3 and later
• SLES 10 SP2 and earlier
	SLES 11 series, 10 SP3 and later:
	`group_by_prio`
	SLES 10 SP2 and earlier:
	`multibus`
		iSCSI only with SUSE Linux Enterprise Server 11 series and 10 SP3 and later: Set this value to `group_by_prio`.
		iSCSI only with SUSE Linux Enterprise Server 10 SP2 and earlier: Set this value to `multibus`.
		Related parameters: This value works with `failback`. If you are using the FC protocol, see the previous row for information on the value you should use.

`path_selector`
Supported SUSE versions:
• SLES 11 SP1 and later
	SUSE 11 and 10 series:
	`"round-robin 0"`
	SLES 11 SP1and later also supports:
	`"least-pending"`
	`"length-load-balancing"`
	`"service-time"`
		Set this value to `"round-robin 0"`.
		This is the recommended value for all versions of SUSE Linux Enterprise Linux Server that the Host Utilities support.

SUSE Linux Enterprise Server DM-Multipath recommended device parameters		
Parameter	**Value**	**Recommendation**

`prio`
Supported SUSE versions:
• SLES 11 series
• SLES 10 SP2 and later
	ALUA environments:
	`"alua"`
	Non-ALUA environments:
	`"ontap"`
		ALUA environments: If you use ALUA, set this value to `"alua"`.
		Non-ALUA environments: If you are not using ALUA, set this value to `"ontap"`.
		Related parameters: This value works with `hardware_handler`. If you are using SUSE Linux Enterprise Server 10 SP1 and earlier, see the next row.

`prio_callout` **Supported SUSE versions:** • SLES 10 SP1 and earlier	**Non-ALUA environments:** `"sbin/mpath_prio_ontap /dev/%n"`	**Non-ALUA environments:** If you do not use ALUA, set this value to `"sbin/mpath_prio_ontap /dev/%n"`. **Related parameters:** This value works with `hardware_handler`. If you are using SUSE Linux Enterprise Server 11 series or 10 SP2 and later, see the previous row.
`product` **Supported SUSE versions:** • All	`"LUN"`	Set this value to `"LUN"`.
`rr_min_io` **Supported SUSE versions:** • SLES 11 series • SLES 10 series	`128`	Set this value to `128`.
`rr_weight` **Supported SUSE versions:** • SLES 11 series • SLES 10 series	`uniform`	Set this value to `uniform`.

SUSE Linux Enterprise Server DM-Multipath recommended device parameters		
Parameter	**Value**	**Recommendation**
`vendor` **Supported SUSE versions:** • All	`"NETAPP"`	This value is required for the NetApp Host Utilities product.

Time-out values when using DM-Multipath

FC only: If you are using the Fibre Channel protocol, use the default values.

iSCSI only: If you are using iSCSI, you must set the following time-out value in the iSCSI configuration file in order to use DM-Multipath.

```
node.session.timeo.replacement_timeout = 5
```

Red Hat Enterprise Linux 4: For systems running Red Hat Enterprise Linux 4, you must modify the /etc/iscsi.conf to uncomment `ConnFailTimeoutof` and give it a value of `5`.

Recommendations for Veritas Storage Foundation settings

NetApp recommendations for Veritas values

When you run the Host Utilities with Veritas Volume Manager (VxVM) and Dynamic Multipathing (VxDMP), NetApp recommends that, in most cases, you use the values provided in the Veritas Release Notes. The exceptions are listed below.

Note

Check the Interoperability Matrix, which is online at support.netapp.com/NOW/products/interoperability, to see which versions of Veritas Storage Foundation the Host Utilities support.

Based on testing done when the version of the Host Utilities was developed, NetApp recommends you set the following values when using Veritas Storage Foundation. Details on how to set these values are in the *Linux Host Utilities Installation and Administration Guide.*

Veritas Storage Foundation recommended settings	
Setting	**Description**
`dmp_restore_interval=60`	The Veritas DMP restore daemon interval is a tunable that specifies the number of seconds the restore daemon waits before checking the paths between the host and the storage system. The NetApp recommended value is 60 seconds. Testing has shown that you get a faster recovery by making the restore daemon poll more often, However, systems set to a longer polling interval take longer to detect path recoveries, which can impact storage system performance during a failover operation.
`dmp_restore_policy=disabled`	The restore daemon policy tunable specifies which paths the restore daemon checks when it polls the system. NetApp recommends that you set the value to `disabled`, which tells the daemon to check only the disabled paths.

Veritas Storage Foundation recommended settings	
Setting	**Description**

For Veritas Storage Foundation 5.1 till 6.0:
`dmp_lun_retry_timeout=300`
For Veritas Storage Foundation 6.x series and above:
`dmp_lun_retry_timeout=60`
	Set the VxDMP tunable dmp_lun_retry_timeout to 300 or 60 based on your environment.
	The tunable dmp_lun_retry_timeout tells VxDMP to continue retrying I/O requests to a LUN when all the paths to the disk have failed. When you set this tunable to 300 or 60, the VxDMP continues to retry paths to the LUN until either the I/O succeeds or 300 or 60 seconds have elapsed.
	Setting this value to 300 or 60 provides for faster recovery from temporary path failures.

Veritas Storage Foundation 5.1 SP1 and later: `dmp_path_age=120`	If you are using Veritas Storage Foundation 5.1 SP1, you must set the tunable `dmp_path_age` to 120. This setting helps minimize the path restoration window and maximize high availability of NetApp storage.
Timeout values for VxDMP	**FC only:** If you are using the Fibre Channel protocol, use the default timeout values. **iSCSI only:** If you are using iSCSI, you must set the following time-out value in the iSCSI configuration file in order to use VxDMP. `node.session.timeo.replacement_timeout = 120`

Veritas Storage Foundation recommended settings	
Setting	**Description**
Red Hat Enterprise Linux 6 series: Create the file `/etc/udev/rules.d/40-rport.rules`	If you are using Red Hat Enterprise Linux 6 series, you must configure it to support Veritas Storage Foundation. At the time this document was prepared, you had to create the file `/etc/udev/rules.d/40-rport.rules` with the following content line: `KERNEL=="rport-*", SUBSYSTEM=="fc_remote_ports", ACTION=="add",RUN+="/bin/sh -c 'echo 20 > /sys/class/fc_remote_ports/%k/fast_io_fail_tmo; echo 864000 >/sys/class/fc_remote_ports/%k/dev_loss_tmo'"` For the latest information, check the Veritas Release Notes for SF5.1SP1PR2.
Red Hat Enterprise Linux 6 series: Set the `IOFENCE timeout` parameter to `30000`.	The default value of the `IOFENCE timeout` parameter is 15000 milliseconds or 15 seconds. This parameter specifies the amount of time in milliseconds that it takes clients to respond to an IOFENCE message before the system halts. When clients receive an IOFENCE message, they must unregister from the GAB driver within the number of milliseconds specified by the `IOFENCE timeout` parameter. If they do not unregister within that time, the system halts. To view the value of this parameter, enter the `gabconfig -l` command on the host. To set the value for this parameter, enter the `gabconfig -f 30000` command. This value does not persist across host reboots.

Veritas Storage Foundation recommended settings	
Setting	**Description**
SUSE Linux Enterprise Server 11: Create the file `/etc/udev/rules.d/40-rport.rules`	If you are using SUSE Linux Enterprise Server 11 series, you must configure it to support Veritas Storage Foundation. Before you configure anything, you should check Symantec TechNote 124725. It contains the latest information and is available at http://www.symantec.com/business/support/index?page=content&id=TECH124725. At the time this document was prepared, you had to create the file `/etc/udev/rules.d/40-rport.rules` with the following content line: `KERNEL=="rport-*", SUBSYSTEM=="fc_remote_ports", ACTION=="add",RUN+="/bin/sh -c 'echo 20 > /sys/class/fc_remote_ports/%k/fast_io_fail_tmo; echo 864000 >/sys/class/fc_remote_ports/%k/dev_loss_tmo'".`

For all other settings, use the values recommended in the Veritas Storage Foundation Release Notes.

Recommendations for Citrix XenServer settings

NetApp recommendations for Citrix XenServer values

When you run the Host Utilities with Citrix XenServer, NetApp recommends that, in most cases, you use the values provided in the Citrix XenServer Release Notes. The exceptions are listed below.

Note

Check the Interoperability Matrix, which is online at support.netapp.com/NOW/products/interoperability, to see which versions of Citrix XenServer the Host Utilities support.

Based on testing done when the version of the Host Utilities was developed, NetApp recommends you set the following values when using Citrix XenServer. Details on how to set these values are in the *Linux Host Utilities Installation and Administration Guide.*

Citrix XenServer DM-Multipath recommended default parameters		
Parameter	**Value**	**Recommendation**
`flush_on_last_del` **Supported Citrix XenServer versions:** • XenServer 6 series	`no`	Set this value to `no`. The default value is `no`. If set to `no`, the multipathd daemon will not disable queueing when the last path to a device has been deleted.
`max_fds` **Supported Citrix XenServer versions:** • XenServer 6 series	`max`	Set this value to `max`. Sets the maximum number of open file descriptors that can be opened by multipath and the multipathd daemon.
`queue_without_daemon` **Supported Citrix XenServer versions:** • XenServer 6 series	`no`	Set this value to `no`. The default value is `yes`. If set to `no`, the multipathd daemon will disable queueing for all devices when it is shut down.

Citrix XenServer DM-Multipath recommended default parameters		
Parameter	**Value**	**Recommendation**

`queue_without_daemon`
Supported Citrix XenServer versions:
• XenServer 6 series
	ALUA environments:
	`"alua"`
	Non-ALUA environments:
	`"ontap"`
		When ALUA is enabled, set this value to `"alua"`.
		When ALUA is not enabled, set this value to `"ontap"`.
		Related parameters: This value works with `hardware_handler`.

`user_friendly_names` **Supported Citrix XenServer versions:** • XenServer 6 series	`no`	Set this value to `no`. If set to `yes`, specifies that the system should use the `/etc/multipath/bindings` file to assign a persistent and unique alias to the multipath, in the form of `mpathn`. If set to no, specifies that the system should use the WWID as the alias for the multipath. In either case, what is specified here will be overridden by any device-specific aliases you specify in the multipaths section of the configuration file.
`failback` **Supported Citrix XenServer versions:** • XenServer 6 series	`immediate`	Set this value to `immediate`. A value of `immediate` specifies immediate failback to the highest priority path group that contains active path.

`features`
Supported Citrix XenServer versions:
XenServer 6 series
	XenServer 6.0, 6.0.2, and 6.1 :
	`"1 queue_if_no_path"`
	XenServer 6.2:
	`"3 queue_if_no_path pg_init_retries 50"`
		XenServer 6.0, 6.0.2, and 6.1:
		Set this value to `"1 queue_if_no_path"`.
		XenServer 6.2:
		Set this value to `"3 queue_if_no_path pg_init_retries 50"`
		If set, any process that issues I/O will wait until one or more paths are restored.

Citrix XenServer DM-Multipath recommended default parameters		
Parameter	**Value**	**Recommendation**
`getuid_callout` **Supported Citrix XenServer versions:** XenServer 6 series	`getuid_callout "/sbin/scsi_id -g -u -s /block/%n"`	Set this value to `getuid_callout "/sbin/scsi_id -g -u -s /block/%n"` Specifies the default program and arguments to call out to obtain a unique path identifier.

`hardware_handler`
Supported Citrix XenServer versions:
XenServer 6 series
	ALUA environments:
	`"1 alua"`
	Non-ALUA environments:
	`"0"`
		Specifies a module that will be used to perform hardware specific actions when switching path groups or handling I/O errors.
		`1 alua`: hardware handler for SCSI-3 ALUA arrays.
		"`0`": For non-alua cases.

`path_checker`
Supported Citrix XenServer versions:
XenServer 6 series
	Citrix XenServer 6.0, 6.0.2, and 6.1:
	`directio`
	Citrix XenServer 6.2:
	`tur`
		Citrix XenServer 6.0 : `directio`
		Citrix XenServer 6.0.2, 6.1, and 6.2: `tur`
		Specifies the default method used to determine the state of the paths.
		`directio`: Read the first sector with direct I/O.
		`tur`: Issue a TEST UNIT READY to the device.

`path_grouping_policy` **Supported Citrix XenServer versions:** XenServer 6 series	`group_by_prio`	Set `group_by_prio.` Specifies the default path grouping policy to apply to unspecified multipaths. `group_by_prio` = 1 priority group per path priority value.

Citrix XenServer DM-Multipath recommended default parameters		
Parameter	**Value**	**Recommendation**
`prio_callout` **Supported Citrix XenServer versions:** XenServer 6 series	**XenServer 6.0, 6.0.2, and 6.1:** `"/sbin/mpath_prio_ontap /dev/%n"`	When ALUA is enabled, set this value to `"/sbin/mpath_prio_alua /dev/%n".` When ALUA is not enabled, set this value to: `"/sbin/mpath_prio_ontap /dev/%n"`. Related parameters: This value works with hardware_handler.
`product` **Supported Citrix XenServer versions:** XenServer 6 series	`"LUN"`	**XenServer 6.0, 6.0.2, and 6.1**: Set this value to "`LUN`". **XenServer 6.2**: Set this value to "`LUN.*`"
`rr_min_io` **Supported Citrix XenServer versions:** XenServer 6 series	`128`	Set this value to `128`. Specifies the number of I/O requests to route to a path before switching to the next path in the current path group.
`rr_weight` **Supported Citrix XenServer versions:** XenServer 6 series	`uniform`	Set this value to `uniform`. If set to uniform, all path weights are equal.
`vendor` **Supported Citrix XenServer versions:** XenServer 6 series	`"NETAPP"`	This is required for the NetApp Host Utilities product.

Citrix XenServer DM-Multipath recommended default parameters		
Parameter	**Value**	**Recommendation**

`prio`
Supported Citrix XenServer versions:
XenServer 6.2 series and later
	ALUA environments:
	`"alua"`
	Non-ALUA environments:
	`"ontap"`
		When ALUA is enabled, set this value to `"alua"`.
		When ALUA is not enabled, set this value to `"ontap"`.
		Related parameters: This value works with `hardware_handler`.

Recommendations for Oracle VM settings

NetApp recommendations for Oracle VM values

When you run the Host Utilities with Oracle VM, NetApp recommends that, in most cases, you use the values provided in the Oracle VM Release Notes. The exceptions are listed below.

Note

Check the Interoperability Matrix, which is online at support.netapp.com/NOW/products/interoperability, to see which versions of Oracle VM the Host Utilities support.

Based on testing done when the version of the Host Utilities was developed, NetApp recommends you set the following values when using Oracle VM. Details on how to set these values are in the *Linux Host Utilities Installation and Administration Guide*

Oracle VM DM-Multipath recommended default parameters		
Parameter	**Value**	**Recommendation**
`flush_on_last_del` **Supported Oracle VM versions:** Oracle VM **3**.0.1, 3.1.1, and 3.2 series	`no`	Set this value to `no`. The default value is `no`. If set to `no`, the multipathd daemon will not disable queueing when the last path to a device has been deleted.
`max_fds` **Supported Oracle VM versions:** Oracle VM 3.0.1, 3.1.1, and 3.2 series	`max`	Set this value to `max`. Sets the maximum number of open file descriptors that can be opened by multipath and the multipathd daemon.
`queue_without_daemon` **Supported Oracle VM versions:** Oracle VM 3.0.1, 3.1.1, and 3.2 series	**Oracle VM 3.1.1:** `"Yes"` **Oracle VM 3.0.1 and 3.2:** `"No"`	Set this value to `no`. The default value is `yes`. If set to `no`, the multipathd daemon will disable queueing for all devices when it is shut down.

Oracle VM DM-Multipath recommended default parameters		
Parameter	**Value**	**Recommendation**
`user_friendly_names` **Supported Oracle VM versions:** Oracle VM 3.0.1, 3.1.1, and 3.2 series	`no`	Set this value to `no`. If set to `yes`, specifies that the system should use the `/etc/multipath/bindings` file to assign a persistent and unique alias to the multipath, in the form of `mpathn`. If set to no, specifies that the system should use the WWID as the alias for the multipath. In either case, what is specified here will be overridden by any device-specific aliases you specify in the multipaths section of the configuration file.
`failback` **Supported Oracle VM versions:** Oracle VM 3.0.1, 3.1.1, and 3.2 series	`immediate`	Set this value to `immediate`. A value of `immediate` specifies immediate failback to the highest priority path group that contains active path.
`features` **Supported Oracle VM versions:** Oracle VM 3.0.1, 3.1.1, and 3.2 series	**OVM 3.0.1:** `"1 queue_if_no_path"` **OVM 3.1.1 and OVM 3.2 series:** `"3 queue if no path pg_init_retries 50"`	Set this value to `3 queue if no path pg_init_retries 50.` Internal testing has shown that using this value reduces possible path failures that can occur if a delayed controller failover exceeds the default time of 60 seconds.
`getuid_callout` **Supported Oracle VM versions:** Oracle VM 3.0.1, 3.1.1, and 3.2 series	`getuid_callout "/sbin/scsi_id -g -u -s /block/%n"`	Set this value to `getuid_callout "/sbin/scsi_id -g -u -s /block/%n"` Specifies the default program and arguments to call out to obtain a unique path identifier.

Oracle VM DM-Multipath recommended default parameters		
Parameter	**Value**	**Recommendation**

`hardware_handler`
Supported Oracle VM versions:
Oracle VM 3.0.1, 3.1.1, and 3.2 series
	ALUA environments:
	`"1 alua"`
	Non-ALUA environments:
	`"0"`
		Specifies a module that will be used to perform hardware specific actions when switching path groups or handling I/O errors.
		`1 alua`: hardware handler for SCSI-3 ALUA arrays.
		"`0`": For non-alua cases.

Oracle VM DM-Multipath recommended device parameters		
Parameter	**Value**	**Recommendation**

`path_checker`
Supported Oracle VM versions:
Oracle VM 3.0.1, 3.1.1, and 3.2 series
	Oracle VM 3.0.1:
	`directio`
	Oracle VM 3.1.1 and Oracle VM 3.2.1:
	`tur`
		Oracle VM 3.0.1: `directio`
		Oracle VM 3.1.1 and 3.2.1: `tur`
		Specifies the default method used to determine the state of the paths.
		`directio`: Read the first sector with direct I/O.
		`tur`: Issue a TEST UNIT READY to the device.

`path_grouping_policy` **Supported Oracle VM versions:** Oracle VM 3.0.1, 3.1.1, and 3.2 series	`group_by_prio`	Set `group_by_prio`. Specifies the default path grouping policy to apply to unspecified multipaths. `group_by_prio` = 1 priority group per path priority value.

`prio`
Supported Oracle VM versions:
Oracle VM 3.0.1, 3.1.1, and 3.2 series
	ALUA environments:
	`"alua"`
	Non-ALUA environments:
	`"ontap"`
		When ALUA is enabled, set this value to `"alua"`.
		When ALUA is not enabled, set this value to `"ontap"`.
		Related parameters: This value works with `hardware_handler`.

Oracle VM DM-Multipath recommended default parameters		
Parameter	**Value**	**Recommendation**
`product` **Supported Oracle VM versions:** Oracle VM 3.0.1, 3.1.1, and 3.2 series	`"LUN"`	Set this value to "`LUN`".
`rr_min_io` **Supported Oracle VM versions:** Oracle VM 3.0.1, 3.1.1, and 3.2 series	`128`	Set this value to `128`. Specifies the number of I/O requests to route to a path before switching to the next path in the current path group.
`rr_weight` **Supported Oracle VM versions:** Oracle VM 3.0.1, 3.1.1, and 3.2 series	`uniform`	Set this value to `uniform`. If set to uniform, all path weights are equal.
`vendor` **Supported Oracle VM versions:** Oracle VM 3.0.1, 3.1.1, and 3.2 series	`"NETAPP"`	This is required for the NetApp Host Utilities product.