SX-Aurora TSUBASA

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NEC HPF Start Guide

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Preface

This document explains how to install, update, and uninstall NEC HPF.
The latest version of this document is available at NEC Aurora Forum:

https://sxauroratsubasa.sakura.ne.jp/wiki/index.php?title=Special:WikiForum&forum=68

The explanation in this document is for customers with the PP support contract for NEC MPI, NEC SDK, or Basic Software/MPI.

It is necessary to install the SX-Aurora TSUBASA software before installing NEC HPF.

Please refer to SX-Aurora TSUBASA Installation Guide for the installation of the SX-Aurora TSUBASA software, whose latest version is available at:

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

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.
Vector Island (VI)	A set of a VH and VEs that are attached to the VH.
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.
NEC yum repository	The yum repository for NEC SX-Aurora TSUBASA software.
NQSV	A job scheduler for the SX-Aurora TSUBASA.
PP support	The support service to provide the technical support for the SX-Aurora software products.
VH name	The hostname of a VH, which is a host computer.
VE number	An identification number of a VE. VE numbers are of VEs attached to a VH are consecutive integer values starting at 0.

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Chapter1 Installation

This chapter explains how to install NEC HPF.
If your SX-Aurora TSUBASA system has access to the Internet, you can use the NEC yum repository on the Internet. If your SX-Aurora TSUBASA system does not have direct access to the Internet, you can set up the yum repository in the local environment. Please refer to SX-Aurora TSUBASA Installation Guide Appendix A for how to set up the local yum repository.

⚠ Note
Please execute command lines starting with "#" as the superuser in this chapter.

1.1 Setup of the NEC HPF Yum Repository

Install NEC SDK and NEC MPI referring to SX-Aurora TSUBASA Installation Guide before installing NEC HPF, because NEC HPF requires the NEC Fortran compiler in NEC SDK and NEC MPI.

Firstly, set up the NEC HPF yum repository. You can use the NEC yum repository on the Internet, or set up the yum repository in the local environment. If you use the yum repository in the local environment, set up the local yum repository for the SX-Aurora TSUBASA software referring to SX-Aurora TSUBASA Installation Guide Appendix A, and then add the NEC HPF local yum repository referring to Appendix A in this document.

If the NEC yum repository on the Internet is available, execute the following command:

```
#yum install https://sxauroratsubasa.sakura.ne.jp/repos/NEC-HPF-release-1.0.2-1.noarch.rpm
```

The following file is installed:

/etc/yum.repos.d/TSUBASA-additional-hpf.repo NEC HPF repository configuration file

If you have the support pack or PP support contract for NEC MPI, NEC SDK, or Basic Software/MPI, edit the NEC HPF yum configuration file /etc/yum.repos.d/TSUBASA-additional-hpf.repo: Enter the 16 digits of the serial number on the serial number card for NEC MPI, excluding the hyphens, in the username field, the right eight digits in the password

field, and 1 in the enabled field. If you have bought the support pack for NEC MPI, NEC SDK, or Basic Software/MPI, the serial number card is included in the file you can download from the internet delivery product download service. If you have the PP support contract, please contact our sales.

Also, edit the line baseurl according to the OS version you use.

The following example shows the description in the yum configuration file to enable the yum repository for NEC HPF.

```
# vi /etc/yum.repos.d/TSUBASA-additional-hpf.repo
[nec-hpf]
   :
baseurl= https://sxauroratsubasa.sakura.ne.jp/repos/archive/hpf/hpf_el7 <- Change the string "@MAJ@" to the major version number of RHEL
   :
username=<serial number>
password=<the right eight digits of the serial number>
enabled=1    <- change from 0 to 1
```

1.2 Installation of NEC HPF

- Installation of the latest version of NEC HPF, which is invoked with the standard path /opt/nec/ve/bin/ve-hpf

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

- Installation of the latest version of NEC HPF, which is invoked from the path local to the version.

```
# TSUBASA_GROUPS="nec-hpf-alternate"
# yum group install $TSUBASA_GROUPS
```

The installed NEC HPF is invoked with /opt/nec/ve/hpf/*{version}*/bin/ve-hpf, where *{version}* is the version of NEC HPF installed, after setting the value of the environment variable VE_HPF_COMPILER_PATH to /opt/nec/ve/hpf/*{version}*.

- Installation of the specific version x.y.z of NEC HPF, which is invoked from the path local to the version.

```
# TSUBASA_GROUPS="nec-hpf-alternate-x-y-z”
# yum group install $TSUBASA_GROUPS
```

The installed NEC HPF is invoked with /opt/nec/ve/hpf/x.y.z/bin/ve-hpf, after setting the value of the environment variable VE_HPF_COMPILER_PATH to /opt/nec/ve/hpf/x.y.z.

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Chapter2 Update

This chapter explains how to update NEC HPF. If you have set up the local yum repository, update it according to Appendix A.

⚠ Note

Please execute command lines starting with "#" as the superuser in this chapter.

2.1 Update of NEC HPF

- Update to the latest version of NEC HPF, which is invoked from the standard path /opt/nec/ve/bin/ve-hpf

```
# TSUBASA_GROUPS="nec-hpf"
# /opt/nec/ve/sbin/TSUBASA-groups-remark.sh $TSUBASA_GROUPS
# yum group update $TSUBASA_GROUPS
```

2.2 Notes on OS Update

Before you update the OS, set the value of the enabled field in the NEC HPF yum configuration file /etc/yum.repos.d/TSUBASA-additional-hpf.repo to 0.

After the update of the OS, edit the baseurl field in the NEC HPF yum configuration file /etc/yum.repos.d/TSUBASA-additional-hpf.repo according to the OS version and set the value of the enabled field to 1.

Chapter3 Uninstallation

This chapter explains how to uninstall NEC HPF.

⚠ Note

Please execute command lines starting with "#" as the superuser in this chapter.

3.1 Uninstallation of NEC HPF

- Uninstallation of NEC HPF, which is invoked with the standard path /opt/nec/ve/bin/ve-hpf

```
#  TSUBASA_GROUPS="nec-hpf"
# /opt/nec/ve/sbin/TSUBASA-groups-remark.sh $TSUBASA_GROUPS
# yum group remove $TSUBASA_GROUPS
```

- Uninstallation of NEC HPF, which is installed to be invoked from the path local to the version.

```
# yum group remove nec-hpf-alternate
```

- Uninstallation of the specific version x.y.z of NEC HPF, which is invoked from the path local to the version.

```
# yum group remove nec-hpf-alternate-x-y-z
```

Chapter4　Compilation and Linking

This chapter explains how to compile and link HPF programs briefly. Refer to NEC HPF User's Guide for details such as available options.

Firstly, execute the following command to read the MPI setup script each time you log in to a VH, in order to set up the MPI and Fortran compilation environment. The setting is available until you log out.

(In the case of bash)

%> **source /opt/nec/ve/mpi/***{version}***/bin/necmpivars.sh**

(In the case of csh)

%> **source /opt/nec/ve/mpi/***{version}***/bin/necmpivars.csh**

Here, *{version}* above is the directory name corresponding to the version of NEC MPI you use. For example, execute the following command to use NEC MPI version 2.5.0.

(In the case of NEC MPI version 2.5.0 and bash)

%> **source /opt/nec/ve/mpi/2.5.0/bin/necmpivars.sh**

Please refer to NEC MPI User's Guide for details.

After the setup of the compilation environment, execute the command ve-hpf to compile and link an HPF program and generate an HPF executable file a.out as follows. HPF executable files are actually MPI executable files. Therefore, they are executed with the command mpirun or mpiexec just like MPI executable files.

```
%> cat file.hpf
        parameter(n=1000)
        double precision a(1000), s
!HPF$ DISTRIBUTE a(BLOCK)
         do i=1,n
           a(i)=1.0
         enddo
         s = 0.0
         do i=1,n
           s = s + a(i)
         enddo
         write(*,*)s
         end
%> ve-hpf   file.hpf
```

Chapter5　Program Execution

This chapter explains how to execute HPF programs briefly. HPF executable files are executed with the command mpirun or mpiexec just like MPI executable files. Please refer to NEC HPF User's Guide and NEC HPF User's Guide for details.

5.1　Interactive Execution

Firstly, execute the following command to read the MPI setup script each time you log in to a VH, in order to set up the MPI and Fortran compilation environment. The setting is available until you log out.

```
(In the case of bash)
%> source /opt/nec/ve/mpi/{version}/bin/necmpivars.sh
(In the case of csh)
%> source /opt/nec/ve/mpi/{version}/bin/necmpivars.csh
```

Here, *{version}* above is the directory name corresponding to the version of NEC MPI you use. For example, execute the following command to use NEC MPI version 2.5.0.

```
(In the case of NEC MPI version 2.5.0 and bash)
%> source /opt/nec/ve/mpi/2.5.0/bin/necmpivars.sh
```

5.1.1　Execution on One VE

Specify a VE number with the option –ve, and the number of processes with the option –np. When the option –ve is omitted, the VE with VE number 0 is used. When the option –np is omitted, one process executes the program.

```
%> mpirun –ve 3 –np 4 ./a.out
```

5.1.2 Execution on Multiple VEs on a VH

Specify the range of VE numbers with the option –ve, the total number of processes with the option –np. The following executes the executable file a.out on the VEs with VE numbers 0 through 3 using four processes.

```
%> mpirun –ve 0-3 –np 4 ./a.out
```

5.1.3 Execution on Multiple VEs on Multiple VHs

Specify a VH name with the option –host.
The following executes the executable file a.out on the VEs with VE numbers 0 through 3 using four processes on each of VHs host0 and host1 (eight processes in total).

```
%> mpirun –host host0 –ve 0-3 –np 4 –host host1 –ve 0-3 –np 4 ./a.out
```

5.2 Batch Execution under NQSV

The following executes the executable file a.out on four VEs using four processes on each of two VHs (eight processes in total).

```
%> cat hpfrun.sh
#PBS –T necmpi
#PBS –b 2                    # Number of logical hosts
#PBS --cpunum-lhost=1        # Number of CPUs per logical host
#PBS --venum-lhost=4         # Number of VE nodes per logical host
source /opt/nec/ve/mpi/{version}/bin/necmpivars.sh
mpirun –np 8 ./a.out
%>/opt/nec/nqsv/bin/qsub ./hpfrun.sh
```

Refer to "NEC Network Queuing System V (NQSV) User's Guide [Operation]" for details of NQSV.

Appendix A How to Set up and Update the Local Yum Repository

A.1 Setup of the NEC HPF Yum Repository

If your SX-Aurora TSUBASA system does not have direct access to the Internet, it is necessary to set up a locally accessible yum repository. Firstly, set up the local yum repository for the SX-Aurora TSUBASA software referring to SX-Aurora TSUBASA Installation Guide Appendix A, and then add the NEC HPF local yum repository according to the following description.

1. Download the following NEC HPF repository configuration package. This package is not needed for update of the yum repository.

   - For RHEL7, RHEL8
     https://sxauroratsubasa.sakura.ne.jp/repos/NEC-HPF-release-1.0.2-1.noarch.rpm

2. You can obtain the zip file of the NEC HPF yum repository from the following links. Please download the file corresponding to your OS version. Please note that access to the file requires the username (the 16 digits of the serial number) and password (the right eight digits of the serial number) of the PP support contract for NEC MPI, NEC SDK, or Basic Software/MPI.

   - RHEL7
     https://sxauroratsubasa.sakura.ne.jp/repos/archive/hpf/hpf_el7.zip
   - RHEL8
     https://sxauroratsubasa.sakura.ne.jp/repos/archive/hpf/hpf_el8.zip

3. Place the files you have downloaded under the directory for the yum repository of the SX-Aurora TSUBASA software and install the NEC HPF repository configuration package.

```
# cd /path/to/repos
# yum install ./NEC-HPF-release-1.0.2-1.noarch.rpm
```

The following file is installed:

/etc/yum.repos.d/TSUBASA-additional-hpf.repo　NEC HPF repository configuration file

4. Specify the location of the local yum repository in the “baseurl=” line in the NEC HPF configuration files (/etc/yum.repos.d/TSUBASA-additional-hpf.repo), and enter 1 in the enabled field.

- Example for RHEL7

(Before)

```
baseurl=https://sxauroratsubasa.sakura.ne.jp/repos/archive/hpf/hpf_el@MAJ@
…
enabled=0
```

(After for standalone systems)

```
baseurl=file:///path/to/repos/hpf_el7
…
enabled=1
```

(After for non-standalone systems)

```
baseurl=http://address.or.name.of.server/path/to/zips/hpf_el7
…
enabled=1
```

5. Delete the yum cache

```
# yum clean all
```

6. Expand the zip file to get the NEC HPF repository

```
# cd /path/to/repos/
# find . -name '*.zip' | xargs -n1 unzip
# rm *.zip
```

A.2 Update of the Local Yum Repository

Place and expand the zip file you have downloaded in Appendix A.1 under the directory for the yum repository (/path/to/repos in the example below) on the repository server.

```
# cd /path/to/repos/
# find . -name '*.zip' | xargs -n1 unzip
# rm *.zip
```

When you have updated the OS on the VHs, it is also necessary to update the version number in the “baseurl=” line in the NEC HPF configuration file to the one corresponding to the OS version.

- Example for the case where the OS is updated from RHEL7 to RHEL8

(Before)

```
baseurl=file:///path/to/repos/hpf_el7
```

(After)

```
baseurl=file:///path/to/repos/hpf_el8
```

Delete the yum cache.

```
# yum clean all
```

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