NEC

SX-Aurora TSUBASA

SX-Aurora TSUBASA

Setup Guide

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Preface

This document is intended for first-time users of the SX-Aurora TSUBASA, and explains how to set up the SX-Aurora TSUBASA system, including hardware setup, installation of the OS and SX-Aurora TSUBASA software, basic environment settings, and execution of sample programs.

This document assumes that the SX-Aurora TSUBASA system is connected to the network that has access to the Internet, customers have bought the support pack, and readers have basic knowledge of Linux and can edit files on Linux using editors such as vi.

The procedures in this document are available for the SX-Aurora TSUBASA software released on January 2023 or later.

--- Mar. 2023 Edition ---

Definitions and Abbreviations

Term	Description
Vector Engine (VE)	The core part of the SX-Aurora TSUBASA system, on which applications are executed. A VE is implemented as a PCI Express card and attached to a server called a vector host.
Vector Host (VH)	A Linux (x86) server to which VEs are attached, in other words, a host computer equipped with VEs.
VMC	Abbreviation of VE Management Controller.
Internet Delivery	The service to provide NEC software products over the Internet. We will notify customers of the URL providing the download service by email, from which you can obtain our software products.
InfiniBand	One of the high-seed and highly reliable interface standards used to connect computers and storage devices (external storage devices) in large-scale system and between computation nodes in supercomputers (HPC clusters). Please refer Installation Guide to install InfiniBand in SX-Aurora TSUBASA system.
License Server	A server that manages licenses for the paid software on the SX-Aurora TSUBASA. This is needed to use the C/C++ compiler and Fortran compiler, which are included in the NEC Software Development Kit for Vector Engine (SDK), or NEC Compat C++ Standard Library for Vector Engine (Compat C++).
NEC yum repository	The yum repository for NEC SX-Aurora TSUBASA software. The yum repository for the free software can be accessed by any user. The yum repository for the paid software can be accessed only by users with PP support contract.
MPI	Abbreviation of Message Passing Interface. MPI is a standard specification for a communication library. It can be used together with OpenMP or automatic parallelization.
Installation Guide	Abbreviation of “SX-Aurora TSUBASA Installation Guide”. The latest version of Installation Guide exists in NEC Aurora Forum. https://sxauroratsubasa.sakura.ne.jp/documentation

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Chapter1 Preparation

This chapter describes preparation for setting up the SX-Aurora TSUBASA system.

1.1 Hardware

Prepare the following equipment to set up the SX-Aurora TSUBASA system.

- A Vector host (A100-1)
  - VE cards (built-in)
  - A DVD drive (built-in)
  - A power cable

  (The setup procedure is explained using a tower type vector host as an example.)
- A Display, display cable, and power cable
- A USB Mouse and USB keyboard
- A LAN cable
- A computer with a writable DVD drive and connection to the Internet for downloading the SX-Aurora TSUBASA software.
- An OS installation DVD (refer to section 1.3 for details)

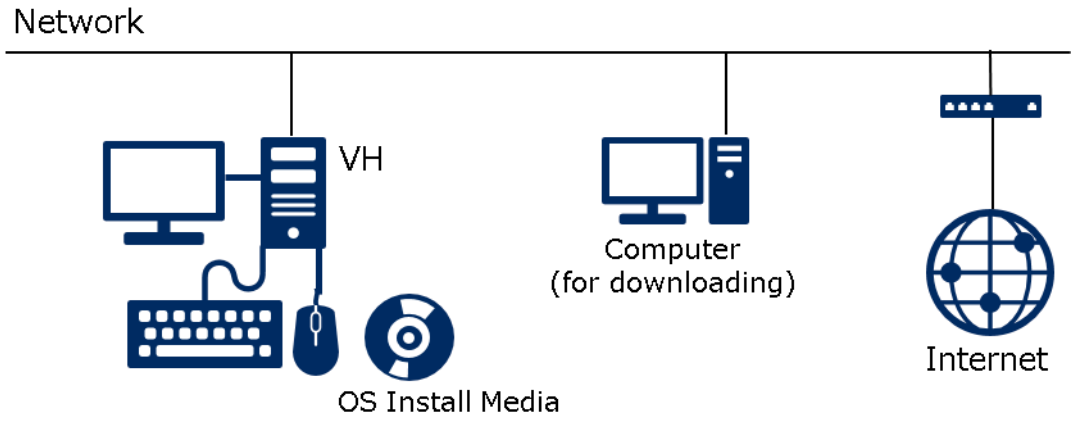


Figure 1 Setup Environment

1.2 Network Environment

To connect the vector host (VH) to a network, prepare network information such as a hostname and IP address in advance. This document uses the following values as an example.

Table 1 Network Information

Information	Example Value
Hostname of the vector host	vh001
Vector host IP address	192.168.1.100/24 (Fixed)
Gateway IP address	192.168.1.1
DNS server IP address	192.168.1.2

- Hereafter, vector host is abbreviated to VH.

1.3 OS Installation DVD

The SX-Aurora TSUBASA software runs on the Linux operating system compatible with the Red Hat Linux.

Please refer to the NEC support portal below for the latest information of the supported distributions and kernel versions.

https://www.support.nec.co.jp/en/View.aspx?id=4140100078 (English)
https://www.support.nec.co.jp/View.aspx?id=3140106285 (Japanese)

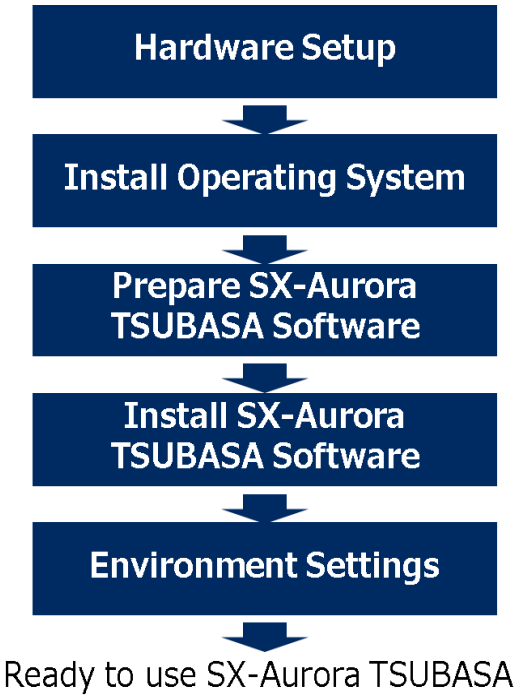
Please prepare an installation DVD of one of the operating systems. The OS installation DVD is needed even if you have already installed the OS on the VH, because the DVD contains packages on which the SX-Aurora TSUBASA software depends. Also, it must not be the one for network installation, but has to contain software package files.

1.4 Check of the Serial Number of the Support Pack

This document explains how to install the free software and paid software for the SX-Aurora TSUBASA from the yum repository on the Internet. The access to the yum repository for the paid software is restricted and requires the serial number of the support pack for the paid software. The serial number is described on the serial number card included in the files you can download from the internet delivery product download service. Section 5.3 shows an example of the serial number card. Please check the serial ID in advance.

1.5 Setup Procedure

The following figure shows the steps for setting up the SX-Aurora TSUBASA system, which are described in the subsequent chapters.



Connect the VH and peripherals. (Chapter2)

Install an OS onto the VH. (Chapter3)

Obtain the SX-Aurora TSUBASA software packages and other related files on the computer for download. (Chapter4)

Install the SX-Aurora TSUBASA software and other related software onto the VH. (Chapter5)

Configure the VH to run the SX-Aurora TSUBASA system. (Chapter6)

⚠ NOTE

This document describes the setup procedure on Rocky Linux 8.6 (Kernel: 4.18.0-372.19.1.el8_6.x86_64) as an example. The procedure can vary depending on the OS and its kernel version.

[Memo] Please use the tables below as a memo when setting up the SX-Aurora TSUBASA system

■Network Information of the VH

Hostname of the VH	
IP address of the VH	
MAC address of the VH (Refer to section 3.13)	

■Account Information

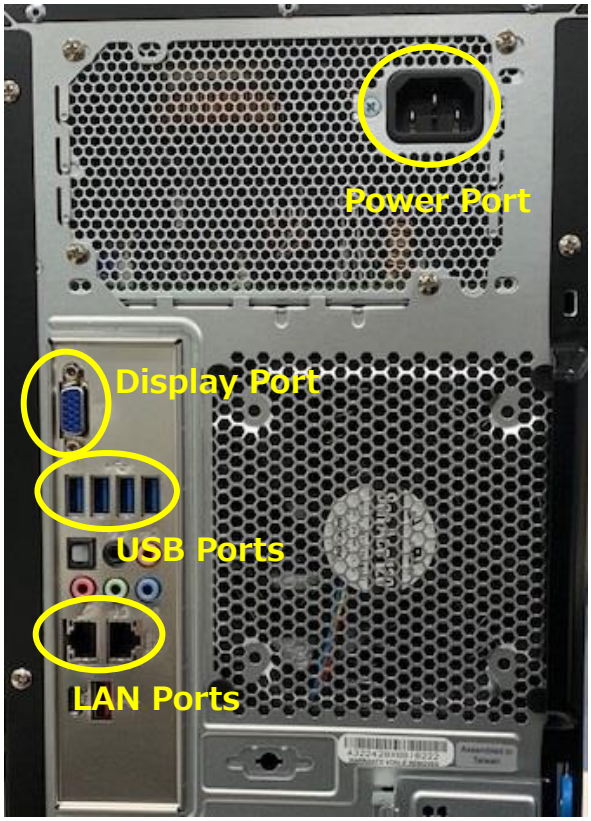
User ID for the NEC Support portal	
Download ID for the Internet Delivery	
Serial Number of the Support Pack for NEC SDK	

Chapter2　Hardware Setup

This chapter illustrates the connection between a VH and peripherals. Layout of panel components of the VH such as ports in the pictures may vary depending on the shipping time.

2.1　Front and Back Panel Components of the VH

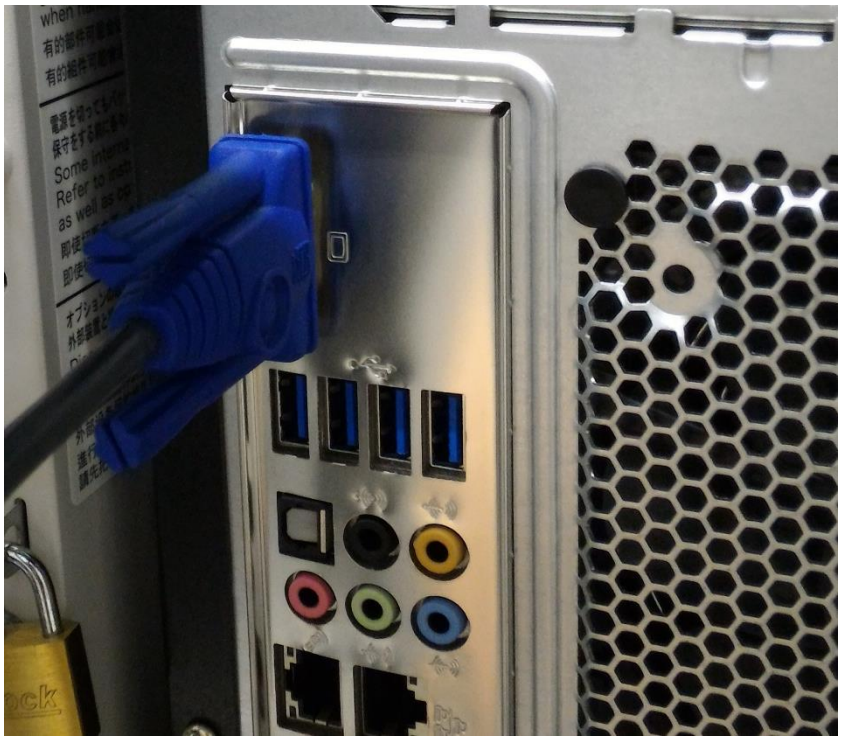
Front Panel



Back Panel

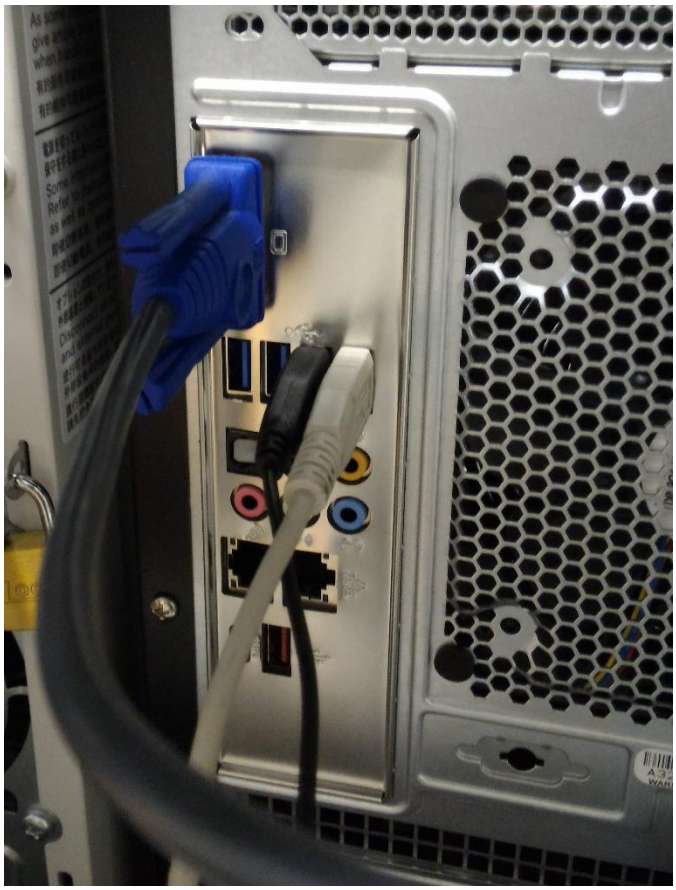
2.2　Connection of a Display

Connect the display port on the back panel and a display with a display cable. Also, connect a power cable to the power port of the display and plug the power cable into an outlet.



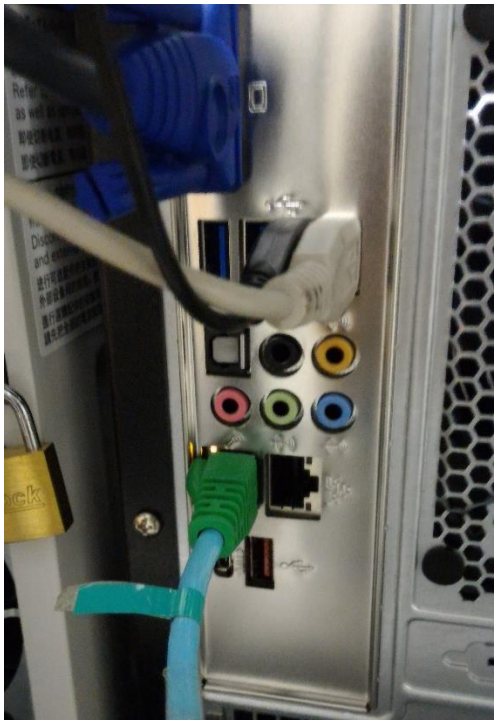
2.3 Connection of a Keyboard and Mouse

Connect the cables of a USB keyboard and USB mouse to USB ports on the back panel.



2.4 Connection of a LAN Cable

Connect one end of a LAN cable to the network and the other end to the LAN port (on the left side) on the back panel.



2.5 Connection of a Power Cable

Connect a power cable to the power port on the back panel and plug the power cable into an outlet.

Chapter3　OS Installation

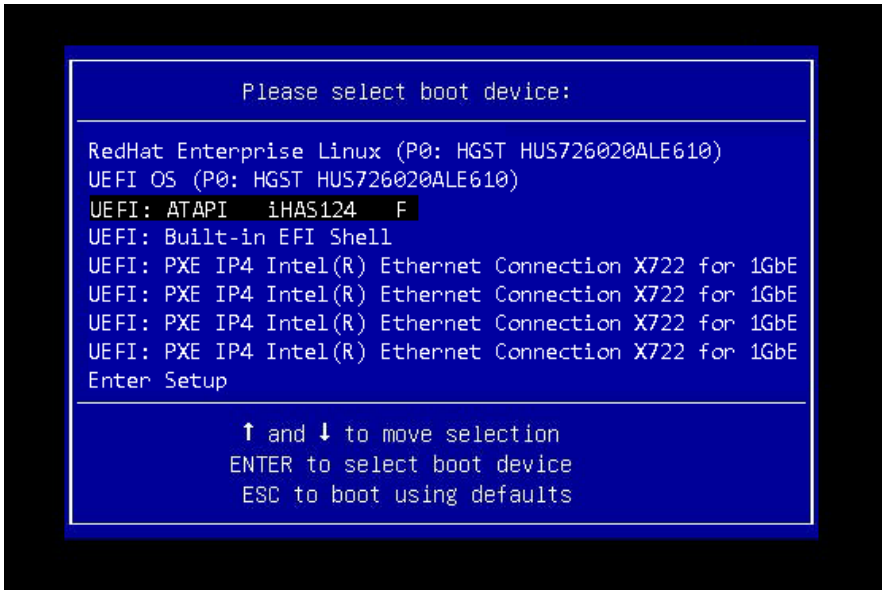
This chapter describes OS installation onto the VH.

3.1　Boot of the VH

Put the OS installation DVD into the DVD drive of the VH immediately after turning on the VH.

Wait a little until you see the NEC logo on the display, and then press the F11 key on the keyboard.

After a short while, the following boot menu will be displayed.

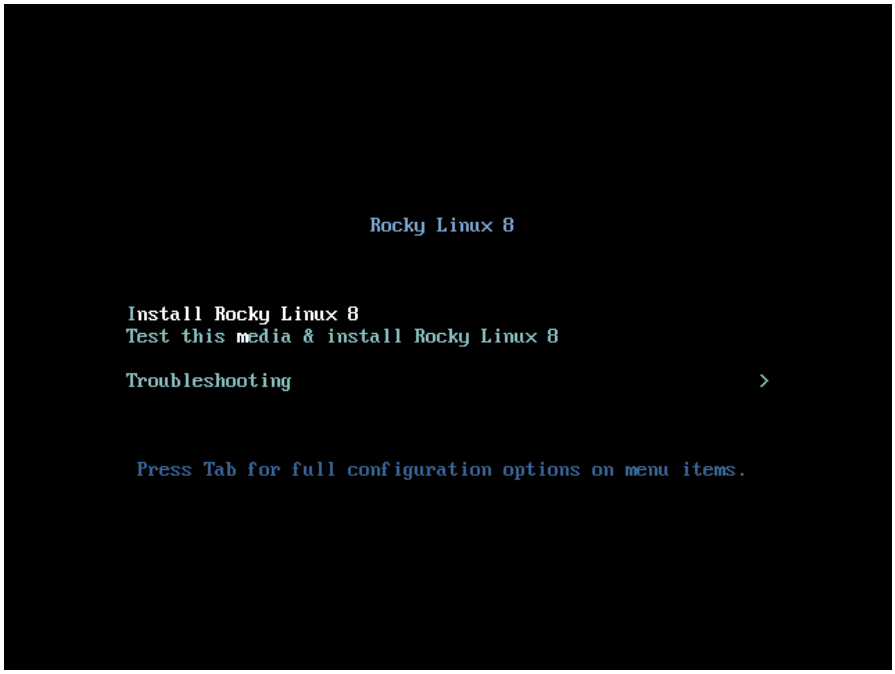


Select “UEFI: ATAPI　iHAS124　F” with the arrow keys on the keyboard, and press the Return key to start booting from the DVD.

3.2 Start of the OS Installer

In a while, the following screen will be displayed.

- This example shows the case of Rocky Linux 8

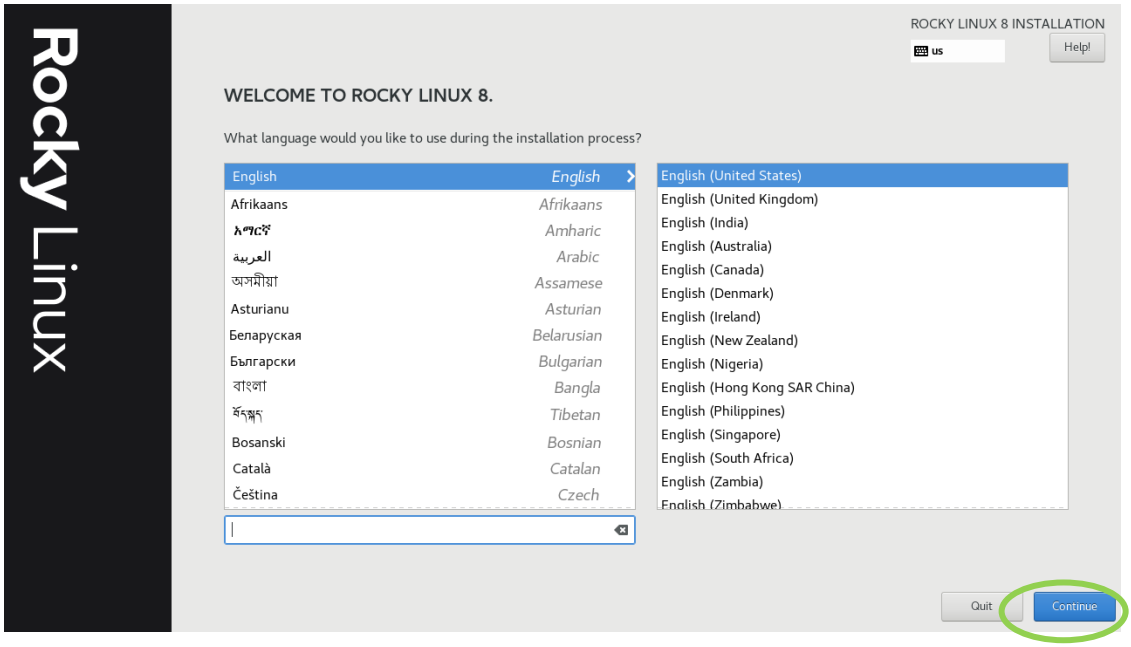


Select “Install Rocky Linux 8” with the arrow keys on the keyboard and press the Return key to start the OS installer.

3.3 Selection of a Language

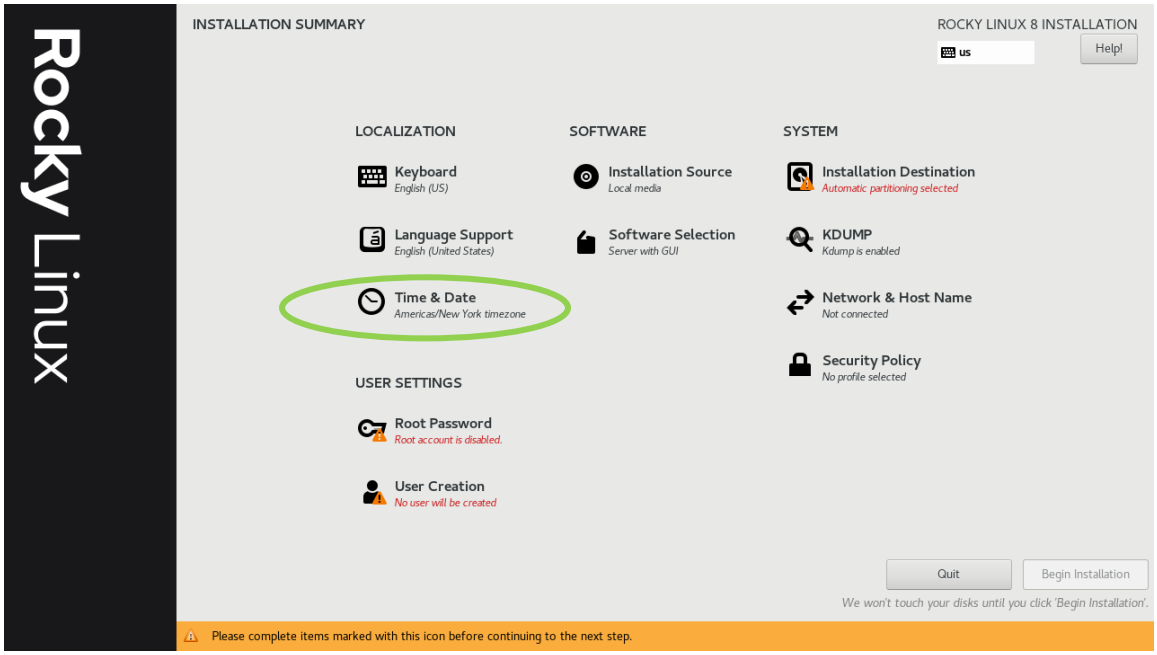
The OS installer will first display the screen for selecting a language used for the installation.

Select your language with the mouse and click on the “Continue” button on the lower right.

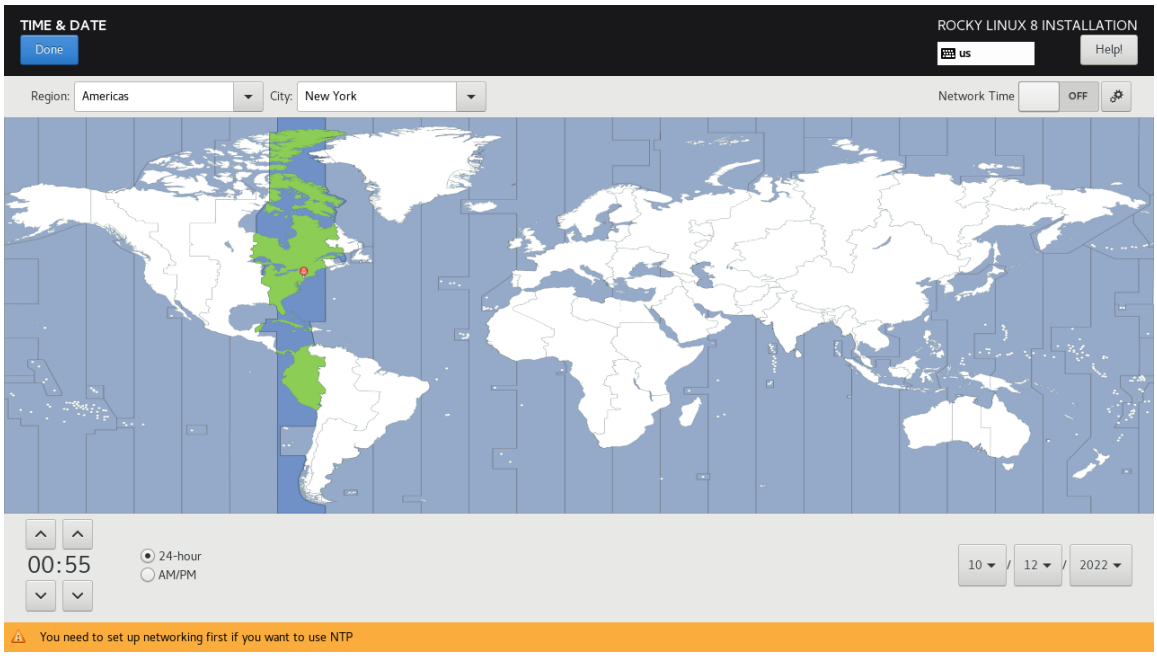


3.4 Selection of Timezone

Click on “Time & Date” in the “LOCALIZATION” part to select the timezone of your country.

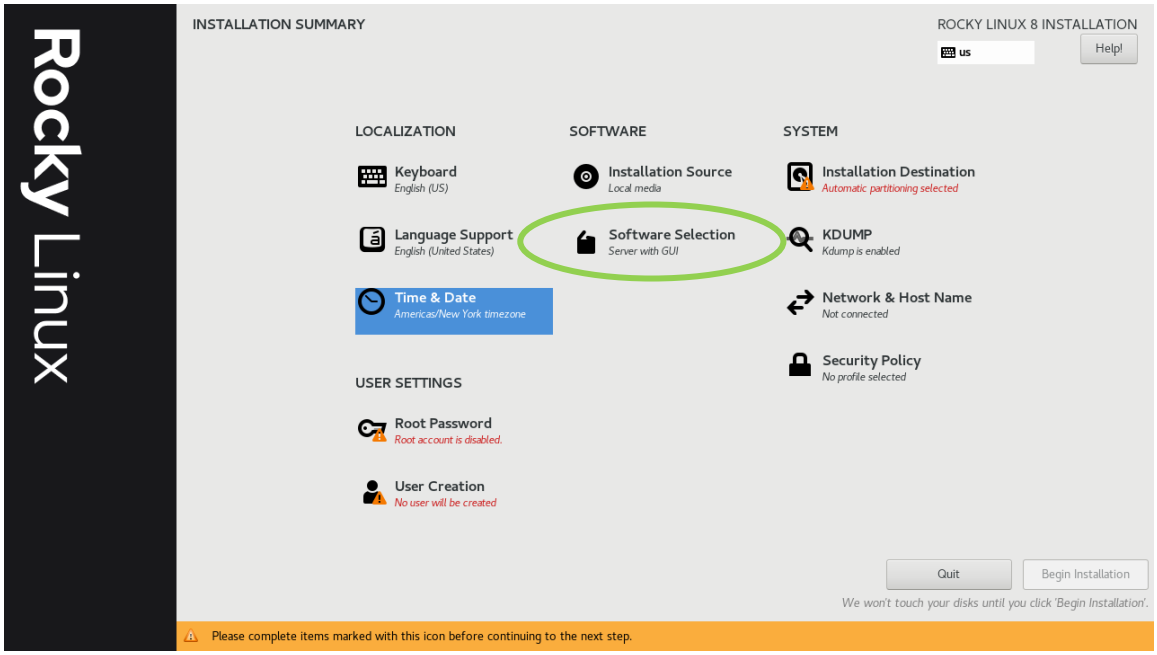


In the “TIME & DATE” screen, select the timezone of your country, and confirm the time and date.

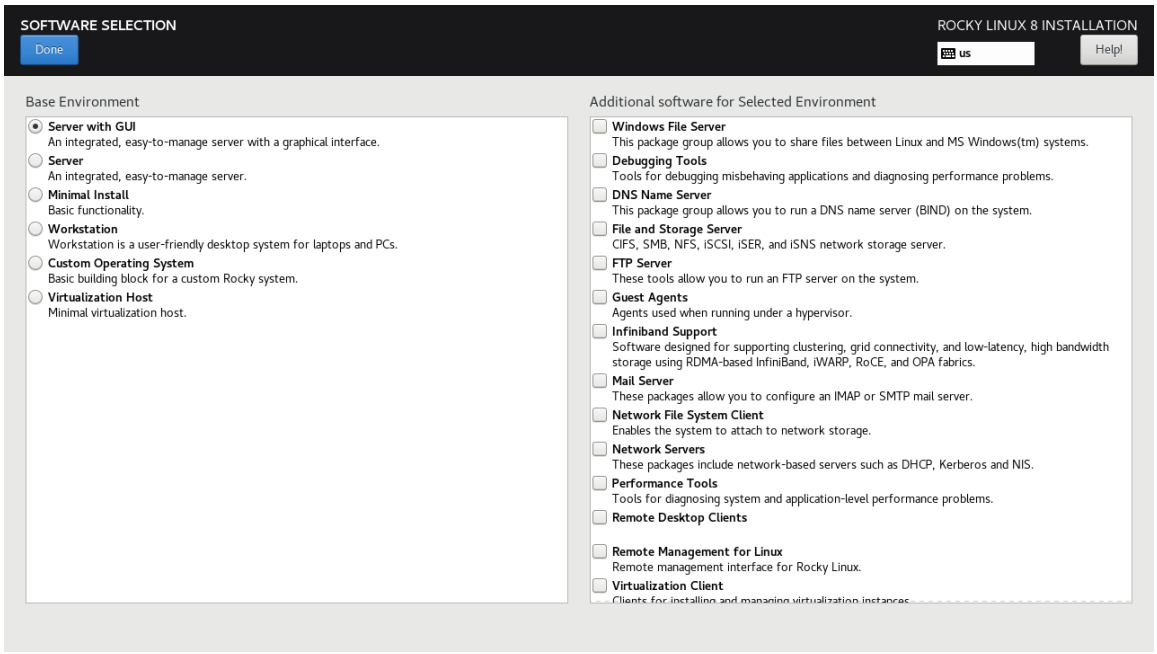


3.5 Selection of Software

Click on “Software Selection” in the “SOFTWARE” part to select software to install.



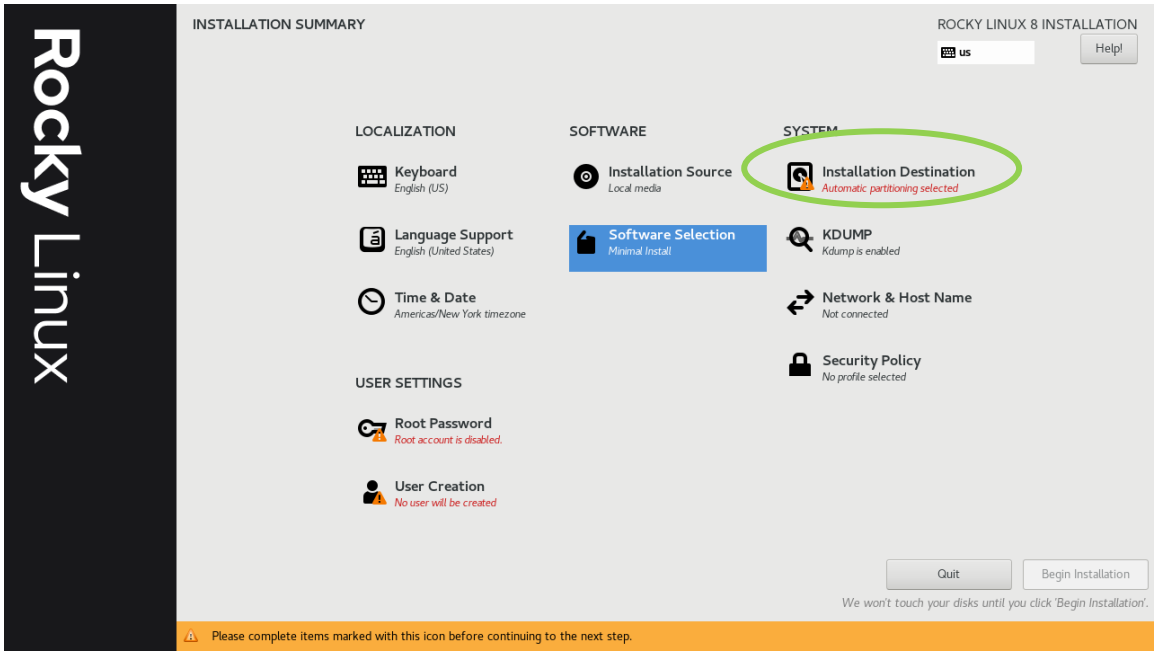
In the “SOFTWARE SELECTION” screen, “Server with GUI” is selected by default. You can change other base environment and select additional software as necessary.



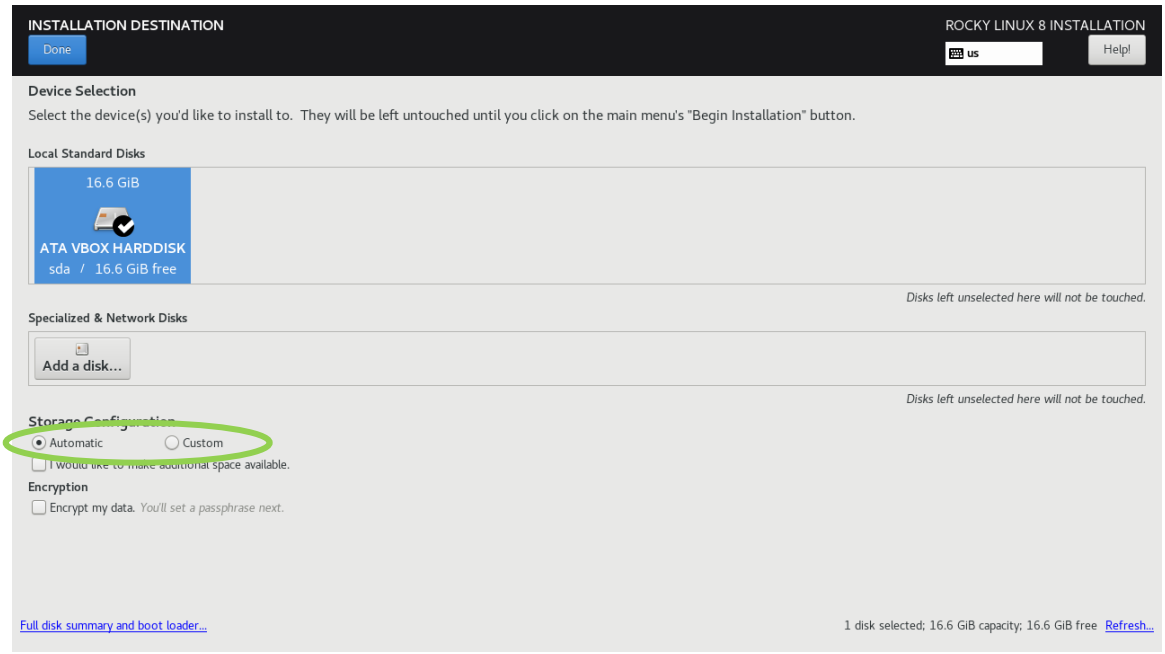
Click on the “Done” button on the upper left after the selection.

3.6 Creation of Installation Destination

Click on “Installation Destination” in the “SYSTEM” part to set the drive and partition onto which the OS is installed.



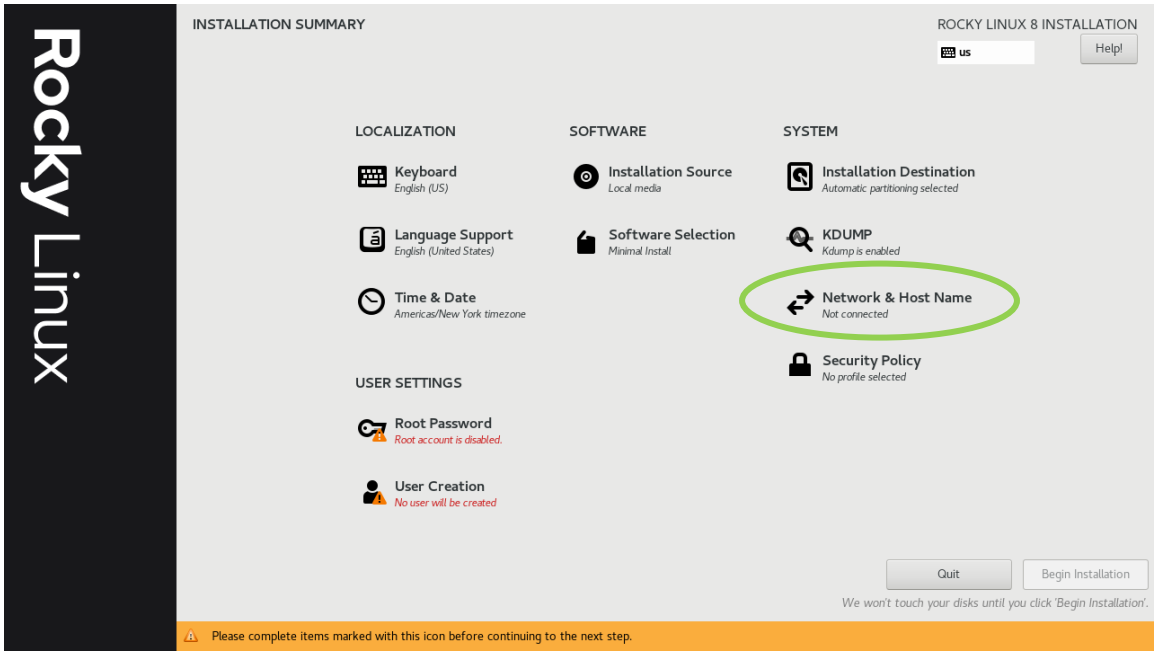
By selecting a disk in the “Device Selection” section and checking “Automatic” in the “Storage Configuration” section, a partition for OS installation using the whole disk is automatically created.



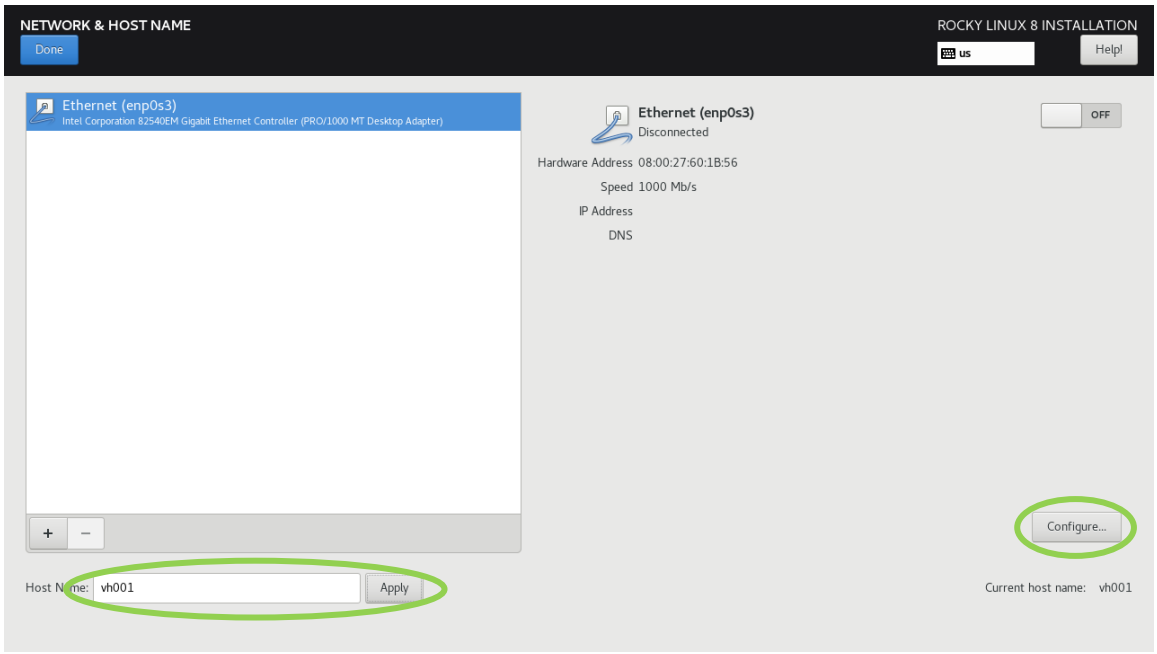
Click on the “Done” button on the upper left after the creation.

3.7 Configuration of Network and Hostname

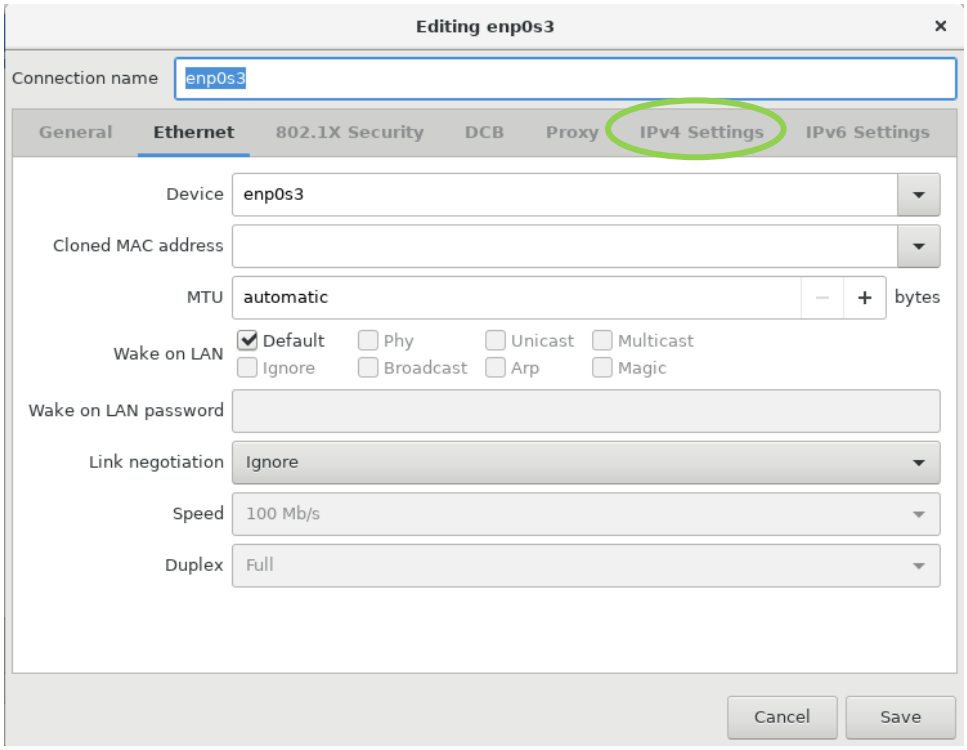
Click on “Network & Host Name” in the “SYSTEM” part to show the “NETWORK & HOST NAME” screen.



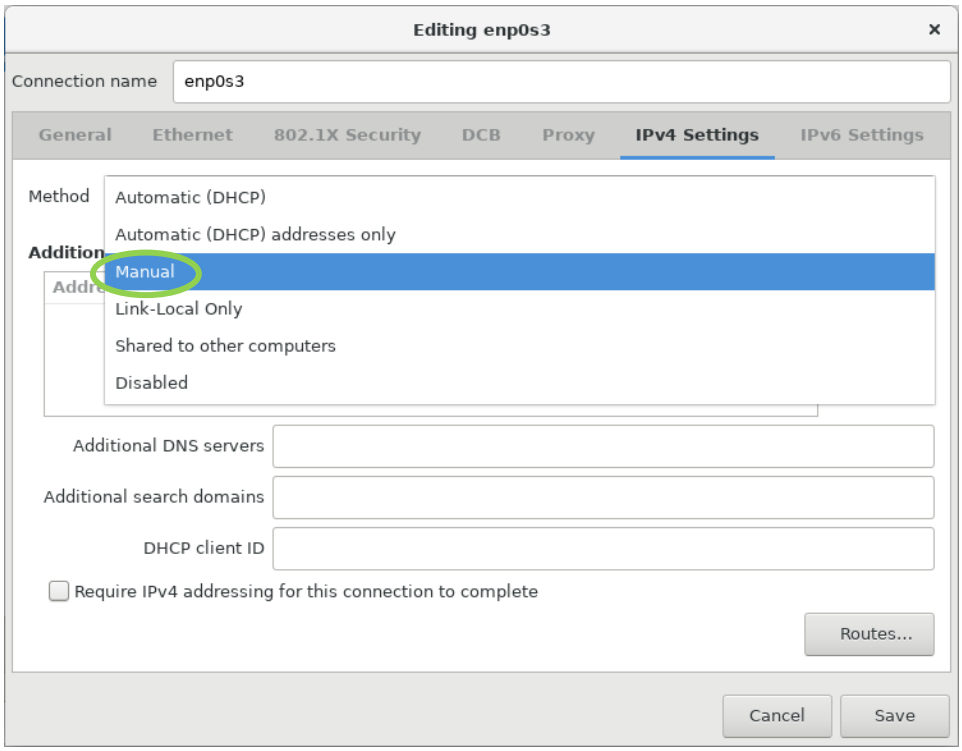
Enter an arbitrary hostname of the VH in the “Host name” field on the lower left (vh001 in this example) and click on the “Apply” button on the right of the field.



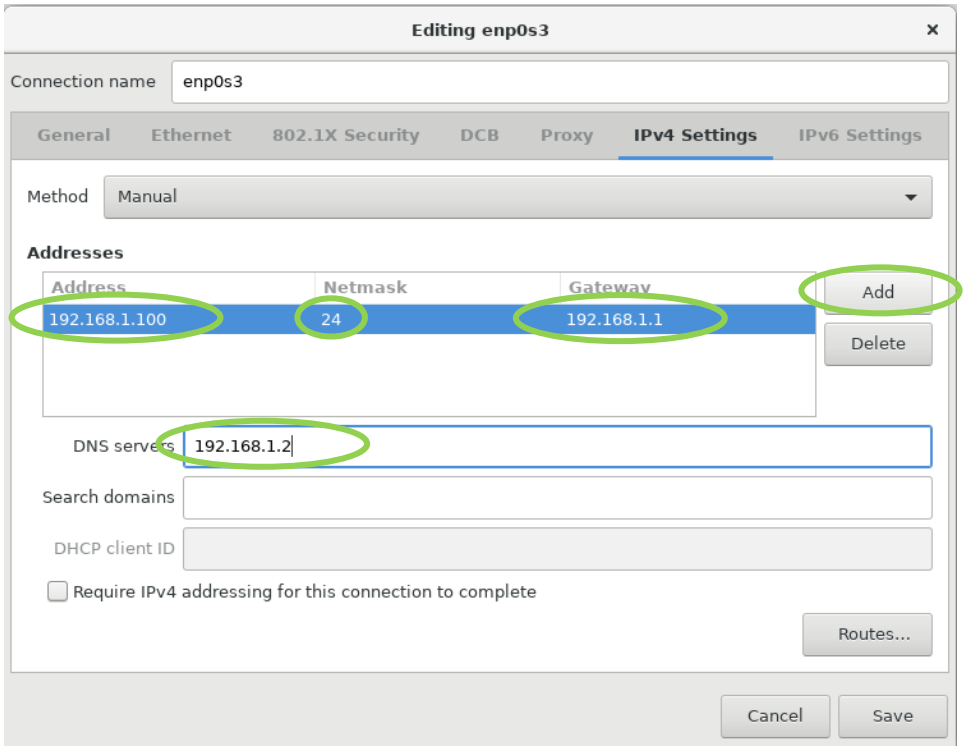
Then click on the “Configure…” button on the lower right to show a screen for configuring the network (as shown in the “Editing eno1” screen below), on which you can configure network information of the VH such as the IP address, gateway, and DNS server. The following uses the example described in section 1.2.



Click on the “IPv4 Settings” tab, and then select “Manual” from the drop-down menu on the “Method” field.

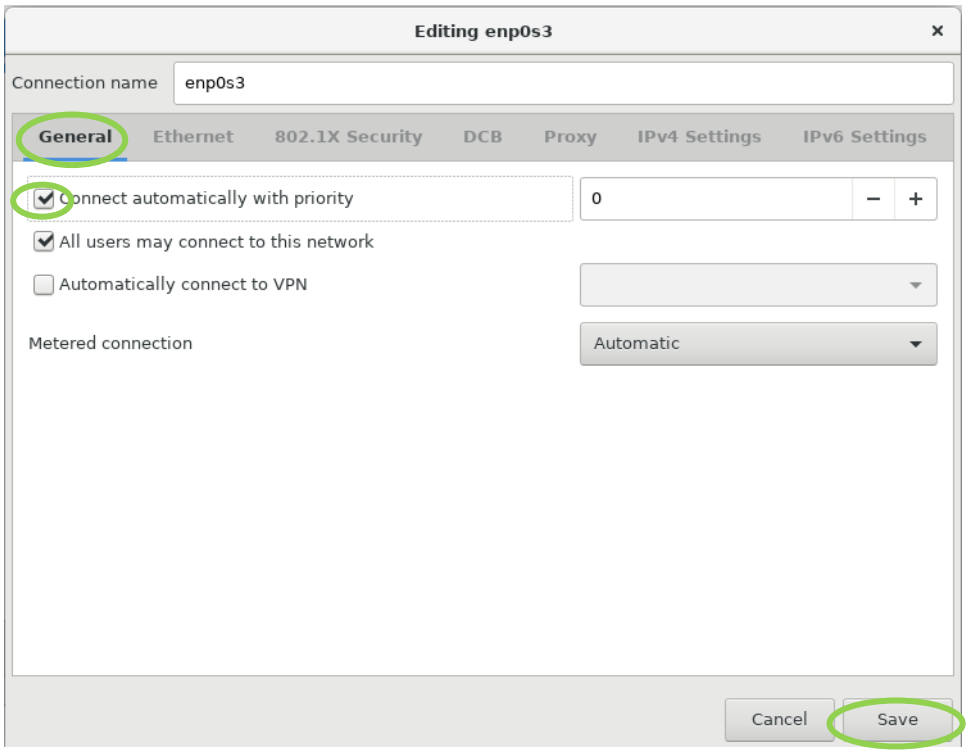


Next, click on the “Add” button on the right of the “Addresses” section, and enter the IP address of the VH, netmask, and IP address of the gateway in the corresponding cells. Also, enter the IP address of the DNS server in the “DNS servers” field under the cells.

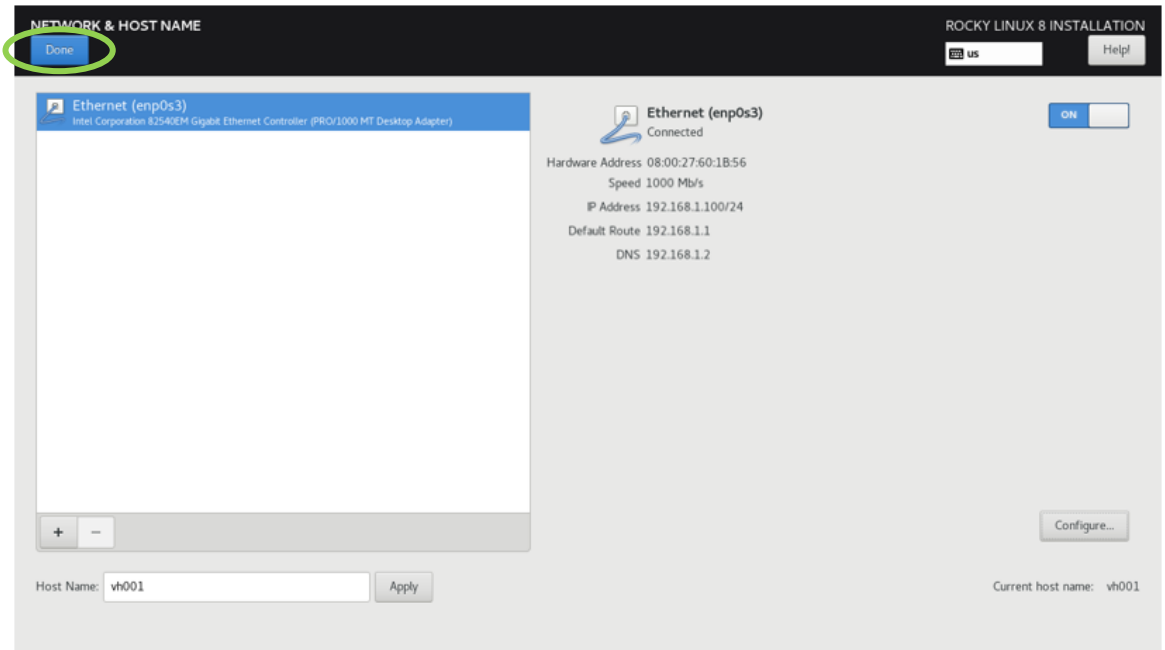


In addition, click on the “General” tab on the screen, and check “Connect automatically with priority”.

After this, click on the “Save” button on the lower right to finish the network configuration.

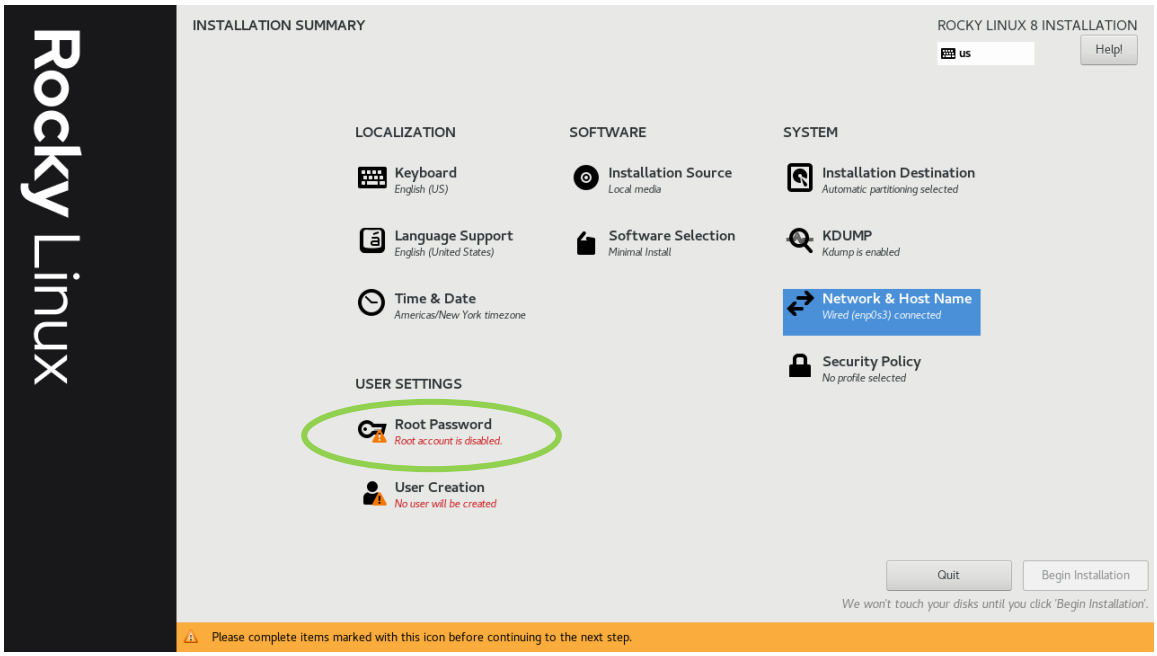


Lastly, click on the “Done” button on the upper left of the “NETWORK & HOST NAME” screen.

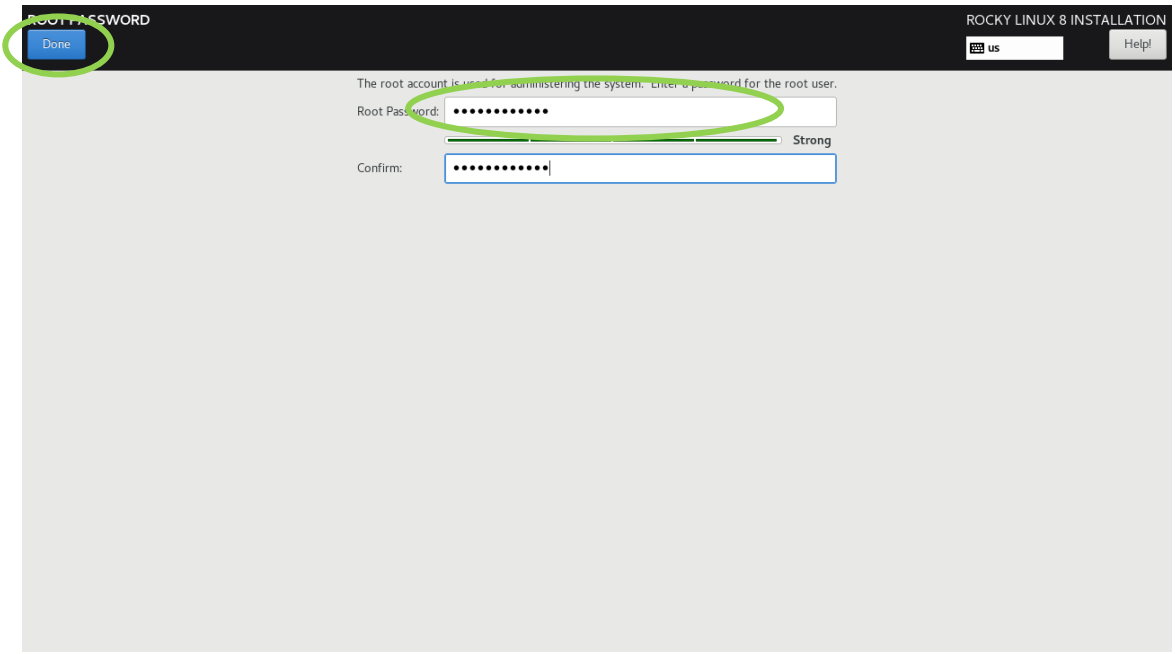


3.8 Setting of the Root Password

Click on “Root Password” in the “USER SETTINGS” part to show the “ROOT PASSWORD” screen.

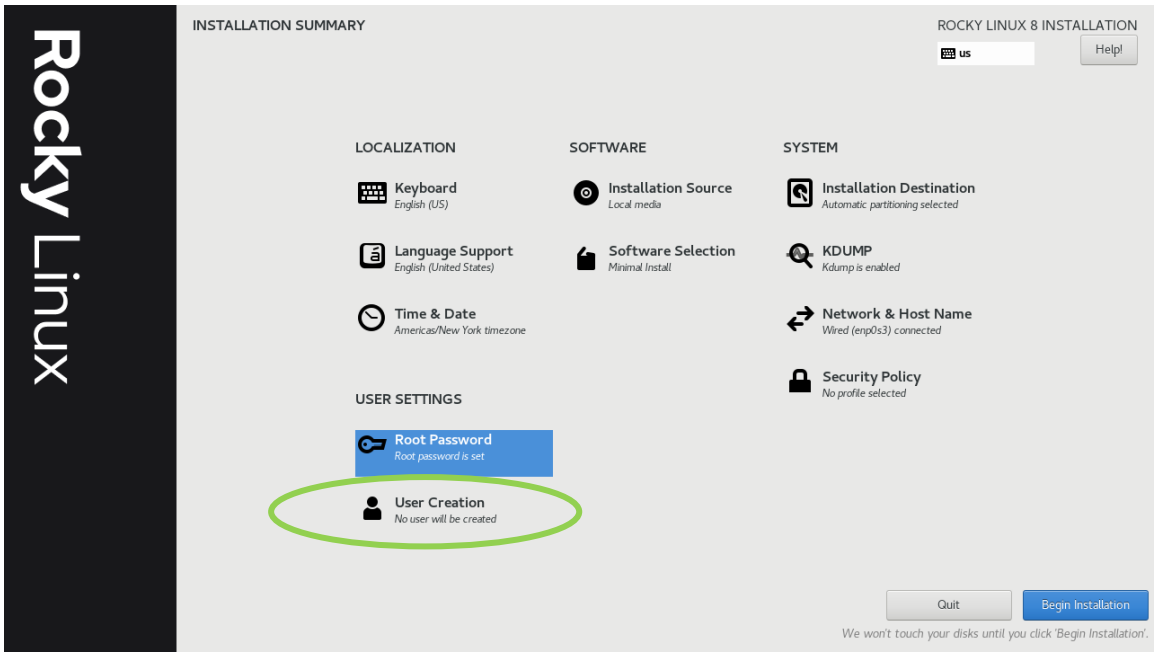


Set the root password by entering it in both of the “Root Password” and “Confirm” fields. Then click on the “Done” button on the upper left.

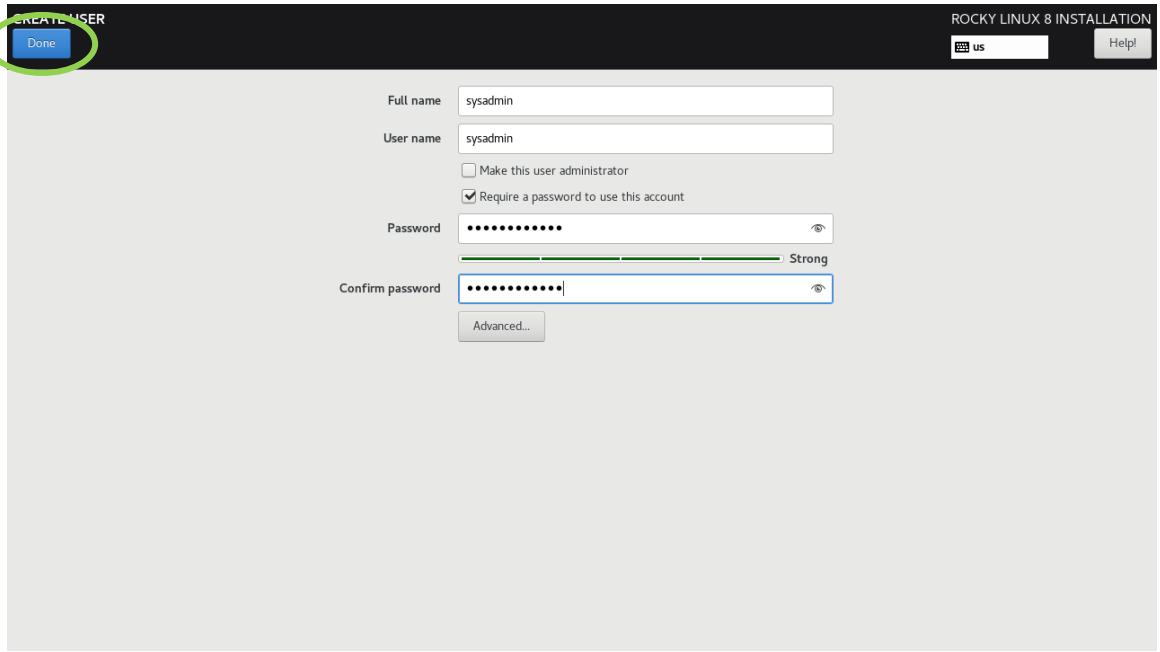


3.9 Creation of a User

Click on the “User Creation” of the “USER SETTINGS” screen to show the screen for creating a user.



Enter the full name of the user in the “Full name” field, login-name in the “User name” field, and password in both of the “Password” and “Confirm password” fields on the screen. If you want to give the user administrative privileges, check the checkbox “Make this user administrator”.

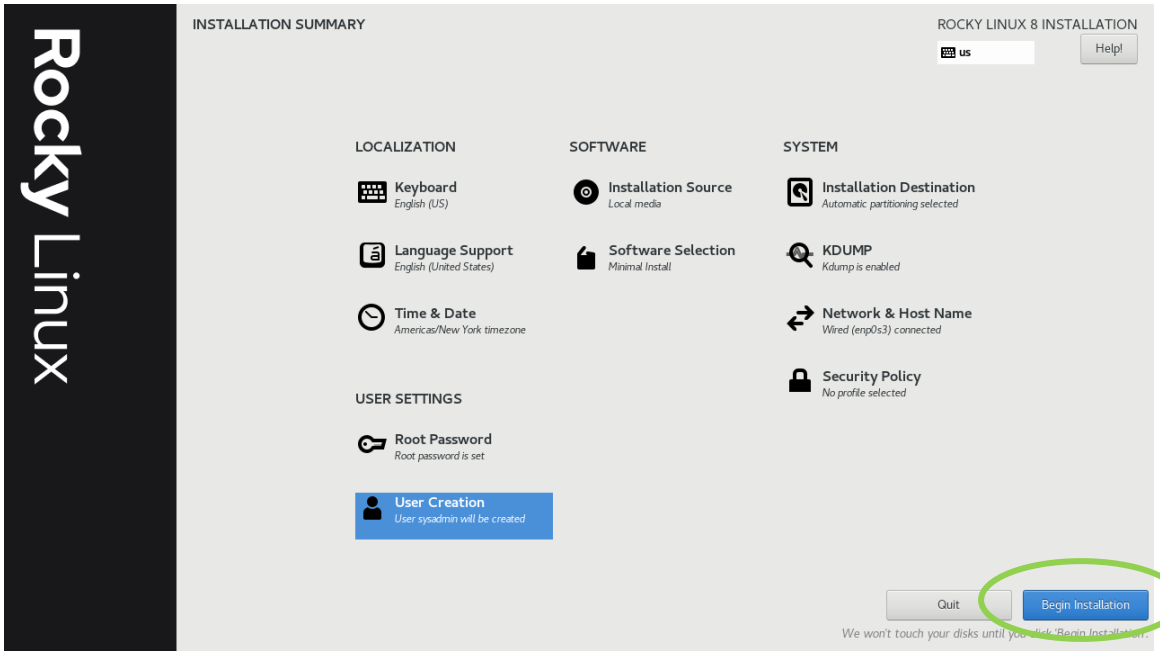


Click on the “Done” button on the upper left to return to the screen showing the progress of the installation, which is displayed on the bottom.

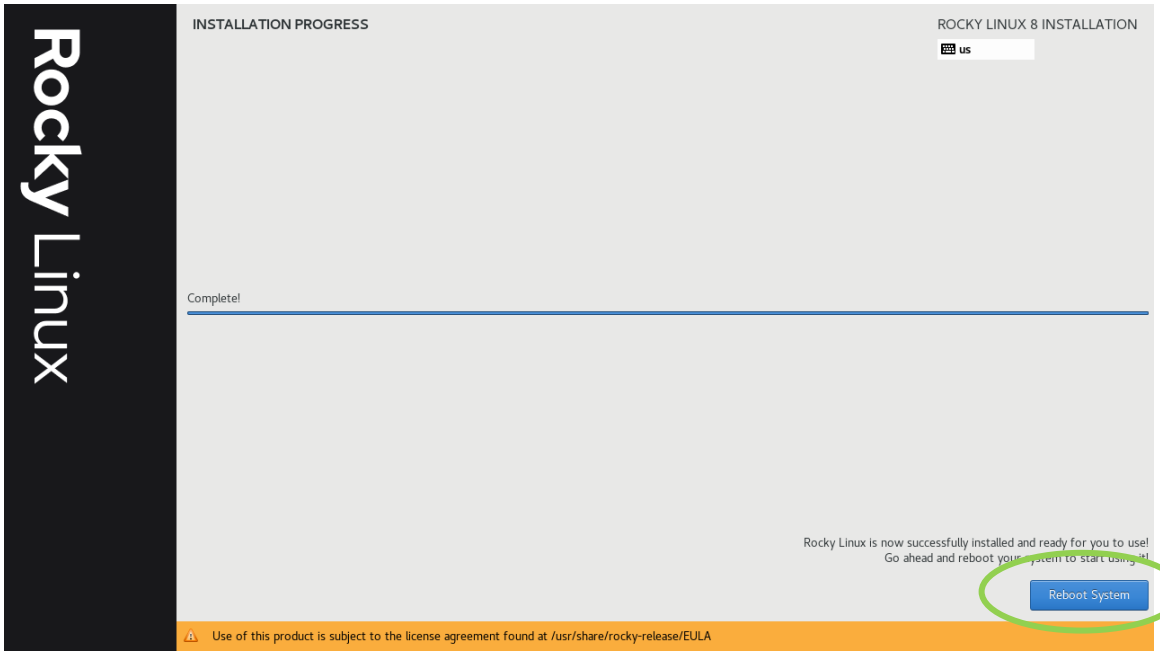
3.10 Start of OS Installation

Click on the “Begin Installation” button on the lower right of the “INSTALLATION SUMMARY”

screen to show the “INSTALLTION PROGRESS” screen.



When the installation is completed, the screen will say “Complete!” on the lower left and display the “Reboot System” button on the lower right.



3.11 Reboot of the VH

Click on the “Reboot” button on the lower right of the screen to reboot the VH. The booted OS will display the login prompt on the console screen.

Please log in as the root user with the password set in section 3.8 as the following operations require administrative privileges.

3.12 Configuration of the Yum Repository for the OS Installation DVD

This section describes how to configure the yum repository for software in the OS installation DVD, which is required for installation of the SX-Aurora TSUBASA software.

(1) Mount of the OS Installation DVD

Put the OS installation DVD into the DVD drive of the VH, if you have ejected it after the installation, and mount it at the directory /media/cdrom.

```
# mkdir /media/cdrom
# mount /dev/cdrom /media/cdrom
```

(2) Creation of the Yum Repository

This step creates a repository configuration file (Rocky-Media.repo) after saving the existing repository so as to install packages from the OS installation DVD with the yum command.

Firstly, save the existing repository configuration files under the directory /etc/yum.repos.d as follows

```
# cd /etc/yum.repos.d
# mkdir repo.save
# mv Rocky-* repo.save
```

Next, create a repository configuration file Rocky-Media.repo with the following content with an editor.

/etc/yum.repos.d/Rocky-Media.repo

```
[media-base]
name=Rocky Linux - x86_64 - Media - BaseOS
baseurl=file:///media/cdrom/BaseOS
enabled=1
gpgcheck=0

[media-appstream]
name=Rocky Linux - x86_64 - Media - AppStream
baseurl=file:///media/cdrom/AppStream
enabled=1
gpgcheck=0
```

Please keep the DVD mounted until installation of the SX-Aurora TSUBASA software is completed.

3.13 Acquisition of the Host Information

Obtain the hostname and MAC address of the VH and take a memo of them, which are needed for obtaining the license file for the SX-Aurora TSUBASA software.

The hostname command shows the hostname.

```
# hostname
vh001
```

Also, find out the MAC address of the network card of the VH from the information displayed with the ip command.

```
# ip addr
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN qlen 1
    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: enp129s0f0: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc mq state UP qlen 1000
    link/ether ac:1f:6b:2d:8c:b4 brd ff:ff:ff:ff:ff:ff
    inet 192.168.1.100/24 brd 192.168.1.255 scope global dynamic enp129s0f0
       valid_lft 1410sec preferred_lft 1410sec
    inet6 fe80::ae1f:6bff:fe2d:8cb4/64 scope link
       valid_lft forever preferred_lft forever
3: enp129s0f1: <NO-CARRIER,BROADCAST,MULTICAST,UP> mtu 1500 qdisc mq state DOWN qlen 1000
    link/ether ac:1f:6b:2d:8c:b5 brd ff:ff:ff:ff:ff:ff
```

Chapter4 Preparation of the SX-Aurora TSUBASA Software

This chapter describes how to obtain software required for the SX-Aurora TSUBASA and the license file for it.

⚠ NOTE

Please perform the operations in this chapter on the computer for download that has access to the Internet prepared in section 1.1.

4.1 Acquisition of Kernel Update Packages

This section explains how to obtain the kernel update packages corresponding to the OS and its version running on the VH. The following kernel update packages are required, in which "*X.XX.X-XXX.X.X*" corresponds to the kernel version.

- RHEL/CentOS 7.X
  - kernel-*X.XX.X-XXX.X.X*.el7.x86_64.rpm
  - kernel-headers- *X.XX.X-XXX.X.X*.el7.x86_64.rpm

- RHEL/CentOS/Rocky Linux 8.*X*
  - kernel-*X.XX.X-XXX.X.X*.el8_*X*.x86_64.rpm
  - kernel-headers-*X.XX.X-XXX.X.X*.el8_*X*.x86_64.rpm
  - kernel-core-*X.XX.X-XXX.X.X*.el8_*X*.x86_64.rpm
  - kernel-modules-*X.XX.X-XXX.X.X*.el8_*X*.x86_64.rpm

Please refer to the NEC support portal below for the latest information of the supported OSes and kernel versions.

https://www.support.nec.co.jp/en/View.aspx?id=4140100078 (English)

https://www.support.nec.co.jp/View.aspx?id=3140106285 (Japanese)

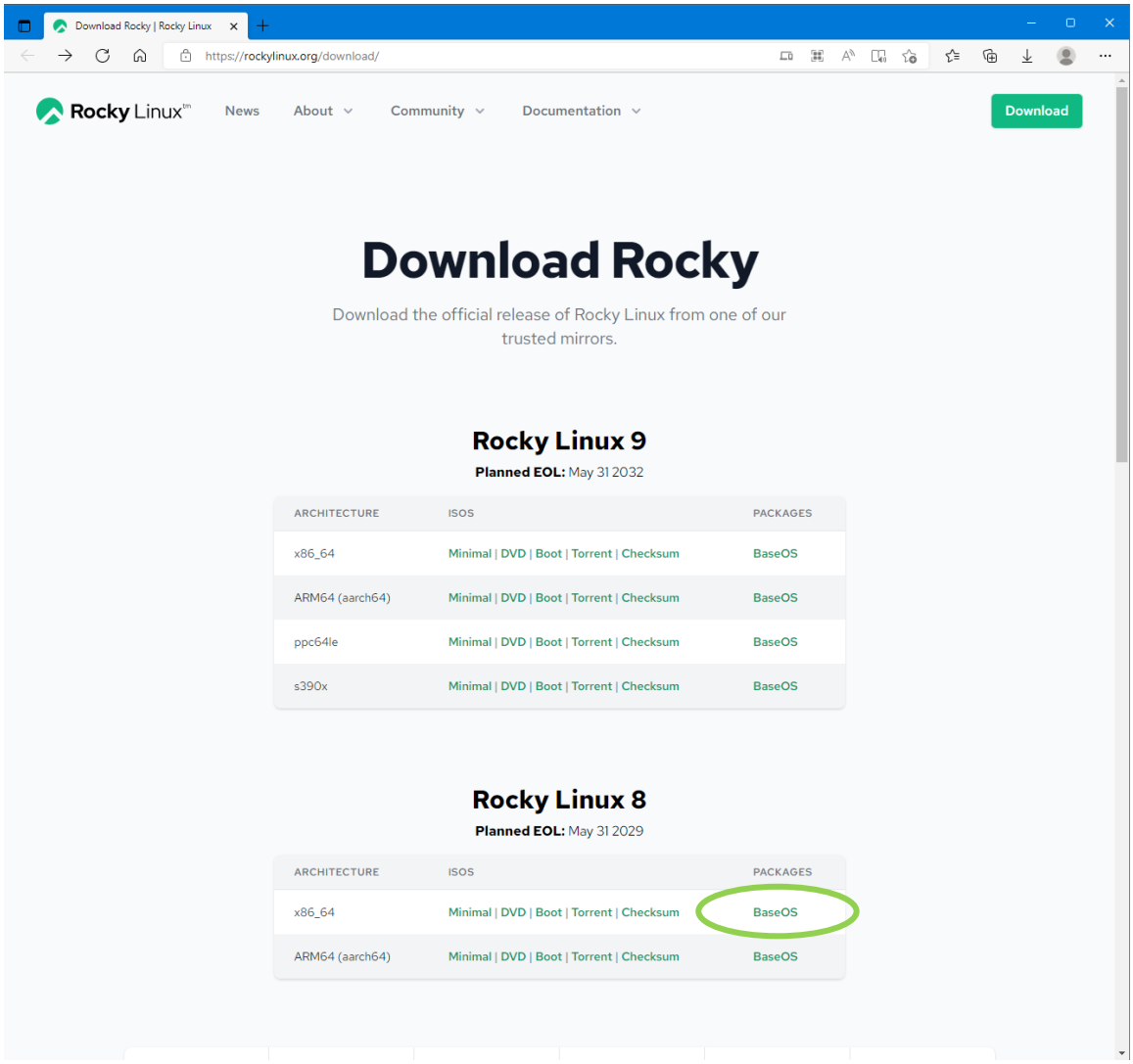
⚠ NOTE

This section explains the operations for Rocky Linux 8.6 (Kernel:4.18.0-372.19.1.el8_6) as an example. The operations may vary depending on the OS and its kernel version.

(1) Access to the Download Site

Launch a web browser on the computer for download and access the following Rocky Linux download site.

https://rockylinux.org/download/



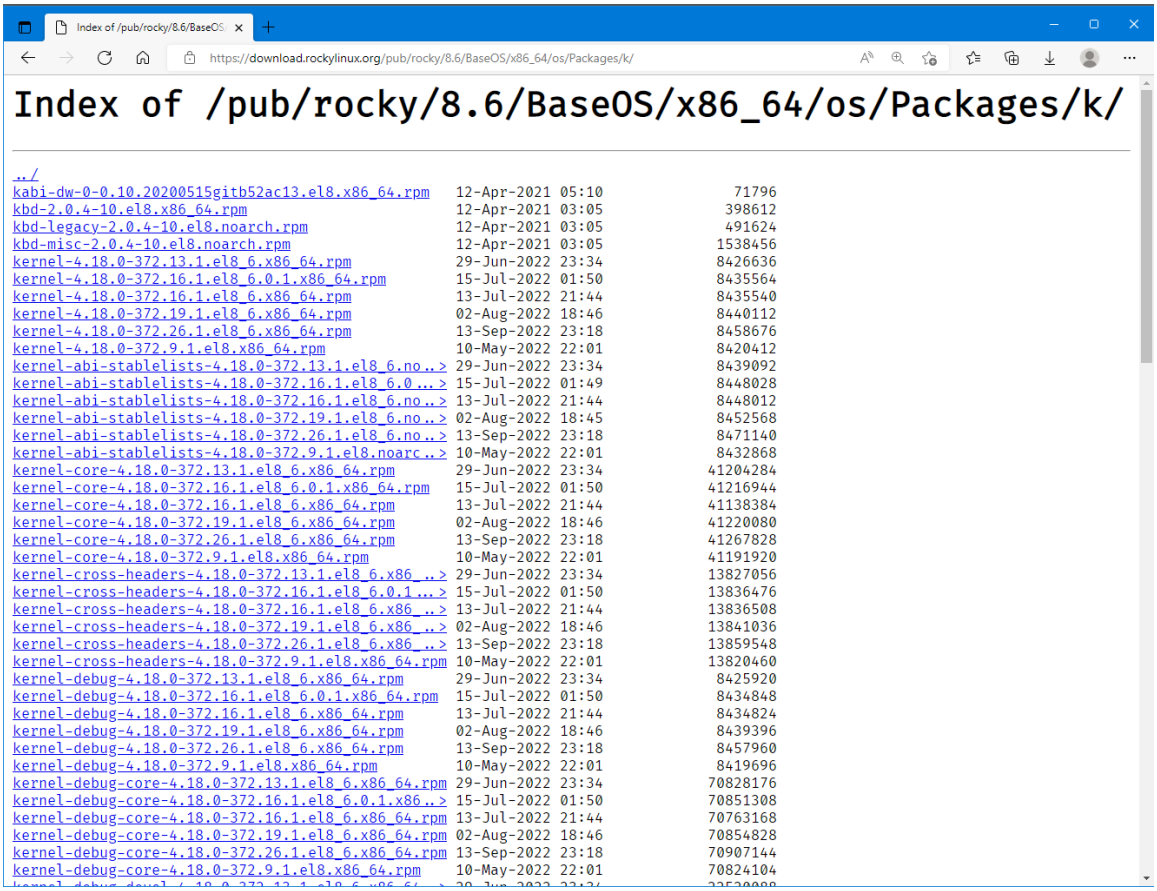
Select x86_64 of your OS version (8.6 in this example), and navigate through the links “os”, “Packages”, and then “k”.

(2) Download of Update Packages

Create an arbitrary directory (folder) to store downloaded files (hereafter, the download directory “Aurora” is used as an example in this document). Then click on the kernel package corresponding to your OS version (kernel-4.18.0-372.19.1.el8_6.x86_64.rpm in this example) on the download site and download it onto the directory.

In addition, download the following packages onto the same directory.

- kernel-headers-4.18.0-372.19.1.el8_6.x86_64.rpm
- kernel-core-4.18.0-372.19.1.el8_6.x86_64.rpm
- kernel-modules-4.18.0-372.19.1.el8_6.x86_64.rpm



⚠ NOTE

The bash-4.4 has a known problem that adversely affects the operation of the SX-Aurora TSUBASA System. It is included in the ISO image of the RHEL/CentOS 8.4. Please update bash-4.4 to a fixed or later version.

The updated packages of bash for each OS are describe at the following URL.

https://www.support.nec.co.jp/en/View.aspx?id=4140100118

The bash package for CentOS 8.4 is below, download it onto the "Aurora" directory.

https://vault.centos.org/8.4.2105/BaseOS/x86_64/os/Packages/

- bash-4.4.20-1.el8_4.x86_64.rpm or later

4.2 Acquisition of the License Certificates

If you have purchased paid software for the SX-Aurora TSUBASA, please obtain the license certificates from the internet delivery product download service according to the operations described in this section.

(1) Access to the Internet Delivery Product Download Service

Access the internet delivery product download service at the URL below with a web browser.

https://idpsv.wsrs.m-dmz1.nec.co.jp/dlservice/

Please read the license agreement carefully and click on the “I agree to the license agreement” button on the bottom of the window if you agree with it.

You will be transferred to the login window. Enter the download ID and password described in the I-distribution product delivery notification, and then click on the “Log in” button on the bottom of the window.

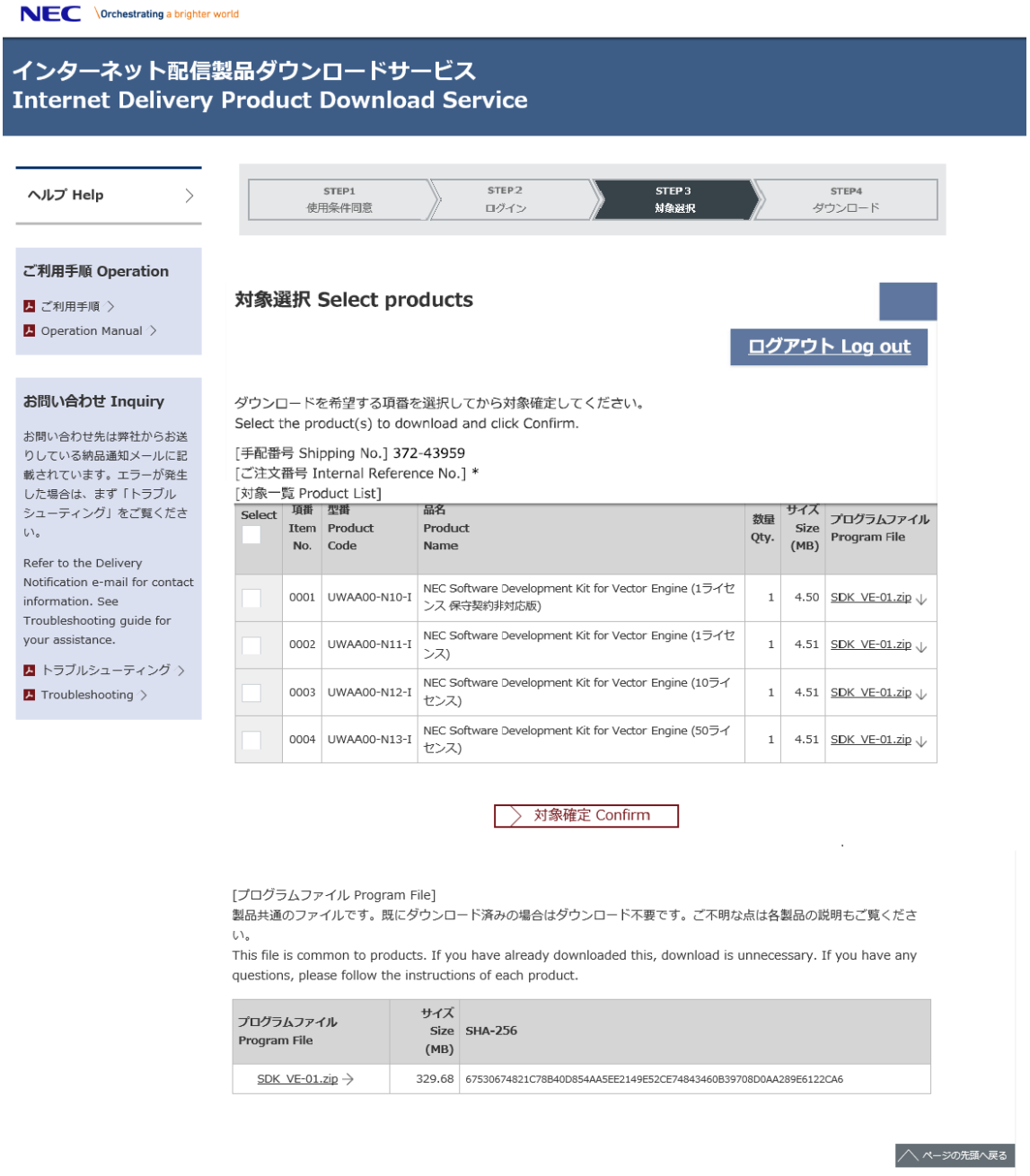
(2) Acquisition of the License Certificates

You will be transferred to the window to select the products from the list below. Please check the selection-boxes on the left of the products you have purchased.

- NEC Software Development Kit for Vector Engine (*XX* License)

Click on the “Confirm” button to download a zip file that includes the license certificates for the selected products and other related documents.

Unzip the zip file, and you will get zip files again which correspond to all the products you have selected. Unzip the zip files you have just extracted and save all the files “License Certificate.pdf”, which will be extracted and are used in section 4.3 and 6.1.



4.3 Acquisition of the License File

This section describes how to obtain the license file from the “HPC Software License Creation” site using the license certificate files downloaded in section 4.2 and the hostname and MAC address of the VH obtained in section 3.13.

(1) Preparation of the Licensing Keys

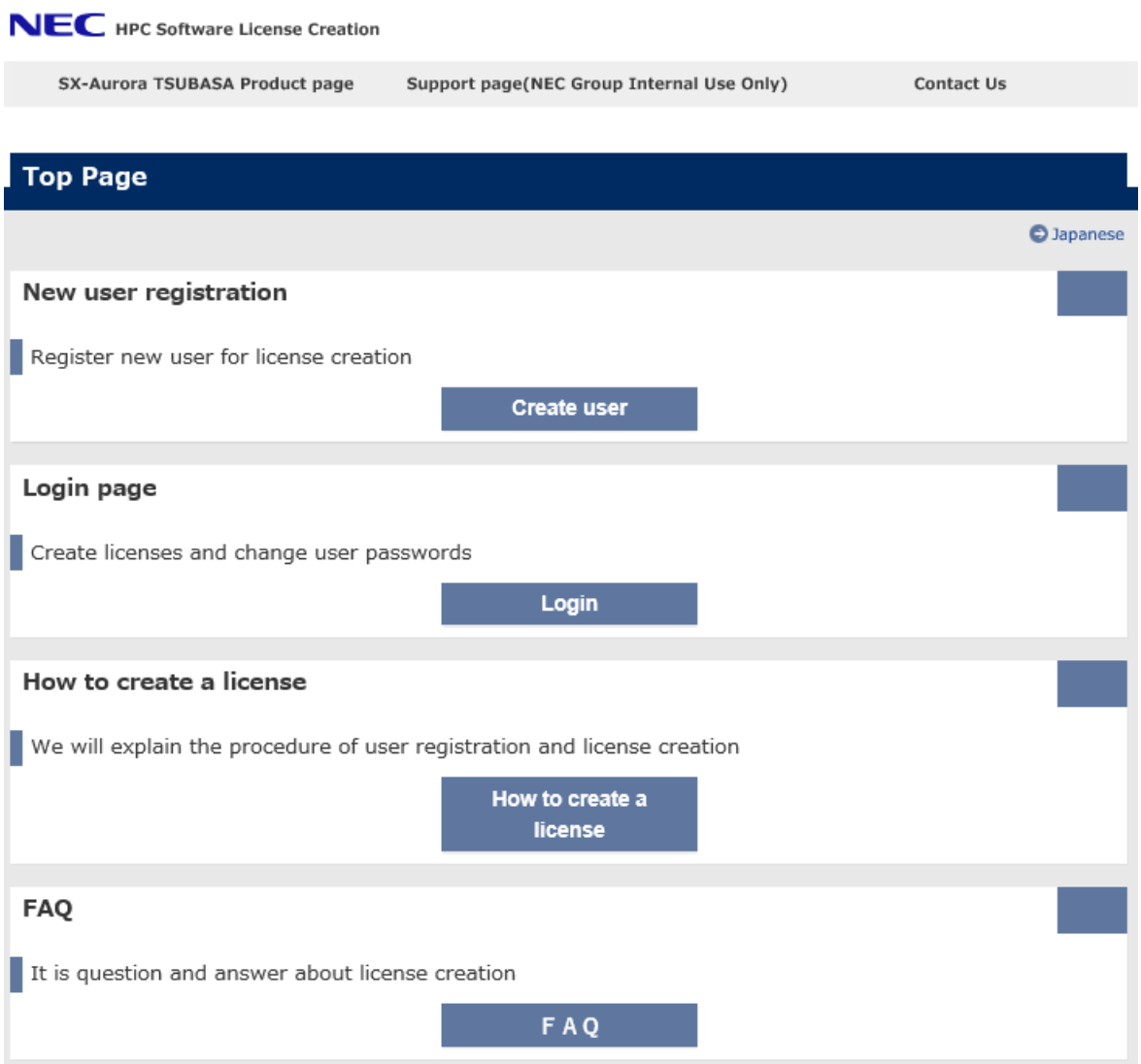
Please note all the licensing keys described in the license certificate files for paid

software (SDK or Compat C++) downloaded in section 4.2.

(2) Access to the “HPC Software License Creation” Site

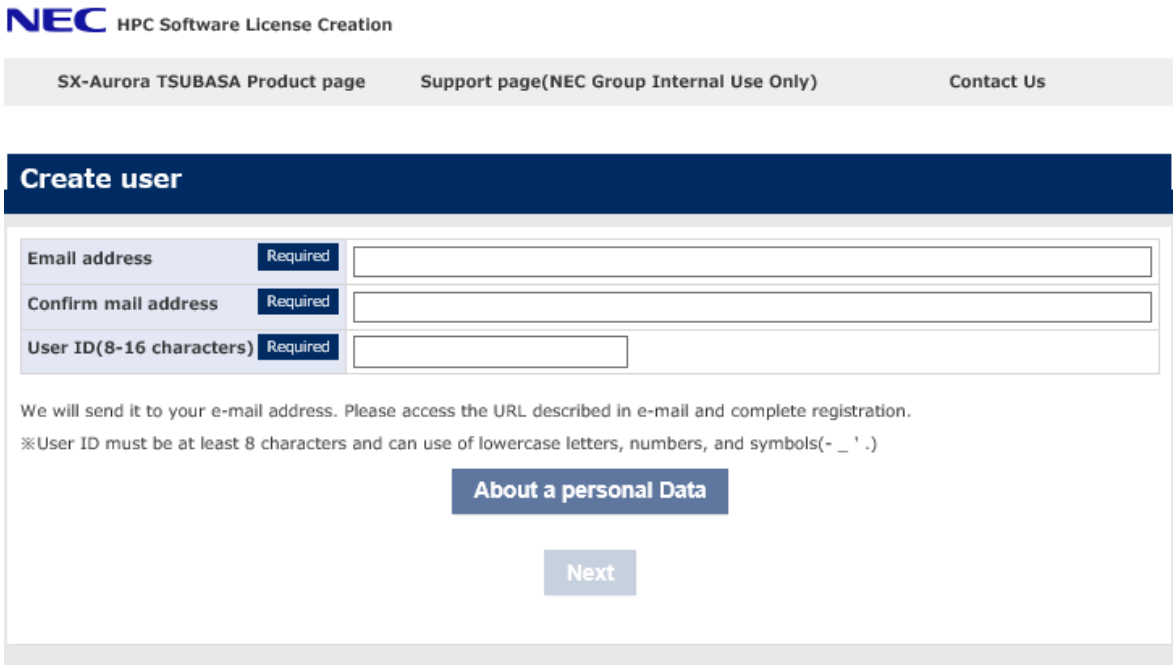
Access the “HPC Software License Creation” site below with a web browser.

https://www.hpc-license.nec.com/aurora/



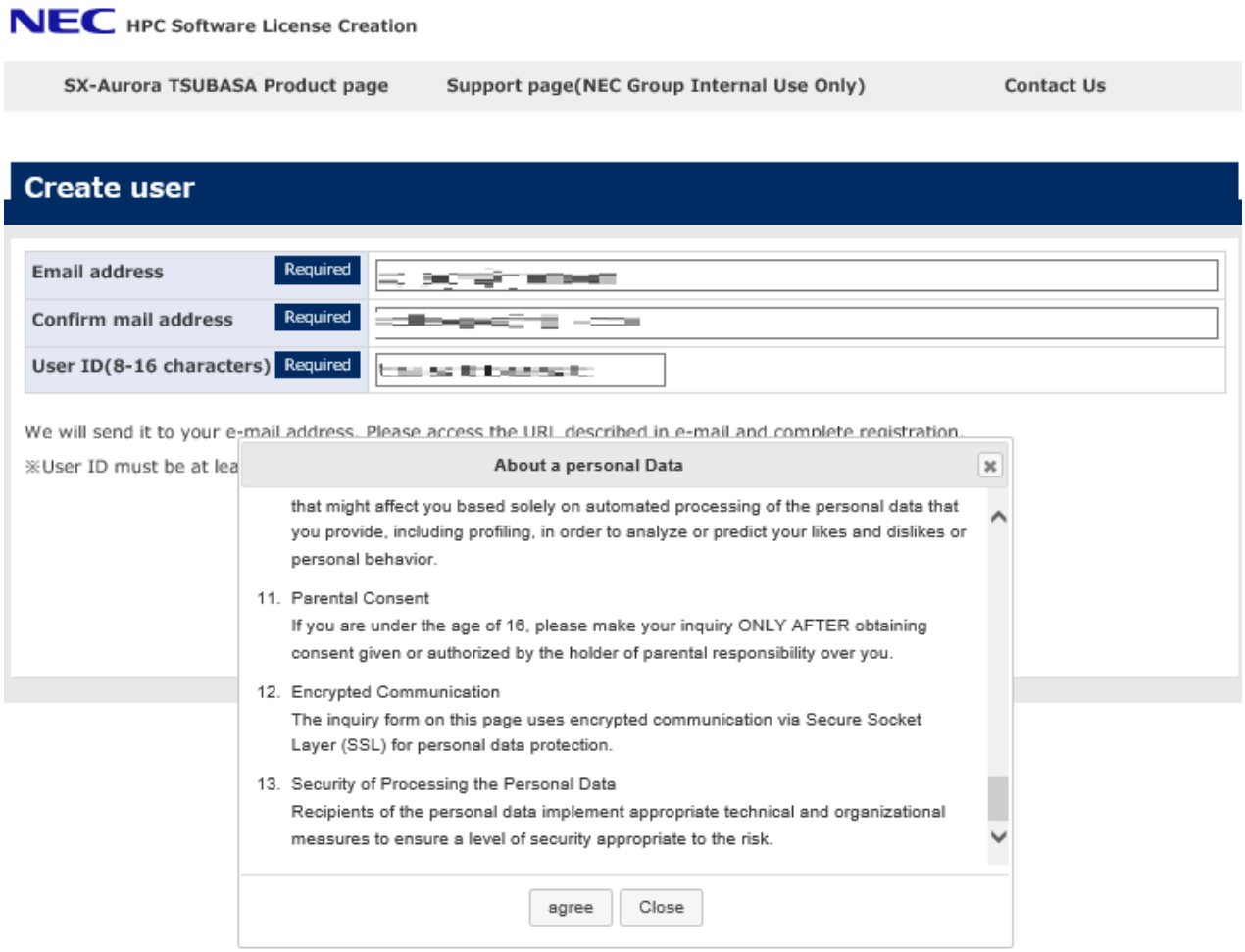
(3) User Registration

Click on the “Create user” button and you will be transferred to the “Create user” page. Enter your e-mail address and desired user ID conforming to the rules on the page, and then click on the “About a personal Data” button.



The “About a personal Data” window will pop up. Please read through while scrolling down the page and click on the “agree” button if you agree with it.

Then, click on the “Next” button on the page you will return to.

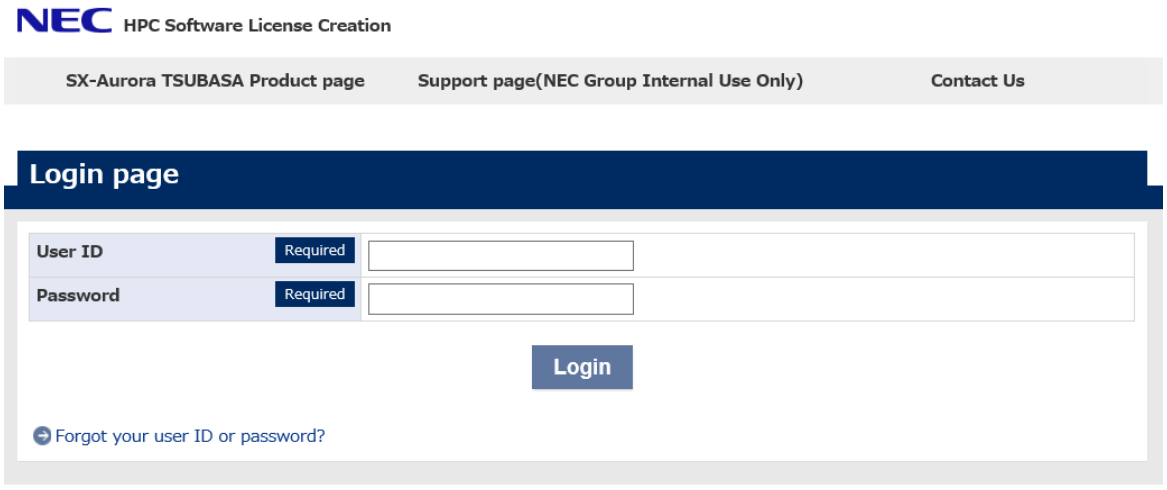


Next, access the URL in the e-mail entitled “Welcome to the NEC HPC Software license system” sent to the entered address, and register a password.

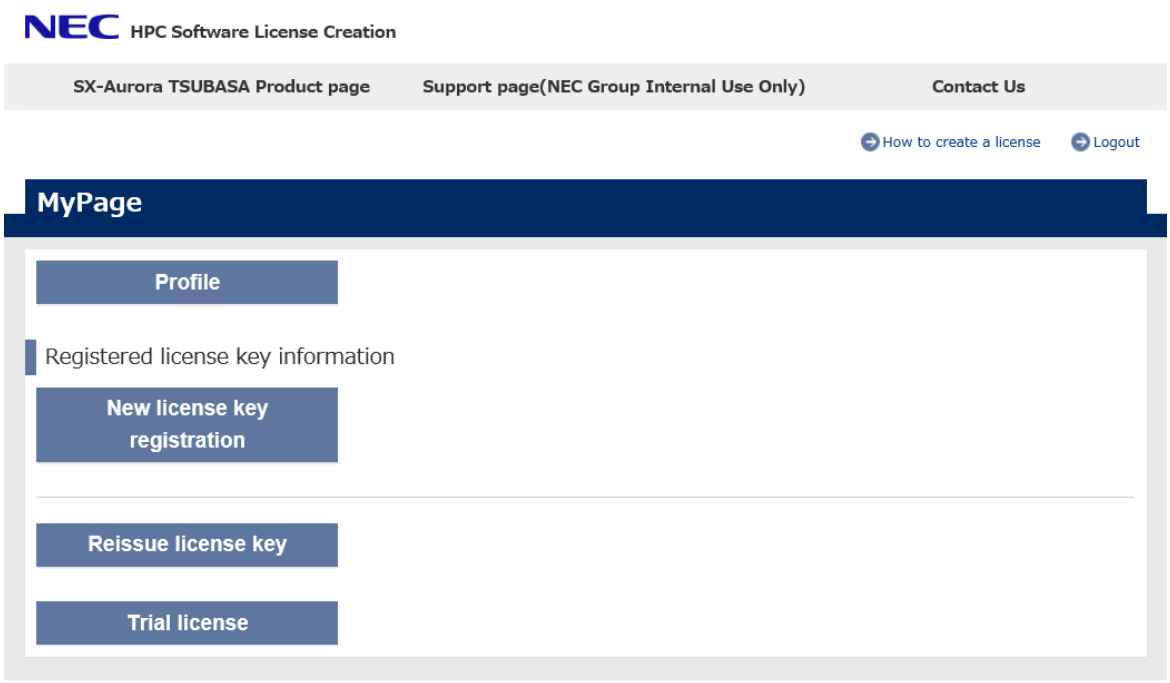
Finally, an e-mail entitled “New User created NEC HPC Software license system” will be sent to the address and the user registration is completed.

(4) Login as the Registered User

Access the “HPC Software License Creation” site again and click on the “Login” button to display the login page.



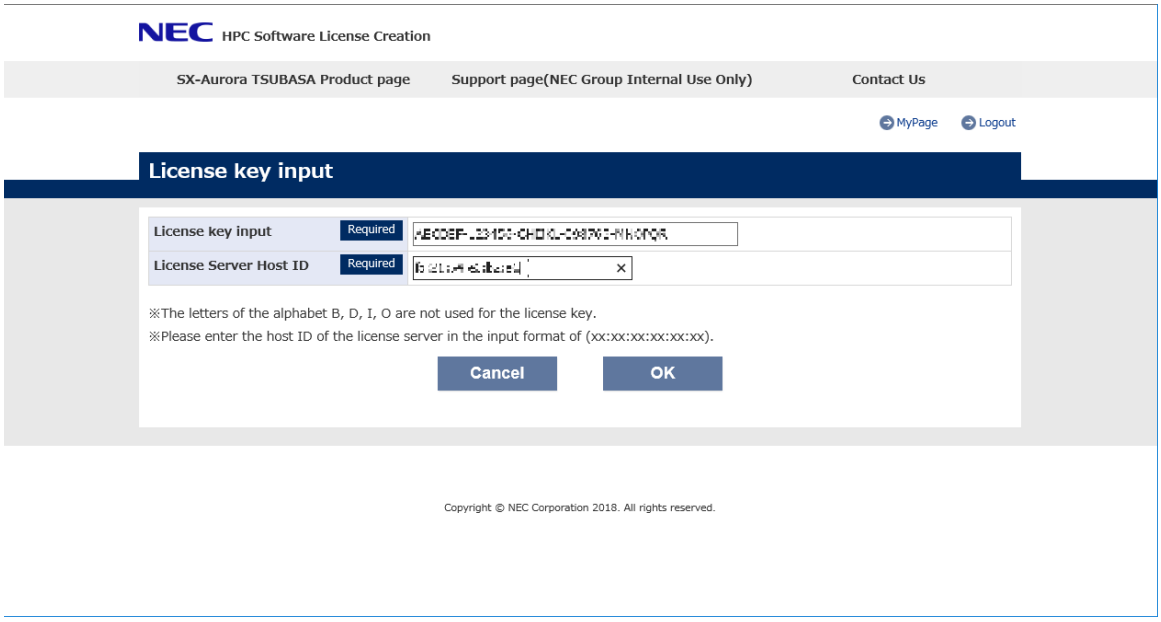
Log in by entering your user ID and password, and you will see your my page.



(5) Registration of the License Keys

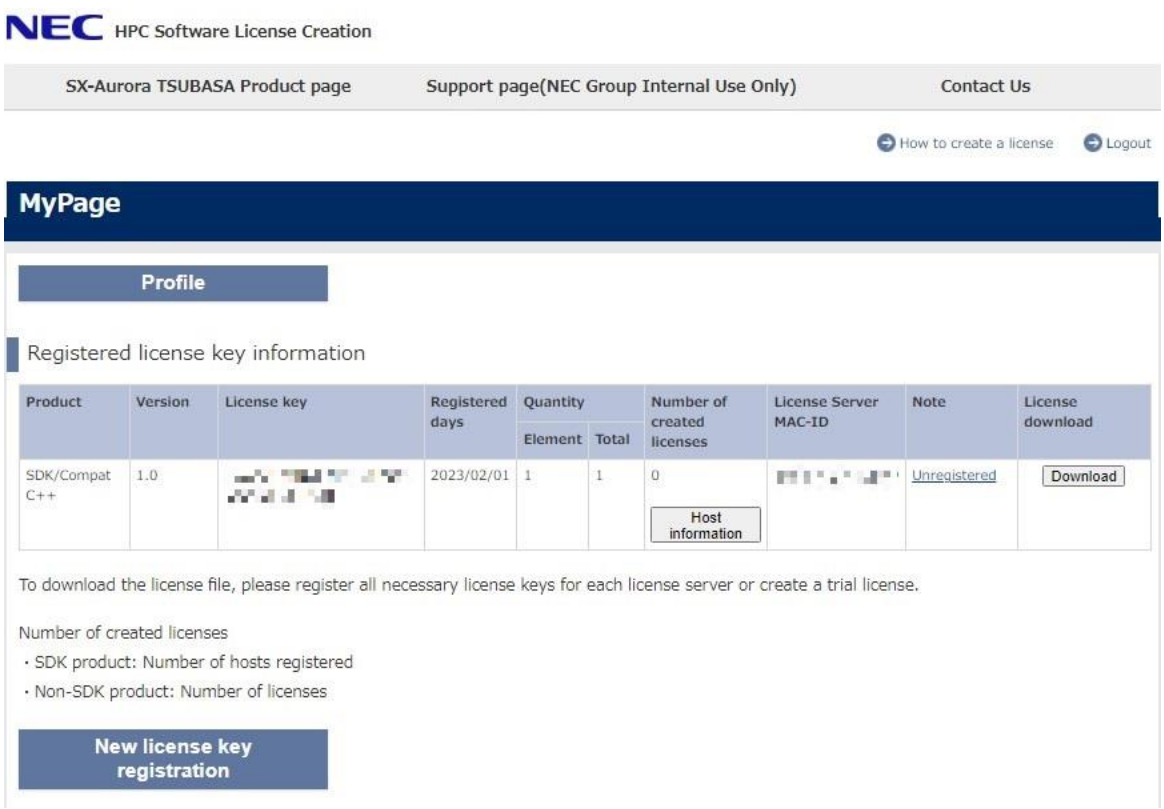
Click on the “New license key registration” button on your my page to open the “License key input” page.

Enter one license key in the “License key input” field and the MAC address of the VH in the “License Server Host ID” field on the page.



The “License key input” window will be displayed by clicking on the “OK” button, and click on the “OK” button again after confirming the registered information.

The license information on the registered license key is displayed on your my page.

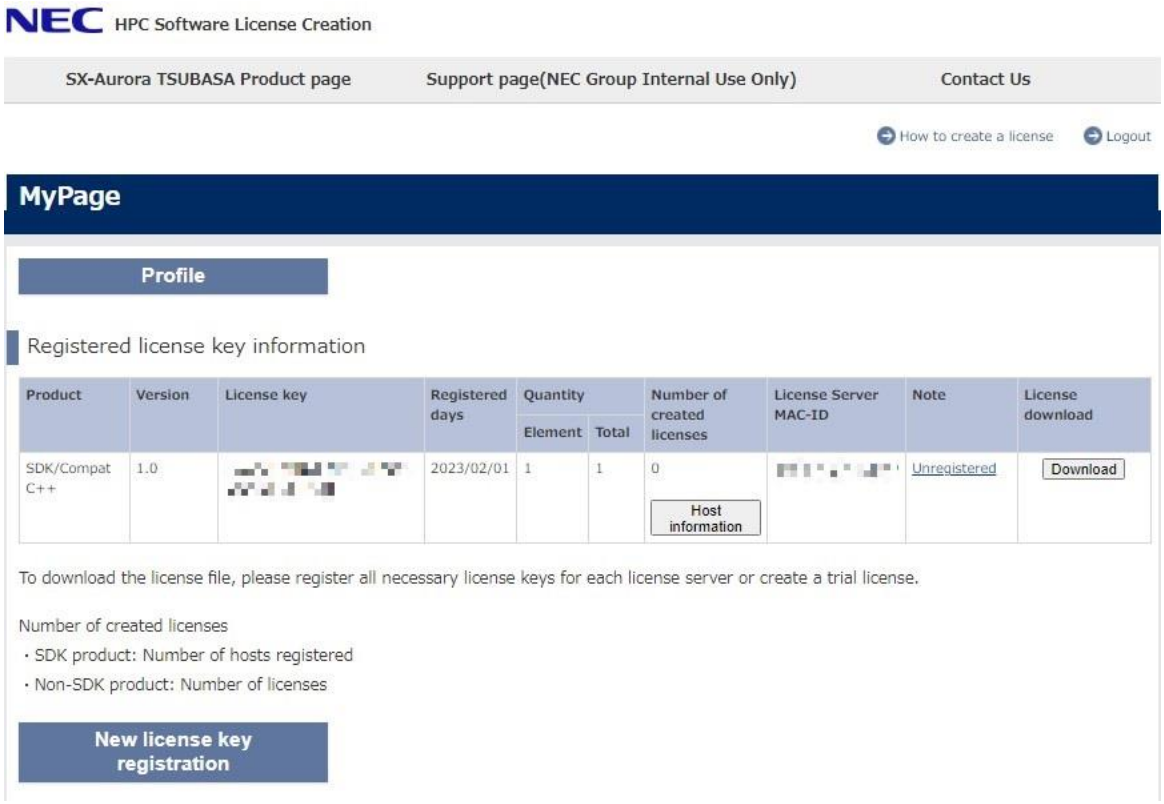


Please repeat step (5) for each license key in the license certificate files.

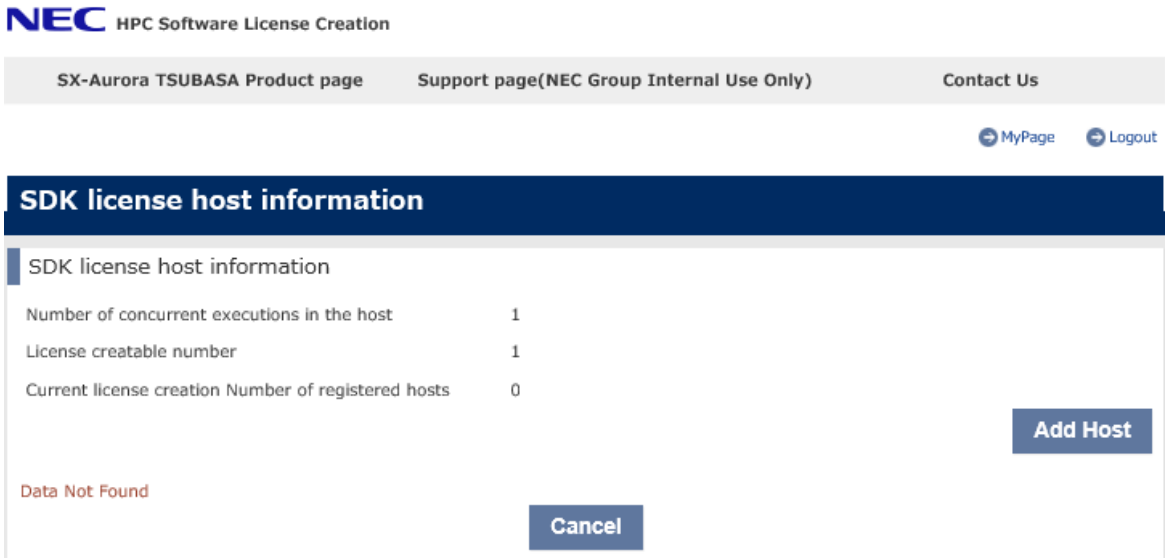
(6) Registration of the VH for Executing the Compilers

After the registration of the license keys for SDK or Compat C++, you will see the "Host information" button in the "Number of created licenses" cell in the "Registered license key information" section on your my page.

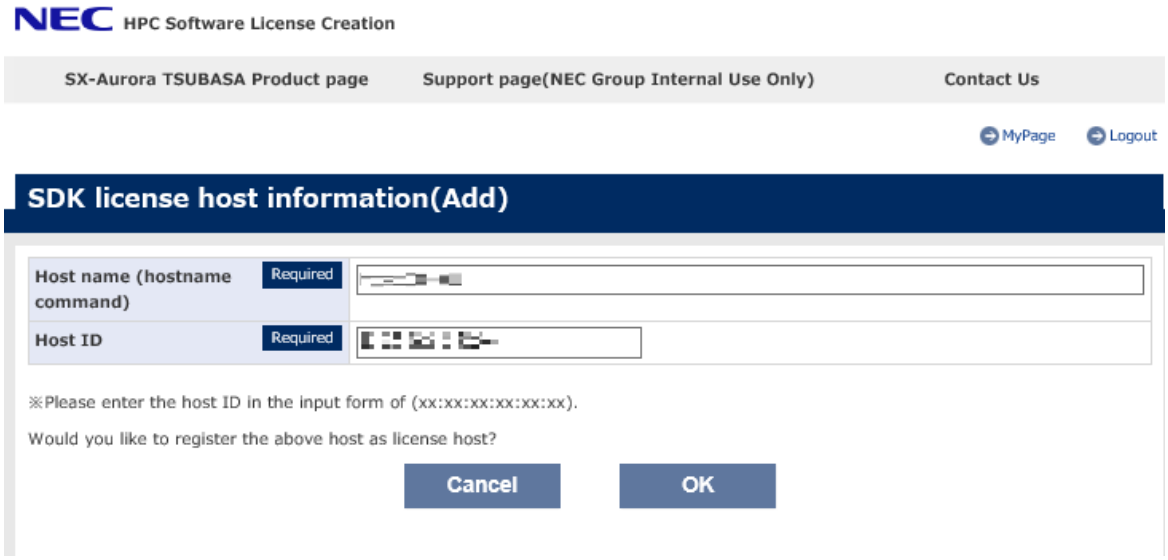
Click on the "Host information" button to register the VH where you execute the compilers.



Click on the "Add Host" button on the "SDK license host information" page.

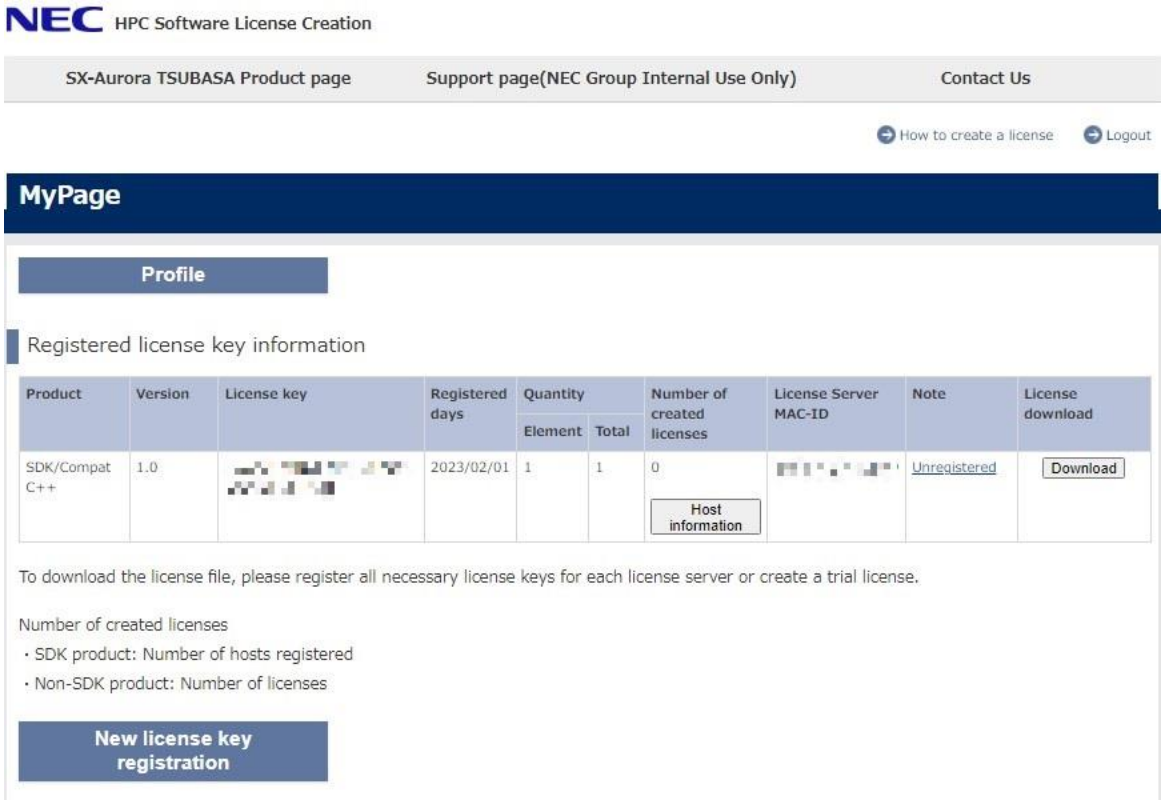


Then enter the hostname and MAC address of the VH on the “SDK license host information(Add)” page, and click on the “OK” button.



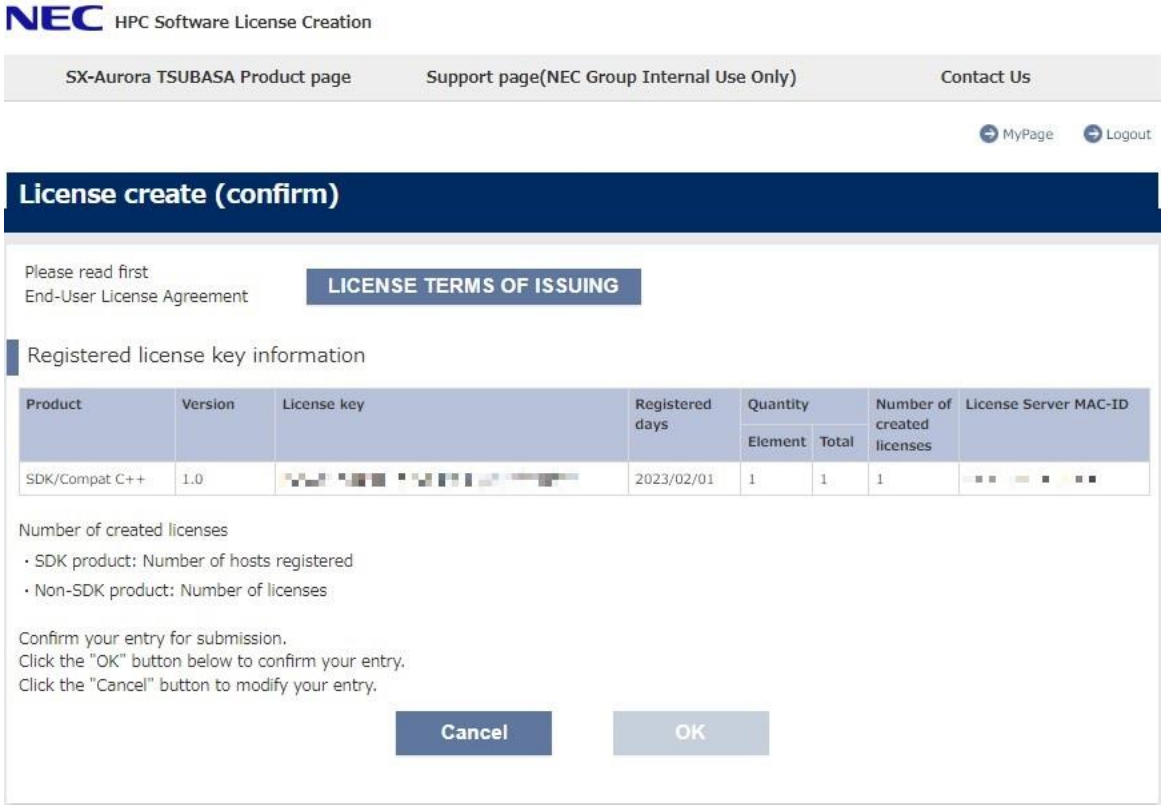
You will see the host information you have registered on the “SDK license host information” window.

Click on the “Cancel” button to finish adding the host information after confirming the contents.



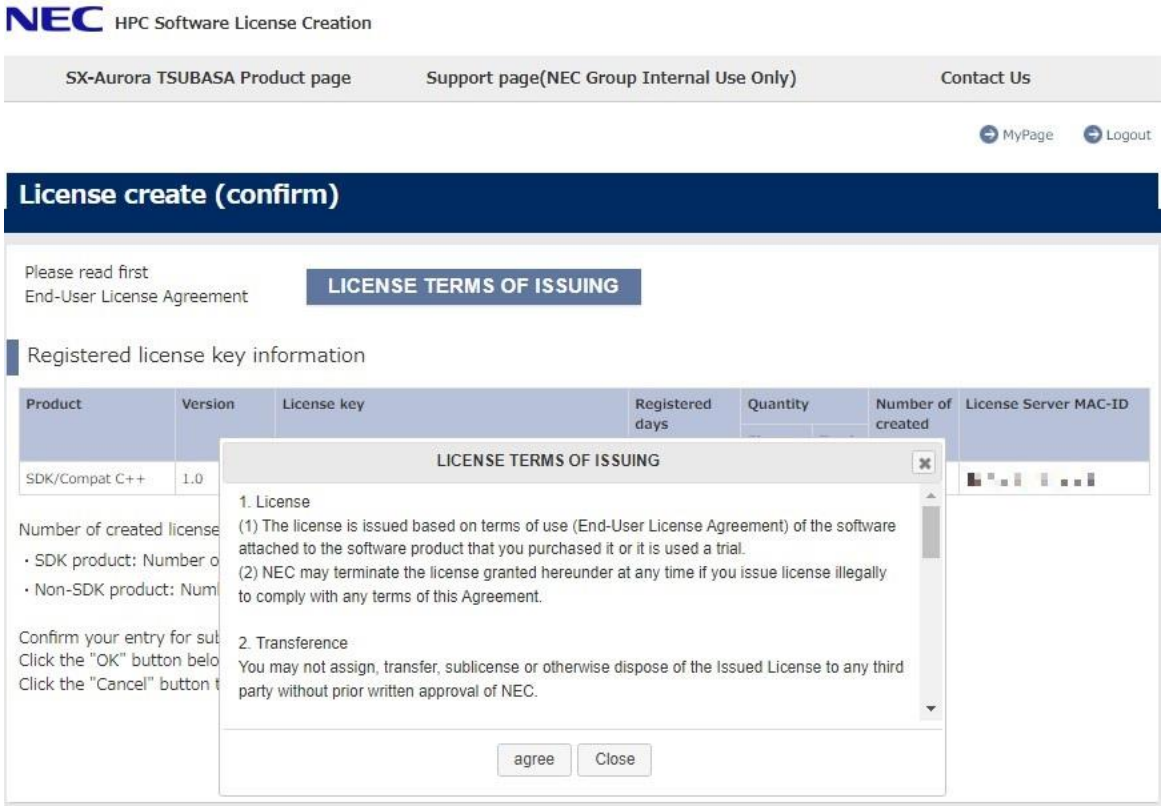
(7) Download of the License File

Click on the “Download” button on the right end of the “Registered license key information” section on your my page to go to the “License create (confirm)” page.

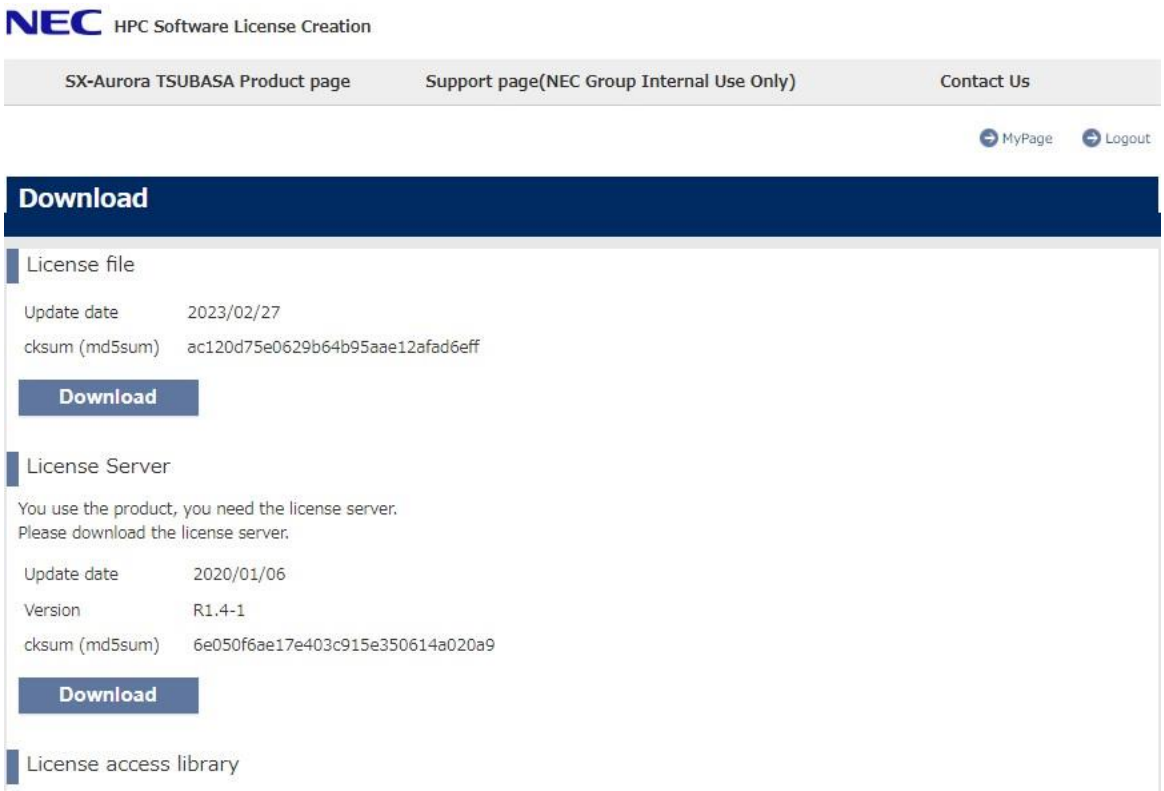


Click on the “LICENSE TERMS OF ISSUING” button on the top of the page and read

through the content on the window that will pop up. Click on the ”agree” button if you agree with it. Please note that the ”agree” button will be activated when you scroll down to the bottom of the window.



Click on the “OK” button on the “License create (confirm)” page and you will be transferred to the “Download” page.



Please download the license file license.dat onto the download directory by clicking on the “Download” button in the “License file” section.

4.4 Transfer of the Files Downloaded

So far, the following files are saved in the download directory.

Table 2 The List of the Files Downloaded

No.	Category	File Name
[1]	Kernel Update Packages	kernel-4.18.0-372.19.1.el8_6.x86_64.rpm kernel-headers-4.18.0-372.19.1.el8_6.x86_64.rpm kernel-core-4.18.0-372.19.1.el8_6.x86_64.rpm kernel-modules-4.18.0-372.19.1.el8_6.x86_64.rpm
[2]	License File	license.dat
([3])	(Only RHEL/CentOS 8.4) Bash Update Package	bash-4.4.20-1.el8_4.x86_64.rpm

Please transfer the files onto the directory /var/tmp/aurora on the VH.

Chapter5 Installation of the SX-Aurora TSUBASA Software

This chapter explains how to install the SX-Aurora TSUBASA software. Please perform the operations in this chapter on the VH as the superuser.

5.1 Update of the Kernel and bash

Apply the kernel update packages ([1] in Table 2) with the yum command.

```
# cd /var/tmp/aurora
# yum install  \
 kernel-4.18.0-372.19.1.el8_6.x86_64.rpm kernel-headers-4.18.0-372.19.1.el8_6.x86_64.rpm \
 kernel-core-4.18.0-372.19.1.el8_6.x86_64.rpm  kernel-modules-4.18.0-372.19.1.el8_6.x86_64.rpm
```

Update bash when you are using RHEL/CentOS 8.4.

```
# yum install bash-4.4.20-1.el8_4.x86_64.rpm
```

Reboot the VH after the update.

```
# reboot
```

You can confirm the updated kernel is running with the uname command after the reboot of the VH.

```
# uname -r
4.18.0-372.19.1.el8_6.x86_64
```

5.2 Mount of the OS Installation DVD

Confirm that the OS installation DVD is in the DVD drive of the VH and mount it at the directory /media/cdrom. This DVD is read at the installation of the SX-Aurora TSUBASA software.

```
# mount /dev/cdrom /media/cdrom
```

5.3 Setup of the Yum Repository

Set up the yum repository to install the SX-Aurora TSUBASA software onto the VH using the yum repository NEC provide on the Internet.

Execute the following command:

```
# yum install https://sxauroratsubasa.sakura.ne.jp/repos/TSUBASA-soft-release-2.8-1.noarch.rpm
```

The following files are installed:

File	Description
/etc/pki/rpm-gpg/RPM-GPG-KEY-TSUBASA-soft	GPG public Key
/etc/yum.repos.d/TSUBASA-restricted.repo	Configuration file for the paid software
/etc/yum.repos.d/TSUBASA-repo.repo	Configuration file for the free software
/opt/nec/ve/sbin/TSUBASA-groups-remark.sh	Script to update the group status
/opt/nec/ve/sbin/terminate-all-ve-services	Script to stop services
/opt/nec/ve/sbin/start-all-ve-services	Script to restart services
/opt/nec/ve/sbin/setup-ve-infiniband.sh	Script to configure InfiniBand

When you cannot access to the yum repository, try it again after few minutes.

The service may not be available due to server maintenance, so please check the following as well.

https://sxauroratsubasa.sakura.ne.jp/forums/

Access to the yum repository for the paid software requires the PP support contract.
Edit the yum configuration file /etc/yum.repos.d/TSUBASA-restricted.repo for the paid software based on the contract details you have: Enter the 16 digits of the serial number on the serial number card, excluding the hyphens, in the username field, the right eight digits

in the password field, and 1 in the enabled field. The serial number card is included in the file you have downloaded from the internet delivery product download service. Figure 2 shows an example of the serial number card.

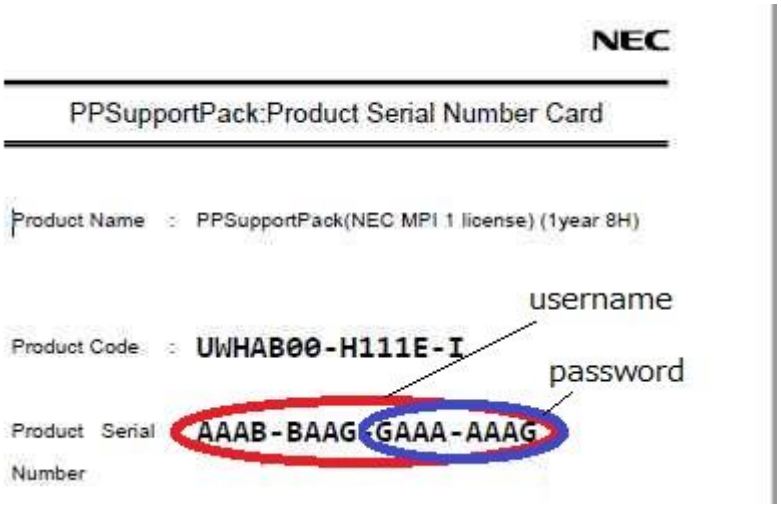


Figure 2 Serial Number Card

The following example shows the description of the yum configuration file to enable the yum repository for the paid software.

```
# vi /etc/yum.repos.d/TSUBASA-restricted.repo
[nec-sdk]
  …
username=<serial number for NEC SDK>
password=<the right eight digits of the serial number for NEC SDK>
enabled=1    ←update 0 to 1
  …
[nec-mpi]
  …
username=<serial number for NEC SDK>
password=<the right eight digits of the serial number for NEC SDK>
enabled=1    ←update 0 to 1
  …
```

5.4 Software Installation

Install the SX-Aurora TSUBASA software with the value of the shell variable TSUBASA_GROUPS set to the group names to be installed according to which paid software

you have bought. Please refer to “SX-Aurora TSUBASA Installation Guide” for the available group names.

```
# TSUBASA_GROUPS="ve-devel nec-sdk-devel nec-mpi-devel"
# /opt/nec/ve/sbin/TSUBASA-groups-remark.sh $TSUBASA_GROUPS
# yum group install $TSUBASA_GROUPS
```

5.5 Status Check of the VE

Confirm the status of the VE is ONLINE with the vecmd command as the superuser. It can take a few minutes until it becomes ONLINE.

```
# /opt/nec/ve/bin/vecmd state get
Vector Engine MMM-Command v1.0.0
Command:
state -N 0 get
--------------------------------------------------------------------------------
VE0 [03:00.0] [ ONLINE ] Last Modif:2017/11/29 10:18:00
--------------------------------------------------------------------------------
Result: Success
```

⚠ NOTE

If “UNINITIALIZED” or “OFFLINE” is displayed, please wait for a short while.

5.6 Update of the VMC Firmware

Check whether update of the VMC firmware is required as follows:

```
# /opt/nec/ve/bin/vecmd fwup check
```

If the message “Updating VMCFW is required.” is displayed, you need to update the VMC firmware. In this case, perform the following operations as the root user.

(1) Set the status of the VEs to the MAINTENANCE mode

```
# /opt/nec/ve/bin/vecmd state set off
# /opt/nec/ve/bin/vecmd state set mnt
```

(2) Execute the vecmd command to update the firmware

```
# /opt/nec/ve/bin/vecmd fwup vmc aurora_MK10.bin
```

* The update of the firmware will take about a few minutes.

(3) Reboot the VHs

```
# reboot
```

(4) Log in as the root user

(5) Check the Status of the VEs

Confirm the status of the VEs is ONLINE. It can take a few minutes until it becomes ONLINE.

```
# /opt/nec/ve/bin/vecmd state get
Vector Engine MMM-Command v1.0.0
Command:
state -N 0 get
--------------------------------------------------------------------------------
VE0 [03:00.0] [ ONLINE ] Last Modif:2017/11/29 10:18:00
--------------------------------------------------------------------------------
Result: Success
```

⚠ NOTE

If “UNINITIALIZED” or “OFFLINE” is displayed, please wait for a short while.

Chapter6 Configuration

This chapter explains how to configure the SX-Aurora TSUBASA system. Perform the procedures in this chapter as the superuser on the VH.

6.1 Configuration of the License Server

(1) Edit of the Configuration File for the License Server

Open the file /opt/nec/aur_license/aur_license.conf with an editor.

```
##########################################
# Vector System License Server Configuration #
##########################################

#########################################################################
# The below variables are used for setting of the license server and the license client.
# - License_server_port
# - License_server_host
#########################################################################

# Port number the server listens (default=7300).
#License_server_port=7300

# License server's hostname (for clients to connect to).
# This setting is for client hosts.
#License_server_host=server-host


#########################################################################
# The below variables are used for only setting of the license server.
# - Heartbeat_interval
# - Heartbeat_timeout_factor
# - Loglevel
#########################################################################

# Heartbeat interval (set by minutes)
Heartbeat_interval=1440

# Heartbeat timeout factor
# Heartbeat will be timed out (Heartbeat interval) * (Heartbeat timeout factor)
# minutes after the expected time.
Heartbeat_timeout_factor=1

# Log level ( error, warning, info, debug )
Loglevel=info
```

Remove the leading “#” from the line “#License_server_host=server-host” in the file and replace the string “server-host” with the hostname of the VH as follows.

```
        :
# License server's hostname (for clients to connect to).
# This setting is for client hosts.
License_server_host=vh001
```

(2) Settings for SELinux

When SELinux is enabled, settings for SELinux are needed for the license server process to access the directory writing its logs. The settings can be performed by semanage and restorecon command as follows.

```
# semanage fcontext -a -t var_log_t "/var/opt/nec/aur_license(/.*)?"
# restorecon -R -F -v -r /var/opt/nec/aur_license
```

If the SELinux is not enabled, skip these settings.

(3) Copy of the License File

Copy the license file license.dat ([2] in Table 2) onto the directory /opt/nec/aur_license.

```
# cp /var/tmp/aurora/license.dat /opt/nec/aur_license
```

(4) Registration of the License Keys

Execute the reg_serialkey command for each of all the license keys in the license certificates for SDK or Compat C++ downloaded in section 4.2.

```
# /opt/nec/aur_license/bin/reg_serialkey xxxxxx-xxxxxx-xxxxxx-xxxxxx-xxxxxx
```

(5) Registration confirmation of the License key

In order to confirm the registered contents in (4), execute the reg_serialkey command with the check option.

```
 # /opt/nec/aur_license/bin/reg_serialkey --check
```

(6) Start of the License Server

Start the license server and configure it to automatically start up when the OS boots.

```
# systemctl start aurlic-server
# systemctl enable aurlic-server
```

6.2 Configuration of NEC MPI

If you use NEC MPI and the firewall is running on the VH, configure to open the ports specified below. If the firewall is off, this procedure is not necessary.

Firstly, check if the firewall is running with the firewall-cmd command as follows.

```
# firewall-cmd --state
running
```

If “running” is displayed, the firewall is running. In this case, open the ports from 25257 to 25266 as follows because NEC MPI uses these ports by default to listen for external connections.

```
# firewall-cmd --zone=public --permanent --add-port=25257-25266/tcp
# firewall-cmd --reload
```

If the firewall-cmd command displays the ports, the firewall configuration is successful.

```
# firewall-cmd --list-port --zone=public
25257-25266/tcp
```

6.3 Configuration of HugePages

This section explains how to configure HugePages for VEOS. Please refer to “SX-Aurora TSUBASA Installation Guide” for detail.

(1) Configure HugePages

```
# /opt/nec/ve/sbin/ve-set-hugepages
```

(2) Confirm HugePages setting

Confirm nr_hugepages nr_overcommit_hugepages are not 0. (The following values are an example.)

```
# /opt/nec/ve/sbin/ve-set-hugepages -s
nr_hugepages:256
nr_overcommit_hugepages:23790
```

Chapter7　Program Execution

This chapter briefly explains how to compile and execute sample programs to verify the configuration of the SX-Aurora TSUBASA system.

7.1　Compilation

You can compile C/C++ programs and Fortran programs with the ncc command and nfort command, respectively.

```
(C/C++ programs)
$ /opt/nec/ve/bin/ncc a.c

(Fortran programs)
$ /opt/nec/ve/bin/nfort a.f90
```

You can compile MPI programs written in C/C++ and Fortran with the mpincc command and mpinfort command respectively, after setting the environment corresponding to the version of NEC MPI with the source command as follows.

```
(bash)
$ source /opt/nec/ve/mpi/<version>/bin/necmpivars.sh
$ mpincc a.c

(csh)
% source /opt/nec/ve/mpi/<version>/bin/necmpivars.csh
% mpincc a.c
```

Please replace <version> above with the version of NEC MPI you use.

7.2　Execution

You can directly run executable files (a.out) compiled with the ncc command and nfort command.

```
$ ./a.out
```

You can run mpi programs compiled with the mpincc command and mpinfort command using the mpirun command specifying the number of processes with the option –np. Note that the environment setting for NEC MPI described in section 7.1 must be available for execution, too.

```
$ mpirun -np 8 a.out
```

7.3 Sample Programs

This section shows execution examples of sample programs, which can be downloaded from the following link:

https://sxauroratsubasa.sakura.ne.jp/repos/file/SetupGuide_examples.tgz

Download and expand the file as follows:

```
$ tar xzf SetupGuide_examples.tgz
$ cd examples
$ ls
sample.c sample.f90 sample-mpi.c
```

(1) C/C++ Program **sample.c**

```
#include <stdio.h>

#define LOOP 1000000000

main()
{
        int n, sign;
        double pi;

        pi = 0.0;
        sign = -1;

        for(n = 0; n <= LOOP; n++){
                sign = (n % 2)?(-1):1;
                pi += (double)sign / (2 * n + 1);
        }
        pi *= 4;

        printf("%.8f\n", pi);
}
```

You can compile and run the program sample.c as follows.

```
$ /opt/nec/ve/bin/ncc sample.c
ncc: vec( 101): sample.c, line 13: Vectorized loop.
$ ./a.out
3.14159265
```

(2) Fortran Program **sample.f90**

```
program main
  implicit none
  integer          :: n
  integer, parameter :: loop=1000000000
  double precision   :: pi

  pi = 0.0d0

  do n = 1, loop
    pi = pi + ((-1.0d0) ** (n - 1)) / (2.0d0 * n - 1.0d0)
  end do

  pi = pi * 4.0d0

  write(*, '(f0.8)') pi
end program main
```

You can compile and run the program sample.f90 as follows.

```
$ /opt/nec/ve/bin/nfort sample.f90
nfort: vec( 101): sample.f90, line 9: Vectorized loop.
$ ./a.out
3.14159265
```

(3) MPI Program **sample-mpi.c**

```
#include <stdio.h>
#include <stdlib.h>
#include <mpi.h>

int
main(int argc, char **argv)
{
    int myrank, nprocs;
    int bufsz, count, typesz;
    int sum, ans;
    int i, j;
    int *sbuf, *rbuf;

    MPI_Init(&argc, &argv);
    MPI_Comm_rank(MPI_COMM_WORLD, &myrank);
    MPI_Comm_size(MPI_COMM_WORLD, &nprocs);
    MPI_Type_size(MPI_INT, &typesz);

    bufsz = 128 * 1024 * 1024;
    count = bufsz / typesz / nprocs;
    sbuf  = (int *) malloc(bufsz);
    rbuf  = (int *) malloc(bufsz);
    for (i = 0; i < count * nprocs; i++)
        sbuf[i] = myrank;

    MPI_Alltoall(sbuf, count, MPI_INT, rbuf, count, MPI_INT, MPI_COMM_WORLD);
```

```
    sum = ans = 0;
    for (i = 0; i < nprocs; i++)
        for (j = 0; j < count; j++)
            sum += rbuf[count * i + j] - i;
    MPI_Reduce(&sum, &ans, 1, MPI_INT, MPI_SUM, 0, MPI_COMM_WORLD);

    if (myrank == 0) {
        if (ans == 0)
            printf("# MPI Execution: Success\n");
        else
            printf("# MPI Execution: Fail\n");
    }

    MPI_Finalize();

    return 0;
}
```

You can compile and run the program sample-mpi.c as follows. The version of NEC MPI is 2.2.0 in this example.

```
(bash)
$ source /opt/nec/ve/mpi/2.2.0/bin/necmpivars.sh
$ mpincc sample-mpi.c
ncc: vec( 101): sample-mpi.c, line 23: Vectorized loop.
ncc: vec( 101): sample-mpi.c, line 30: Vectorized loop.
$ mpirun -np 8 a.out
# MPI Execution: Success

(csh)
% source /opt/nec/ve/mpi/2.2.0/bin/necmpivars.csh
% mpincc sample-mpi.c
ncc: vec( 101): sample-mpi.c, line 23: Vectorized loop.
ncc: vec( 101): sample-mpi.c, line 30: Vectorized loop.
% mpirun -np 8 a.out
# MPI Execution: Success
```

⚠ NOTE

Once the setup of the SX-Aurora TSUBASA system is successfully completed, you can delete the files under the working directory /var/tmp/aurora, as they are not needed for operation of the SX-Aurora TSUBASA system.

SX-Aurora TSUBASA System Software

SX-Aurora TSUBASA

Setup Guide

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