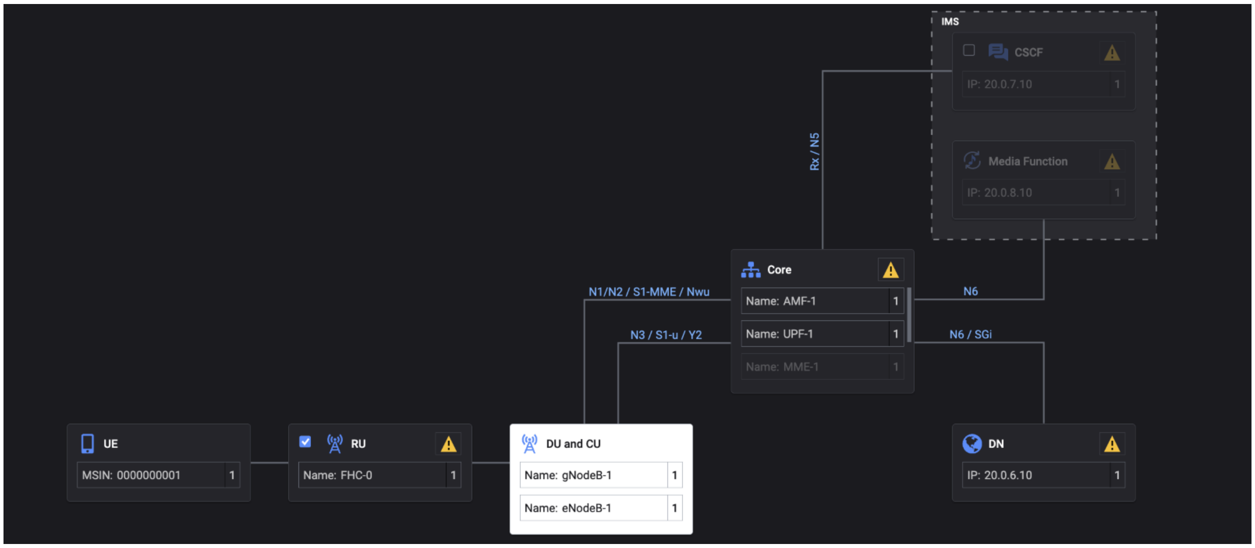
RU SIM Topology - Deployment Guide



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ORAN SIM CE Deployment Guide

For ORAN SIM CE deployment please follow instructions from document that can be downloaded from here: https://github.com/Keysight/oran-sim-ce/blob/main/Resources/Open%20RAN%20SIM%20CE%202.0/User%20Guides/ORAN_SIM_CE_DeploymentGuide.pdf

RU Agent – Deployment Guide

The purpose of this document is to describe the complete procedure needed to install and configure RuSIM on a system of generic third-party machines. This document complies with the UeSIM/RuSIM v24.0.0 release package.
RuSIM can be deployed on a system of third-party machines made of a "Control Node" and of one or more "Managed Nodes".
An Automatic Software Configurator (ASC) utility tool is provided to run on the Control Node machine and can be applied to configure either a single system-server or a cluster of system-servers indicated as Managed Nodes, where the RuSIM system will be installed.

Configure RuSIM on Linux - Overall procedure

Perform the following steps to install and configure the RuSIM emulation system.

- Install Linux OS and system software installation on the Managed Node/s, as described in Cap 1: OS and System Software Installation.
- Run ASC on the Control Node, as described in Chapter 3 “Run ASC on Control Node”
- Download from https://www.keysight.com/find/softwaremanager the following software packages on a remote system console (a generic client PC):
    - lnxlsutools_x.x-x.bsx
    - oran_mplane-x.x.x.lnx.tar.gz
    - oran_mplane_soap-x.x.x.lnx.tar.gz
    - UeSIM-vx.x-x-LNX.pbp.
    -
- For example:
    - lnxlsutools_2.6-16.bsx
    - oran_mplane-22.0.2100.lnx.tar.gz
    - oran_mplane_soap-22.0.2100.lnx.tar.gz
    - UeSIM-v24.0-88-LNX.pbp.

- From the client PC (the one used at point 3), open a Web browser to connect to the primary node.

In the address bar of the Web browser, type the IP address of the primary node machine, in the following format:
*http://IP address (*for example: *http://225.16.138.11*).
A dedicated Web GUI is shown.

- From the Web GUI:
    - select the **Packages Management\Packages Repository** tab
    - select each package to be installed (the packages downloaded at point 3)

    - for each selected package, click on the **Upload Package** button to upload the package
    - for each selected package, click on the **Install** button to install the package.
- Configure the RuSIM system to start and run the RuSIM test scenarios, as described in Chapter 4 "Configure the RUSIM"
- From the Web GUI:
    - select the **System Operations** menu
    - click on the **Start** button to start the installed software on the involved Managed Nodes.
- From the Web GUI, it is now possible to create and configure ORAN cells

1. OS and System Software Installation

1.1 HOW TO Install Linux OS

To be able to use a third-party machine to host the RuSIM emulation system, a custom ISO is provided to install Rocky Linux 9 OS and all the required software packages.

This paragraph describes how to install the custom ISO on a target machine.

1.1.1 Prerequisites

1.1.1.2 Hardware requirements

Each target machine, acting as Managed Node, where the custom ISO will be installed must fulfill a basic set of hardware requirements, listed in the following Table 1.

1.1.1.3 BIO Settings

RuSIM needs specific BIOS settings, depending on the target machine used to host the emulation system: it is required to check and update (if needed) the BIOS settings of each machine used as Managed Node.

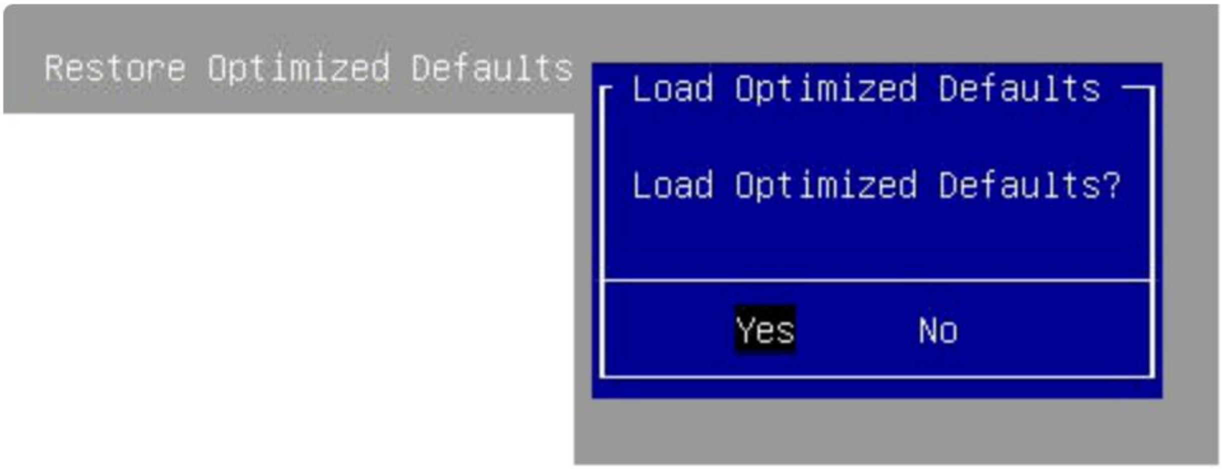
1.1.1.3.1 56 Cores Equipment

BIOS Settings configuration required for the following machine: Supermicro 56c – BIOS Version 3.1a [2019/10/16].

NOTE: it is required to load the following Supermicro default settings, before applying further BIOS settings.

From the BIOS **Save & Exit** menu, set:

- Restore Optimized Defaults
    - Load Optimized Defaults?
        - Yes



Restore Optimized Defaults

Load Optimized Defaults

Load Optimized Defaults?

Yes No

Then apply the following BIOS settings:

```
Advanced
    Boot Feature
            Quiet Boot → Disabled
            Wait For “F1” If Error → Disabled
            Restore on AC Power Loss → Power On
    CPU Configuration
            Hyper-Threading [ALL] → Disable
            Intel Virtualization Technology
                      LINUX → Enabled
            LLC Prefetch → Enable
            Advanced Power Management Configuration
                Power Technology → Custom
                Power Performance Tuning
                        LINUX → OS Controls EPB
                Energy Performance BIAS Settings → Max Performance w
                Hardware PM State Control
                    Hardware P-States → Native Mode with No Legacy Support
                CPU C State Control
                    CPU C6 report → Disable
                    Enhanced Halt State (C1E) → Disable
                Package C State Control
                    Package C State → C0/C1 state
                CPU T State Control
                    Software Controlled T-states → Disable
    Chipset Configuration
            North Bridge
                UPI Configuration
                    Link L0p Enable → Disable
                    Link L1 Enable → Disable
                    XPT Prefetch → Enable
                    Stale AtoS → Enable
                    LLC Dead Line Alloc → Disable
                Memory Configuration
                    PPR Type → Auto
                    Memory RAS Configuration
                        Correctable Error Threshold → 100
```

```
                         Intel Run Sure → Disable
                         Patrol Scrub → Disable
                IIO Configuration
                     Intel VT for Directed I/O (VT-d)
                         Intel VT for Directed I/O (VT-d)
                             LINUX: Enabled
    PCIe/PCI/PnP Configuration
            Above 4G Decoding
                   LINUX: Enabled
        SR-IOV Support
                   LINUX: Enabled
            Onboard NVME 1 OPROM → Legacy
            Onboard NVME 2 OPROM → Legacy
            Onboard LAN Device → Enable
            Onboard LAN 1 OPROM → Disabled
            Network Stack Configuration
                Network Stack à Disabled
    Super IO Configuration
            Serial Port 2 Configuration
                Serial Port → Disabled
    Serial Port Console Redirection
            COM2/SOL
            Console Redirection → Disabled
    ACPI Settings
            WHEA Support → Disabled
    Trusted Computing
            Security Device Support → Disable
IPMI
    BMC Network Configuration
            Update IPMI LAN Configuration → Yes
            IPMI LAN Selection → Dedicated
            Configuration Address source → Static
            Station IP address → 10.108.66.20
            Subnet mask → 255.255.255.0
            Gateway IP address → 10.108.66.1

Boot
    Boot Mode Select → LEGACY
    FIXED BOOT ORDER Priorities
    Boot Option #1 → USB Hard Disk
    Boot Option #2 → USB Key
    Boot Option #3 → Hard Disk: <Brand Name>
    Boot Option #4 → Disabled
    Boot Option #5 → Disabled
    Boot Option #6 → Disabled
    Boot Option #7 → Disabled
    Boot Option #8 → Disabled
    Hard Disk Drive BSS Priorities
            Boot Option #1 → [sSATA P4: <Brand Name>]
            Boot Option #2 → [sSATA P5: <Brand Name>]

    NETWORK Drive BBS Priorities
            Boot Option #1 → Disabled
            …
            Boot Option #12 → Disabled
```

1.1.1.3.2 112 Cores Equipment

BIOS Settings configuration required for the following machine: 112c – BIOS Version 3.1b [2019/10/10]

NOTE: it is required to load the following Supermicro default settings, before applying further BIOS settings.

From the BIOS **Save & Exit** menu, set:

```
    Restore Optimized Defaults
        Load Optimized Defaults?
            Yes
```

Then apply the following BIOS settings:

```
Advanced
    Boot Feature
            Quiet Boot → Disabled
            Wait For “F1” If Error → Disabled
            Restore on AC Power Loss → Power On
    CPU Configuration
            Hyper-Threading [ALL] → Disable
            Intel Virtualization Technology
                       LINUX → Enabled
            LLC Prefetch → Enable

            Advanced Power Management Configuration
                Power Technology → Custom
                Power Performance Tuning
                         LINUX → OS Controls EPB
                Energy Performance BIAS Settings → Max Performance

             Hardware PM State Control
                    Hardware P-States à Native Mode with No Legacy Support
                CPU C State Control
                    CPU C6 report → Disable
                    Enhanced Halt State (C1E) → Disable
                Package C State Control
                    Package C State → C0/C1 state
                CPU T State Control
                    Software Controlled T-states → Disable

     Chipset Configuration
            North Bridge
                UPI Configuration
                    Link L0p Enable → Disable
                    Link L1 Enable → Disable
                    XPT Prefetch → Enable
                    Stale AtoS → Enable
                    LLC Dead Line Alloc → Disable

                Memory Configuration
                    Memory RAS Configuration
                      ( !! out of sequence changes !! )
                        ADDDC Sparing → Disable

                        Intel Run Sure → Disable
                        Patrol Scrub → Disable
                IIO Configuration
                    Intel VT for Directed I/O (VT-d)
                        Intel VT for Directed I/O (VT-d)
                            LINUX: Enabled

                    IIO-PCIE Express Global Options
                        PCIe Hot Plug → Disable

    PCIe/PCI/PnP Configuration
            Above 4G Decoding
                      LINUX: Enabled

            SR-IOV Support
                      LINUX: Enabled
            Network Stack Configuration
                Network Stack → Disabled

    Super IO Configuration
            Serial Port 2 Configuration
                Serial Port → Disabled

    Serial Port Console Redirection
            COM2/SOL
            Console Redirection → Disabled

    ACPI Settings
            WHEA Support → Disabled

    Trusted Computing
            Security Device Support → Disable


IPMI
    BMC Network Configuration
            Update IPMI LAN Configuration → Yes
            IPMI LAN Selection → Dedicated
            Configuration Address source → Static
            Station IP address → 10.108.66.20
            Subnet mask → 255.255.255.0
            Gateway IP address → 10.108.66.1


Boot

    Boot Mode Select → LEGACY

    FIXED BOOT ORDER Priorities
    Boot Option #1 → USB Hard Disk
    Boot Option #2 → USB Key
    Boot Option #3 → Hard Disk: <Brand Name>
    Boot Option #4 → Disabled
    Boot Option #5 → Disabled
    Boot Option #6 → Disabled
    Boot Option #7 → Disabled
    Boot Option #8 → Disabled
```

Hard Disk Drive BSS Priorities

Boot Option #1 → [sSATA P0: <Brand Name>]

Boot Option #2 → [sSATA P1: <Brand Name>]

NETWORK Drive BBS Priorities

- Boot Option #1 → Disabled
- …
- Boot Option #12 → Disabled

Table 1

Category	Requirement Name	Requirement	Comments
CPU	Number of Sockets	Minimum 1	Minimum 2 sockets preferred
	Number of cores per socket	Minimum 24	28 or 32 cores preferred
	Processor clock	Minimum 2.3GHz	
	Processor turbo mode	enabled	Bios setting OS control CPU states. DPDK should be able to enable turbo on certain specific cores (TDP)
	Memory speed	Minimum 3200	
	Memory NUMA/SUBNUMA	At least 1 numa domain per socket	No memory interleaving is allowed
	Instructions Extension	AVX-512, 2 units min	AVX2 is not recommended
System	SSD	1 drive, min 500 GB	
	DDR	128 GB	
	DMA Engines	8 engines per Numa domain. Must be dpdk supported	Can operate without but with a performance penalty
Network Interface Cards	ORAN NIC	Intel 710DA2 or 810CQDA2	minimum 1 NIC card
	Cluster NIC	Mellanox X-5	Not required in minimum configurations
	Management NIC	Minimum 1 GE management port,	Remote KVM access required

1.2 Install the ISO

The ISO is made accessible to the target machine via IPMI.

The ISO can be provided via different medias, for example via USB key, CD ROM or IPMI; in this HOW TO, let's assume:

- the ISO is installed on the target machine via IPMI
- to perform a single boot installation.

NOTE: the client PC and the target machine where the ISO will be installed must be on the same LAN (no Internet connection is needed).

Follow the procedure described below to install the custom ISO via IPMI.

1. From a client PC (it can be the Control Node), open a Web browser to connect to the target machine.

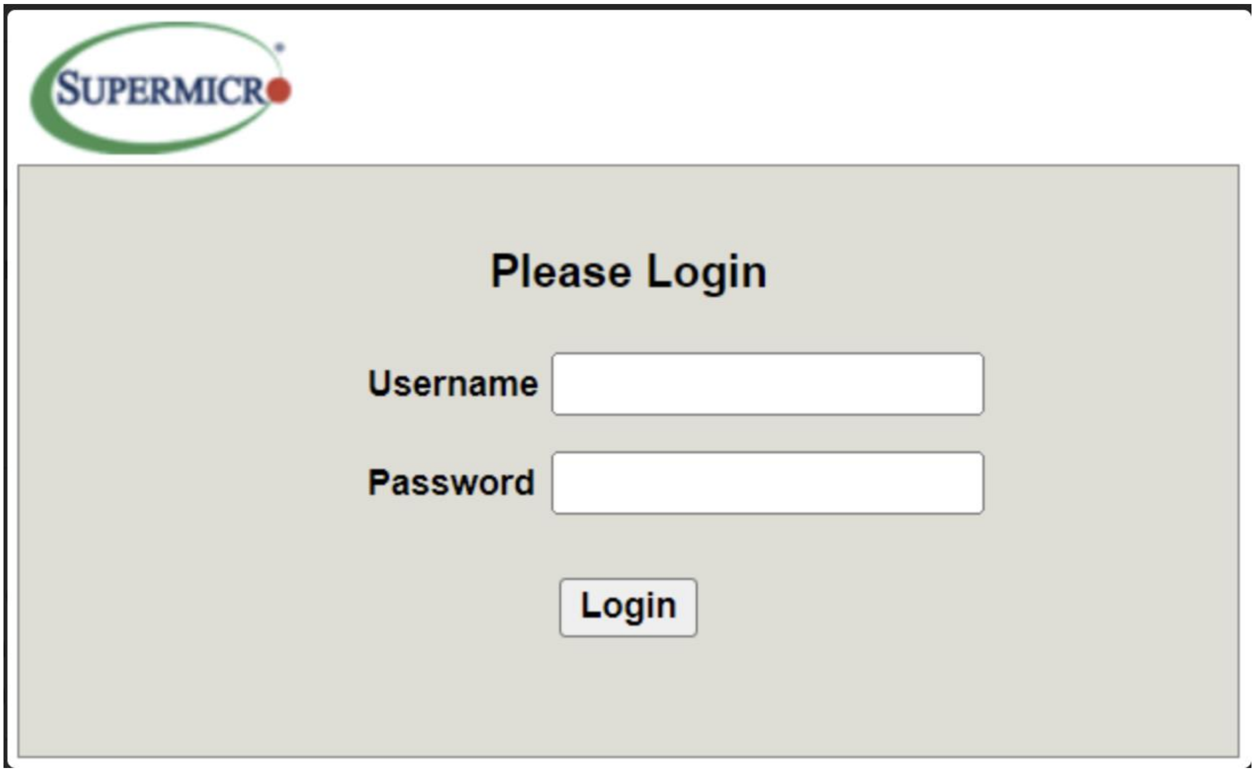
In the address bar of the Web browser, type the IPMI IP address of the target machine, in the following format:

http://IP address (for example: http://225.16.138.11).

2. Login to the IPMI console.

As an example, let's assume to log in to a Supermicro machine.

Default credentials are ADMIN/ADMIN.



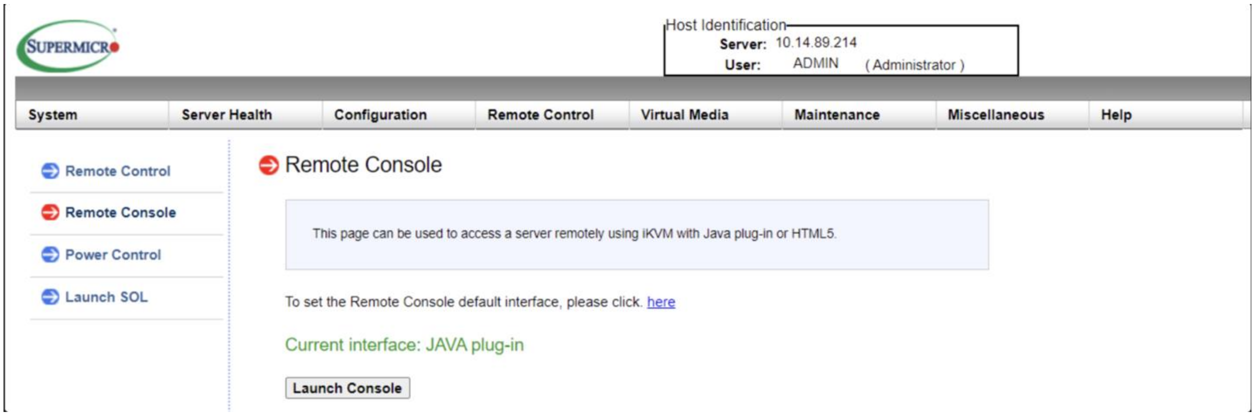
3. Open the remote console using Java plugin.

From toolbar located at the top, select the Remote Control tab (refer to the following figure).

From the menu on the left, select the Remote Console menu item:

if the current interface is Java, then click on the **Launch Console** button to download the console plugin on the client PC

if the current interface is HTML5, click on the "here" link and change it to Java.



Host Identification
Server: 10.14.89.214
User: ADMIN (Administrator)

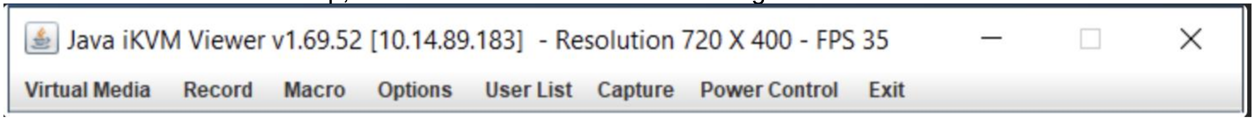
Remote Console

This page can be used to access a server remotely using iKVM with Java plug-in or HTML5.

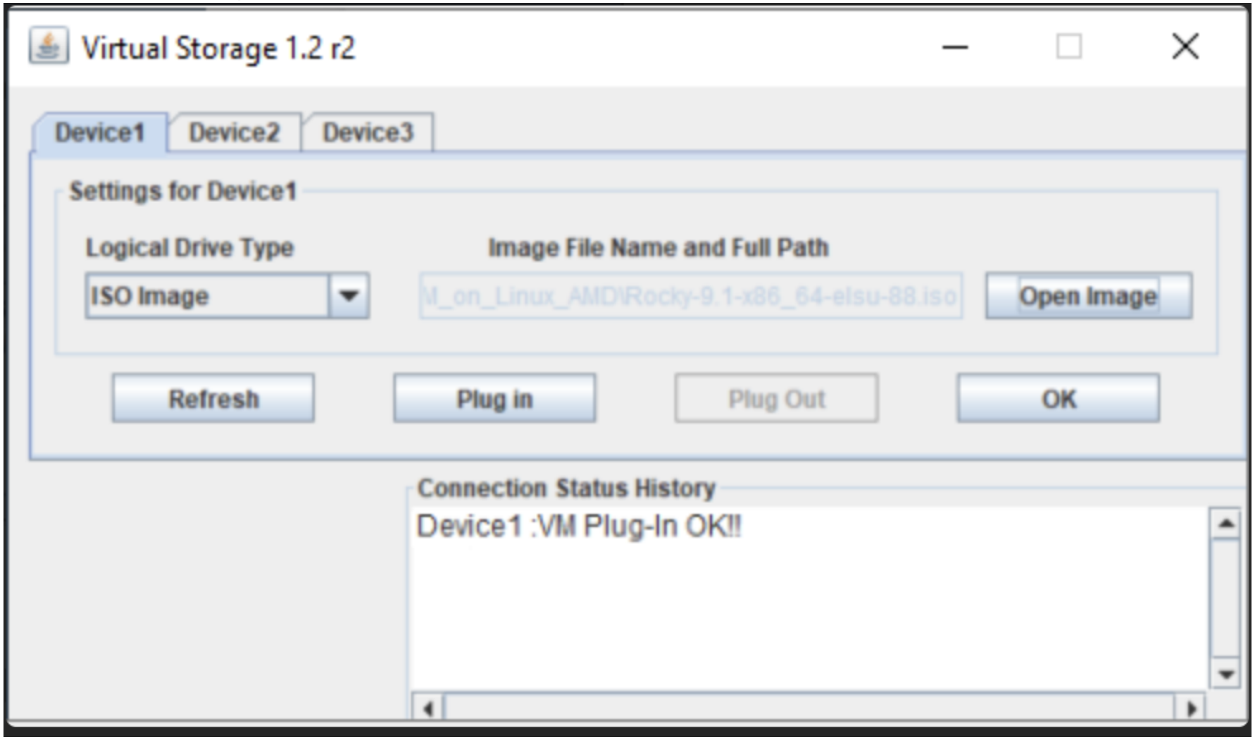
To set the Remote Console default interface, please click. here

Current interface: JAVA plug-in

4. Once Java console application has been downloaded, open it with double click.
(NOTE: To execute Java application on local PC, it is required to have Java installed on it).
The Java iKVM Viewer opens.
5. From the toolbar located at the top, chose Virtual Media\ Virtual Storage.


Java iKVM Viewer v1.69.52 [10.14.89.183] - Resolution 720 X 400 - FPS 35

The Virtual Storage window opens.


Virtual Storage 1.2 r2

Logical Drive Type: ISO Image

Image File Name and Full Path: M_on_Linux_AMD\Rocky-9.1-x86_64-elsu-88.iso

Connection Status History

Device1 :VM Plug-In OK!!

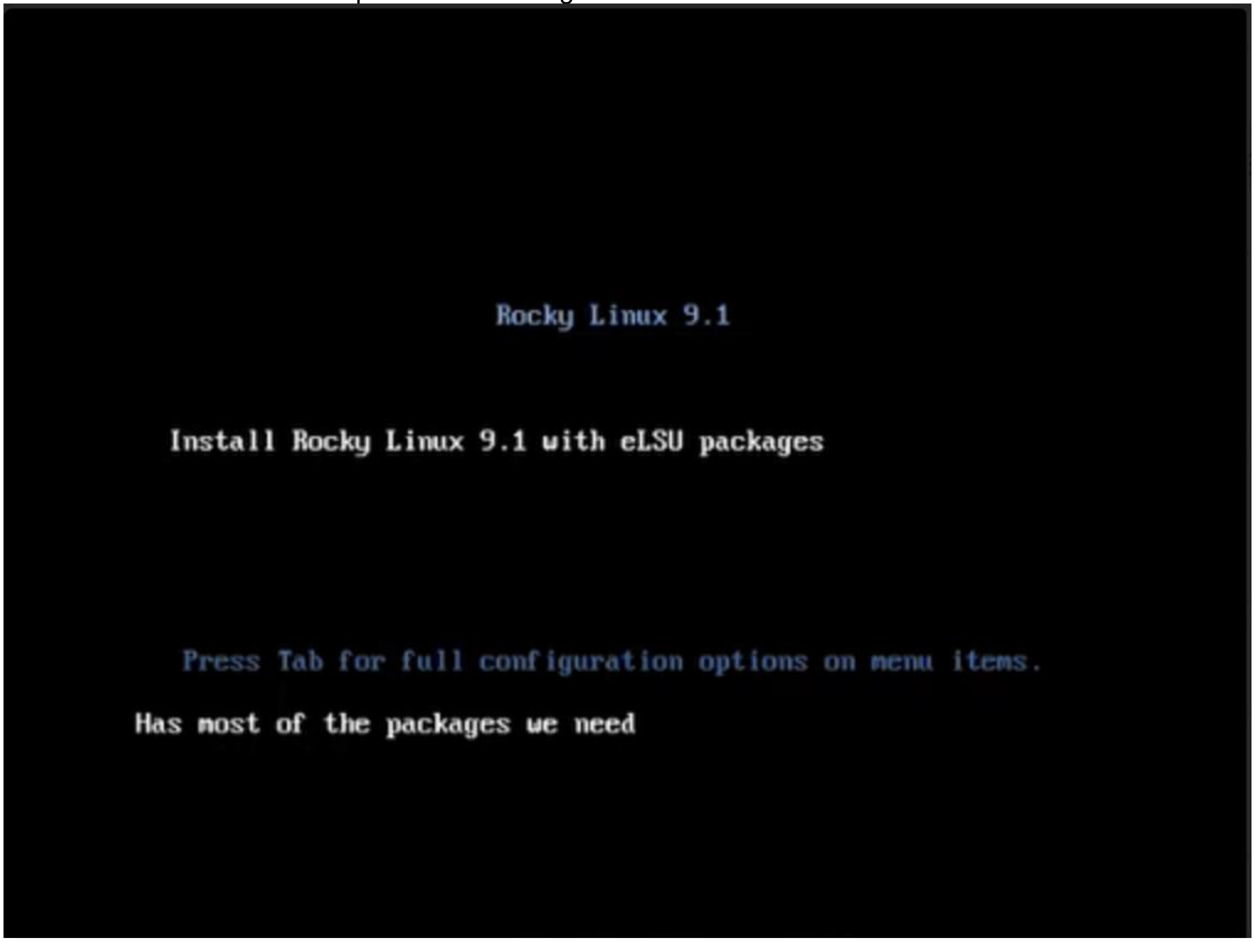
6. In the **Logical Drive Type** drop-down menu, select: ISO image
Then click on the **Open Image** button and select the custom KS rocky 9.1 ISO previously downloaded on the control PC (the ISO can be downloaded from a dedicated KSM section: ISO image OS).

7. Click on the **Plug in** button.

The machine see the ISO as a CDROM virtual driver.

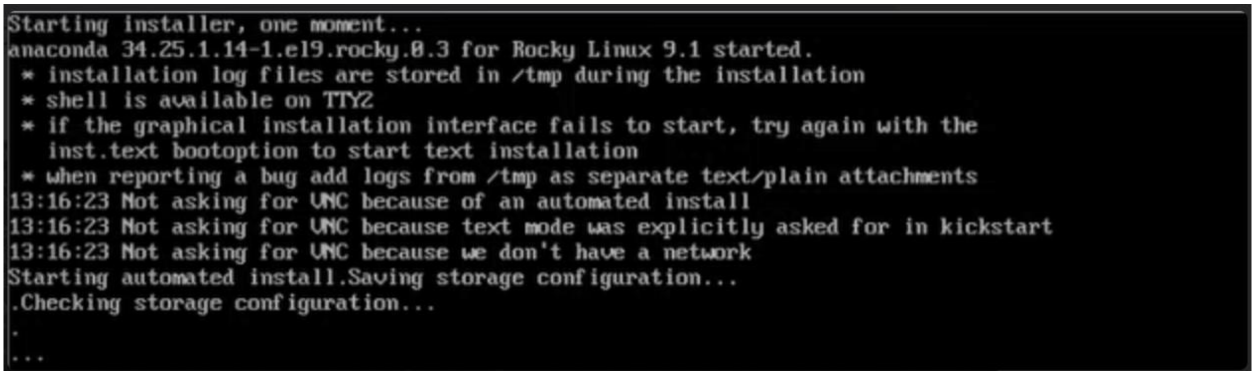
8. Boot the machine from ATEN Virtual CDROM
If the machine is not booting ATEN Virtual CDROM, please check and adjust boot options in Supermicro BIOS setting as follows:
in Boot\FIXED BOOT ORDER Priorities, set: Boot Option #1 → "ATEN Virtual CDROM"

Once the machine has booted from ATEN Virtual CDROM, follow the instructions provided on the screen.
A text-based user interface is provided to manage the installation:



```
Rocky Linux 9.1

Install Rocky Linux 9.1 with eLSU packages

Press Tab for full configuration options on menu items.
Has most of the packages we need
```

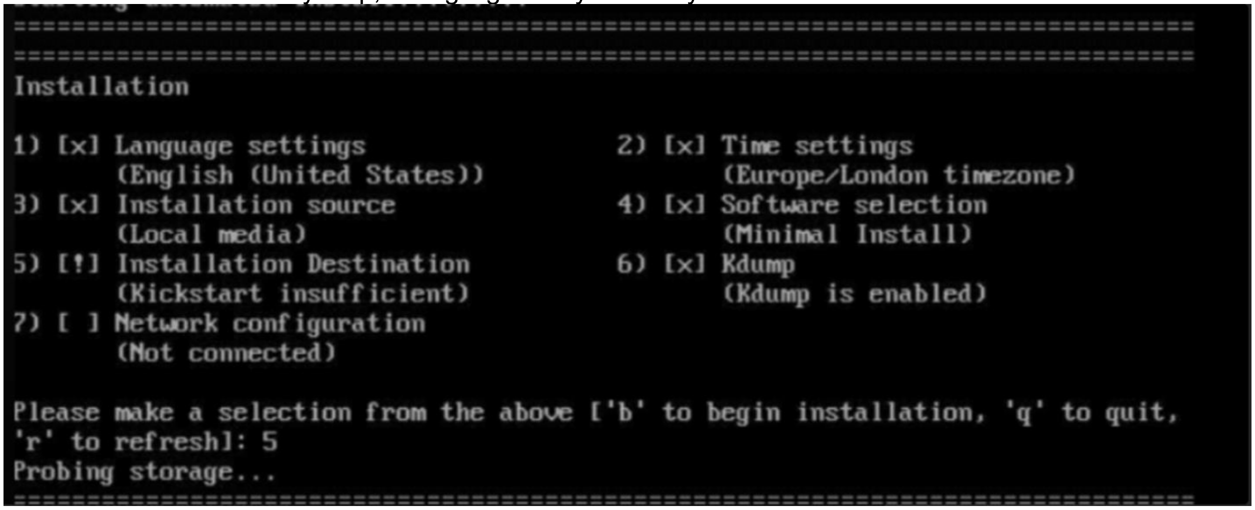
9. Select **Install Rocky Linux 9.1 with eLSU package**, then press the **Enter** key.
The installation process provides information on the installation progress:



```
Starting installer, one moment...
anaconda 34.25.1.14-1.el9.rocky.0.3 for Rocky Linux 9.1 started.
 * installation log files are stored in /tmp during the installation
 * shell is available on TTY2
 * if the graphical installation interface fails to start, try again with the
   inst.text bootoption to start text installation
 * when reporting a bug add logs from /tmp as separate text/plain attachments
13:16:23 Not asking for VNC because of an automated install
13:16:23 Not asking for VNC because text mode was explicitly asked for in kickstart
13:16:23 Not asking for VNC because we don't have a network
Starting automated install.Saving storage configuration...
.Checking storage configuration...
.
...
```

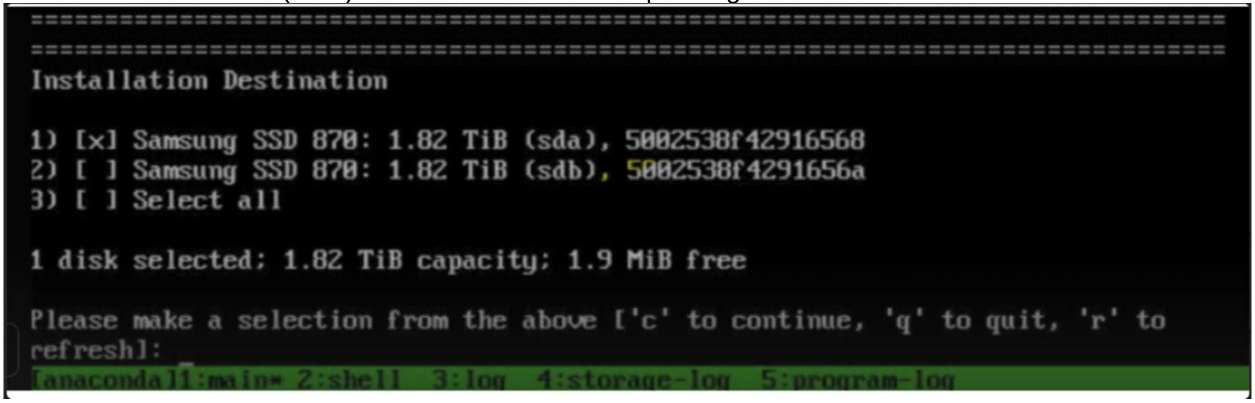
10. When asked, choose the 5 Installation Destination option to select the target installation drive: write 5 in the command shell and press enter.

NOTE: this is a mandatory step, as highlighted by the “!” symbol.



```
================================================================================
================================================================================
Installation

1) [x] Language settings                 2) [x] Time settings
       (English (United States))                (Europe/London timezone)
3) [x] Installation source               4) [x] Software selection
       (Local media)                            (Minimal Install)
5) [!] Installation Destination          6) [x] Kdump
       (Kickstart insufficient)                 (Kdump is enabled)
7) [ ] Network configuration
       (Not connected)

Please make a selection from the above ['b' to begin installation, 'q' to quit,
'r' to refresh]: 5
Probing storage...
================================================================================
```

A list of installed drives (SSD) is shown with the corresponding UUID.



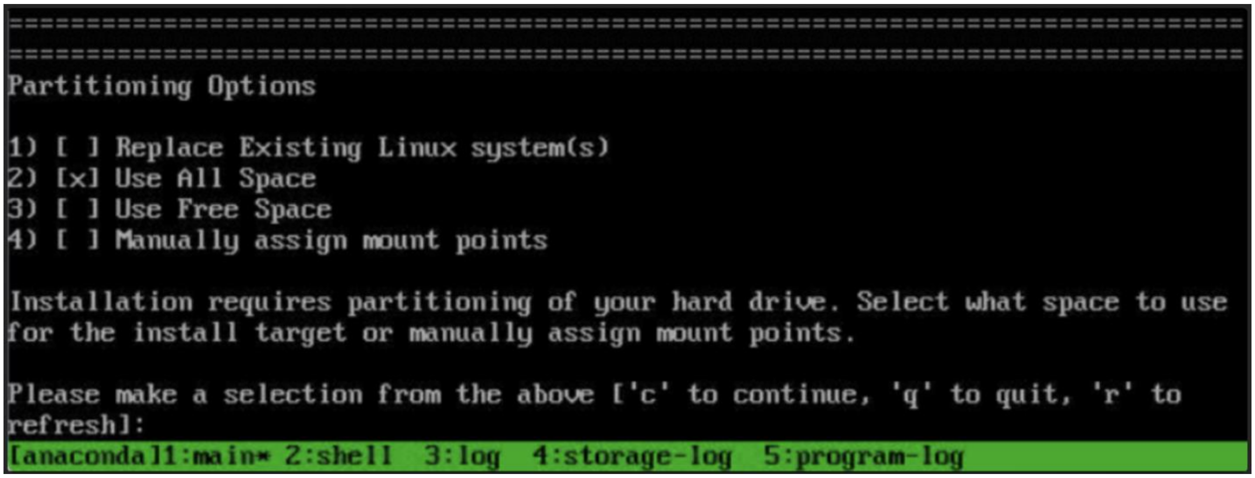
```
================================================================================
================================================================================
Installation Destination

1) [x] Samsung SSD 870: 1.82 TiB (sda), 5002538f42916568
2) [ ] Samsung SSD 870: 1.82 TiB (sdb), 5002538f4291656a
3) [ ] Select all

1 disk selected; 1.82 TiB capacity; 1.9 MiB free

Please make a selection from the above ['c' to continue, 'q' to quit, 'r' to
refresh]: _
[anaconda]1:main* 2:shell  3:log  4:storage-log  5:program-log
```

11. Select a single drive from the list in order to install the Rocky KS ISO only on one disk (don't touch the content of the second disk: it will remain free).

If at the end of the installation the system is not booting, it is possible that the machine is trying to boot starting from the wrong disk (the void one); please check and adjust boot options in Supermicro BIOS setting as follows:

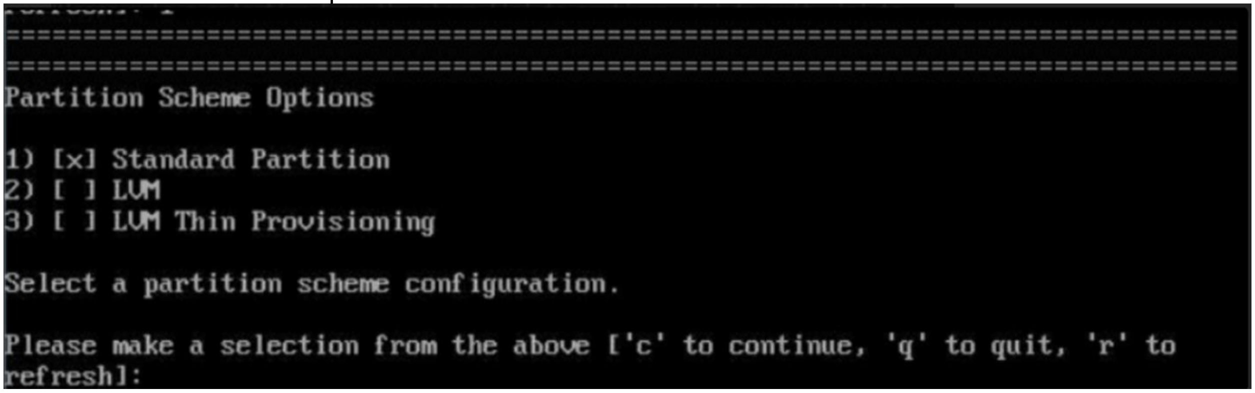
in Boot\Hard Disk Drive BSS Priorities, set the proper order of the disks.

A list of Partitioning Options is shown.



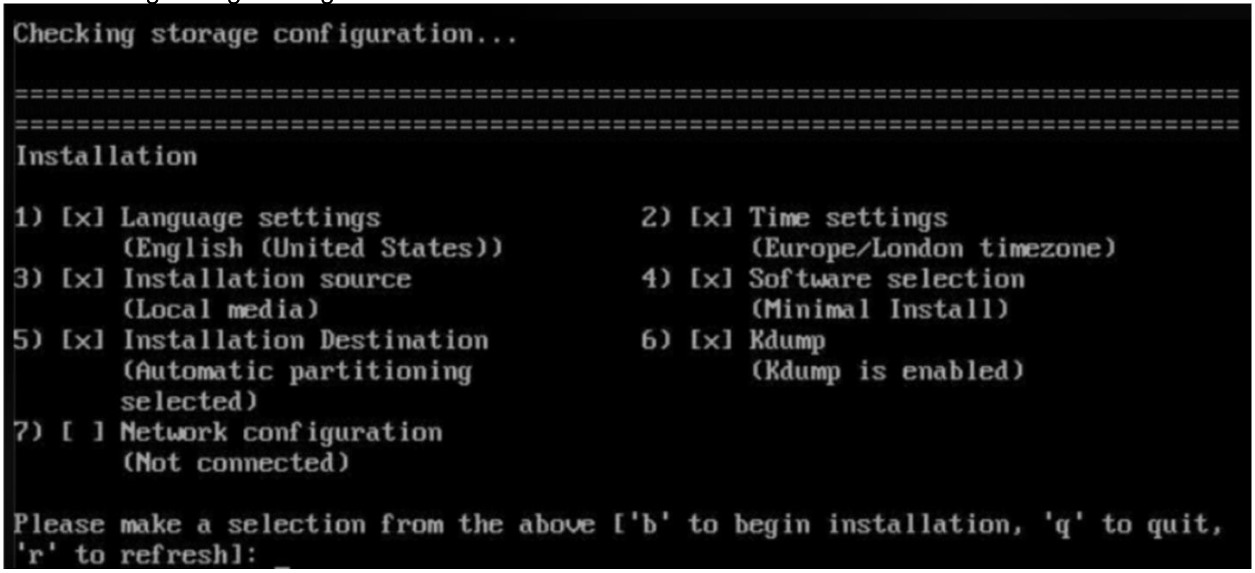
```
================================================================================
================================================================================
Partitioning Options

1) [ ] Replace Existing Linux system(s)
2) [x] Use All Space
3) [ ] Use Free Space
4) [ ] Manually assign mount points

Installation requires partitioning of your hard drive. Select what space to use
for the install target or manually assign mount points.

Please make a selection from the above ['c' to continue, 'q' to quit, 'r' to
refresh]:
[anaconda]1:main* 2:shell  3:log  4:storage-log  5:program-log
```

12. To perform a clean installation from scratch, select: Use All Space.
A list of Partition Scheme Options is shown:



```
================================================================================
================================================================================
Partition Scheme Options

1) [x] Standard Partition
2) [ ] LVM
3) [ ] LVM Thin Provisioning

Select a partition scheme configuration.

Please make a selection from the above ['c' to continue, 'q' to quit, 'r' to
refresh]:
```

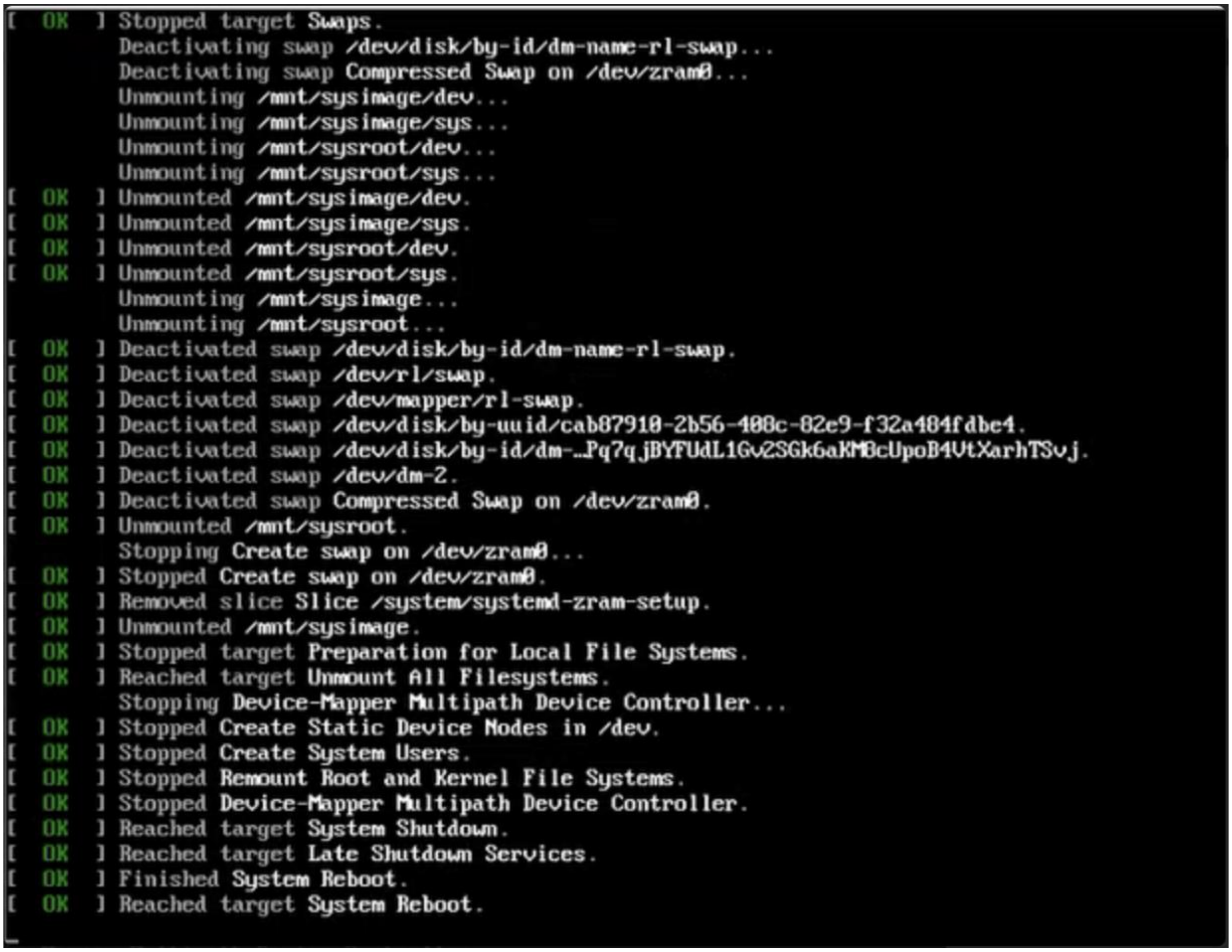
13. Select: Standard Partition.
The following storage configuration list is shown:



```
Checking storage configuration...

================================================================================
================================================================================
Installation

1) [x] Language settings                 2) [x] Time settings
       (English (United States))                (Europe/London timezone)
3) [x] Installation source               4) [x] Software selection
       (Local media)                            (Minimal Install)
5) [x] Installation Destination          6) [x] Kdump
       (Automatic partitioning                  (Kdump is enabled)
       selected)
7) [ ] Network configuration
       (Not connected)

Please make a selection from the above ['b' to begin installation, 'q' to quit,
'r' to refresh]: _
```

14. Once all the needed options have been selected, type "b + enter" to start the installation.

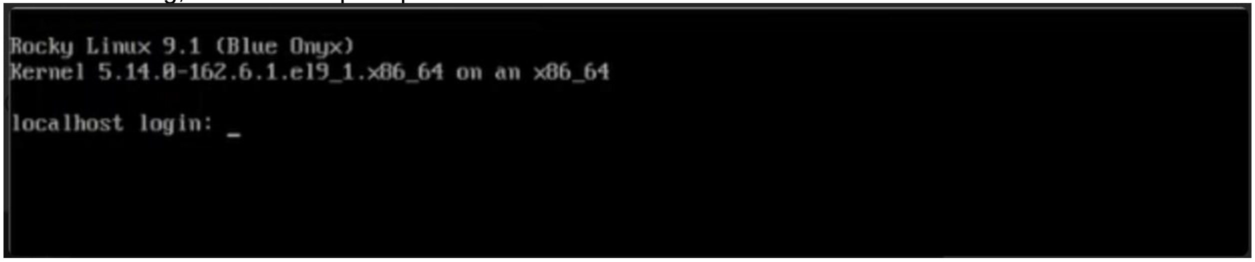
Once the installation process is complete (it may take more then 30 minutes), the machine reboots.



```
[  OK  ] Stopped target Swaps.
         Deactivating swap /dev/disk/by-id/dm-name-rl-swap...
         Deactivating swap Compressed Swap on /dev/zram0...
         Unmounting /mnt/sysimage/dev...
         Unmounting /mnt/sysimage/sys...
         Unmounting /mnt/sysroot/dev...
         Unmounting /mnt/sysroot/sys...
[  OK  ] Unmounted /mnt/sysimage/dev.
[  OK  ] Unmounted /mnt/sysimage/sys.
[  OK  ] Unmounted /mnt/sysroot/dev.
[  OK  ] Unmounted /mnt/sysroot/sys.
         Unmounting /mnt/sysimage...
         Unmounting /mnt/sysroot...
[  OK  ] Deactivated swap /dev/disk/by-id/dm-name-rl-swap.
[  OK  ] Deactivated swap /dev/rl/swap.
[  OK  ] Deactivated swap /dev/mapper/rl-swap.
[  OK  ] Deactivated swap /dev/disk/by-uuid/cab87910-2b56-408c-82e9-f32a404fdbe4.
[  OK  ] Deactivated swap /dev/disk/by-id/dm-…Pq7qjBYFUdL1Gv2SGk6aKMBcUpoB4VtXarhTSvj.
[  OK  ] Deactivated swap /dev/dm-2.
[  OK  ] Deactivated swap Compressed Swap on /dev/zram0.
[  OK  ] Unmounted /mnt/sysroot.
         Stopping Create swap on /dev/zram0...
[  OK  ] Stopped Create swap on /dev/zram0.
[  OK  ] Removed slice Slice /system/systemd-zram-setup.
[  OK  ] Unmounted /mnt/sysimage.
[  OK  ] Stopped target Preparation for Local File Systems.
[  OK  ] Reached target Unmount All Filesystems.
         Stopping Device-Mapper Multipath Device Controller...
[  OK  ] Stopped Create Static Device Nodes in /dev.
[  OK  ] Stopped Create System Users.
[  OK  ] Stopped Remount Root and Kernel File Systems.
[  OK  ] Stopped Device-Mapper Multipath Device Controller.
[  OK  ] Reached target System Shutdown.
[  OK  ] Reached target Late Shutdown Services.
[  OK  ] Finished System Reboot.
[  OK  ] Reached target System Reboot.
_
```

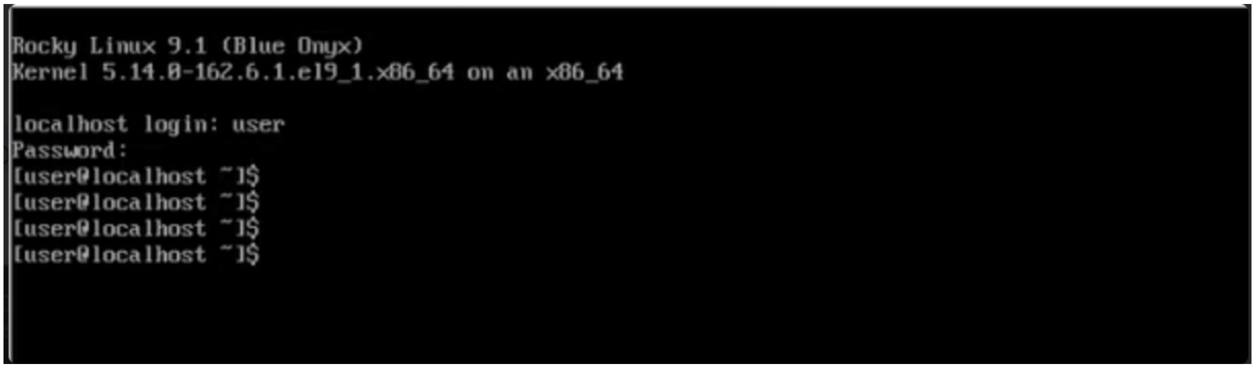
15. Once the machine has booted, chose “Plug Out” to remove the Virtual ISO.
16. Reboot your system from Linux drive.

After rebooting, a command prompt is shown:



```
Rocky Linux 9.1 (Blue Onyx)
Kernel 5.14.0-162.6.1.el9_1.x86_64 on an x86_64

localhost login: _
```

17. At first boot, login with credentials user/user into the system using IPMI remote console.



```
Rocky Linux 9.1 (Blue Onyx)
Kernel 5.14.0-162.6.1.el9_1.x86_64 on an x86_64

localhost login: user
Password:
[user@localhost ~]$
[user@localhost ~]$
[user@localhost ~]$
[user@localhost ~]$
```

1.3 Configure IP Address

It is now required to configure the IP address corresponding to the machine's O&M interface.

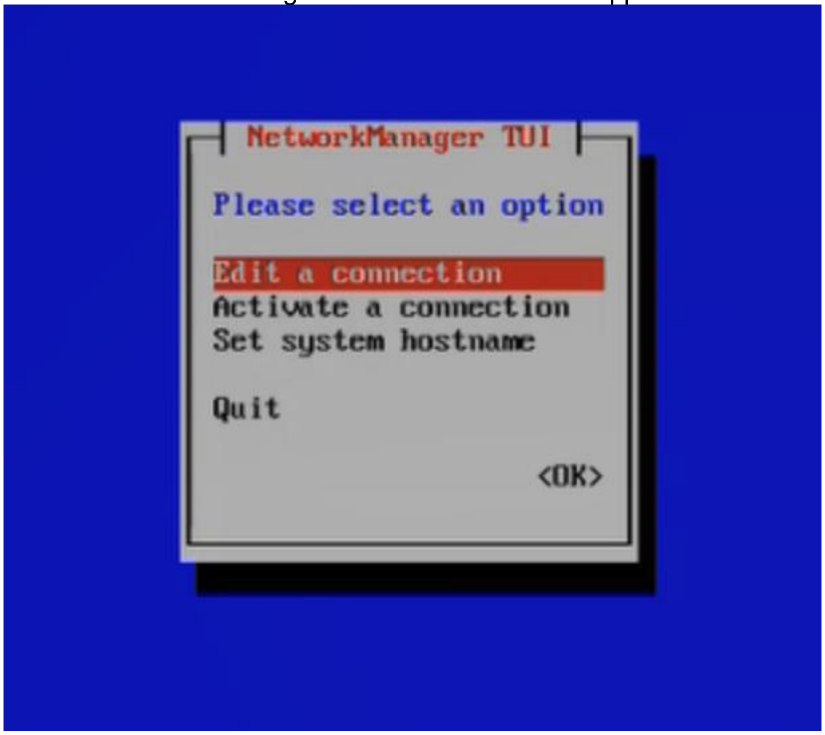
NOTE: it is required to configure an IPv4 address coherent with the customer network, so that the machine is reachable within the network. The configuration of a proper IP address is customer's responsibility.

To configure the IP address, perform the steps described below.

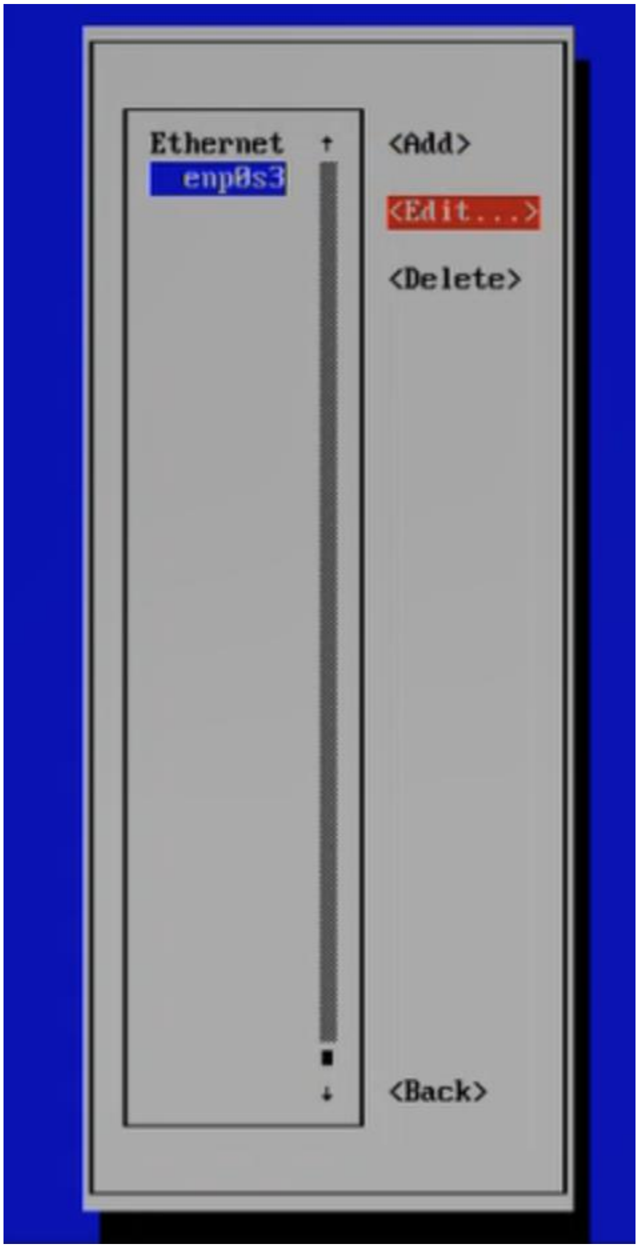
1. Launch the Network Manager Text User Interface command line tool by using the following command:

```
sudo nmtui
```

NOTE: IP address configuration via DHCP is not supported.



2. Select the **Edit a connection** menu item, then press the **Enter** key.



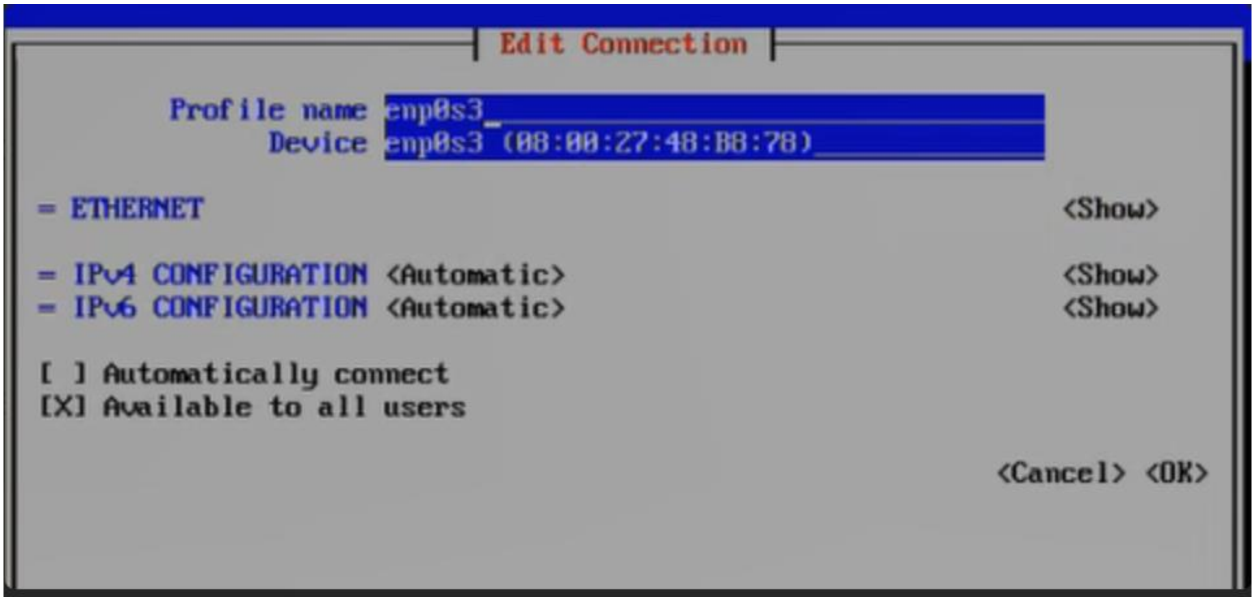
3. Select the O&M interface: the IP address will be assigned to it.

In the example shown in the figure above, only one interface is available: select enp0s3.

NOTE: it is possible that several network interfaces are available. It is required to select the O&M one: it is customer's responsibility to identify the O&M interface and to select it.

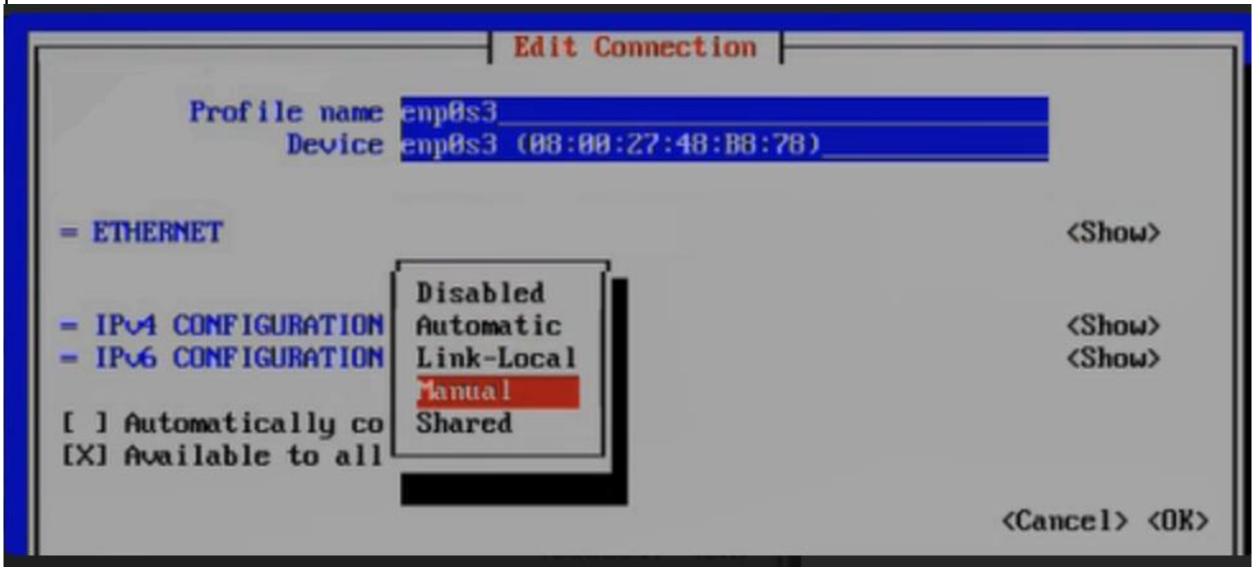
4. In the menu on the right, select the Edit menu item, then press the Enter key.

The following menu is shown:



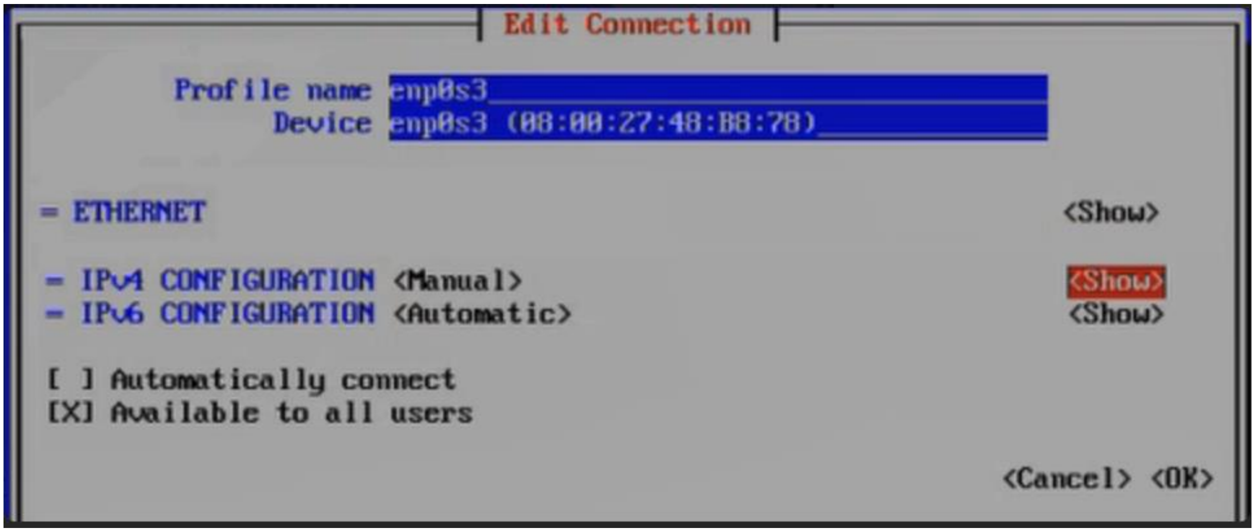
```
                         Edit Connection

       Profile name enp0s3_
             Device enp0s3 (08:00:27:48:B8:78)_

= ETHERNET                                                    <Show>

= IPv4 CONFIGURATION <Automatic>                              <Show>
= IPv6 CONFIGURATION <Automatic>                              <Show>

[ ] Automatically connect
[X] Available to all users

                                                       <Cancel> <OK>
```

5. Select the **IPv4 CONFIGURATION** menu item and set it to the Manual value, then press **Enter**:



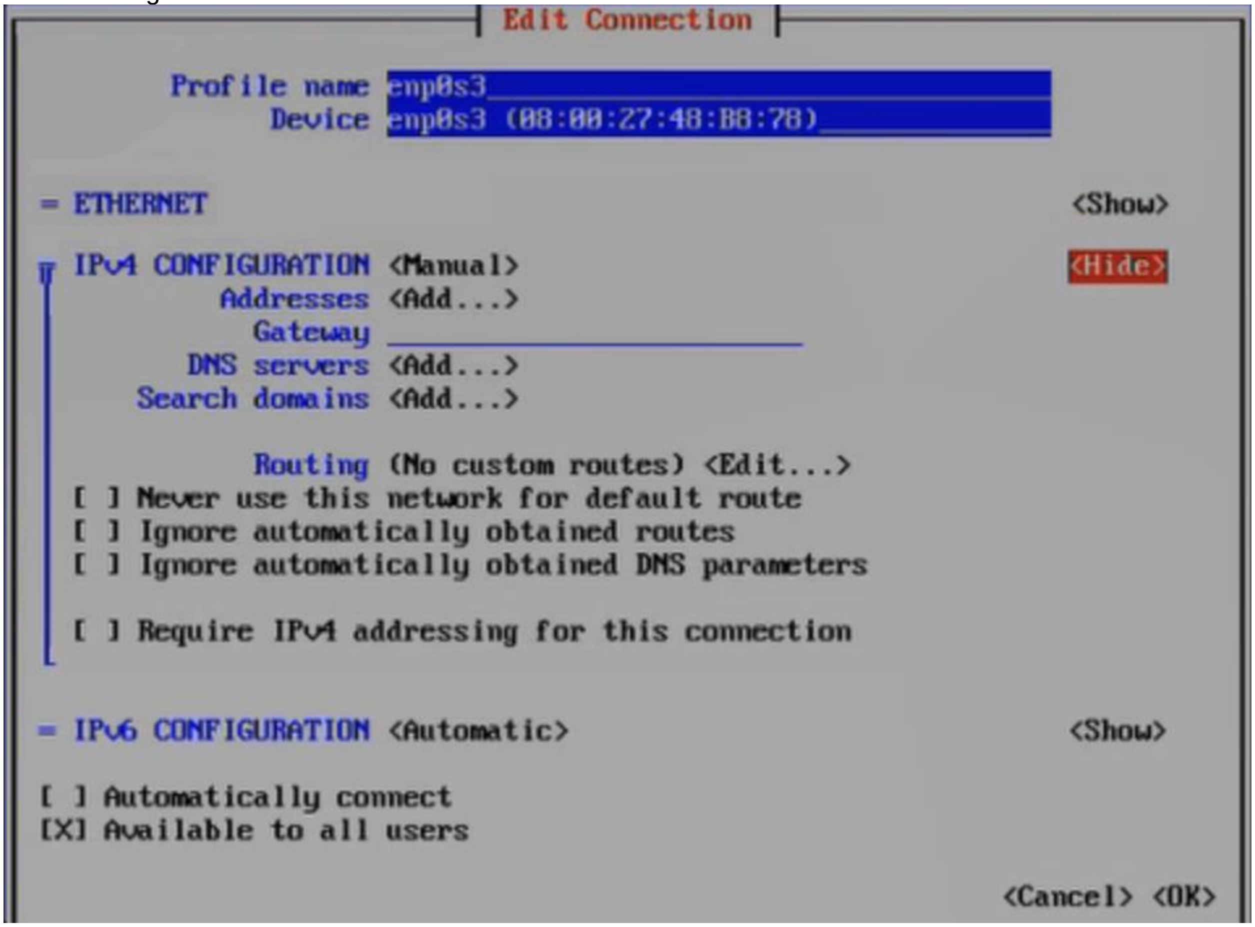
```
                         Edit Connection

       Profile name enp0s3
             Device enp0s3 (08:00:27:48:B8:78)_

= ETHERNET                                                    <Show>

                     Disabled
= IPv4 CONFIGURATION Automatic                                <Show>
= IPv6 CONFIGURATION Link-Local                               <Show>
                     Manual
[ ] Automatically co Shared
[X] Available to all

                                                       <Cancel> <OK>
```

6. Select the **Show** option, then press **Enter**:



```
                    ┤ Edit Connection ├

        Profile name enp0s3_____________________________
              Device enp0s3 (08:00:27:48:B8:78)_________

= ETHERNET                                          <Show>

= IPv4 CONFIGURATION <Manual>                       <Show>
= IPv6 CONFIGURATION <Automatic>                    <Show>

[ ] Automatically connect
[X] Available to all users

                                             <Cancel> <OK>
```

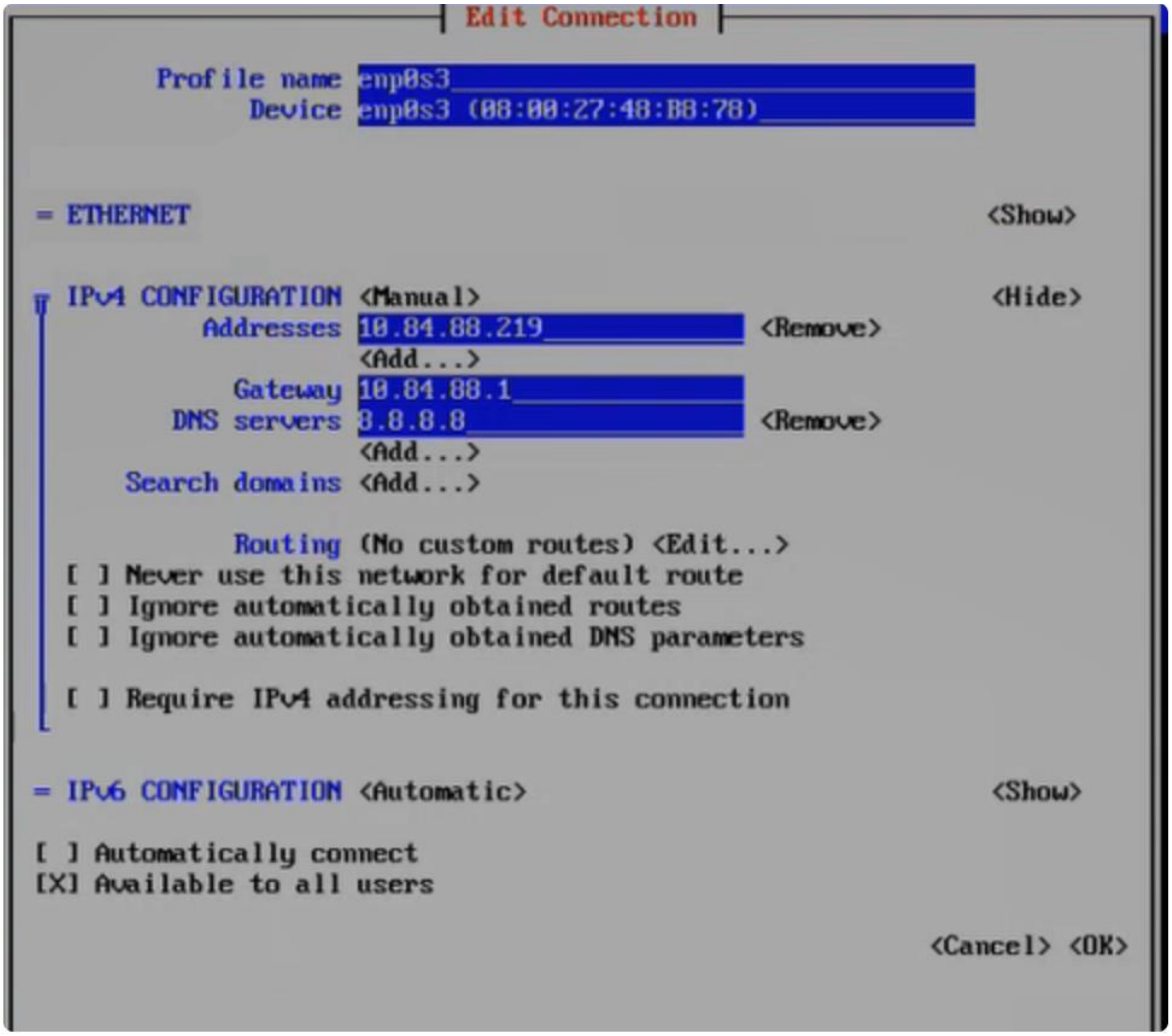
The following menu is shown:

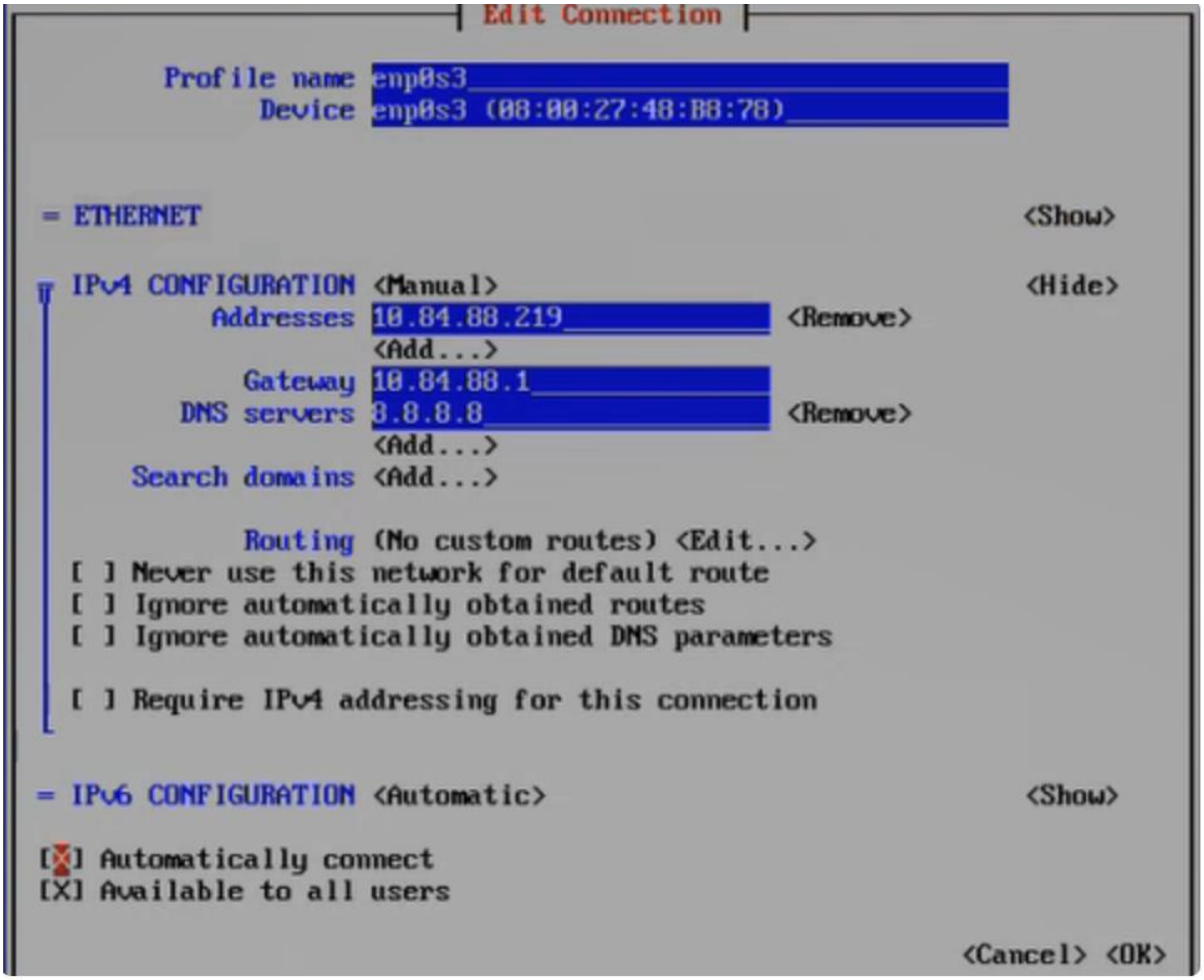


```
                    ┤ Edit Connection ├

        Profile name enp0s3_____________________________
              Device enp0s3 (08:00:27:48:B8:78)_________

= ETHERNET                                          <Show>

╤ IPv4 CONFIGURATION <Manual>                       <Hide>
│          Addresses <Add...>
│            Gateway ___________________
│        DNS servers <Add...>
│     Search domains <Add...>
│
│            Routing (No custom routes) <Edit...>
│ [ ] Never use this network for default route
│ [ ] Ignore automatically obtained routes
│ [ ] Ignore automatically obtained DNS parameters
│
│ [ ] Require IPv4 addressing for this connection
└

= IPv6 CONFIGURATION <Automatic>                    <Show>

[ ] Automatically connect
[X] Available to all users

                                             <Cancel> <OK>
```

7. Configure properly the following fields to comply with the customer's network:
   - Address
   - Gateway
   - DNS servers.

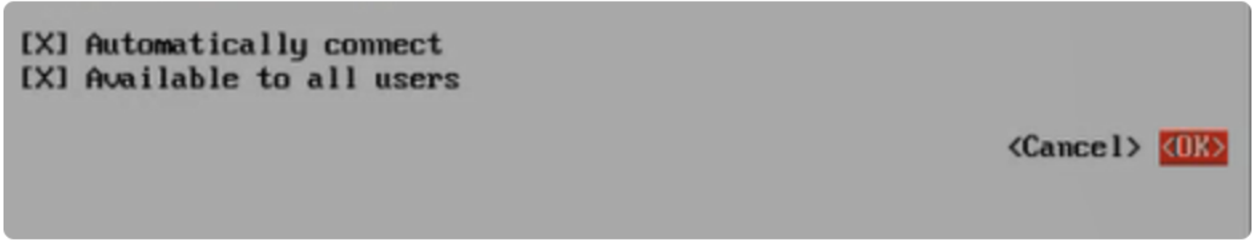
See the following figure as a configuration example.





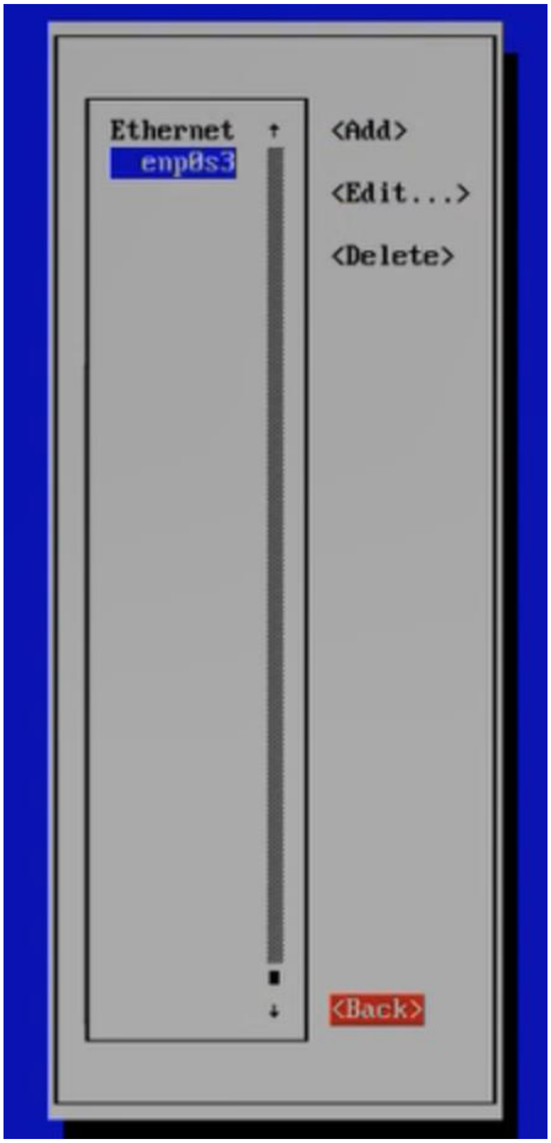
```
                        ┤ Edit Connection ├

         Profile name  enp0s3
               Device  enp0s3 (08:00:27:48:B8:78)


 = ETHERNET                                                     <Show>

 ╤ IPv4 CONFIGURATION  <Manual>                                 <Hide>
 │           Addresses  10.84.88.219          <Remove>
 │                      <Add...>
 │             Gateway  10.84.88.1
 │         DNS servers  8.8.8.8               <Remove>
 │                      <Add...>
 │      Search domains  <Add...>
 │
 │             Routing  (No custom routes) <Edit...>
 │  [ ] Never use this network for default route
 │  [ ] Ignore automatically obtained routes
 │  [ ] Ignore automatically obtained DNS parameters
 │
 │  [ ] Require IPv4 addressing for this connection
 └

 = IPv6 CONFIGURATION  <Automatic>                              <Show>

 [X] Automatically connect
 [X] Available to all users

                                                      <Cancel> <OK>
```

9. Select **OK** to save the configured settings, then press **Enter**:

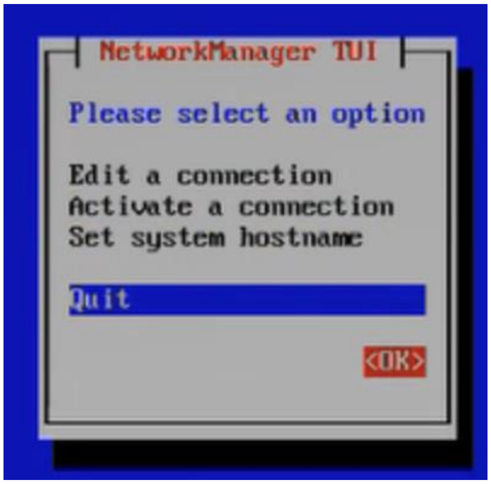


```
[X] Automatically connect
[X] Available to all users

                                                   <Cancel> <OK>
```

10. Select **Back** in the next menu, then press **Enter**:



11. Select **OK** in the main Network Manager menu, then press **Enter**:



The IP address of the machine's O&M interface has been configured.

Once the operations described in this HOW TO have been performed, it is possible to run the Automatic Software Configurator (ASC) needed to configure the machines for the deployment of the RuSIM system.

2. Install docker engine on the Control Node

2.1 How To Install Docker engine

ASC is delivered as a docker image that can be run either on Linux or Windows control nodes.
To be able to run ASC on a machine to use it as Control Node, it is required to install docker engine on that machine.
Depending on the OS run by the Control Node, it is required to follow different instructions.

2.1.1 Installing docker engine on UBUNTU

Installing docker engine on **UBUNTU**-22.04 (code release jammy):
a. in case **no** internet connection is available:

Download the following packages and copy the packages into the UBUNTU-22.04 machine (using an USB key or SCP):
https://download.docker.com/linux/ubuntu/dists/jammy/pool/stable/amd64/containerd.io_1.6.9-1_amd64.deb https://download.docker.com/linux/ubuntu/dists/jammy/pool/stable/amd64/docker-ce-cli_24.0.0-1~ubuntu.22.04~jammy_amd64.deb
https://download.docker.com/linux/ubuntu/dists/jammy/pool/stable/amd64/docker-ce_24.0.0-1~ubuntu.22.04~jammy_amd64.deb

- Then issue the following commands:

```
sudo dpkg -i docker-ce-cli_24.0.0-1~ubuntu.22.04~jammy_amd64.deb
sudo dpkg -i containerd.io_1.6.9-1_amd64.deb
sudo dpkg -i docker-ce_24.0.0-1~ubuntu.22.04~jammy_amd64.deb
sudo usermod -aG docker <username> # to be able to run docker without sudo,
logout/login needed
```

b. in case an internet connection is available:
Issue the following commands:

```
sudo apt install docker.io
sudo usermod -aG docker <username> # to be able to run docker without sudo,
logout/login needed
```

2.1.2 Installing docker engine on generic DEBIAN

Issue the following commands:

```
sudo apt-get remove docker docker-engine docker.io containerd runc
sudo apt-get update
sudo apt-get install     ca-certificates     curl     gnupg     lsb-
release
sudo mkdir -m 0755 -p /etc/apt/keyrings
curl -fsSL https://download.docker.com/linux/ubuntu/gpg | sudo gpg --
dearmor -o /etc/apt/keyrings/docker.gpg
echo \
  "deb [arch="$(dpkg --print-architecture)" signed-
by=/etc/apt/keyrings/docker.gpg] https://download.docker.com/linux/ubuntu
\
  "$(. /etc/os-release && echo "$VERSION_CODENAME")" stable" | \
sudo tee /etc/apt/sources.list.d/docker.list > /dev/null
sudo apt-get update
sudo apt-get install docker-ce docker-ce-cli containerd.io docker-buildx-
plugin docker-compose-plugin
```

```
sudo usermod -aG docker <username> # to be able to run docker without
sudo, logout/login needed
sudo systemctl enable docker
sudo systemctl start docker
```

2.1.3 Installing docker engine on ROCKY, RHEL

Issue the following commands:

```
sudo dnf check-update
sudo dnf config-manager --add-repo
https://download.docker.com/linux/centos/docker-ce.repo
sudo dnf -y install docker-ce docker-ce-cli containerd.io
sudo usermod -aG docker user  # to be able to run docker without sudo,
logout/login needed
sudo systemctl start docker
sudo systemctl enable docker
```

2.1.3 Installing docker engine on Windows (running WSL2)

Issue the following commands:

```
# Search for Command Prompt, right-click the top result, and select the
Run as administrator option, then type:
wsl --install
# Restart your computer to finish the WSL installation on Windows 10, then
reopen Command Prompt (administrator mode) and type
wsl --set-default-version 2
# Install Ubuntu-20.04
wsl --install -d Ubuntu-20.04
# Follow displayed instructions to configure a user, to verify that WSL2
was installed you can run (from a Command prompt) this command:
wsl --list --verbose
```

```
# From the WSL2 Ubuntu shell issue the following commands:
sudo apt-get update
sudo apt-get install     ca-certificates     curl     gnupg     lsb-
release
sudo mkdir -m 0755 -p /etc/apt/keyrings
curl -fsSL https://download.docker.com/linux/ubuntu/gpg | sudo gpg --
dearmor -o /etc/apt/keyrings/docker.gpg
echo \
  "deb [arch="$(dpkg --print-architecture)" signed-
by=/etc/apt/keyrings/docker.gpg] https://download.docker.com/linux/ubuntu
\
  "$(. /etc/os-release && echo "$VERSION_CODENAME")" stable" | \
sudo tee /etc/apt/sources.list.d/docker.list > /dev/null
sudo apt-get update
sudo apt-get install docker-ce docker-ce-cli containerd.io docker-buildx-
plugin docker-compose-plugin
sudo usermod -aG docker <username> # to be able to run docker without
sudo, logout/login needed
sudo service docker start
```

2.1.4 How To Install Docker Container

It is now possible to install the docker container by using the following commands:

```
sudo service docker start
tar xvf autoswconf-X.Y.Z.docker.tar.gz
cd autoswconf-X.Y.Z.docker.tar.gz
./docker_asc.sh
```

3. Run ASC on the Control Node

ASC can be run in different ways according to the Control Node Operating System (OS).
ASC can be used on any OS capable of running docker: Linux OS and Windows (using WSL2).
Later in this document, ASC usage is described in case the Control Node is a Linux machine.

3.1 How to use ASC

Perform the following steps to use the Automatic Software Configurator.

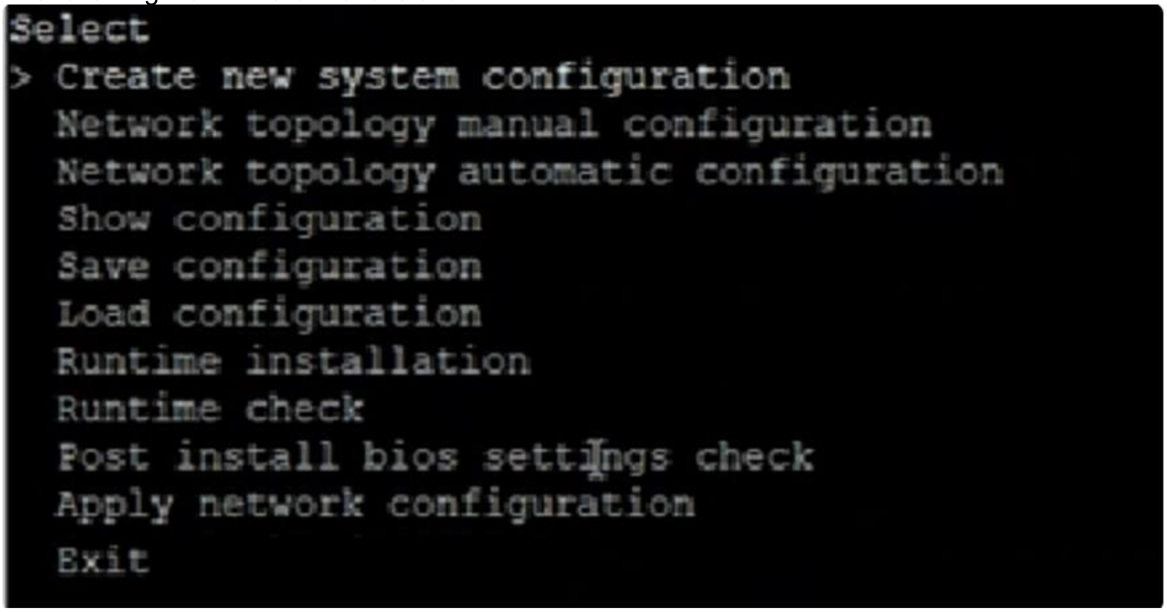
1. Download from KSM (https://ksm.software.keysight.com/sign-in) the released ASC package onto the Control Node machine.

The ASC software package complies with the following naming convention: *autoSWConf-x.y.z.docker.tar.gz*.

2. Launch the wizard on the Control Node machine by using the following commands:

```
tar xf autoswconf-1.0.0.docker.tar.gz
cd autoswconf-1.0.0
./docker-asc.sh
```

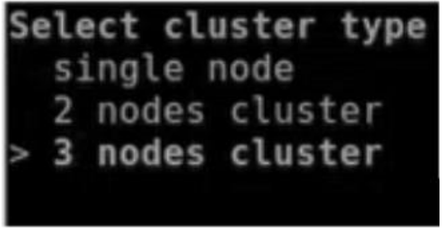
The following main wizard menu is shown.



```
Select
> Create new system configuration
  Network topology manual configuration
  Network topology automatic configuration
  Show configuration
  Save configuration
  Load configuration
  Runtime installation
  Runtime check
  Post install bios settings check
  Apply network configuration
  Exit
```

3. Select **Create new System Configuration** to create a new basic configuration.

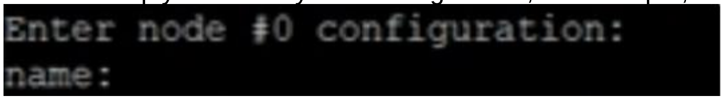
It is requested to specify the cluster type.



```
Select cluster type
  single node
  2 nodes cluster
> 3 nodes cluster
```

4. Select cluster type.

It must comply with the system configuration; for example, select a 3 nodes cluster configuration.

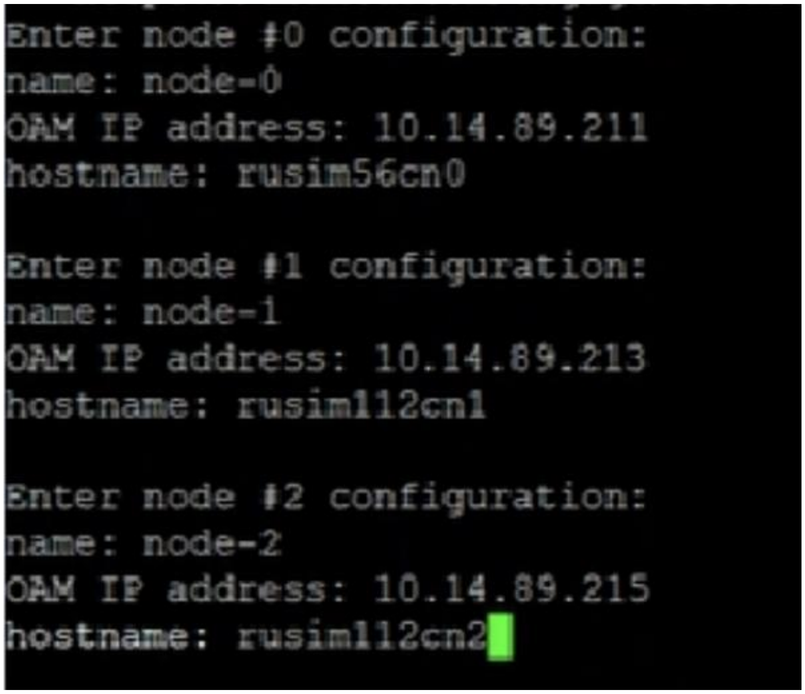


```
Enter node #0 configuration:
name:
```

5. For each node, insert name, IP address and hostname.

NOTE: nodes' names are fixed; it is required to specify the following names:

name for node #0: node-0
name for node #1: node-1
name for node #2: node-2



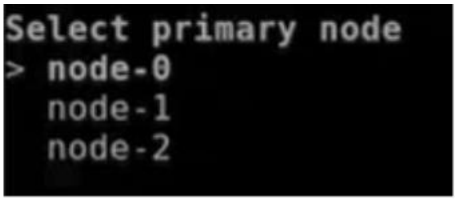
```
Enter node #0 configuration:
name: node-0
OAM IP address: 10.14.89.211
hostname: rusim56cn0

Enter node #1 configuration:
name: node-1
OAM IP address: 10.14.89.213
hostname: rusim112cn1

Enter node #2 configuration:
name: node-2
OAM IP address: 10.14.89.215
hostname: rusim112cn2
```

6. Select the Primary node.

It is the node where:

- the configuration manager runs
- Redis database is stored
- lsustart, stop, clean and get report commands are executed
- lsu-geometry and the lsuconfig YAML files are stored.

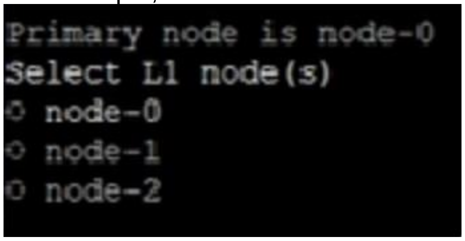
For example, set node 0.



```
Select primary node
> node-0
  node-1
  node-2
```

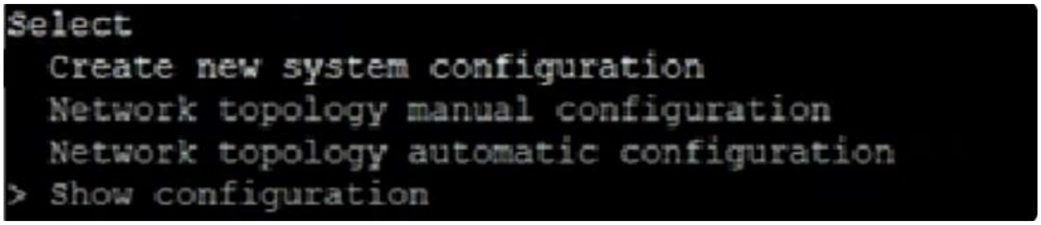
7. Select L1 node(s).

These are the nodes hosting L1; it is possible to select more than one node.
For example, set node 1 and 2.



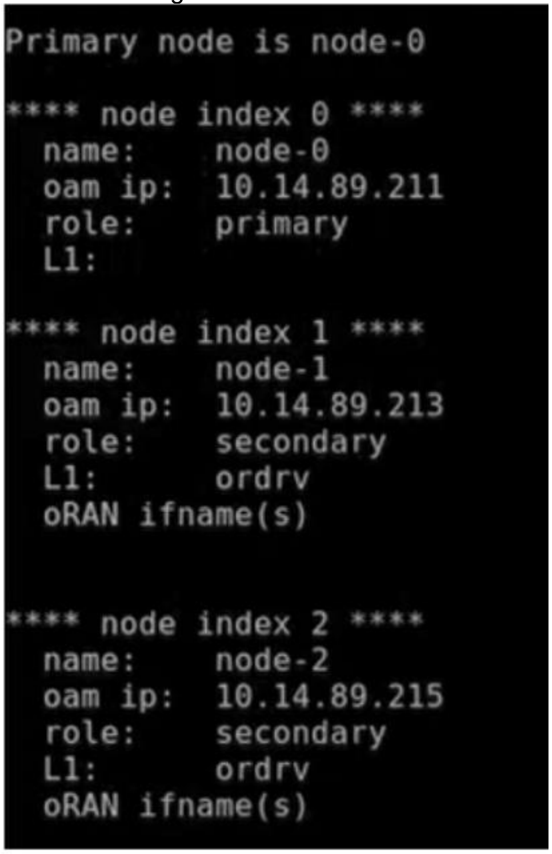
```
Primary node is node-0
Select L1 node(s)
○ node-0
○ node-1
○ node-2
```

8. **Select** Show Configuration **to see the configured data**



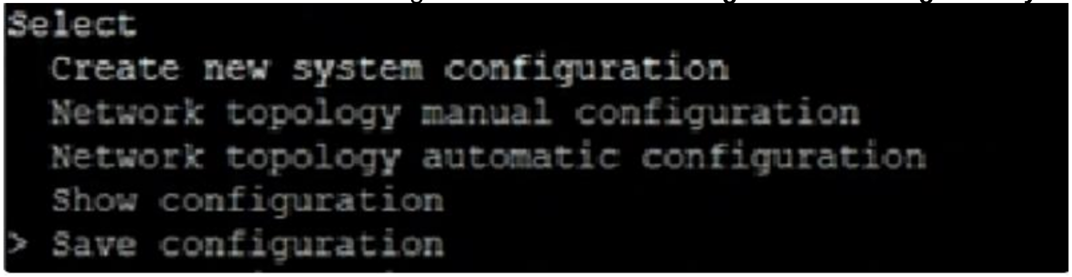
```
Select
  Create new system configuration
  Network topology manual configuration
  Network topology automatic configuration
> Show configuration
```

The data configured for each node are shown. See the following figure as an example:



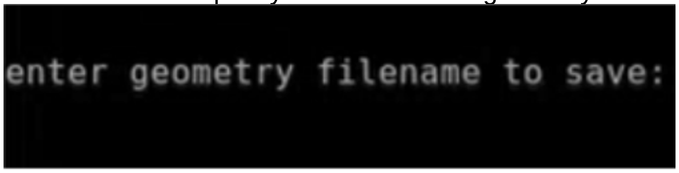
```
Primary node is node-0

**** node index 0 ****
  name:    node-0
  oam ip:  10.14.89.211
  role:    primary
  L1:

**** node index 1 ****
  name:    node-1
  oam ip:  10.14.89.213
  role:    secondary
  L1:      ordrv
  oRAN ifname(s)


**** node index 2 ****
  name:    node-2
  oam ip:  10.14.89.215
  role:    secondary
  L1:      ordrv
  oRAN ifname(s)
```

9. **Select** Save Configuration **to save the configured data in a geometry file.**



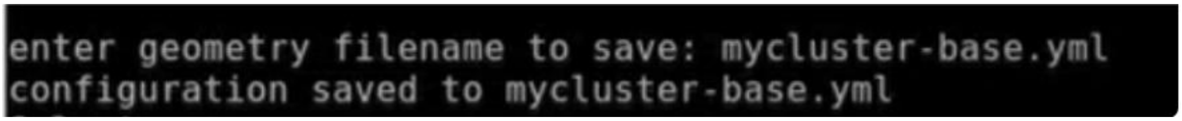
```
Select
  Create new system configuration
  Network topology manual configuration
  Network topology automatic configuration
  Show configuration
> Save configuration
```

10. Specify the name of the geometry file where the configured data will be saved.



```
enter geometry filename to save:
```

For example, enter: mycluster-base.yml

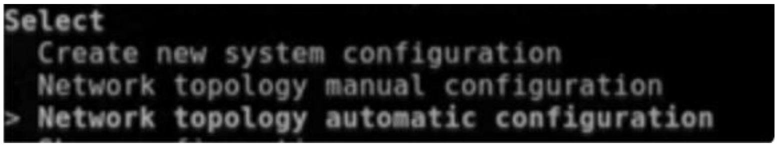


```
enter geometry filename to save: mycluster-base.yml
configuration saved to mycluster-base.yml
```

The current configuration has been saved and exiting the wizard will not result in data loss.
The saved configuration may be reloaded during future wizard execution.

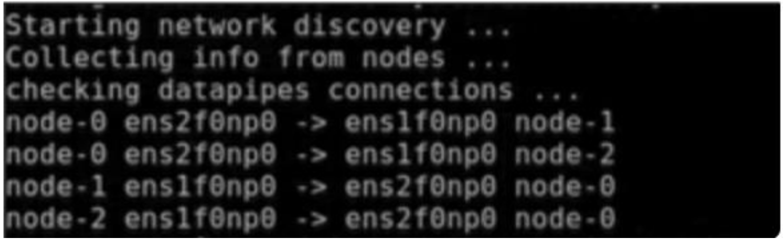
NOTE: the **Newtork topology manual configuration** command is available, but improper use can lead to system malfunction; therefore, only users with advanced knowledge of the system should use it.

11. Select **Newtork topology automatic configuration**



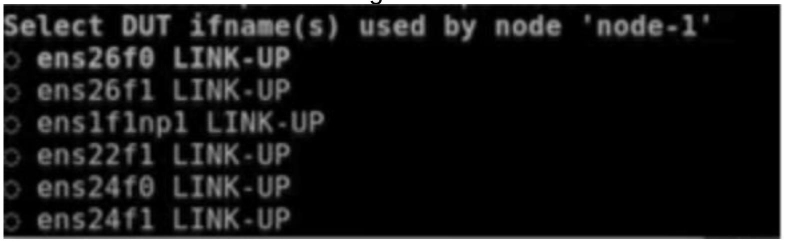
```
Select
  Create new system configuration
  Network topology manual configuration
> Network topology automatic configuration
```

This command generates a query from the control node to all the connected nodes to get the list of the interfaces between the nodes.
NOTE: to understand the topology of the nodes, it is required the nodes are physically connected and are associated to an IP address.
As a result, a list of the interfaces that connect the nodes to each other is shown.



```
Starting network discovery ...
Collecting info from nodes ...
checking datapipes connections ...
node-0 ens2f0np0 -> ens1f0np0 node-1
node-0 ens2f0np0 -> ens1f0np0 node-2
node-1 ens1f0np0 -> ens2f0np0 node-0
node-2 ens1f0np0 -> ens2f0np0 node-0
```

Then, for each node, the system shows also a list of the interfaces that are possibly connected to a Device Under Test (DUT).
The LINK-UP/LINK-DOWN information is also shown: it may be useful to understand if a cable is correctly connected or it is malfunctioning.



```
Select DUT ifname(s) used by node 'node-1'
○ ens26f0 LINK-UP
○ ens26f1 LINK-UP
○ ens1f1np1 LINK-UP
○ ens22f1 LINK-UP
○ ens24f0 LINK-UP
○ ens24f1 LINK-UP
```

12. Select DUT interfaces

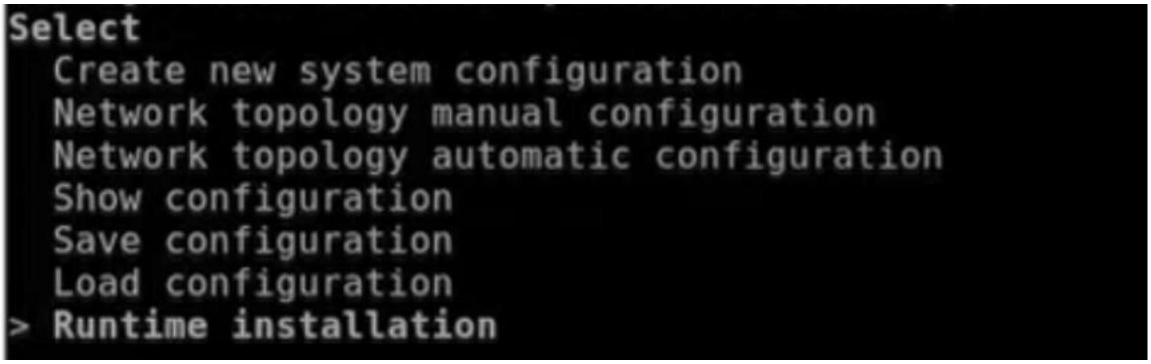
For each node, it is possible to select the interfaces used for DUT connection.
It is possible to select more than one DUT interface for each node.

13. Check and save configuration

It is then suggested to check the network configuration by using the Show configuration option.
If the defined network configuration is suitable, save it by using the **Save configuration** option.

If the current (or loaded from a previously saved one) configuration complies with testing needs, then run the following command.

14. Select **Runtime installation**



```
Select
  Create new system configuration
  Network topology manual configuration
  Network topology automatic configuration
  Show configuration
  Save configuration
  Load configuration
> Runtime installation
```

The Runtime installation command performs the installation of the required utility software packages, needed to support RuSIM, on all the managed nodes defined in the geometry file.
The execution of this command usually takes up to 20 minutes.
NOTE: software packages installation can be performed only once: it is possible to change the system geometry without re-installing software packages.
NOTE: the **Runtime check** command is reserved to Keysight support personnel for debug purposes.

15. Select **Post install bios settings check**

This command performs a check of the BIOS setting and provides an on-screen report; it is required to fix errors, if any.

16. Select **Apply network configuration**

This command applies the geometry to the nodes: it configures network settings for each node, according to the data defined in the geometry file.
NOTE: it is possible to change the geometry without re-installing the software packages, so without running again the Runtime installation command.
For example, it is possible to change one 3-nodes cluster into two clusters (a 1-node and a 2-node cluster) by only performing the following commands:
- Create new System Configuration
- Network topology configuration
- Apply network configuration.

NOTE: defining two clusters requires to define 2 separate geometry files.
Once the operations described in this HOW TO have been performed, the system of machines in ready for the deployment of RuSIM: it is then possible to install RuSIM software packages.

4. Configure the RuSIM

Configure the RuSIM system to start and run the RuSIM test scenarios, as described below:

4.1 Installation

The Resource Manager application is part of the system-server Base Software and is included in the package bubble UeSIM-vx.x-x-LNX.pbp. The package bubble can be installed via Web GUI or the following command line:

```
$ ./sudo lsuinstall.py /updates/UeSIM-vx.y-z-LNX.pbp
```

The Resource Manager application will be installed in the /opt/keysight/resource_manager directory, here after we call it the Resource Manager directory.
It contains a set of utilities and subdirectories, as listed below:

```
(envrm) [root@rusim56cn0 resource_manager]# ll
total 224
-rwxr-xr-x 1 root root 87425 Mar 13 13:44 business_logic.py
drwxr-xr-x 2 root root   160 Mar 13 14:49 certificates
drwxr-xr-x 5 root root    74 Mar 13 14:48 envrm
-rw-r--r-- 1 root root  1505 Mar 13 14:49 gen_certs.log
-rwxr-xr-x 1 root root 10082 Mar 13 13:44 gen_certs.py
```

```
-rwxr-xr-x 1 root root  7232 Mar 13 13:44 geometry.py
-rwxr-xr-x 1 root root   105 Mar 13 13:44 globvars.py
-rwxr-xr-x 1 root root  1985 Mar 13 13:44 hw_discovery.py
-rwxr-xr-x 1 root root 19292 Mar 13 13:44 hw_discovery_module.py
-rw-r--r-- 1 root root   671 Mar 13 14:49 make_service.log
-rwxr-xr-x 1 root root  5700 Mar 13 13:44 make_service.py
drwxr-xr-x 2 root root  4096 Mar 13 14:48 mockups
-rwxr-xr-x 1 root root  2131 Mar 13 13:44 net_discovery.py
-rwxr-xr-x 1 root root 13157 Mar 13 13:44 network_discovery_module.py
drwxr-xr-x 2 root root    29 Mar 13 14:48 outputs
-rw-r--r-- 1 root root    58 Mar 13 13:44 requirements.txt
-rwxr-xr-x 1 root root 17939 Mar 13 13:44 resource_manager.py
-rw-r--r-- 1 root root   530 Mar 13 14:49 resource_manager.service
-rwxr-xr-x 1 root root   599 Mar 13 13:44 resources_rm.py
-rw-r--r-- 1 root root  1725 Mar 13 13:44 rm_service_pb2.py
-rw-r--r-- 1 root root  1244 Mar 13 13:44 rm_service_pb2.pyi
-rw-r--r-- 1 root root  3861 Mar 13 13:44 rm_service_pb2_grpc.py
drwxr-xr-x 2 root root   123 Mar 13 14:48 saved_configs
```

A short description for the main utilities is provided below.

resource_manager.py	**command to invoke the Resource Manager application.**
hw_discovery.py	**command to invoke the hardware discovery utility, used to create the template of the hardware JSON mockup file.** **hw_discovery.py [-f xxx_hw_template.json]**
net_discovery.py	**command to invoke the network discovery utility, used to create the template of the network YAML mockup file.** **net_discovery.py [-f xxx_net_template.yaml]**

A short description for the main subdirectories is provided below.

outputs	**subdirectory where the output YAML files are saved, for example the standard output file lsu-config.yaml.**
saved_configs	**subdirectory where the user input JSON files are saved.**
mockups	**subdirectory where the system-server mockup files are saved.** **The hardware JSON file contains the hardware information such as CPU list, disk information, network device.** **The cluster YAML files includes the list of system-servers.** **The net YAML files includes network device, PCI address, etc.**

4.2 Preparing environment

On the secondary system-server the Resource Manager application is launched during the reboot of the system-server and the resource_manager.service will be automatically activated. No action is needed on the part of the User.

On the primary system-server before launching the Resource Manager application, the following preliminary steps are needed:

- connect to the Primary system-server by using a SSH client or the SSH command and inserting Username and Password, for example: $ ssh user@10.14.89.211
- become super user: $ sudo -s
- set the Resource Manager directory as the current directory, for example: $ cd /opt/keysight/resource_manager
- activate the python environment by launching: $ source envrm/bin/activate, (envrm) will be added to the prompt
- specify the name of the log file by launching: $ export LOGFILE="logfile_rm.txt"

4.3 Running on primary system-server

Run the Resource Manager application on the primary system-server by launching:

```
$ ./resource_manager.py primary
```

The information on all involved system-servers will be shown. For example:

```
test_primary    10.14.89.211 user/user  Primary system-server
test_node1      10.14.89.213 user/user  Secondary system-server
test_node2      10.14.89.215 user/user  Secondary system-server
```

Now the Resource Manager application is ready to retrieve information on the test scenario from the user. The following question appears. The user inputs can be retrieved from a saved JSON configuration file or via a console line user interface according to the response provided to the question.

```
Do you want to load a saved configuration? [y/N]
```

- yes: The user inputs will be retrieved from a previously saved JSON configuration file, refer to the Load configurations section for details.
- no: The user inputs will be collected via a console line user interface through a set of questions and user's answers, refer to the Collecting user inputs section for details.

4.3.1 Running with options

The Resource Manager application provides a set of options. It is possible to show all the possible parameter/options and their usage with the -h option. For example:

```
$ ./resource_manager.py -h
usage: resource_manager.py [-h] [-m mockup_filename.yaml] [-l
input_cfg_filename.json] [-g input_geom_filename.yaml] cmd

positional arguments:
  cmd                   cmd = Either 'primary' or 'secondary'.

optional arguments:
  -h, --help            show this help message and exit
  -m mockup_filename.yaml, --mockup-file mockup_filename.yaml
                        The hardware mock-up description file (optional)
  -l input_cfg_filename.json, --load-cfg-file input_cfg_filename.json
                        The user configuration input file (optional)
  -g input_geom_filename.yaml, --load-geom-file input_geom_filename.yaml
                        The lsu-geometry input file (optional)
```

As shown in the above message, the following parameter/options are available.

cmd	**specifies where to run Resource Manager: the primary or secondary system-server; its valid value is primary or secondary, but only primary can be used by users.**
-h	**shows the help information;**
-m mockup_filename.yaml	**specifies the mockup YAML file name to be used to mock-up the HW information, for example mockup_filename.yaml.** **The -m option is used to activate the mockup function and the specified YAML file is loaded as the system-server hardware description file, instead of the standard request/reply to the secondaries. The mockup files must be stored in the /mockups subdirectory.**
-l input_cfg_filename.json	**specifies the input JSON file to be loaded, for example input_cfg_filename.json; it should be one of the previously saved user configuration input file, refer also to the Load configurations section;**
-g input_geom_filename.yaml	**specifies the LSU geometry YAML file name to be loaded as input, for example input_geom_filename.yaml. When it is omitted the standard LSU geometry YAML file (/lsu/cfg/lsu-geometry.yaml) is loaded.**

4.4 Collecting user inputs

The user inputs can be collected via a console line user interface through a set of questions that user needs to answer one by one.

The interactive user inputs part will be activated only if you choose to not want to load a saved configuration.

Do you want to load a saved configuration? [y/N] no

The following user inputs are queried:

- oRAN connection choice [ON,OFF] default=OFF
- RF connection choice [ON,OFF] default=OFF
- number of NR 2x2 cells/beams [0...32]
- number of NR 4x4 cells/beams [0...16]
- number of LTE cells [0...16]
- NR ciphering [ON,OFF]
- NR attach procedures per second (CAPS) [1...750] default=20
- SIP enabled [ON,OFF]
- NR Max Throughput (Mbps) [1000,2000,3000,...16000] default=2000
- LTE Max Throughput (Mbps) [100,200,300,...1500] default=500
- Ue Max Configured (in whole system, Lte and Nr) [1... 36000] default = 1000
- MultiUser [ON,OFF] default=OFF
- MAC2MAC Testing [ON,OFF] default=OFF
- LTEEVO [ON,OFF] default=ON
- FADING [ON,OFF] default=OFF
- Enable Shared Cores [Yes/No] default=No
- Layer 2 NR_DC [On/Off] default=Off

Based on to the value type: True/False, Y/N, On/Off, integer or list, the following rules are applied to the answers to be provided by the user.

True/False	the > sign indicates the answer, using the up/down arrow button to change the position of the > sign and the return button to confirm;
Y/N	digit the y or n button and then the return button to confirm;
On/Off	the > sign indicates the answer, using the up/down arrow button to change the position of the > sign and the return button to confirm;
[0...maximum]	enter an integer value in the specified range and then the return button to confirm;
[1000, 2000, 3000,...maximum]	enter one of the listed value and then the return button to confirm.

The default value will be assumed when the return button is pressed without entering any value or change.

Note: Once confirmed an answer, it is not possible to change its value. The only way to correct a user input is to redo the user inputs procedure by relaunch the Resource Manager program: $ ./resource_manager.py primary

At the end of the user inputs procedure, the user is invited to insert a description for the current configuration before the final validation.

```
Write the short description of current configuration: first resource manager configuration
```

A short description can be provided for the current configuration, for example: first resource manager configuration, and then press the return button to confirm.

The following message indicates the complete and successful user inputs acquisition.

```
Completed user inputs!
Validated user inputs!
```

An interactive user inputs example is shown in Example 1.

4.5 Saving and loading configurations

The Resource Manager application provides the possibility to:

- save the user input configurations in a JSON file after the validation of the user inputs;
- load a previous saved JSON configuration file as user inputs.

4.5.1 Save configurations

When the user inputs acquisition is completed and validated, the following question appears and provides the possibility to save the user inputs in a JSON file for future use. For example:

```
Do you want to save the current configuration? [y/N] yes

Write the name of the file where to save current configuration:
first_rm_cfg
```

This example saves the user inputs in the first_rm_cfg.json file under the /saved_configs subdirectory. The user inputs are saved as human friendly JSON python objects.

4.5.2 Load configurations

When the user inputs have already been collected via a console line user interface and stored in a JSON configuration file in the /saved_configs subdirectory, the Resource Manager application is able to retrieve the user inputs from the saved JSON configuration file in order to regenerate the output YAML configuration. This function is useful when an updated Resource Manager software has been installed or a new LSU geometry file has been created.

The following ways can be used to load a previously saved JSON configuration file:

use the -l option of the resource_manager.py command to specify the file name to be loaded, for example:

```
$ ./resource_manager.py -l first_rm_cfg.json primary
```

- answer yes to the question "Do you want to load a saved configuration? [y/N]" and select the JSON file to be used from the list by moving the up/down arrow. All the files present in the /saved_configs subdirectory are listed. For example:

```
Do you want to load a saved configuration? [y/N] yes

Choose one of these configurations:
> File: <first_rm_cfg.json>; first resource manager configuration
   File: <second_rm_cfg.json>; second resource manager configuration
   File: <third_rm_cfg.json>; third resource manager configuration

Do you want to save the current configuration? [y/N] no
```

- The above example will load the first_rm_cfg.json file as input and will not save the current configuration.

4.6 Generate outputs

After the validation of the user inputs is completed the YAML configuration file will be generated and saved in the /outputs subdirectory.

It is possible to specify a user defined name for the YAML configuration file instead of the standard file name: lsu-config.yaml. For example:

```
Do you want to save the YAML config file to standard location "lsu-
config.yaml"? [y/N] no
Write the name of the file where to save current YAML object:
RM_first_cfg.yaml

Saving the YAML object...
Done!
```

The above example will generate the YAML configuration and save it in the /output/RM_first_cfg.yaml file.

The YAML configuration file is used as the input of the lsustart.py command. It defines a specific number of processes and cores to be assigned to the RuSIM software modules and protocol stacks.

The number of processes to be assigned to:

- BB
- rlcmac NR/LTE
- Stk

- PDCP

The number of cores to be assigned to:

- oRAN/AP driver
- BB
- TSTM
- IPSIG
- IPTG
- RTP

Core Agent – Deployment Guide

Based on the platform where you can deploy your Core agent, please follow the instruction from the same user guide used for ORAN SIM CE. Instructions for agents will be in chapters named: “Agent(s) Installation”.

Install 5GCTE service on RU agent

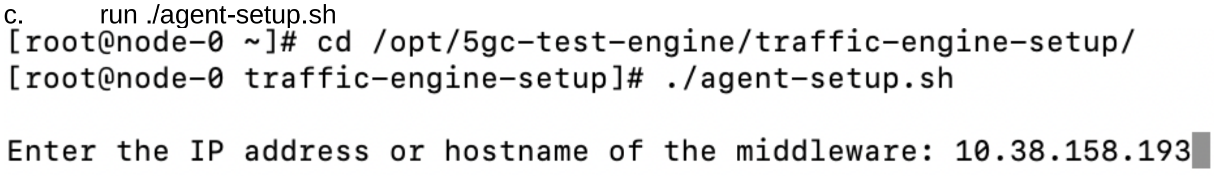
Install Traffic Engine on target COTS server (LSU)

- dnf install -y protobuf-c unbound-libs zeromq
- mkdir /opt/5gc-test-engine
- tar xzf LoadCore-Traffic-Engine-7065-4fa960a486-20240325T132537Z.tgz -C /opt/5gc-test-engine
- cp /opt/5gc-test-engine/traffic-engine-setup/etc/systemd/system/*.service /etc/systemd/system/
- cp /opt/5gc-test-engine/traffic-engine-setup/etc/rsyslog.d/01-portmanager.conf /etc/rsyslog.d/01-portmanager.conf
- cp /opt/5gc-test-engine/traffic-engine-setup/etc/logrotate.d/portmanager /etc/logrotate.d/portmanager
- systemctl daemon-reload
- systemctl restart rsyslog.service

Link Agents to ORAN SIM CE MW

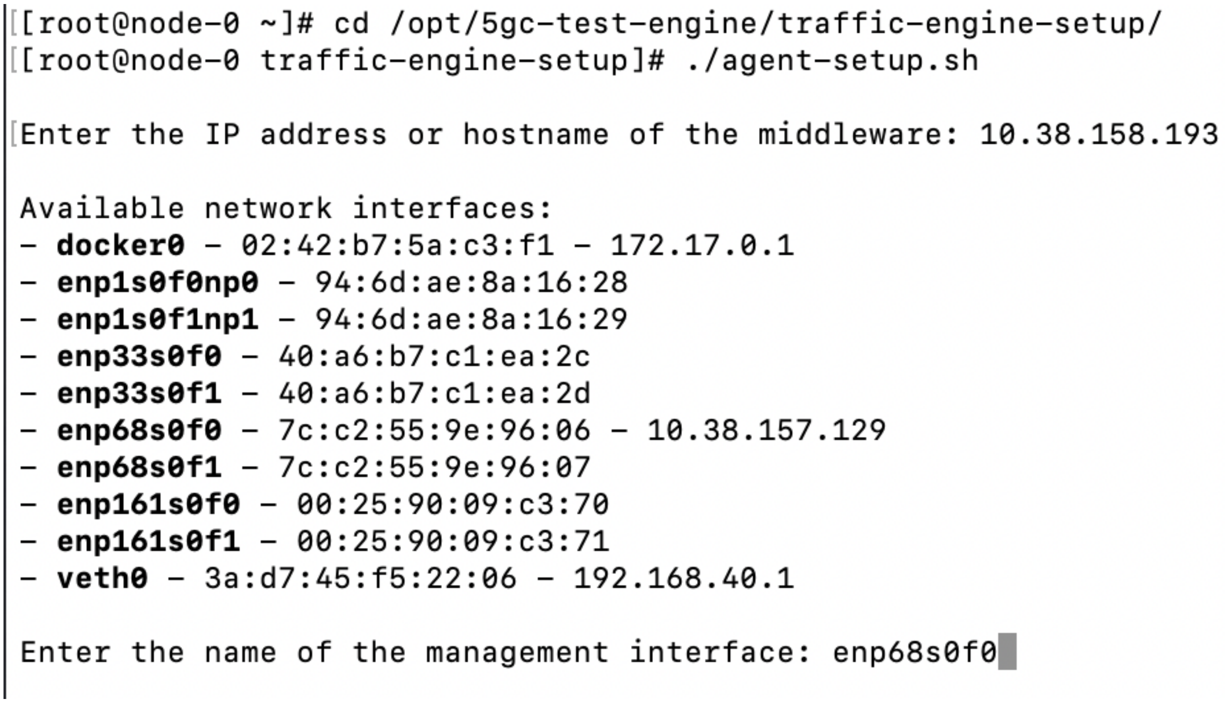
To link the RU agent to ORAN SIM CE MW, follow below steps:

a. ssh with root/root credentials
b. go to “cd /opt/5gc-test-engine/traffic-engine-setup/”
c. run ./agent-setup.sh



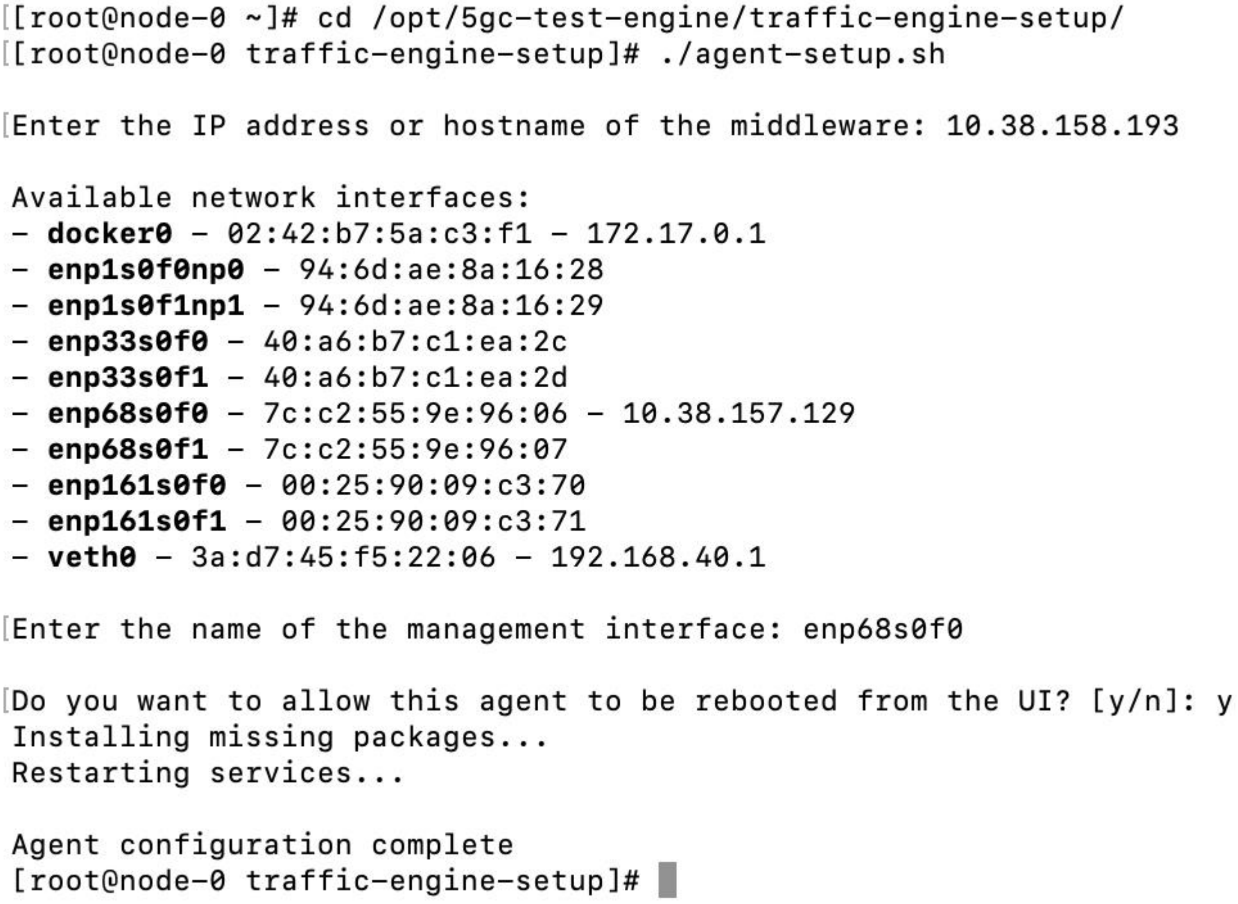
```
[root@node-0 ~]# cd /opt/5gc-test-engine/traffic-engine-setup/
[root@node-0 traffic-engine-setup]# ./agent-setup.sh

Enter the IP address or hostname of the middleware: 10.38.158.193
```

d. Enter MW IP:



```
[[root@node-0 ~]# cd /opt/5gc-test-engine/traffic-engine-setup/
[[root@node-0 traffic-engine-setup]# ./agent-setup.sh

[Enter the IP address or hostname of the middleware: 10.38.158.193

 Available network interfaces:
 - docker0 - 02:42:b7:5a:c3:f1 - 172.17.0.1
 - enp1s0f0np0 - 94:6d:ae:8a:16:28
 - enp1s0f1np1 - 94:6d:ae:8a:16:29
 - enp33s0f0 - 40:a6:b7:c1:ea:2c
 - enp33s0f1 - 40:a6:b7:c1:ea:2d
 - enp68s0f0 - 7c:c2:55:9e:96:06 - 10.38.157.129
 - enp68s0f1 - 7c:c2:55:9e:96:07
 - enp161s0f0 - 00:25:90:09:c3:70
 - enp161s0f1 - 00:25:90:09:c3:71
 - veth0 - 3a:d7:45:f5:22:06 - 192.168.40.1

 Enter the name of the management interface: enp68s0f0
```

e. Enter the name of the management interface.



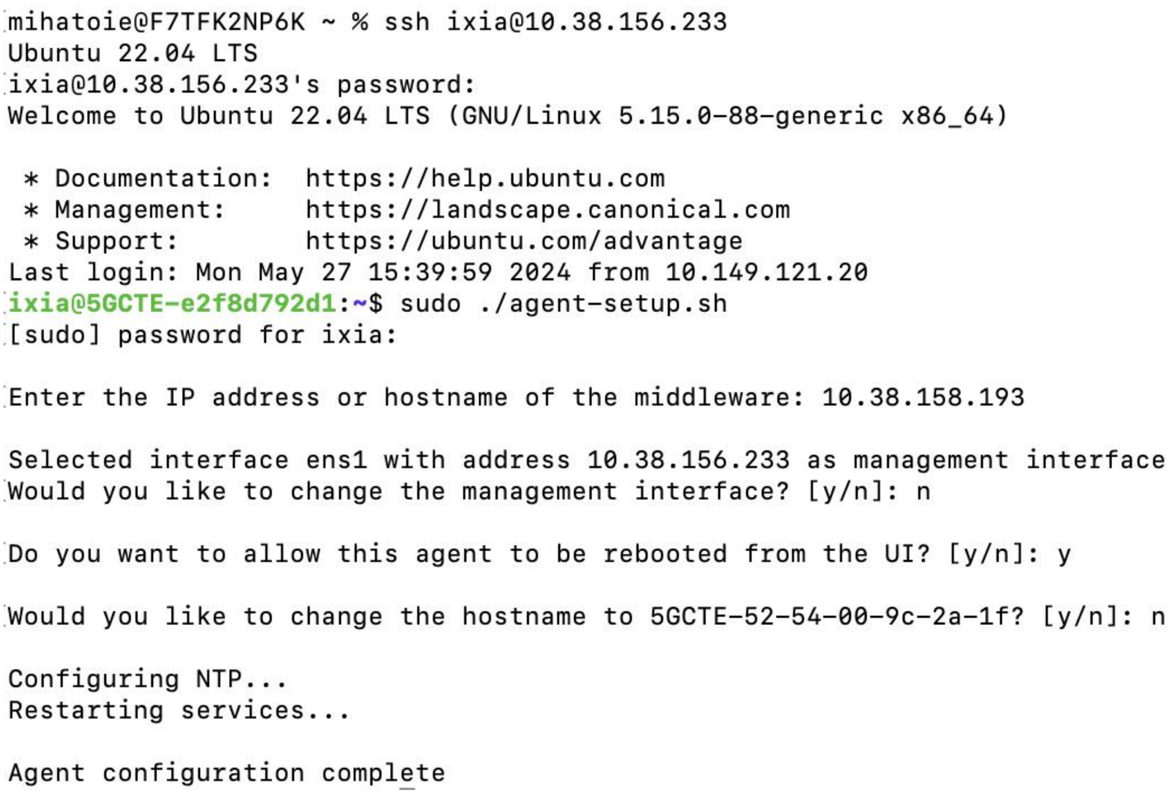
```
[[root@node-0 ~]# cd /opt/5gc-test-engine/traffic-engine-setup/
[[root@node-0 traffic-engine-setup]# ./agent-setup.sh

[Enter the IP address or hostname of the middleware: 10.38.158.193

 Available network interfaces:
 - docker0 - 02:42:b7:5a:c3:f1 - 172.17.0.1
 - enp1s0f0np0 - 94:6d:ae:8a:16:28
 - enp1s0f1np1 - 94:6d:ae:8a:16:29
 - enp33s0f0 - 40:a6:b7:c1:ea:2c
 - enp33s0f1 - 40:a6:b7:c1:ea:2d
 - enp68s0f0 - 7c:c2:55:9e:96:06 - 10.38.157.129
 - enp68s0f1 - 7c:c2:55:9e:96:07
 - enp161s0f0 - 00:25:90:09:c3:70
 - enp161s0f1 - 00:25:90:09:c3:71
 - veth0 - 3a:d7:45:f5:22:06 - 192.168.40.1

[Enter the name of the management interface: enp68s0f0

[Do you want to allow this agent to be rebooted from the UI? [y/n]: y
 Installing missing packages...
 Restarting services...

 Agent configuration complete
 [root@node-0 traffic-engine-setup]#
```

f. Respond with “y” to the next question.

To link the CORE agent to ORAN SIM CE MW follow below steps:

a. ssh to agent with ixia/ixia credentials
b. run sudo ./agent-setup.sh
c. Enter the IP of the MW
d. Set the management interface
e. Respond with y or n to question related to agent reboot from UI
f. Respond with y or n to question related to host name

Example:



```
mihatoie@F7TFK2NP6K ~ % ssh ixia@10.38.156.233
Ubuntu 22.04 LTS
ixia@10.38.156.233's password:
Welcome to Ubuntu 22.04 LTS (GNU/Linux 5.15.0-88-generic x86_64)

 * Documentation:  https://help.ubuntu.com
 * Management:     https://landscape.canonical.com
 * Support:        https://ubuntu.com/advantage
Last login: Mon May 27 15:39:59 2024 from 10.149.121.20
ixia@5GCTE-e2f8d792d1:~$ sudo ./agent-setup.sh
[sudo] password for ixia:

Enter the IP address or hostname of the middleware: 10.38.158.193

Selected interface ens1 with address 10.38.156.233 as management interface
Would you like to change the management interface? [y/n]: n

Do you want to allow this agent to be rebooted from the UI? [y/n]: y

Would you like to change the hostname to 5GCTE-52-54-00-9c-2a-1f? [y/n]: n

Configuring NTP...
Restarting services...

Agent configuration complete
```

Licensing

Oran SIM CE licensing

Please follow the licensing process from ORAN_SIM_CE deployment guide.

RU Agent licensing

The license file for RU agent will be generated using Keysight software based on customer needs.
On the RU agent the file contains the licenses *hostid.llf* file will be put in /lsu/licensing path.
ORAN SIM CE will check license availability before test starts.
Official documents can be downloaded from: https://www.keysight.com/find/softwaremanager