

# 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)/
vserver(cDOT/FlashRay)    lun-pathname    device    host    lun
                           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    vservers
path    path    /dev/  host    vservers
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
```

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Revision #7

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