SAN & iSCSI

SAN - Storage Area Network, iSCSI - Internet Small Computer System Interface

- iSCSI and multipath on CentOS 7
- Learning
- Multipath on RedHat (NetApp FAS2240)
- FAQ

iSCSI and multipath on CentOS 7

????

- iSCSI Storage: NetApp FAS8200
- Linux OS: CentOS 7
- Server H/W: HP DL380 Gen10
- iSCSI ????: 10G SFP ????? x 2

?????

???? nmtui ????????? IP ? Mask

> ??: ???????? Bonding?

?? iSCSI

?? iscsi ??

```
yum install iscsi-initiator-utils
```

?? iscsid.conf: `/etc/iscsi/iscsid.conf`

```
# □□ timeout
#node.session.timeo.replacement_timeout = 120
node.session.timeo.replacement_timeout = 5


# □□ node □□ Login
node.startup = automatic
```

?? initiator name: `/etc/iscsi/initiatorname.iscsi`

????????

- iqn.\<year-to-date\>.\<your-domain\>.\<your-hostname\>:redhat-disk ?? InitiatorName=iqn.2019-02.mycompany.bdb7-a:redhat-disk
- initiator name ??? Storage ??????
- ??? Host ?????????

?? multipath ? netapp_linux_unified_host_utilities

```
yum install device-mapper-multipath

yum install libhbaapi

rpm -ivh netapp_linux_unified_host_utilities-7-1.x86_64.rpm
```

> ?????? libhbaapi??? sanlun ??????

?? iSCSI storage

??????

```
iscsiadm -m iface -I iscsi_ens2f0 --op=new
iscsiadm -m iface -I iscsi_ens3f0 --op=new
```

Discovery for the storage

```
iscsiadm -m discovery -t sendtargets -p <ip-to-iscsi-storage>:3260
```

> ?? NetApp storage ????? iSCSI IPs????????? IP ?????????????? IP?

```
[root@bdb7-b RPMs]# iscsiadm -m discovery -t sendtargets -p 10.18.104.32:3260
    10.18.104.32:3260,1038 iqn.1992-08.com.netapp:sn.58042162340f11e9892700a098e3ab45:vs.16
    10.18.104.34:3260,1040 iqn.1992-08.com.netapp:sn.58042162340f11e9892700a098e3ab45:vs.16
    10.18.104.33:3260,1039 iqn.1992-08.com.netapp:sn.58042162340f11e9892700a098e3ab45:vs.16
    10.18.104.31:3260,1037 iqn.1992-08.com.netapp:sn.58042162340f11e9892700a098e3ab45:vs.16
    10.18.104.32:3260,1038 iqn.1992-08.com.netapp:sn.58042162340f11e9892700a098e3ab45:vs.16
    10.18.104.34:3260,1040 iqn.1992-08.com.netapp:sn.58042162340f11e9892700a098e3ab45:vs.16
    10.18.104.33:3260,1039 iqn.1992-08.com.netapp:sn.58042162340f11e9892700a098e3ab45:vs.16
    10.18.104.31:3260,1037 iqn.1992-08.com.netapp:sn.58042162340f11e9892700a098e3ab45:vs.16
```

Login nodes

iscsiadm -m node -l all

????????????

[root@bdb7-b RPMs]# iscsiadm -m node -l all
    Logging in to [iface: iscsi_ens2f0, target: iqn.1992-
08.com.netapp:sn.58042162340f11e9892700a098e3ab45:vs.16, portal: 10.18.104.32,3260] (multiple)
    Logging in to [iface: iscsi_ens3f0, target: iqn.1992-
08.com.netapp:sn.58042162340f11e9892700a098e3ab45:vs.16, portal: 10.18.104.32,3260] (multiple)
    Logging in to [iface: iscsi_ens2f0, target: iqn.1992-
08.com.netapp:sn.58042162340f11e9892700a098e3ab45:vs.16, portal: 10.18.104.34,3260] (multiple)
    Logging in to [iface: iscsi_ens3f0, target: iqn.1992-
08.com.netapp:sn.58042162340f11e9892700a098e3ab45:vs.16, portal: 10.18.104.34,3260] (multiple)
    Logging in to [iface: iscsi_ens2f0, target: iqn.1992-
08.com.netapp:sn.58042162340f11e9892700a098e3ab45:vs.16, portal: 10.18.104.33,3260] (multiple)
    Logging in to [iface: iscsi_ens3f0, target: iqn.1992-
08.com.netapp:sn.58042162340f11e9892700a098e3ab45:vs.16, portal: 10.18.104.33,3260] (multiple)
    Logging in to [iface: iscsi_ens2f0, target: iqn.1992-
08.com.netapp:sn.58042162340f11e9892700a098e3ab45:vs.16, portal: 10.18.104.31,3260] (multiple)
    Logging in to [iface: iscsi_ens3f0, target: iqn.1992-
08.com.netapp:sn.58042162340f11e9892700a098e3ab45:vs.16, portal: 10.18.104.31,3260] (multiple)
    Login to [iface: iscsi_ens2f0, target: iqn.1992-
08.com.netapp:sn.58042162340f11e9892700a098e3ab45:vs.16, portal: 10.18.104.32,3260] successful.
    Login to [iface: iscsi_ens3f0, target: iqn.1992-
08.com.netapp:sn.58042162340f11e9892700a098e3ab45:vs.16, portal: 10.18.104.32,3260] successful.
    Login to [iface: iscsi_ens2f0, target: iqn.1992-
08.com.netapp:sn.58042162340f11e9892700a098e3ab45:vs.16, portal: 10.18.104.34,3260] successful.
    Login to [iface: iscsi_ens3f0, target: iqn.1992-
08.com.netapp:sn.58042162340f11e9892700a098e3ab45:vs.16, portal: 10.18.104.34,3260] successful.
    Login to [iface: iscsi_ens2f0, target: iqn.1992-
08.com.netapp:sn.58042162340f11e9892700a098e3ab45:vs.16, portal: 10.18.104.33,3260] successful.
    Login to [iface: iscsi_ens3f0, target: iqn.1992-
08.com.netapp:sn.58042162340f11e9892700a098e3ab45:vs.16, portal: 10.18.104.33,3260] successful.
    Login to [iface: iscsi_ens2f0, target: iqn.1992-
08.com.netapp:sn.58042162340f11e9892700a098e3ab45:vs.16, portal: 10.18.104.31,3260] successful.
    Login to [iface: iscsi_ens3f0, target: iqn.1992-
08.com.netapp:sn.58042162340f11e9892700a098e3ab45:vs.16, portal: 10.18.104.31,3260] successful.

?? sanlun ?? LUN Disks

```
[root@bdb7-b RPMs]# sanlun lun show
  controller(7mode/E-Series)/                        device      host           lun
  vserver(cDOT/FlashRay)      lun-pathname           filename    adapter  protocol  size    product
  -------------------------------------------------------------------------------------------------
  TPEDBISCSISVM01      /vol/BDB7_B_4_vol/BDB7_B_4    /dev/sdag    host19    iSCSI    500.1g  cDOT
  TPEDBISCSISVM01      /vol/BDB7_B_4_vol/BDB7_B_4    /dev/sdaf    host20    iSCSI    500.1g  cDOT
  TPEDBISCSISVM01      /vol/BDB7_B_4_vol/BDB7_B_4    /dev/sdae    host17    iSCSI    500.1g  cDOT
  TPEDBISCSISVM01      /vol/BDB7_B_4_vol/BDB7_B_4    /dev/sdad    host18    iSCSI    500.1g  cDOT
  TPEDBISCSISVM01      /vol/BDB7_B_4_vol/BDB7_B_4    /dev/sdac    host16    iSCSI    500.1g  cDOT
  TPEDBISCSISVM01      /vol/BDB7_B_4_vol/BDB7_B_4    /dev/sdab    host15    iSCSI    500.1g  cDOT
  TPEDBISCSISVM01      /vol/BDB7_B_3_vol/BDB7_B_3    /dev/sdz     host20    iSCSI    500.1g  cDOT
  TPEDBISCSISVM01      /vol/BDB7_B_3_vol/BDB7_B_3    /dev/sdaa    host19    iSCSI    500.1g  cDOT
  TPEDBISCSISVM01      /vol/BDB7_B_4_vol/BDB7_B_4    /dev/sdy     host14    iSCSI    500.1g  cDOT
  TPEDBISCSISVM01      /vol/BDB7_B_3_vol/BDB7_B_3    /dev/sdx     host18    iSCSI    500.1g  cDOT
  TPEDBISCSISVM01      /vol/BDB7_B_3_vol/BDB7_B_3    /dev/sdw     host17    iSCSI    500.1g  cDOT
  TPEDBISCSISVM01      /vol/BDB7_B_3_vol/BDB7_B_3    /dev/sdt     host16    iSCSI    500.1g  cDOT
  TPEDBISCSISVM01      /vol/BDB7_B_3_vol/BDB7_B_3    /dev/sdu     host15    iSCSI    500.1g  cDOT
  ...
```

?? multipath

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

```
mpathconf --enable --with_multipathd y
```

?? device alias name ? LUN WWID ???

> ???? RedHat 7.6 ? multipathd ??????? user_friendly_names yes
>   ??? NetApp ? LUN disks ??????? mpath X ???????????
> WWID??????????
> ??????????????????? WWID ???

?? /etc/multipath.conf , ????????????

```
...
multipaths {
    multipath {
        wwid    3600a0980383136312d3f4e387455564b
```

```
            alias   mpath1
        }
        multipath {
            wwid    3600a0980383136312d3f4e387455564c
            alias   mpath2
        }
        multipath {
            wwid    3600a0980383136312d3f4e387455564d
            alias   mpath3
        }
        multipath {
            wwid    3600a0980383136312d3f4e387455564e
            alias   mpath4
        }
    }
```

> wwid ????? multipath -l ??
>
> alias ?????????LUN disks???????? sanlun lun show ??

?????

```
systemctl reload multipathd
```

?? multipath -l?????? WWID ? Alias Name

```
mpath2 (3600a0980383136312d3f4e387455564c) dm-5 NETAPP  ,LUN C-Mode
size=500G features='4 queue_if_no_path pg_init_retries 50 retain_attached_hw_handle' hwhandler='1 alua'
wp=rw
|-+- policy='service-time 0' prio=0 status=active
| |- 12:0:0:1 sdo  8:224  active undef running
| |- 13:0:0:1 sds  65:32  active undef running
| |- 15:0:0:1 sdaa 65:160 active undef running
| `- 16:0:0:1 sdae 65:224 active undef running
`-+- policy='service-time 0' prio=0 status=enabled
  |- 10:0:0:1 sdg  8:96   active undef running
  |- 11:0:0:1 sdk  8:160  active undef running
  |- 14:0:0:1 sdw  65:96  active undef running
```

```
`- 9:0:0:1  sdc  8:32   active undef running
```

???? iSCSI LUNs

> ?????????????????????

?? /etc/fstab , ? iSCSI disk ?????? _netdev

```
#device        mount point    FS    Options Backup  fsck
/dev/myvg/mylv  /mydisk        xfs   _netdev  0    0
```

?? netfs ??????

```
## CentOS 7
systemctl enable remote-fs.target


## CentOS 4/5/6
chkconfig netfs on
```

?? MTU ??

????? MTU ? 1500????? iSCSI ????????? 9000??? Linux ?????????? Switch ? iSCSI
Storage (iSCSI Target) ?????????

RedHat 7.x) ?????????????? frame ???????

```
UNSUCCESSFUL

# ping -M do -c 4 -s  8196 10.1.1.21
PING 10.1.1.21 (10.1.1.21) 8185(8213) bytes of data.
PING 10.1.1.21(10.1.1.21) 8196(8224) bytes of data.
ping: local error: Message too long, mtu=1500
ping: local error: Message too long, mtu=1500


SUCCESSFUL

# ping -M do -c 4 -s 1408 10.1.1.21
PING 10.1.1.21 (10.1.1.21) 1408(1436) bytes of data.
1416 bytes from 10.1.1.21: icmp_seq=1 ttl=58 time=224 ms
```

???? MTU (NOTE: ??????)

```
ip link set dev ens2f0 mtu 9000
```

???????? iSCSI ???????? ifcfg-ethXX??????

```
MTU="9000"
```

????????

????? LUN disk

1. iSCSI Storage ?? LUN disk ???????? Linux host?

2. ?????? Linux host ?????

3. ??(discover)????? LUN disk

```
[root@bdb7-b ~]# /usr/bin/rescan-scsi-bus.sh
Scanning SCSI subsystem for new devices
Scanning host 0 for  SCSI target IDs  0 1 2 3 4 5 6 7, all LUNs
Scanning host 1 for  SCSI target IDs  0 1 2 3 4 5 6 7, all LUNs
Scanning host 2 for  SCSI target IDs  0 1 2 3 4 5 6 7, all LUNs
Scanning host 3 for  SCSI target IDs  0 1 2 3 4 5 6 7, all LUNs
 Scanning for device 3 0 0 0 ...
OLD: Host: scsi3 Channel: 00 Id: 00 Lun: 00
    Vendor: HPE     Model: DVDROM DUD0N     Rev: UMD1
    Type:   CD-ROM               ANSI SCSI revision: 05
Scanning host 4 for  SCSI target IDs  0 1 2 3 4 5 6 7, all LUNs
Scanning host 5 for  SCSI target IDs  0 1 2 3 4 5 6 7, all LUNs
Scanning host 6 for  all SCSI target IDs, all LUNs
Scanning host 7 for  SCSI target IDs  0 1 2 3 4 5 6 7, all LUNs
 Scanning for device 7 0 0 0 ...
```

4. ?? sanlun ????? LUN disk

```
[root@bdb7-b ~]# sanlun lun show all
controller(7mode/E-Series)/                       device      host           lun
vserver(cDOT/FlashRay)     lun-pathname            filename    adapter  protocol  size    product
-------------------------------------------------------------------------------------------------------
TPEDBISCSISVM01           /vol/BDB7_B_6_vol/BDB7_B_6   /dev/sdaw    host16     iSCSI    500.1g cDOT
```

TPEDBISCSISVM01	/vol/BDB7_B_6_vol/BDB7_B_6	/dev/sdav	host15	iSCSI	500.1g	cDOT
TPEDBISCSISVM01	/vol/BDB7_B_6_vol/BDB7_B_6	/dev/sdau	host14	iSCSI	500.1g	cDOT
TPEDBISCSISVM01	/vol/BDB7_B_6_vol/BDB7_B_6	/dev/sdat	host13	iSCSI	500.1g	cDOT
TPEDBISCSISVM01	/vol/BDB7_B_6_vol/BDB7_B_6	/dev/sdas	host12	iSCSI	500.1g	cDOT
TPEDBISCSISVM01	/vol/BDB7_B_6_vol/BDB7_B_6	/dev/sdar	host11	iSCSI	500.1g	cDOT
TPEDBISCSISVM01	/vol/BDB7_B_6_vol/BDB7_B_6	/dev/sdaq	host10	iSCSI	500.1g	cDOT
TPEDBISCSISVM01	/vol/BDB7_B_6_vol/BDB7_B_6	/dev/sdap	host9	iSCSI	500.1g	cDOT
TPEDBISCSISVM01	/vol/BDB7_B_5_vol/BDB7_B_5	/dev/sdao	host15	iSCSI	500.1g	cDOT
TPEDBISCSISVM01	/vol/BDB7_B_5_vol/BDB7_B_5	/dev/sdan	host16	iSCSI	500.1g	cDOT
TPEDBISCSISVM01	/vol/BDB7_B_4_vol/BDB7_B_4	/dev/sdam	host16	iSCSI	500.1g	cDOT

...

5. ?? multipath ????? LUN disk

```
[root@bdb7-b alang]# multipath -ll
mpath2 (3600a098038313631305d4e2d6f774744) dm-6 NETAPP  ,LUN C-Mode
size=500G 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
| |- 9:0:0:1  sdf  8:80   active ready running
| |- 12:0:0:1 sdt  65:48  active ready running
| |- 16:0:0:1 sdah 66:16  active ready running
| `- 15:0:0:1 sdai 66:32  active ready running
`-+- policy='service-time 0' prio=10 status=enabled
  |- 11:0:0:1 sdg  8:96   active ready running
  |- 10:0:0:1 sde  8:64   active ready running
  |- 14:0:0:1 sdu  65:64  active ready running
  `- 13:0:0:1 sdv  65:80  active ready running
mpath1 (3600a098038313631305d4e2d6f774743) dm-5 NETAPP  ,LUN C-Mode
size=500G 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
| |- 9:0:0:0  sdc  8:32   active ready running
| |- 12:0:0:0 sdr  65:16  active ready running
| |- 16:0:0:0 sdaf 65:240 active ready running
| `- 15:0:0:0 sdag 66:0   active ready running
`-+- policy='service-time 0' prio=10 status=enabled
  |- 11:0:0:0 sdd  8:48   active ready running
  |- 10:0:0:0 sdb  8:16   active ready running
  |- 13:0:0:0 sdq  65:0   active ready running
```

```
      `- 14:0:0:0 sds  65:32  active ready running
3600a098038313631305d4e2d6f77474a dm-26 NETAPP  ,LUN C-Mode
size=500G 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
| |- 9:0:0:5  sdap 66:144 active ready running
| |- 12:0:0:5 sdas 66:192 active ready running
| |- 15:0:0:5 sdav 66:240 active ready running
| `- 16:0:0:5 sdaw 67:0   active ready running
`-+- policy='service-time 0' prio=10 status=enabled
  |- 10:0:0:5 sdaq 66:160 active ready running
  |- 11:0:0:5 sdar 66:176 active ready running
  |- 13:0:0:5 sdat 66:208 active ready running
  `- 14:0:0:5 sdau 66:224 active ready running
...
```

6. ?? LUN WWID ? mpathX ???

?? `/etc/multipath.conf` : ??? wwid ? alias ???

```
# added by alang
multipaths {
    multipath {
        wwid    3600a098038313631305d4e2d6f774743
        alias   mpath1
    }
    multipath {
        wwid    3600a098038313631305d4e2d6f774744
        alias   mpath2
    }
    multipath {
        wwid    3600a098038313631305d4e2d6f774745
        alias   mpath3
    }
    multipath {
        wwid    3600a098038313631305d4e2d6f774746
        alias   mpath4
    }
    multipath {
        wwid    3600a098038313631305d4e2d6f774747
```

```
            alias   mpath5
     }
     multipath {
            wwid   3600a098038313631305d4e2d6f77474a
            alias   mpath6
     }
}
```

7. ?? multipath ??

```
[root@bdb7-b alang]# systemctl reload multipathd


[root@bdb7-b alang]# multipath -ll
mpath2 (3600a098038313631305d4e2d6f774744) dm-6 NETAPP  ,LUN C-Mode
size=500G 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
| |- 12:0:0:1 sdt  65:48  active ready running
| |- 15:0:0:1 sdai 66:32  active ready running
| |- 16:0:0:1 sdah 66:16  active ready running
| `- 9:0:0:1  sdf  8:80   active ready running
`-+- policy='service-time 0' prio=10 status=enabled
  |- 10:0:0:1 sde  8:64   active ready running
  |- 11:0:0:1 sdg  8:96   active ready running
  |- 13:0:0:1 sdv  65:80  active ready running
  `- 14:0:0:1 sdu  65:64  active ready running
mpath1 (3600a098038313631305d4e2d6f774743) dm-5 NETAPP  ,LUN C-Mode
size=500G 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
| |- 12:0:0:0 sdr  65:16  active ready running
| |- 15:0:0:0 sdag 66:0   active ready running
| |- 16:0:0:0 sdaf 65:240 active ready running
| `- 9:0:0:0  sdc  8:32   active ready running
`-+- policy='service-time 0' prio=10 status=enabled
  |- 10:0:0:0 sdb  8:16   active ready running
  |- 11:0:0:0 sdd  8:48   active ready running
  |- 13:0:0:0 sdq  65:0   active ready running
  `- 14:0:0:0 sds  65:32  active ready running
mpath6 (3600a098038313631305d4e2d6f77474a) dm-26 NETAPP  ,LUN C-Mode
```

```
size=500G 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
| |- 12:0:0:5 sdas 66:192 active ready running
| |- 15:0:0:5 sdav 66:240 active ready running
| |- 16:0:0:5 sdaw 67:0   active ready running
| `- 9:0:0:5  sdap 66:144 active ready running
`-+- policy='service-time 0' prio=10 status=enabled
  |- 10:0:0:5 sdaq 66:160 active ready running
  |- 11:0:0:5 sdar 66:176 active ready running
  |- 13:0:0:5 sdat 66:208 active ready running
  `- 14:0:0:5 sdau 66:224 active ready running
```

?????? disk mpath6 ??? LVM ?????

????

?? disk path ????

- ??????? Storage LUN ????
- LUN ??? Size
- Storage ? path ????

```
[root@bdb7-a ~]# sanlun lun show -p

                ONTAP Path: TPEDBISCSISVM01:/vol/BDB7_A_2_vol/BDB7_A_2
                      LUN: 1
                 LUN Size: 500.1g
                  Product: cDOT
              Host Device: mpath2(3600a0980383136312d3f4e387455564c)
         Multipath Policy: service-time 0
        Multipath Provider: Native
--------- ---------- ------- ------------ ----------------------------------------------
host      vserver
path      path     /dev/   host         vserver
state     type     node    adapter      LIF
--------- ---------- ------- ------------ ----------------------------------------------
up        primary   sdo     host12       TPEDBISCSISVM01_iSCSI2
up        primary   sds     host13       TPEDBISCSISVM01_iSCSI2
up        primary   sdaa    host15       TPEDBISCSISVM01_iSCSI1
up        primary   sdae    host16       TPEDBISCSISVM01_iSCSI1
```

up	secondary	sdg	host10	TPEDBISCSISVM01_iSCSI4
up	secondary	sdk	host11	TPEDBISCSISVM01_iSCSI3
up	secondary	sdw	host14	TPEDBISCSISVM01_iSCSI4
up	secondary	sdc	host9	TPEDBISCSISVM01_iSCSI3

?? multipathd ???????

```
multipathd show config
```

> ??: ??????? Storage??????????????????????????????????????

???? iSCSI connections

```
# iscsiadm -m session --op show
tcp: [1] 10.18.104.32:3260,1038 iqn.1992-08.com.netapp:sn.58042162340f11e9892700a098e3ab45:vs.16 (non-flash)
tcp: [2] 10.18.104.33:3260,1039 iqn.1992-08.com.netapp:sn.58042162340f11e9892700a098e3ab45:vs.16 (non-flash)
tcp: [3] 10.18.104.34:3260,1040 iqn.1992-08.com.netapp:sn.58042162340f11e9892700a098e3ab45:vs.16 (non-flash)
tcp: [4] 10.18.104.34:3260,1040 iqn.1992-08.com.netapp:sn.58042162340f11e9892700a098e3ab45:vs.16 (non-flash)
tcp: [5] 10.18.104.33:3260,1039 iqn.1992-08.com.netapp:sn.58042162340f11e9892700a098e3ab45:vs.16 (non-flash)
tcp: [6] 10.18.104.31:3260,1037 iqn.1992-08.com.netapp:sn.58042162340f11e9892700a098e3ab45:vs.16 (non-flash)
tcp: [7] 10.18.104.31:3260,1037 iqn.1992-08.com.netapp:sn.58042162340f11e9892700a098e3ab45:vs.16 (non-flash)
tcp: [8] 10.18.104.32:3260,1038 iqn.1992-08.com.netapp:sn.58042162340f11e9892700a098e3ab45:vs.16 (non-flash)


#iSCSI Logout All
iscsiadm --mode node --logoutall=all

#iSCSI Login All
iscsiadm -m node -l
```

Learning

iSCSI

- How to configure iSCSI target & initiator on RHEL/CentOS 7.6

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_mo  d
```

SAN Storge ?????

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

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

Accesing LUNs on host

sanlun fcp show adapter -v	Displays HBA information.
sanlun fcp show adapter	Display WWPN of HBA cards
sanlun lun show all	Lists available LUNs as seen by the sanlun script.
sanlun lun show -p	Provides multipath information for both DM-Multipath and Veritas Storage Foundation TM dynamic multipathing solutions.
ls -lh /dev/mapper/	Lists DM-Multipath devices generated for LUNs.
e2label *device label*	Creates a persistent label for a file system. device is the partition; label 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 Li nux Host Utilities Installation and Set up Guide for more details
>   Warning: libHBAAPI.so library not found, some sanlun commands may
> not work. Refe r 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/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 XXXXXXXXXXXXXXXX: 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 CentOS (2.6.18-398.el5-Multipath)          <== 啟用 Multipath
      root (hd0,0)
      kernel /vmlinuz-2.6.18-398..........
      initrd /initrd-2.6.18-398.el5.multipath.img    <== 剛剛產生initrd 的檔案名稱
```

????

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

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

FAQ

???? /dev/sda ? Local Disk ?? SAN DIsk

Solution:

```
#> lsscsi
[2:0:0:0]   cd/dvd hp      DVD-ROM DTA0N    WBD0 /dev/sr0
  state=running queue_depth=1 scsi_level=6 type=5 device_blocked=0 timeout=0
[3:0:0:0]   tape   IBM     ULT3580-HH5     D2AD /dev/st0
  state=running queue_depth=32 scsi_level=7 type=1 device_blocked=0 timeout=900
[3:0:1:0]   tape   IBM     ULT3580-HH5     D2AD /dev/st1
  state=running queue_depth=32 scsi_level=7 type=1 device_blocked=0 timeout=900
[3:0:1:1]   mediumx IBM    3573-TL        C.20 -
  state=running queue_depth=32 scsi_level=6 type=8 device_blocked=0 timeout=0
[3:0:2:0]   disk   IBM    1726-4xx FAStT 0617 /dev/sda        <======
  state=running queue_depth=32 scsi_level=6 type=0 device_blocked=0 timeout=60
[3:0:2:31]  disk   IBM    Universal Xport 0617 -
  state=running queue_depth=32 scsi_level=6 type=0 device_blocked=0 timeout=60
```

> IBM FAStT ? IBM Storage ????
>
> ???? lsscsi ????? yum install lsscsi

???? HBA Card ? port WWN

???: ? systool

```
# Install
yum install sysfsutils
#
systool -c fc_host -v
systool -c fc_transport -v
```

???? `/sys/class/fc_host/{host#}/port_name`

```
#> cat /sys/class/fc_host/host5/port_name
0x2100001b32837bcd
```

???? `/proc/scsi/{adapter-type}/{host#}`

```
#> 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;
```

mpathX v.s. dm-X

????? multipath??? LUN ?????? /dev/mapper/mpathX?????? pvcreate ? LUN ??? PV ????
pvdisplay -C ??????????? /dev/dm-X??????????????? mpathX ???? dm-X?

???? `dmsetup`

```
[root@bdb3 ~]# dmsetup ls
mpath1  (253, 4)
rootVG-varLV    (253, 1)
rootVG-swapLV   (253, 3)
rootVG-rootLV   (253, 0)
rootVG-worktmpLV      (253, 2)
```

> mpath1 (253,4)?4 ????? /dev/dm-4

???? `multipath`

```
[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]
```

? partition ????

? mpathb ?? partition ????????????????????

> WARNING: Re-reading the partition table failed with error 22: Invalid argument.
> The kernel still uses the old table. The new table will be used at
> the next reboot or after you run partprobe(8) or kpartx(8)

??????????????? partition ????

```
partprobe /dev/mapper/mpathb
```