Ceph Installation Configuration and Administration Reference

prepared by Danny Lin

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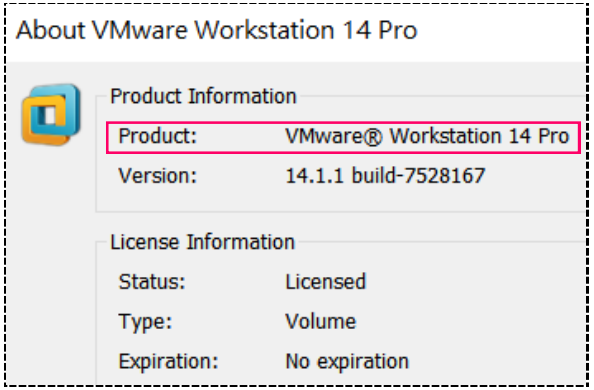
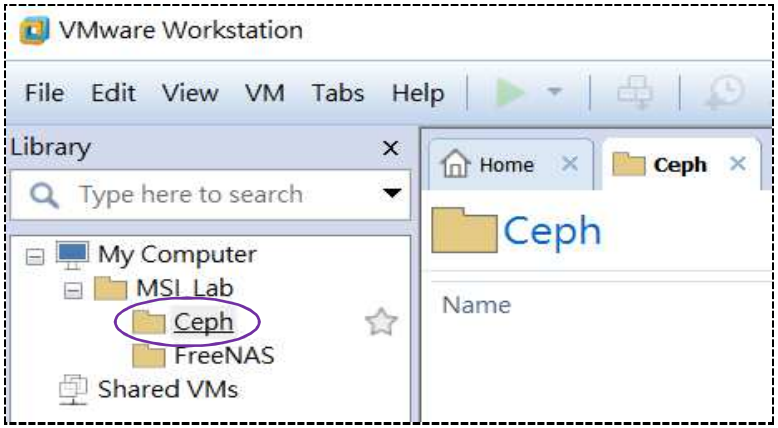
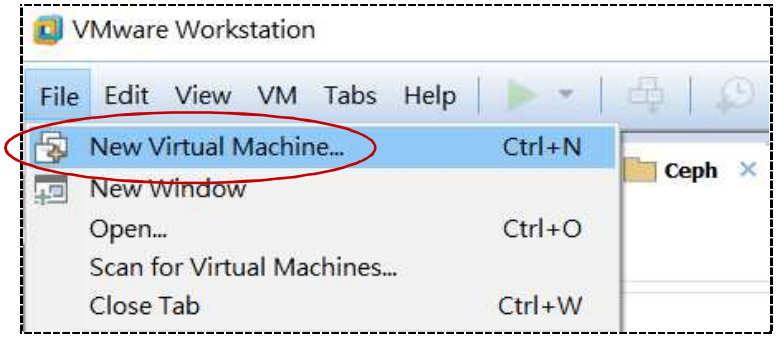
Reference information		
Item	*Description*	URLs
1	*Welcome to Ceph*	http://docs.ceph.com/docs/mimic/
2	*Ceph Storage Cluster*	http://docs.ceph.com/docs/mimic/rados/
3	*Ceph Development*	http://docs.ceph.com/docs/mimic/rados/deployment/
4	*Product Documentation for Red Hat Ceph Storage*	https://access.redhat.com/documentation/en-us/red_hat_ceph_storage/
5	*How to build a Ceph Distributed Storage Cluster on CentOS 7*	https://www.howtoforge.com/tutorial/how-to-build-a-ceph-cluster-on-centos-7/
6	*Monitoring of a Ceph Cluster with Ceph-dash on CentOS 7*	https://www.howtoforge.com/tutorial/monitoring-of-a-ceph-cluster-with-ceph-dash/
7	*Ceph Releases*	http://docs.ceph.com/docs/master/releases/
8	*Pool, PG and CRUSH Config Reference*	http://docs.ceph.com/docs/master/rados/configuration/pool-pg-config-ref/

1. We use VMware Workstation Pro 14 to demo how to install, configure and administrate the Ceph storage:

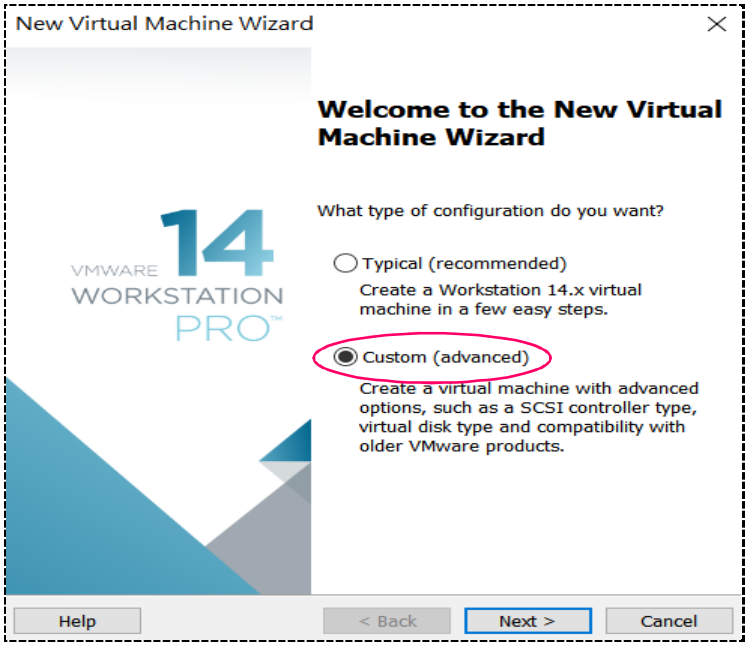


2. We create new VM for OS – CentOS 7.5 (1804) installation:

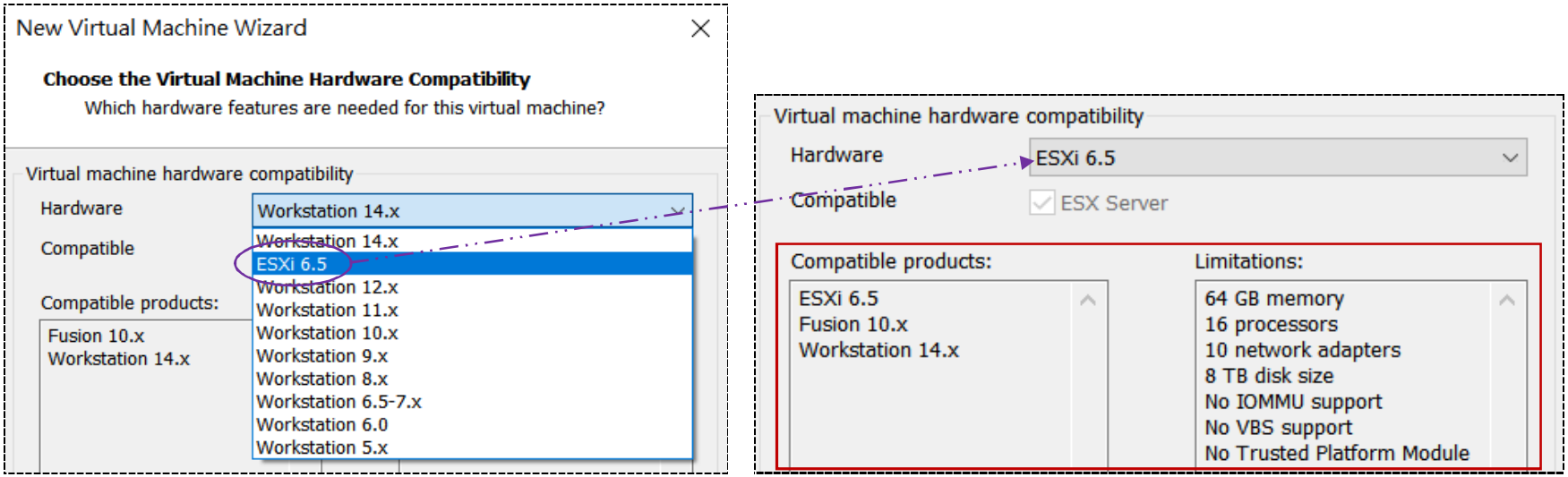




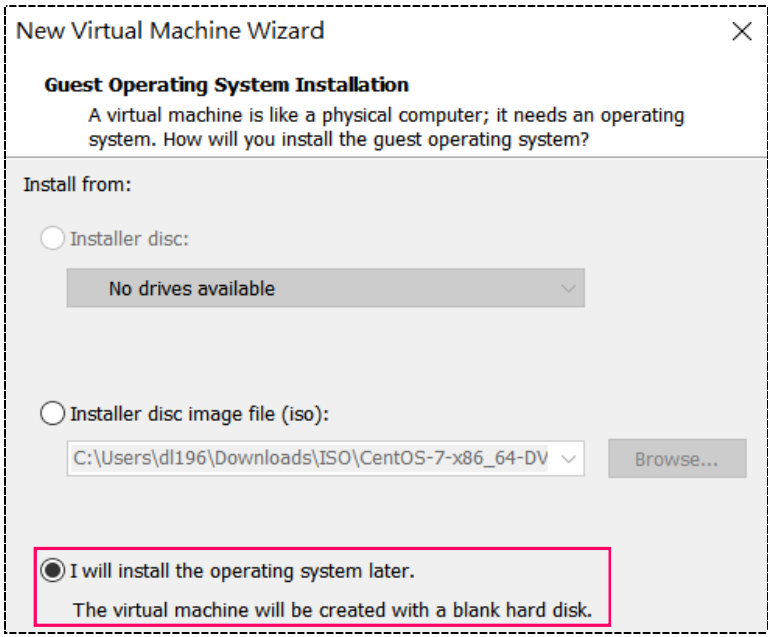
3. We choose “custom (advanced)” to configure more for VM:

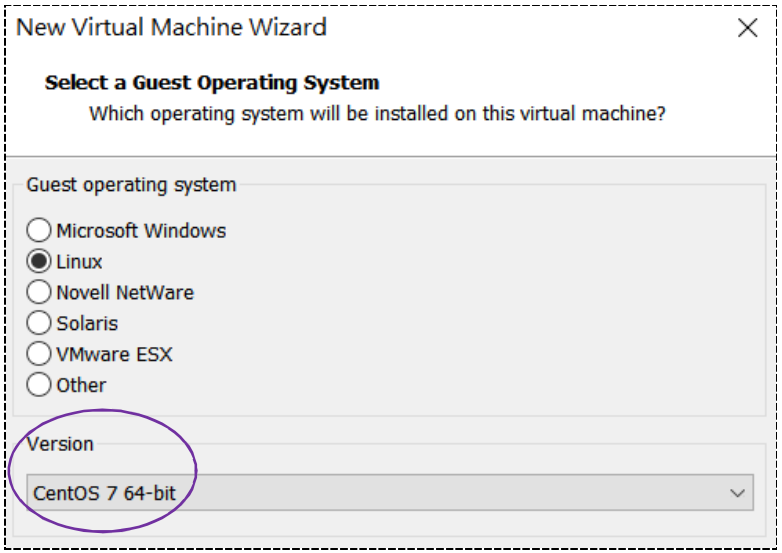


4. We change from "WS 14.x" to "ESXi 6.5" for VM H/W compatibility, the limitations are as the listed:

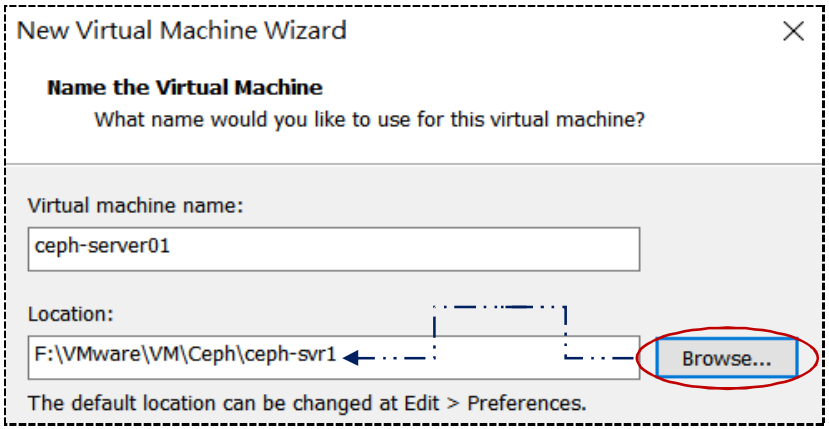


5. We will install OS later, just want to create VM first, and select Linux, CentOS 7 64-bit, for guest OS:

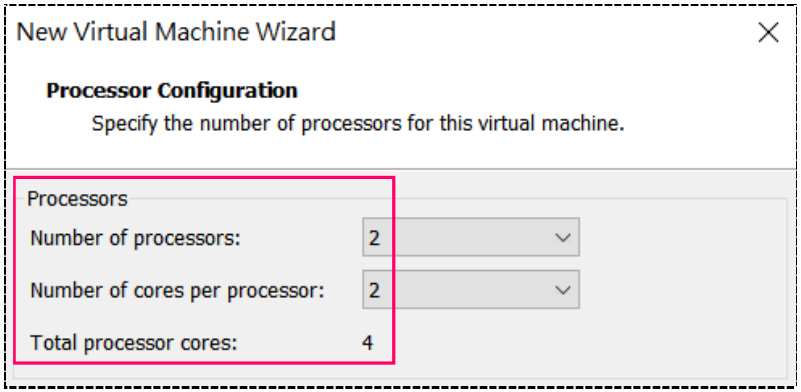


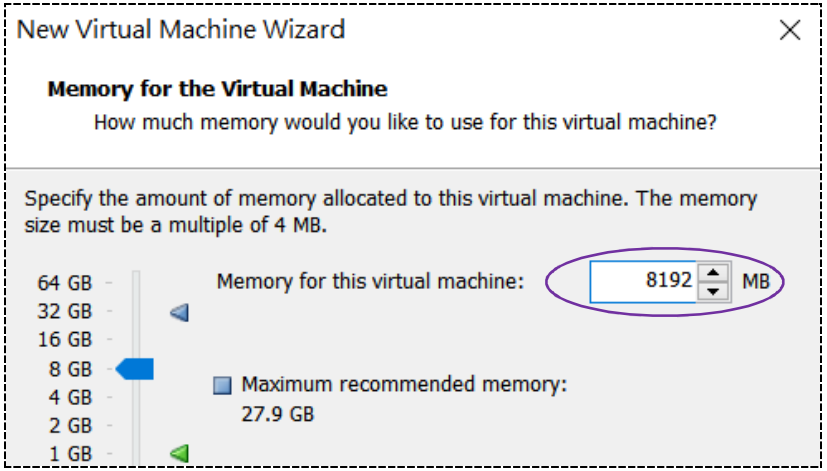


6. We name the VM as ceph-server01, then browse the location to hold VM information:

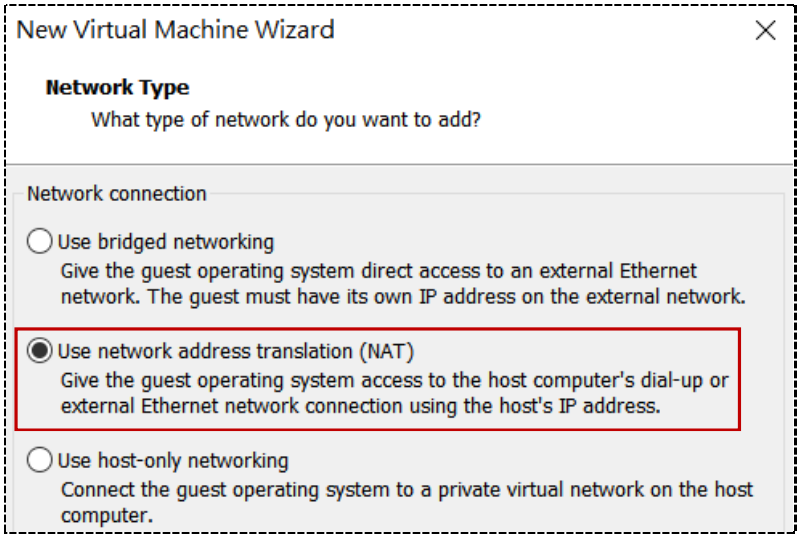


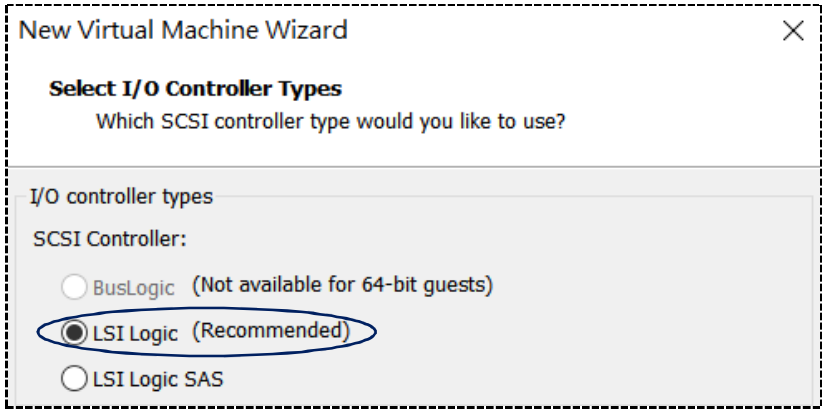
7. We choose 2 processors, 2 cores per processor for CPU configuration and 8192 MB for memory:



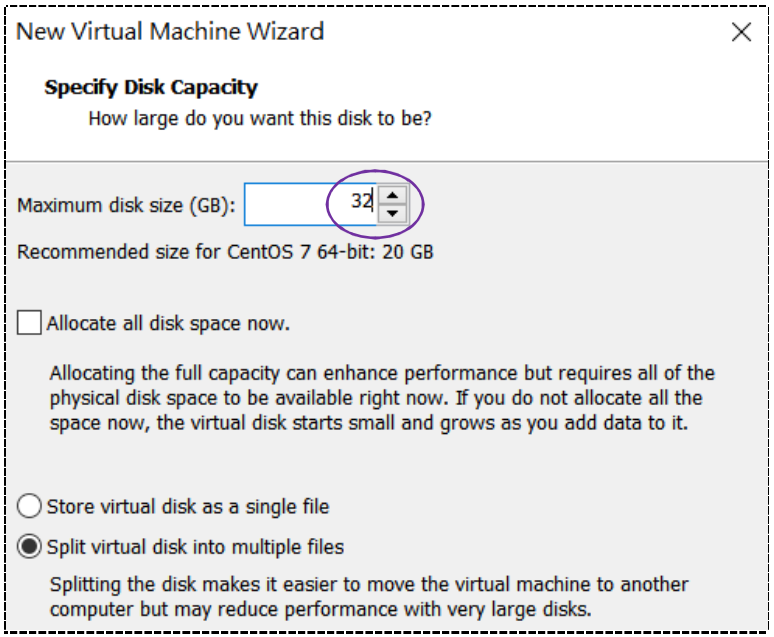


8. We choose NAT for network configuration and use LSI Logic for disk I/O SCSI controller:

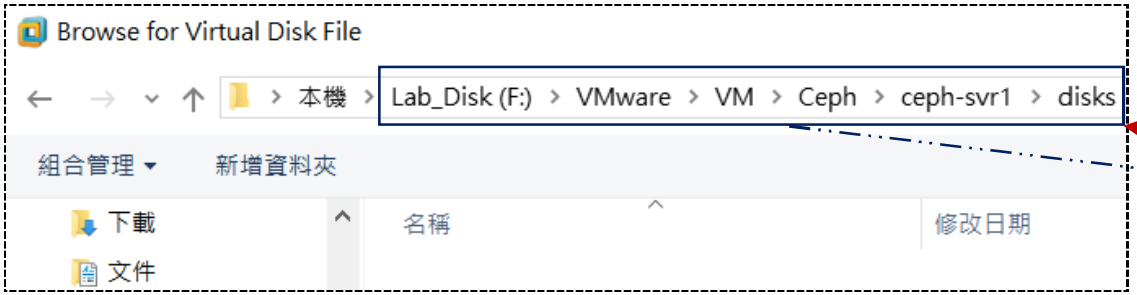


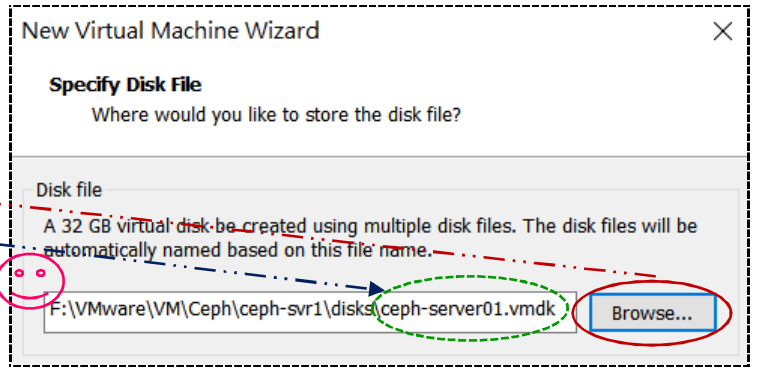


9. We create a new virtual disk and use 32 GB for disk size:

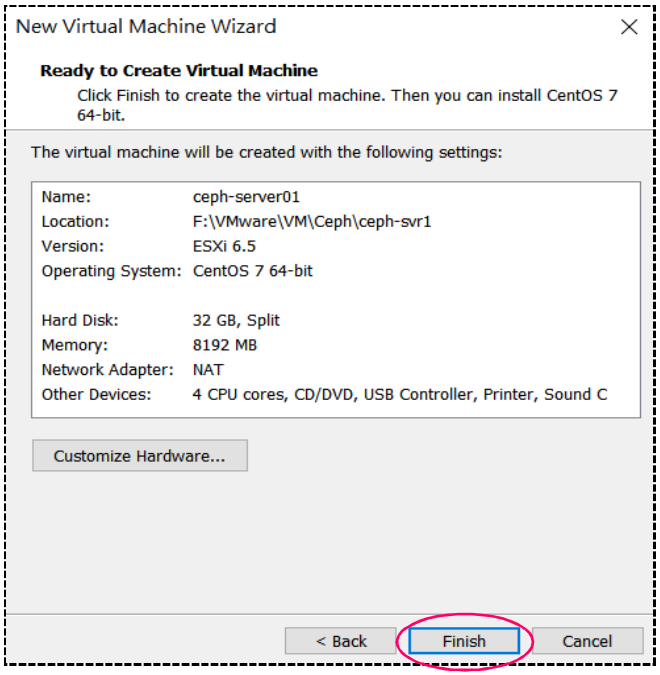


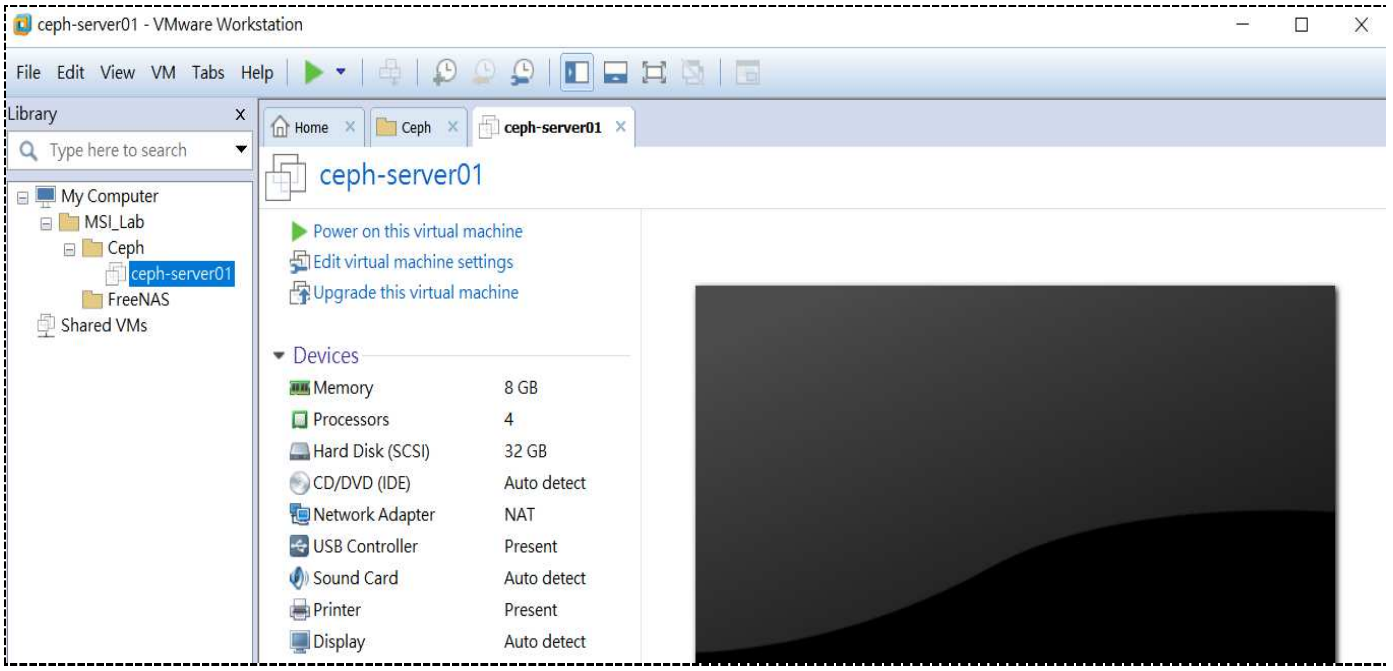
10. We browse the location to hold VM virtual disk:



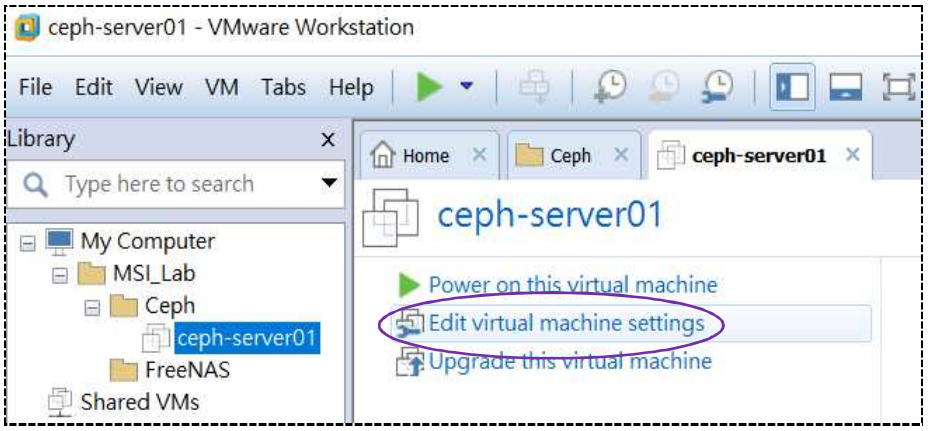


11. The VM has been created successfully:

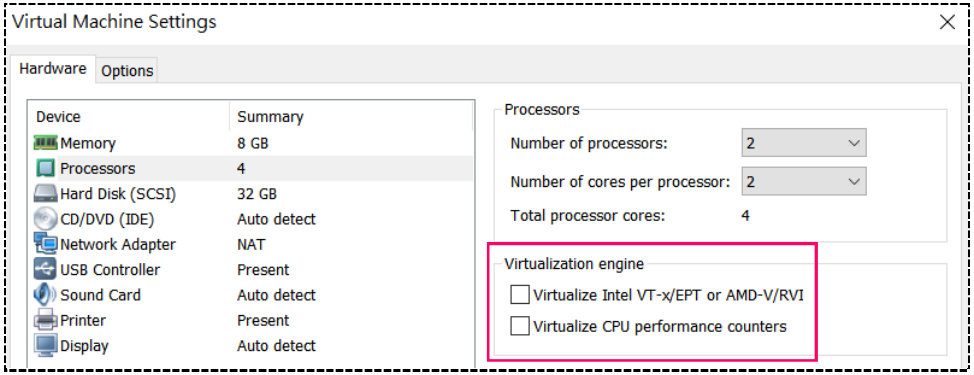


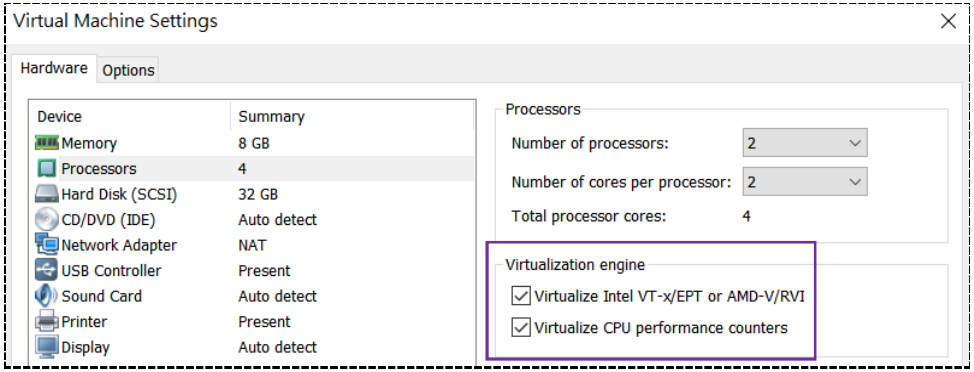


12. We edit virtual machine settings for more customization:

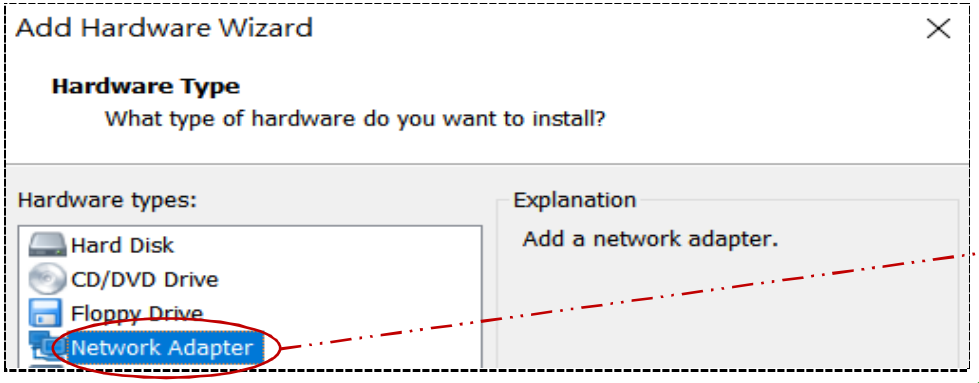


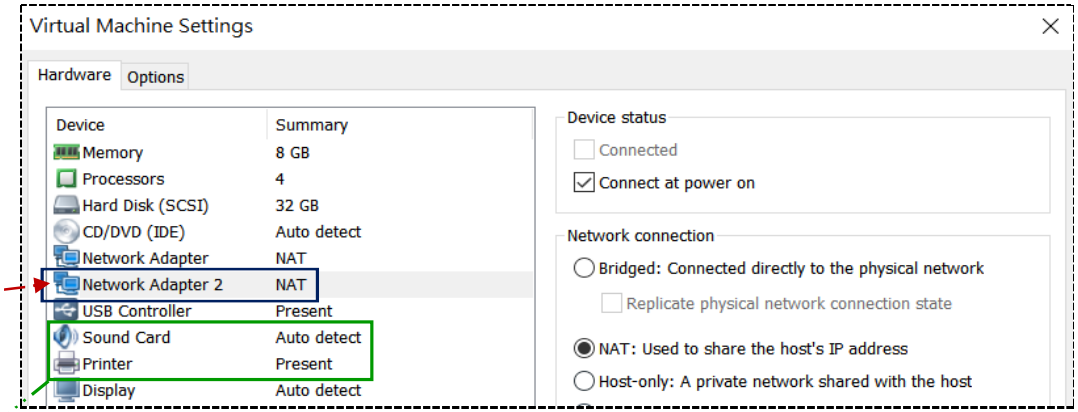
13. We enable H/W virtualization engine for CPUs:



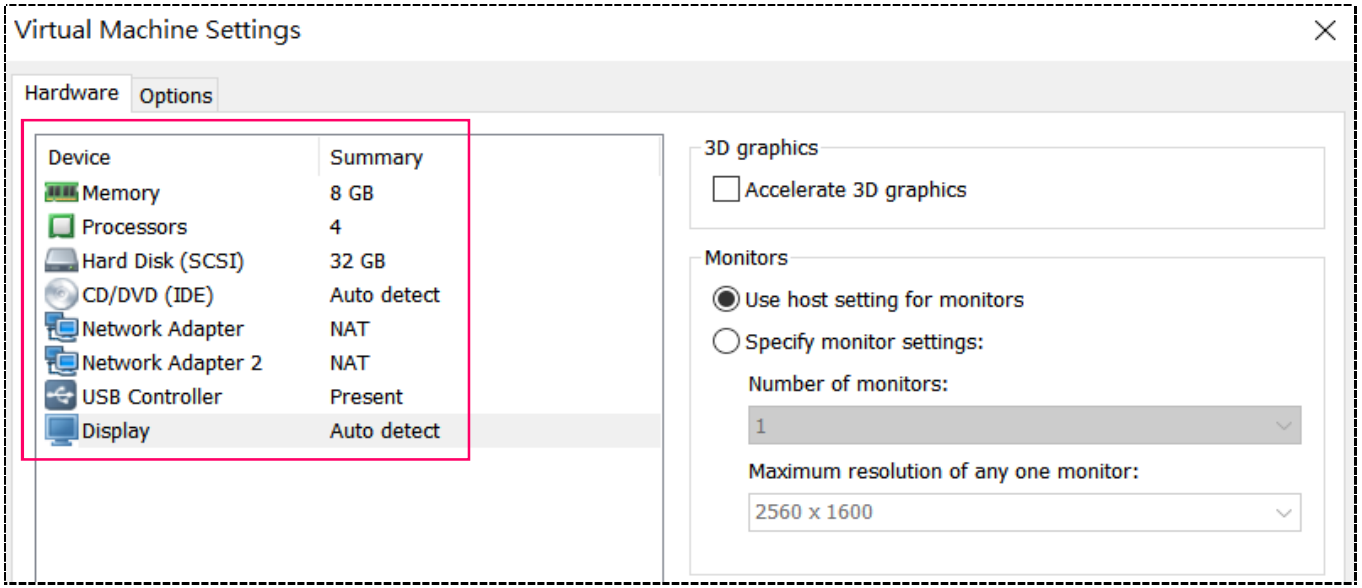


14. We add another network adapter:

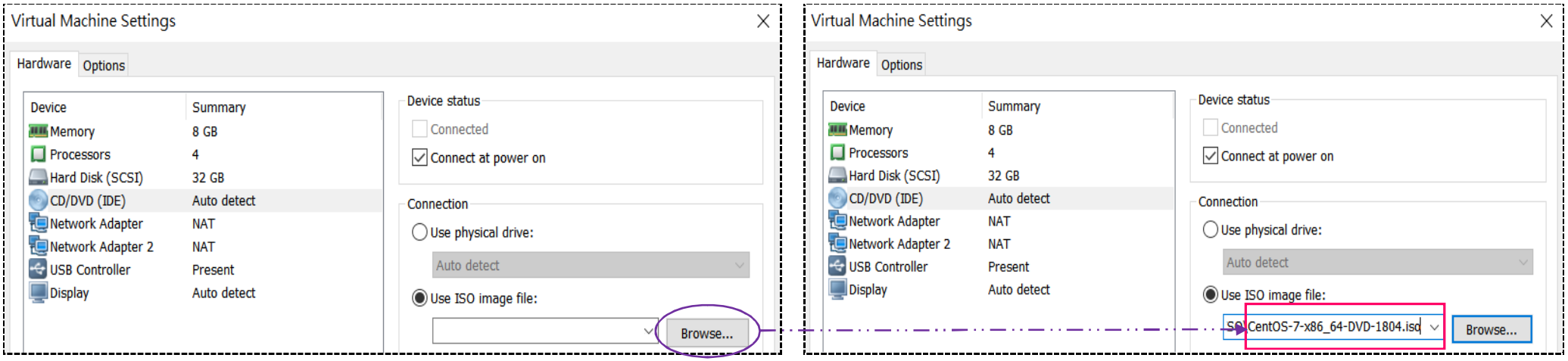




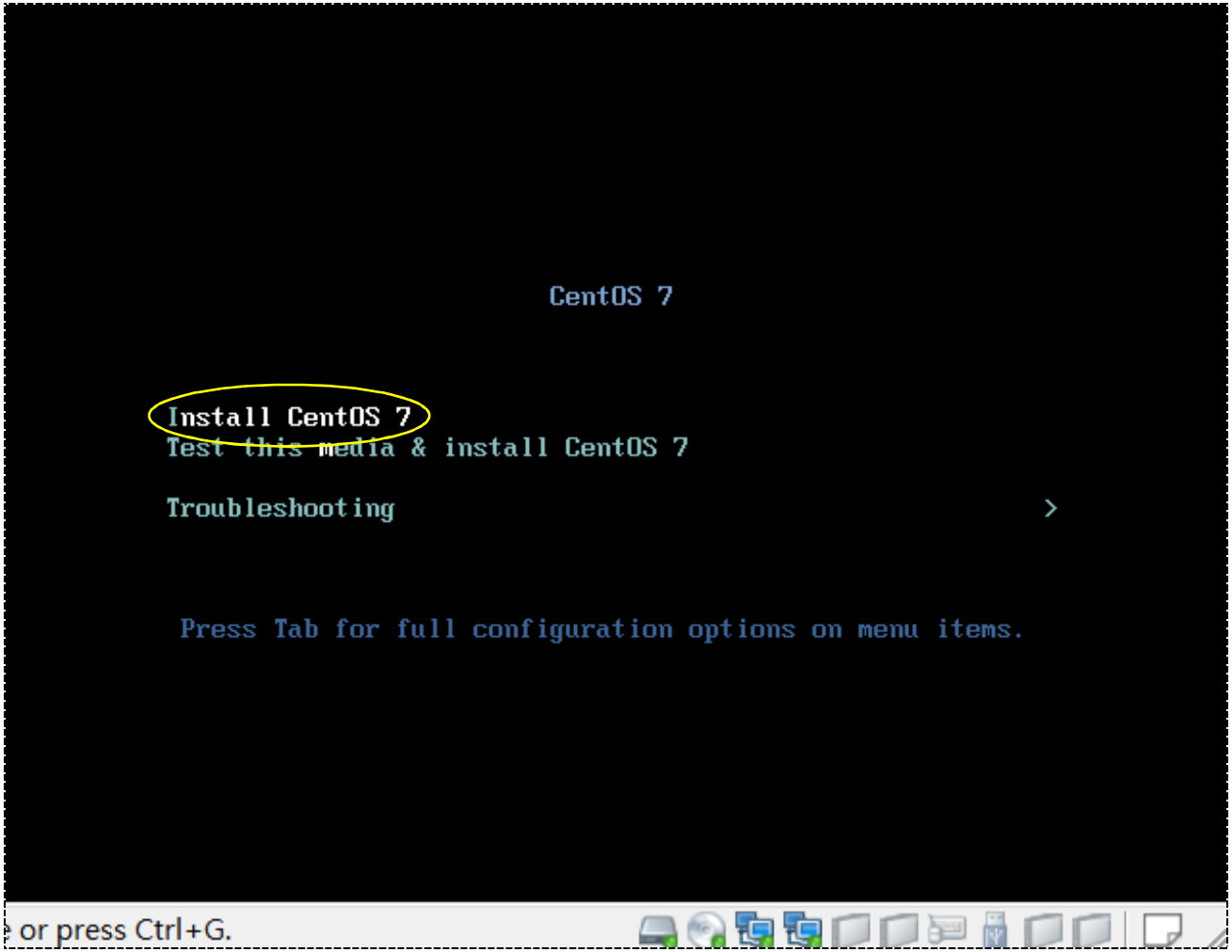
15. We remove unneeded H/W – sound card and printer:



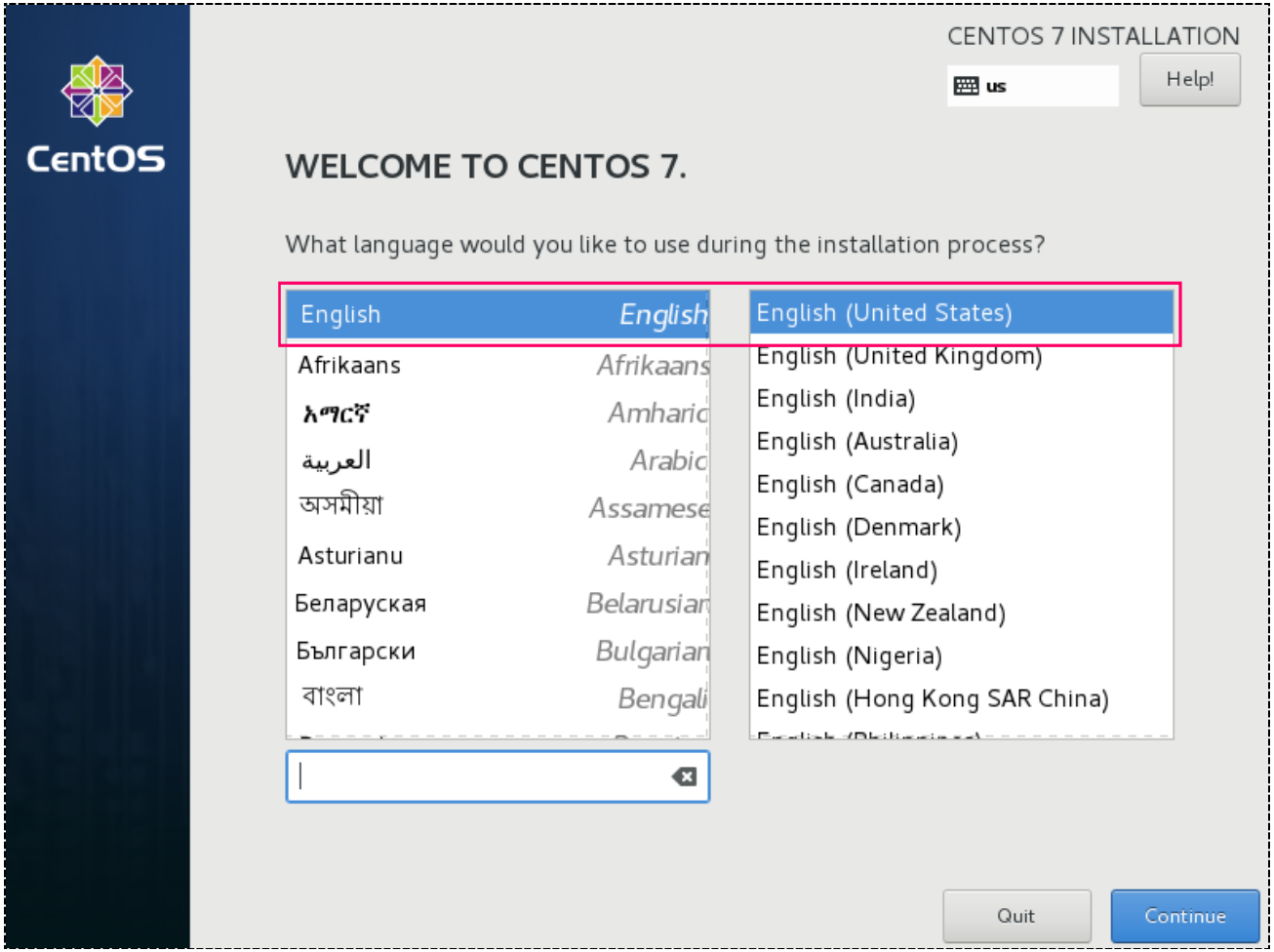
16. We browse the CentOS 7.5 (1804) ISO image for guest OS installation:



17. We power on the VM and start the guest OS installation:



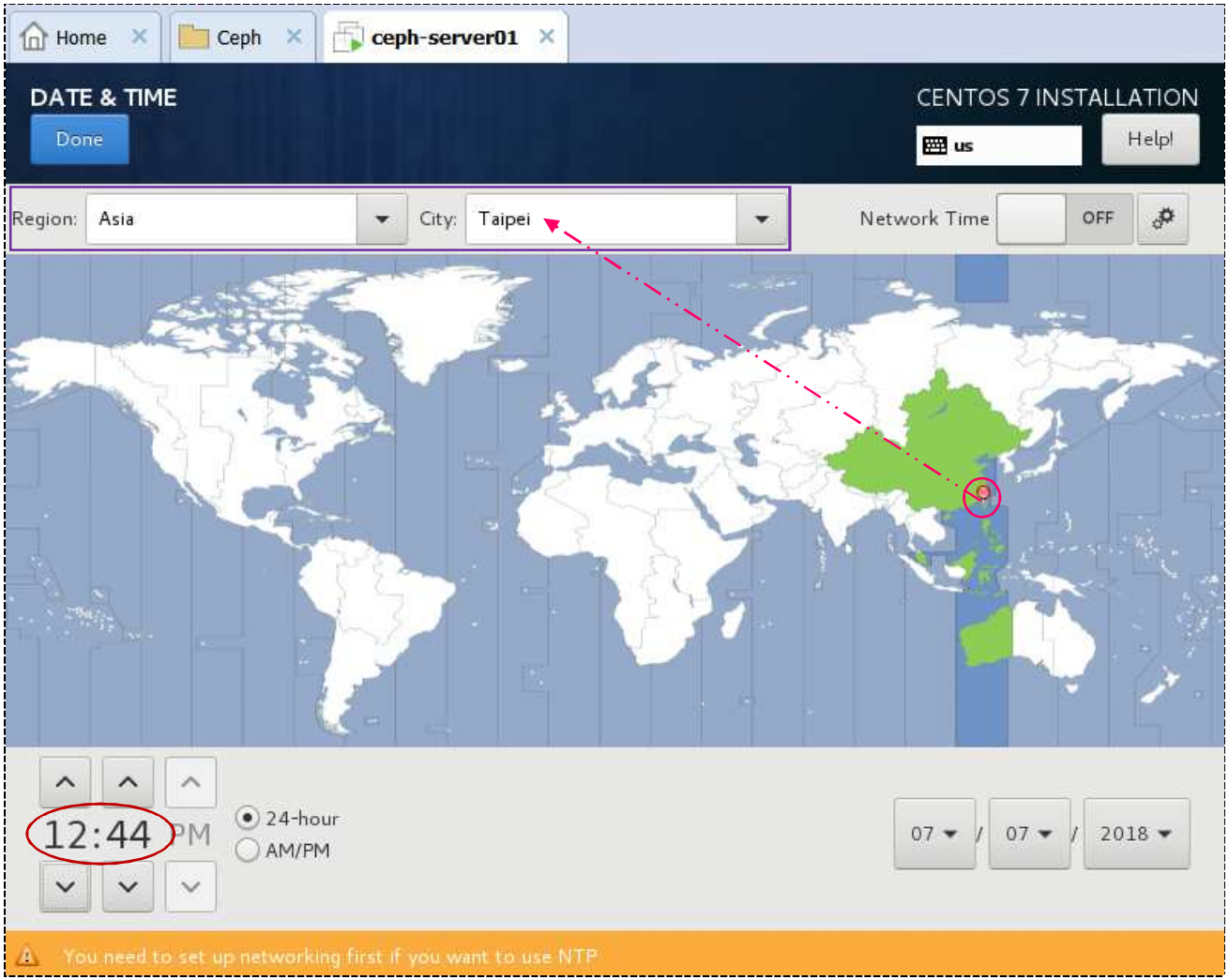
18. We choose English as the language for installation process:



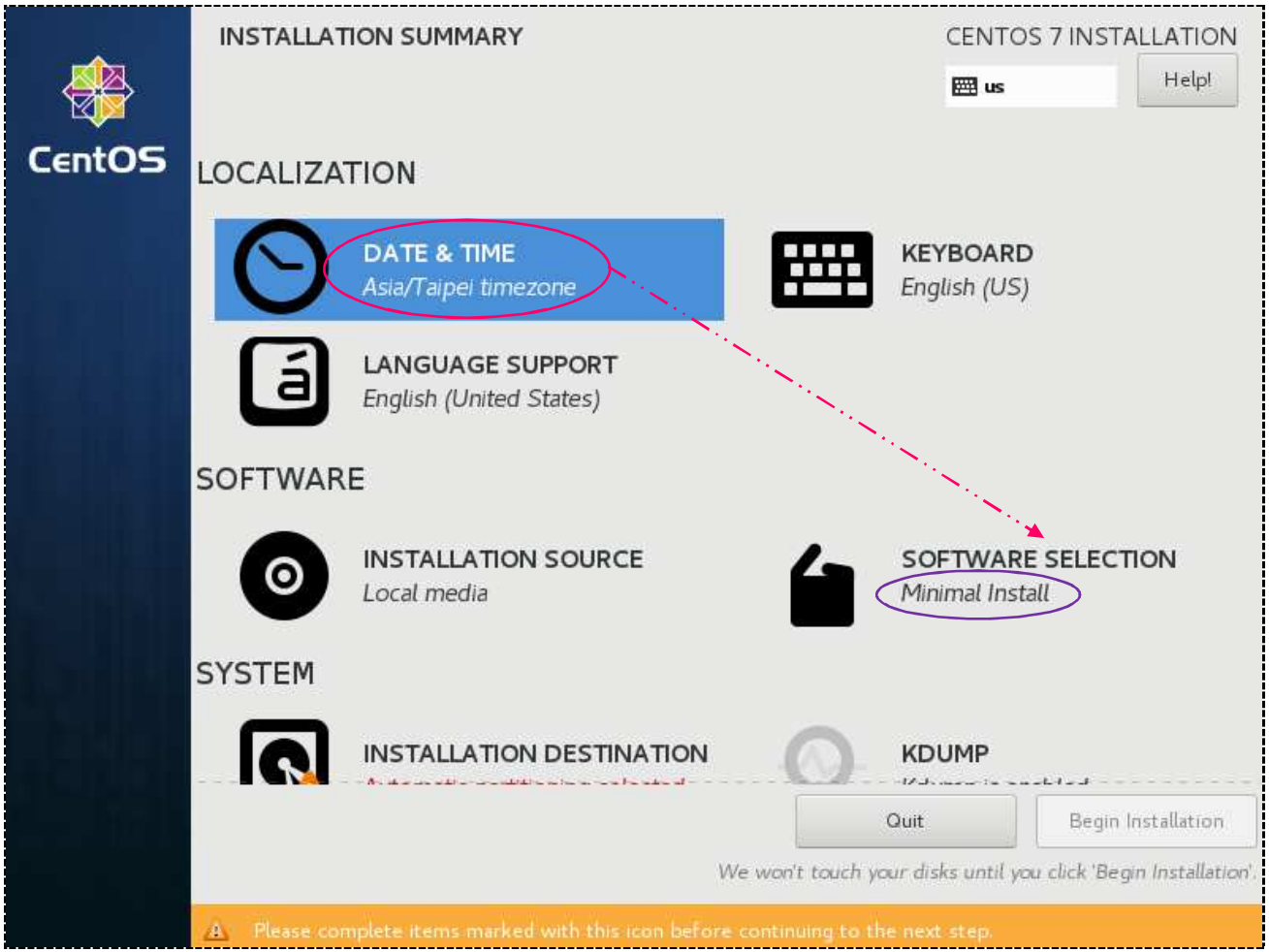
19. First of all, We will change the date & time setting from “Americas/New York” to “Asia/Taipei”:

w

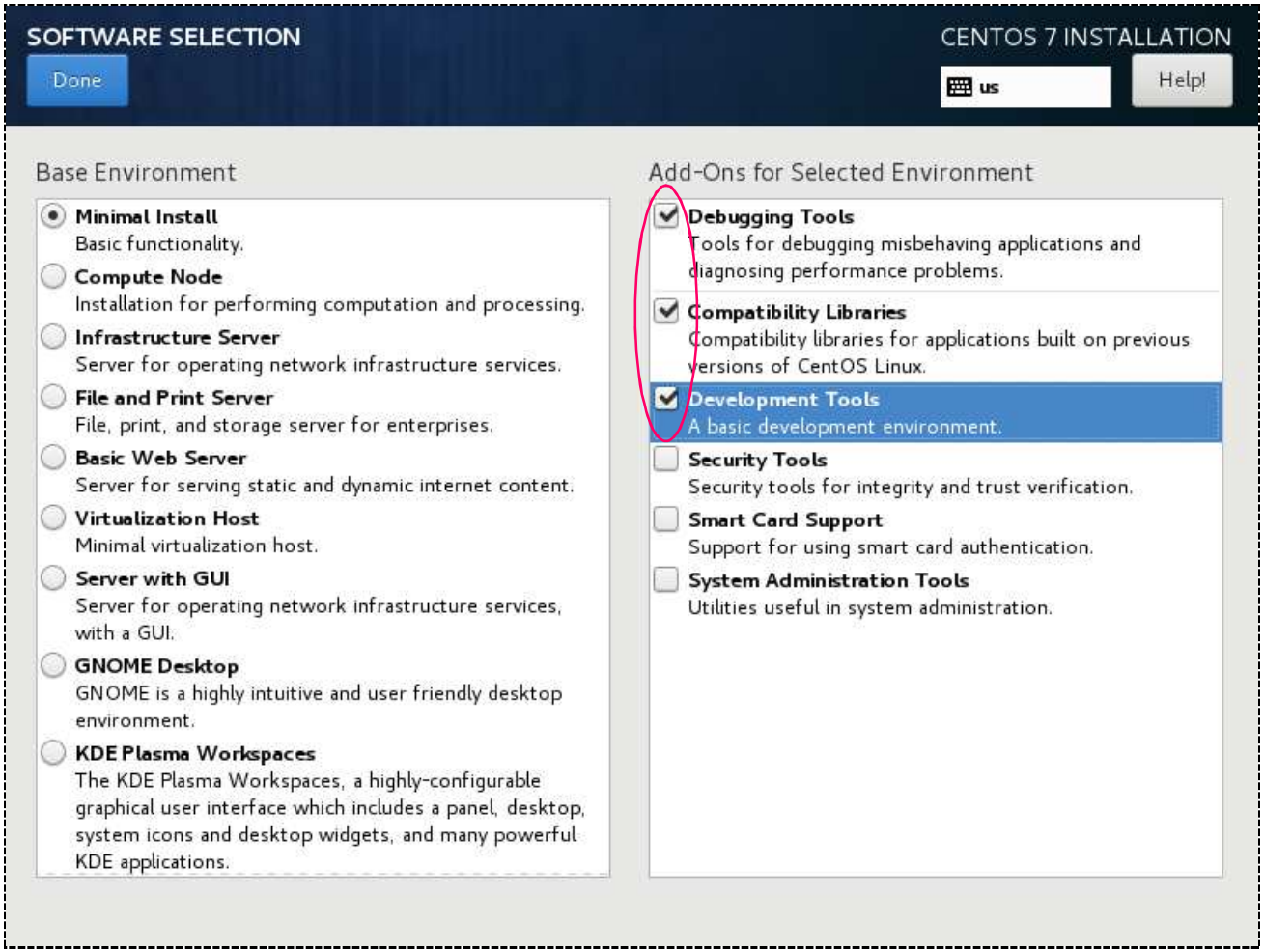
20. In addition to changing the timezone to “Asia/Taipei”, we update the time in the lower-left corner accordingly:



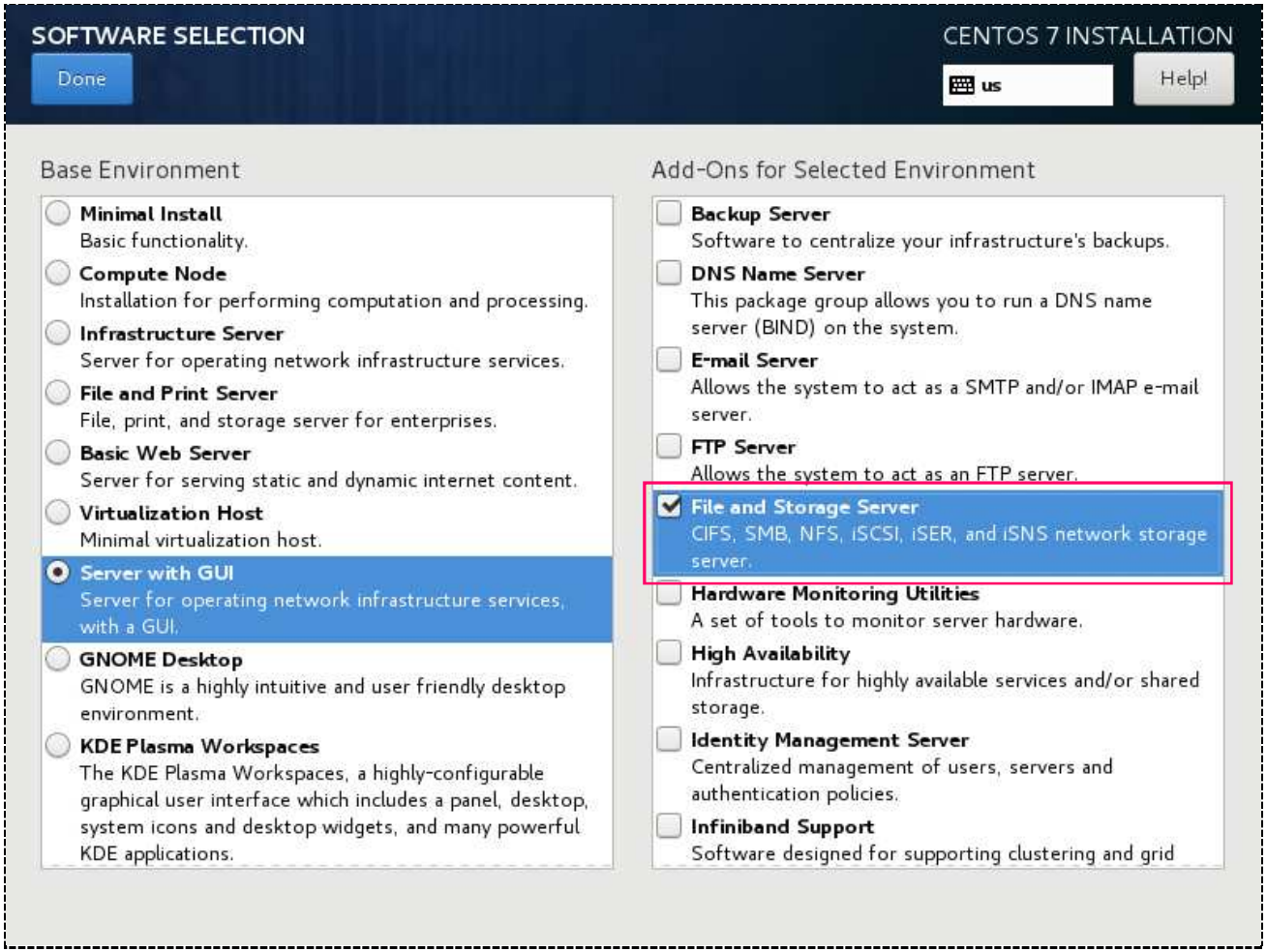
21. Then, we focus on the software selection for customization:



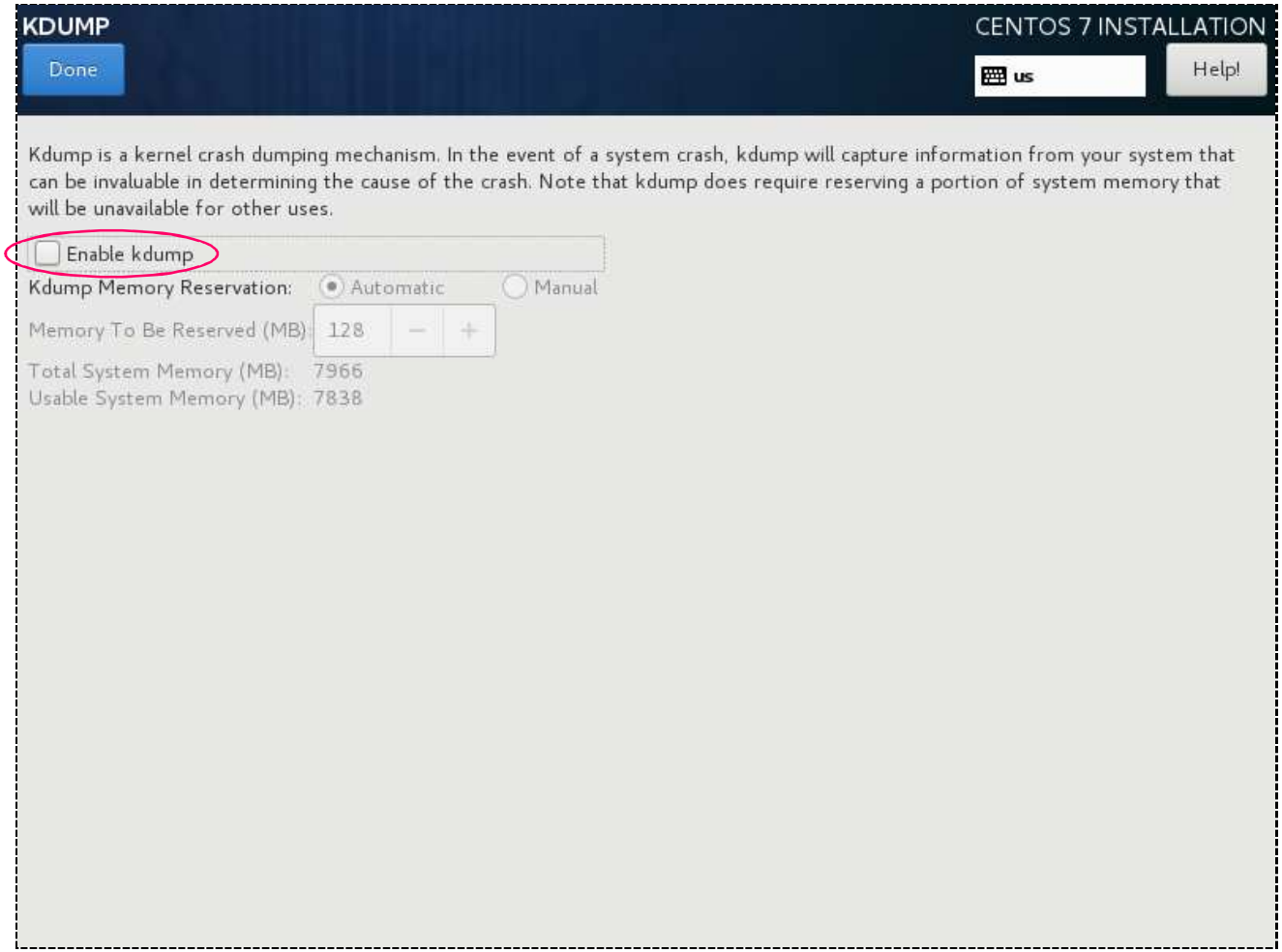
22. For minimal install, we add “debugging tools”, “compatibility libraries” and “development tools”:



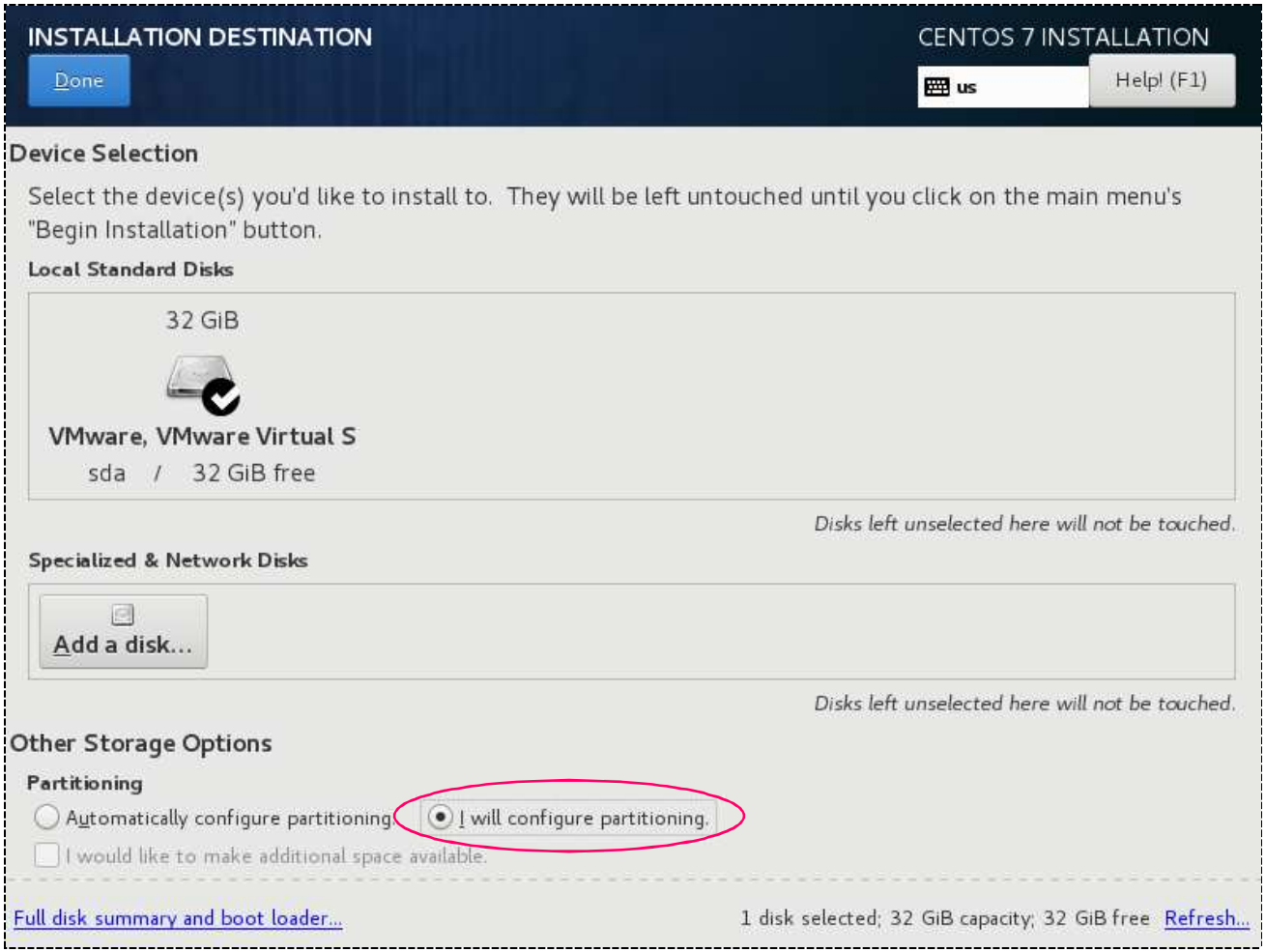
23. For server with GUI, we add “file and storage server”:



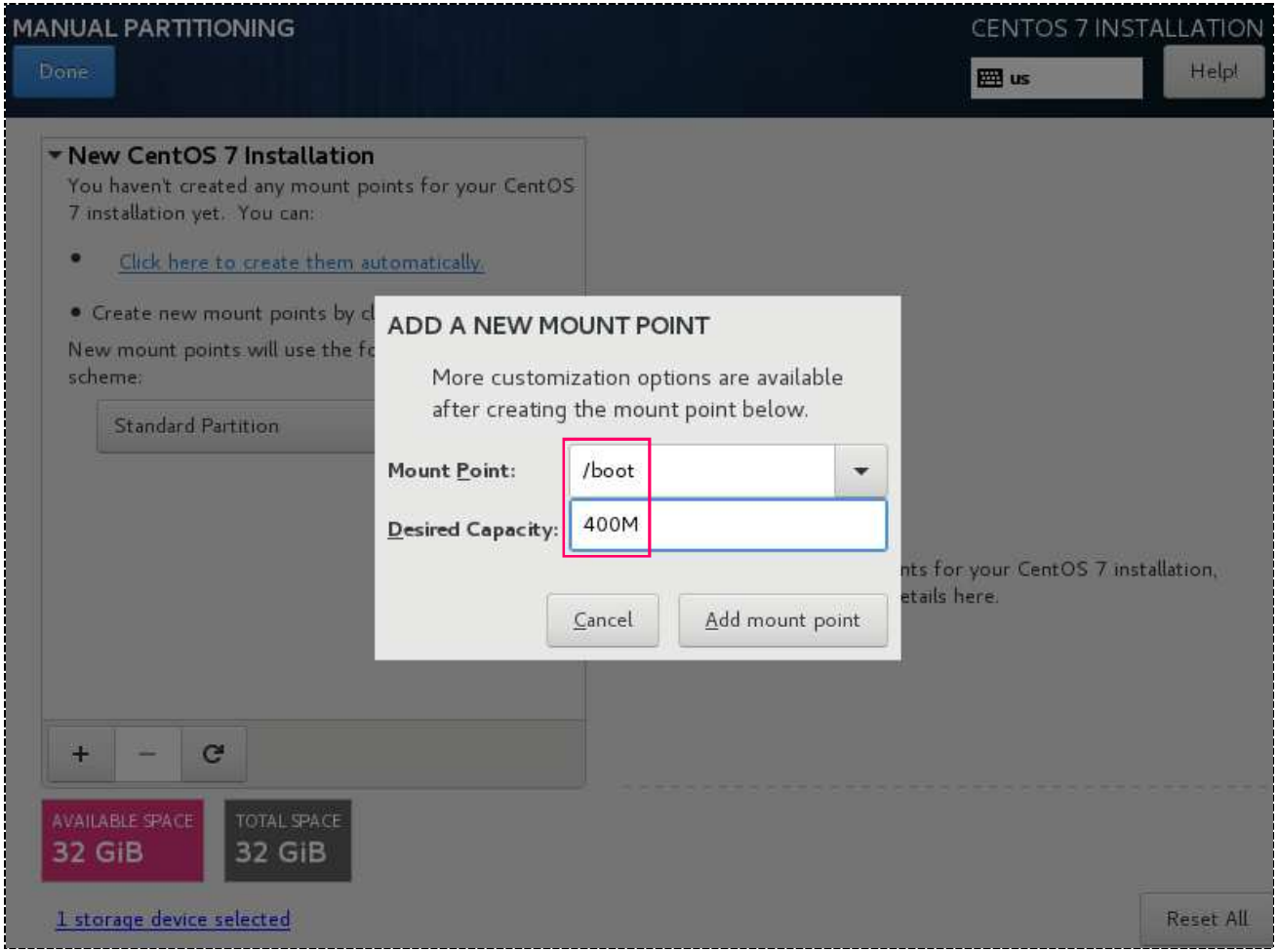
24. At the same time, we disable kdump to reduce the reserved memory:



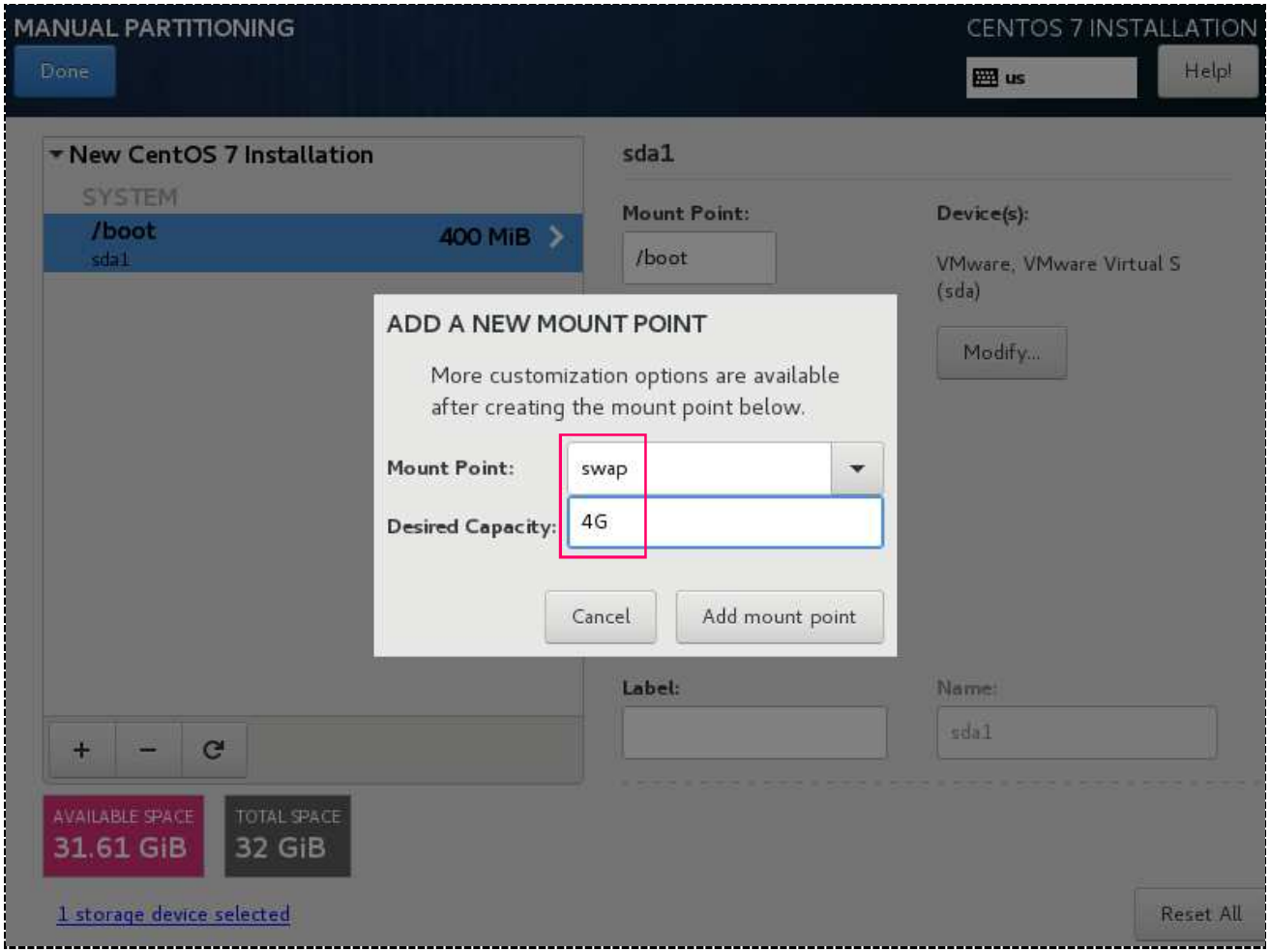
25. Now, we customize the disk partitions:


INSTALLATION DESTINATION
Done
CENTOS 7 INSTALLATION
us
Help! (F1)
Device Selection
Select the device(s) you'd like to install to. They will be left untouched until you click on the main menu's "Begin Installation" button.
Local Standard Disks
32 GiB
VMware, VMware Virtual S
sda / 32 GiB free
Disks left unselected here will not be touched.
Specialized & Network Disks
Add a disk...
Disks left unselected here will not be touched.
Other Storage Options
Partitioning
Automatically configure partitioning.
I will configure partitioning.
I would like to make additional space available.
Full disk summary and boot loader...
1 disk selected; 32 GiB capacity; 32 GiB free
Refresh...

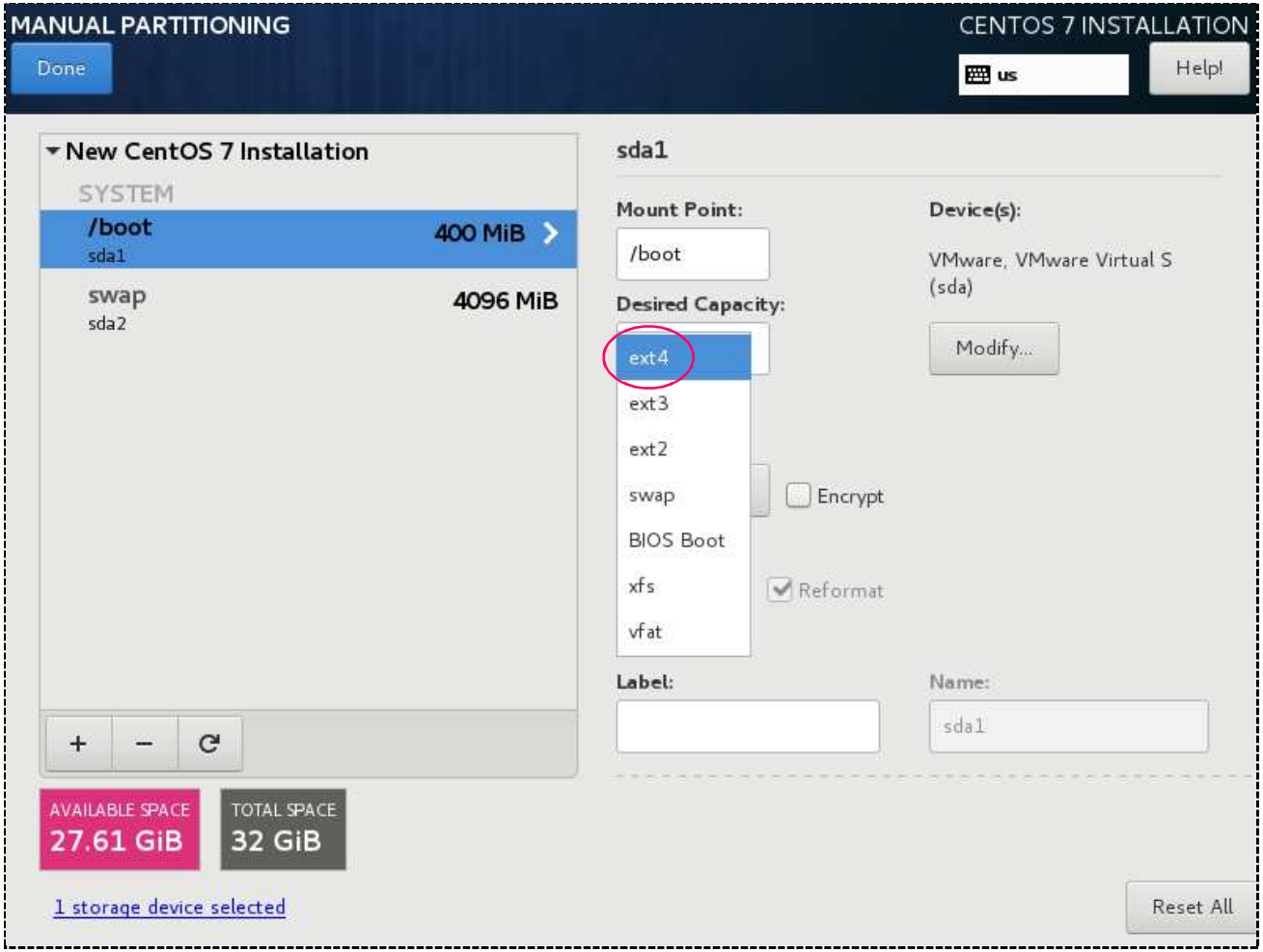
26. We create boot partition with size of 400 MB and mount it on /boot:



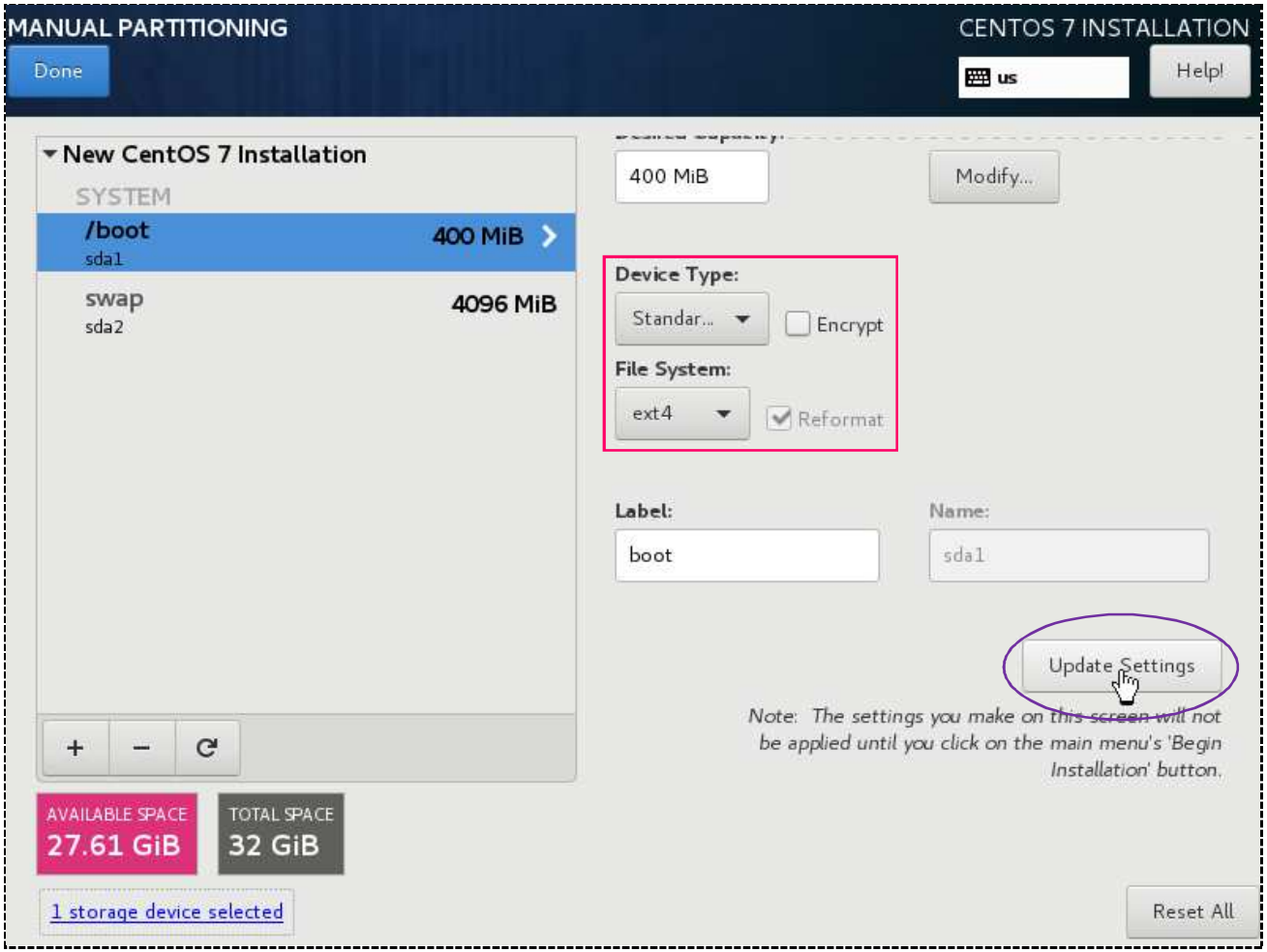
27. We create swap partition with size of 4 GB and use it as swap space:



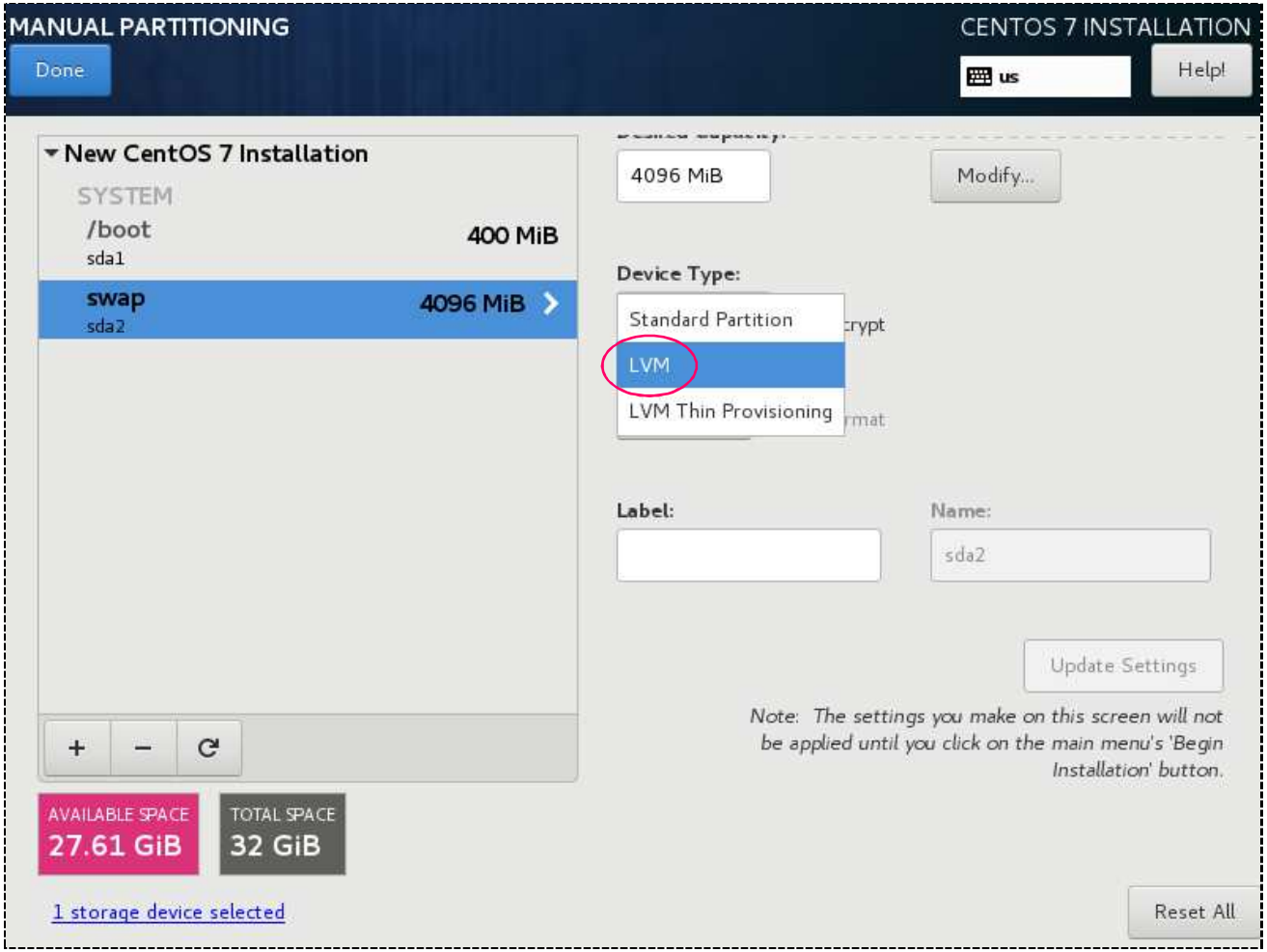
28. For /boot file system, we use ext4 format instead of xfs and label it as boot:



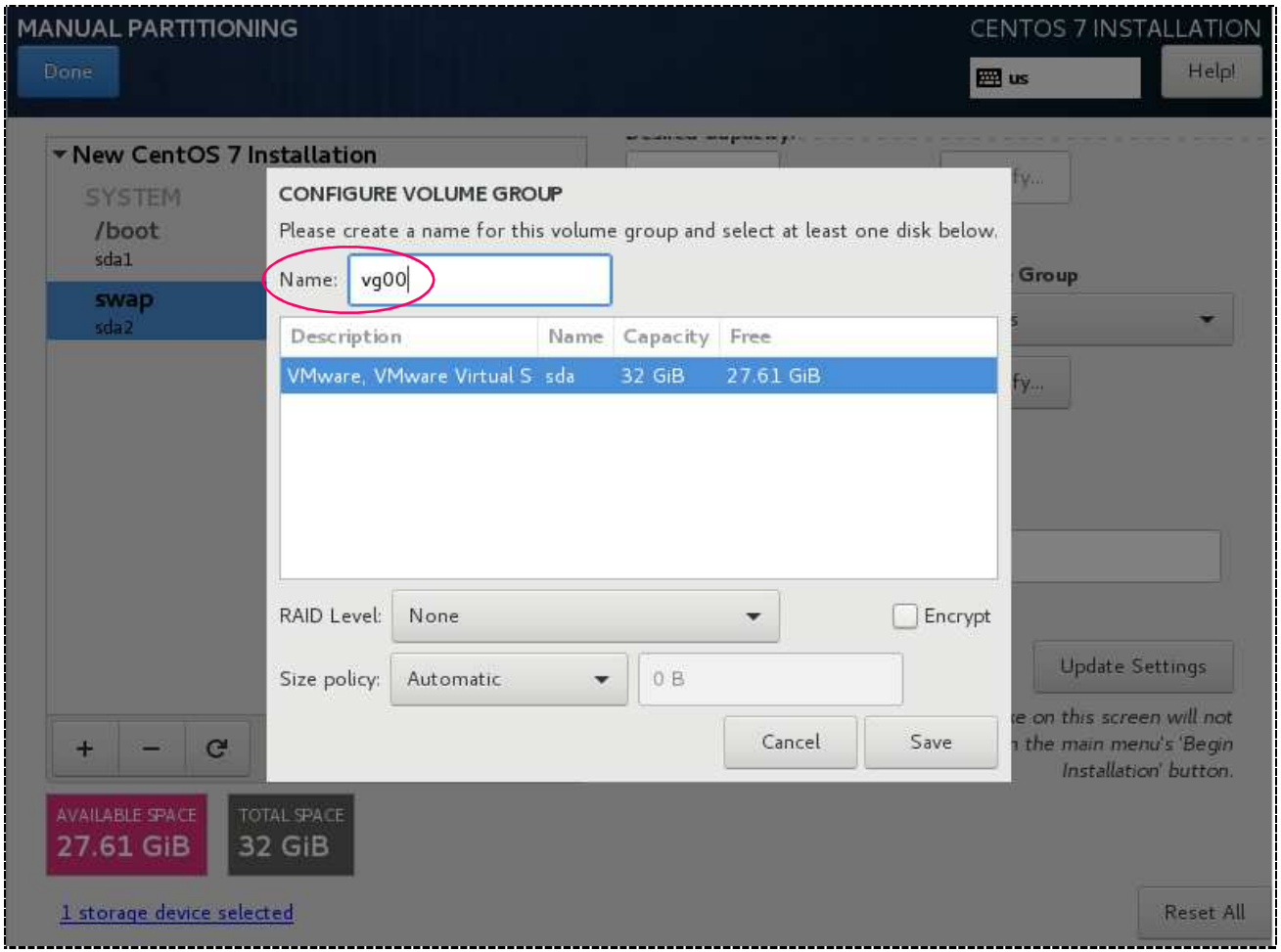
29. Please remember to click “update settings” to let changes take effect immediately:



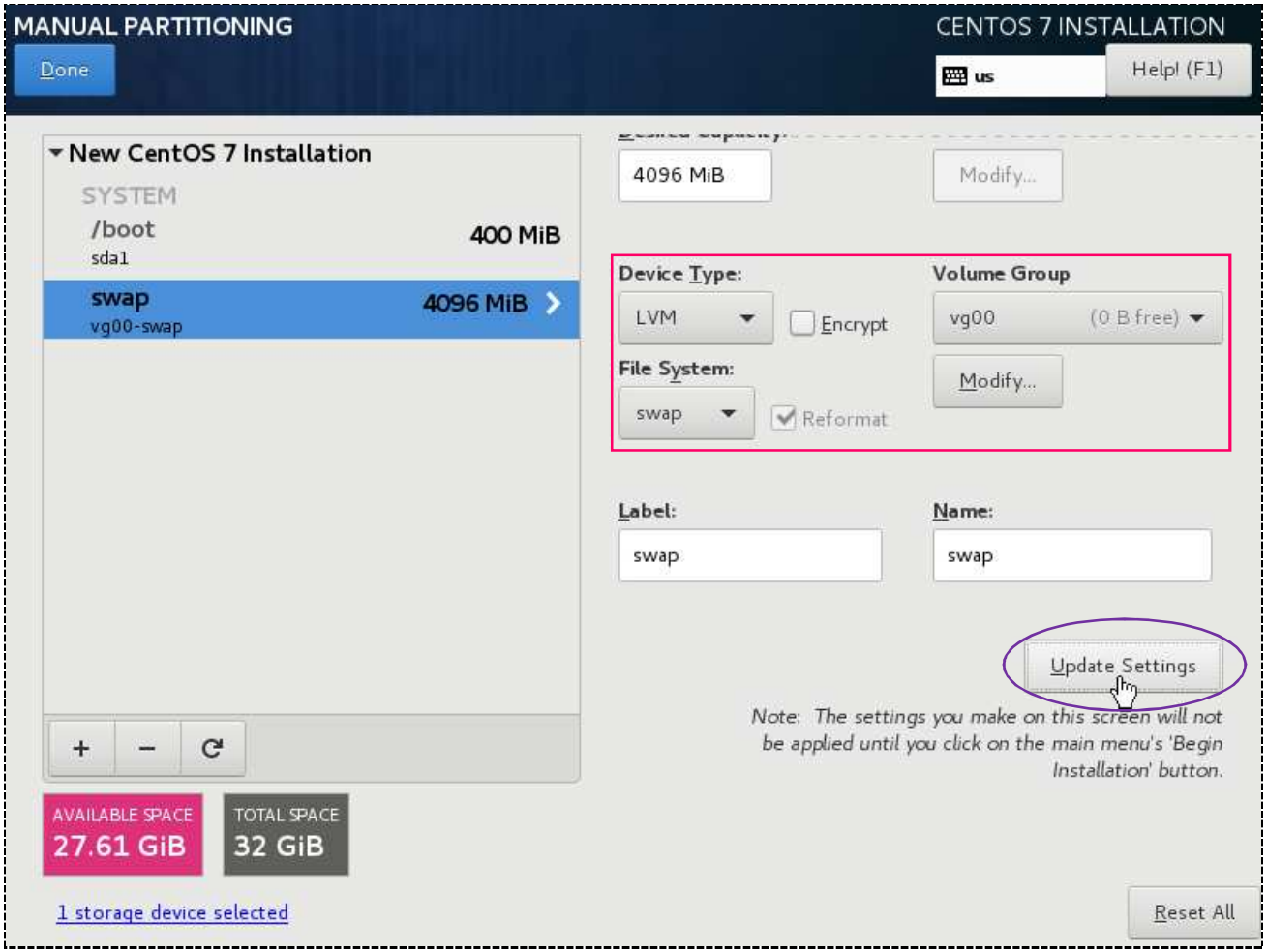
30. For swap partition, we use LVM instead of standard partition:



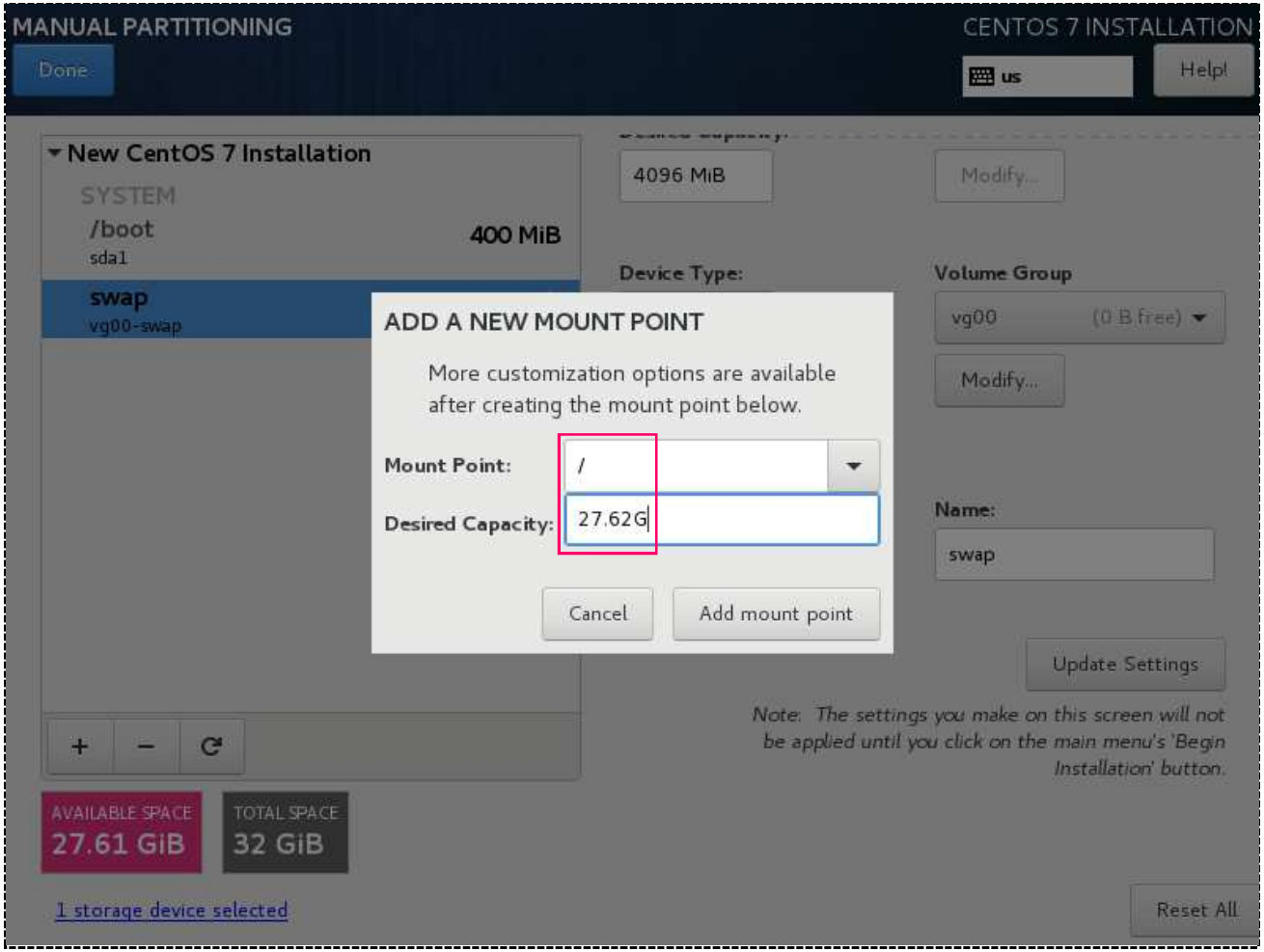
31. We name the volume group as vg00 for LVM:



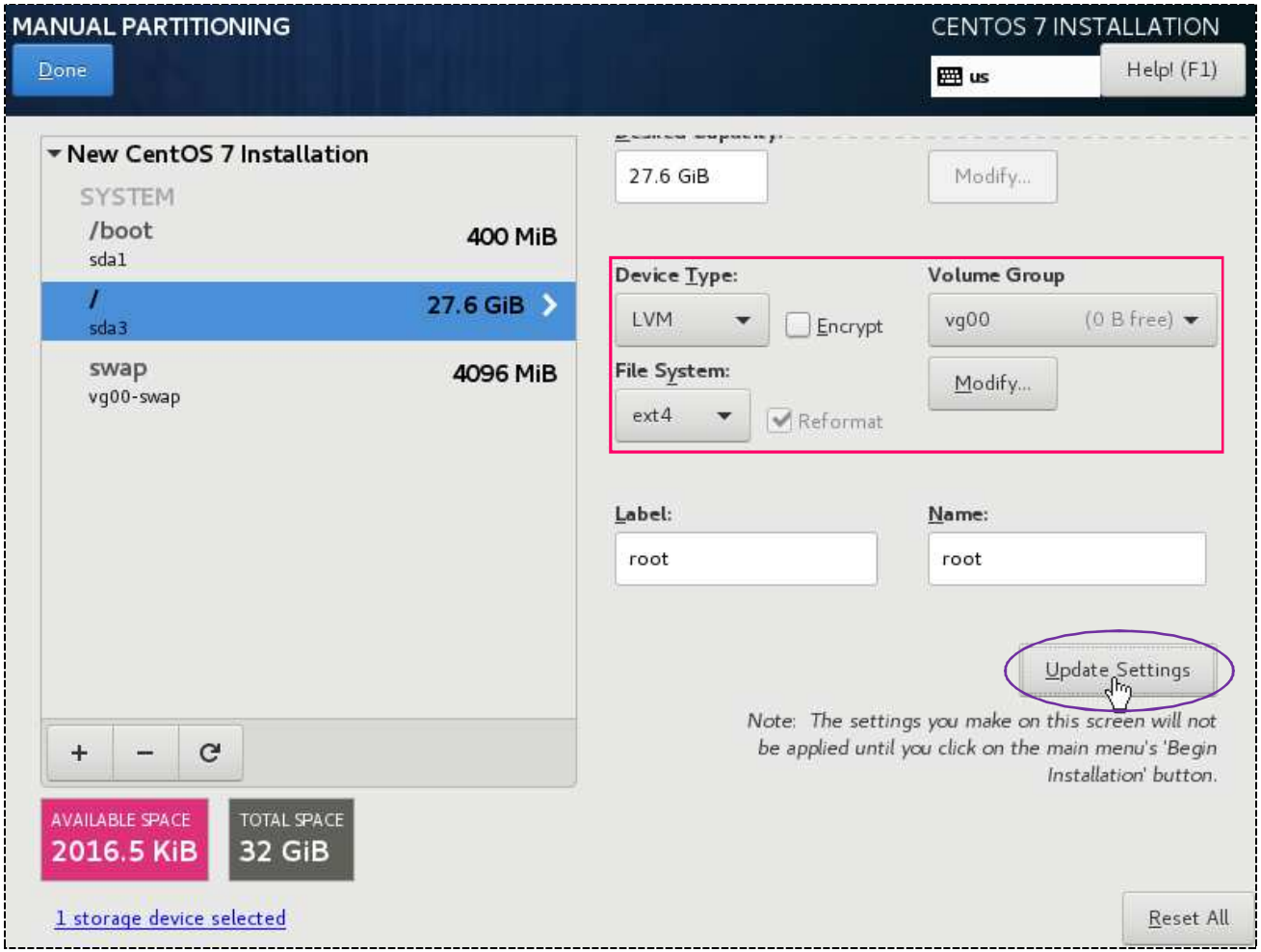
32. Please remember to click “update settings” to let changes take effect immediately:



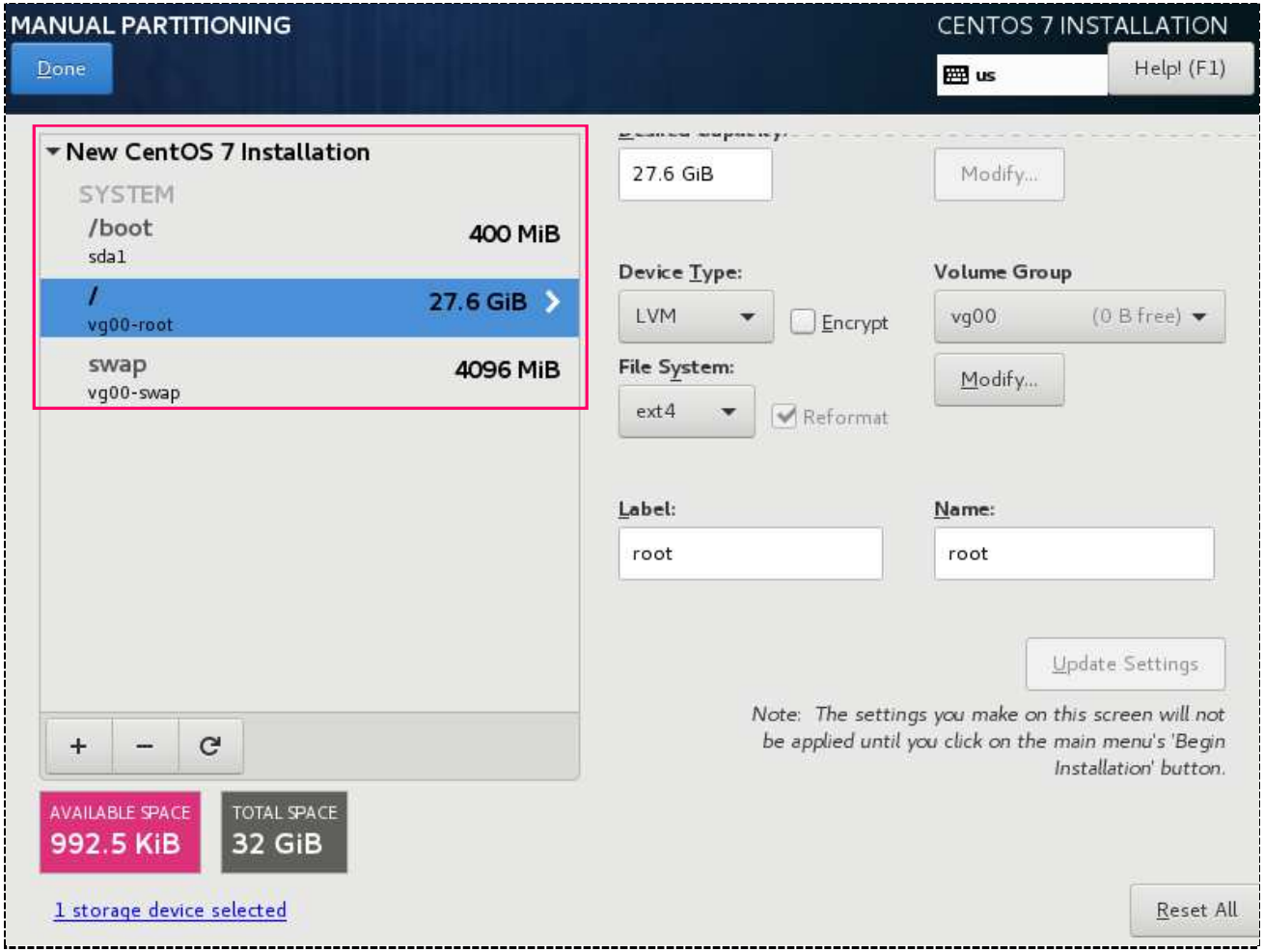
33. We create root partition with size of 27.62 GB (with size for a little more than available space) and mount it on /:



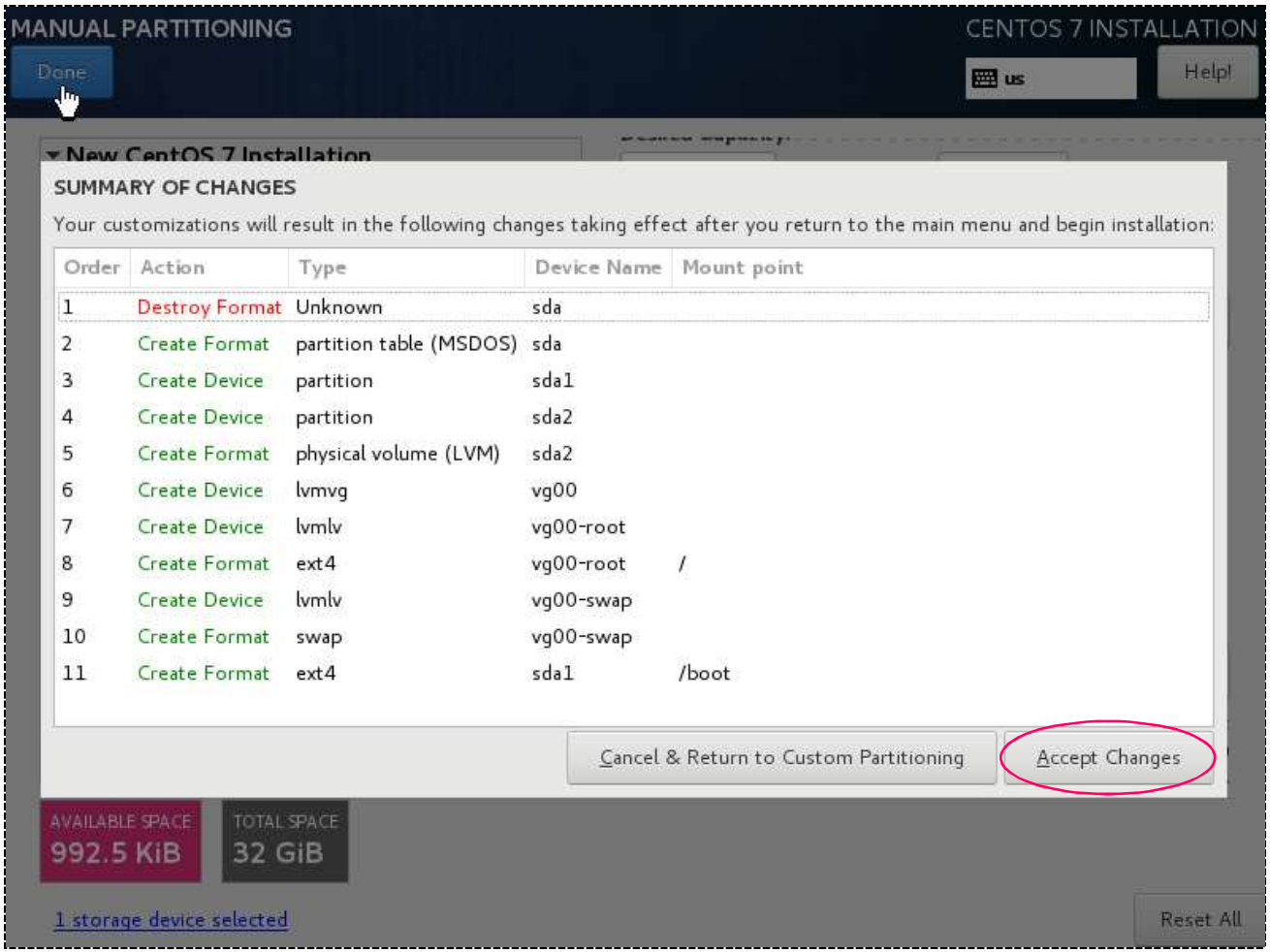
34. For root partition, we use LVM instead of standard partition, ext4 format instead of xfs and label it as root; remember to click “update settings” to let changes take effect immediately:

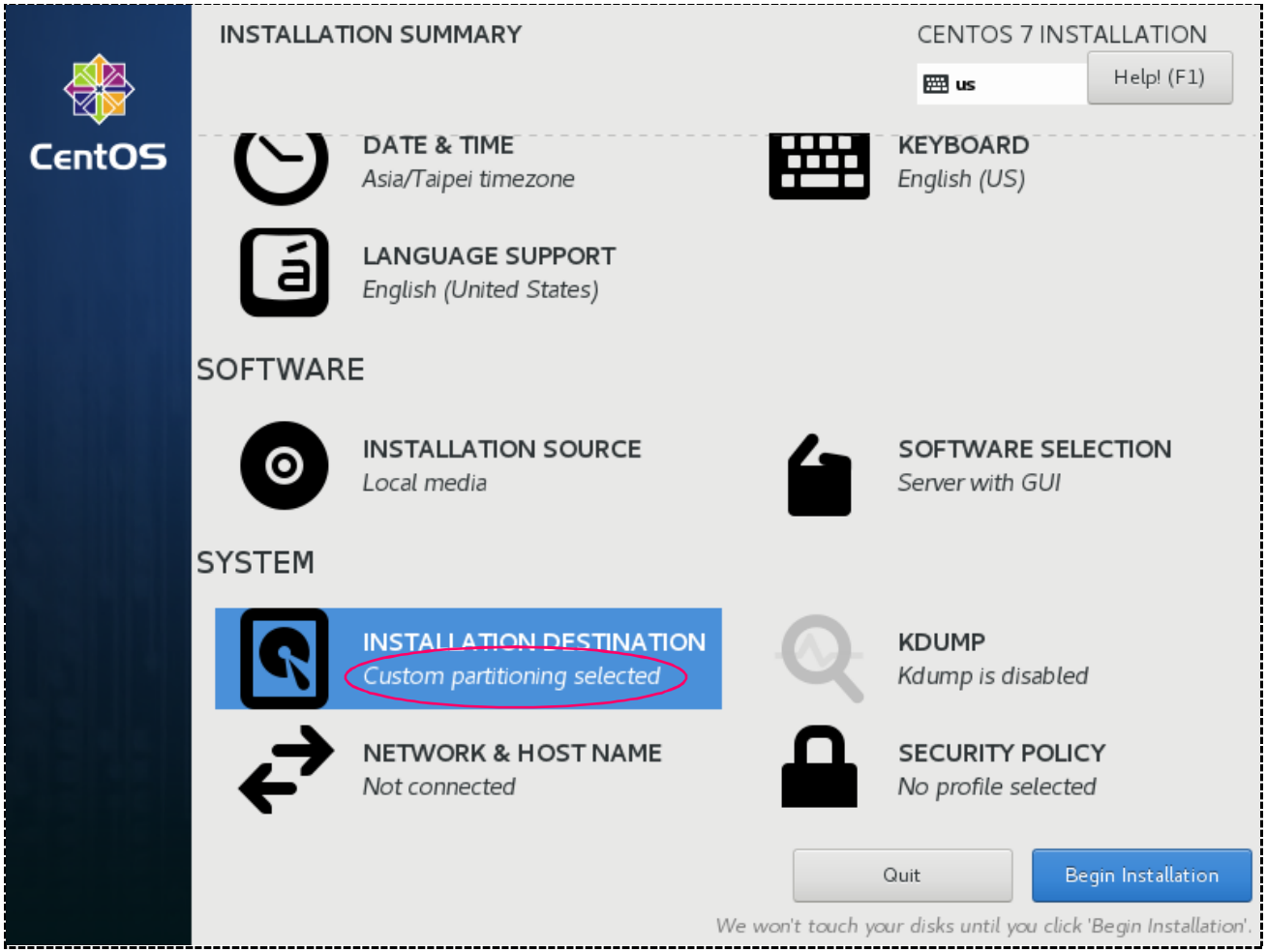


35. This is our final partition table for guest OS installation:

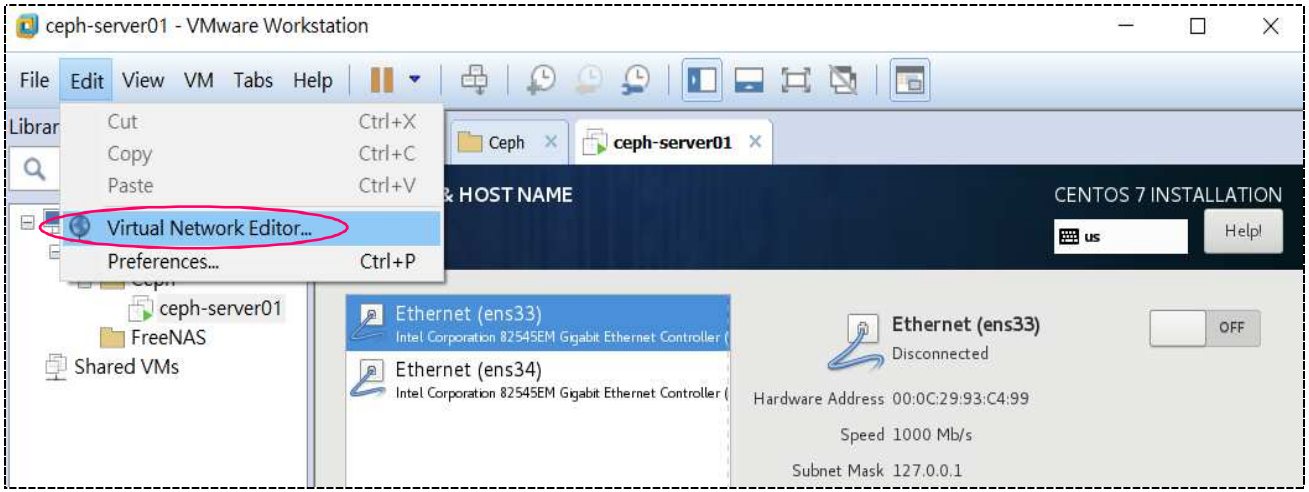


36. We accept changes for final partition table:

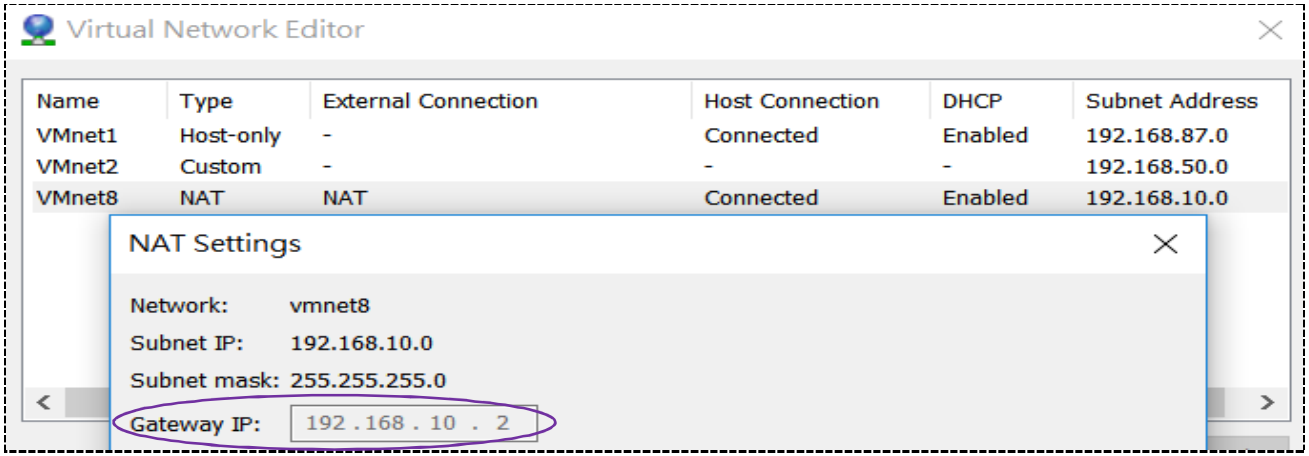



CentOS
INSTALLATION SUMMARY
CENTOS 7 INSTALLATION
us
Help! (F1)
DATE & TIME
Asia/Taipei timezone
KEYBOARD
English (US)
LANGUAGE SUPPORT
English (United States)
SOFTWARE
INSTALLATION SOURCE
Local media
SOFTWARE SELECTION
Server with GUI
SYSTEM
INSTALLATION DESTINATION
Custom partitioning selected
KDUMP
Kdump is disabled
NETWORK & HOST NAME
Not connected
SECURITY POLICY
No profile selected
Quit
Begin Installation
We won't touch your disks until you click 'Begin Installation'.

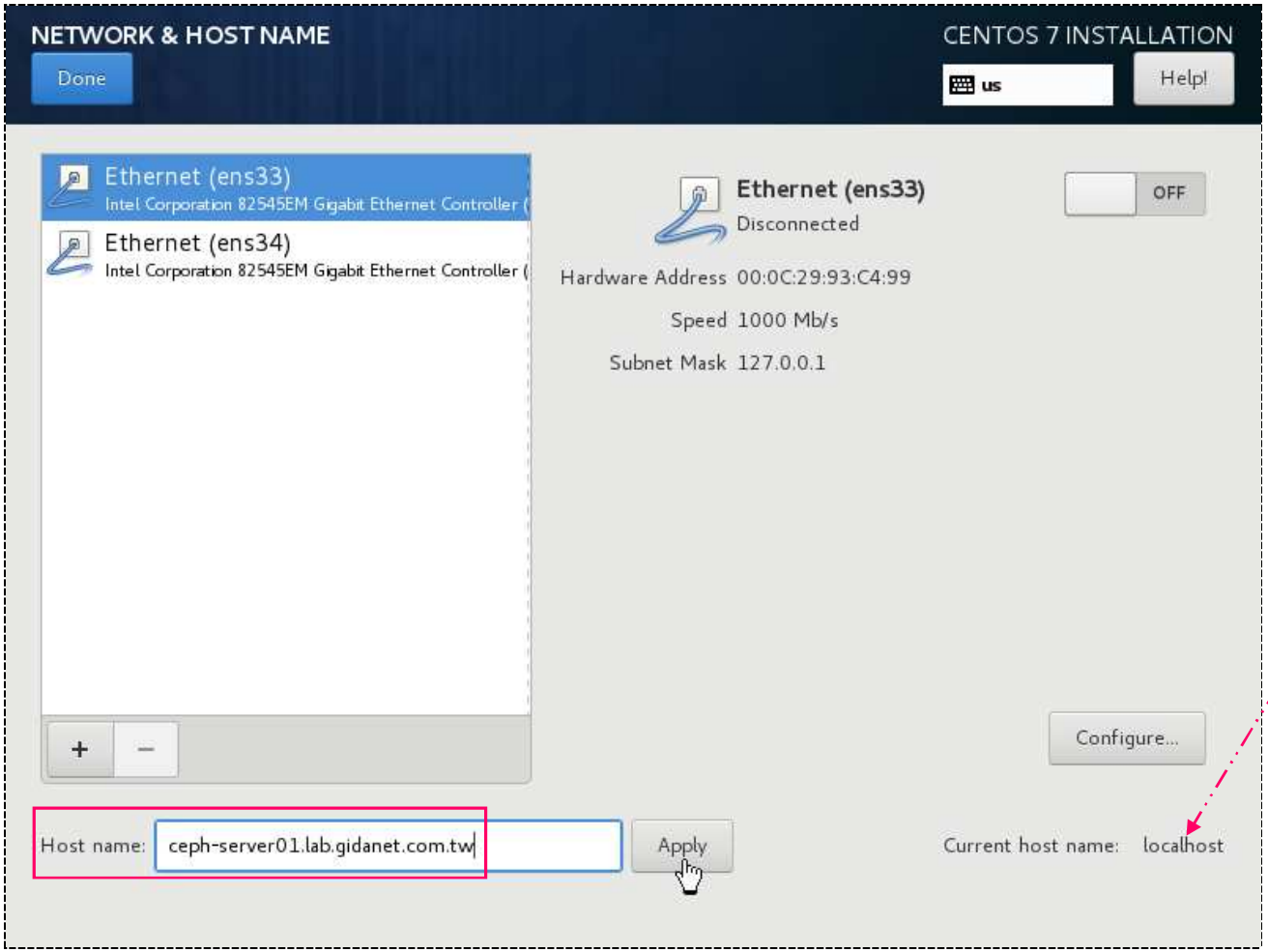
37. Before configuring network, we check the VMware Workstation virtual network settings, especially, for NAT, so we can assign static IP addresses and default gateway for Ceph servers:



38. The default gateway is 192.168.10.2 and IP subnet address is 192.168.10.0/24:

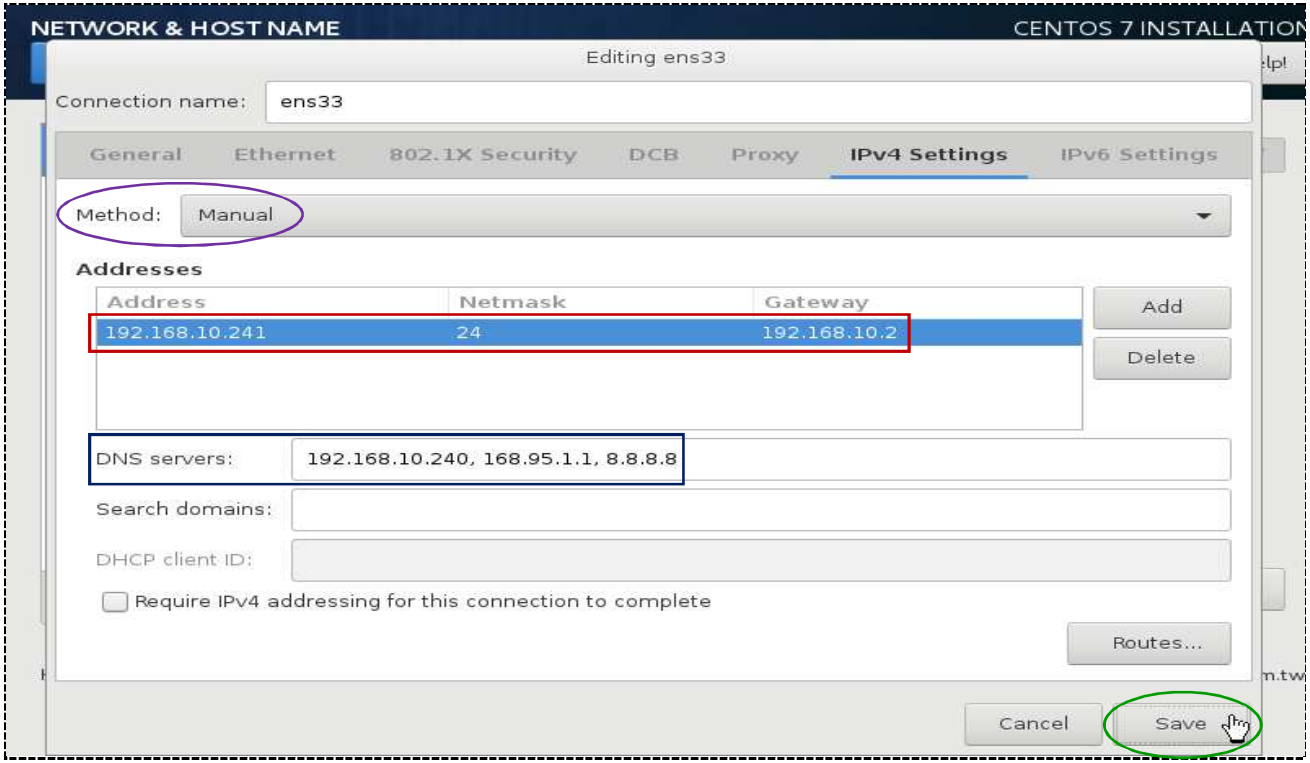


39. For network, we configure hostname first, remember to click “apply”, the current hostname will be updated immediately:

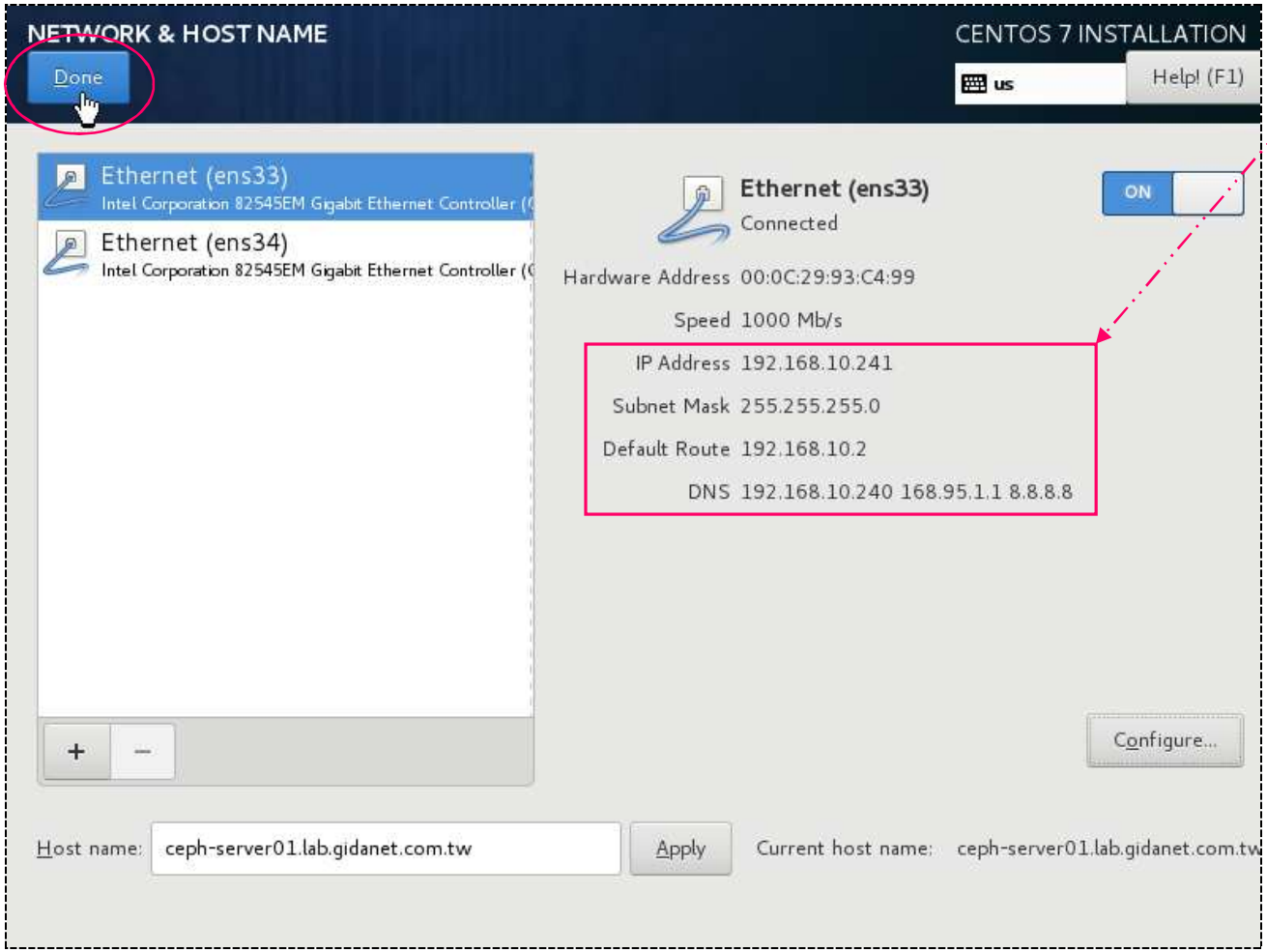


40. The network interface, ens33, is configured to automatically connect to network, assigned a static IP, default gateway and DNS servers; please remember to click “save” to save the configuration information:

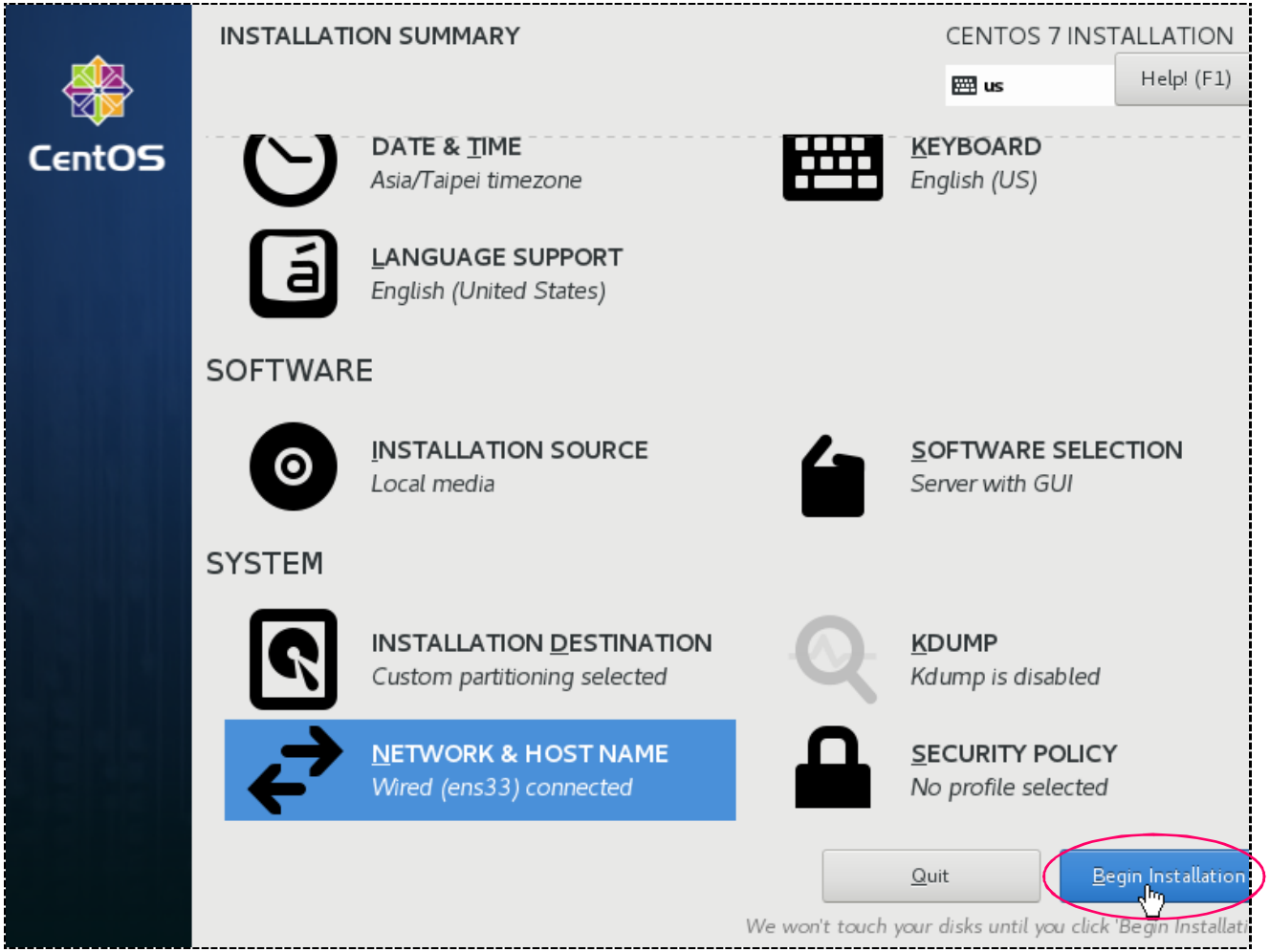

NETWORK & HOST NAME
CENTOS 7 INSTALLATIO
Editing ens33
Connection name:
ens33
General
Ethernet
802.1X Security
DCB
Proxy
IPv4 Settings
IPv6 Settings
Automatically connect to this network when it is available
Connection priority for auto-activation:
0
All users may connect to this network
Automatically connect to VPN when using this connection


NETWORK & HOST NAME
CENTOS 7 INSTALLATION
Editing ens33
Connection name:
ens33
General
Ethernet
802.1X Security
DCB
Proxy
IPv4 Settings
IPv6 Settings
Method:
Manual
Addresses
Address
Netmask
Gateway
192.168.10.241
24
192.168.10.2
Add
Delete
DNS servers:
192.168.10.240, 168.95.1.1, 8.8.8.8
Search domains:
DHCP client ID:
Require IPv4 addressing for this connection to complete
Routes...
Cancel
Save

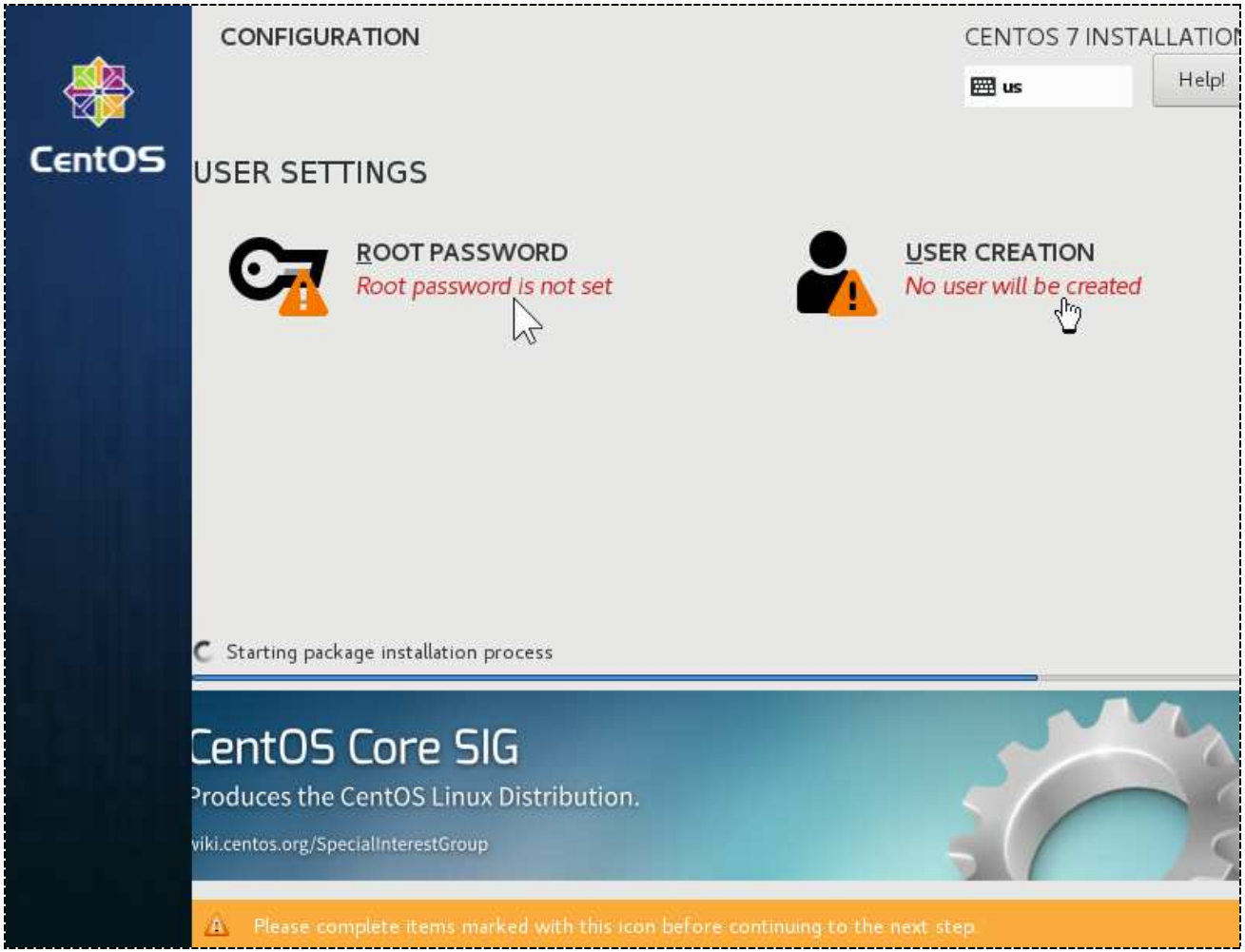
41. The network interface has been configured successfully, we can find the information here:



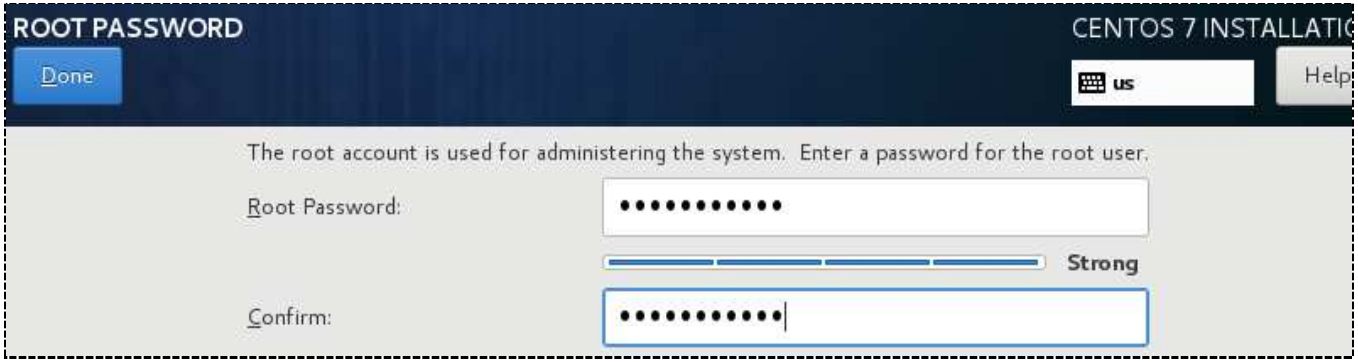
42. After completing all customization and configuration, the installation is beginning:



43. During the installation, we can set root password and add one user account:

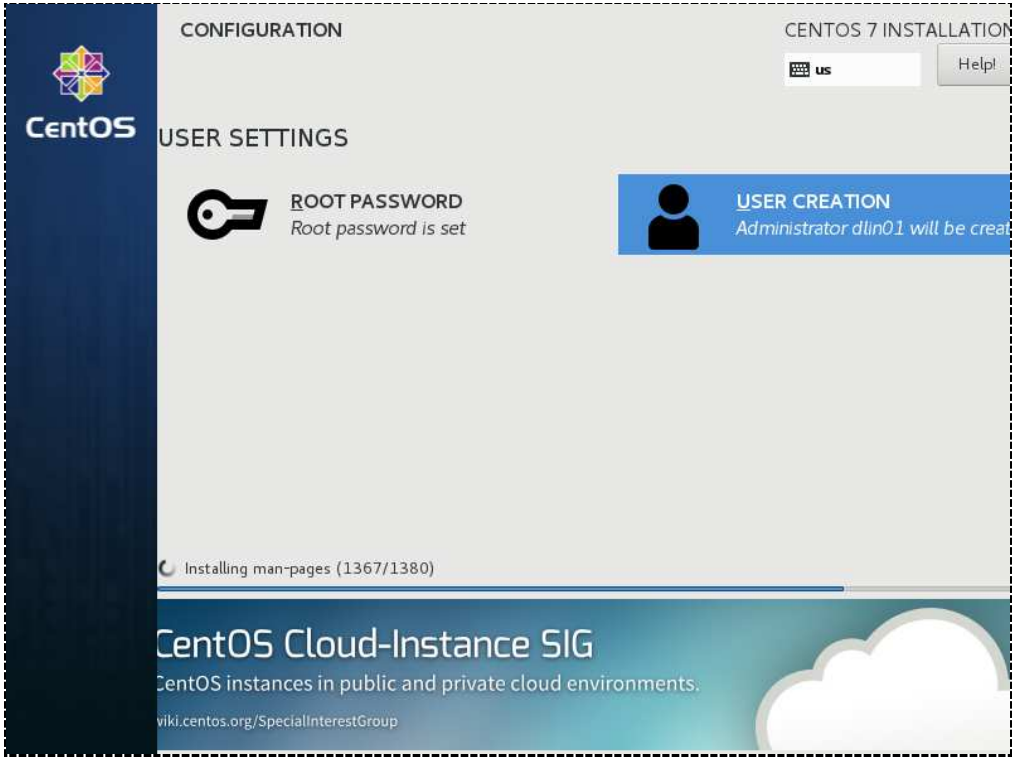


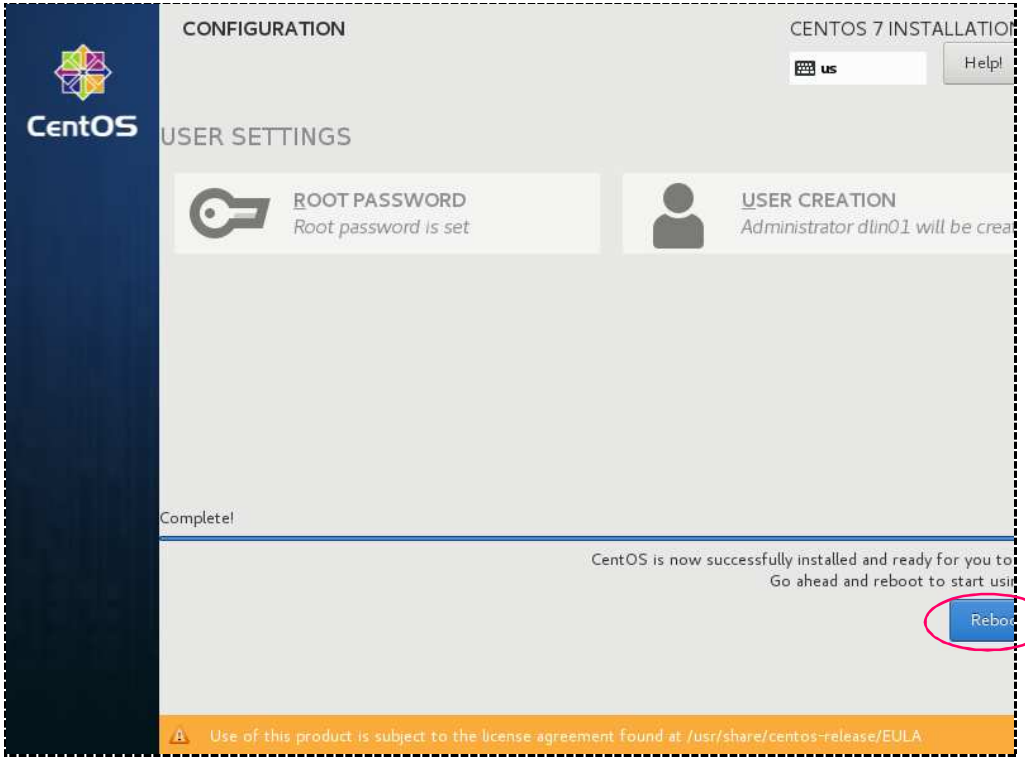
44. The root password is set with one strong password: (ChimaKaimen)

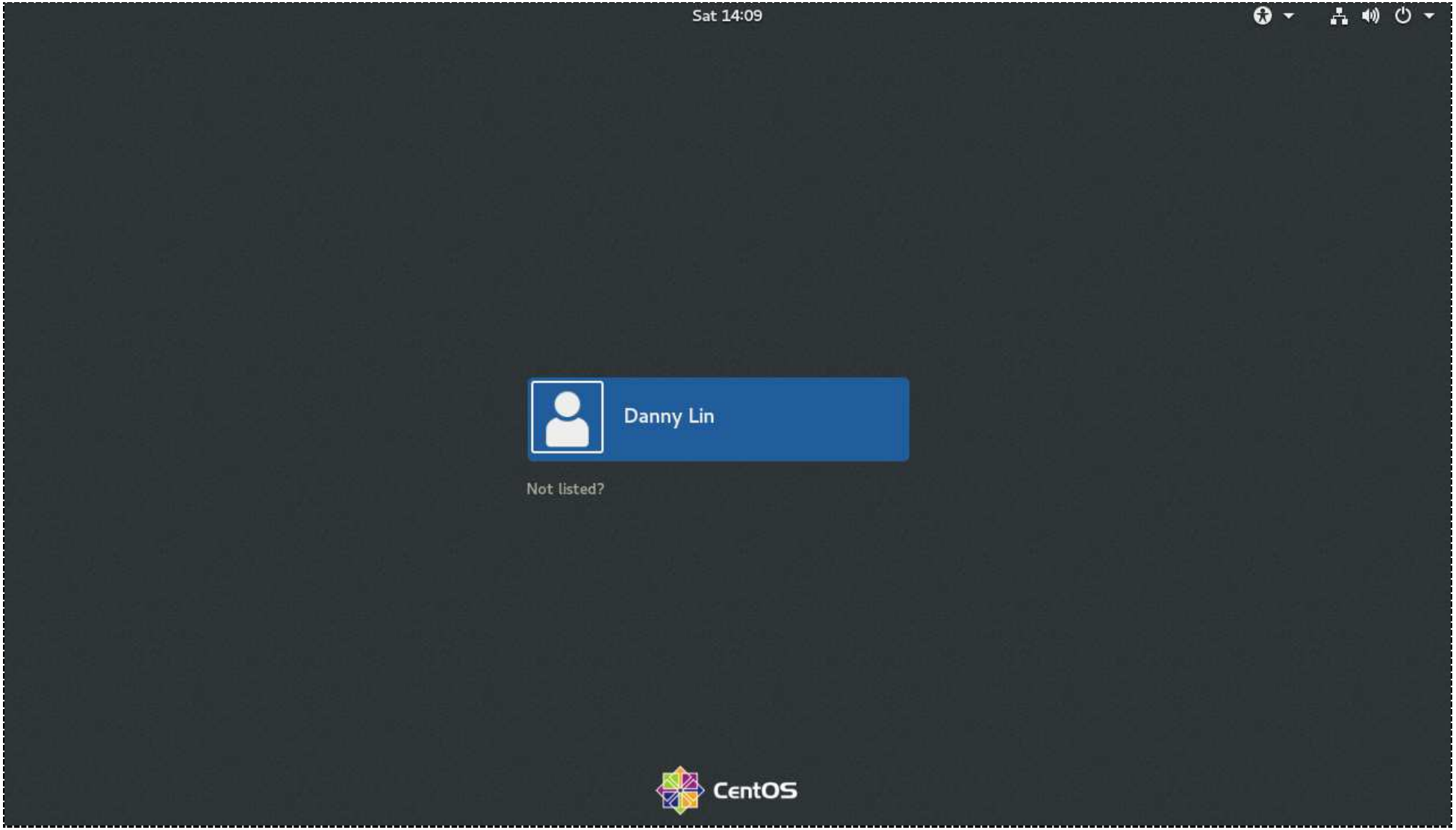


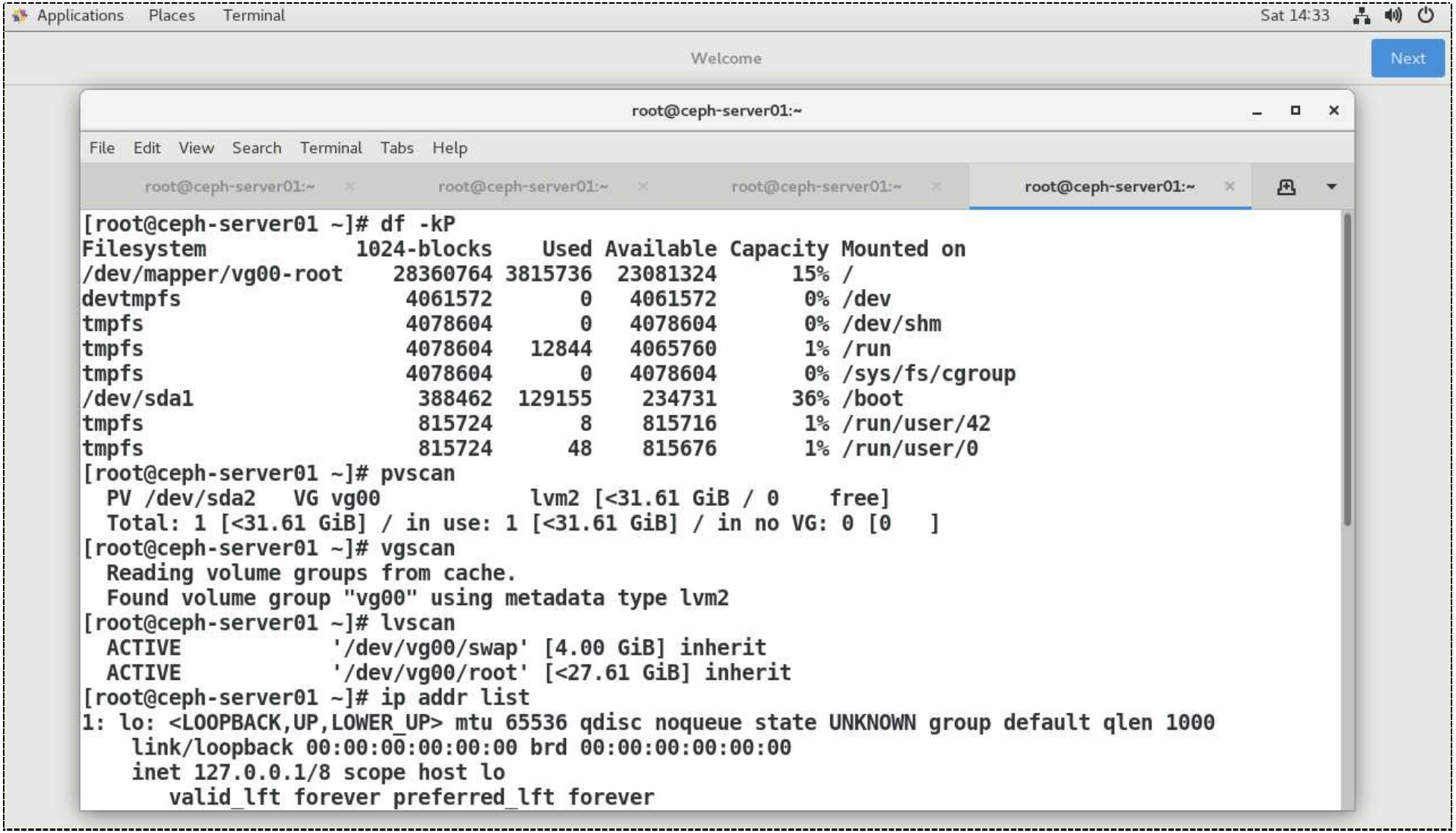
45. The user account is added with one strong password: (01DLin!qaz)

46. Finally, we click reboot to complete the installation:

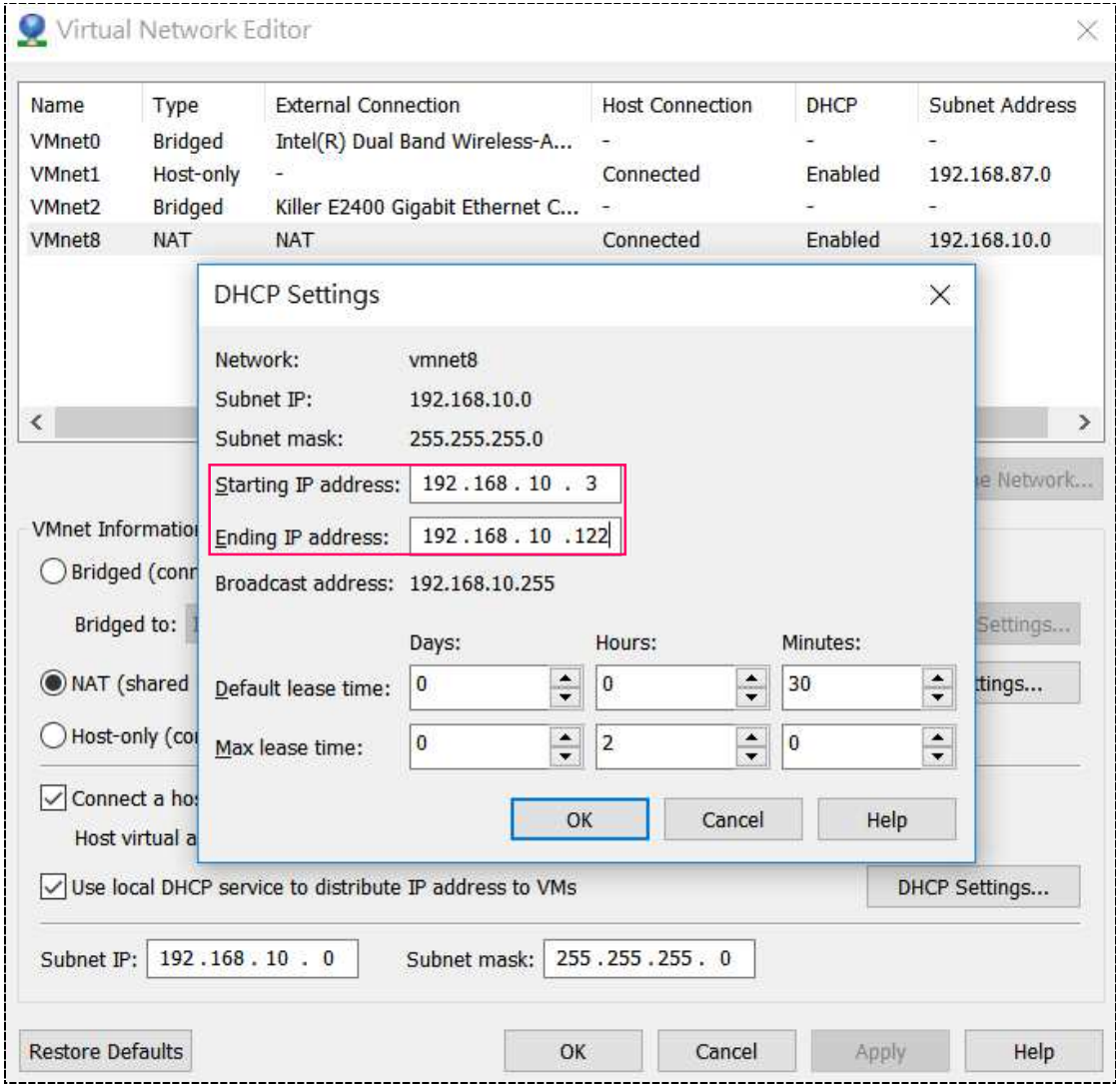




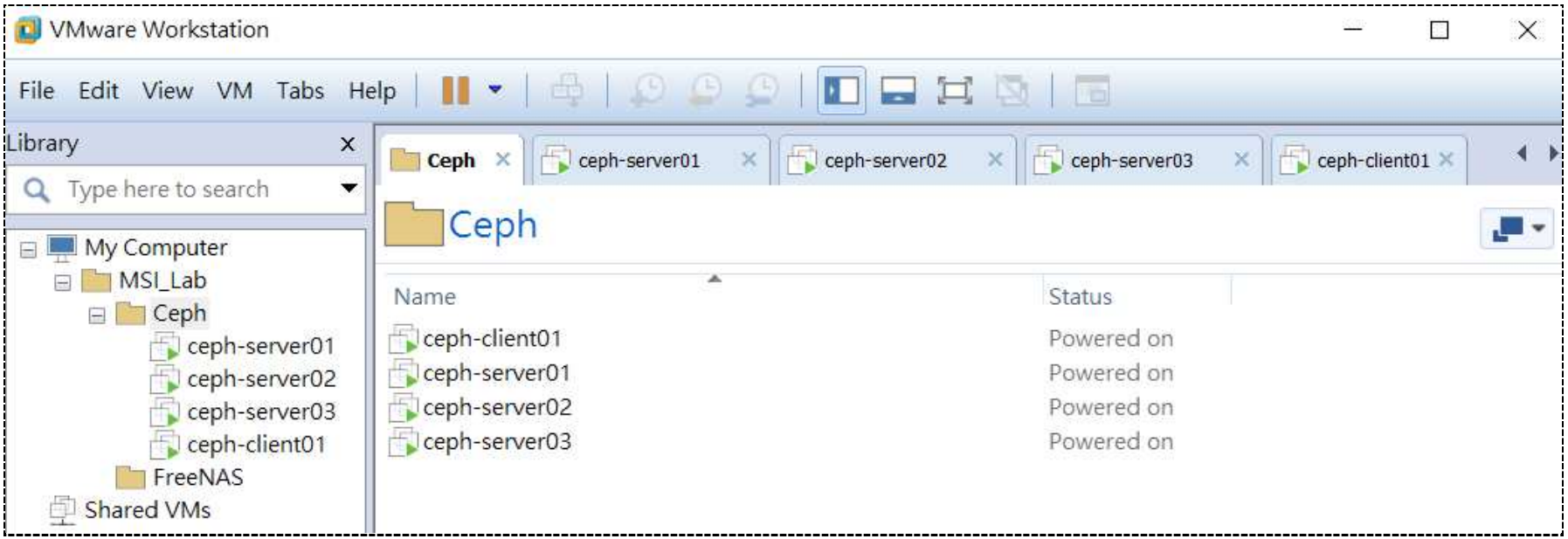

Sat 14:09
Danny Lin
Not listed?
CentOS


Applications Places Terminal
Sat 14:33
Welcome
Next
root@ceph-server01:~
File Edit View Search Terminal Tabs Help
root@ceph-server01:~
root@ceph-server01:~
root@ceph-server01:~
root@ceph-server01:~
[root@ceph-server01 ~]# df -kP
Filesystem 1024-blocks Used Available Capacity Mounted on
/dev/mapper/vg00-root 28360764 3815736 23081324 15% /
devtmpfs 4061572 0 4061572 0% /dev
tmpfs 4078604 0 4078604 0% /dev/shm
tmpfs 4078604 12844 4065760 1% /run
tmpfs 4078604 0 4078604 0% /sys/fs/cgroup
/dev/sda1 388462 129155 234731 36% /boot
tmpfs 815724 8 815716 1% /run/user/42
tmpfs 815724 48 815676 1% /run/user/0
[root@ceph-server01 ~]# pvscan
PV /dev/sda2 VG vg00 lvm2 [<31.61 GiB / 0 free]
Total: 1 [<31.61 GiB] / in use: 1 [<31.61 GiB] / in no VG: 0 [0]
[root@ceph-server01 ~]# vgscan
Reading volume groups from cache.
Found volume group "vg00" using metadata type lvm2
[root@ceph-server01 ~]# lvscan
ACTIVE '/dev/vg00/swap' [4.00 GiB] inherit
ACTIVE '/dev/vg00/root' [<27.61 GiB] inherit
[root@ceph-server01 ~]# ip addr list
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default qlen 1000
link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
inet 127.0.0.1/8 scope host lo
valid_lft forever preferred_lft forever

47. For the static IP addresses used by us for Ceph servers, we change the NAT DHCP range from 192.168.10.128 ~ 192.168.10.254 to 192.168.10.3 ~ 192.168.10.122:



48. Finally, we create and install three Ceph storage server nodes and one client node:



49. Before configuring the bond network interface, we disable and stop the NetworkManager service: (executed on all Ceph storage server/client nodes)

```
[root@ceph-server01 ~]# systemctl status NetworkManager | grep Active
   Active: active (running) since Sat 2018-07-07 14:06:00 CST; 40min ago

[root@ceph-server01 ~]# systemctl disable NetworkManager; systemctl stop NetworkManager; systemctl status NetworkManager
Removed symlink /etc/systemd/system/multi-user.target.wants/NetworkManager.service.
Removed symlink /etc/systemd/system/dbus-org.freedesktop.NetworkManager.service.
Removed symlink /etc/systemd/system/dbus-org.freedesktop.nm-dispatcher.service.
● NetworkManager.service - Network Manager
   Loaded: loaded (/usr/lib/systemd/system/NetworkManager.service; disabled; vendor preset: enabled)
   Active: inactive (dead) since Sat 2018-07-07 14:47:13 CST; 9ms ago
```

```
     Docs: man:NetworkManager(8)
  Process: 878 ExecStart=/usr/sbin/NetworkManager --no-daemon (code=exited, status=0/SUCCESS)
 Main PID: 878 (code=exited, status=0/SUCCESS)

Jul 07 14:06:09 ceph-server01.lab.gidanet.com.tw NetworkManager[878]: <info>  [1530943569.4101] devic...)
Jul 07 14:06:09 ceph-server01.lab.gidanet.com.tw NetworkManager[878]: <info>  [1530943569.4127] devic....
Jul 07 14:06:09 ceph-server01.lab.gidanet.com.tw NetworkManager[878]: <info>  [1530943569.4860] devic...)
Jul 07 14:06:09 ceph-server01.lab.gidanet.com.tw NetworkManager[878]: <info>  [1530943569.4863] devic...d
Jul 07 14:06:09 ceph-server01.lab.gidanet.com.tw NetworkManager[878]: <info>  [1530943569.4863] devic...0
Jul 07 14:47:13 ceph-server01.lab.gidanet.com.tw systemd[1]: Stopping Network Manager...
Jul 07 14:47:13 ceph-server01.lab.gidanet.com.tw NetworkManager[878]: <info>  [1530946033.7579] caugh....
Jul 07 14:47:13 ceph-server01.lab.gidanet.com.tw NetworkManager[878]: <info>  [1530946033.7617] devic...0
Jul 07 14:47:13 ceph-server01.lab.gidanet.com.tw NetworkManager[878]: <info>  [1530946033.7651] exiti...)
Jul 07 14:47:13 ceph-server01.lab.gidanet.com.tw systemd[1]: Stopped Network Manager.
Hint: Some lines were ellipsized, use -l to show in full.
```

50. We check (list) and probe bonding kernel module to load it: (executed on all Ceph storage server/client nodes)

```
[root@ceph-server01 ~]# lsmod | grep bonding

[root@ceph-server01 ~]# modprobe bonding; lsmod | grep bonding
bonding               149864  0
```

51. We edit and create the bond0 (virtual) network interface configuration: (executed on all Ceph storage server/client nodes)

```
[root@ceph-server01 ~]# vi /etc/sysconfig/network-scripts/ifcfg-bond0
DEVICE=bond0
NAME=bond0
TYPE=Bond
```

```
BOOTPROTO=none
ONBOOT=yes
DEFROUTE=yes
IPV4_FAILURE_FATAL=no
IPV6INIT=no
IPADDR=192.168.10.241
PREFIX=24
GATEWAY=192.168.10.2
DNS1=192.168.10.240
DNS2=168.95.1.1
DNS3=8.8.8.8
BONDING_MASTER=yes
BONDING_OPTS="mode=active-backup miimon=100 primary=ens33"
```

52. We edit and update the physical network interface configuration to match the bonding requirement: (executed on all Ceph storage server/client nodes)

```
[root@ceph-server01 ~]# vi /etc/sysconfig/network-scripts/ifcfg-ens33 /etc/sysconfig/network-scripts/ifcfg-ens34
DEVICE=ens33
TYPE=Ethernet
BOOTPROTO=none
ONBOOT=yes
MASTER=bond0
SLAVE=yes

DEVICE=ens34
TYPE=Ethernet
BOOTPROTO=none
```

```
ONBOOT=yes
MASTER=bond0
SLAVE=yes
```

53. After editing the network interface configuration, we restart and check the status of network service: (executed on all Ceph storage server/client nodes)

```
[root@ceph-server01 ~]# systemctl restart network; systemctl status network
```

```
● network.service - LSB: Bring up/down networking
   Loaded: loaded (/etc/rc.d/init.d/network; bad; vendor preset: disabled)
   Active: active (running) since Sat 2018-07-07 15:11:25 CST; 13ms ago
     Docs: man:systemd-sysv-generator(8)
  Process: 4574 ExecStop=/etc/rc.d/init.d/network stop (code=exited, status=0/SUCCESS)
  Process: 4793 ExecStart=/etc/rc.d/init.d/network start (code=exited, status=0/SUCCESS)
    Tasks: 2
   CGroup: /system.slice/network.service
           ├─4999 /bin/bash /etc/sysconfig/network-scripts/ifup-eth ifcfg-bond0 boot
           └─5001 sleep 2

Jul 07 15:11:20 ceph-server01.lab.gidanet.com.tw systemd[1]: Starting LSB: Bring up/down networking...
Jul 07 15:11:20 ceph-server01.lab.gidanet.com.tw network[4793]: Bringing up loopback interface:  [  OK  ]
Jul 07 15:11:25 ceph-server01.lab.gidanet.com.tw network[4793]: Bringing up interface bond0:  [  OK  ]
Jul 07 15:11:25 ceph-server01.lab.gidanet.com.tw systemd[1]: Started LSB: Bring up/down networking.
Hint: Some lines were ellipsized, use -l to show in full.
```

54. We use command to check the NIC information - ens33, ens34 and bond0: (executed on all Ceph storage server/client nodes)

```
[root@ceph-server01 ~]# ip addr list
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default qlen 1000
```

```
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
    inet 127.0.0.1/8 scope host lo
       valid_lft forever preferred_lft forever
    inet6 ::1/128 scope host
       valid_lft forever preferred_lft forever
2: ens33: <BROADCAST,MULTICAST,SLAVE,UP,LOWER_UP> mtu 1500 qdisc pfifo_fast master bond0 state UP group default qlen 1000
    link/ether 00:0c:29:93:c4:99 brd ff:ff:ff:ff:ff:ff
3: ens34: <BROADCAST,MULTICAST,SLAVE,UP,LOWER_UP> mtu 1500 qdisc pfifo_fast master bond0 state UP group default qlen 1000
    link/ether 00:0c:29:93:c4:99 brd ff:ff:ff:ff:ff:ff
4: virbr0: <NO-CARRIER,BROADCAST,MULTICAST,UP> mtu 1500 qdisc noqueue state DOWN group default qlen 1000
    link/ether 52:54:00:f4:1e:9f brd ff:ff:ff:ff:ff:ff
    inet 192.168.122.1/24 brd 192.168.122.255 scope global virbr0
       valid_lft forever preferred_lft forever
5: virbr0-nic: <BROADCAST,MULTICAST> mtu 1500 qdisc pfifo_fast master virbr0 state DOWN group default qlen 1000
    link/ether 52:54:00:f4:1e:9f brd ff:ff:ff:ff:ff:ff
6: bond0: <BROADCAST,MULTICAST,MASTER,UP,LOWER_UP> mtu 1500 qdisc noqueue state UP group default qlen 1000
    link/ether 00:0c:29:93:c4:99 brd ff:ff:ff:ff:ff:ff
    inet 192.168.10.241/24 brd 192.168.10.255 scope global bond0
       valid_lft forever preferred_lft forever
    inet6 fe80::20c:29ff:fe93:c499/64 scope link
       valid_lft forever preferred_lft forever

[root@ceph-server01 ~]# ip route list
default via 192.168.10.2 dev bond0
169.254.0.0/16 dev bond0 scope link metric 1006
192.168.10.0/24 dev bond0 proto kernel scope link src 192.168.10.241
192.168.122.0/24 dev virbr0 proto kernel scope link src 192.168.122.1
```

55. We use command to check the bond0 information to make sure the settings configured as what we want them to be: (executed on all Ceph storage server/client nodes)

```
[root@ceph-server01 ~]# cat /proc/net/bonding/bond0
Ethernet Channel Bonding Driver: v3.7.1 (April 27, 2011)

Bonding Mode: fault-tolerance (active-backup)
Primary Slave: ens33 (primary_reselect always)
Currently Active Slave: ens33
MII Status: up
MII Polling Interval (ms): 100
Up Delay (ms): 0
Down Delay (ms): 0

Slave Interface: ens33
MII Status: up
Speed: 1000 Mbps
Duplex: full
Link Failure Count: 0
Permanent HW addr: 00:0c:29:93:c4:99
Slave queue ID: 0

Slave Interface: ens34
MII Status: up
Speed: 1000 Mbps
Duplex: full
Link Failure Count: 0
```

Permanent HW addr: 00:0c:29:93:c4:a3
Slave queue ID: 0

56. We create a Ceph user - cephuser, set password and configure sudo for "cephuser": (executed on all Ceph storage server nodes)

[root@ceph-server01 ~]# useradd -d /home/cephuser -m cephuser

[root@ceph-server01 ~]# passwd cephuser (01Ceph!qaz)

[root@ceph-server01 ~]# echo "cephuser ALL = (root) NOPASSWD:ALL" | tee /etc/sudoers.d/cephuser
cephuser ALL = (root) NOPASSWD:ALL

[root@ceph-server01 ~]# chmod 0440 /etc/sudoers.d/cephuser

57. We install NTP for time synchronization between Ceph servers and Ceph clients: (executed on all Ceph storage server/client nodes)

[root@ceph-server01 ~]# yum install -y ntp ntpdate ntp-doc
:::::::::
Installed:
  ntp.x86_64 0:4.2.6p5-28.el7.centos   ntp-doc.noarch 0:4.2.6p5-28.el7.centos

Dependency Installed:
  autogen-libopts.x86_64 0:5.18-5.el7

Complete!

58. We execute ntpdate command to set a date/time via NTP protocol from local NTP server (Taiwan): (executed on all Ceph

storage server/client nodes)

```
[root@ceph-server01 ~]# ntpdate 0.tw.pool.ntp.org
8 Jul 21:55:23 ntpdate[4578]: step time server 103.18.128.60 offset -2.117082 sec
```

59. We set the hardware clock (RTC) to the current system time: (executed on all Ceph storage server/client nodes)

```
[root@ceph-server01 ~]# hwclock --systohc
```

60. We enable, start and check the status of ntpd service: (executed on all Ceph storage server/client nodes)

```
[root@ceph-server01 ~]# systemctl enable ntpd; systemctl start ntpd; systemctl status ntpd
Created symlink from /etc/systemd/system/multi-user.target.wants/ntpd.service to /usr/lib/systemd/system/ntpd.service.
● ntpd.service - Network Time Service
   Loaded: loaded (/usr/lib/systemd/system/ntpd.service; enabled; vendor preset: disabled)
   Active: active (running) since Sun 2018-07-08 21:58:02 CST; 8ms ago
  Process: 4641 ExecStart=/usr/sbin/ntpd -u ntp:ntp $OPTIONS (code=exited, status=0/SUCCESS)
 Main PID: 4642 (ntpd)
    Tasks: 1
   CGroup: /system.slice/ntpd.service
           └─4642 /usr/sbin/ntpd -u ntp:ntp -g

Jul 08 21:58:02 ceph-server01.lab.gidanet.com.tw ntpd[4642]: ntp_io: estimated max descriptors: 1024...16
Jul 08 21:58:02 ceph-server01.lab.gidanet.com.tw ntpd[4642]: Listen and drop on 0 v4wildcard 0.0.0.0...23
Jul 08 21:58:02 ceph-server01.lab.gidanet.com.tw ntpd[4642]: Listen and drop on 1 v6wildcard :: UDP 123
Jul 08 21:58:02 ceph-server01.lab.gidanet.com.tw ntpd[4642]: Listen normally on 2 lo 127.0.0.1 UDP 123
Jul 08 21:58:02 ceph-server01.lab.gidanet.com.tw ntpd[4642]: Listen normally on 3 bond0 192.168.10.2...23
Jul 08 21:58:02 ceph-server01.lab.gidanet.com.tw ntpd[4642]: Listen normally on 4 virbr0 192.168.122...23
Jul 08 21:58:02 ceph-server01.lab.gidanet.com.tw ntpd[4642]: Listen normally on 5 lo ::1 UDP 123
Jul 08 21:58:02 ceph-server01.lab.gidanet.com.tw ntpd[4642]: Listen normally on 6 bond0 fe80::20c:29...23
```

```
Jul 08 21:58:02 ceph-server01.lab.gidanet.com.tw ntpd[4642]: Listening on routing socket on fd #23 f...es
Jul 08 21:58:02 ceph-server01.lab.gidanet.com.tw systemd[1]: Started Network Time Service.
Hint: Some lines were ellipsized, use -l to show in full.
```

61. We install/update the open virtual machine tools for virtual machines hosted on VMware: (executed on all Ceph storage server/client nodes)

```
[root@ceph-server01 ~]# yum install -y open-vm-tools
:::::::::
Updated:
  open-vm-tools.x86_64 0:10.1.10-3.el7_5.1

Dependency Updated:
  open-vm-tools-desktop.x86_64 0:10.1.10-3.el7_5.1

Complete!
```

62. We disable security-enhanced linux: (executed on all Ceph storage server/client nodes)

```
[root@ceph-server01 ~]# sed -i 's/SELINUX=enforcing/SELINUX=disabled/g' /etc/selinux/config
```

63. After rebooting, we use command to check and make sure the security-enhanced linux is disabled: (executed on all Ceph storage server/client nodes)

```
[root@ceph-server01 ~]# getenforce
Disabled
```

64. We configure /etc/hosts for easy access to Ceph servers and Ceph clients by means of hostname: (executed on all Ceph storage server/client nodes)

```
[root@ceph-server01 ~]# vi /etc/hosts
```

```
127.0.0.1   localhost localhost.localdomain localhost4 localhost4.localdomain4
::1         localhost localhost.localdomain localhost6 localhost6.localdomain6

192.168.10.241 ceph-server01.lab.gidanet.com.tw ceph-server01
192.168.10.242 ceph-server02.lab.gidanet.com.tw ceph-server02
192.168.10.243 ceph-server03.lab.gidanet.com.tw ceph-server03

192.168.10.231 ceph-client01.lab.gidanet.com.tw ceph-client01
```

65. We configure ssh server so password-less ssh access for “cephuser”: (executed on the first Ceph storage server node)

```
[root@ceph-server01 ~]# su - cephuser

[cephuser@ceph-server01 ~]$ ssh-keygen
Generating public/private rsa key pair.
Enter file in which to save the key (/home/cephuser/.ssh/id_rsa):
Created directory '/home/cephuser/.ssh'.
Enter passphrase (empty for no passphrase):
Enter same passphrase again:
Your identification has been saved in /home/cephuser/.ssh/id_rsa.
Your public key has been saved in /home/cephuser/.ssh/id_rsa.pub.
The key fingerprint is:
SHA256:Np29+z3CaIyOMHCIgsH8sMWK2U413jO3Xm1B8egp0As cephuser@ceph-server01.lab.gidanet.com.tw
The key's randomart image is:
+---[RSA 2048]----+
|          .      |
|o .    .   +     |
|.+.o. E . o .    |
```

```
|o=B+.  o = +     |
|=++++.. S * .    |
|.o  o+ o + . .   |
|  .  o. . = +    |
|     .o..o + + o |
|      ..... ..o o|
+----[SHA256]-----+
```

```
[cephuser@ceph-server01 ~]$ vi ~/.ssh/config
Host ceph-server01
        Hostname ceph-server01
        User cephuser

Host ceph-server02
        Hostname ceph-server02
        User cephuser

Host ceph-server03
        Hostname ceph-server03
        User cephuser

Host ceph-client01
        Hostname ceph-client01
        User cephuser
```

```
[cephuser@ceph-server01 ~]$ chmod 644 ~/.ssh/config; ls -l ~/.ssh/config
-rw-r--r--. 1 cephuser cephuser 294 Jul  8 22:14 /home/cephuser/.ssh/config
```

```
[cephuser@ceph-server01 ~]$ ssh-keyscan ceph-server02 ceph-server03 ceph-client01 >> ~/.ssh/known_hosts
# ceph-server02:22 SSH-2.0-OpenSSH_7.4
# ceph-server02:22 SSH-2.0-OpenSSH_7.4
# ceph-server02:22 SSH-2.0-OpenSSH_7.4
# ceph-server03:22 SSH-2.0-OpenSSH_7.4
# ceph-server03:22 SSH-2.0-OpenSSH_7.4
# ceph-server03:22 SSH-2.0-OpenSSH_7.4
# ceph-client01:22 SSH-2.0-OpenSSH_7.4
# ceph-client01:22 SSH-2.0-OpenSSH_7.4
# ceph-client01:22 SSH-2.0-OpenSSH_7.4

[cephuser@ceph-server01 ~]$ ssh-copy-id ceph-server02
/bin/ssh-copy-id: INFO: Source of key(s) to be installed: "/home/cephuser/.ssh/id_rsa.pub"
/bin/ssh-copy-id: INFO: attempting to log in with the new key(s), to filter out any that are already installed
/bin/ssh-copy-id: INFO: 1 key(s) remain to be installed -- if you are prompted now it is to install the new keys
cephuser@ceph-server02's password:

Number of key(s) added: 1

Now try logging into the machine, with:   "ssh 'ceph-server02'"
and check to make sure that only the key(s) you wanted were added.

[cephuser@ceph-server01 ~]$ ssh-copy-id ceph-server03
:::::::::

[cephuser@ceph-server01 ~]$ ssh-copy-id ceph-client01
```

::::::::::

66. We test password-less ssh access for "cephuser": (executed on the first Ceph storage server node)

```
[cephuser@ceph-server01 ~]$ date; ssh ceph-server02 date
Tue Jul 10 21:41:53 CST 2018
Tue Jul 10 21:41:53 CST 2018

[cephuser@ceph-server01 ~]$ date; ssh ceph-server03 date
Tue Jul 10 21:42:18 CST 2018
Tue Jul 10 21:42:18 CST 2018

[cephuser@ceph-server01 ~]$ date; ssh ceph-client01 date
Tue Jul 10 21:42:26 CST 2018
Tue Jul 10 21:42:26 CST 2018
```

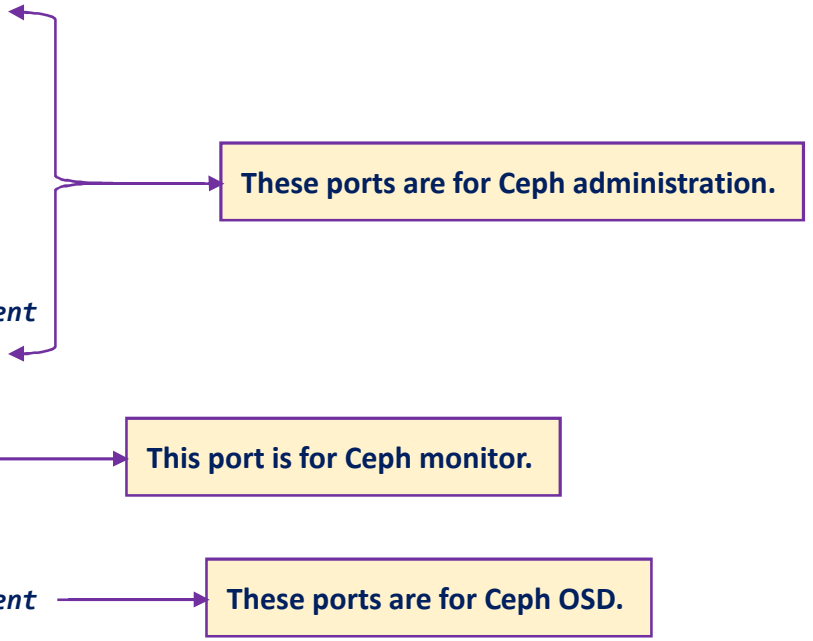
67. We check the status of firewalld service, if it is not running, we enable and start it: (executed on all Ceph storage server nodes)

```
[root@ceph-server01 ~]# systemctl status firewalld
● firewalld.service - firewalld - dynamic firewall daemon
   Loaded: loaded (/usr/lib/systemd/system/firewalld.service; enabled; vendor preset: enabled)
   Active: active (running) since Mon 2018-07-09 17:40:04 CST; 3h 9min ago
     Docs: man:firewalld(1)
 Main PID: 792 (firewalld)
    Tasks: 2
   CGroup: /system.slice/firewalld.service
           └─792 /usr/bin/python -Es /usr/sbin/firewalld --nofork --nopid
```

```
Jul 09 17:39:43 ceph-server01.lab.gidanet.com.tw systemd[1]: Starting firewalld - dynamic firewall d.....
Jul 09 17:40:04 ceph-server01.lab.gidanet.com.tw systemd[1]: Started firewalld - dynamic firewall daemon.
Hint: Some lines were ellipsized, use -l to show in full.
```

68. We open the following ports needed by Ceph administration, Ceph monitor and Ceph OSD: (executed on all Ceph storage server nodes)

```
[root@ceph-server01 ~]# firewall-cmd --zone=public --add-port=80/tcp --permanent
success

[root@ceph-server01 ~]# firewall-cmd --zone=public --add-port=2003/tcp --permanent
success

[root@ceph-server01 ~]# firewall-cmd --zone=public --add-port=4505-4506/tcp --permanent
success

[root@ceph-server01 ~]# firewall-cmd --zone=public --add-port=6789/tcp --permanent
success

[root@ceph-server01 ~]# firewall-cmd --zone=public --add-port=6800-7300/tcp --permanent
success

[root@ceph-server01 ~]# firewall-cmd --reload
success

[root@ceph-server01 ~]# iptables -L IN_public_allow
Chain IN_public_allow (1 references)
target     prot opt source               destination
```



```
ACCEPT     tcp  --  anywhere             anywhere             tcp dpt:ssh ctstate NEW
ACCEPT     tcp  --  anywhere             anywhere             tcp dpt:http ctstate NEW
ACCEPT     tcp  --  anywhere             anywhere             tcp dpt:cfinger ctstate NEW
ACCEPT     tcp  --  anywhere             anywhere             tcp dpts:4505:4506 ctstate NEW
ACCEPT     tcp  --  anywhere             anywhere             tcp dpt:smc-https ctstate NEW
ACCEPT     tcp  --  anywhere             anywhere             tcp dpts:6800:7300 ctstate NEW
```

69. We add the Ceph repository and install the Ceph deployment tool "ceph-deploy" with the yum command: (executed on all Ceph storage server nodes)

```
[root@ceph-server01 ~]# rpm -Uhv http://download.ceph.com/rpm-jewel/el7/noarch/ceph-release-1-1.el7.noarch.rpm
:::::::::
Updating / installing...
   1:ceph-release-1-1.el7             ################################# [100%]

[root@ceph-server01 ~]# rpm -qa --last | grep -e librados2 -e librbd1
librbd1-0.94.5-2.el7.x86_64                  Tue 10 Jul 2018 09:57:54 AM CST
librados2-0.94.5-2.el7.x86_64                Tue 10 Jul 2018 09:57:54 AM CST

[root@ceph-server01 ~]# cat >> /etc/yum.repos.d/ceph.repo
[Ceph]
name=Ceph packages for $basearch
baseurl=http://download.ceph.com/rpm-jewel/el7/$basearch
enabled=1
gpgcheck=1
type=rpm-md
gpgkey=https://download.ceph.com/keys/release.asc
priority=1
```

```
[Ceph-noarch]
name=Ceph noarch packages
baseurl=http://download.ceph.com/rpm-jewel/el7/noarch
enabled=1
gpgcheck=1
type=rpm-md
gpgkey=https://download.ceph.com/keys/release.asc
priority=1

[ceph-source]
name=Ceph source packages
baseurl=http://download.ceph.com/rpm-jewel/el7/SRPMS
enabled=1
gpgcheck=1
type=rpm-md
gpgkey=https://download.ceph.com/keys/release.asc
priority=1
```

70. We download two rpms, then install them to solve the rpm dependency issue before installing ceph-deploy: (executed on all Ceph storage server nodes)

```
[root@ceph-server01 ~]# wget -c ftp://ftp.pbone.net/mirror/ftp.centos.org/7.5.1804/storage/x86_64/ceph-jewel/lttng-ust-2.4.1-1.el7.1.x86_64.rpm

[root@ceph-server01 ~]# wget -c ftp://ftp.pbone.net/mirror/ftp.centos.org/7.5.1804/storage/x86_64/ceph-jewel/userspace-rcu-0.7.16-1.el7.x86_64.rpm
```

```
[root@ceph-server01 ~]# yum -y install lttng-ust-2.4.1-1.el7.1.x86_64.rpm userspace-rcu-0.7.16-1.el7.x86_64.rpm
:::::::::
Installed:
  lttng-ust.x86_64 0:2.4.1-1.el7.1                    userspace-rcu.x86_64 0:0.7.16-1.el7

Complete!
```

71. We update all currently installed packages then install ceph-deploy: (executed on all Ceph storage server nodes)

```
[root@ceph-server01 ~]# yum -y update && yum -y install ceph-deploy
:::::::::
:::::::::
  sudo.x86_64 0:1.8.19p2-14.el7_5
  systemtap.x86_64 0:3.2-8.el7_5
  systemtap-client.x86_64 0:3.2-8.el7_5
  systemtap-devel.x86_64 0:3.2-8.el7_5
  systemtap-runtime.x86_64 0:3.2-8.el7_5
  targetcli.noarch 0:2.1.fb46-6.el7_5
  tzdata.noarch 0:2018e-3.el7
  tzdata-java.noarch 0:2018e-3.el7
  vdo.x86_64 0:6.1.0.168-18
  xorg-x11-drv-wacom.x86_64 0:0.34.2-5.el7

Complete!
:::::::::
:::::::::
Installed:
  ceph-deploy.noarch 0:1.5.39-0
```

```
Complete!
```

72. We change user to cephuser for creating and configuring Ceph cluster:

```
[root@ceph-server01 ~]# su - cephuser
```

73. We create cluster directory to hold cluster related configuration files: (executed on the first Ceph storage server node)

```
[cephuser@ceph-server01 ~]$ mkdir cluster

[cephuser@ceph-server01 ~]$ cd cluster

[cephuser@ceph-server01 cluster]$ ceph-deploy --help
usage: ceph-deploy [-h] [-v | -q] [--version] [--username USERNAME]
                   [--overwrite-conf] [--ceph-conf CEPH_CONF]
                   COMMAND ...

Easy Ceph deployment

    -^-
   /   \
   |O o|  ceph-deploy v2.0.0
   ).-.(
  '/|||\`
  | '|` |
    '|`

Full documentation can be found at: http://ceph.com/ceph-deploy/docs
```

```
optional arguments:
  -h, --help            show this help message and exit
  -v, --verbose         be more verbose
  -q, --quiet           be less verbose
  --version             the current installed version of ceph-deploy
  --username USERNAME   the username to connect to the remote host
  --overwrite-conf      overwrite an existing conf file on remote host (if
                        present)
  --ceph-conf CEPH_CONF
                        use (or reuse) a given ceph.conf file

commands:
  COMMAND               description
    new                 Start deploying a new cluster, and write a
                        CLUSTER.conf and keyring for it.
    install             Install Ceph packages on remote hosts.
    rgw                 Ceph RGW daemon management
    mgr                 Ceph MGR daemon management
    mds                 Ceph MDS daemon management
    mon                 Ceph MON Daemon management
    gatherkeys          Gather authentication keys for provisioning new nodes.
    disk                Manage disks on a remote host.
    osd                 Prepare a data disk on remote host.
    repo                Repo definition management
    admin               Push configuration and client.admin key to a remote
                        host.
```

```
config          Copy ceph.conf to/from remote host(s)
uninstall       Remove Ceph packages from remote hosts.
purgedata       Purge (delete, destroy, discard, shred) any Ceph data
                from /var/lib/ceph
purge           Remove Ceph packages from remote hosts and purge all
                data.
forgetkeys      Remove authentication keys from the local directory.
pkg             Manage packages on remote hosts.
calamari        Install and configure Calamari nodes. Assumes that a
                repository with Calamari packages is already
                configured. Refer to the docs for examples
                (http://ceph.com/ceph-deploy/docs/conf.html)
```

74. We create a new cluster configuration with ceph-deploy command: (executed on the first Ceph storage server node)

```
[cephuser@ceph-server01 cluster]$ ceph-deploy new ceph-server01
[ceph_deploy.conf][DEBUG ] found configuration file at: /home/cephuser/.cephdeploy.conf
[ceph_deploy.cli][INFO  ] Invoked (1.5.39): /bin/ceph-deploy new ceph-server01
[ceph_deploy.cli][INFO  ] ceph-deploy options:
[ceph_deploy.cli][INFO  ]  username                      : None
[ceph_deploy.cli][INFO  ]  func                          : <function new at 0x7f1ebd1b4aa0>
[ceph_deploy.cli][INFO  ]  verbose                       : False
[ceph_deploy.cli][INFO  ]  overwrite_conf                : False
[ceph_deploy.cli][INFO  ]  quiet                         : False
[ceph_deploy.cli][INFO  ]  cd_conf                       : <ceph_deploy.conf.cephdeploy.Conf instance at 0x7f1ebc930050>
[ceph_deploy.cli][INFO  ]  cluster                       : ceph
[ceph_deploy.cli][INFO  ]  ssh_copykey                   : True
[ceph_deploy.cli][INFO  ]  mon                           : ['ceph-server01']
```

```
[ceph_deploy.cli][INFO  ]  public_network                : None
[ceph_deploy.cli][INFO  ]  ceph_conf                     : None
[ceph_deploy.cli][INFO  ]  cluster_network               : None
[ceph_deploy.cli][INFO  ]  default_release               : False
[ceph_deploy.cli][INFO  ]  fsid                          : None
[ceph_deploy.new][DEBUG ] Creating new cluster named ceph
[ceph_deploy.new][INFO  ] making sure passwordless SSH succeeds
[ceph-server01][DEBUG ] connection detected need for sudo
[ceph-server01][DEBUG ] connected to host: ceph-server01
[ceph-server01][DEBUG ] detect platform information from remote host
[ceph-server01][DEBUG ] detect machine type
[ceph-server01][DEBUG ] find the location of an executable
[ceph-server01][INFO  ] Running command: sudo /usr/sbin/ip link show
[ceph-server01][INFO  ] Running command: sudo /usr/sbin/ip addr show
[ceph-server01][DEBUG ] IP addresses found: [u'192.168.10.241', u'192.168.122.1']
[ceph_deploy.new][DEBUG ] Resolving host ceph-server01
[ceph_deploy.new][DEBUG ] Monitor ceph-server01 at 192.168.10.241
[ceph_deploy.new][DEBUG ] Monitor initial members are ['ceph-server01']
[ceph_deploy.new][DEBUG ] Monitor addrs are ['192.168.10.241']
[ceph_deploy.new][DEBUG ] Creating a random mon key...
[ceph_deploy.new][DEBUG ] Writing monitor keyring to ceph.mon.keyring...
[ceph_deploy.new][DEBUG ] Writing initial config to ceph.conf...
```

75. We check the cluster configuration: (executed on the first Ceph storage server node)

```
[cephuser@ceph-server01 cluster]$ cat ceph.conf
[global]
fsid = 4d00630f-ff91-4bf0-b7e1-fe9f616753ea
```

```
mon_initial_members = ceph-server01
mon_host = 192.168.10.241
auth_cluster_required = cephx
auth_service_required = cephx
auth_client_required = cephx
```

[cephuser@ceph-server01 cluster]$ cp -p ceph.conf ceph.conf.ORIG

76. We update the cluster configuration by adding network definition: (executed on the first Ceph storage server node)

[cephuser@ceph-server01 cluster]$ vi ceph.conf

```
:::::::::

# Your network address
public network = 192.168.10.0/24
osd pool default size = 2
```

77. We install Ceph on all Ceph storage nodes: (executed on the first Ceph storage server node)

[cephuser@ceph-server01 cluster]$ ceph-deploy install ceph-server01 ceph-server02 ceph-server03

```
[ceph_deploy.cli][INFO  ] Invoked (1.5.39): /bin/ceph-deploy install ceph-server01 ceph-server02 ceph-server03
[ceph_deploy.cli][INFO  ] ceph-deploy options:
[ceph_deploy.cli][INFO  ]  verbose                       : False
[ceph_deploy.cli][INFO  ]  testing                       : None
[ceph_deploy.cli][INFO  ]  cd_conf                       : <ceph_deploy.conf.cephdeploy.Conf instance at 0x7ff6eca862d8>
[ceph_deploy.cli][INFO  ]  cluster                       : ceph
[ceph_deploy.cli][INFO  ]  dev_commit                    : None
[ceph_deploy.cli][INFO  ]  install_mds                   : False
[ceph_deploy.cli][INFO  ]  stable                        : None
```

```
[ceph_deploy.cli][INFO  ]  default_release               : False
[ceph_deploy.cli][INFO  ]  username                      : None
[ceph_deploy.cli][INFO  ]  adjust_repos                  : True
[ceph_deploy.cli][INFO  ]  func                          : <function install at 0x7ff6ed9562a8>
[ceph_deploy.cli][INFO  ]  install_mgr                   : False
[ceph_deploy.cli][INFO  ]  install_all                   : False
[ceph_deploy.cli][INFO  ]  repo                          : False
[ceph_deploy.cli][INFO  ]  host                          : ['ceph-server01', 'ceph-server02', 'ceph-server03']
[ceph_deploy.cli][INFO  ]  install_rgw                   : False
[ceph_deploy.cli][INFO  ]  install_tests                 : False
[ceph_deploy.cli][INFO  ]  repo_url                      : None
[ceph_deploy.cli][INFO  ]  ceph_conf                     : None
[ceph_deploy.cli][INFO  ]  install_osd                   : False
[ceph_deploy.cli][INFO  ]  version_kind                  : stable
[ceph_deploy.cli][INFO  ]  install_common                : False
[ceph_deploy.cli][INFO  ]  overwrite_conf                : False
[ceph_deploy.cli][INFO  ]  quiet                         : False
[ceph_deploy.cli][INFO  ]  dev                           : master
[ceph_deploy.cli][INFO  ]  nogpgcheck                    : False
[ceph_deploy.cli][INFO  ]  local_mirror                  : None
[ceph_deploy.cli][INFO  ]  release                       : None
[ceph_deploy.cli][INFO  ]  install_mon                   : False
[ceph_deploy.cli][INFO  ]  gpg_url                       : None
[ceph_deploy.install][DEBUG ] Installing stable version jewel on cluster ceph hosts ceph-server01 ceph-server02 ceph-server03
[ceph_deploy.install][DEBUG ] Detecting platform for host ceph-server01 ...
[ceph-server01][DEBUG ] connection detected need for sudo
[ceph-server01][DEBUG ] connected to host: ceph-server01
```

```
[ceph-server01][DEBUG ] detect platform information from remote host
[ceph-server01][DEBUG ] detect machine type
[ceph_deploy.install][INFO  ] Distro info: CentOS Linux 7.5.1804 Core
[ceph-server01][INFO  ] installing Ceph on ceph-server01
[ceph-server01][INFO  ] Running command: sudo yum clean all
[ceph-server01][DEBUG ] Loaded plugins: fastestmirror, langpacks
[ceph-server01][DEBUG ] Cleaning repos: Ceph Ceph-noarch base ceph-source extras updates
[ceph-server01][DEBUG ] Cleaning up everything
[ceph-server01][DEBUG ] Maybe you want: rm -rf /var/cache/yum, to also free up space taken by orphaned data from disabled or removed repos
[ceph-server01][DEBUG ] Cleaning up list of fastest mirrors
[ceph-server01][INFO  ] Running command: sudo yum -y install epel-release
[ceph-server01][DEBUG ] Loaded plugins: fastestmirror, langpacks
[ceph-server01][DEBUG ] Determining fastest mirrors
:::::::::
:::::::::
[ceph-server03][DEBUG ] Dependencies Resolved
[ceph-server03][DEBUG ]
[ceph-server03][DEBUG ] ================================================================================
[ceph-server03][DEBUG ]  Package                    Arch        Version               Repository   Size
[ceph-server03][DEBUG ] ================================================================================
[ceph-server03][DEBUG ] Installing:
[ceph-server03][DEBUG ]  ceph                       x86_64      2:10.2.11-0.el7       Ceph        3.0 k
[ceph-server03][DEBUG ]  ceph-radosgw               x86_64      2:10.2.11-0.el7       Ceph        267 k
[ceph-server03][DEBUG ] Installing for dependencies:
[ceph-server03][DEBUG ]  boost-program-options      x86_64      1.53.0-27.el7         base        156 k
[ceph-server03][DEBUG ]  boost-regex                x86_64      1.53.0-27.el7         base        300 k
[ceph-server03][DEBUG ]  ceph-base                  x86_64      2:10.2.11-0.el7       Ceph        4.2 M
```

```
[ceph-server03][DEBUG ]  ceph-common              x86_64      2:10.2.11-0.el7      Ceph         17 M
[ceph-server03][DEBUG ]  ceph-mds                 x86_64      2:10.2.11-0.el7      Ceph        2.8 M
[ceph-server03][DEBUG ]  ceph-mon                 x86_64      2:10.2.11-0.el7      Ceph        3.1 M
[ceph-server03][DEBUG ]  ceph-osd                 x86_64      2:10.2.11-0.el7      Ceph        9.5 M
[ceph-server03][DEBUG ]  ceph-selinux             x86_64      2:10.2.11-0.el7      Ceph         20 k
[ceph-server03][DEBUG ]  fcgi                     x86_64      2.4.0-25.el7         epel         47 k
[ceph-server03][DEBUG ]  hdparm                   x86_64      9.43-5.el7           base         83 k
[ceph-server03][DEBUG ]  leveldb                  x86_64      1.12.0-11.el7        epel        161 k
[ceph-server03][DEBUG ]  libbabeltrace            x86_64      1.2.4-3.el7          epel        147 k
[ceph-server03][DEBUG ]  libcephfs1               x86_64      2:10.2.11-0.el7      Ceph        1.9 M
[ceph-server03][DEBUG ]  libradosstriper1         x86_64      2:10.2.11-0.el7      Ceph        1.8 M
[ceph-server03][DEBUG ]  librgw2                  x86_64      2:10.2.11-0.el7      Ceph        3.0 M
[ceph-server03][DEBUG ]  mailcap                  noarch      2.1.41-2.el7         base         31 k
[ceph-server03][DEBUG ]  python-babel             noarch      0.9.6-8.el7          base        1.4 M
[ceph-server03][DEBUG ]  python-cephfs            x86_64      2:10.2.11-0.el7      Ceph         78 k
[ceph-server03][DEBUG ]  python-flask             noarch      1:0.10.1-4.el7       extras      204 k
[ceph-server03][DEBUG ]  python-itsdangerous      noarch      0.23-2.el7           extras       24 k
[ceph-server03][DEBUG ]  python-jinja2            noarch      2.7.2-2.el7          base        515 k
[ceph-server03][DEBUG ]  python-markupsafe        x86_64      0.11-10.el7          base         25 k
[ceph-server03][DEBUG ]  python-rados             x86_64      2:10.2.11-0.el7      Ceph        149 k
[ceph-server03][DEBUG ]  python-rbd               x86_64      2:10.2.11-0.el7      Ceph         79 k
[ceph-server03][DEBUG ]  python-requests          noarch      2.6.0-1.el7_1        base         94 k
[ceph-server03][DEBUG ]  python-urllib3           noarch      1.10.2-5.el7         base        102 k
[ceph-server03][DEBUG ]  python-werkzeug          noarch      0.9.1-2.el7          extras      562 k
[ceph-server03][DEBUG ]
[ceph-server03][DEBUG ] Transaction Summary
[ceph-server03][DEBUG ] ================================================================================
```

```
[ceph-server03][DEBUG ] Install  2 Packages (+27 Dependent packages)
[ceph-server03][DEBUG ]
[ceph-server03][DEBUG ] Total download size: 47 M
[ceph-server03][DEBUG ] Installed size: 178 M
:::::::::
:::::::::
[ceph-server03][DEBUG ] Installed:
[ceph-server03][DEBUG ]   ceph.x86_64 2:10.2.11-0.el7         ceph-radosgw.x86_64 2:10.2.11-0.el7
[ceph-server03][DEBUG ]
[ceph-server03][DEBUG ] Dependency Installed:
[ceph-server03][DEBUG ]   boost-program-options.x86_64 0:1.53.0-27.el7
[ceph-server03][DEBUG ]   boost-regex.x86_64 0:1.53.0-27.el7
[ceph-server03][DEBUG ]   ceph-base.x86_64 2:10.2.11-0.el7
[ceph-server03][DEBUG ]   ceph-common.x86_64 2:10.2.11-0.el7
[ceph-server03][DEBUG ]   ceph-mds.x86_64 2:10.2.11-0.el7
[ceph-server03][DEBUG ]   ceph-mon.x86_64 2:10.2.11-0.el7
[ceph-server03][DEBUG ]   ceph-osd.x86_64 2:10.2.11-0.el7
[ceph-server03][DEBUG ]   ceph-selinux.x86_64 2:10.2.11-0.el7
[ceph-server03][DEBUG ]   fcgi.x86_64 0:2.4.0-25.el7
[ceph-server03][DEBUG ]   hdparm.x86_64 0:9.43-5.el7
[ceph-server03][DEBUG ]   leveldb.x86_64 0:1.12.0-11.el7
[ceph-server03][DEBUG ]   libbabeltrace.x86_64 0:1.2.4-3.el7
[ceph-server03][DEBUG ]   libcephfs1.x86_64 2:10.2.11-0.el7
[ceph-server03][DEBUG ]   libradosstriper1.x86_64 2:10.2.11-0.el7
[ceph-server03][DEBUG ]   librgw2.x86_64 2:10.2.11-0.el7
[ceph-server03][DEBUG ]   mailcap.noarch 0:2.1.41-2.el7
[ceph-server03][DEBUG ]   python-babel.noarch 0:0.9.6-8.el7
```

```
[ceph-server03][DEBUG ]   python-cephfs.x86_64 2:10.2.11-0.el7
[ceph-server03][DEBUG ]   python-flask.noarch 1:0.10.1-4.el7
[ceph-server03][DEBUG ]   python-itsdangerous.noarch 0:0.23-2.el7
[ceph-server03][DEBUG ]   python-jinja2.noarch 0:2.7.2-2.el7
[ceph-server03][DEBUG ]   python-markupsafe.x86_64 0:0.11-10.el7
[ceph-server03][DEBUG ]   python-rados.x86_64 2:10.2.11-0.el7
[ceph-server03][DEBUG ]   python-rbd.x86_64 2:10.2.11-0.el7
[ceph-server03][DEBUG ]   python-requests.noarch 0:2.6.0-1.el7_1
[ceph-server03][DEBUG ]   python-urllib3.noarch 0:1.10.2-5.el7
[ceph-server03][DEBUG ]   python-werkzeug.noarch 0:0.9.1-2.el7
[ceph-server03][DEBUG ]
[ceph-server03][DEBUG ] Complete!
[ceph-server03][INFO  ] Running command: sudo ceph --version
[ceph-server03][DEBUG ] ceph version 10.2.11 (e4b061b47f07f583c92a050d9e84b1813a35671e)
```

```
[cephuser@ceph-server01 cluster]# rpm -qa --last | grep -e " Wed 11 Jul 2018 04:3"
mailcap-2.1.41-2.el7.noarch                 Wed 11 Jul 2018 04:37:10 PM CST
ceph-radosgw-10.2.11-0.el7.x86_64           Wed 11 Jul 2018 04:37:10 PM CST
ceph-mon-10.2.11-0.el7.x86_64               Wed 11 Jul 2018 04:37:10 PM CST
ceph-mds-10.2.11-0.el7.x86_64               Wed 11 Jul 2018 04:37:10 PM CST
ceph-10.2.11-0.el7.x86_64                   Wed 11 Jul 2018 04:37:10 PM CST
ceph-osd-10.2.11-0.el7.x86_64               Wed 11 Jul 2018 04:37:09 PM CST
ceph-selinux-10.2.11-0.el7.x86_64           Wed 11 Jul 2018 04:36:54 PM CST
ceph-base-10.2.11-0.el7.x86_64              Wed 11 Jul 2018 04:36:54 PM CST
ceph-common-10.2.11-0.el7.x86_64            Wed 11 Jul 2018 04:36:53 PM CST
libbabeltrace-1.2.4-3.el7.x86_64            Wed 11 Jul 2018 04:36:51 PM CST
hdparm-9.43-5.el7.x86_64                    Wed 11 Jul 2018 04:36:51 PM CST
```

```
boost-regex-1.53.0-27.el7.x86_64                Wed 11 Jul 2018 04:36:51 PM CST
python-urllib3-1.10.2-5.el7.noarch              Wed 11 Jul 2018 04:36:50 PM CST
python-requests-2.6.0-1.el7_1.noarch            Wed 11 Jul 2018 04:36:50 PM CST
python-markupsafe-0.11-10.el7.x86_64            Wed 11 Jul 2018 04:36:50 PM CST
python-jinja2-2.7.2-2.el7.noarch                Wed 11 Jul 2018 04:36:50 PM CST
python-itsdangerous-0.23-2.el7.noarch           Wed 11 Jul 2018 04:36:50 PM CST
python-flask-0.10.1-4.el7.noarch                Wed 11 Jul 2018 04:36:50 PM CST
libradosstriper1-10.2.11-0.el7.x86_64           Wed 11 Jul 2018 04:36:50 PM CST
python-werkzeug-0.9.1-2.el7.noarch              Wed 11 Jul 2018 04:36:49 PM CST
python-rbd-10.2.11-0.el7.x86_64                 Wed 11 Jul 2018 04:36:49 PM CST
python-cephfs-10.2.11-0.el7.x86_64              Wed 11 Jul 2018 04:36:49 PM CST
python-babel-0.9.6-8.el7.noarch                 Wed 11 Jul 2018 04:36:49 PM CST
librgw2-10.2.11-0.el7.x86_64                    Wed 11 Jul 2018 04:36:49 PM CST
leveldb-1.12.0-11.el7.x86_64                    Wed 11 Jul 2018 04:36:49 PM CST
boost-program-options-1.53.0-27.el7.x86_64      Wed 11 Jul 2018 04:36:49 PM CST
python-rados-10.2.11-0.el7.x86_64               Wed 11 Jul 2018 04:36:48 PM CST
libcephfs1-10.2.11-0.el7.x86_64                 Wed 11 Jul 2018 04:36:48 PM CST
fcgi-2.4.0-25.el7.x86_64                        Wed 11 Jul 2018 04:36:48 PM CST
gpg-pubkey-352c64e5-52ae6884                    Wed 11 Jul 2018 04:33:15 PM CST
ceph-release-1-1.el7.noarch                     Wed 11 Jul 2018 04:32:50 PM CST
yum-plugin-priorities-1.1.31-45.el7.noarch      Wed 11 Jul 2018 04:32:28 PM CST
epel-release-7-11.noarch                        Wed 11 Jul 2018 04:31:35 PM CST
```

78. Based on timestamp, we check how many Ceph related rpms installed: (executed on all Ceph storage server nodes)

```
[cephuser@ceph-server01 cluster]$ rpm -qa --last | grep -e " Wed 11 Jul 2018 04:3" | wc -l
33
```

```
[cephuser@ceph-server02 ~]$ rpm -qa --last | grep -e " Wed 11 Jul 2018 04:[34]" | wc -l
33

[cephuser@ceph-server03 ~]$ rpm -qa --last | grep -e " Wed 11 Jul 2018 04:[34]" | wc -l
33
```

79. We deploy ceph-mon on the first node:

```
[cephuser@ceph-server01 cluster]$ ceph-deploy mon create-initial
[ceph_deploy.conf][DEBUG ] found configuration file at: /home/cephuser/.cephdeploy.conf
[ceph_deploy.cli][INFO  ] Invoked (1.5.39): /bin/ceph-deploy mon create-initial
[ceph_deploy.cli][INFO  ] ceph-deploy options:
[ceph_deploy.cli][INFO  ]  username                      : None
[ceph_deploy.cli][INFO  ]  verbose                       : False
[ceph_deploy.cli][INFO  ]  overwrite_conf                : False
[ceph_deploy.cli][INFO  ]  subcommand                    : create-initial
[ceph_deploy.cli][INFO  ]  quiet                         : False
[ceph_deploy.cli][INFO  ]  cd_conf                       : <ceph_deploy.conf.cephdeploy.Conf instance at 0x7f75c9de7368>
[ceph_deploy.cli][INFO  ]  cluster                       : ceph
[ceph_deploy.cli][INFO  ]  func                          : <function mon at 0x7f75c9e31b90>
[ceph_deploy.cli][INFO  ]  ceph_conf                     : None
[ceph_deploy.cli][INFO  ]  default_release               : False
[ceph_deploy.cli][INFO  ]  keyrings                      : None
[ceph_deploy.mon][DEBUG ] Deploying mon, cluster ceph hosts ceph-server01
[ceph_deploy.mon][DEBUG ] detecting platform for host ceph-server01 ...
[ceph-server01][DEBUG ] connection detected need for sudo
[ceph-server01][DEBUG ] connected to host: ceph-server01
[ceph-server01][DEBUG ] detect platform information from remote host
```

```
[ceph-server01][DEBUG ] detect machine type
[ceph-server01][DEBUG ] find the location of an executable
[ceph_deploy.mon][INFO  ] distro info: CentOS Linux 7.5.1804 Core
[ceph-server01][DEBUG ] determining if provided host has same hostname in remote
[ceph-server01][DEBUG ] get remote short hostname
[ceph-server01][DEBUG ] deploying mon to ceph-server01
[ceph-server01][DEBUG ] get remote short hostname
[ceph-server01][DEBUG ] remote hostname: ceph-server01
[ceph-server01][DEBUG ] write cluster configuration to /etc/ceph/{cluster}.conf
[ceph-server01][DEBUG ] create the mon path if it does not exist
[ceph-server01][DEBUG ] checking for done path: /var/lib/ceph/mon/ceph-ceph-server01/done
[ceph-server01][DEBUG ] done path does not exist: /var/lib/ceph/mon/ceph-ceph-server01/done
[ceph-server01][INFO  ] creating keyring file: /var/lib/ceph/tmp/ceph-ceph-server01.mon.keyring
[ceph-server01][DEBUG ] create the monitor keyring file
[ceph-server01][INFO  ] Running command: sudo ceph-mon --cluster ceph --mkfs -i ceph-server01 --keyring /var/lib/ceph/tmp/ceph-ceph-
server01.mon.keyring --setuser 167 --setgroup 167
[ceph-server01][DEBUG ] ceph-mon: renaming mon.noname-a 192.168.10.241:6789/0 to mon.ceph-server01
[ceph-server01][DEBUG ] ceph-mon: set fsid to 4d00630f-ff91-4bf0-b7e1-fe9f616753ea
[ceph-server01][DEBUG ] ceph-mon: created monfs at /var/lib/ceph/mon/ceph-ceph-server01 for mon.ceph-server01
[ceph-server01][INFO  ] unlinking keyring file /var/lib/ceph/tmp/ceph-ceph-server01.mon.keyring
[ceph-server01][DEBUG ] create a done file to avoid re-doing the mon deployment
[ceph-server01][DEBUG ] create the init path if it does not exist
[ceph-server01][INFO  ] Running command: sudo systemctl enable ceph.target
[ceph-server01][INFO  ] Running command: sudo systemctl enable ceph-mon@ceph-server01
[ceph-server01][WARNIN] Created symlink from /etc/systemd/system/ceph-mon.target.wants/ceph-mon@ceph-server01.service to
/usr/lib/systemd/system/ceph-mon@.service.
[ceph-server01][INFO  ] Running command: sudo systemctl start ceph-mon@ceph-server01
```

```
[ceph-server01][INFO  ] Running command: sudo ceph --cluster=ceph --admin-daemon /var/run/ceph/ceph-mon.ceph-server01.asok mon_status
[ceph-server01][DEBUG ] ********************************************************************************
[ceph-server01][DEBUG ] status for monitor: mon.ceph-server01
[ceph-server01][DEBUG ] {
[ceph-server01][DEBUG ]   "election_epoch": 3,
[ceph-server01][DEBUG ]   "extra_probe_peers": [],
[ceph-server01][DEBUG ]   "monmap": {
[ceph-server01][DEBUG ]     "created": "2018-07-11 17:12:15.929639",
[ceph-server01][DEBUG ]     "epoch": 1,
[ceph-server01][DEBUG ]     "fsid": "4d00630f-ff91-4bf0-b7e1-fe9f616753ea",
[ceph-server01][DEBUG ]     "modified": "2018-07-11 17:12:15.929639",
[ceph-server01][DEBUG ]     "mons": [
[ceph-server01][DEBUG ]       {
[ceph-server01][DEBUG ]         "addr": "192.168.10.241:6789/0",
[ceph-server01][DEBUG ]         "name": "ceph-server01",
[ceph-server01][DEBUG ]         "rank": 0
[ceph-server01][DEBUG ]       }
[ceph-server01][DEBUG ]     ]
[ceph-server01][DEBUG ]   },
[ceph-server01][DEBUG ]   "name": "ceph-server01",
[ceph-server01][DEBUG ]   "outside_quorum": [],
[ceph-server01][DEBUG ]   "quorum": [
[ceph-server01][DEBUG ]     0
[ceph-server01][DEBUG ]   ],
[ceph-server01][DEBUG ]   "rank": 0,
[ceph-server01][DEBUG ]   "state": "leader",
[ceph-server01][DEBUG ]   "sync_provider": []
```

```
[ceph-server01][DEBUG ] }
[ceph-server01][DEBUG ] ********************************************************************************
[ceph-server01][INFO  ] monitor: mon.ceph-server01 is running
[ceph-server01][INFO  ] Running command: sudo ceph --cluster=ceph --admin-daemon /var/run/ceph/ceph-mon.ceph-server01.asok mon_status
[ceph_deploy.mon][INFO  ] processing monitor mon.ceph-server01
[ceph-server01][DEBUG ] connection detected need for sudo
[ceph-server01][DEBUG ] connected to host: ceph-server01
[ceph-server01][DEBUG ] detect platform information from remote host
[ceph-server01][DEBUG ] detect machine type
[ceph-server01][DEBUG ] find the location of an executable
[ceph-server01][INFO  ] Running command: sudo ceph --cluster=ceph --admin-daemon /var/run/ceph/ceph-mon.ceph-server01.asok mon_status
[ceph_deploy.mon][INFO  ] mon.ceph-server01 monitor has reached quorum!
[ceph_deploy.mon][INFO  ] all initial monitors are running and have formed quorum
[ceph_deploy.mon][INFO  ] Running gatherkeys...
[ceph_deploy.gatherkeys][INFO  ] Storing keys in temp directory /tmp/tmphsaQGC
[ceph-server01][DEBUG ] connection detected need for sudo
[ceph-server01][DEBUG ] connected to host: ceph-server01
[ceph-server01][DEBUG ] detect platform information from remote host
[ceph-server01][DEBUG ] detect machine type
[ceph-server01][DEBUG ] get remote short hostname
[ceph-server01][DEBUG ] fetch remote file
[ceph-server01][INFO  ] Running command: sudo /usr/bin/ceph --connect-timeout=25 --cluster=ceph --admin-daemon=/var/run/ceph/ceph-mon.ceph-server01.asok mon_status
[ceph-server01][INFO  ] Running command: sudo /usr/bin/ceph --connect-timeout=25 --cluster=ceph --name mon. --keyring=/var/lib/ceph/mon/ceph-ceph-server01/keyring auth get client.admin
[ceph-server01][INFO  ] Running command: sudo /usr/bin/ceph --connect-timeout=25 --cluster=ceph --name mon. --keyring=/var/lib/ceph/mon/ceph-ceph-server01/keyring auth get client.bootstrap-mds
```

```
[ceph-server01][INFO  ] Running command: sudo /usr/bin/ceph --connect-timeout=25 --cluster=ceph --name mon. --
keyring=/var/lib/ceph/mon/ceph-ceph-server01/keyring auth get client.bootstrap-mgr
[ceph-server01][INFO  ] Running command: sudo /usr/bin/ceph --connect-timeout=25 --cluster=ceph --name mon. --
keyring=/var/lib/ceph/mon/ceph-ceph-server01/keyring auth get-or-create client.bootstrap-mgr mon allow profile bootstrap-mgr
[ceph-server01][INFO  ] Running command: sudo /usr/bin/ceph --connect-timeout=25 --cluster=ceph --name mon. --
keyring=/var/lib/ceph/mon/ceph-ceph-server01/keyring auth get client.bootstrap-osd
[ceph-server01][INFO  ] Running command: sudo /usr/bin/ceph --connect-timeout=25 --cluster=ceph --name mon. --
keyring=/var/lib/ceph/mon/ceph-ceph-server01/keyring auth get client.bootstrap-rgw
[ceph_deploy.gatherkeys][INFO  ] Storing ceph.client.admin.keyring
[ceph_deploy.gatherkeys][INFO  ] Storing ceph.bootstrap-mds.keyring
[ceph_deploy.gatherkeys][INFO  ] Storing ceph.bootstrap-mgr.keyring
[ceph_deploy.gatherkeys][INFO  ] keyring 'ceph.mon.keyring' already exists
[ceph_deploy.gatherkeys][INFO  ] Storing ceph.bootstrap-osd.keyring
[ceph_deploy.gatherkeys][INFO  ] Storing ceph.bootstrap-rgw.keyring
[ceph_deploy.gatherkeys][INFO  ] Destroy temp directory /tmp/tmphsaQGC
```

80. We deploy (create more monitors - a single monitor per node) ceph-mon on the other nodes:

```
[cephuser@ceph-server01 cluster]$ ceph-deploy mon create ceph-server02 ceph-server03
::::::::::
::::::::::
[ceph-server03][DEBUG ] ********************************************************************************
[ceph-server03][DEBUG ] status for monitor: mon.ceph-server03
[ceph-server03][DEBUG ] {
[ceph-server03][DEBUG ]   "election_epoch": 0,
[ceph-server03][DEBUG ]   "extra_probe_peers": [
[ceph-server03][DEBUG ]     "192.168.10.241:6789/0"
[ceph-server03][DEBUG ]   ],
```

```
[ceph-server03][DEBUG ]   "monmap": {
[ceph-server03][DEBUG ]     "created": "2018-07-11 17:12:15.929639",
[ceph-server03][DEBUG ]     "epoch": 2,
[ceph-server03][DEBUG ]     "fsid": "4d00630f-ff91-4bf0-b7e1-fe9f616753ea",
[ceph-server03][DEBUG ]     "modified": "2018-07-11 17:15:12.105763",
[ceph-server03][DEBUG ]     "mons": [
[ceph-server03][DEBUG ]       {
[ceph-server03][DEBUG ]         "addr": "192.168.10.241:6789/0",
[ceph-server03][DEBUG ]         "name": "ceph-server01",
[ceph-server03][DEBUG ]         "rank": 0
[ceph-server03][DEBUG ]       },
[ceph-server03][DEBUG ]       {
[ceph-server03][DEBUG ]         "addr": "192.168.10.242:6789/0",
[ceph-server03][DEBUG ]         "name": "ceph-server02",
[ceph-server03][DEBUG ]         "rank": 1
[ceph-server03][DEBUG ]       }
[ceph-server03][DEBUG ]     ]
[ceph-server03][DEBUG ]   },
[ceph-server03][DEBUG ]   "name": "ceph-server03",
[ceph-server03][DEBUG ]   "outside_quorum": [
[ceph-server03][DEBUG ]     "ceph-server01",
[ceph-server03][DEBUG ]     "ceph-server02"
[ceph-server03][DEBUG ]   ],
[ceph-server03][DEBUG ]   "quorum": [],
[ceph-server03][DEBUG ]   "rank": -1,
[ceph-server03][DEBUG ]   "state": "probing",
[ceph-server03][DEBUG ]   "sync_provider": []
```

```
[ceph-server03][DEBUG ] }
[ceph-server03][DEBUG ] ********************************************************************************
[ceph-server03][INFO  ] monitor: mon.ceph-server03 is currently at the state of probing
[ceph-server03][INFO  ] Running command: sudo ceph --cluster=ceph --admin-daemon /var/run/ceph/ceph-mon.ceph-server03.asok mon_status
[ceph-server03][WARNIN] ceph-server03 is not defined in `mon initial members`
[ceph-server03][WARNIN] monitor ceph-server03 does not exist in monmap
```

81. We use command to check the relationship of ceph-mon on all Ceph server nodes:

```
[cephuser@ceph-server01 cluster]$ sudo netstat -antlp | grep mon
tcp        0      0 192.168.10.241:6789     0.0.0.0:*               LISTEN      75654/ceph-mon
tcp        0      0 192.168.10.241:6789     192.168.10.243:53366    ESTABLISHED 75654/ceph-mon
tcp        0      0 192.168.10.241:6789     192.168.10.242:47806    ESTABLISHED 75654/ceph-mon

[cephuser@ceph-server02 ~]$ sudo netstat -antlp | grep mon
tcp        0      0 192.168.10.242:6789     0.0.0.0:*               LISTEN      76131/ceph-mon
tcp        0      0 192.168.10.242:6789     192.168.10.243:34014    ESTABLISHED 76131/ceph-mon
tcp        0      0 192.168.10.242:47806    192.168.10.241:6789     ESTABLISHED 76131/ceph-mon

[cephuser@ceph-server03 ~]$ sudo netstat -antlp | grep mon
tcp        0      0 192.168.10.243:6789     0.0.0.0:*               LISTEN      76236/ceph-mon
tcp        0      0 192.168.10.243:53366    192.168.10.241:6789     ESTABLISHED 76236/ceph-mon
tcp        0      0 192.168.10.243:34014    192.168.10.242:6789     ESTABLISHED 76236/ceph-mon
```

82. We list keyring files: (executed on the first Ceph storage server node)

```
[cephuser@ceph-server01 cluster]$ ls -alt
total 200
-rw-rw-r--  1 cephuser cephuser 157316 Jul 11 17:19 ceph-deploy-ceph.log
```

```
drwxrwxr-x  2 cephuser cephuser   4096 Jul 11 17:12 .
-rw-------  1 cephuser cephuser    113 Jul 11 17:12 ceph.bootstrap-rgw.keyring
-rw-------  1 cephuser cephuser    113 Jul 11 17:12 ceph.bootstrap-osd.keyring
-rw-------  1 cephuser cephuser     71 Jul 11 17:12 ceph.bootstrap-mgr.keyring
-rw-------  1 cephuser cephuser    113 Jul 11 17:12 ceph.bootstrap-mds.keyring
-rw-------  1 cephuser cephuser    129 Jul 11 17:12 ceph.client.admin.keyring
drwx------. 7 cephuser cephuser   4096 Jul 11 16:29 ..
-rw-rw-r--  1 cephuser cephuser    287 Jul 11 16:29 ceph.conf
-rw-rw-r--  1 cephuser cephuser    205 Jul 11 16:27 ceph.conf.ORIG
-rw-------  1 cephuser cephuser     73 Jul 11 16:27 ceph.mon.keyring
```

83. We install jq package for JSON output processing: (executed on all Ceph storage server nodes)

```
[root@ceph-server01 ~]# yum -y install jq
:::::::::
Installed:
  jq.x86_64 0:1.5-1.el7

Dependency Installed:
  oniguruma.x86_64 0:5.9.5-3.el7

Complete!
```

84. We check Ceph cluster status: (executed on any Ceph storage server node)

```
[root@ceph-server01 ~]# ceph --cluster ceph quorum_status | jq
{
  "election_epoch": 20,
  "quorum": [
```

```
    0,
    1,
    2
  ],
  "quorum_names": [
    "ceph-server01",
    "ceph-server02",
    "ceph-server03"
  ],
  "quorum_leader_name": "ceph-server01",
  "monmap": {
    "epoch": 3,
    "fsid": "4d00630f-ff91-4bf0-b7e1-fe9f616753ea",
    "modified": "2018-07-11 17:15:19.056801",
    "created": "2018-07-11 17:12:15.929639",
    "mons": [
      {
        "rank": 0,
        "name": "ceph-server01",
        "addr": "192.168.10.241:6789/0"
      },
      {
        "rank": 1,
        "name": "ceph-server02",
        "addr": "192.168.10.242:6789/0"
      },
      {
```

```
        "rank": 2,
        "name": "ceph-server03",
        "addr": "192.168.10.243:6789/0"
      }
    ]
  }
}
```

```
[root@ceph-server01 ~]# ceph quorum_status --format json-pretty
```

```
{
    "election_epoch": 28,
    "quorum": [
        0,
        1,
        2
    ],
    "quorum_names": [
        "ceph-server01",
        "ceph-server02",
        "ceph-server03"
    ],
    "quorum_leader_name": "ceph-server01",
    "monmap": {
        "epoch": 3,
        "fsid": "4d00630f-ff91-4bf0-b7e1-fe9f616753ea",
        "modified": "2018-07-11 17:15:19.056801",
```

```
        "created": "2018-07-11 17:12:15.929639",
        "mons": [
            {
                "rank": 0,
                "name": "ceph-server01",
                "addr": "192.168.10.241:6789\/0"
            },
            {
                "rank": 1,
                "name": "ceph-server02",
                "addr": "192.168.10.242:6789\/0"
            },
            {
                "rank": 2,
                "name": "ceph-server03",
                "addr": "192.168.10.243:6789\/0"
            }
        ]
    }
}
```


85. We use command to scan newly added SCSI disks without rebooting server: (executed on all Ceph storage server nodes)

```
[root@ceph-server01 ~]# grep mpt /sys/class/scsi_host/host?/proc_name
/sys/class/scsi_host/host0/proc_name:mptspi

[root@ceph-server01 ~]# echo "- - -" > /sys/class/scsi_host/host0/scan
```

86. After scanning newly added SCSI disks, we use command to list them: (executed on all Ceph storage server nodes)

```
[root@ceph-server01 ~]# lsblk
NAME            MAJ:MIN RM  SIZE RO TYPE MOUNTPOINT
sda               8:0    0   32G  0 disk
├─sda1            8:1    0  400M  0 part /boot
└─sda2            8:2    0 31.6G  0 part
  ├─vg00-root   253:0    0 27.6G  0 lvm  /
  └─vg00-swap   253:1    0    4G  0 lvm  [SWAP]
sdb               8:16   0  180G  0 disk
sdc               8:32   0  180G  0 disk
sdd               8:48   0  180G  0 disk
sde               8:64   0  180G  0 disk
sr0              11:0    1  4.2G  0 rom
```

87. We change user to cephuser again to check and add OSDs to cluster: (executed on the first Ceph storage server node)

```
[root@ceph-server01 ~]# su - cephuser

[cephuser@ceph-server01 ~]$ cd cluster

[cephuser@ceph-server01 cluster]$ ceph-deploy disk list ceph-server01 ceph-server02 ceph-server03 2>&1 | grep unknown
[ceph-server01][DEBUG ] /dev/sdb other, unknown
[ceph-server01][DEBUG ] /dev/sdc other, unknown
[ceph-server01][DEBUG ] /dev/sdd other, unknown
[ceph-server01][DEBUG ] /dev/sde other, unknown
[ceph-server02][DEBUG ] /dev/sdb other, unknown
[ceph-server02][DEBUG ] /dev/sdc other, unknown
[ceph-server02][DEBUG ] /dev/sdd other, unknown
```

```
[ceph-server02][DEBUG ] /dev/sde other, unknown
[ceph-server03][DEBUG ] /dev/sdb other, unknown
[ceph-server03][DEBUG ] /dev/sdc other, unknown
[ceph-server03][DEBUG ] /dev/sdd other, unknown
[ceph-server03][DEBUG ] /dev/sde other, unknown
```

88. We use a simple command pipeline to compose command line option used by ceph-deploy command to prepare OSDs: (executed on the first Ceph storage server node)

```
[cephuser@ceph-server01 cluster]$ ceph-deploy disk list ceph-server01 ceph-server02 ceph-server03 2>&1 | grep unknown | awk -F\] '{ print $1 $3 }' | cut -c 2- | awk '{ printf( "%s:%s\n", $1, $2 ) }'
ceph-server01:/dev/sdb
ceph-server01:/dev/sdc
ceph-server01:/dev/sdd
ceph-server01:/dev/sde
ceph-server02:/dev/sdb
ceph-server02:/dev/sdc
ceph-server02:/dev/sdd
ceph-server02:/dev/sde
ceph-server03:/dev/sdb
ceph-server03:/dev/sdc
ceph-server03:/dev/sdd
ceph-server03:/dev/sde
```

89. We use “ceph-deploy disk zap” command to erase a device's partition table and contents: (executed on the first Ceph storage server node)

```
[cephuser@ceph-server01 cluster]$ for SERVER_DISKS in `ceph-deploy disk list ceph-server01 ceph-server02 ceph-server03 2>&1 | grep unknown | awk -F\] '{ print $1 $3 }' | cut -c 2- | awk '{ printf( "%s:%s\n", $1, $2 ) }'`
```

```
> do
>     ceph-deploy disk zap ${SERVER_DISKS}
> done
:::::::::
:::::::::
[ceph_deploy.conf][DEBUG ] found configuration file at: /home/cephuser/.cephdeploy.conf
[ceph_deploy.cli][INFO  ] Invoked (1.5.39): /bin/ceph-deploy disk zap ceph-server03:/dev/sde
[ceph_deploy.cli][INFO  ] ceph-deploy options:
[ceph_deploy.cli][INFO  ]  username                      : None
[ceph_deploy.cli][INFO  ]  verbose                       : False
[ceph_deploy.cli][INFO  ]  overwrite_conf                : False
[ceph_deploy.cli][INFO  ]  subcommand                    : zap
[ceph_deploy.cli][INFO  ]  quiet                         : False
[ceph_deploy.cli][INFO  ]  cd_conf                       : <ceph_deploy.conf.cephdeploy.Conf instance at 0x7fa0ee6ad680>
[ceph_deploy.cli][INFO  ]  cluster                       : ceph
[ceph_deploy.cli][INFO  ]  func                          : <function disk at 0x7fa0ee6fc500>
[ceph_deploy.cli][INFO  ]  ceph_conf                     : None
[ceph_deploy.cli][INFO  ]  default_release               : False
[ceph_deploy.cli][INFO  ]  disk                          : [('ceph-server03', '/dev/sde', None)]
[ceph_deploy.osd][DEBUG ] zapping /dev/sde on ceph-server03
[ceph-server03][DEBUG ] connection detected need for sudo
[ceph-server03][DEBUG ] connected to host: ceph-server03
[ceph-server03][DEBUG ] detect platform information from remote host
[ceph-server03][DEBUG ] detect machine type
[ceph-server03][DEBUG ] find the location of an executable
[ceph_deploy.osd][INFO  ] Distro info: CentOS Linux 7.5.1804 Core
[ceph-server03][DEBUG ] zeroing last few blocks of device
```

```
[ceph-server03][DEBUG ] find the location of an executable
[ceph-server03][INFO  ] Running command: sudo /usr/sbin/ceph-disk zap /dev/sde
[ceph-server03][DEBUG ] Creating new GPT entries.
[ceph-server03][DEBUG ] GPT data structures destroyed! You may now partition the disk using fdisk or
[ceph-server03][DEBUG ] other utilities.
[ceph-server03][DEBUG ] Creating new GPT entries.
[ceph-server03][DEBUG ] The operation has completed successfully.
```

90. We use "ceph-deploy osd prepare" command to prepare disks for Ceph OSDs: (executed on the first Ceph storage server node)

```
[cephuser@ceph-server01 cluster]$ for SERVER_DISKS in `ceph-deploy disk list ceph-server01 ceph-server02 ceph-server03 2>&1 | grep unknown | awk -F\] '{ print $1 $3 }' | cut -c 2- | awk '{ printf( "%s:%s\n", $1, $2 ) }'`
> do
>     ceph-deploy osd prepare ${SERVER_DISKS}
> done
:::::::::
:::::::::
[ceph_deploy.conf][DEBUG ] found configuration file at: /home/cephuser/.cephdeploy.conf
[ceph_deploy.cli][INFO  ] Invoked (1.5.39): /bin/ceph-deploy osd prepare ceph-server03:/dev/sde
[ceph_deploy.cli][INFO  ] ceph-deploy options:
[ceph_deploy.cli][INFO  ]  username                      : None
[ceph_deploy.cli][INFO  ]  block_db                      : None
[ceph_deploy.cli][INFO  ]  disk                          : [('ceph-server03', '/dev/sde', None)]
[ceph_deploy.cli][INFO  ]  dmcrypt                       : False
[ceph_deploy.cli][INFO  ]  verbose                       : False
[ceph_deploy.cli][INFO  ]  bluestore                     : None
[ceph_deploy.cli][INFO  ]  block_wal                     : None
[ceph_deploy.cli][INFO  ]  overwrite_conf                : False
```

```
[ceph_deploy.cli][INFO  ]  subcommand                    : prepare
[ceph_deploy.cli][INFO  ]  dmcrypt_key_dir               : /etc/ceph/dmcrypt-keys
[ceph_deploy.cli][INFO  ]  quiet                         : False
[ceph_deploy.cli][INFO  ]  cd_conf                       : <ceph_deploy.conf.cephdeploy.Conf instance at 0x7fe51c1802d8>
[ceph_deploy.cli][INFO  ]  cluster                       : ceph
[ceph_deploy.cli][INFO  ]  fs_type                       : xfs
[ceph_deploy.cli][INFO  ]  filestore                     : None
[ceph_deploy.cli][INFO  ]  func                          : <function osd at 0x7fe51c1c2488>
[ceph_deploy.cli][INFO  ]  ceph_conf                     : None
[ceph_deploy.cli][INFO  ]  default_release               : False
[ceph_deploy.cli][INFO  ]  zap_disk                      : False
[ceph_deploy.osd][DEBUG ] Preparing cluster ceph disks ceph-server03:/dev/sde:
[ceph-server03][DEBUG ] connection detected need for sudo
[ceph-server03][DEBUG ] connected to host: ceph-server03
[ceph-server03][DEBUG ] detect platform information from remote host
[ceph-server03][DEBUG ] detect machine type
[ceph-server03][DEBUG ] find the location of an executable
[ceph_deploy.osd][INFO  ] Distro info: CentOS Linux 7.5.1804 Core
[ceph_deploy.osd][DEBUG ] Deploying osd to ceph-server03
[ceph-server03][DEBUG ] write cluster configuration to /etc/ceph/{cluster}.conf
[ceph_deploy.osd][DEBUG ] Preparing host ceph-server03 disk /dev/sde journal None activate False
[ceph-server03][DEBUG ] find the location of an executable
[ceph-server03][INFO  ] Running command: sudo /usr/sbin/ceph-disk -v prepare --cluster ceph --fs-type xfs -- /dev/sde
[ceph-server03][WARNIN] command: Running command: /usr/bin/ceph-osd --cluster=ceph --show-config-value=fsid
[ceph-server03][WARNIN] command: Running command: /usr/bin/ceph-osd --check-allows-journal -i 0 --log-file $run_dir/$cluster-osd-check.log --cluster ceph --setuser ceph --setgroup ceph
[ceph-server03][WARNIN] command: Running command: /usr/bin/ceph-osd --check-wants-journal -i 0 --log-file $run_dir/$cluster-osd-check.log --
```

```
cluster ceph --setuser ceph --setgroup ceph
[ceph-server03][WARNIN] command: Running command: /usr/bin/ceph-osd --check-needs-journal -i 0 --log-file $run_dir/$cluster-osd-check.log --
cluster ceph --setuser ceph --setgroup ceph
[ceph-server03][WARNIN] get_dm_uuid: get_dm_uuid /dev/sde uuid path is /sys/dev/block/8:64/dm/uuid
[ceph-server03][WARNIN] set_type: Will colocate journal with data on /dev/sde
[ceph-server03][WARNIN] command: Running command: /usr/bin/ceph-osd --cluster=ceph --show-config-value=osd_journal_size
[ceph-server03][WARNIN] get_dm_uuid: get_dm_uuid /dev/sde uuid path is /sys/dev/block/8:64/dm/uuid
[ceph-server03][WARNIN] get_dm_uuid: get_dm_uuid /dev/sde uuid path is /sys/dev/block/8:64/dm/uuid
[ceph-server03][WARNIN] get_dm_uuid: get_dm_uuid /dev/sde uuid path is /sys/dev/block/8:64/dm/uuid
[ceph-server03][WARNIN] command: Running command: /usr/bin/ceph-conf --cluster=ceph --name=osd. --lookup osd_mkfs_options_xfs
[ceph-server03][WARNIN] command: Running command: /usr/bin/ceph-conf --cluster=ceph --name=osd. --lookup osd_fs_mkfs_options_xfs
[ceph-server03][WARNIN] command: Running command: /usr/bin/ceph-conf --cluster=ceph --name=osd. --lookup osd_mount_options_xfs
[ceph-server03][WARNIN] command: Running command: /usr/bin/ceph-conf --cluster=ceph --name=osd. --lookup osd_fs_mount_options_xfs
[ceph-server03][WARNIN] get_dm_uuid: get_dm_uuid /dev/sde uuid path is /sys/dev/block/8:64/dm/uuid
[ceph-server03][WARNIN] get_dm_uuid: get_dm_uuid /dev/sde uuid path is /sys/dev/block/8:64/dm/uuid
[ceph-server03][WARNIN] ptype_tobe_for_name: name = journal
[ceph-server03][WARNIN] get_dm_uuid: get_dm_uuid /dev/sde uuid path is /sys/dev/block/8:64/dm/uuid
[ceph-server03][WARNIN] create_partition: Creating journal partition num 2 size 5120 on /dev/sde
[ceph-server03][WARNIN] command_check_call: Running command: /sbin/sgdisk --new=2:0:+5120M --change-name=2:ceph journal --partition-
guid=2:564443ce-a09f-4ad4-a745-d44accd7d96e --typecode=2:45b0969e-9b03-4f30-b4c6-b4b80ceff106 --mbrtogpt -- /dev/sde
[ceph-server03][DEBUG ] The operation has completed successfully.
[ceph-server03][WARNIN] update_partition: Calling partprobe on created device /dev/sde
[ceph-server03][WARNIN] command_check_call: Running command: /usr/bin/udevadm settle --timeout=600
[ceph-server03][WARNIN] command: Running command: /usr/bin/flock -s /dev/sde /sbin/partprobe /dev/sde
[ceph-server03][WARNIN] command_check_call: Running command: /usr/bin/udevadm settle --timeout=600
[ceph-server03][WARNIN] get_dm_uuid: get_dm_uuid /dev/sde uuid path is /sys/dev/block/8:64/dm/uuid
[ceph-server03][WARNIN] get_dm_uuid: get_dm_uuid /dev/sde uuid path is /sys/dev/block/8:64/dm/uuid
```

```
[ceph-server03][WARNIN] get_dm_uuid: get_dm_uuid /dev/sde2 uuid path is /sys/dev/block/8:66/dm/uuid
[ceph-server03][WARNIN] prepare_device: Journal is GPT partition /dev/disk/by-partuuid/564443ce-a09f-4ad4-a745-d44accd7d96e
[ceph-server03][WARNIN] prepare_device: Journal is GPT partition /dev/disk/by-partuuid/564443ce-a09f-4ad4-a745-d44accd7d96e
[ceph-server03][WARNIN] get_dm_uuid: get_dm_uuid /dev/sde uuid path is /sys/dev/block/8:64/dm/uuid
[ceph-server03][WARNIN] set_data_partition: Creating osd partition on /dev/sde
[ceph-server03][WARNIN] get_dm_uuid: get_dm_uuid /dev/sde uuid path is /sys/dev/block/8:64/dm/uuid
[ceph-server03][WARNIN] ptype_tobe_for_name: name = data
[ceph-server03][WARNIN] get_dm_uuid: get_dm_uuid /dev/sde uuid path is /sys/dev/block/8:64/dm/uuid
[ceph-server03][WARNIN] create_partition: Creating data partition num 1 size 0 on /dev/sde
[ceph-server03][WARNIN] command_check_call: Running command: /sbin/sgdisk --largest-new=1 --change-name=1:ceph data --partition-
guid=1:51efd095-73d1-46ee-b8ed-23492fadf339 --typecode=1:89c57f98-2fe5-4dc0-89c1-f3ad0ceff2be --mbrtogpt -- /dev/sde
[ceph-server03][DEBUG ] The operation has completed successfully.
[ceph-server03][WARNIN] update_partition: Calling partprobe on created device /dev/sde
[ceph-server03][WARNIN] command_check_call: Running command: /usr/bin/udevadm settle --timeout=600
[ceph-server03][WARNIN] command: Running command: /usr/bin/flock -s /dev/sde /sbin/partprobe /dev/sde
[ceph-server03][WARNIN] command_check_call: Running command: /usr/bin/udevadm settle --timeout=600
[ceph-server03][WARNIN] get_dm_uuid: get_dm_uuid /dev/sde uuid path is /sys/dev/block/8:64/dm/uuid
[ceph-server03][WARNIN] get_dm_uuid: get_dm_uuid /dev/sde uuid path is /sys/dev/block/8:64/dm/uuid
[ceph-server03][WARNIN] get_dm_uuid: get_dm_uuid /dev/sde1 uuid path is /sys/dev/block/8:65/dm/uuid
[ceph-server03][WARNIN] populate_data_path_device: Creating xfs fs on /dev/sde1
[ceph-server03][WARNIN] command_check_call: Running command: /sbin/mkfs -t xfs -f -i size=2048 -- /dev/sde1
[ceph-server03][DEBUG ] meta-data=/dev/sde1              isize=2048   agcount=4, agsize=11468735 blks
[ceph-server03][DEBUG ]          =                       sectsz=512   attr=2, projid32bit=1
[ceph-server03][DEBUG ]          =                       crc=1        finobt=0, sparse=0
[ceph-server03][DEBUG ] data     =                       bsize=4096   blocks=45874939, imaxpct=25
[ceph-server03][DEBUG ]          =                       sunit=0      swidth=0 blks
[ceph-server03][DEBUG ] naming   =version 2              bsize=4096   ascii-ci=0 ftype=1
```

```
[ceph-server03][DEBUG ] log      =internal log           bsize=4096   blocks=22399, version=2
[ceph-server03][DEBUG ]          =                       sectsz=512   sunit=0 blks, lazy-count=1
[ceph-server03][DEBUG ] realtime =none                   extsz=4096   blocks=0, rtextents=0
[ceph-server03][WARNIN] mount: Mounting /dev/sde1 on /var/lib/ceph/tmp/mnt.ClKHfP with options noatime,inode64
[ceph-server03][WARNIN] command_check_call: Running command: /usr/bin/mount -t xfs -o noatime,inode64 -- /dev/sde1
/var/lib/ceph/tmp/mnt.ClKHfP
[ceph-server03][WARNIN] command: Running command: /sbin/restorecon /var/lib/ceph/tmp/mnt.ClKHfP
[ceph-server03][WARNIN] populate_data_path: Preparing osd data dir /var/lib/ceph/tmp/mnt.ClKHfP
[ceph-server03][WARNIN] command: Running command: /sbin/restorecon -R /var/lib/ceph/tmp/mnt.ClKHfP/ceph_fsid.6783.tmp
[ceph-server03][WARNIN] command: Running command: /usr/bin/chown -R ceph:ceph /var/lib/ceph/tmp/mnt.ClKHfP/ceph_fsid.6783.tmp
[ceph-server03][WARNIN] command: Running command: /sbin/restorecon -R /var/lib/ceph/tmp/mnt.ClKHfP/fsid.6783.tmp
[ceph-server03][WARNIN] command: Running command: /usr/bin/chown -R ceph:ceph /var/lib/ceph/tmp/mnt.ClKHfP/fsid.6783.tmp
[ceph-server03][WARNIN] command: Running command: /sbin/restorecon -R /var/lib/ceph/tmp/mnt.ClKHfP/magic.6783.tmp
[ceph-server03][WARNIN] command: Running command: /usr/bin/chown -R ceph:ceph /var/lib/ceph/tmp/mnt.ClKHfP/magic.6783.tmp
[ceph-server03][WARNIN] command: Running command: /sbin/restorecon -R /var/lib/ceph/tmp/mnt.ClKHfP/journal_uuid.6783.tmp
[ceph-server03][WARNIN] command: Running command: /usr/bin/chown -R ceph:ceph /var/lib/ceph/tmp/mnt.ClKHfP/journal_uuid.6783.tmp
[ceph-server03][WARNIN] adjust_symlink: Creating symlink /var/lib/ceph/tmp/mnt.ClKHfP/journal -> /dev/disk/by-partuuid/564443ce-a09f-4ad4-
a745-d44accd7d96e
[ceph-server03][WARNIN] command: Running command: /sbin/restorecon -R /var/lib/ceph/tmp/mnt.ClKHfP
[ceph-server03][WARNIN] command: Running command: /usr/bin/chown -R ceph:ceph /var/lib/ceph/tmp/mnt.ClKHfP
[ceph-server03][WARNIN] unmount: Unmounting /var/lib/ceph/tmp/mnt.ClKHfP
[ceph-server03][WARNIN] command_check_call: Running command: /bin/umount -- /var/lib/ceph/tmp/mnt.ClKHfP
[ceph-server03][WARNIN] get_dm_uuid: get_dm_uuid /dev/sde uuid path is /sys/dev/block/8:64/dm/uuid
[ceph-server03][WARNIN] command_check_call: Running command: /sbin/sgdisk --typecode=1:4fbd7e29-9d25-41b8-afd0-062c0ceff05d -- /dev/sde
[ceph-server03][DEBUG ] Warning: The kernel is still using the old partition table.
[ceph-server03][DEBUG ] The new table will be used at the next reboot.
[ceph-server03][DEBUG ] The operation has completed successfully.
```

```
[ceph-server03][WARNIN] update_partition: Calling partprobe on prepared device /dev/sde
[ceph-server03][WARNIN] command_check_call: Running command: /usr/bin/udevadm settle --timeout=600
[ceph-server03][WARNIN] command: Running command: /usr/bin/flock -s /dev/sde /sbin/partprobe /dev/sde
[ceph-server03][WARNIN] command_check_call: Running command: /usr/bin/udevadm settle --timeout=600
[ceph-server03][WARNIN] command_check_call: Running command: /usr/bin/udevadm trigger --action=add --sysname-match sde1
[ceph-server03][INFO  ] checking OSD status...
[ceph-server03][DEBUG ] find the location of an executable
[ceph-server03][INFO  ] Running command: sudo /bin/ceph --cluster=ceph osd stat --format=json
[ceph_deploy.osd][DEBUG ] Host ceph-server03 is now ready for osd use.
```

91. We show Ceph cluster status: (executed on any Ceph storage server node)

```
[cephuser@ceph-server01 cluster]$ ceph status
    cluster 4d00630f-ff91-4bf0-b7e1-fe9f616753ea
     health HEALTH_WARN
            too few PGs per OSD (10 < min 30)
     monmap e3: 3 mons at {ceph-server01=192.168.10.241:6789/0,ceph-server02=192.168.10.242:6789/0,ceph-server03=192.168.10.243:6789/0}
            election epoch 36, quorum 0,1,2 ceph-server01,ceph-server02,ceph-server03
     osdmap e69: 12 osds: 12 up, 12 in
            flags sortbitwise,require_jewel_osds
      pgmap v142: 64 pgs, 1 pools, 0 bytes data, 0 objects
            1299 MB used, 2106 GB / 2107 GB avail
                  64 active+clean
```

92. We show utilization statistics, including disk usage (bytes) and object counts, over the entire system and broken down by pool: (executed on any Ceph storage server node)

```
[cephuser@ceph-server01 cluster]$ rados df
pool name                 KB      objects       clones     degraded      unfound           rd        rd KB           wr        wr KB
```

```
rbd                     0            0            0            0            0            0            0            0            0
  total used         1330912            0
  total avail     2209023584
  total space     2210354496
```

***[cephuser@ceph-server01 cluster]$ ceph-deploy disk list ceph-server01 ceph-server02 ceph-server03 2>&1 | grep 'ceph [dj]'* (executed on the first Ceph storage server node)**

```
[ceph-server01][DEBUG ]  /dev/sdb2 ceph journal, for /dev/sdb1
[ceph-server01][DEBUG ]  /dev/sdb1 ceph data, active, cluster ceph, osd.0, journal /dev/sdb2
[ceph-server01][DEBUG ]  /dev/sdc2 ceph journal, for /dev/sdc1
[ceph-server01][DEBUG ]  /dev/sdc1 ceph data, active, cluster ceph, osd.1, journal /dev/sdc2
[ceph-server01][DEBUG ]  /dev/sdd2 ceph journal, for /dev/sdd1
[ceph-server01][DEBUG ]  /dev/sdd1 ceph data, active, cluster ceph, osd.2, journal /dev/sdd2
[ceph-server01][DEBUG ]  /dev/sde2 ceph journal, for /dev/sde1
[ceph-server01][DEBUG ]  /dev/sde1 ceph data, active, cluster ceph, osd.3, journal /dev/sde2
[ceph-server02][DEBUG ]  /dev/sdb2 ceph journal, for /dev/sdb1
[ceph-server02][DEBUG ]  /dev/sdb1 ceph data, active, cluster ceph, osd.4, journal /dev/sdb2
[ceph-server02][DEBUG ]  /dev/sdc2 ceph journal, for /dev/sdc1
[ceph-server02][DEBUG ]  /dev/sdc1 ceph data, active, cluster ceph, osd.5, journal /dev/sdc2
[ceph-server02][DEBUG ]  /dev/sdd2 ceph journal, for /dev/sdd1
[ceph-server02][DEBUG ]  /dev/sdd1 ceph data, active, cluster ceph, osd.6, journal /dev/sdd2
[ceph-server02][DEBUG ]  /dev/sde2 ceph journal, for /dev/sde1
[ceph-server02][DEBUG ]  /dev/sde1 ceph data, active, cluster ceph, osd.7, journal /dev/sde2
[ceph-server03][DEBUG ]  /dev/sdb2 ceph journal, for /dev/sdb1
[ceph-server03][DEBUG ]  /dev/sdb1 ceph data, active, cluster ceph, osd.8, journal /dev/sdb2
[ceph-server03][DEBUG ]  /dev/sdc2 ceph journal, for /dev/sdc1
[ceph-server03][DEBUG ]  /dev/sdc1 ceph data, active, cluster ceph, osd.9, journal /dev/sdc2
```

```
[ceph-server03][DEBUG ]  /dev/sdd2 ceph journal, for /dev/sdd1
[ceph-server03][DEBUG ]  /dev/sdd1 ceph data, active, cluster ceph, osd.10, journal /dev/sdd2
[ceph-server03][DEBUG ]  /dev/sde2 ceph journal, for /dev/sde1
[ceph-server03][DEBUG ]  /dev/sde1 ceph data, active, cluster ceph, osd.11, journal /dev/sde2
```

***[cephuser@ceph-server01 cluster]$ lsblk* (executed on any Ceph storage server node)**

```
NAME          MAJ:MIN RM  SIZE RO TYPE MOUNTPOINT
sda             8:0    0   32G  0 disk
 ├─sda1          8:1    0  400M  0 part /boot
 └─sda2          8:2    0 31.6G  0 part
   ├─vg00-root 253:0    0 27.6G  0 lvm  /
   └─vg00-swap 253:1    0    4G  0 lvm  [SWAP]
sdb             8:16   0  180G  0 disk
 ├─sdb1          8:17   0  175G  0 part /var/lib/ceph/osd/ceph-0
 └─sdb2          8:18   0    5G  0 part
sdc             8:32   0  180G  0 disk
 ├─sdc1          8:33   0  175G  0 part /var/lib/ceph/osd/ceph-1
 └─sdc2          8:34   0    5G  0 part
sdd             8:48   0  180G  0 disk
 ├─sdd1          8:49   0  175G  0 part /var/lib/ceph/osd/ceph-2
 └─sdd2          8:50   0    5G  0 part
sde             8:64   0  180G  0 disk
 ├─sde1          8:65   0  175G  0 part /var/lib/ceph/osd/ceph-3
 └─sde2          8:66   0    5G  0 part
sr0            11:0    1  4.2G  0 rom
```

***[cephuser@ceph-server01 cluster]$ scp -pr . ceph-server02:~/cluster/* (executed on the first Ceph storage server node)**

```
ceph.bootstrap-osd.keyring                    100%  113     4.6KB/s   00:00
ceph.conf.ORIG                                100%  205    11.4KB/s   00:00
ceph.bootstrap-mgr.keyring                    100%   71    43.1KB/s   00:00
ceph.client.admin.keyring                     100%  129    71.6KB/s   00:00
ceph.bootstrap-rgw.keyring                    100%  113    74.6KB/s   00:00
ceph.bootstrap-mds.keyring                    100%  113    71.6KB/s   00:00
ceph-deploy-ceph.log                          100%  429KB   1.4MB/s   00:00
ceph.conf                                     100%  287   121.7KB/s   00:00
ceph.mon.keyring                              100%   73    41.8KB/s   00:00
```

[cephuser@ceph-server01 cluster]$ scp -pr . ceph-server03:~/cluster/ (executed on the first Ceph storage server node)

::::::::::

93. We deploy the management key to all Ceph storage nodes: (executed on the first Ceph storage server node)

[cephuser@ceph-server01 cluster]$ ceph-deploy admin ceph-server01 ceph-server02 ceph-server03

```
[ceph_deploy.conf][DEBUG ] found configuration file at: /home/cephuser/.cephdeploy.conf
[ceph_deploy.cli][INFO  ] Invoked (1.5.39): /bin/ceph-deploy admin ceph-server01 ceph-server02 ceph-server03
[ceph_deploy.cli][INFO  ] ceph-deploy options:
[ceph_deploy.cli][INFO  ]  username                      : None
[ceph_deploy.cli][INFO  ]  verbose                       : False
[ceph_deploy.cli][INFO  ]  overwrite_conf                : False
[ceph_deploy.cli][INFO  ]  quiet                         : False
[ceph_deploy.cli][INFO  ]  cd_conf                       : <ceph_deploy.conf.cephdeploy.Conf instance at 0x7efe02c723b0>
[ceph_deploy.cli][INFO  ]  cluster                       : ceph
[ceph_deploy.cli][INFO  ]  client                        : ['ceph-server01', 'ceph-server02', 'ceph-server03']
[ceph_deploy.cli][INFO  ]  func                          : <function admin at 0x7efe03d90e60>
[ceph_deploy.cli][INFO  ]  ceph_conf                     : None
```

```
[ceph_deploy.cli][INFO  ]  default_release               : False
[ceph_deploy.admin][DEBUG ] Pushing admin keys and conf to ceph-server01
[ceph-server01][DEBUG ] connection detected need for sudo
[ceph-server01][DEBUG ] connected to host: ceph-server01
[ceph-server01][DEBUG ] detect platform information from remote host
[ceph-server01][DEBUG ] detect machine type
[ceph-server01][DEBUG ] write cluster configuration to /etc/ceph/{cluster}.conf
[ceph_deploy.admin][DEBUG ] Pushing admin keys and conf to ceph-server02
[ceph-server02][DEBUG ] connection detected need for sudo
[ceph-server02][DEBUG ] connected to host: ceph-server02
[ceph-server02][DEBUG ] detect platform information from remote host
[ceph-server02][DEBUG ] detect machine type
[ceph-server02][DEBUG ] write cluster configuration to /etc/ceph/{cluster}.conf
[ceph_deploy.admin][DEBUG ] Pushing admin keys and conf to ceph-server03
[ceph-server03][DEBUG ] connection detected need for sudo
[ceph-server03][DEBUG ] connected to host: ceph-server03
[ceph-server03][DEBUG ] detect platform information from remote host
[ceph-server03][DEBUG ] detect machine type
[ceph-server03][DEBUG ] write cluster configuration to /etc/ceph/{cluster}.conf
```

94. We change permission so the management key can be read by non-root user: (executed on all Ceph storage server nodes)

```
[cephuser@ceph-server01 cluster]$ sudo chmod +r /etc/ceph/ceph.client.admin.keyring
```

95. We install some rpms for building up Ceph Dashboard – Web admin: (executed on all Ceph storage server nodes)

```
[root@ceph-server01 ~]# yum -y install httpd mod_wsgi mod_ssl git
:::::::::
Installed:
```

```
  httpd.x86_64 0:2.4.6-80.el7.centos.1      mod_ssl.x86_64 1:2.4.6-80.el7.centos.1      mod_wsgi.x86_64 0:3.4-12.el7_0

Dependency Installed:
  httpd-tools.x86_64 0:2.4.6-80.el7.centos.1

Complete!
```

96. We enable, start and check the status of httpd service: (executed on all Ceph storage server nodes)

```
[root@ceph-server01 ~]# systemctl enable httpd; systemctl start httpd; systemctl status httpd
Created symlink from /etc/systemd/system/multi-user.target.wants/httpd.service to /usr/lib/systemd/system/httpd.service.
● httpd.service - The Apache HTTP Server
   Loaded: loaded (/usr/lib/systemd/system/httpd.service; enabled; vendor preset: disabled)
   Active: active (running) since Thu 2018-07-12 22:03:21 CST; 4ms ago
     Docs: man:httpd(8)
           man:apachectl(8)
 Main PID: 3945 (httpd)
   Status: "Processing requests..."
    Tasks: 3
   CGroup: /system.slice/httpd.service
           ├─3945 /usr/sbin/httpd -DFOREGROUND
           ├─3948 /usr/sbin/httpd -DFOREGROUND
           ├─3949 /usr/sbin/httpd -DFOREGROUND
           └─3951 /usr/sbin/httpd -DFOREGROUND

Jul 12 22:03:21 ceph-server01.lab.gidanet.com.tw systemd[1]: Starting The Apache HTTP Server...
Jul 12 22:03:21 ceph-server01.lab.gidanet.com.tw systemd[1]: Started The Apache HTTP Server.
```

97. We use git command to clone (download) Ceph Dashboard: (executed on all Ceph storage server nodes)

```
[root@ceph-server01 ~]# cd /var/www/html

[root@ceph-server01 html]# git clone https://github.com/Crapworks/ceph-dash.git
Cloning into 'ceph-dash'...
remote: Counting objects: 1004, done.
remote: Total 1004 (delta 0), reused 0 (delta 0), pack-reused 1004
Receiving objects: 100% (1004/1004), 4.66 MiB | 991.00 KiB/s, done.
Resolving deltas: 100% (482/482), done.

[root@ceph-server01 html]# chown -R apache ceph-dash
```

98. We copy template and edit configuration file for Ceph Dashboard: (executed on all Ceph storage server nodes)

```
[root@ceph-server01 html]# cd ceph-dash

[root@ceph-server01 ceph-dash]# cp -p contrib/apache/cephdash /etc/httpd/conf.d/cephdash.conf

[root@ceph-server01 ceph-dash]# vi /etc/httpd/conf.d/cephdash.conf
<VirtualHost *:80>
    ServerName ceph-server01.lab.gidanet.com.tw

    RewriteEngine On
    RewriteCond %{REQUEST_URI} !^/server-status
    RewriteRule ^/?(.*) https://%{HTTP_HOST}/$1 [R,L]
</VirtualHost>

<VirtualHost *:443>
```

```
    ServerName ceph-server01.lab.gidanet.com.tw

    WSGIDaemonProcess cephdash user=apache group=apache processes=1 threads=5
    WSGIScriptAlias / /var/www/html/ceph-dash/contrib/wsgi/cephdash.wsgi
    WSGIPassAuthorization On

    SSLEngine on
    SSLCertificateFile /etc/httpd/ssl/ssl.crt
    SSLCertificateKeyFile /etc/httpd/ssl/ssl.key

    <Directory /var/www/html/ceph-dash>
        WSGIProcessGroup cephdash
        WSGIApplicationGroup %{GLOBAL}
        Order deny,allow
        Allow from all

        AuthType Basic
        AuthName "Restricted Content"
        AuthUserFile /etc/httpd/.htpasswd
        Require valid-user
    </Directory>
</VirtualHost>
```

99. We edit the default httpd configuration file: (executed on all Ceph storage server nodes)

```
[root@ceph-server01 ceph-dash]# vi /etc/httpd/conf/httpd.conf

[root@ceph-server01 ceph-dash]# grep -e ceph -e 192.168 /etc/httpd/conf/httpd.conf
```

```
Listen 192.168.10.241:80
ServerAdmin root@ceph-server01.lab.gidanet.com.tw
ServerName ceph-server01.lab.gidanet.com.tw:80

[root@ceph-server01 ceph-dash]# mkdir -p /etc/httpd/ssl/
```

100. Based on configuration, we generate two SSL files – ssl.key and ssl.crt: (executed on all Ceph storage server nodes)

```
[root@ceph-server01 ceph-dash]# openssl req -x509 -nodes -days 365 -newkey rsa:2048 \
> -keyout /etc/httpd/ssl/ssl.key -out /etc/httpd/ssl/ssl.crt
Generating a 2048 bit RSA private key
........+++
.....................................................................................................+++
writing new private key to '/etc/httpd/ssl/ssl.key'
-----
You are about to be asked to enter information that will be incorporated
into your certificate request.
What you are about to enter is what is called a Distinguished Name or a DN.
There are quite a few fields but you can leave some blank
For some fields there will be a default value,
If you enter '.', the field will be left blank.
-----
Country Name (2 letter code) [XX]:TW
State or Province Name (full name) []:Taiwan
Locality Name (eg, city) [Default City]:Taipei
Organization Name (eg, company) [Default Company Ltd]:Gidanet
Organizational Unit Name (eg, section) []:Lab
Common Name (eg, your name or your server's hostname) []:ceph-server01.lab.gidanet.com.tw
```

Email Address []:dl1963inet@outlook.com

101. We change permission for the SSL files, read/write by root only: (executed on all Ceph storage server nodes)

```
[root@ceph-server01 ceph-dash]# chmod 600 /etc/httpd/ssl/*
```

102. We create .htpasswd for basic authentication to access Ceph Dashboard: (executed on all Ceph storage server nodes)

```
[root@ceph-server01 ceph-dash]# htpasswd -c /etc/httpd/.htpasswd cephdashbd
New password: (01Ceph!qaz)
Re-type new password:
Adding password for user cephdashbd
```

103. We test configuration, restart and check the status of httpd service: (executed on all Ceph storage server nodes)

```
[root@ceph-server01 ceph-dash]# apachectl configtest
Syntax OK

[root@ceph-server01 ceph-dash]# systemctl restart httpd; systemctl status httpd
100.httpd.service - The Apache HTTP Server
   Loaded: loaded (/usr/lib/systemd/system/httpd.service; enabled; vendor preset: disabled)
   Active: active (running) since Thu 2018-07-12 22:39:02 CST; 11ms ago
     Docs: man:httpd(8)
           man:apachectl(8)
  Process: 4354 ExecStop=/bin/kill -WINCH ${MAINPID} (code=exited, status=0/SUCCESS)
 Main PID: 4361 (httpd)
   Status: "Processing requests..."
    Tasks: 14
   CGroup: /system.slice/httpd.service
           ├─4361 /usr/sbin/httpd -DFOREGROUND
```

```
           ├─4362 /usr/sbin/httpd -DFOREGROUND
           ├─4363 /usr/sbin/httpd -DFOREGROUND
           ├─4364 /usr/sbin/httpd -DFOREGROUND
           ├─4365 /usr/sbin/httpd -DFOREGROUND
           ├─4367 /usr/sbin/httpd -DFOREGROUND
           └─4368 /usr/sbin/httpd -DFOREGROUND

Jul 12 22:39:02 ceph-server01.lab.gidanet.com.tw systemd[1]: Starting The Apache HTTP Server...
Jul 12 22:39:02 ceph-server01.lab.gidanet.com.tw systemd[1]: Started The Apache HTTP Server.
```

104. We open the https port for Ceph Dashboard access: (executed on all Ceph storage server nodes)

```
[root@ceph-server01 ceph-dash]# firewall-cmd --zone=public --add-port=443/tcp --permanent
success

[root@ceph-server01 ceph-dash]# firewall-cmd --reload
success
```

105. We add two lines as below so more logging generated for trouble-shooting: (executed on all Ceph storage server nodes)

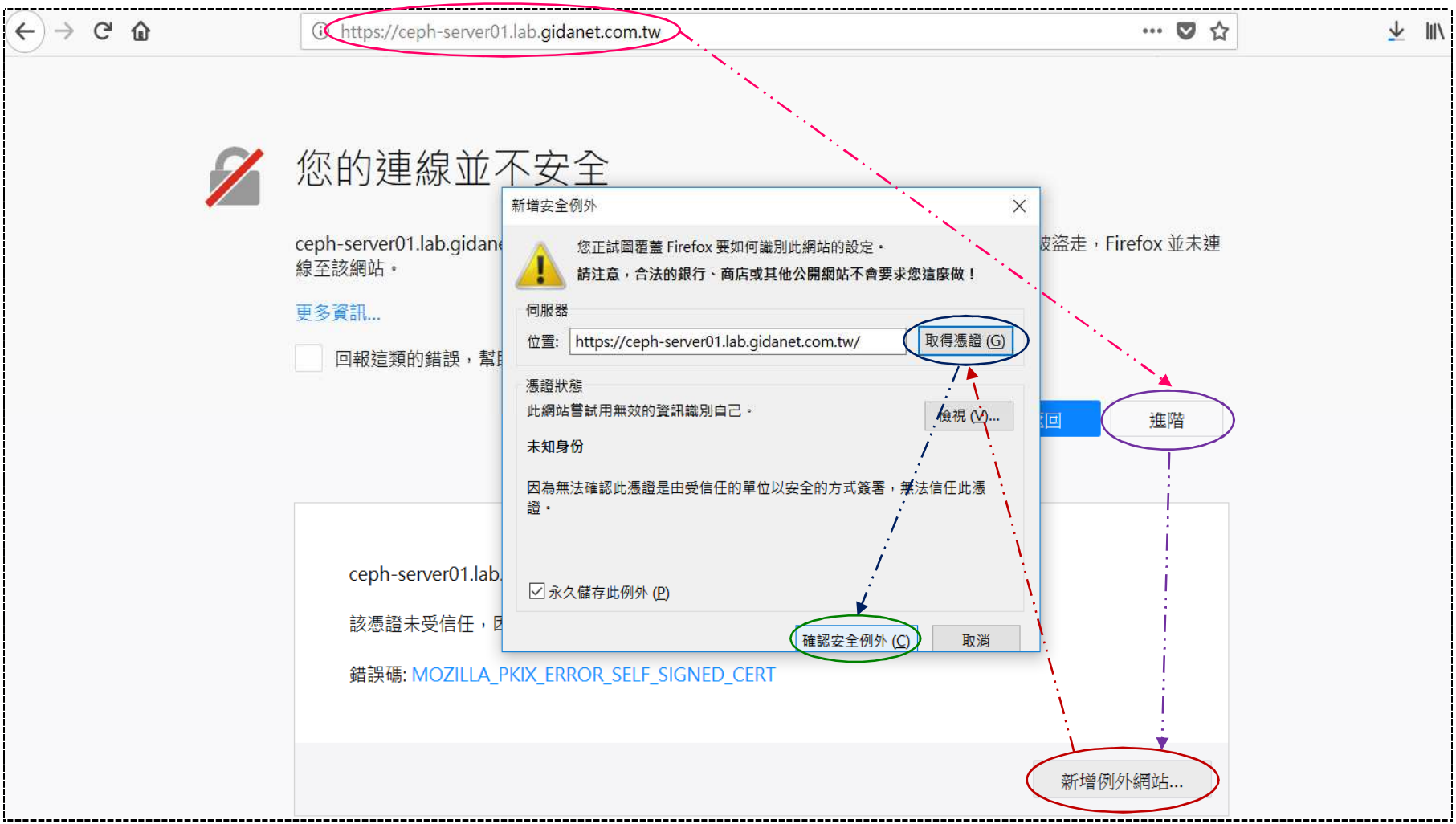
```
[root@ceph-server01 ceph-dash]# vi /var/www/html/ceph-dash/contrib/wsgi/cephdash.wsgi
:::::::::
import logging
logging.basicConfig(stream=sys.stderr)
:::::::::
```

106. We change permission so WSGI script can be executed and keyring file can be read by apache: (executed on all Ceph storage server nodes)

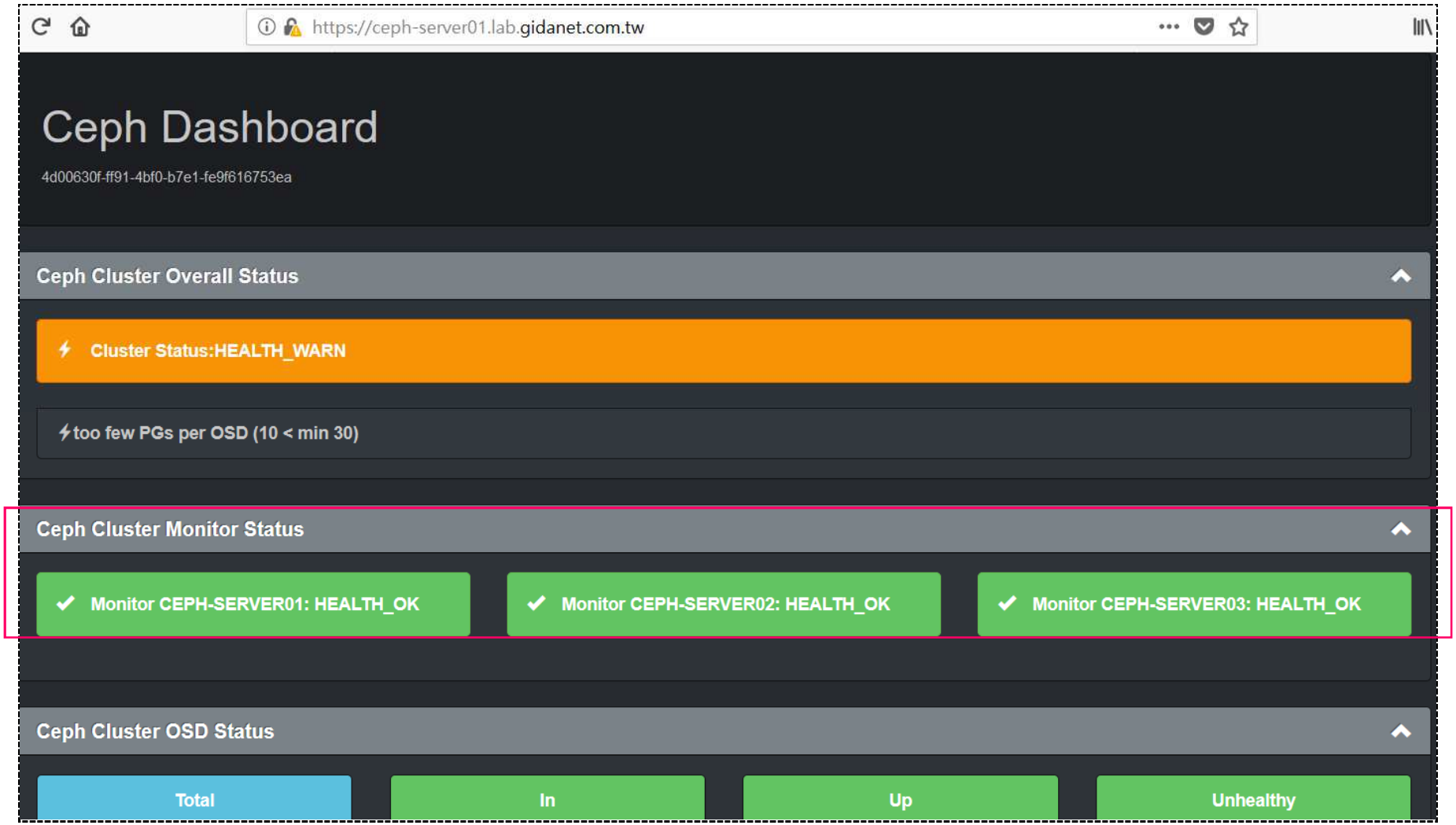
```
[root@ceph-server01 ceph-dash]# chmod +x /var/www/html/ceph-dash/contrib/wsgi/cephdash.wsgi
```

```
[root@ceph-server01 ceph-dash]# chmod +r /etc/ceph/ceph.client.admin.keyring
```

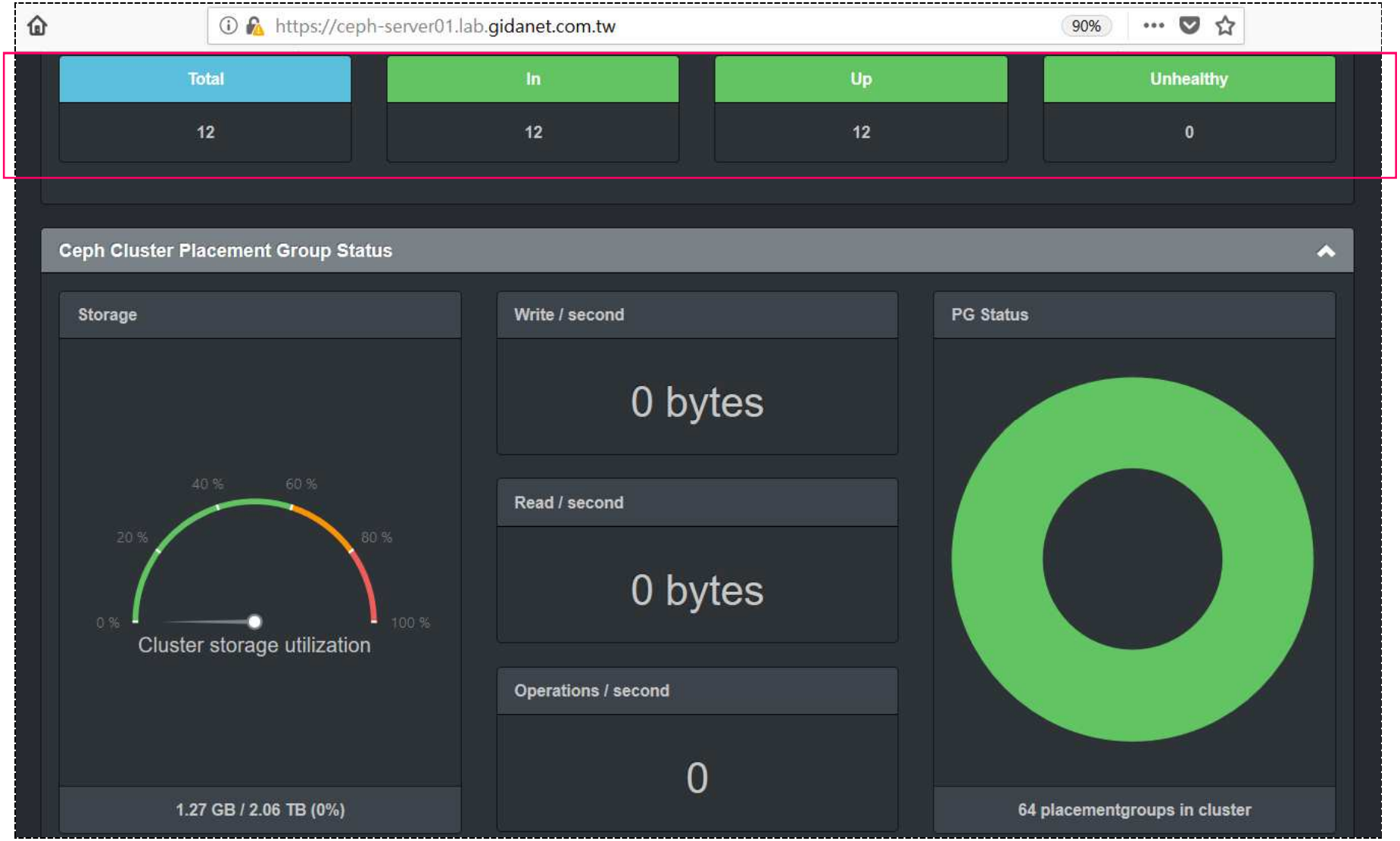
107. Then we use browser to connect the Ceph dashboard web site:



108. The Ceph cluster monitors are running well on all Ceph storage nodes:



109. The Ceph cluster OSDs are running well, too, on all Ceph storage nodes:



110. We can use curl CLI to connect dashboard web site and check the output for trouble-shooting:

[root@ceph-server01 ceph-dash]# curl -u cephdashbd:01Ceph\!qaz -k --basic https://ceph-server01.lab.gidanet.com.tw/