

# Multipath on RedHat (NetApp FAS2240)

Multipath ? CentOS/RedHat ?????????? port ? HBA ??? Storage???????????????

????

- RedHat 4.7
- NetApp FAS2240
- SAN Switch x 2
- HBA Card: QLogic, port x 2

```
#>lspci
```

```
Fibre Channel: QLogic Corp. ISP2532-based 8Gb Fibre Channel to PCI Express HBA (rev 02)
```

## RedHat ? HBA Card ??

?????????????? RedHat ????? HBA ?????? RedHat ?????? HBA ??

?????????? RedHat ????? /etc/modprobe.conf?????????

```
alias scsi_hostadapter2 qla2500
```

```
“ scsi_hostadapterX ???????????
```

?? HBA ?? WWN

```
#> cat /proc/scsi/qla2xxx/2
```

```
SCSI Device Information:
```

```
scsi-qla0-adapter-node=5001438004253c81;
```

```
scsi-qla0-adapter-port=5001438004253c80; <---- WWN
```

```
scsi-qla0-target-0=50001fe1500e28fd;
```

```
scsi-qla0-target-1=50001fe1500e28f9;
```

```
scsi-qla0-target-2=500a09829140a66c;
```

“ ??? HBA port ??? /proc/scsi/qla2xxx/3?????

?? port ??? WWN

NetApp storage ?? LUN ?? WWN ?? Host Mapping ?????

????????

```
# lsmod | grep qla
qla2500                209985  0
qla2xxx                203681  13 qla2500
scsi_transport_fc      19521   1 qla2xxx
scsi_mod               153489  7
ib_srp,qla2xxx,scsi_transport_fc,sr_mod,libata,cciss,sd_mod
```

## SAN Storage ?????

1. ? NetApp storage?SAN switch?RedHat ????????
2. ?? RedHat ? HBA ? ? port ??? WWN
3. ?? NetApp?? LUNs ????? WWN Hosts

## ?? Multipath

“ ???RedHat ?????????? multipath.conf ??????????????????????  
<https://access.redhat.com/labs/multipathhelper/>

????????

```
rpm -q device-mapper
rpm -q device-mapper-multipath
yum install device-mapper
yum install device-mapper-multipath
```

## CentOS 5.x)

?? /etc/multipath.conf

```
# Blacklist all devices by default. Remove this to enable multipathing
# on the default devices.
devnode_blacklist {
#     devnode "*" << 
}

## Use user friendly names, instead of using WWIDs as names.
defaults {
    user_friendly_names yes
}
```

“ ????????? multipathd ????????????? LUNs ?????????????”

?? multipathd ??

```
#> service multipathd start
#> chkconfig multipathd on
```

## CentOS 6/7)

???????? /etc/multipath.conf???????????????????????? multipathd ??????????

```
#> mpathconf --enable --with_multipathd y
```

“ ???? multipath.conf”

## ?? multupah ???

CentOS 5.x

```
[root@cdb3-b ~]# multipath -ll
mpath1 (360a98000383035537824474d3936556a) dm-4 NETAPP,LUN
[size=700G][features=3 queue_if_no_path pg_init_retries 50][hwhandler=0][rw]
\_ round-robin 0 [prio=4][active]
\_ 1:0:1:0 sdb      8:16  [active][ready]
\_ 2:0:1:0 sdd      8:48  [active][ready]
```

```
\_ round-robin 0 [prio=1][enabled]
\_ 1:0:0:0 sda      8:0  [active][ready]
\_ 2:0:0:0 sdc      8:32 [active][ready]
```

## CentOS 6.x

```
[root@cdb3 ~]# multipath -ll
mpathb (360a98000383035537824474d39365568) dm-2 NETAPP,LUN
size=700G features='4 queue_if_no_path pg_init_retries 50 retain_attached_hw_handle'
hwhandler='0' wp=rw
|-+- policy='round-robin 0' prio=4 status=active
|  |- 1:0:1:0 sdc 8:32 active ready running
|  `-- 2:0:1:0 sde 8:64 active ready running
`--+- policy='round-robin 0' prio=1 status=enabled
    |- 1:0:0:0 sdb 8:16 active ready running
    `-- 2:0:0:0 sdd 8:48 active ready running
```

## ?? NetApp ????

### ?????? LUN ??? - NetApp Linux Host Utilities

```
yum install libnl
rpm -ivh QConvergeConsoleCLI-1.0.01-32.x86_64.rpm
rpm -ivh netapp_linux_host_utilities-6-2.x86_64.rpm
```

“ - ?????????????????? sanlun ??

- ?? CentOS 5.x/6.x

## ?? LUN ????????

???????????? LUN disks (? dual path SAN ??????? LUN disks)???????????????????? mpathXX  
???????

```
#> multipath -l
mpath1 (360a98000424732615124444150534a35)
[size=100 GB][features="1 queue_if_no_path"][hwhandler="0"]
\_ round-robin 0 [active]
\_ 2:0:2:0 sde 8:64 [active]
```

```
\_ 3:0:2:0 sdf 8:80 [active]
```

```
mpath0 (3600508b400068e5c00012000001a0000)
```

```
[size=100 GB][features="1 queue_if_no_path"][hwhandler="0"]
```

```
\_ round-robin 0 [active]
```

```
\_ 2:0:0:1 sda 8:0 [active]
```

```
\_ 3:0:0:1 sdc 8:32 [active]
```

```
\_ round-robin 0 [enabled]
```

```
\_ 2:0:1:1 sdb 8:16 [active]
```

```
\_ 3:0:1:1 sdd 8:48 [active]
```

“ mpathX ?????? LVM ? PV ??????? filesystem?????? /dev/mapper/mpathX

2:0:0:1 ????? host : channel : ID : LUN

Host 2 ? Host 3 ?? HBA ????? port ??? port ?????

## ??/? LUN ????????

?????

- <https://library.netapp.com/ecmdocs/ECMP1654943/html/GUID-F88A86D2-F3A9-4440-8C32-539BFEA6BED1.html>
- <https://access.redhat.com/solutions/3941>

## CentOS/RedHat 5.x ??

? CentOS/RedHat 5 ????? SLES 10 ????????????????

```
yum install sg3_utils
```

????????? LUN Disk

```
□□□□□□ LUN Disks
```

```
#> sanlun lun show all
```

```
□□□□ LUN
```

```
#> scsi-rescan
```

```
NOTE: □□□□□□ LUN□□□□□ -a
```

```
#> scsi-rescan -a
```

```
□□□□□□ LUN Disks
```

```
#> sanlun lun show all
```

?? LUN ???

?????? LUN disk ????????????

1. ?? `umount` ??
2. ?? `lvremove` ?? LV
3. ?????? `vgremove` ?? VG
4. ?? `pvremove` ?? PV
5. ?? `multipath -f mpathXX` ?? multipathXX  
NOTE: ?????????????? LUN ?????? Hang?
6. ? Storage ?????????? LUN disk  
NOTE: ? LUN ???????? `sanlun lun show all` ?????? LUN ??? unknown?
7. ?? `scsi-rescan -r` ?????????? LUN disk  
NOTE: ??????????????????  
4 device(s) removed.  
[5:0:1:0]  
[5:0:3:0]  
[6:0:1:0]  
[6:0:3:0]  
????? `sanlun lun show all` ??? unknown ??????

## CentOS/RedHat 4.x?

- [Vmware Linux Guest Add a New Hard Disk Without Rebooting Guest](#)

????????? script

1. remove-LUNs.sh
2. rescan-LUNs.sh

?? LUN disk ??

1. ? NetApp storage ??? LUN Mapping ???
2. ? RedHat ??? `rescan-LUNs.sh`
3. ? RedHat ??? `multipath -l`

???? LUN disk

1. ? RedHat ?????? mpathX

2. ? RedHat ??? `sanlun lun show all` ?? LUN ??? NetApp ???  
 ????? sanlun ?????? NetApp ??? `netapp_linux_host_utilities-6-2.x86_64.rpm`
3. ? NetApp ?????? LUN
4. ? RedHat ??? `multipath -l`
5. ????? LUN disks ? `host:channel:id:LUN`
6. ?? `remove-LUNs.sh <host> <channel> <id> <LUN>`

## ?? LUN disk ????

1. ?? LUN ID ? `sd[X]` ???

```
smartctl -a /dev/sd[X]
```

2. ?? LUN disk???????

```
echo 1 > /sys/block/sd[X]/device/rescan
```

```
lsblk | grep sd[X]
```

3. Resize PV

```
pvresize /dev/sd[X]
```

4. ?????? SOP ?? LV ? Filesystem ????

## LVM ??

- ?? LUN disk ??? PV

```
#> pvcreate /dev/mapper/mpath6
```

“ PV ?????? `pvdisplay` ?????? `dm-X?`

- ???? VG (??? PV)

```
#> vgcreate dbVG /dev/mapper/mpath6
```

## ??????

multipath

<code>/etc/init.d/multipathd start</code>	Manually starts the multipathing service on the Linux host.
<code>multipath -ll</code>	Displays the multipathing configuration.
<code>multipath -v2</code>	Creates the initial multipathing configuration.
<code>multipath -f <i>device_map</i></code>	Removes an existing LUN from the multipathing configuration.
<code>multipath -ll -v2 -d</code>	Displays the multipathing configuration in verbose mode.
<code>multipath -t ? multipathd show config</code>	??????????

## Accessing LUNs on host

<code>sanlun fcp show adapter -v</code>	Displays HBA information.
<code>sanlun fcp show adapter</code>	Display WWPN of HBA cards
<code>sanlun lun show all</code>	Lists available LUNs as seen by the sanlun script.
<code>sanlun lun show -p</code>	Provides multipath information for both DM-Multipath and Veritas Storage Foundation TM dynamic multipathing solutions.
<code>ls -lh /dev/mapper/</code>	Lists DM-Multipath devices generated for LUNs.
<code>e2label <i>device label</i></code>	Creates a persistent label for a file system. <i>device</i> is the partition; <i>label</i> is a unique string up to 16 characters. Not needed with DM-Multipath.

## Q & A

### Q: RHEL 7 ????? alias path

“ ?? NetApp Storage??? `multipath -ll`

```

360a98000443437576f2444726e556d76 dm-2 NETAPP ,LUN
size=800G 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
|`- 6:0:0:0 sdb 8:16 active ready running
`+- policy='service-time 0' prio=10 status=enabled
  `- 6:0:3:0 sdc 8:32 active ready running

```

???? alias name: `mpathXX`

???????https://access.redhat.com/solutions/2061463

?? multipath ????????

```
multipath -t
```

“???? NetApp ????”

??????? multipath.conf??? NetApp ?????

“NOTE: ??? NetApp Storage?”

```
defaults {
    user_friendly_names yes
    find_multipaths yes
}

devices {
    device {
        vendor "NETAPP"
        product "LUN.*"
        path_grouping_policy "group_by_prio"
        path_checker "tur"
        features "3 queue_if_no_path pg_init_retries 50"
        hardware_handler "0"
        prio "ontap"
        failback immediate
        rr_weight "uniform"
        rr_min_io 128
        flush_on_last_del "yes"
        dev_loss_tmo "infinity"
        user_friendly_names yes
        retain_attached_hw_handler yes
        detect_prio yes
    }
}
```

?????

```
#> systemctl reload multipathd

#> multipath -ll
mpatha (360a98000443437576f2444726e556d76) dm-2 NETAPP ,LUN
size=800G 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
|  |- 4:0:0:0 sdb 8:16 active ready running
|   `-- 6:0:0:0 sdd 8:48 active ready running
`-+- policy='service-time 0' prio=10 status=enabled
    |- 4:0:3:0 sdc 8:32 active ready running
    `-- 6:0:3:0 sde 8:64 active ready running
```

Q: ?? netapp\_linux\_host\_utilities ??????????

“ Warning: libnl.so library not found, some sanlun commands may not work. Refer Linux Host Utilities Installation and Setup Guide for more details  
Warning: libHBAAPI.so library not found, some sanlun commands may not work. Refer Linux Host Utilities Installation and Setup Guide for more details

Solution: ??? libnl

```
yum install libnl
```

???????????

- [http://driverdownloads.qlogic.com/QLogicDriverDownloads\\_UI/ResourceByOS.aspx?productid=1043&oemid=372&oemcatid=111969](http://driverdownloads.qlogic.com/QLogicDriverDownloads_UI/ResourceByOS.aspx?productid=1043&oemid=372&oemcatid=111969)
- [http://driverdownloads.qlogic.com/QLogicDriverDownloads\\_UI/SearchByOs.aspx?ProductCategory=39&OsCategory=2&Os=65&OsCategoryName=Linux&ProductCategoryName=Fibre+Channel+HBAs&OSName=Linux+Red+Hat+%2864-bit%29](http://driverdownloads.qlogic.com/QLogicDriverDownloads_UI/SearchByOs.aspx?ProductCategory=39&OsCategory=2&Os=65&OsCategoryName=Linux&ProductCategoryName=Fibre+Channel+HBAs&OSName=Linux+Red+Hat+%2864-bit%29)
- QConvergeConsole CLI (x64)
- SANsurfer CLI (x86/x64)

Q: ?? pvscan?vgscan ??????????????

|

Found duplicate PV XXXXXXXXXXXXXXXXXXXX: using /dev/sdb not /dev/sda

Solution:

???????????? multipath ? LVM ??????? CentOS 4/5 ?? LVM ?????????????????????????????????  
multipath ??LVM ????? mpathX ? dm-X ?????????? sdX ???

?? LVM ??? sdX ??????????? /etc/lvm/lvm.conf????????????????????LVM ??? sdX  
????????????????? initrd ?????????????? grub.conf ????????

???????:

1. ?? /etc/lvm/lvm.conf

```
...  
filter = [ "r|/dev/sd.*|", "a|/.*|" ]  
...
```

“ r|/dev/sd.\*| ?????????? sda, sdb, ...????????????????????????????????????????????????????????

?????

?? pvscan ? vgscan????????? Warning?????? 2?

2. ?? initrd ??????

```
#> cd /boot  
#> mkinitrd -f -v /boot/initrd-$(uname -r).multipath.img $(uname -r)
```

?? /boot/grub/grub.conf  
?? title ??????????????????????

```
title Cent0S (2.6.18-398.el5-Multipath) <== [] Multipath  
    root (hd0,0)  
    kernel /vmlinuz-2.6.18-398.....  
    initrd /initrd-2.6.18-398.el5.multipath.img <== [][]initrd [][]
```

?????

3. ?????????????????????????????????

????????????????????????????????????? grub.conf ? default=1?

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Revision #8

Created 2022-03-09 09:30:48 CST by A-Lang (Admin)

Updated 2022-05-27 01:47:12 CST by A-Lang (Admin)