Citrix

SAN hosts and cloud clients

NetApp
February 26, 2024

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Use Citrix Hypervisor with ONTAP

You can configure ONTAP SAN host configuration settings for Citrix Hypervisor 8 series OS releases with FC, FCoE and iSCSi protocols.

SAN Booting

What you'll need

If you decide to use SAN booting, it must be supported by your configuration. You can use the NetApp Interoperability Matrix Tool to verify that your OS, HBA, HBA firmware and the HBA boot BIOS, and ONTAP version are supported.

Steps

1. Map the SAN boot LUN to the host.
2. Verify that multiple paths are available.

   Multiple paths become available after the host OS is up and running on the paths.

3. Enable SAN booting in the server BIOS for the ports to which the SAN boot LUN is mapped.

   For information on how to enable the HBA BIOS, see your vendor-specific documentation.

4. Reboot the host to verify that the boot is successful.

Multipathing

For Citrix Hypervisor (CH) 8.x the `/etc/multipath.conf` file must exist, but you do not need to make specific changes to the file. CH 8.x is compiled with all settings required to recognize and correctly manage ONTAP LUNs.
You can use the `/sbin/mpathutil` status command to verify the settings for your ONTAP LUNs.
The following sections provide sample multipath output for a LUN mapped to ASA personas.

All SAN Array (ASA) Configuration

For All SAN Array (ASA) configuration there should be one group of paths with single priorities. All the paths are Active/Optimized, which means they are serviced by the controller and I/O is sent on all the active paths.

Example

The following example displays the correct output for an ONTAP LUN with four Active/Optimized paths:

```
# mpathutil status
3600a0980383034467424a357579386a dm-13 NETAPP  ,LUN C-Mode
size=30G features='4 queue_if_no_path pg_init_retries 50
retain_attached_hw_handle' hwhandler='1 alua' wp=rw
policy='service-time 0' prio=50 status=active
  |- 11:0:7:1    sdfi   130:64   active ready running
  |- 11:0:9:1    sdiy  8:288     active ready running
  |- 11:0:10:1  sdml 69:464   active ready running
  |- 11:0:11:1  sdpt  131:304  active ready running
```

Do not use an excessive number of paths to a single LUN. No more than 4 paths should be required. More than 8 paths might cause path issues during storage failures.

Non-ASA Configuration

For non-ASA configuration there should be two groups of paths with different priorities. The paths with the higher priorities are Active/Optimized, meaning they are serviced by the controller where the aggregate is located. The paths with the lower priorities are active but are non-optimized because they are served from a different controller. The non-optimized paths are only used when no optimized paths are available.

Example

The following example displays the correct output for an ONTAP LUN with two Active/Optimized paths and two Active/non-Optimized paths:

```
# mpathutil status
3600a0980383034467424a357579386a dm-13 NETAPP  ,LUN C-Mode
size=30G features='4 queue_if_no_path pg_init_retries 50
retain_attached_hw_handle' hwhandler='1 alua' wp=rw
|-+- policy='service-time 0' prio=50 status=active
 |- 1:0:0:11   sde   8:64    active ready running
`- 12:0:8:11  sdua  66:544  active ready running
`-+- policy='service-time 0' prio=10 status=enabled
   |- 1:0:9:11   sddo  71:96   active ready running
   `- 12:0:26:11 sdyt  129:720 active ready running
```

Do not use an excessive number of paths to a single LUN. No more than four paths should be required. More than eight paths might cause path issues during storage failures.

Recommended Settings

The Citrix Hypervisor 8.x OS is compiled with all settings required to recognize and correctly manage ONTAP LUNs. For Citrix Hypervisor 8.x, an empty zerobyte `/etc/multipath.conf` file must exist, but you do not need to make specific changes to the file.

Enable the host multipath service from the **Xencenter Management Portal** and verify that the multipath service is enabled and running.

```
# systemct1 status multipathd
multipathd.service - Device-Mapper Multipath Device Controller
  Loaded:  load (/usr/lib/systemd/system/multipathd.service; enabled;
vendor preset: enabled)
 Drop-In:  /etc/systemd/system/multipathd.service.d
            slice.config
  Active:  active (running) since Fri YYYY-MM-DD 00:00:26 IST; 1 month 9
days ago
Main PID:  3789 (multipathd)
  CGroup:  /control.slice/multipathd.service
           3789  /sbin/multipathd
```

There is no requirement to append content to the `/etc/multipath.conf` file, unless you have devices that you do not want to be managed by multipath or you have existing settings that override defaults. You can add the following syntax to the multipath.conf file to exclude the unwanted devices.

```
# cat /etc/multipath.conf
blacklist {
     wwid    <DevId>
     devnode "^(ram|raw|loop|fd|md|dm-|sr|scd|st)[0-9]*"
     devnode "^hd[a-z]"
     devnode "^cciss.*"
}
```

Replace the **<DevID>** with the WWID string of the device you want to exclude.

Example

In this example for Citrix Hypervisor 8.x, `sda` is the local SCSI disk that we need to add to the blacklist.

1. Run the following command to determine the WWID:

   ```
   # lib/udev/scsi_id -gud /dev/sda
   3600a0980383034587724507145353l7a
   ```

2. Add this WWID to the blacklist stanza in the `/etc/multipath.conf`:

```
#cat /etc/multipath.conf
blacklist {
  wwid    3600a0980383034587724507145353l7a
  devnode "^(ram|raw|loop|fd|md|dm-|sr|scd|st)[0-9*]"
  devnode "^hd[a-z]"
  devnode "^cciss.*"
}
```

Refer to the multipath parameter runtime configuration by using the `$multipathd show config` command. You should always check your running configuration for legacy settings that might be overriding default settings, especially in the defaults section.

The following table shows the critical **multipathd** parameters for ONTAP LUNs and the required values. If a host is connected to LUNs from other vendors and any of these parameters are overridden, they need to be corrected by later stanzas in **multipath.conf** that apply specifically to ONTAP LUNs. If this is not done, the ONTAP LUNs might not work as expected. The following defaults should only be overridden in consultation with NetApp and/or the OS vendor and only when the impact is fully understood.

Parameter	Setting
`detect_prio`	yes
`dev_loss_tmo`	"infinity"
`failback`	immediate
`fast_io_fail_tmo`	5
`features`	"3 queue_if_no_path pg_init_retries 50"
`flush_on_last_del`	"yes"
`hardware_handler`	"0"
`path_checker`	"tur"
`path_grouping_policy`	"group_by_prio"
`path_selector`	"service-time 0"
`polling_interval`	5
`prio`	"ontap"
`product`	LUN.*
`retain_attached_hw_handler`	yes
`rr_weight`	"uniform"
`user_friendly_names`	no
`vendor`	NETAPP

Example

The following example illustrates how to correct an overridden default. In this case, the **multipath.conf** file defines values for **path_checker** and **detect_prio** that are not compatible with ONTAP LUNs. If they cannot be

removed because of other SAN arrays attached to the host, these parameters can be corrected specifically for ONTAP LUNs with a device stanza.

```
# cat /etc/multipath.conf
defaults {
  path_checker readsector0
  detect_prio no
}
devices{
        device{
                vendor "NETAPP "
                product "LUN.*"
                path_checker tur
                detect_prio yes
        }
}
```

Citrix Hypervisor recommends use of Citrix VM tools for all Linux and Windows based guest VMs for a supported configuration.

Known issues

The Citrix Hypervisor with ONTAP release has the following known issues:

NetApp Bug ID	Title	Description	Citrix Tracker ID
1242343	Kernel disruption on Citrix Hypervisor 8.0 with QLogic QLE2742 32GB FC during storage failover operations	Kernel disruption might occur during storage failover operations on Citrix Hypervisor 8.0 kernel (4.19.0+1) with QLogic QLE2742 32GB HBA. This issue prompts a reboot of the operating system and causes application disruption. If kdump is configured, the kernel disruption generates a vmcore file under the /var/crash/ directory. You can use the vmcore file to understand the cause of the failure. After the kernel disruption, you can recover the operating system by rebooting the host operating system and restarting the application.	NETAPP-98

Use Citrix XenServer with ONTAP

You can configure ONTAP SAN host configuration settings for Citrix XenServer 7 series OS releases with FC, FCoE, and iSCSi protocols.

SAN Booting

What you'll need

If you decide to use SAN booting, it must be supported by your configuration. You can use the NetApp Interoperability Matrix Tool to verify that your OS, HBA, HBA firmware and the HBA boot BIOS, and ONTAP version are supported.

Steps

1. Map the SAN boot LUN to the host.
2. Verify that multiple paths are available.

   Multiple paths become available after the host OS is up and running on the paths.

3. Enable SAN booting in the server BIOS for the ports to which the SAN boot LUN is mapped.

   For information on how to enable the HBA BIOS, see your vendor-specific documentation.

4. Reboot the host to verify that the boot is successful.

Multipathing

Multipath support in Citrix XenServer is based on the Device Mapper Multipathd components. Device mapper nodes are not automatically created for all LUNs presented to the XenServer and are only provisioned when LUNs are actively used by the Storage Management Layer (API). Citrix XenServer Storage Manager API plugin handles activating and deactivating multipath nodes automatically.

Due to incompatibilities with the Integrated Multipath Management architecture, Citrix recommends that you use the Citrix XenCenter application for managing the storage configuration. If it is necessary to query the status of Device Mapper tables manually, or list active device mapper multipath nodes on the system, you can use the `/sbin/mpathutil status` command to verify the settings for your ONTAP LUNs. For more information refer to the standard vendor documentation for Citrix XenServer.

Non-ASA configurations

For non-ASA configurations, there should be two groups of paths with different priorities. The paths with the higher priorities are Active/Optimized, meaning they are serviced by the controller where the aggregate is located. The paths with the lower priorities are active but are non-optimized because they are served from a different controller. The non-optimized paths are only used when no optimized paths are available.

Example

The following example displays the correct output for an ONTAP LUN with two Active/Optimized paths and two Active/Non-Optimized paths:

```
# mpathutil status
show topology
3600a0980383034587724507145353l7a dm-0 NETAPP  , LUN C-Mode
size=80G features='4 queue_if_no_path pg_init_retries 50
retain_attached_hw_handle' hwhandler='1 alua' wp=rw
|-+- policy='service-time 0' prio=50 status=active
| |- 2:0:2:0   sdc   8:32    active ready running
| |- 12:0:5:0  sdn   8:208   active ready running
| |- 2:0:6:0   sdg   8:96    active ready running
| `- 12:0:0:0  sdi   8:128   active ready running
|-+- policy='service-time 0' prio=10 status=enabled
  |- 2:0:0:0   sda   8:0     active ready running
  |- 2:0:1:0   sdb   8:16    active ready running
  |- 12:0:3:0  sd1   8:176   active ready running
  `-12:0:6:0   sdo   8:224   active ready running
[root@sanhost ~]#
```

Do not use an excessive number of paths to a single LUN. No more than four paths should be required. More than eight paths might cause path issues during storage failures.

All SAN Array Configuration

In All SAN Array (ASA) configurations, all paths to a given Logical Unit (LUN) are active and optimized. This means I/O can be served through all paths at the same time, thereby enabling better performance.

Example

The following example displays the correct output for an ONTAP LUN with all four Active/Optimized paths:

```
# mpathutil status
show topology
3600a0980383034587724507145353l7a dm-0 NETAPP  , LUN C-Mode
size=80G features='4 queue_if_no_path pg_init_retries 50
retain_attached_hw_handle' hwhandler='1 alua' wp=rw
|-+- policy='service-time 0' prio=50 status=active
| |- 2:0:2:0   sdc   8:32    active ready running
| |- 12:0:5:0  sdn   8:208   active ready running
| |- 2:0:6:0   sdg   8:96    active ready running
| `- 12:0:0:0  sdi   8:128   active ready running
[root@sanhost ~]#
```

Do not use an excessive number of paths to a single LUN. No more than four paths should be required. More than eight paths might cause path issues during storage failures.

Recommended Settings

The Citrix XenServer 7.x OS is compiled with all settings required to recognize and correctly manage ONTAP LUNs. For Citrix XenServer 7.x, an empty zerobyte `/etc/multipath.conf` file must exist, but you do not need to make specific changes to the file.

Enable the host multipath service from the **Xencenter Management Portal** and verify that the multipath service is enabled and running.

```
# systemct1 status multipathd
multipathd.service - Device-Mapper Multipath Device Controller
  Loaded:  load (/usr/lib/systemd/system/multipathd.service; enabled;
vendor preset: enabled)
 Drop-In:  /etc/systemd/system/multipathd.service.d
            slice.config
  Active:  active (running) since Fri YYYY-MM-DD 00:00:26 IST; 1 month 9
days ago
Main PID:  3789 (multipathd)
  CGroup:  /control.slice/multipathd.service
           3789  /sbin/multipathd
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There is no requirement to append content to the `/etc/multipath.conf` file, unless you have devices that you do not want to be managed by multipath or you have existing settings that override defaults. You can add the following syntax to the `multipath.conf` file to exclude the unwanted devices.

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# cat /etc/multipath.conf
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     wwid    <DevId>
     devnode "^(ram|raw|loop|fd|md|dm-|sr|scd|st)[0-9]*"
     devnode "^hd[a-z]"
     devnode "^cciss.*"
}
```

Replace the **<DevID>** with the WWID string of the device you want to exclude.

Example

In this example for Citrix XenServer 7.x, `sda` is the local SCSI disk that we need to add to the blacklist.

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2. Add this WWID to the blacklist stanza in the `/etc/multipath.conf`:

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```

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`flush_on_last_del`	"yes"
`hardware_handler`	"0"
`path_checker`	"tur"
`path_grouping_policy`	"group_by_prio"
`path_selector`	"service-time 0"
`polling_interval`	5
`prio`	"ontap"
`product`	LUN.*
`retain_attached_hw_handler`	yes
`rr_weight`	"uniform"
`user_friendly_names`	no
`vendor`	NETAPP

Example

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  detect_prio no
}
devices{
        device{
                vendor "NETAPP "
                product "LUN.*"
                path_checker tur
                detect_prio yes
        }
}
```

Citrix XenServer recommends use of Citrix VM tools for all Linux and Windows based guest VMs for a supported configuration.

Known issues

There are no known issues for the Citrix XenServer with ONTAP release.

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