



Linux[®] Unified Host Utilities 7.1

Recommended Host Settings for Linux[®] Unified Host Utilities 7.1

August 2016 | 215-11445_A0
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Recommendations for the host settings

It is best to use certain values for host parameters when you run the Linux Unified 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 might differ depending on your system environment and the version of the operating system that you are using.

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

- For information to help you install, configure, and use the Host Utilities, you can see the Linux Unified Host Utilities documentation in the NetApp Support Site.
- The Interoperability Matrix, which is online at [NetApp Interoperability](#) to verify that the Host Utilities support your system setup.

For detailed information about 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.

You can find examples of the `multipath.conf` files in the document [Using Linux Hosts with ONTAP Storage](#).

Improving I/O performance on Red Hat Enterprise Linux/Oracle Linux hosts

Red Hat Enterprise Linux/Oracle Linux 6 and 7 now have a tuned package with a `tuned-adm` command to set different server profiles on the host depending on the environment. This includes an enterprise-storage profile for configurations where LUNs from enterprise storage arrays are used.

The enterprise-storage profile enables a number of performance fine-tuning measures, such as switching the I/O scheduler to “deadline” from the default “cfq” scheduler, as well as increasing the readahead, setting the CPU governor to performance mode, and so on.

Note: You can use the virtual-guest profile for Red Hat Enterprise Linux/Oracle Linux as a guest virtual machine. The virtual guest profile is based on the enterprise-storage profile.

Recommended server profiles on Red Hat Enterprise Linux/Oracle Linux

Profile Settings	Value	Descriptions
Current active profile Supported RHEL/OL Versions: RHEL/OL 6 and 7 series	enterprise-storage	Red Hat Enterprise Linux/Oracle Linux 6 and 7: set this value to enterprise-storage
Current active profile Supported RHEL/OL Versions: RHEL/OL 6 and 7 series	virtual-guest	Red Hat Enterprise Linux/Oracle Linux 6 and 7: set this value to virtual-guest

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

You need to know the recommended settings for the default section of the DM-Multipath `multipath.conf` file on hosts running Red Hat Enterprise Linux/Oracle Linux. In most cases, the Red Hat settings also apply to Oracle Linux. If Oracle Linux requires a different value, that value is listed.

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
<code>flush_on_last_del</code> Supported versions: <ul style="list-style-type: none"> RHEL/OL 7 series, RHEL/OL 6 series, 5.2 and later, 4.7 RHEL 5 update 3 and later RHEL 4 update 7 and later 	RHEL/OL: yes	Red Hat Enterprise Linux: Set this value to yes . The default value is no .
<code>max_fds</code> Supported versions: <ul style="list-style-type: none"> RHEL 7 series, 6 series, and OL 7 series, OL 6 series RHEL 5.2 and later RHEL 4 update 7 and later 	RHEL/OL 7 series, RHEL/OL 6, 5.2 and later, 4.7: max	RHEL/OL 7 series, RHEL/OL 6 series, 5.2 and later, 4.7: Set this value to max .
<code>pg_prio_calc</code> Supported Red Hat versions: <ul style="list-style-type: none"> RHEL 5 update 6 and later 	avg	Set this value to avg .
<code>queue_without_daemon</code> Supported versions: <ul style="list-style-type: none"> RHEL 7 series, 6 series, and OL 7 series, OL 6 series RHEL 5 update 3 and later 	RHEL/OL: no	Red Hat Enterprise Linux/Oracle Linux: Set this value to no . The default value is yes .

Red Hat Enterprise Linux DM-Multipath recommended default parameters		
Parameter	Value	Recommendation
<p><code>user_friendly_names</code></p> <p>Supported versions:</p> <ul style="list-style-type: none"> RHEL 7 series, 6 series, and OL 7 series, OL 6 series RHEL 5 series and OL 5 series RHEL 4 series 	no	<p>Set this value to no.</p> <p>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.</p> <p>In addition, by setting this value to no, you avoid some of the problems that have been seen when <code>user_friendly_names</code> is set to yes. There have been several Red Hat Bugzilla reports about these issues.</p> <p>Note: Red Hat Enterprise Virtualization Hypervisor nodes require that you set this value to no.</p>
<p><code>dev_loss_tmo</code></p> <p>Supported versions:</p> <ul style="list-style-type: none"> RHEL 7 series, 6 update 1 and later, and OL 7 series, OL 6 series 	<p>RHEL/OL 6.1: 2147483647</p> <p>RHEL/OL 6.2 and later:infinity</p>	<p>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.</p> <p>Red Hat Enterprise Linux/Oracle Linux 6.1 :</p> <p>Set this value to 2147483647 seconds.</p> <p>Red Hat Enterprise Linux/Oracle Linux 6.2 and later :</p> <p>Set this value to infinity, so that the link is never lost.</p>
<p><code>fast_io_fail_tmo</code></p> <p>Supported versions:</p> <ul style="list-style-type: none"> RHEL 7 series, 6 update 1 and later, and OL 7 series, OL 6 series 	5	<p>Set this value to 5.</p> <p>Related parameters: This value works with the value for <code>dev_loss_tmo</code>.</p>

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

You need to know 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 is listed.

Red Hat Enterprise Linux/Oracle Linux DM-Multipath recommended device parameters		
Parameter	Value	Recommendation
failback Supported Red Hat versions: <ul style="list-style-type: none"> RHEL 7 series, RHEL 6 series, and OL 7 series, 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 <code>path_grouping_policy</code> .
features Supported Red Hat versions: <ul style="list-style-type: none"> RHEL 7 series, RHEL 6 series, and OL 7 series, OL 6 series RHEL 5 series and OL 5 series RHEL 4 series 	RHEL 6.1/OL 6.1 and later, RHEL 5.7 and later: <code>3 queue_if_no_path pg_init_retries 50</code> RHEL 6.0/OL 6.0, 5.1-5.6 and 4 series: <code>1 queue_if_no_path</code>	Red Hat Enterprise Linux/Oracle Linux 6.1 and later, Red Hat Enterprise Linux 5.7 and later: Set this value to <code>3 queue if no path pg_init_retries 50</code> . 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/Oracle Linux 6.0, Red Hat Enterprise Linux prior to 5.7: Set this value to <code>1 queue_if_no_path</code> Related parameters: If you specify <code>path_no_retry</code> in the default section of the <code>multipath.conf</code> file, that value overrides the <code>features</code> value and could cause an operating system crash during a takeover/giveback procedure.

Red Hat Enterprise Linux/Oracle Linux DM-Multipath recommended device parameters		
Parameter	Value	Recommendation
<p><code>getuid_callout</code></p> <p>Supported Red Hat versions:</p> <ul style="list-style-type: none"> • RHEL 7 series and OL 7 series • RHEL 6 series and OL 6 series • RHEL 5 series and OL 5 series • RHEL 4 series 	<p>RHEL 7/OL 7 series: <code>uid_attribute "ID_SERIAL" RHEL 6/OL 6 series:</code></p> <pre>/lib/udev/scsi_id -g -u -d /dev/%n</pre> <p>RHEL 5 and 4 series:</p> <pre>/sbin/scsi_id -g -u -s /block/%n</pre>	<p>Red Hat Enterprise Linux/Oracle Linux 7 series:</p> <p><code>uid_attribute "ID_SERIAL"</code></p> <p>Red Hat Enterprise Linux/Oracle Linux 6 series:</p> <p>Set this value to <code>/lib/udev/scsi_id -g -u -d /dev/%n</code>.</p> <p>Red Hat Enterprise Linux 5 series and 4 series:</p> <p>Set this value to <code>/sbin/scsi_id -g -u -s /block/%n</code></p>
<p><code>hardware_handler</code></p> <p>Supported Red Hat versions:</p> <ul style="list-style-type: none"> • RHEL 7 series, RHEL 6 series, and, OL 7 series, OL 6 series • RHEL 5 series and OL 5 series • RHEL 4 series 	<p>ALUA environments (RHEL 6/Oracle Linux 6 series and 5 series): 1</p> <p>alua Non-ALUA environments (RHEL 4 series): 0</p>	<p>Red Hat Enterprise Linux/Oracle Linux 6 series and 5 series:</p> <p>Set this value to 1 <code>alua</code>.</p> <p>Red Hat Enterprise Linux 4 series:</p> <p>Set this value to 0.</p> <p>Related parameters:</p> <p>This value works with the value for <code>prior prio_callout</code>.</p>

Red Hat Enterprise Linux/Oracle Linux DM-Multipath recommended device parameters		
Parameter	Value	Recommendation
<p><code>path_checker</code></p> <p>Supported Red Hat versions:</p> <ul style="list-style-type: none"> RHEL 7 series, RHEL 6 series, and, OL 7 series, OL 6 series RHEL 5.1 and later RHEL 4.7 and later 	<p>RHEL 6.1/OL 6.1 and later, RHEL 5.7 and later: <code>tur</code> RHEL 6.0/OL 6.0, 5.1-5.6, RHEL 4.7 and later: <code>directio</code></p>	<p>Red Hat Enterprise Linux/Oracle Linux 6.1 and later, Red Hat Enterprise Linux 5.8 and later:</p> <p>Set this value to <code>tur</code>. Internal testing has shown that using <code>tur</code> instead of <code>directio</code> improves performance. The <code>tur</code> parameter uses SG_input/output (I/O) requests that are inserted at the head of the request queue. The <code>directio</code> parameter uses FS block requests, which are added to the end of the request queue.</p> <p>As a result, on a busy device, the <code>path_checker tur</code> requests are serviced immediately while the <code>path_checker directio</code> must wait for the current I/O load to complete.</p> <p>Red Hat Enterprise Linux/Oracle Linux 6.0, 5.1-5.7 and 4.7 and later:</p> <p>Set this value to <code>directio</code>, which is the default.</p> <p>Related parameters:</p> <p>If you are using Red Hat Enterprise Linux 5 or 4.6 and earlier, the value for this parameter is <code>readsector0</code>.</p>
<p><code>path_checker</code></p> <p>Supported Red Hat versions:</p> <ul style="list-style-type: none"> RHEL 5 and OL 5 series RHEL 4.6 and earlier 	<p><code>readsector0</code></p>	<p>Set this value to <code>readsector0</code></p> <p>Related parameters:</p> <p>If you are using Red Hat Enterprise Linux 5.1 and later, or 4.7 and later, the value for this parameter is <code>directio</code>.</p>
<p><code>path_grouping_policy</code></p> <p>Supported Red Hat versions:</p> <ul style="list-style-type: none"> RHEL 7 series, RHEL 6 series, and, OL 7 series, OL 6 series RHEL 5 series and OL 5 series RHEL 4 series 	<p><code>group_by_prio</code></p>	<p>FC only:</p> <p>Set this value to <code>group_by_prio</code>.</p> <p>Related parameters:</p> <p>This value works with <code>failback</code>. If you are using the iSCSI protocol, see the next row for information on the value you should use.</p>

Red Hat Enterprise Linux/Oracle Linux DM-Multipath recommended device parameters		
Parameter	Value	Recommendation
path_selector Supported Red Hat versions: <ul style="list-style-type: none"> RHEL 7 series, 6 series, and OL 7 series, OL 6 series RHEL 5 series and OL 5 series RHEL 4 series 	RHEL/OL 7 series, 6 series, 5 series, and 4 series: <code>round-robin 0</code> RHEL/OL 7 series and 6 series also support: <code>queue-length 0</code> <code>service-time 0</code>	Red Hat Enterprise Linux/Oracle Linux 6 series, 5 series, and 4 series: Set this value to <code>round-robin 0</code> . Red Hat Enterprise Linux/Oracle Linux 7 series: Set this value to <code>service-time 0</code> . This is the recommended value for all versions of Red Hat Enterprise Linux that the Host Utilities support.
prio Supported Red Hat versions: <ul style="list-style-type: none"> RHEL 7 series, RHEL 6 series, and OL 7 series, OL 6 series 	ALUA environments: <code>alua</code> Non-ALUA environments: <code>ontap</code>	The recommended value is <code>alua</code> , which is the value required when you are using ALUA. Related parameters: This value works with <code>hardware_handler</code> . If you are using Red Hat Enterprise Linux 5 series or 4 series, see the next row.
prio_callout Supported Red Hat versions: <ul style="list-style-type: none"> RHEL 5 series and OL 5 series RHEL 4 series 	ALUA environments: <code>/sbin/mpath_prio_alua /dev/%n</code> Non-ALUA environments: <code>/sbin/mpath_prio_ontap /dev/%n</code>	Red Hat Enterprise Linux 5.1 and later: When ALUA is enabled, set this value to <code>/sbin/mpath_prio_alua /dev/%n</code> . Red Hat Enterprise Linux 5 series and 4 series: When ALUA is not enabled, set this value to <code>/sbin/mpath_prio_ontap /dev/%n</code> . Related parameters: This value works with <code>hardware_handler</code> . If you are using Red Hat Enterprise Linux 6 series, see the information about <code>prio</code> .
product Supported Red Hat versions: <ul style="list-style-type: none"> All 	LUN	Red Hat Enterprise Linux/Oracle Linux 6.2 and earlier: <code>LUN</code> Red Hat Enterprise Linux/Oracle Linux 6.3 and later: <code>LUN.*</code>

Red Hat Enterprise Linux/Oracle Linux DM-Multipath recommended device parameters		
Parameter	Value	Recommendation
rr_min_io Supported Red Hat versions: <ul style="list-style-type: none"> • RHEL 7 series, RHEL 6 series, and, OL 7 series OL 6 series • RHEL 5 series and OL 5 series • RHEL 4 series 	RHEL/OL 6 series, 5 series, or 4 series:128 RHEL/OL 7 series:1000	Red Hat Enterprise Linux/Oracle Linux 6 series, 5 series, or 4 series: Set this value to 128 . Red Hat Enterprise Linux/Oracle Linux 7 series: Set this value to 1000 . Note: If you are using Red Hat Enterprise Linux 4 update 7 or earlier, place <code>rr_min_io</code> in the default section of the <code>multlipath.conf</code> file.
rr_weight Supported Red Hat versions: <ul style="list-style-type: none"> • RHEL 7 series, RHEL 6 series, and OL 7 series, OL 6 series • RHEL 5 series and OL 5 series • RHEL 4 series 	uniform	Set this value to uniform .
vendor Supported Red Hat versions: <ul style="list-style-type: none"> • All 	NETAPP	This value is required for the NetApp Host Utilities product.

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

You need to know the recommended settings for the default section of the DM-Multipath `multipath.conf` file on hosts running SUSE Linux Enterprise Server.

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
<code>flush_on_last_del</code> Supported SUSE versions: <ul style="list-style-type: none"> SLES 11 SP1 and later SLES 12 series 	yes	Set this value to yes . The default value is no .
<code>queue_without_daemon</code> Supported SUSE versions: <ul style="list-style-type: none"> SLES 11 SP2 and later SLES 12 series 	no	Set this value to no .
<code>max_fds</code> Supported SUSE versions: <ul style="list-style-type: none"> SLES 11 SP1 and later SLES 10 SP4 SLES 12 series 	max	SUSE Linux Enterprise Server 11 SP1 and later and 10 SP4 and SUSE Linux Enterprise Server 12 series: 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.
<code>max_fds</code> Supported SUSE versions: <ul style="list-style-type: none"> SLES 11 SLES 10 SP3 and earlier 	8192	SUSE Linux Enterprise Server 11 and 10 SP3 and earlier: Set this value to 8192 .
<code>user_friendly_names</code> Supported SUSE versions: <ul style="list-style-type: none"> SLES 12 series 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

You need to know 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: <ul style="list-style-type: none"> SLES 12 series SLES 11 series SLES 10 series 	immediate	Set this value to immediate . Related parameters: The value works with Path Group priorities.
features Supported SUSE versions: <ul style="list-style-type: none"> SLES 12 series SLES 11 series SLES 10 series 	SUSE Linux Enterprise Server 11 SP2 and later: 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 and later: 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 <code>multipath.conf</code> file, that value overrides the <code>features</code> value and could cause an operating system crash during a takeover/giveback procedure.
getuid_callout Supported SUSE versions: <ul style="list-style-type: none"> SLES 12 series SLES 11 series SLES 10 series 	SLES 12 and 11 series: <code>/lib/udev/scsi_id -g -u -d /dev/%n</code> SLES 10 series: <code>/sbin/scsi_id -g -u -s/block/%n</code>	SUSE Linux Enterprise Server 12 and 11 series: Set this value to <code>/lib/udev/scsi_id -g -u -d/dev/%n</code> . SUSE Linux Enterprise Server 10 series: Set this value to <code>/sbin/scsi_id -g -u -s/block/%n</code> .
hardware_handler Supported SUSE versions: <ul style="list-style-type: none"> SLES 12 series 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 <code>prio</code> or <code>prio_callout</code> .

SUSE Linux Enterprise Server DM-Multipath recommended device parameters		
Parameter	Value	Recommendation
path_checker Supported SUSE versions: <ul style="list-style-type: none"> • SLES 12 series • SLES 11 series • SLES 10 with SP2 and later 	tur	Set this value to tur .
path_grouping_policy Supported SUSE versions: <ul style="list-style-type: none"> • SLES 12 series • 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: <ul style="list-style-type: none"> • SLES 12 series • SLES 11 series • SLES 10 SP3 and later • SLES 10 SP2 and earlier 	SLES 12, 11 series, and 10 SP3 and later: group_by_prio SLES 10 SP2 and earlier: multibus	iSCSI only with SUSE Linux Enterprise Server 12, 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: <ul style="list-style-type: none"> • SLES 11 SP1 and later • SLES 12 series • SLES 11 series • SLES 10 series 	SLES 12, 11, and 10 series: round-robin 0 SLES 11 SP1 and later, SLES 12 series 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
<p>prio</p> <p>Supported SUSE versions:</p> <ul style="list-style-type: none"> SLES 12 series SLES 11 series SLES 10 SP2 and later 	<p>ALUA environments: alua</p> <p>Non-ALUA environments: ontap</p>	<p>ALUA environments: If you use ALUA, set this value to alua.</p> <p>Non-ALUA environments: If you are not using ALUA, set this value to ontap.</p> <p>Related parameters: This value works with hardware_handler. If you are using SUSE Linux Enterprise Server 10 SP1 and earlier, see the next row.</p>
<p>prio_callout</p> <p>Supported SUSE versions:</p> <ul style="list-style-type: none"> SLES 10 SP1 and earlier 	<p>Non-ALUA environments: sbin/mpath_prio_ontap /dev/%n</p>	<p>Non-ALUA environments: If you do not use ALUA, set this value to sbin/mpath_prio_ontap/dev/%n.</p> <p>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.</p>
<p>product</p> <p>Supported SUSE versions:</p> <ul style="list-style-type: none"> All 	LUN	Set this value to LUN .
<p>rr_min_io</p> <p>Supported SUSE versions:</p> <ul style="list-style-type: none"> SLES 12 series SLES 11 series SLES 10 series 	128	Set this value to 128 .
<p>rr_weight</p> <p>Supported SUSE versions:</p> <ul style="list-style-type: none"> SLES 12 series SLES 11 series SLES 10 series 	uniform	Set this value to uniform .
<p>vendor</p> <p>Supported SUSE versions:</p> <ul style="list-style-type: none"> All 	NETAPP	This value is required for the NetApp Host Utilities product.

Time-out values when using DM-Multipath

You should use the applicable time-out values for the protocols and software in your environment.

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

iSCSI only: If you are using iSCSI, to use DM-Multipath you must set the time-out value in the iSCSI configuration file to 5: `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` file to uncomment `ConnFailTimeoutof` and give it a value of 5.

Recommendations for Veritas Storage Foundation settings

When you run the Host Utilities with Veritas Volume Manager (VxVM) and Dynamic Multipathing (VxDMP), in most cases you should use the values provided in the Veritas Release Notes.

Note: Check the Interoperability Matrix, which is online at [NetApp 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, it is best to set the following values when using Veritas Storage Foundation. Details about how to set these values are in the [Linux Unified Host Utilities 7.1 Installation Guide](#)

Recommendations for Veritas values

You should use the Veritas values recommended by NetApp to get optimum system performance.

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

Veritas Storage Foundation recommended settings	
Setting	Description
dmp_restore_interval=60	<p>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.</p> <p>The 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.</p>
dmp_restore_policy=disabled	<p>The restore daemon policy tunable specifies which paths the restore daemon checks when it polls the system.</p> <p>The value should be set to disabled, which tells the daemon to check only the disabled paths.</p>
<p>For Veritas Storage Foundation 5.1 to 6.0: dmp_lun_retry_timeout=300</p> <p>For Veritas Storage Foundation 6 series and InfoScale 7 series: dmp_lun_retry_timeout=60</p>	<p>Set the VxDMP tunable dmp_lun_retry_timeout to 300 or 60 based on your environment.</p> <p>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.</p> <p>Setting this value to 300 or 60 provides for faster recovery from temporary path failures.</p>
<p>Veritas Storage Foundation 5.1 SP1 and later, Veritas Storage Foundation 6 series and InfoScale 7 series: dmp_path_age=120</p>	<p>If you are using Veritas Storage Foundation 5.1 SP1 and later, Veritas Storage Foundation 6 series and InfoScale 7 series you must set the tunable dmp_path_age to 120.</p> <p>This setting helps minimize the path restoration window and maximize high availability of NetApp storage.</p>

Veritas Storage Foundation recommended settings	
Setting	Description
Timeout values for VxDMP	<p>FC only: If you are using Fibre Channel, use the default timeout values.</p> <p>iSCSI only: If you are using iSCSI, you must set the time-out value to 120 in the iSCSI configuration file to use VxDMP: <code>node.session.timeo.replacement_timeout = 120.</code></p>
<p>Red Hat Enterprise Linux 6 series and Red Hat Enterprise Linux 7 series:</p> <p>Create the file <code>/etc/udev/rules.d/40-rport.rules</code>.</p>	<p>If you are using Red Hat Enterprise Linux 6 series and Red Hat Enterprise Linux 7 series, you must configure it to support Veritas Storage Foundation.</p> <p>At the time this document was prepared, you had to create the file <code>/etc/udev/rules.d/40-rport.rules</code> with the following content line:</p> <pre>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'"</pre>
<p>Red Hat Enterprise Linux 6 series:</p> <p>Set the <code>IOFENCE</code> timeout parameter to 30000.</p>	<p>The default value of the <code>IOFENCE</code> 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 <code>IOFENCE</code> message before the system halts. When clients receive an <code>IOFENCE</code> message, they must unregister from the GAB driver within the number of milliseconds specified by the <code>IOFENCE</code> timeout parameter. If they do not unregister within that time, the system halts.</p> <p>To view the value of this parameter, enter the <code>gabconfig -l</code> command on the host.</p> <p>To set the value for this parameter, enter the <code>gabconfig -f 30000</code> command. This value does not persist across host reboots.</p>
<p>SUSE Linux Enterprise Server 11:</p> <p>Create the file <code>/etc/udev/rules.d/40-rport.rules</code></p>	<p>If you are using SUSE Linux Enterprise Server 11 series, you must configure it to support Veritas Storage Foundation.</p> <p>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.</p> <p>At the time this document was prepared, you had to create the file <code>/etc/udev/rules.d/40-rport.rules</code> with the following content line:</p> <pre>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'".</pre>

Recommendations for Citrix XenServer settings

When you run the Host Utilities with Citrix XenServer, in most cases you should use the values provided in the Citrix XenServer Release Notes.

Note: Check the Interoperability Matrix, which is online at [NetApp 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, it is best to set the following values when using Citrix XenServer. Details about how to set these values are in the [Linux Unified Host Utilities 7.1 Installation Guide](#).

Recommendations for Citrix XenServer values

You should use the NetApp recommended default parameter values of Citrix XenServer DM-Multipath to get expected output.

Citrix XenServer DM-Multipath recommended default parameters		
Parameter	Value	Recommendation
<code>flush_on_last_del</code> Supported Citrix XenServer versions: <ul style="list-style-type: none"> XenServer 6series XenServer 7 series 	no yes	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.
<code>max_fds</code> Supported Citrix XenServer versions: <ul style="list-style-type: none"> XenServer 6 series and 7 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.
<code>queue_without_daemon</code> Supported Citrix XenServer versions: <ul style="list-style-type: none"> XenServer 6 series and 7 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.
<code>user_friendly_names</code> Supported Citrix XenServer versions: <ul style="list-style-type: none"> XenServer 6 series and 7 series 	no	Set this value to no . If set to yes , specifies that the system should use the <code>/etc/multipath/bindings</code> file to assign a persistent and unique alias to the multipath, in the form of <code>mpathn</code> . 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.

Citrix XenServer DM-Multipath recommended default parameters		
Parameter	Value	Recommendation
failback Supported Citrix XenServer versions: <ul style="list-style-type: none"> XenServer 6 series and 7 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 and 7 series	XenServer 6.0, 6.0.2, and 6.1: "1 queue_if_no_path" XenServer 6.2, 6.5 and 7.0: "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, 6.5 and 7.0: Set this value to 3 queue_if_no_path pg_init_retries 50
getuid_callout Supported Citrix XenServer versions: XenServer 6 series and 7 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
hardware_handler Supported Citrix XenServer versions: XenServer 6 series and 7 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 and 7 series	Citrix XenServer 6.0, 6.0.2, and 6.1:directio Citrix XenServer 6.2 and above:tur	Citrix XenServer 6.0: directio Citrix XenServer 6.0.2, 6.1, and 6.2 and above: 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 and 7 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
<p>prio_callout</p> <p>Supported Citrix XenServer versions:</p> <p>XenServer 6.0,6.0.2 and 6.1</p>	<p>XenServer 6.0, 6.0.2, and 6.1:</p> <p>/sbin/mpath_prio_ontap /dev/%n</p>	<p>When ALUA is enabled, set this value to /sbin/mpath_prio_alua /dev/%n.</p> <p>When ALUA is not enabled, set this value to: /sbin/mpath_prio_ontap /dev/%n.</p> <p>Related parameters: This value works with hardware_handler.</p>
<p>product</p> <p>Supported Citrix XenServer versions:</p> <p>XenServer 6 series and 7 series</p>	LUN	<p>XenServer 6.0, 6.0.2, and 6.1:</p> <p>Set this value to LUN.</p> <p>XenServer 6.2, 6.5 and 7 series:</p> <p>Set this value to LUN.*.</p>
<p>rr_min_io</p> <p>Supported Citrix XenServer versions:</p> <p>XenServer 6 series and 7 series</p>	128	<p>Set this value to 128.</p> <p>Specifies the number of I/O requests to route to a path before switching to the next path in the current path group.</p>
<p>rr_weight</p> <p>Supported Citrix XenServer versions:</p> <p>XenServer 6 series and 7 series</p>	uniform	<p>Set this value to uniform.</p> <p>If set to uniform, all path weights are equal.</p>
<p>vendor</p> <p>Supported Citrix XenServer versions:</p> <p>XenServer 6 series and 7 series</p>	NETAPP	<p>This is required for the NetApp Host Utilities product.</p>
<p>prio</p> <p>Supported Citrix XenServer versions:</p> <p>XenServer 6.2 and above</p> <p>XenServer 7 series</p>	<p>ALUA environments:</p> <p>alua</p> <p>Non-ALUA environments:</p> <p>ontap</p>	<p>When ALUA is enabled, set this value to alua.</p> <p>When ALUA is not enabled, set this value to ontap.</p> <p>Related parameters: This value works with hardware_handler.</p>

Recommendations for Oracle VM settings

When you run the Host Utilities with Oracle VM, in most cases you should use the values provided in the Oracle VM Release Notes.

Note: Check the Interoperability Matrix, which is online at [NetApp 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, it is best to set the following values when using Oracle VM. Details about how to set these values in the [Linux Unified Host Utilities 7.1 Installation Guide](#).

Recommendations for Oracle VM values

You should use the NetApp recommended default parameter values for Oracle VM to get expected output.

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 Oracle VM 3.3 series and 3.4 series	no yes	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, 3.2 series, 3.3 series, and 3.4 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, 3.2 series, 3.3 series, and 3.4 series	Oracle VM 3.1.1: yes Oracle VM 3.0.1, 3.2 series, 3.3 series, and 3.4 series: no	Set this value to no . The default value is yes .

Oracle VM DM-Multipath recommended default parameters		
Parameter	Value	Recommendation
<code>user_friendly_names</code> Supported Oracle VM versions: Oracle VM 3.0.1, 3.1.1, 3.2 series, 3.3 series, and 3.4 series	no	Set this value to no . If set to yes, specifies that the system should use the <code>/etc/multipath/bindings</code> file to assign a persistent and unique alias to the multipath, in the form of <code>mpathn</code> . 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 <code>multipaths</code> section of the configuration file.
<code>failback</code> Supported Oracle VM versions: Oracle VM 3.0.1, 3.1.1, 3.2 series, 3.3 series, and 3.4 series	immediate	Set this value to immediate . A value of <code>immediate</code> specifies immediate failback to the highest priority path group that contains active path.
<code>features</code> Supported Oracle VM versions: Oracle VM 3.0.1, 3.1.1, 3.2 series, 3.3 series, and 3.4 series	Oracle VM 3.0.1: <code>1</code> <code>queue_if_no_path</code> Oracle VM 3.1.1 and 3.2 series: <code>3 queue if no path</code> <code>pg_init_retries 50</code>	Set this value to 3 queue if no path <code>pg_init_retries 50</code> . 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.
<code>getuid_callout</code> Supported Oracle VM versions: Oracle VM 3.0.1, 3.1.1, 3.2 series, 3.3 series, and 3.4 series	<code>getuid_callout /sbin/scsi_id -g -u -s /block/%n</code>	Set this value to <code>getuid_callout /sbin/scsi_id -g -u -s /block/%n</code> Specifies the default program and arguments to call out to obtain a unique path identifier.
<code>hardware_handler</code> Supported Oracle VM versions: Oracle VM 3.0.1, 3.1.1, 3.2 series, 3.3 series, and 3.4 series	ALUA environments: <code>1 alua</code> Non-ALUA environments: <code>0</code>	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 default parameters		
Parameter	Value	Recommendation
path_checker Supported Oracle VM versions: Oracle VM 3.0.1, 3.1.1, 3.2 series, 3.3 series, and 3.4 series	Oracle VM 3.0.1: directio Oracle VM 3.1.1, 3.2 series, 3.3 series, and 3.4 series: tur	Oracle VM 3.0.1: directio Oracle VM 3.1.1, 3.2 series, 3.3 series, and 3.4 series: 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, 3.2 series, 3.3 series, and 3.4 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, 3.2 series, 3.3 series, and 3.4 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 .
product Supported Oracle VM versions: Oracle VM 3.0.1, 3.1.1, 3.2 series, 3.3 series, and 3.4 series	LUN	Set this value to LUN.* .
rr_min_io Supported Oracle VM versions: Oracle VM 3.0.1, 3.1.1, 3.2 series, 3.3 series, and 3.4 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, 3.2 series, 3.3 series, and 3.4 series	uniform	Set this value to uniform . If set to uniform, all path weights are equal.

Oracle VM DM-Multipath recommended default parameters		
Parameter	Value	Recommendation
vendor Supported Oracle VM versions: Oracle VM 3.0.1, 3.1.1, 3.2 series, 3.3 series, and 3.4 series	NETAPP	This is required for the NetApp Host Utilities product.

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