3PAR StoreServ存储 RHEL6.8主机iSCSI多路径配置

主机相关 存储配置 孙清雷 2019-05-19 发表

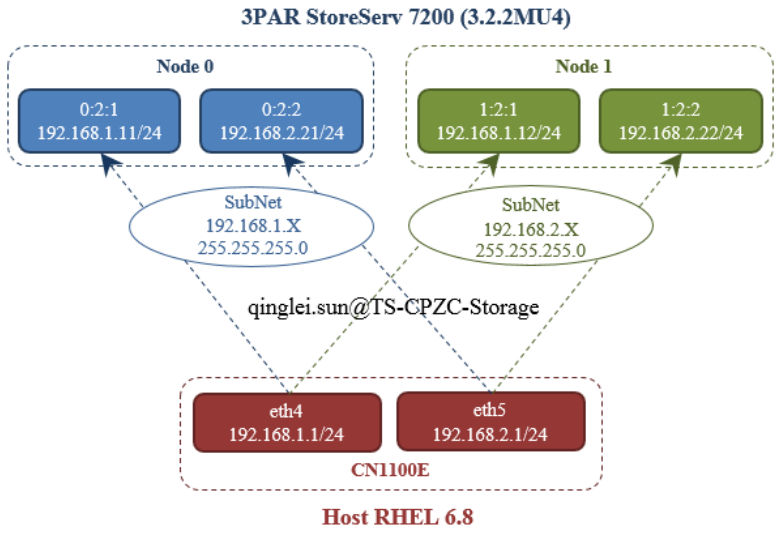
组网及说明

测试用使用StoreServ 7200，3PAR OS版本为3.2.2MU4。

配置步骤

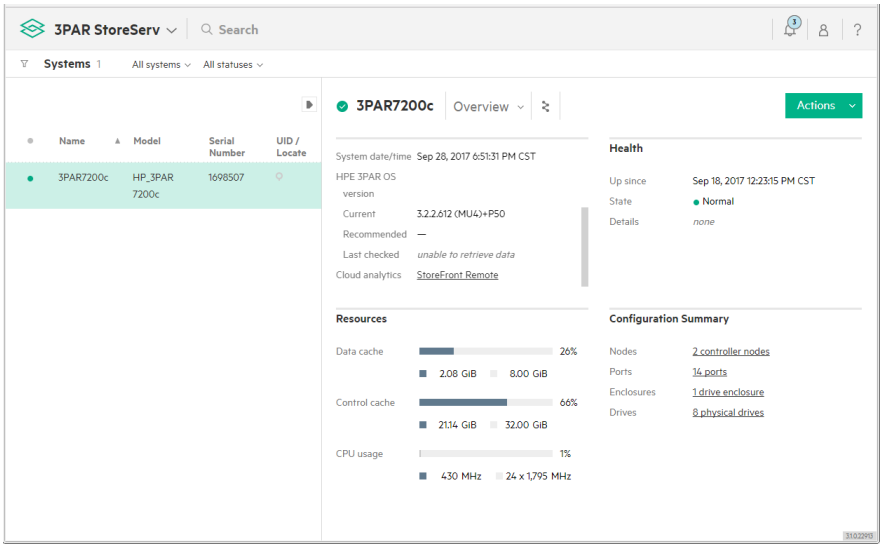
注意 主机实施务必以最新版本的《HPE 3PAR Red Hat Enterprise Linux and Oracle Linux Implementation Guide》为准。

本次测试场景为主机端未配置iface，而将两个网卡设置不同网段，分别连接至相同网段的存储端iSCSI端口，实现4条iSCSI路径，连接示意如下

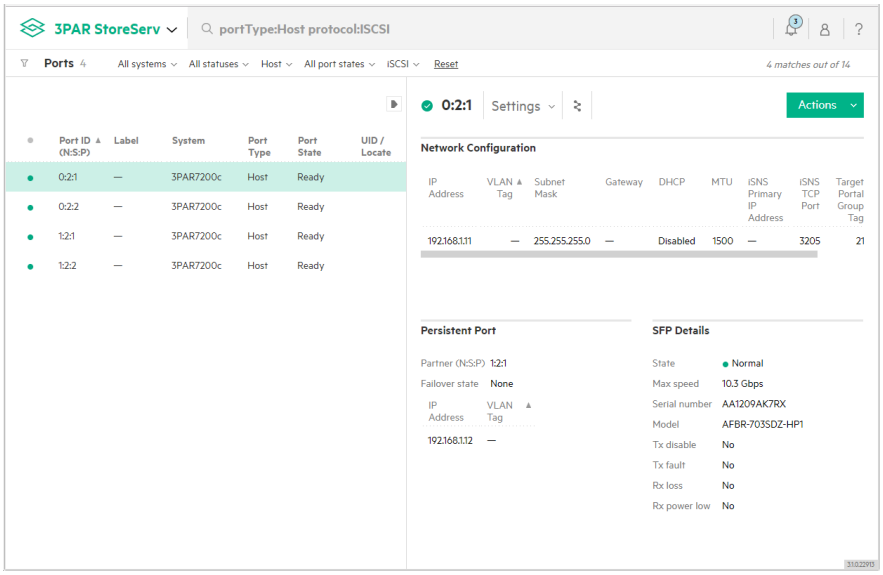


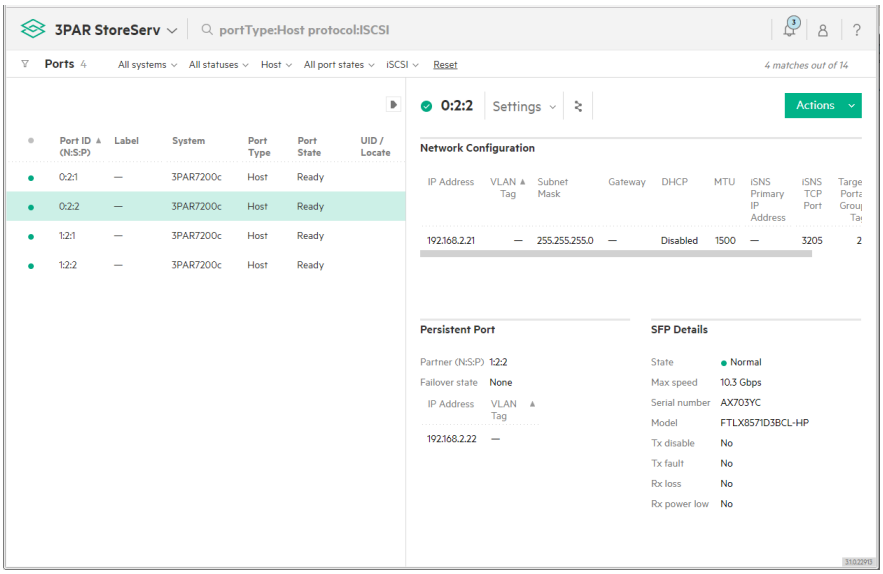
存储端信息如下

3PAR StoreServ 7200c，OS 3.2.2 MU4。

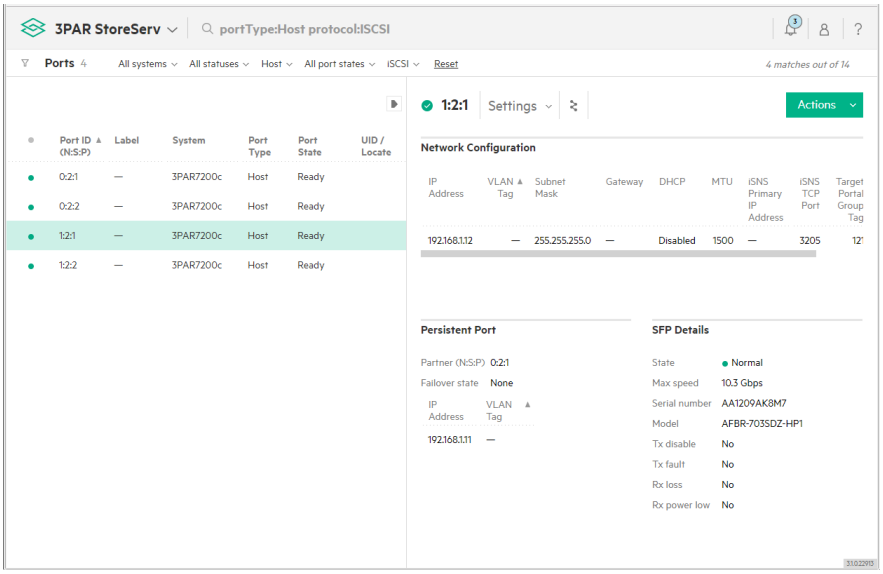


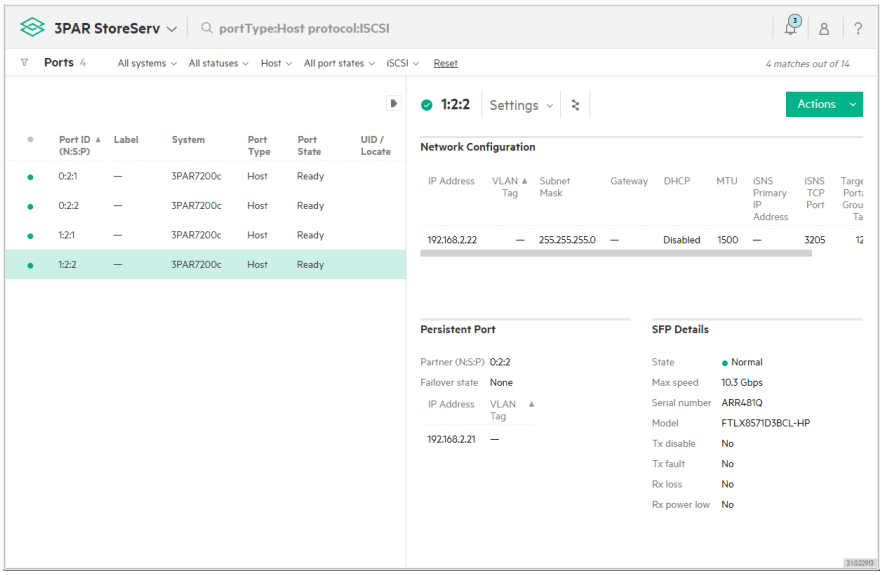
Node 0 iSCSI端口0:2:1 192.168.1.11/24，iSCSI端口0:2:2 192.168.2.21/24，未设置网关。





Node 1 iSCSI端口1:2:1 192.168.1.12/24，iSCSI端口1:2:2 192.168.2.22/24，未设置网关。





主机端信息如下

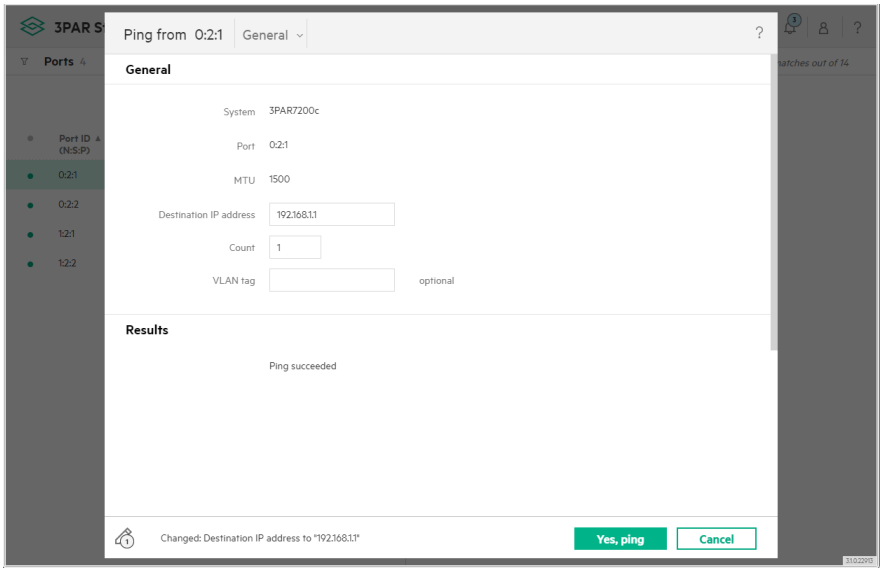
RHEL 6.8，eth4 192.168.1.1/24，eth5 192.168.2.1/24。

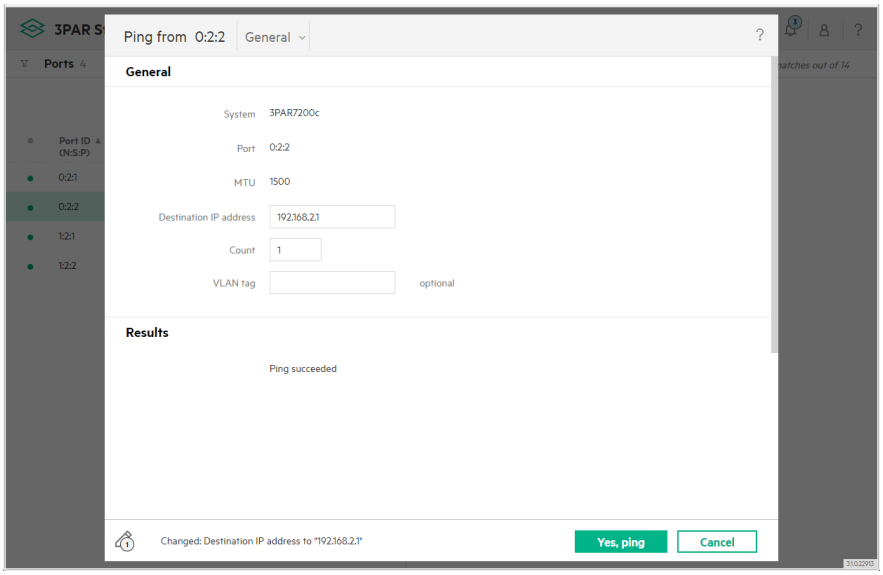
```
[root@SunQingleiTest ~]# lsb_release -a
LSB Version:    :base-4.0-amd64:base-4.0-noarch:core-4.0-amd64:core-4.0-noarch:graphics-4.0-amd64:graphics-4.0-noarch:printing-4.0-amd64:printing-4.0-
Distributor ID: RedHatEnterpriseServer
Description:    Red Hat Enterprise Linux Server release 6.8 (Santiago)
Release:        6.8
Codename:       Santiago
[root@SunQingleiTest ~]# uname -a
Linux SunQingleiTest 2.6.32-642.el6.x86_64 #1 SMP Wed Apr 13 00:51:26 EDT 2016 x86_64 x86_64 x86_64 GNU/Linux
[root@SunQingleiTest ~]# ifconfig
eth0      Link encap:Ethernet  HWaddr 78:E7:D1:8D:D5:F4
          inet addr:10.12.172.215  Bcast:10.12.172.255  Mask:255.255.255.0
          inet6 addr: fe80::7ae7:d1ff:fe8d:d5f4/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:95837 errors:0 dropped:0 overruns:0 frame:0
          TX packets:142 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:6714027 (6.4 MiB)  TX bytes:21132 (20.6 KiB)

eth4      Link encap:Ethernet  HWaddr FC:15:B4:44:08:B0
          inet addr:192.168.1.1  Bcast:192.168.1.255  Mask:255.255.255.0
          inet6 addr: fe80::fe15:b4ff:fe44:8b0/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:15411 errors:0 dropped:0 overruns:0 frame:0
          TX packets:34 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:914326 (892.8 KiB)  TX bytes:3772 (3.6 KiB)

eth5      Link encap:Ethernet  HWaddr FC:15:B4:44:08:B4
          inet addr:192.168.2.1  Bcast:192.168.2.255  Mask:255.255.255.0
          inet6 addr: fe80::fe15:b4ff:fe44:8b4/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:15131 errors:0 dropped:0 overruns:0 frame:0
          TX packets:29 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:918630 (897.0 KiB)  TX bytes:1818 (1.7 KiB)

lo        Link encap:Local Loopback
          inet addr:127.0.0.1  Mask:255.0.0.0
          inet6 addr: ::1/128 Scope:Host
          UP LOOPBACK RUNNING  MTU:65536  Metric:1
          RX packets:20 errors:0 dropped:0 overruns:0 frame:0
          TX packets:20 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:0
          RX bytes:1568 (1.5 KiB)  TX bytes:1568 (1.5 KiB)

[root@SunQingleiTest ~]#
```

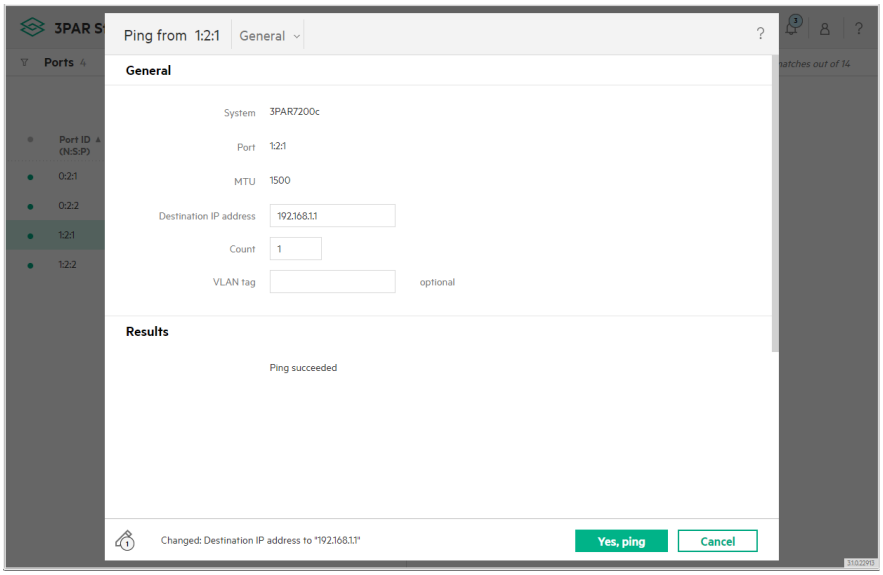
主机端可ping通存储端4个iSCSI端口。

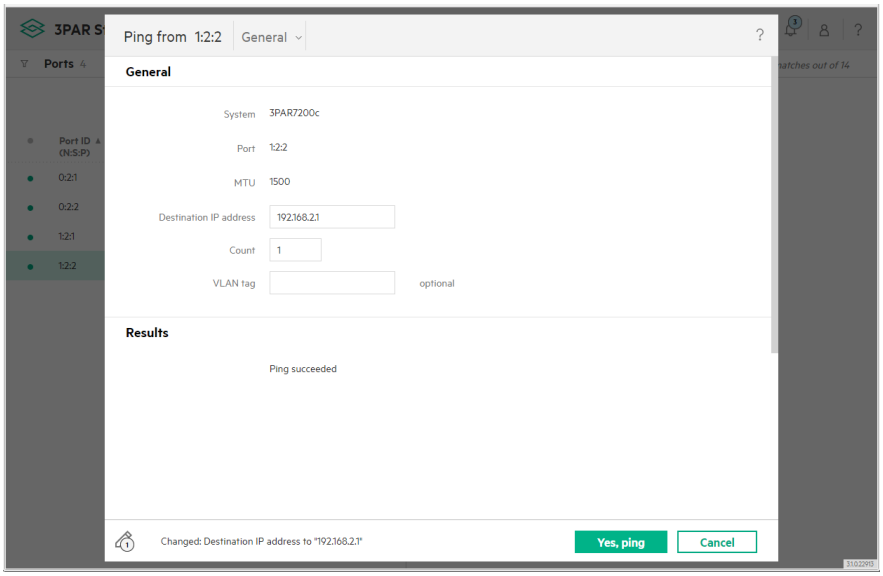
```
[root@SunQingleiTest ~]# ping 192.168.1.11
PING 192.168.1.11 (192.168.1.11) 56(84) bytes of data.
64 bytes from 192.168.1.11: icmp_seq=1 ttl=64 time=1.06 ms
64 bytes from 192.168.1.11: icmp_seq=2 ttl=64 time=0.273 ms
64 bytes from 192.168.1.11: icmp_seq=3 ttl=64 time=0.284 ms
^C
--- 192.168.1.11 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2524ms
rtt min/avg/max/mdev = 0.273/0.540/1.065/0.371 ms
[root@SunQingleiTest ~]# ping 192.168.1.12
PING 192.168.1.12 (192.168.1.12) 56(84) bytes of data.
64 bytes from 192.168.1.12: icmp_seq=1 ttl=64 time=1.53 ms
64 bytes from 192.168.1.12: icmp_seq=2 ttl=64 time=0.290 ms
64 bytes from 192.168.1.12: icmp_seq=3 ttl=64 time=0.286 ms
^C
--- 192.168.1.12 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2573ms
rtt min/avg/max/mdev = 0.286/0.704/1.538/0.590 ms
[root@SunQingleiTest ~]# ping 192.168.2.21
PING 192.168.2.21 (192.168.2.21) 56(84) bytes of data.
64 bytes from 192.168.2.21: icmp_seq=1 ttl=64 time=1.62 ms
64 bytes from 192.168.2.21: icmp_seq=2 ttl=64 time=0.269 ms
64 bytes from 192.168.2.21: icmp_seq=3 ttl=64 time=0.273 ms
^C
--- 192.168.2.21 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2574ms
rtt min/avg/max/mdev = 0.269/0.721/1.622/0.637 ms
[root@SunQingleiTest ~]# ping 192.168.2.22
PING 192.168.2.22 (192.168.2.22) 56(84) bytes of data.
64 bytes from 192.168.2.22: icmp_seq=1 ttl=64 time=1.58 ms
64 bytes from 192.168.2.22: icmp_seq=2 ttl=64 time=0.288 ms
64 bytes from 192.168.2.22: icmp_seq=3 ttl=64 time=0.290 ms
^C
--- 192.168.2.22 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2751ms
rtt min/avg/max/mdev = 0.288/0.720/1.582/0.609 ms
[root@SunQingleiTest ~]#
```

存储端iSCSI端口可ping通主机网卡，网络均正常。


Ping from 0:2:1
General
System 3PAR7200c
Port 0:2:1
MTU 1500
Destination IP address 192.168.1.1
Count 1
VLAN tag
optional
Results
Ping succeeded
Changed: Destination IP address to "192.168.1.1"
Yes, ping
Cancel


Ping from 0:2:2
General
System 3PAR7200c
Port 0:2:2
MTU 1500
Destination IP address 192.168.2.1
Count 1
VLAN tag
optional
Results
Ping succeeded
Changed: Destination IP address to "192.168.2.1"
Yes, ping
Cancel


Ping from 1:2:1
General
System 3PAR7200c
Port 1:2:1
MTU 1500
Destination IP address 192.168.1.1
Count 1
VLAN tag
optional
Results
Ping succeeded
Changed: Destination IP address to "192.168.1.1"
Yes, ping
Cancel



未配置之前，主机端未见3PAR存储设备。

```
[root@SunQingleiTest ~]# cat /proc/scsi/scsi
Attached devices:
Host: scsi0 Channel: 03 Id: 00 Lun: 00
  Vendor: HP       Model: P410i            Rev: 6.64
  Type:   RAID                             ANSI  SCSI revision: 05
Host: scsi0 Channel: 00 Id: 00 Lun: 01
  Vendor: HP       Model: LOGICAL VOLUME   Rev: 6.64
  Type:   Direct-Access                    ANSI  SCSI revision: 05
Host: scsi0 Channel: 00 Id: 00 Lun: 00
  Vendor: HP       Model: LOGICAL VOLUME   Rev: 6.64
  Type:   Direct-Access                    ANSI  SCSI revision: 05
Host: scsi0 Channel: 00 Id: 00 Lun: 02
  Vendor: HP       Model: LOGICAL VOLUME   Rev: 6.64
  Type:   Direct-Access                    ANSI  SCSI revision: 05
Host: scsi1 Channel: 00 Id: 04 Lun: 00
  Vendor: HP       Model: Ultrium 5-SCSI   Rev: Y6PW
  Type:   Sequential-Access                ANSI  SCSI revision: 06
Host: scsi1 Channel: 00 Id: 05 Lun: 00
  Vendor: HP       Model: Ultrium 5-SCSI   Rev: Y6NW
  Type:   Sequential-Access                ANSI  SCSI revision: 06
Host: scsi1 Channel: 00 Id: 06 Lun: 00
  Vendor: HP       Model: MSL G3 Series    Rev: 6.70
  Type:   Medium Changer                   ANSI  SCSI revision: 05
[root@SunQingleiTest ~]#
```

fdisk -l，仅见服务器本地逻辑驱动器所对应的磁盘设备，分别为sda、sdb和sdc。

```
[root@SunQingleiTest ~]# fdisk -l

Disk /dev/sda: 146.8 GB, 146778685440 bytes
255 heads, 63 sectors/track, 17844 cylinders
Units = cylinders of 16065 * 512 = 8225280 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
Disk identifier: 0x0001b02b

   Device Boot      Start         End      Blocks   Id  System
/dev/sda1   *           1          64      512000   83  Linux
Partition 1 does not end on cylinder boundary.
/dev/sda2              64       17845   142825472   8e  Linux LVM

Disk /dev/sdb: 293.6 GB, 293564211200 bytes
255 heads, 32 sectors/track, 70265 cylinders
Units = cylinders of 8160 * 512 = 4177920 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
Disk identifier: 0x37565c53

   Device Boot      Start         End      Blocks   Id  System
/dev/sdb1   *           1       70266   286681088    7  HPFS/NTFS

WARNING: GPT (GUID Partition Table) detected on '/dev/sdc'! The util fdisk doesn't support GPT. Use GNU Parted.


Disk /dev/sdc: 146.8 GB, 146778685440 bytes
255 heads, 63 sectors/track, 17844 cylinders
Units = cylinders of 16065 * 512 = 8225280 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
Disk identifier: 0x0008a60a

   Device Boot      Start         End      Blocks   Id  System
/dev/sdc1               1       17845   143338559+  ee  GPT

Disk /dev/mapper/vg_sunqingleitest-lv_root: 53.7 GB, 53687091200 bytes
255 heads, 63 sectors/track, 6527 cylinders
Units = cylinders of 16065 * 512 = 8225280 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
Disk identifier: 0x00000000


Disk /dev/mapper/vg_sunqingleitest-lv_swap: 6257 MB, 6257901568 bytes
255 heads, 63 sectors/track, 760 cylinders
Units = cylinders of 16065 * 512 = 8225280 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
Disk identifier: 0x00000000


Disk /dev/mapper/vg_sunqingleitest-lv_home: 86.3 GB, 86306193408 bytes
255 heads, 63 sectors/track, 10492 cylinders
Units = cylinders of 16065 * 512 = 8225280 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
```

主机端已安装iSCSI initiator。

```
[root@SunQingleiTest ~]# rpm -qa | grep iscsi-initiator*
iscsi-initiator-utils-6.2.0.873-21.el6.x86_64
[root@SunQingleiTest ~]# rpm -qa | grep device-mapper*
device-mapper-event-libs-1.02.117-7.el6.x86_64
device-mapper-1.02.117-7.el6.x86_64
device-mapper-persistent-data-0.6.2-0.1.rc7.el6.x86_64
device-mapper-libs-1.02.117-7.el6.x86_64
device-mapper-event-1.02.117-7.el6.x86_64
[root@SunQingleiTest ~]#
```

编辑iSCSI配置文件/etc/iscsi/iscsid.conf，修改内容如下

```
[root@SunQingleiTest ~]# vim /etc/iscsi/iscsid.conf
[root@SunQingleiTest ~]#
```

```
#*****************
# Startup settings
#*****************

# To request that the iscsi initd scripts startup a session set to "automatic".
# node.startup = automatic
#
# To manually startup the session set to "manual". The default is automatic.
node.startup = automatic
node.conn[0].startup = automatic

# For "automatic" startup nodes, setting this to "Yes" will try logins on each
# available iface until one succeeds, and then stop.  The default "No" will try
# logins on all availble ifaces simultaneously.
node.leading_login = No
```

node.session.timeo.

```
# ********
# Timeouts
# ********
#
# See the iSCSI README's Advanced Configuration section for tips
# on setting timeouts when using multipath or doing root over iSCSI.
#
# To specify the length of time to wait for session re-establishment
# before failing SCSI commands back to the application when running
# the Linux SCSI Layer error handler, edit the line.
# The value is in seconds and the default is 120 seconds.
# Special values:
# - If the value is 0, IO will be failed immediately.
# - If the value is less than 0, IO will remain queued until the session
# is logged back in, or until the user runs the logout command.
node.session.timeo.replacement_timeout = 10

# To specify the time to wait for login to complete, edit the line.
# The value is in seconds and the default is 15 seconds.
node.conn[0].timeo.login_timeout = 15

# To specify the time to wait for logout to complete, edit the line.
# The value is in seconds and the default is 15 seconds.
node.conn[0].timeo.logout_timeout = 15

# Time interval to wait for on connection before sending a ping.
node.conn[0].timeo.noop_out_interval = 10

# To specify the time to wait for a Nop-out response before failing
# the connection, edit this line. Failing the connection will
# cause IO to be failed back to the SCSI layer. If using dm-multipath
# this will cause the IO to be failed to the multipath layer.
node.conn[0].timeo.noop_out_timeout = 5

# To specify the time to wait for abort response before
# failing the operation and trying a logical unit reset edit the line.
# The value is in seconds and the default is 15 seconds.
node.session.err_timeo.abort_timeout = 15

# To specify the time to wait for a logical unit response
# before failing the operation and trying session re-establishment
# edit the line.
# The value is in seconds and the default is 30 seconds.
node.session.err_timeo.lu_reset_timeout = 30

# To specify the time to wait for a target response
# before failing the operation and trying session re-establishment
# edit the line.
# The value is in seconds and the default is 30 seconds.
node.session.err_timeo.tgt_reset_timeout = 30


#******
# Retry
#******
-- INSERT --
```

如果主机端需要使用多个发起方端口(多个网卡)进行iSCSI连接，需要编辑/etc/sysctl.conf文件来修改与网络相关的内核参数，添加net.ipv4.conf.all.arp_filter = 1。

```
# Kernel sysctl configuration file for Red Hat Linux
#
# For binary values, 0 is disabled, 1 is enabled.  See sysctl(8) and
# sysctl.conf(5) for more details.
#
# Use '/sbin/sysctl -a' to list all possible parameters.

# Controls IP packet forwarding
net.ipv4.ip_forward = 0

# Controls source route verification
net.ipv4.conf.default.rp_filter = 1

# Do not accept source routing
net.ipv4.conf.default.accept_source_route = 0

# Controls the System Request debugging functionality of the kernel
kernel.sysrq = 0

# Controls whether core dumps will append the PID to the core filename.
# Useful for debugging multi-threaded applications.
kernel.core_uses_pid = 1

# Controls the use of TCP syncookies
net.ipv4.tcp_syncookies = 1

# Controls the default maxmimum size of a mesage queue
kernel.msgmnb = 65536

# Controls the maximum size of a message, in bytes
kernel.msgmax = 65536

# Controls the maximum shared segment size, in bytes
kernel.shmmax = 68719476736

# Controls the maximum number of shared memory segments, in pages
kernel.shmall = 4294967296

net.ipv4.conf.all.arp_filter = 1
~
~
~
~
~
~
~
~
~
~
~
~
~
~
~
~
~
~
-- INSERT --
```

对于RHEL6，修改后需要执行sysctl –p使内核参数生效。

```
[root@SunQingleiTest ~]# vim /etc/sysctl.conf
[root@SunQingleiTest ~]# sysctl -p
net.ipv4.ip_forward = 0
net.ipv4.conf.default.rp_filter = 1
net.ipv4.conf.default.accept_source_route = 0
kernel.sysrq = 0
kernel.core_uses_pid = 1
net.ipv4.tcp_syncookies = 1
kernel.msgmnb = 65536
kernel.msgmax = 65536
kernel.shmmax = 68719476736
kernel.shmall = 4294967296
net.ipv4.conf.all.arp_filter = 1
[root@SunQingleiTest ~]#
```

启动open-iscsi模块，/etc/init.d/iscsi start。

启动iSCSI，chkconfig iscsi on、chkconfig iscsid on。

检查iSCSI状态，chkconfig --list | grep iscsi。

验证iSCSI模块是否加载，lsmod | grep iscsi。

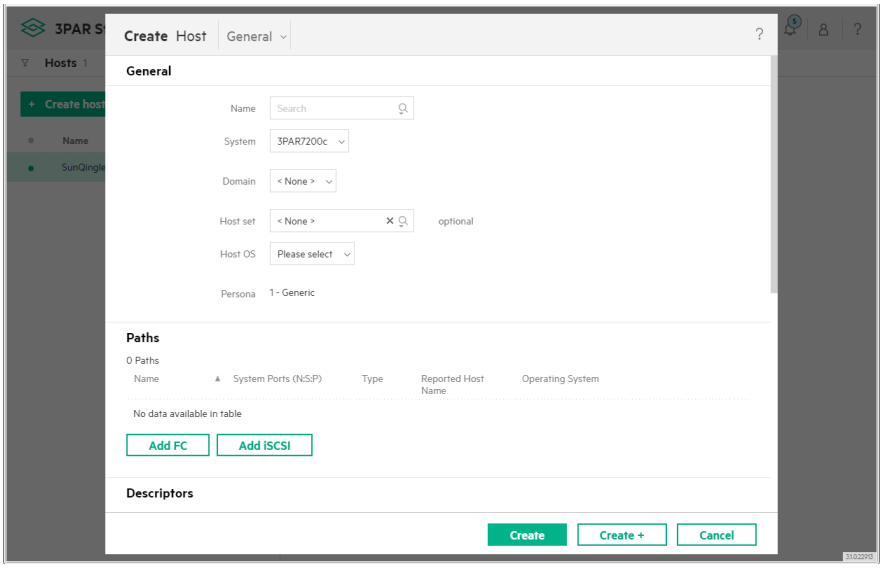
```
[root@SunQingleiTest ~]# /etc/init.d/iscsi start
[root@SunQingleiTest ~]# chkconfig iscsi on
[root@SunQingleiTest ~]# chkconfig iscsid on
[root@SunQingleiTest ~]# chkconfig --list | grep iscsi
iscsi           0:off   1:off   2:on    3:on    4:on    5:on    6:off
iscsid          0:off   1:off   2:on    3:on    4:on    5:on    6:off
[root@SunQingleiTest ~]# lsmod | grep iscsi
be2iscsi              108083  0
iscsi_boot_sysfs       9458  1 be2iscsi
libiscsi              48140  1 be2iscsi
scsi_transport_iscsi    99144  2 be2iscsi,libiscsi
[root@SunQingleiTest ~]#
```

查看RHEL主机的iqn信息，cat /etc/iscsi/initiator.iscsi

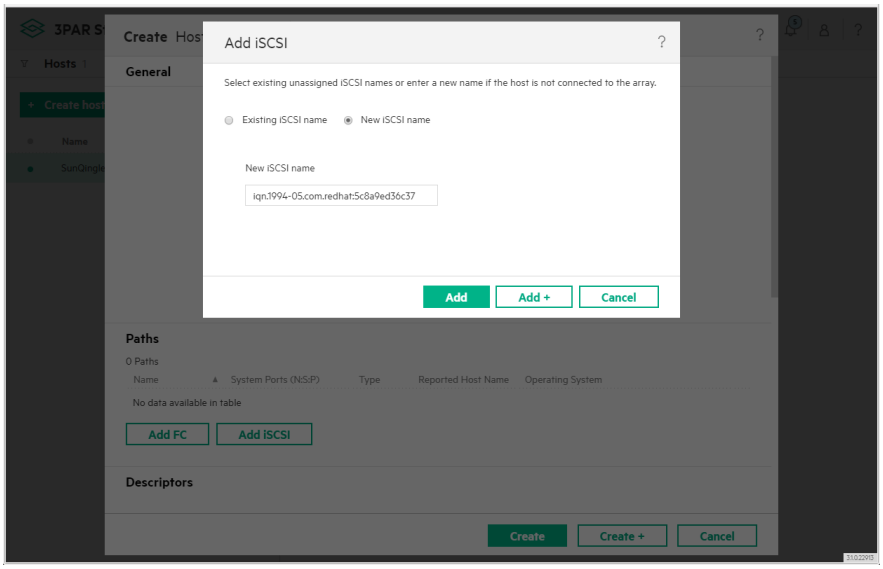
iqn.1994-05.com.redhat:5c8a9ed36c37

```
[root@SunQingleiTest ~]# cat /etc/iscsi/initiatorname.iscsi
InitiatorName=iqn.1994-05.com.redhat:5c8a9ed36c37
[root@SunQingleiTest ~]#
```

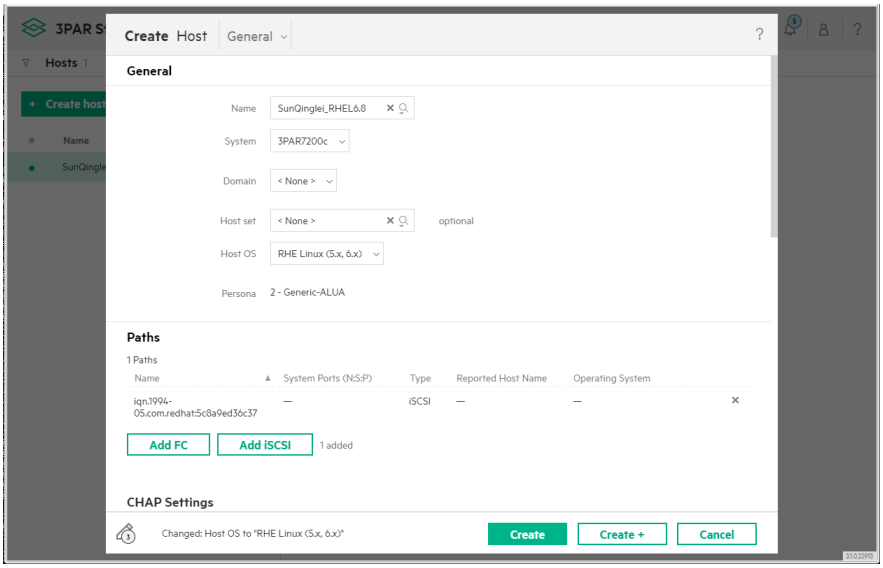
SSMC界面，创建主机，点击Add iSCSI，创建iSCSI 主机。



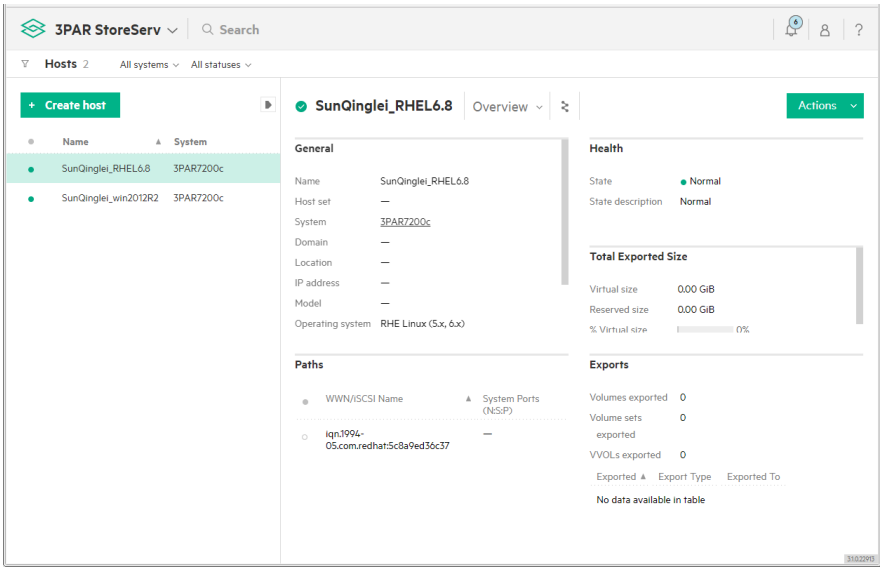
点选新iSCSI名称，输入RHEL主机的iqn信息。



按需输入主机名称，测试中主机名称为“SunQinglei_RHEL6.8”，主机OS类型选择RHE Linux (5.x，6.x)，角色相应设置为“2 - Generic -ALUA”。其余选项暂不设置。



主机“SunQinglei_RHEL6.8”已创建完成，注意，由于主机端与存储端未进行iSCSI连接，故主机概况 - 路径信息的系统端口为空。

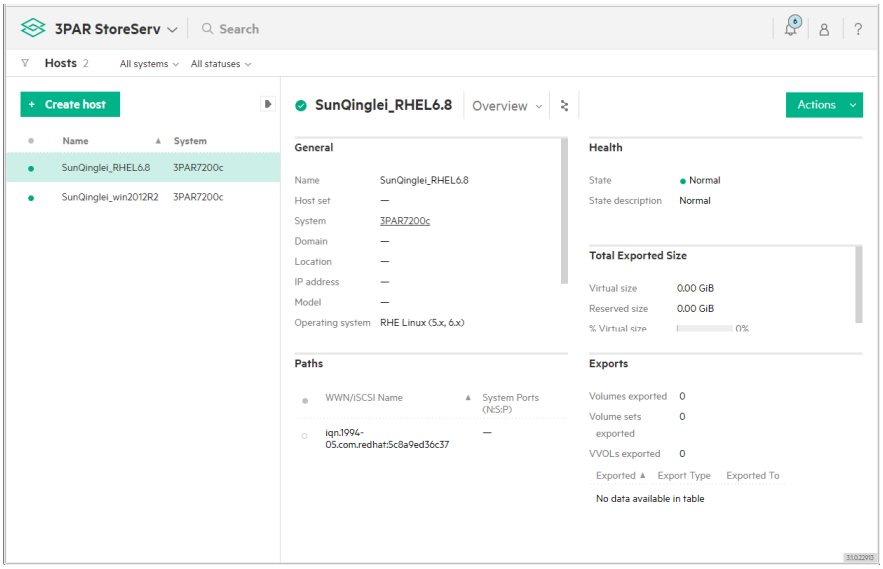


RHEL主机使用iscsiadm命令对存储端的4个iSCSI端口进行发现操作。

发现后，iscsiadm --mode node，可见已将存储端4个iSCSI端口识别为4个iSCSI目标。

```
[root@SunQingleiTest ~]# iscsiadm --mode discovery --type sendtargets --portal 192.168.1.11:3260
Starting iscsid:                                           [  OK  ]
192.168.1.11:3260,21 iqn.2000-05.com.3pardata:20210002ac0180cb
[root@SunQingleiTest ~]# iscsiadm --mode discovery --type sendtargets --portal 192.168.1.12:3260
192.168.1.12:3260,121 iqn.2000-05.com.3pardata:21210002ac0180cb
[root@SunQingleiTest ~]# iscsiadm --mode discovery --type sendtargets --portal 192.168.2.21:3260
192.168.2.21:3260,22 iqn.2000-05.com.3pardata:20220002ac0180cb
[root@SunQingleiTest ~]# iscsiadm --mode discovery --type sendtargets --portal 192.168.2.22:3260
192.168.2.22:3260,122 iqn.2000-05.com.3pardata:21220002ac0180cb
[root@SunQingleiTest ~]#
[root@SunQingleiTest ~]# iscsiadm --mode node
192.168.2.22:3260,122 iqn.2000-05.com.3pardata:21220002ac0180cb
192.168.1.12:3260,121 iqn.2000-05.com.3pardata:21210002ac0180cb
192.168.1.11:3260,21 iqn.2000-05.com.3pardata:20210002ac0180cb
192.168.2.21:3260,22 iqn.2000-05.com.3pardata:20220002ac0180cb
[root@SunQingleiTest ~]#
```

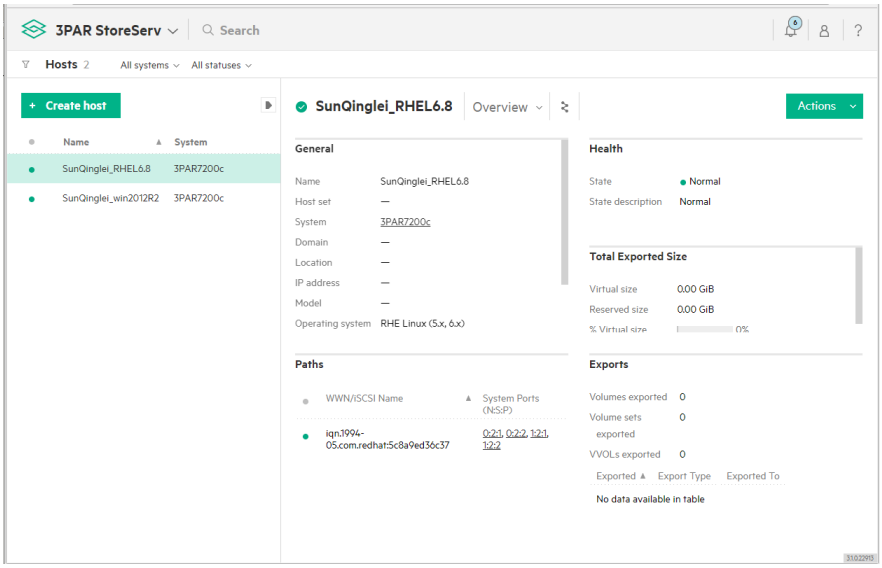
主机端仅发现存储目标，未建立iSCSI连接，存储端的主机路径信息的系统端口仍为空。



主机端对所有已发现的存储目标进行iSCSI login，建立iSCSI连接。

```
[root@SunQingleiTest ~]# iscsiadm --mode node --login all
Logging in to [iface: default, target: iqn.2000-05.com.3pardata:21220002ac0180cb, portal: 192.168.2.22,3260] (multiple)
Logging in to [iface: default, target: iqn.2000-05.com.3pardata:21210002ac0180cb, portal: 192.168.1.12,3260] (multiple)
Logging in to [iface: default, target: iqn.2000-05.com.3pardata:20210002ac0180cb, portal: 192.168.1.11,3260] (multiple)
Logging in to [iface: default, target: iqn.2000-05.com.3pardata:20220002ac0180cb, portal: 192.168.2.21,3260] (multiple)
Login to [iface: default, target: iqn.2000-05.com.3pardata:21220002ac0180cb, portal: 192.168.2.22,3260] successful.
Login to [iface: default, target: iqn.2000-05.com.3pardata:21210002ac0180cb, portal: 192.168.1.12,3260] successful.
Login to [iface: default, target: iqn.2000-05.com.3pardata:20210002ac0180cb, portal: 192.168.1.11,3260] successful.
Login to [iface: default, target: iqn.2000-05.com.3pardata:20220002ac0180cb, portal: 192.168.2.21,3260] successful.
[root@SunQingleiTest ~]#
```

存储端相应可见，主机的路径信息中系统端口变为4个iSCSI端口，说明RHEL主机端已连接至存储端的iSCSI端口。



建立iSCSI连接后，可见iSCSI会话情况。

```
[root@SunQingleiTest ~]# iscsiadm --mode session
tcp: [1] 192.168.2.22:3260,122 iqn.2000-05.com.3pardata:21220002ac0180cb (non-flash)
tcp: [2] 192.168.1.12:3260,121 iqn.2000-05.com.3pardata:21210002ac0180cb (non-flash)
tcp: [3] 192.168.1.11:3260,21 iqn.2000-05.com.3pardata:20210002ac0180cb (non-flash)
tcp: [4] 192.168.2.21:3260,22 iqn.2000-05.com.3pardata:20220002ac0180cb (non-flash)
[root@SunQingleiTest ~]#
```

对于RHEL6，可以通过service iscsi status查看iSCSI服务状态。

该命令可以方便地观察主机端已连接的iSCSI目标信息，包括发起端(主机网卡)、目标端(存储iSCSI端口)以及存储目标所包含的SCSI设备。

主机端与存储端建立了4条iSCSI会话，主机端发现了4个存储目标，以下图为例，存储目标iqn.2000-05.com.3pardata:21220002ac0180cb是由主机端网卡eth4与存储端iSCSI端口1:2:2之间建立的iSCS连接，Attached SCSI Device可见主机端识别到存储端的SES机箱设备，LUN 254。

注* 对于SES机箱设备管理标准，此处不再展开说明。

```
[root@SunQingleiTest ~]# service iscsi status
iSCSI Transport Class version 2.0-870
version 6.2.0-873.21.el6
Target: iqn.2000-05.com.3pardata:21220002ac0180cb (non-flash)
        Current Portal: 192.168.2.22:3260,122
        Persistent Portal: 192.168.2.22:3260,122
                **********
                Interface:
                **********
                Iface Name: default
                Iface Transport: tcp
                Iface Initiatorname: iqn.1994-05.com.redhat:5c8a9ed36c37
                Iface IPaddress: 192.168.2.1
                Iface HWaddress: <empty>
                Iface Netdev: <empty>
                SID: 1
                iSCSI Connection State: LOGGED IN
                iSCSI Session State: LOGGED_IN
                Internal iscsid Session State: NO CHANGE
                *********
                Timeouts:
                *********
                Recovery Timeout: 10
                Target Reset Timeout: 30
                LUN Reset Timeout: 30
                Abort Timeout: 15
                *****
                CHAP:
                *****
                username: <empty>
                password: ********
                username_in: <empty>
                password_in: ********
                ************************
                Negotiated iSCSI params:
                ************************
                HeaderDigest: None
                DataDigest: None
                MaxRecvDataSegmentLength: 262144
                MaxXmitDataSegmentLength: 65536
                FirstBurstLength: 65536
                MaxBurstLength: 262144
                ImmediateData: No
                InitialR2T: Yes
                MaxOutstandingR2T: 1
                ************************
                Attached SCSI devices:
                ************************
                Host Number: 10 State: running
                scsi10 Channel 00 Id 0 Lun: 254
```

```
Target: iqn.2000-05.com.3pardata:21210002ac0180cb (non-flash)
        Current Portal: 192.168.1.12:3260,121
        Persistent Portal: 192.168.1.12:3260,121
                **********
                Interface:
                **********
                Iface Name: default
                Iface Transport: tcp
                Iface Initiatorname: iqn.1994-05.com.redhat:5c8a9ed36c37
                Iface IPaddress: 192.168.1.1
                Iface HWaddress: <empty>
                Iface Netdev: <empty>
                SID: 2
                iSCSI Connection State: LOGGED IN
                iSCSI Session State: LOGGED_IN
                Internal iscsid Session State: NO CHANGE
                *********
                Timeouts:
                *********
                Recovery Timeout: 10
                Target Reset Timeout: 30
                LUN Reset Timeout: 30
                Abort Timeout: 15
                *****
                CHAP:
                *****
                username: <empty>
                password: ********
                username_in: <empty>
                password_in: ********
                ************************
                Negotiated iSCSI params:
                ************************
                HeaderDigest: None
                DataDigest: None
                MaxRecvDataSegmentLength: 262144
                MaxXmitDataSegmentLength: 65536
                FirstBurstLength: 65536
                MaxBurstLength: 262144
                ImmediateData: No
                InitialR2T: Yes
                MaxOutstandingR2T: 1
                ************************
                Attached SCSI devices:
                ************************
                Host Number: 11 State: running
                scsi11 Channel 00 Id 0 Lun: 254
```

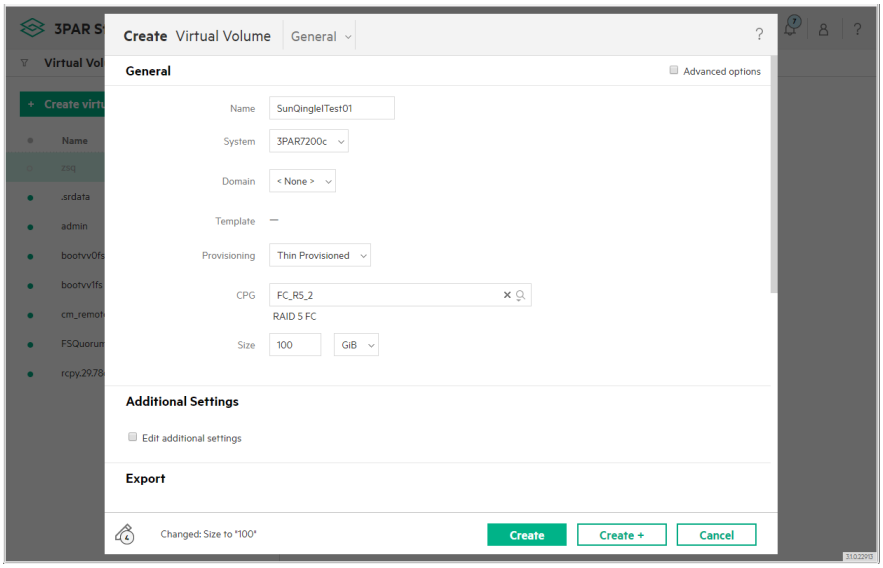
```
Target: iqn.2000-05.com.3pardata:20210002ac0180cb (non-flash)
        Current Portal: 192.168.1.11:3260,21
        Persistent Portal: 192.168.1.11:3260,21
                **********
                Interface:
                **********
                Iface Name: default
                Iface Transport: tcp
                Iface Initiatorname: iqn.1994-05.com.redhat:5c8a9ed36c37
                Iface IPaddress: 192.168.1.1
                Iface HWaddress: <empty>
                Iface Netdev: <empty>
                SID: 3
                iSCSI Connection State: LOGGED IN
                iSCSI Session State: LOGGED_IN
                Internal iscsid Session State: NO CHANGE
                *********
                Timeouts:
                *********
                Recovery Timeout: 10
                Target Reset Timeout: 30
                LUN Reset Timeout: 30
                Abort Timeout: 15
                *****
                CHAP:
                *****
                username: <empty>
                password: ********
                username_in: <empty>
                password_in: ********
                ************************
                Negotiated iSCSI params:
                ************************
                HeaderDigest: None
                DataDigest: None
                MaxRecvDataSegmentLength: 262144
                MaxXmitDataSegmentLength: 65536
                FirstBurstLength: 65536
                MaxBurstLength: 262144
                ImmediateData: No
                InitialR2T: Yes
                MaxOutstandingR2T: 1
                ************************
                Attached SCSI devices:
                ************************
                Host Number: 12 State: running
                scsi12 Channel 00 Id 0 Lun: 254
```

```
Target: iqn.2000-05.com.3pardata:20220002ac0180cb (non-flash)
        Current Portal: 192.168.2.21:3260,22
        Persistent Portal: 192.168.2.21:3260,22
                **********
                Interface:
                **********
                Iface Name: default
                Iface Transport: tcp
                Iface Initiatorname: iqn.1994-05.com.redhat:5c8a9ed36c37
                Iface IPaddress: 192.168.2.1
                Iface HWaddress: <empty>
                Iface Netdev: <empty>
                SID: 4
                iSCSI Connection State: LOGGED IN
                iSCSI Session State: LOGGED_IN
                Internal iscsid Session State: NO CHANGE
                *********
                Timeouts:
                *********
                Recovery Timeout: 10
                Target Reset Timeout: 30
                LUN Reset Timeout: 30
                Abort Timeout: 15
                *****
                CHAP:
                *****
                username: <empty>
                password: ********
                username_in: <empty>
                password_in: ********
                ************************
                Negotiated iSCSI params:
                ************************
                HeaderDigest: None
                DataDigest: None
                MaxRecvDataSegmentLength: 262144
                MaxXmitDataSegmentLength: 65536
                FirstBurstLength: 65536
                MaxBurstLength: 262144
                ImmediateData: No
                InitialR2T: Yes
                MaxOutstandingR2T: 1
                ************************
                Attached SCSI devices:
                ************************
                Host Number: 13 State: running
                scsi13 Channel 00 Id 0 Lun: 254
[root@SunQingleiTest ~]#
```

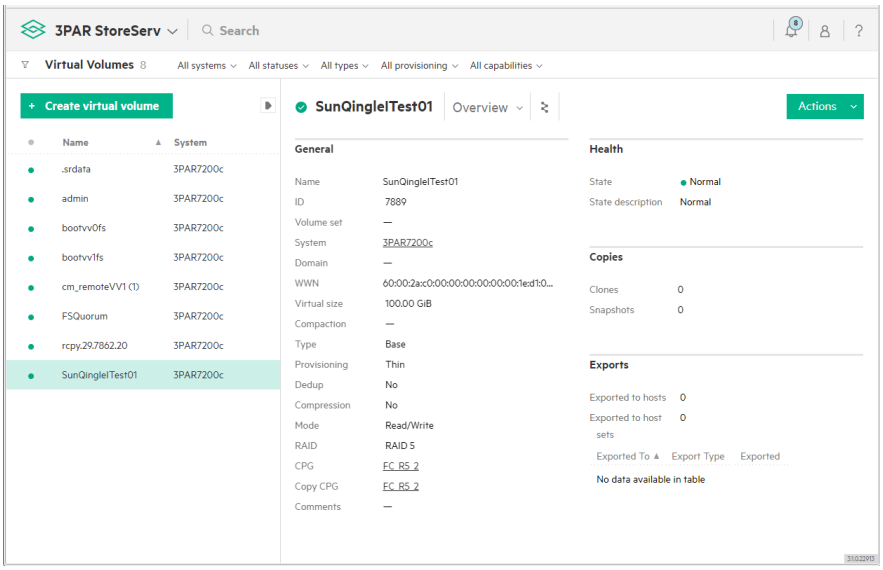
此时，RHEL主机端查看已识别的SCSI设备，已发现新增4个3PAR机箱设备，LUN 254。

```
[root@SunQingleiTest ~]# cat /proc/scsi/scsi
Attached devices:
Host: scsi0 Channel: 03 Id: 00 Lun: 00
  Vendor: HP       Model: P410i            Rev: 6.64
  Type:   RAID                             ANSI  SCSI revision: 05
Host: scsi0 Channel: 00 Id: 00 Lun: 01
  Vendor: HP       Model: LOGICAL VOLUME   Rev: 6.64
  Type:   Direct-Access                    ANSI  SCSI revision: 05
Host: scsi0 Channel: 00 Id: 00 Lun: 00
  Vendor: HP       Model: LOGICAL VOLUME   Rev: 6.64
  Type:   Direct-Access                    ANSI  SCSI revision: 05
Host: scsi0 Channel: 00 Id: 00 Lun: 02
  Vendor: HP       Model: LOGICAL VOLUME   Rev: 6.64
  Type:   Direct-Access                    ANSI  SCSI revision: 05
Host: scsi1 Channel: 00 Id: 04 Lun: 00
  Vendor: HP       Model: Ultrium 5-SCSI   Rev: Y6PW
  Type:   Sequential-Access                ANSI  SCSI revision: 06
Host: scsi1 Channel: 00 Id: 05 Lun: 00
  Vendor: HP       Model: Ultrium 5-SCSI   Rev: Y6NW
  Type:   Sequential-Access                ANSI  SCSI revision: 06
Host: scsi1 Channel: 00 Id: 06 Lun: 00
  Vendor: HP       Model: MSL G3 Series    Rev: 6.70
  Type:   Medium Changer                   ANSI  SCSI revision: 05
Host: scsi5 Channel: 00 Id: 00 Lun: 00
  Vendor: HP       Model: Virtual DVD-ROM  Rev:
  Type:   CD-ROM                           ANSI  SCSI revision: 00
Host: scsi12 Channel: 00 Id: 00 Lun: 254
  Vendor: 3PARdata Model: SES              Rev: 3224
  Type:   Enclosure                        ANSI  SCSI revision: 06
Host: scsi10 Channel: 00 Id: 00 Lun: 254
  Vendor: 3PARdata Model: SES              Rev: 3224
  Type:   Enclosure                        ANSI  SCSI revision: 06
Host: scsi11 Channel: 00 Id: 00 Lun: 254
  Vendor: 3PARdata Model: SES              Rev: 3224
  Type:   Enclosure                        ANSI  SCSI revision: 06
Host: scsi13 Channel: 00 Id: 00 Lun: 254
  Vendor: 3PARdata Model: SES              Rev: 3224
  Type:   Enclosure                        ANSI  SCSI revision: 06
[root@SunQingleiTest ~]#
```

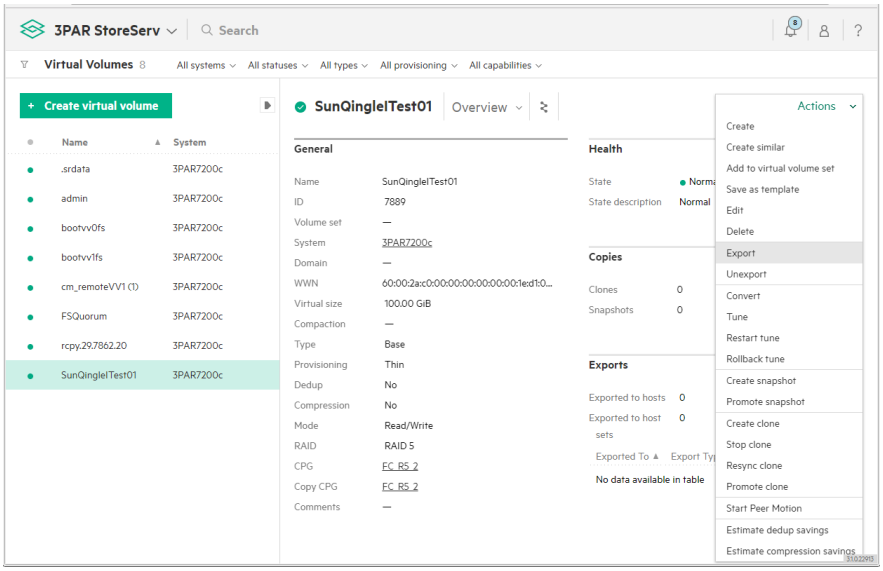
存储端创建存储卷“SunQingleiTest01”，精简模式，大小100GiB。

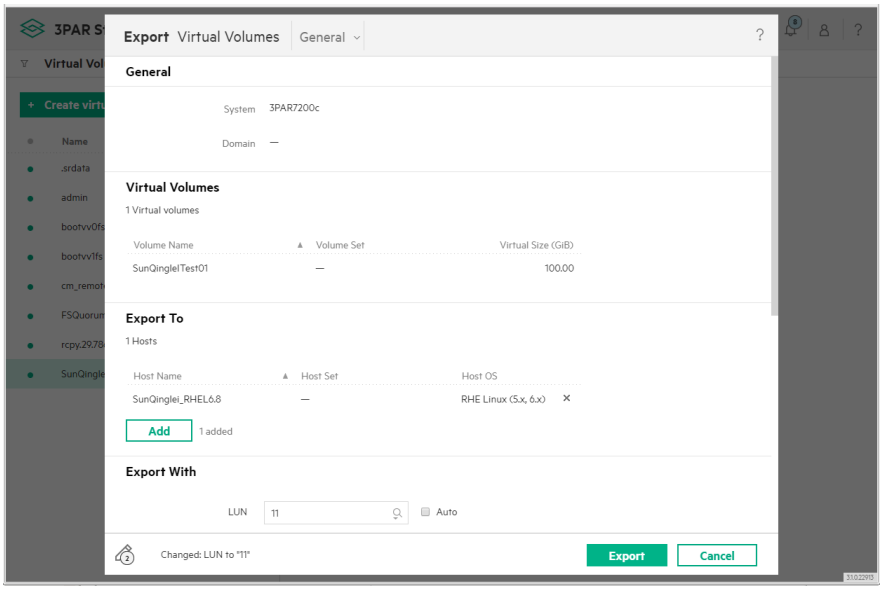


存储卷“SunQingleiTest01”创建完成。



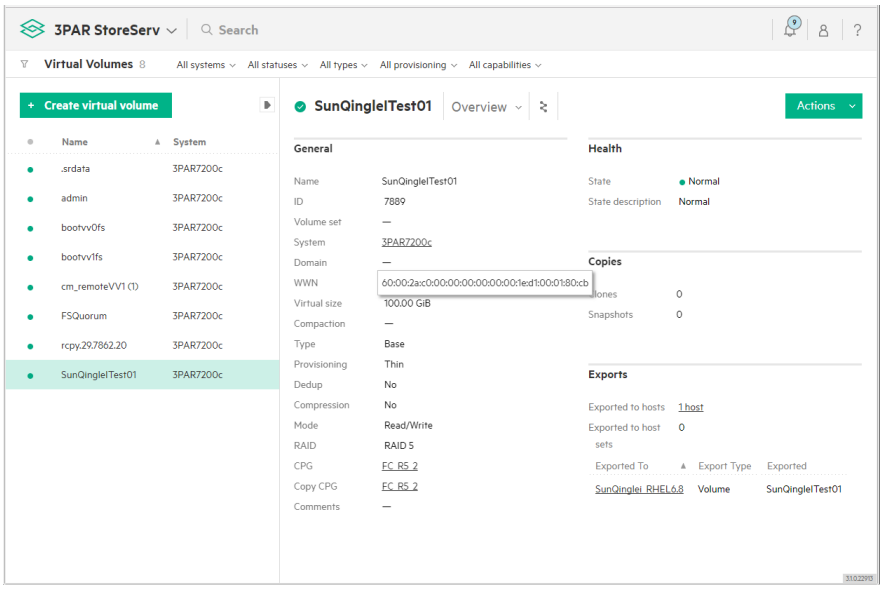
存储卷“SunQingleiTest01”导出至主机“SunQinglei_RHEL6.8”，为方便区分，LUN值设置为11。





导出完成。

另，SSMC界面可见存储卷的WWN信息。



存储端导出存储卷至主机后，RHEL主机不能自动识别。

```
[root@SunQingleiTest ~]#
[root@SunQingleiTest ~]# cat /proc/scsi/scsi
Attached devices:
Host: scsi0 Channel: 03 Id: 00 Lun: 00
  Vendor: HP       Model: P410i            Rev: 6.64
  Type:   RAID                             ANSI  SCSI revision: 05
Host: scsi0 Channel: 00 Id: 00 Lun: 01
  Vendor: HP       Model: LOGICAL VOLUME   Rev: 6.64
  Type:   Direct-Access                    ANSI  SCSI revision: 05
Host: scsi0 Channel: 00 Id: 00 Lun: 00
  Vendor: HP       Model: LOGICAL VOLUME   Rev: 6.64
  Type:   Direct-Access                    ANSI  SCSI revision: 05
Host: scsi0 Channel: 00 Id: 00 Lun: 02
  Vendor: HP       Model: LOGICAL VOLUME   Rev: 6.64
  Type:   Direct-Access                    ANSI  SCSI revision: 05
Host: scsi1 Channel: 00 Id: 04 Lun: 00
  Vendor: HP       Model: Ultrium 5-SCSI   Rev: Y6PW
  Type:   Sequential-Access                ANSI  SCSI revision: 06
Host: scsi1 Channel: 00 Id: 05 Lun: 00
  Vendor: HP       Model: Ultrium 5-SCSI   Rev: Y6NW
  Type:   Sequential-Access                ANSI  SCSI revision: 06
Host: scsi1 Channel: 00 Id: 06 Lun: 00
  Vendor: HP       Model: MSL G3 Series    Rev: 6.70
  Type:   Medium Changer                   ANSI  SCSI revision: 05
Host: scsi5 Channel: 00 Id: 00 Lun: 00
  Vendor: HP       Model: Virtual DVD-ROM  Rev:
  Type:   CD-ROM                           ANSI  SCSI revision: 00
Host: scsi12 Channel: 00 Id: 00 Lun: 254
  Vendor: 3PARdata Model: SES              Rev: 3224
  Type:   Enclosure                        ANSI  SCSI revision: 06
Host: scsi10 Channel: 00 Id: 00 Lun: 254
  Vendor: 3PARdata Model: SES              Rev: 3224
  Type:   Enclosure                        ANSI  SCSI revision: 06
Host: scsi11 Channel: 00 Id: 00 Lun: 254
  Vendor: 3PARdata Model: SES              Rev: 3224
  Type:   Enclosure                        ANSI  SCSI revision: 06
Host: scsi13 Channel: 00 Id: 00 Lun: 254
  Vendor: 3PARdata Model: SES              Rev: 3224
  Type:   Enclosure                        ANSI  SCSI revision: 06
[root@SunQingleiTest ~]#
```

对于iSCSI连接方式，RHEL主机需要重新查找新增设备。3PAR存储是MLPT类型，故使用iscsiadm --mode session –rescan，重新扫描当前iSCSI会话即可。

注* 根据存储产品的类型，重新扫描方式不同。对于SLPT类型的设备(如LeftHand)，则需要重新发现存储目标。

```
[root@SunQingleiTest ~]# iscsiadm -m session -R
Rescanning session [sid: 1, target: iqn.2000-05.com.3pardata:21220002ac0180cb, portal: 192.168.2.22,3260]
Rescanning session [sid: 2, target: iqn.2000-05.com.3pardata:21210002ac0180cb, portal: 192.168.1.12,3260]
Rescanning session [sid: 3, target: iqn.2000-05.com.3pardata:20210002ac0180cb, portal: 192.168.1.11,3260]
Rescanning session [sid: 4, target: iqn.2000-05.com.3pardata:20220002ac0180cb, portal: 192.168.2.21,3260]
[root@SunQingleiTest ~]#
```

重新扫描iSCSI会话后，可见每个存储目标所包含的SCSI设备中出现磁盘设备，可见LUN值为11，即存储卷“SunQingleiTest01”。

```
[root@SunQingleiTest ~]# service iscsi status
iSCSI Transport Class version 2.0-870
version 6.2.0-873.21.el6
Target: iqn.2000-05.com.3pardata:21220002ac0180cb (non-flash)
        Current Portal: 192.168.2.22:3260,122
        Persistent Portal: 192.168.2.22:3260,122
                **********
                Interface:
                **********
                Iface Name: default
                Iface Transport: tcp
                Iface Initiatorname: iqn.1994-05.com.redhat:5c8a9ed36c37
                Iface IPaddress: 192.168.2.1
                Iface HWaddress: <empty>
                Iface Netdev: <empty>
                SID: 1
                iSCSI Connection State: LOGGED IN
                iSCSI Session State: LOGGED_IN
                Internal iscsid Session State: NO CHANGE
                *********
                Timeouts:
                *********
                Recovery Timeout: 10
                Target Reset Timeout: 30
                LUN Reset Timeout: 30
                Abort Timeout: 15
                *****
                CHAP:
                *****
                username: <empty>
                password: ********
                username_in: <empty>
                password_in: ********
                ************************
                Negotiated iSCSI params:
                ************************
                HeaderDigest: None
                DataDigest: None
                MaxRecvDataSegmentLength: 262144
                MaxXmitDataSegmentLength: 65536
                FirstBurstLength: 65536
                MaxBurstLength: 262144
                ImmediateData: No
                InitialR2T: Yes
                MaxOutstandingR2T: 1
                ************************
                Attached SCSI devices:
                ************************
                Host Number: 10 State: running
                scsi10 Channel 00 Id 0 Lun: 11
                        Attached scsi disk sdd          State: running
                scsi10 Channel 00 Id 0 Lun: 254
```

```
Target: iqn.2000-05.com.3pardata:21210002ac0180cb (non-flash)
        Current Portal: 192.168.1.12:3260,121
        Persistent Portal: 192.168.1.12:3260,121
                **********
                Interface:
                **********
                Iface Name: default
                Iface Transport: tcp
                Iface Initiatorname: iqn.1994-05.com.redhat:5c8a9ed36c37
                Iface IPaddress: 192.168.1.1
                Iface HWaddress: <empty>
                Iface Netdev: <empty>
                SID: 2
                iSCSI Connection State: LOGGED IN
                iSCSI Session State: LOGGED_IN
                Internal iscsid Session State: NO CHANGE
                *********
                Timeouts:
                *********
                Recovery Timeout: 10
                Target Reset Timeout: 30
                LUN Reset Timeout: 30
                Abort Timeout: 15
                *****
                CHAP:
                *****
                username: <empty>
                password: ********
                username_in: <empty>
                password_in: ********
                ************************
                Negotiated iSCSI params:
                ************************
                HeaderDigest: None
                DataDigest: None
                MaxRecvDataSegmentLength: 262144
                MaxXmitDataSegmentLength: 65536
                FirstBurstLength: 65536
                MaxBurstLength: 262144
                ImmediateData: No
                InitialR2T: Yes
                MaxOutstandingR2T: 1
                ************************
                Attached SCSI devices:
                ************************
                Host Number: 11 State: running
                scsi11 Channel 00 Id 0 Lun: 11
                        Attached scsi disk sde          State: running
                scsi11 Channel 00 Id 0 Lun: 254
```

```
Target: iqn.2000-05.com.3pardata:20210002ac0180cb (non-flash)
        Current Portal: 192.168.1.11:3260,21
        Persistent Portal: 192.168.1.11:3260,21
                **********
                Interface:
                **********
                Iface Name: default
                Iface Transport: tcp
                Iface Initiatorname: iqn.1994-05.com.redhat:5c8a9ed36c37
                Iface IPaddress: 192.168.1.1
                Iface HWaddress: <empty>
                Iface Netdev: <empty>
                SID: 3
                iSCSI Connection State: LOGGED IN
                iSCSI Session State: LOGGED_IN
                Internal iscsid Session State: NO CHANGE
                *********
                Timeouts:
                *********
                Recovery Timeout: 10
                Target Reset Timeout: 30
                LUN Reset Timeout: 30
                Abort Timeout: 15
                *****
                CHAP:
                *****
                username: <empty>
                password: ********
                username_in: <empty>
                password_in: ********
                ************************
                Negotiated iSCSI params:
                ************************
                HeaderDigest: None
                DataDigest: None
                MaxRecvDataSegmentLength: 262144
                MaxXmitDataSegmentLength: 65536
                FirstBurstLength: 65536
                MaxBurstLength: 262144
                ImmediateData: No
                InitialR2T: Yes
                MaxOutstandingR2T: 1
                ************************
                Attached SCSI devices:
                ************************
                Host Number: 12 State: running
                scsi12 Channel 00 Id 0 Lun: 11
                        Attached scsi disk sdf          State: running
                scsi12 Channel 00 Id 0 Lun: 254
```

```
Target: iqn.2000-05.com.3pardata:20220002ac0180cb (non-flash)
        Current Portal: 192.168.2.21:3260,22
        Persistent Portal: 192.168.2.21:3260,22
                **********
                Interface:
                **********
                Iface Name: default
                Iface Transport: tcp
                Iface Initiatorname: iqn.1994-05.com.redhat:5c8a9ed36c37
                Iface IPaddress: 192.168.2.1
                Iface HWaddress: <empty>
                Iface Netdev: <empty>
                SID: 4
                iSCSI Connection State: LOGGED IN
                iSCSI Session State: LOGGED_IN
                Internal iscsid Session State: NO CHANGE
                *********
                Timeouts:
                *********
                Recovery Timeout: 10
                Target Reset Timeout: 30
                LUN Reset Timeout: 30
                Abort Timeout: 15
                *****
                CHAP:
                *****
                username: <empty>
                password: ********
                username_in: <empty>
                password_in: ********
                ************************
                Negotiated iSCSI params:
                ************************
                HeaderDigest: None
                DataDigest: None
                MaxRecvDataSegmentLength: 262144
                MaxXmitDataSegmentLength: 65536
                FirstBurstLength: 65536
                MaxBurstLength: 262144
                ImmediateData: No
                InitialR2T: Yes
                MaxOutstandingR2T: 1
                ************************
                Attached SCSI devices:
                ************************
                Host Number: 13 State: running
                scsi13 Channel 00 Id 0 Lun: 11
                        Attached scsi disk sdg          State: running
                scsi13 Channel 00 Id 0 Lun: 254
[root@SunQingleiTest ~]#
```

查看SCSI设备，可见已识别到4个3PAR存储磁盘设备，LUN 11。

```
[root@SunQingleiTest ~]# cat /proc/scsi/scsi
Attached devices:
Host: scsi0 Channel: 03 Id: 00 Lun: 00
  Vendor: HP       Model: P410i            Rev: 6.64
  Type:   RAID                             ANSI  SCSI revision: 05
Host: scsi0 Channel: 00 Id: 00 Lun: 01
  Vendor: HP       Model: LOGICAL VOLUME   Rev: 6.64
  Type:   Direct-Access                    ANSI  SCSI revision: 05
Host: scsi0 Channel: 00 Id: 00 Lun: 00
  Vendor: HP       Model: LOGICAL VOLUME   Rev: 6.64
  Type:   Direct-Access                    ANSI  SCSI revision: 05
Host: scsi0 Channel: 00 Id: 00 Lun: 02
  Vendor: HP       Model: LOGICAL VOLUME   Rev: 6.64
  Type:   Direct-Access                    ANSI  SCSI revision: 05
Host: scsi1 Channel: 00 Id: 04 Lun: 00
  Vendor: HP       Model: Ultrium 5-SCSI   Rev: Y6PW
  Type:   Sequential-Access                ANSI  SCSI revision: 06
Host: scsi1 Channel: 00 Id: 05 Lun: 00
  Vendor: HP       Model: Ultrium 5-SCSI   Rev: Y6NW
  Type:   Sequential-Access                ANSI  SCSI revision: 06
Host: scsi1 Channel: 00 Id: 06 Lun: 00
  Vendor: HP       Model: MSL G3 Series    Rev: 6.70
  Type:   Medium Changer                   ANSI  SCSI revision: 05
Host: scsi5 Channel: 00 Id: 00 Lun: 00
  Vendor: HP       Model: Virtual DVD-ROM  Rev:
  Type:   CD-ROM                           ANSI  SCSI revision: 00
Host: scsi12 Channel: 00 Id: 00 Lun: 254
  Vendor: 3PARdata Model: SES              Rev: 3224
  Type:   Enclosure                        ANSI  SCSI revision: 06
Host: scsi10 Channel: 00 Id: 00 Lun: 254
  Vendor: 3PARdata Model: SES              Rev: 3224
  Type:   Enclosure                        ANSI  SCSI revision: 06
Host: scsi11 Channel: 00 Id: 00 Lun: 254
  Vendor: 3PARdata Model: SES              Rev: 3224
  Type:   Enclosure                        ANSI  SCSI revision: 06
Host: scsi13 Channel: 00 Id: 00 Lun: 254
  Vendor: 3PARdata Model: SES              Rev: 3224
  Type:   Enclosure                        ANSI  SCSI revision: 06
Host: scsi10 Channel: 00 Id: 00 Lun: 11
  Vendor: 3PARdata Model: VV               Rev: 3224
  Type:   Direct-Access                    ANSI  SCSI revision: 06
Host: scsi11 Channel: 00 Id: 00 Lun: 11
  Vendor: 3PARdata Model: VV               Rev: 3224
  Type:   Direct-Access                    ANSI  SCSI revision: 06
Host: scsi12 Channel: 00 Id: 00 Lun: 11
  Vendor: 3PARdata Model: VV               Rev: 3224
  Type:   Direct-Access                    ANSI  SCSI revision: 06
Host: scsi13 Channel: 00 Id: 00 Lun: 11
  Vendor: 3PARdata Model: VV               Rev: 3224
  Type:   Direct-Access                    ANSI  SCSI revision: 06
[root@SunQingleiTest ~]#
```

fdisk -l，可见将存储卷对应的重复磁盘设备识别为sdd、sde、sdf和sdg。

```
Disk /dev/sdd: 107.4 GB, 107374182400 bytes
255 heads, 63 sectors/track, 13054 cylinders
Units = cylinders of 16065 * 512 = 8225280 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 16384 bytes / 16777216 bytes
Disk identifier: 0x00000000


Disk /dev/sdf: 107.4 GB, 107374182400 bytes
255 heads, 63 sectors/track, 13054 cylinders
Units = cylinders of 16065 * 512 = 8225280 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 16384 bytes / 16777216 bytes
Disk identifier: 0x00000000


Disk /dev/sde: 107.4 GB, 107374182400 bytes
255 heads, 63 sectors/track, 13054 cylinders
Units = cylinders of 16065 * 512 = 8225280 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 16384 bytes / 16777216 bytes
Disk identifier: 0x00000000


Disk /dev/sdg: 107.4 GB, 107374182400 bytes
255 heads, 63 sectors/track, 13054 cylinders
Units = cylinders of 16065 * 512 = 8225280 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 16384 bytes / 16777216 bytes
Disk identifier: 0x00000000

[root@SunQingleiTest ~]#
```

查看sdd~sdg的WWID，均相同且与存储端查看的存储卷WWID相同。至此，已完成RHEL主机对3PAR存储卷的配置、识别。

```
[root@SunQingleiTest ~]#
[root@SunQingleiTest ~]# scsi_id -g -u /dev/sdd
360002ac0000000000001ed1000180cb
[root@SunQingleiTest ~]# scsi_id -g -u /dev/sdf
360002ac0000000000001ed1000180cb
[root@SunQingleiTest ~]# scsi_id -g -u /dev/sde
360002ac0000000000001ed1000180cb
[root@SunQingleiTest ~]# scsi_id -g -u /dev/sdg
360002ac0000000000001ed1000180cb
[root@SunQingleiTest ~]#
```

RHEL主机已安装device mapper multipath。

开启多路径服务。

```
[root@SunQingleiTest ~]# mpathconf
multipath is enabled
find_multipaths is disabled
user_friendly_names is enabled
dm_multipath module is not loaded
multipathd is chkconfiged off
[root@SunQingleiTest ~]# mpathconf --find_multipaths y
[root@SunQingleiTest ~]# mpathconf
multipath is enabled
find_multipaths is enabled
user_friendly_names is enabled
dm_multipath module is not loaded
multipathd is chkconfiged off
[root@SunQingleiTest ~]# service multipathd reload
Reloading multipathd:                                      [FAILED]
[root@SunQingleiTest ~]# service multipathd reload
Reloading multipathd:                                      [FAILED]
[root@SunQingleiTest ~]# service multipathd restart
ux_socket_connect: No such file or directory
Stopping multipathd daemon:                                [FAILED]
Starting multipathd daemon:                                [  OK  ]
[root@SunQingleiTest ~]#
```

multipath -ll，显示多路径设备，可见多路径软件已自动将3PAR存储卷所对应的重复磁盘聚合为多路径设备mpathd。

```
[root@SunQingleiTest ~]# multipath -ll
mpathd (360002ac0000000000001ed1000180cb) dm-3 3PARdata,VV
size=100G features='0' hwhandler='0' wp=rw
`-+- policy='round-robin 0' prio=1 status=active
  |- 10:0:0:11 sdd 8:48 active ready running
  |- 12:0:0:11 sdf 8:80 active ready running
  |- 13:0:0:11 sdg 8:96 active ready running
  `- 11:0:0:11 sde 8:64 active ready running
[root@SunQingleiTest ~]#
```

```
Disk /dev/sdd: 107.4 GB, 107374182400 bytes
255 heads, 63 sectors/track, 13054 cylinders
Units = cylinders of 16065 * 512 = 8225280 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 16384 bytes / 16777216 bytes
Disk identifier: 0x00000000


Disk /dev/sdf: 107.4 GB, 107374182400 bytes
255 heads, 63 sectors/track, 13054 cylinders
Units = cylinders of 16065 * 512 = 8225280 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 16384 bytes / 16777216 bytes
Disk identifier: 0x00000000


Disk /dev/sde: 107.4 GB, 107374182400 bytes
255 heads, 63 sectors/track, 13054 cylinders
Units = cylinders of 16065 * 512 = 8225280 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 16384 bytes / 16777216 bytes
Disk identifier: 0x00000000


Disk /dev/sdg: 107.4 GB, 107374182400 bytes
255 heads, 63 sectors/track, 13054 cylinders
Units = cylinders of 16065 * 512 = 8225280 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 16384 bytes / 16777216 bytes
Disk identifier: 0x00000000


Disk /dev/mapper/mpathd: 107.4 GB, 107374182400 bytes
255 heads, 63 sectors/track, 13054 cylinders
Units = cylinders of 16065 * 512 = 8225280 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 16384 bytes / 16777216 bytes
Disk identifier: 0x00000000

[root@SunQingleiTest ~]#
```

编辑多路径配置文件/etc/multipath.conf。

multipath.conf默认内容如下

```
# This is a basic configuration file with some examples, for device mapper
# multipath.
# For a complete list of the default configuration values, see
# /usr/share/doc/device-mapper-multipath-0.4.9/multipath.conf.defaults
# For a list of configuration options with descriptions, see
# /usr/share/doc/device-mapper-multipath-0.4.9/multipath.conf.annotated
#
# REMEMBER: After updating multipath.conf, you must run
#
# service multipathd reload
#
# for the changes to take effect in multipathd

## By default, devices with vendor = "IBM" and product = "S/390.*" are
## blacklisted. To enable mulitpathing on these devies, uncomment the
## following lines.
#blacklist_exceptions {
#       device {
#               vendor  "IBM"
#               product "S/390.*"
#       }
#}

## Use user friendly names, instead of using WWIDs as names.
defaults {
        find_multipaths yes
        user_friendly_names yes
}
##
## Here is an example of how to configure some standard options.
##
#
#defaults {
#       udev_dir                /dev
#       polling_interval        10
#       path_selector           "round-robin 0"
#       path_grouping_policy    multibus
#       getuid_callout          "/lib/udev/scsi_id --whitelisted --device=/dev/%n"
#       prio                    alua
#       path_checker            readsector0
#       rr_min_io               100
#       max_fds                 8192
#       rr_weight               priorities
#       failback                immediate
#       no_path_retry           fail
#       user_friendly_names     yes
#}
##
## The wwid line in the following blacklist section is shown as an example
## of how to blacklist devices by wwid.  The 2 devnode lines are the
## compiled in default blacklist. If you want to blacklist entire types
## of devices, such as all scsi devices, you should use a devnode line.
## However, if you want to blacklist specific devices, you should use
## a wwid line.  Since there is no guarantee that a specific device will
## not change names on reboot (from /dev/sda to /dev/sdb for example)
## devnode lines are not recommended for blacklisting specific devices.
```

```
##
#blacklist {
#       wwid 26353900f02796769
#       devnode "^(ram|raw|loop|fd|md|dm-|sr|scd|st)[0-9]*"
#       devnode "^hd[a-z]"
#}
#multipaths {
#       multipath {
#               wwid                    3600508b4000156d700012000000b0000
#               alias                   yellow
#               path_grouping_policy    multibus
#               path_checker            readsector0
#               path_selector           "round-robin 0"
#               failback                manual
#               rr_weight               priorities
#               no_path_retry           5
#       }
#       multipath {
#               wwid                    1DEC_____321816758474
#               alias                   red
#       }
#}
#devices {
#       device {
#               vendor                  "COMPAQ  "
#               product                 "HSV110 (C)COMPAQ"
#               path_grouping_policy    multibus
#               getuid_callout          "/lib/udev/scsi_id --whitelisted --device=/dev/%n"
#               path_checker            readsector0
#               path_selector           "round-robin 0"
#               hardware_handler        "0"
#               failback                15
#               rr_weight               priorities
#               no_path_retry           queue
#       }
#       device {
#               vendor                  "COMPAQ  "
#               product                 "MSA1000         "
#               path_grouping_policy    multibus
#       }
#}

blacklist
}
```

按照3PAR存储Linux实施手册进行优化配置，编辑defaults、devices信息如下

```
## Use user friendly names, instead of using WWIDs as names.
defaults {
        find_multipaths yes
        user_friendly_names yes
        polling_interval 10
}
##
```

```
#}

blacklist {
}

devices {
         device {
                 vendor                "3PARdata"
                 product               "VV"
                 path_grouping_policy  group_by_prio
                 path_selector         "round-robin 0"
                 path_checker          tur
                 features              "0"
                 hardware_handler      "1 alua"
                 prio                  alua
                 failback              immediate
                 rr_weight             uniform
                 no_path_retry         18
                 rr_min_io_rq          1
                 detect_prio           yes
                 fast_io_fail_tmo      10
                 dev_loss_tmo          14
                }
}

-- INSERT --
```

编辑配置文件后，重新加载配置文件，service multipathd reload。

校验配置文件，multipath -v2。注* 务必执行校验命令，如果配置文件中的内容有误或者与设备类型不符，执行校验命令后会输出提示信息。

重启多路径服务，service multipathd restart。

查看多路径信息，multipath -ll，可见多路径磁盘设备命名已按照配置文件修改为WWID显示，并可见修改后的路径处理策略。

群组优先级变为50。

```
[root@SunQingleiTest ~]# vim /etc/multipath.conf
[root@SunQingleiTest ~]# service multipathd reload
Reloading multipathd:                                      [  OK  ]
[root@SunQingleiTest ~]# multipath -v2
[root@SunQingleiTest ~]# service multipathd restart
ok
Stopping multipathd daemon:                                [  OK  ]
Starting multipathd daemon:                                [  OK  ]
[root@SunQingleiTest ~]# multipath -ll
mpathd (360002ac0000000000001ed1000180cb) dm-3 3PARdata,VV
size=100G features='1 queue_if_no_path' hwhandler='1 alua' wp=rw
`-+- policy='round-robin 0' prio=50 status=active
  |- 10:0:0:11 sdd 8:48 active ready running
  |- 12:0:0:11 sdf 8:80 active ready running
  |- 13:0:0:11 sdg 8:96 active ready running
  `- 11:0:0:11 sde 8:64 active ready running
[root@SunQingleiTest ~]#
```

对聚合后的磁盘设备进行格式化分区、写入文件系统、挂载至目录，不再赘述。

至此，已完成多路径配置。

```
[root@SunQingleiTest ~]# fdisk /dev/mapper/mpathd
Device contains neither a valid DOS partition table, nor Sun, SGI or OSF disklabel
Building a new DOS disklabel with disk identifier 0xbbbc022f.
Changes will remain in memory only, until you decide to write them.
After that, of course, the previous content won't be recoverable.

Warning: invalid flag 0x0000 of partition table 4 will be corrected by w(rite)

WARNING: DOS-compatible mode is deprecated. It's strongly recommended to
         switch off the mode (command 'c') and change display units to
         sectors (command 'u').

Command (m for help): n
Command action
   e   extended
   p   primary partition (1-4)
p
Partition number (1-4): 1
First cylinder (1-13054, default 3):
Using default value 3
Last cylinder, +cylinders or +size{K,M,G} (3-13054, default 13054):
Using default value 13054

Command (m for help): t
Selected partition 1
Hex code (type L to list codes): 83

Command (m for help): w
The partition table has been altered!

Calling ioctl() to re-read partition table.

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)
Syncing disks.
```

```
[root@SunQingleiTest ~]# fdisk -l /dev/mapper/mpathd

Disk /dev/mapper/mpathd: 107.4 GB, 107374182400 bytes
255 heads, 63 sectors/track, 13054 cylinders
Units = cylinders of 16065 * 512 = 8225280 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 16384 bytes / 16777216 bytes
Disk identifier: 0xbbbc022f

            Device Boot      Start         End      Blocks   Id  System
/dev/mapper/mpathdp1               3       13054   104840190   83  Linux
Partition 1 does not start on physical sector boundary.
[root@SunQingleiTest ~]# mkfs -t ext4 /dev/mapper/mpathdp1
mke2fs 1.41.12 (17-May-2010)
/dev/mapper/mpathdp1 alignment is offset by 15360 bytes.
This may result in very poor performance, (re)-partitioning suggested.
Discarding device blocks: done
Filesystem label=
OS type: Linux
Block size=4096 (log=2)
Fragment size=4096 (log=2)
Stride=4 blocks, Stripe width=4096 blocks
6553600 inodes, 26210047 blocks
1310502 blocks (5.00%) reserved for the super user
First data block=0
Maximum filesystem blocks=4294967296
800 block groups
32768 blocks per group, 32768 fragments per group
8192 inodes per group
Superblock backups stored on blocks:
        32768, 98304, 163840, 229376, 294912, 819200, 884736, 1605632, 2654208,
        4096000, 7962624, 11239424, 20480000, 23887872

Writing inode tables: done
Creating journal (32768 blocks): done
Writing superblocks and filesystem accounting information: done

This filesystem will be automatically checked every 24 mounts or
180 days, whichever comes first.  Use tune2fs -c or -i to override.
[root@SunQingleiTest ~]#
```

配置关键点