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<tr>
<td>November 2015</td>
<td>1.0</td>
<td>Document has been updated for Revision 1.0.</td>
</tr>
<tr>
<td>September 2015</td>
<td>0.7</td>
<td>Document has been updated for Revision 0.7.</td>
</tr>
<tr>
<td>April 2015</td>
<td>0.5</td>
<td>Initial Alpha release of document.</td>
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Preface

This manual is part of the documentation set for the Intel® Omni-Path Fabric (Intel® OP Fabric), which is an end-to-end solution consisting of adapters, edge switches, director switches and fabric management and development tools.

The Intel® OP Fabric delivers a platform for the next generation of High-Performance Computing (HPC) systems that is designed to cost-effectively meet the scale, density, and reliability requirements of large-scale HPC clusters.

Both the Intel® OP Fabric and standard InfiniBand® are able to send Internet Protocol (IP) traffic over the fabric, or IPoFabric. In this document, however, it is referred to as IP over IB or IPoIB. From a software point of view, IPoFabric and IPoIB behave the same way and, in fact, use the same ib_ipoib driver to send IP traffic over the ib0 and/or ib1 ports.

Intended Audience

The intended audience for the Intel® Omni-Path (Intel® OP) document set is network administrators and other qualified personnel.

Documentation Set

The following are the list of the complete end-user publications set for the Intel® Omni-Path product. These documents can be downloaded from https://downloadcenter.intel.com/.

- Hardware Documents:
  - Intel® Omni-Path Fabric Switches Hardware Installation Guide
  - Intel® Omni-Path Fabric Switches GUI User Guide
  - Intel® Omni-Path Fabric Switches Command Line Interface Reference Guide
  - Intel® Omni-Path Edge Switch Platform Configuration Reference Guide
  - Intel® Omni-Path Fabric Managed Switches Release Notes
  - Intel® Omni-Path Fabric Externally-Managed Switches Release Notes
  - Intel® Omni-Path Host Fabric Interface Installation Guide
  - Intel® Omni-Path Host Fabric Interface Release Notes

- Software Documents:
  - Intel® Omni-Path Fabric Software Installation Guide
  - Intel® Omni-Path Fabric Suite Fabric Manager User Guide
  - Intel® Omni-Path Fabric Suite FastFabric User Guide
  - Intel® Omni-Path Fabric Host Software User Guide
  - Intel® Omni-Path Fabric Suite Fabric Manager GUI Online Help
Documentation Conventions

This guide uses the following documentation conventions:

- **Note:** provides additional information.
- **Caution:** indicates the presence of a hazard that has the potential of causing damage to data or equipment.
- **Warning:** indicates the presence of a hazard that has the potential of causing personal injury.
- Text in blue font indicates a hyperlink (jump) to a figure, table, or section in this guide. Links to Web sites are also shown in blue. For example:
  
  See License Agreements on page 10 for more information.

  For more information, visit www.intel.com.

- Text in bold font indicates user interface elements such as a menu items, buttons, check boxes, or column headings. For example:

  Click the **Start** button, point to **Programs**, point to **Accessories**, and then click **Command Prompt**.

- Text in Courier font indicates a file name, directory path, or command line text. For example:

  Enter the following command: `sh ./install.bin`

- Key names and key strokes are shown in underlined bold uppercase letters. For example:

  Press **CTRL+P** and then press the **UP ARROW** key.

- Text in *italics* indicates terms, emphasis, variables, or document titles. For example:

  For a complete listing of license agreements, refer to the *Intel® Software End User License Agreement*.

License Agreements

This software is provided under one or more license agreements. Please refer to the license agreement(s) provided with the software for specific detail. Do not install or use the software until you have carefully read and agree to the terms and conditions of the license agreement(s). By loading or using the software, you agree to the terms of the license agreement(s). If you do not wish to so agree, do not install or use the software.
Technical Support

Technical support for Intel® Omni-Path products is available 24 hours a day, 365 days a year. Please contact Intel Customer Support or visit www.intel.com for additional detail.
1.0 Overview

The installation of the Intel® Omni-Path Software is accomplished using a Text User Interface (TUI) to guide you through the installation process. You also have the ability to use command line interface (CLI) commands to accomplish the installation or install rpms individually.

1.1 Installation Packages Overview

The following software installation packages are available for an Intel® Omni-Path Fabric:

- Intel® Omni-Path Fabric Host Software – This is the basic installation package that installs the Intel® Omni-Path Fabric Host Software components needed to set up a compute node with drivers, stacks, and basic tools for local configuration and monitoring.

- Intel® Omni-Path Fabric Suite Software – This installation package provides special features and includes the Intel® Omni-Path Fabric Host Software (IFS) package, along with the Intel® Omni-Path Fabric Suite FastFabric Toolset (FastFabric) and the Intel® Omni-Path Fabric Suite Fabric Manager (Fabric Manager).

- Intel® Omni-Path Fabric Suite Fabric Manager GUI – This installation package provides a number of features for viewing and monitoring the fabric or multiple fabrics.

1.1.1 Intel® Omni-Path Fabric Host Software

The Intel® Omni-Path Fabric Host Software installation package (IntelOPA-Basic.DISTRO.VERSION.tgz) includes the following components:

- OFED OPA Stack
- OFED IBACM
- Intel HFI Components
- OPA Tools
- OFED OPA Development
- OFED IP over IB
- MVAPICH2 (verbs, gcc)
- OpenMPI (verbs, gcc)
- GASNet (hfi, gcc)
- OpenSHMEM (hfi, gcc)
- MVAPICH2 (hfi, PGI)
- MVAPICH2 (hfi, Intel)
• OpenMPI (hfi, gcc)
• OpenMPI (hfi, PGI)
• OpenMPI (hfi, Intel)
• MPI Source
• OFED Debug Info

Note: There is a separate Intel® Omni-Path Fabric Host Software installation package for each of the supported Linux* distributions. Refer to the release notes of the package version being installed for a list of supported Linux* distributions.

1.1.1.1 OS RPMs Installation Prerequisites

In addition to normal OS installation options, the following OS RPMs must be installed before installing the Intel® Omni-Path software.

Note: Use the version distributed with your OS distribution.

RHEL*

Install the following packages using yum from the RHEL* distro.
• libibmad
• libibverbs
• librdmacm
• libibcm
• qperf
• perftest
• rdma
• infinipath-psm
• expat
• elfutils-libelf-devel
• libstdc++-devel
• gcc-gfortran
• atlas
• tcl
• expect
• tcsh
• sysfsutils
• pciutils
• opensm-devel (RHEL* 7.1)
• opensm-libs (RHEL* 7.1)

For compiling IFS software, the following packages are required.
• libibverbs-devel
• libibmad-devel
• librdmacm-devel
• ibacm-devel
• openssl-devel (1.0.1 or higher)
• libuuid-devel
• expat-devel
• infinipath-psm-devel

**SLES**

Install the following packages using zypper from the SLES * distro.

• libibmad5
• libibverbs1
• librdmacm1
• libibcm1
• qperf
• perftest
• rdma
• libexpat1
• opensm-devel
• opensm-libs3
• libpsm_infinipath1
• libelf-devel
• libudev-devel
• texlive-latex
• texlive-babel-english
• texlive-psnfss
• texlive-courier

For compiling IFS software, the following packages are required.

• libibverbs-devel
• libibmad-devel
• librdmacm-devel
• ibacm-devel
• libopenssl-devel (1.0.1 or higher)
• libuuid-devel
• libexpat-devel
• infinipath-psm-devel
• rpm-build

Depending on which packages you choose, there may be additional prerequisites. For additional information, refer to the Release Notes for your specific release and installation type.
1.1.2 **Intel® Omni-Path Fabric Suite Software**

The Intel® Omni-Path Fabric Suite (IntelOPA-IFS.DISTRO.VERSION.tgz) installation package installs the installation package listed in *Intel® Omni-Path Fabric Host Software* on page 12, and requires the same prerequisites listed in OS RPMs Installation Prerequisites on page 13. It also installs:

- FastFabric
- OPA FM


*Note:* There is a separate IFS installation package for each of the supported Linux* distributions. Refer to the release notes of the version being installed for a list of supported Linux* distributions.

1.1.3 **Intel® Omni-Path Fabric Suite Fabric Manager GUI**

The Intel® Omni-Path Fabric Suite Fabric Manager GUI (Fabric Manager GUI) installation package installs the application for monitoring the fabric from a computer external to the fabric.
2.0 Fabric Software Pre-Installation

This section provides the information and procedures needed prior to installing, configuring, and verifying the fabric software. Typically, the site implementation engineer performs the tasks described in this section to ensure that the fabric is ready for the software installation.

The procedures will be marked with one of the following qualifications when required:

- **(Linux)** – Tasks are only applicable when Linux* is being used.
- **(Host)** – Tasks are only applicable when Intel® Omni-Path Fabric Host Software (Intel’s OFED Delta RPMs) or Intel® Omni-Path Fabric Suite is being used on the hosts.
- **(Switch)** – Tasks are applicable only when Intel® Omni-Path Switches or Chassis are being used.
- **(All)** – Tasks are generally applicable to all environments.

*Note:* Some of the Linux* steps may be applicable to other Unix-like operating systems if it is required to enable use of non-specific Intel® Omni-Path Fabric Suite FastFabric Toolset commands (such as opacmdall) against the given hosts.

2.1 Installation Prerequisites

**Design of the Fabric**

Prior to the installation and setup of the fabric, it is important that the design and installation of the hardware be planned carefully. The design plan must include the following information:

- Identification of servers that will function as the administration or fabric management nodes, where the Intel® Omni-Path Fabric Suite (IFS) will be installed.

- Server memory requirements based on the software being used:
  - IFS, including the Intel® Omni-Path Fabric Suite Fabric Manager, requires at least 500 MB of physical memory for each Fabric Manager instance. When managing a cluster of 500 nodes or more, 1GB of memory per Fabric Manager instance is required.
  - When running multiple Fabric Manager instances on a single management node, the physical memory requirements should be multiplied by the number of Fabric Manager instances.

- Swap disk space allowance should follow recommendations for the given version of Linux*. Swap space should be twice the size of the physical memory on the server running the Fabric Manager.

- Ensure at least one central processing unit (CPU) core is available per Fabric Manager instance. For example, four Fabric Manager instances on a single management node would require four CPU cores.
Set Up the Fabric

The following steps provide the information to set up the fabric. For information about the configuration files used by FastFabric, refer to Configuration on page 86.

1. (All) Ensure all hardware is installed:
   - Servers
   - Core and edge switches.
   
   Note: When installing externally managed switches such as the Intel® Omni-Path Edge Switch 100 Family without a management module, the Node GUID is required. The Node GUID can be found on a label on the case of the switch and will be needed to configure and manage the switches with the IFS.

2. (All) Ensure an Intel® Omni-Path Host Fabric Interface (HFI) is installed in each server. Refer to the Intel® Omni-Path Host Fabric Interface Installation Guide for instructions.

3. (All) The hardware configuration should be reviewed to ensure everything has been installed according to plan. After the software installation, Intel® Omni-Path Fabric Suite FastFabric tools may be used to help verify the installation.

4. (Linux) Ensure the required Operating System (OS) version (with the same kernel version) is installed on all hosts. The fabric management node(s) (hosts that will run FastFabric) should have a full installation and must include the Tcl and Expect OS RPMs.

   For MPI clusters, install the C and Fortran compilers along with their associated tools on the fabric management nodes.

   Note: Refer to the Intel® Omni-Path Fabric Software Release Notes for a list of supported OS versions.

5. (Linux) Enable remote login as root on each host. In order for FastFabric to manage the hosts, the fabric management node must be able to securely log in as root to each host. This can be accomplished using ssh.

   Note: To simplify the use of FastFabric, set up root access on the nodes in the fabric using ssh. The same root password must be set on all nodes in the fabric. After root access through ssh has been set up using FastFabric, the root passwords can be changed.

6. (All) Resolve the TCP/IP Host Names.

   FastFabric and TCP/IP must resolve host names to the management network and/or IPoIB IP addresses. If the management network is not IPoIB, each host must have both a management network name and an IPoIB network name. To do this, use the actual host name as the management network name and $HOSTNAME$-opa as the IPoIB network name, where $HOSTNAME$ is the management network name of the given host.

   Name resolution is accomplished by configuring a DNS server on the management network, with both management network and IPoIB addresses for each host and each Intel internally-managed chassis. Alternatively, an /etc/hosts file can be created on the fabric management node; FastFabric can then propagate this /etc/hosts file to all the other hosts.

   If using the /etc/hosts file approach:
   - On the master node, add all the Ethernet and IPoIB addresses into the /etc/hosts file.
For the IPoIB convention, use \textit{HOSTNAME-opa}.

The \texttt{localhost} line should not be edited.

The \texttt{/etc/hosts} file should not have any node-specific data.

Copy the file to every node, as described in \textit{Copy /etc/hosts to all hosts} on page 56.

If using Domain Name System (DNS):

- Refer to the documentation for the domain name system (DNS) server being used. Make sure to edit the \texttt{/etc/resolv.conf} configuration file on the fabric management node to use the proper DNS server.
- Refer to the Linux* OS documentation for more information about configuring the \texttt{/etc/resolv.conf} file. This file is typically configured during OS installation.
- If \texttt{/etc/resolv.conf} must be manually configured for each host, FastFabric can aid in copying the file to all the hosts.
- The \texttt{/etc/resolv.conf} file created on the fabric management node must not have any node-specific data and must be appropriate for use on all hosts.
- Copying the \texttt{/etc/resolv.conf} file to all the nodes is accomplished during the OS installation.
- If the \texttt{/etc/resolv.conf} file was not set up on all the hosts during the OS installation, the \textbf{FastFabric Copy a file to all hosts} operation can be used during the Install Host Software on the Remaining Hosts Using the FastFabric TUI procedures to copy the \texttt{/etc/resolv.conf} file from the fabric management node to all the other nodes.

7. \textbf{(All)} Set up a Network Time Protocol (NTP) server.

Configure an NTP server for the cluster, and set all Linux* hosts and internally managed chassis to sync to the NTP server. The setup of the internally managed chassis is described in \textit{Configure Intel® Omni-Path Chassis} on page 30.
3.0 Download and Extract Installation Packages

The following sections discuss downloading the software package from an Intel web page or other Intel secured location, and unpacking the included tar file.

3.1 Download the Intel® Omni-Path Software

1. Using a Web browser, type intel.com in the address field and press Enter.
2. From the selection bar at the bottom of the screen, click on Download Center.
3. In the "Search downloads" field type Omni-Path and select the search icon.
4. Select the Omni-Scale product you are wanting to download.
5. On the Available Downloads page select the file(s) you need for the OSs you have installed on your fabric.
6. Follow the instructions to download the file(s)

3.2 Unpack the Tar File

Use the following procedure to unpack the tar file.

**Basic**

```
IntelOPA-Basic.DISTRO.VERSION.tgz
```

**IFS**

```
IntelOPA-IFS.DISTRO.VERSION.tgz
```

1. Open an SSH client session and log into the host where the package is being installed.
2. Copy the tar file to the /root directory.
3. Change directory to /root.
   
```
cd /root
```

4. Unpack the tar file.

**Basic**

```
tar xvfz IntelOPA-Basic.DISTRO.VERSION.tgz
```

**IFS**

```
tar xvfz IntelOPA-IFS.DISTRO.VERSION.tgz
```
4.0 Install the Intel® Omni-Path Fabric Software

This section provides information and procedures to install the Intel® Omni-Path Fabric on the Management Node. There are two ways of installing the software:

- Install using the Install TUI (Recommended). Refer to Intel® Omni-Path Software Installation Using the Install TUI on page 20
- Install using CLI commands. Refer to Intel® Omni-Path Software Installation Using CLI Commands on page 23

All pre-installation requirements must be met prior to installing the software. When installing a fabric/cluster, Intel recommends installing the software on the Fabric Management Node using the Install TUI, and then using FastFabric to configure the Fabric Management Node and to install the software on the remaining hosts.

The installation, configuration, and verification procedures provide step-by-step instructions for a typical, single subnet fabric. For information about the installation and verification of multiple subnet fabrics, see Multi-Subnet Fabrics on page 101.

4.1 Before You Install

Refer to the Release Notes for a list of compatible OSs.

If the managed cluster has IPoIB settings on the compute nodes that are incompatible with the Fabric Management Node, do not run IPoIB on the Fabric Management Nodes. For example, when compute nodes use 12K Maximum Transmission Unit (MTU) and the Fabric Management Nodes use a 8K MTU, you would not run IPoIB settings on the Fabric Management Nodes. Refer to the Intel® Omni-Path Fabric Host Software User Guide, ”Intel® Omni-Path Cluster Setup and Administration” section, ”MTU Size” subsection for detailed information.

4.2 Intel® Omni-Path Software Installation Using the Install TUI

The installation of the Intel® Omni-Path Software (Intel® OPA Software) using the Install TUI installs the basic software or the IFS software that was downloaded to your fabric. The following procedure goes step-by-step through the installation and defines the different items for the basic and IFS installation. When needed, the procedure specifies Basic or IFS accordingly. This procedure presumes that you are logged in and have completed all pre-installation requirements.

Perform the following procedure to install the Intel® OPA Software:

1. Change directory to IntelOPA-[Basic|IFS].DISTRO.VERSION directory.

   Basic

   ```bash
cd IntelOPA-Basic.DISTRO.VERSION
```
IFS

cd IntelOPA-IFS.DISTRO.VERSION

2. Start the Install TUI:

./INSTALL

The Intel OPA VERSION Software main menu appears.

Intel OPA VERSION Software
1) Install/Uninstall Software
2) Reconfigure OFED IP over IB
3) Reconfigure Driver Autostart
4) Generate Supporting Information for Problem Report
6) FastFabric (Host/Chassis/Switch Setup/Admin)
X) Exit

3. Select 1) Install/Uninstall Software.

Screen 1 of 2 of the Intel OPA Install Menu appears.

Intel OPA Install (VERSION release) Menu

Please Select Install Action (screen 1 of 2):
0) OFED OPA Stack [ Install ] [Available] VERSION
1) OFED IBACM [ Install ] [Available] VERSION
2) Intel HFI Components [ Install ] [Available] VERSION
3) OPA Tools [ Install ] [Available] VERSION
4) OFED OPA Development [ Install ] [Available] VERSION
5) FastFabric [ Install ] [Available] VERSION
6) OFED IP over IB [ Install ] [Available] VERSION
7) OPA FM [ Install ] [Available] VERSION
8) MVAPICH2 (hfi,gcc) [ Install ] [Available] VERSION
9) MVAPICH2 (hfi,Intel) [ Install ] [Available] VERSION
a) MVAPICH2 (hfi,PGI) [ Install ] [Available] VERSION
b) OpenMPI (hfi,gcc) [ Install ] [Available] VERSION
c) OpenMPI (hfi,Intel) [ Install ] [Available] VERSION
d) OpenMPI (hfi,PGI) [ Install ] [Available] VERSION

N) Next Screen
P) Perform the selected actions I) Install All
R) Re-Install All U) Uninstall All
X) Return to Previous Menu (or ESC)

Note: The previous menu is an example of the IntelOPA-IFS Install TUI. The Basic Install TUI would show 6) FastFabric and 8) OPA FM as [Don't Install].

Note: Intel HFI Components selection contains the enhanced Intel® Omni-Path Host Fabric Interface (HFI) driver optimized stack for MPI (PSM) on HIFIs and OpenMPI, as well as user tools.

4. Review the items to be installed; the default value is in brackets (Install or Don't Install). To change a value, type the alphanumeric character associated with the item.

5. Press N to go to the next screen.
Screen 2 of 2 of the **Intel OPA Install Menu** appears.

<table>
<thead>
<tr>
<th>Intel OPA Install (VERSION release) Menu</th>
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</thead>
<tbody>
<tr>
<td>Please Select Install Action (screen 2 of 2):</td>
</tr>
<tr>
<td>0) GASNet (hfi,gcc) [ Install ] [Available] VERSION</td>
</tr>
<tr>
<td>1) OpenSHMEM (hfi,gcc) [ Install ] [Available] VERSION</td>
</tr>
<tr>
<td>2) MVAPICH2 (verbs,gcc) [ Install ] [Available] VERSION</td>
</tr>
<tr>
<td>3) OpenMPI (verbs,gcc) [ Install ] [Available] VERSION</td>
</tr>
<tr>
<td>4) MPI Source [ Install ] [Available] VERSION</td>
</tr>
<tr>
<td>5) OFED Debug Info [Don't Install] [Available] VERSION</td>
</tr>
</tbody>
</table>

N) Next Screen  
P) Perform the selected actions  
I) Install All  
R) Re-Install All  
U) Uninstall All  
X) Return to Previous Menu (or ESC)

6. **Review the items to be installed; the default value is in brackets (Install or Don’t Install). To change a value, type the alphanumeric character associated with the item.**

7. **Press P to perform the selected actions from the two screens.**

The system prompts:

Preparing OFED VERSION release for Install...  
Rebuild OFED SRPMs (a=all, p=prompt per SRPM, n=only as needed?) [n]:

8. **Select the default by pressing Enter.**

The system displays prompts that require your response as it is going through the installation

9. **For each system prompt, select the default by pressing Enter.**

The **Intel OPA Autostart Menu** appears.

<table>
<thead>
<tr>
<th>Intel OPA Autostart (VERSION release) Menu</th>
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</thead>
<tbody>
<tr>
<td>Please Select Autostart Option:</td>
</tr>
<tr>
<td>0) OFED OPA Stack () [Enable]</td>
</tr>
<tr>
<td>1) OFED IBACM (ibacm) [Disable]</td>
</tr>
<tr>
<td>2) Intel HFI Components () [Enable]</td>
</tr>
<tr>
<td>3) OFED IP over IB () [Enable]</td>
</tr>
<tr>
<td>4) OPA FM (opafm) [Enable]</td>
</tr>
</tbody>
</table>

P) Perform the autostart changes  
S) Autostart All  
R) Autostart None  
X) Return to Previous Menu (or ESC)

**Note:** The previous menu is an example of the IntelOPA-IFS Autostart Menu. The IntelOPA-Basic Autostart Menu does not show 5) OPA FM (opafm).

10. **Review the items for Autostart; the default value is in brackets (Enable or Disable). To change a value, type the alphanumeric character associated with the item.**

Intel recommends leaving all of the Autostart selections set to the default values.

11. **Press P to perform the selected actions from the screen.**

The system prompts:

Hit any key to continue...
12. Press any key to proceed with the installation.
   The system prompts:
   
   Firmware Update unnecessary
   Hit any key to continue...

13. Press any key to proceed with the installation.
   The system prompts:
   
   A System Reboot is recommended to activate the software changes
   Hit any key to continue...

14. Press any key to proceed with the installation.
   The installation completes and returns to the main menu.

15. Press X to exit.

16. Restart the network.

ifdown ib0
ifup ib0

If you have finished the IntelOPA-IFS installation of the Management Node, continue setting up your Management Node by proceeding to the Configure Intel Chassis section

4.3 Intel® Omni-Path Software Installation Using CLI Commands

The installation of the Intel® Omni-Path Software (Intel® OPA Software) using CLI commands can install the basic software or the IFS software that was downloaded to your fabric. The ./INSTALL command has many options for installation including installing single components, uninstalls, and enabling and disabling autostart of components. For more information on the ./INSTALL syntax and options refer to section Install Command. The following procedure steps through the installation and defines the different items for the Basic and IFS installations. When needed, the procedure specifies Basic or IFS accordingly. This procedure presumes that you are logged in and have completed all pre-installation requirements.

Perform the following procedure to install the Intel® OPA Software in a default configuration:

1. Change directory to IntelOPA-[Basic|IFS].DISTRO.VERSION directory.

   Basic
   
   cd IntelOPA-Basic.DISTRO.VERSION

   IFS
   
   cd IntelOPA-IFS.DISTRO.VERSION

2. Start the default installation by typing ./INSTALL -n.
The installation will complete with the following system prompt:

```
A System Reboot is recommended to activate the software changes
Done Installing OPA Software.
```

3. Reboot the server.

```reboot```

If you have finished the IntelOPA-IFS installation of the Management Node, continue setting up your Management Node by proceeding to the Configure Intel Chassis section.

4.3.1 Install Command

The `.INSTALL` command for the Basic and IFS installations are issued from the following directories:

- **Intel Basic directory:**
  ```
  cd IntelOPA-Basic.DISTRO.VERSION
  ```

- **Intel IFS directory:**
  ```
  cd IntelOPA-IFS.DISTRO.VERSION
  ```

**Basic**

```
```

**Syntax**

```
./INSTALL [-r root] [-v|--vv] [-a|-n|-U|-u|-s|-O|-N|-i comp|--e comp] [-E comp]
[-D comp] [--user_configure_options 'options'] [--kernel_configure_options
'options']
```

or

```
./INSTALL -C
```

or

```
./INSTALL -V
```

**Options**

<table>
<thead>
<tr>
<th>No option selected</th>
<th>Display the Intel OPA Software TUI.</th>
</tr>
</thead>
</table>

---

Intel® Omni-Path Fabric—Install the Intel® Omni-Path Fabric Software

Installation Guide

November 2015

Order No.: H76467-1.0
-a  Installs all ULPs and drivers with the default options.

-n  Installs all ULPs and drivers with the default options, but does not change the autostart options.

-U  Upgrades/re-installs all presently installed ULPs and drivers with the default options, and does not change the autostart options.

-i  comp  Installs the given component with the default options. This option can appear multiple times on a command line.

-u  Uninstalls all ULPs and drivers with the default options.

-s  Enables autostart for all installed software.

-e  comp  Uninstalls the given component with the default options. This option can appear multiple times on a command line.

-E  comp  Enables autostart of given component. This option can appear with -D or multiple times on a command line.

Note: To permit control over which installed software is configured for autostart, combined this option with -a, -n, -i, -e and -U options.

-D  comp  Disables autostart of the given component. This option can appear with -E or multiple times on a command line.

Note: To permit control over which installed software is configured for autostart, combined this option with -a, -n, -i, -e and -U options.


-C  Shows the list of supported component names.

-V  Outputs the version number of the software.
-r dir
Specifies an alternate root directory. The default is `/`.

*Note:* This option is to permit boot images to be constructed that include Intel® Omni-Path Software so that the boot images can later be used for network boot of Intel® Omni-Path Fabric enabled nodes.

*Note:* Intel® Omni-Path Fabric Suite FastFabric use is not permitted in this environment.

-O
Keeps the current modified rpm configuration file

-N
Uses a new default rpm configuration file

--rebuild
Forces a rebuild of OFED_DELTA srpms.

--user_queries
Permits non-root users to query the fabric. This is the default.

--no_user_queries
Non-root users cannot query the fabric.

--user_configure_options options
Specifies additional OFED build options for user space srpms. This forces a rebuild of all user srpms.

--kernel_configure_options options
Specifies additional OFED build options for driver srpms. This forces a rebuild of all driver srpms.

--prefix dir
Specifies an alternate directory prefix for the OFED_Delta installation. Default is `/usr`. This causes a rebuild of needed srpms.

--without-depcheck
Disables the check of OS dependencies.

--force
Forces the installation, even if the distributions do not match. Use of this option can result in undefined behaviors.

--answer keyword=value
Provides an answer to a question which might occur during the operation. Answers to questions which are not asked are ignored. Invalid answers will result in prompting for interactive installations or use of the default for non-interactive installations.

**Possible Questions:**

UserQueries Allow non-root users to access the UMAD interface.
**Note:** Allowing access to umadX device files may present a security risk. However, this allows tools such as opasaquery, opaportinfo, etc to be used by non-root users.

Default options retain existing configuration files

### Other Information

**Supported component (comp) names:**

- opa_stack, ibacm, mpi_selector, intel_hfi, ib_wfr_lite, oftools, opa_stack_dev, fastfabric, delta_ipolb, opafm, mvapich2, openmpi, gasnet, openshmem, mvapich2_gcc_hfi, mvapich2_pgi_hfi, mvapich2_intel_hfi, openmpi_gcc_hfi, openmpi_pgi_hfi, openmpi_intel_hfi, delta_mpisrc, delta_debug

**Supported component (comp) name aliases:**

- opa, ipolb, mpi, mpisrc, opadev

### 4.4 IPoIB IPV4 Configuration Using the Software TUI

**Prerequisites:** Have a list of the IP addresses and netmasks for each interface you are going to set up.

The following procedure can be done during the Software TUI installation or after the installation is complete. If you are configuring the IPoIB IPV4 during the Software TUI installation start with Step 2 and when complete go back to the Software TUI installation and continue where you left off.

The following procedure presumes you are logged on and at the **Intel OPA Software main menu**.

1. **Select 2) Reconfigure OFED IP over IB** from the Intel OPA Software main menu.
   
   The system prompts:
   
   ```
   Configure OFED IP over IB IPV4 addresses now? [n]:
   ```

2. **Press y** to configure OFED IP over IB IPV4.
The system prompts:

You may configure an OFED IP over IB interface for each HFI port
Or you may select to have OFED IP over IB only run on some HFI ports
Or you may select to configure redundant HFI ports with a pair of HFI ports running a single OFED IP over IB interface
How many OFED IP over IB interfaces would you like to configure? [1]:

3. Press **Enter** for the default of 1 or type in the number of interfaces you are going to configure.

If you selected the default, the system prompts:

About to create OFED IP over IB ifcfg files in
/etc/sysconfig/network-scripts
Use interface name ib0? [y]:

If you selected something other than the default, the system prompts:

About to create OFED IP over IB ifcfg files in
/etc/sysconfig/network-scripts
Configure interface names sequentially starting with ib0? [y]:

4. Continue the setup by answering and following the prompts to set up the OFED IP over IB interfaces.

Setup completes and returns to the main menu

### 4.5 IPoIB IPV4 Configuration Using CLI Commands

**Prerequisites:** Have a list of the IP addresses and netmasks for each interface you are going to set up.

The following procedure presumes you are logged on and at the Intel OPA Software main menu.

1. Type `opahostadmin -f /etc/sysconfig/opa/hosts configipoib`.
   This creates the `ifcfg-ibX` configuration file for each host, using the host IP addresses from the `/etc/hosts` file.

### 4.6 Install IPoIB IPV6

To install IPoIB for IPV6 on the management node use the following procedures for the OS on the Fabric management node.

**On Red Hat**:  
1. Edit file `/etc/sysconfig/network` to add the following line:

   ```
   NETWORKING_IPV6=yes
   ```

2. Edit file `ifcfg-if-name` to add the following lines:

   ```
   IPV6INIT=yes
   IPV6ADDR="ipv6addr/prefix-length"
   ```
3. Restart the network.

**On SUSE® Enterprise:**

1. Edit `ifcfg-ifname` to add the following line:

   ```bash
   IPADDR=ipv6addr/prefix-length
   ```

   IPV6 address should look like the following:

   ```plaintext
   3ffe::6/64
   ```

2. Restart the network.
5.0 Configure Intel® Omni-Path Chassis

Use Intel® Omni-Path Fabric Suite FastFabric to install and configure internally managed switches, such as the Intel® Omni-Path Director Switch 100 Family. See the switch documentation for information about installing and configuring switches made by other manufacturers.

5.1 Intel Chassis Configuration Pre-requisites

Ensure the internally managed switches are configured to use the Intel® Omni-Path Fabric Suite FastFabric tool set, by performing the following steps. Refer to the Intel® Omni-Path Fabric Switches Hardware Installation Guide for more details:

1. (Switch) Connect each chassis to the management network through its Ethernet management port. For chassis with redundant management, connect both Ethernet management ports.

2. (Switch) Set up the netmask and gateway addresses on each Intel chassis, following the procedures in the Intel® Omni-Path Fabric Switches GUI User Guide.

3. (Switch) Assign each Intel chassis a unique IP address, and appropriately configure the Ethernet management port network settings.

4. (Switch) For a chassis with redundant management, assign a unique IP address for each Intel Management Module or Intel Management Spine, and configure their Ethernet management port network settings.

5. (Switch) Select a unique name for each Intel chassis, Management Module, and Spine. This name should be configured in DNS or /etc/hosts as the TCP/IP name for the Ethernet management port.

Note: The chassis node description will be set later.

6. (Switch) Configure the administrator password on each Intel chassis.

Note: All versions of Intel® Omni-Path Chassis 100 Family firmware permit SSH keys to be configured within the chassis for secure password-less login. To simplify the configuration of SSH security using FastFabric, configure all chassis with the same initial administrator password (or leave the default "adminpass" until FastFabric has set up ssh keys), configure the SSH keys, then change the administrator passwords. After ssh has been set up using FastFabric, Intel recommends you change the admin passwords.

7. (Switch) Copy the relevant chassis firmware files onto the FastFabric management node. When performing the Chassis Configuration procedures, the *.spkg files will be used to upgrade the firmware on each chassis.

Note: Place all files at a given firmware level into a single directory, whose name indicates the firmware revision number.
5.2 Configure Chassis Using Intel® Omni-Path Fabric Suite FastFabric

Refer to the Intel® Omni-Path Fabric Suite FastFabric User Guide for more information on how to use the FastFabric TUI.

1. (Switch) Type opafastfabric and press Enter.

The Intel FastFabric OPA Tools menu is displayed.

```
Intel FastFabric OPA Tools
Version: X.X.X.X

1) Chassis Setup/Admin
2) Externally Managed Switch Setup/Admin
3) Host Setup
4) Host Verification/Admin
5) Fabric Monitoring
X) Exit
```

2. (Switch) Press 1.

The FastFabric OPA Chassis Setup/Admin Menu is displayed.

```
FastFabric OPA Chassis Setup/Admin Menu
Chassis File: /etc/sysconfig/opa/chassis

Setup:
0) Edit config and select/edit Chassis file [ Skip ]
1) Verify Chassis via Ethernet ping [ Skip ]
2) Update Chassis firmware [ Skip ]
3) Setup Chassis basic configuration [ Skip ]
4) Setup password-less ssh/scp [ Skip ]
5) Reboot Chassis [ Skip ]
6) Get basic Chassis configuration [ Skip ]
7) Configure Chassis Fabric Manager (FM) [ Skip ]
8) Update Chassis FM security files [ Skip ]
9) Get Chassis FM security files [ Skip ]

Admin:
a) Check OPA Fabric status [ Skip ]
b) Control Chassis Fabric Manager (FM) [ Skip ]
c) Generate all Chassis Problem Report Info [ Skip ]
d) Run a command on all chassis [ Skip ]

Review:
e) View opachasssisadmin result files [ Skip ]

P) Perform the selected actions N) Select None
X) Return to Previous Menu (or ESC)
```

3. (Switch) Select the items in the Setup section that are required or needed for your fabric.

Type the alphanumeric character associated with the item to toggle the selection from Skip to Perform.

4. Press P.

Perform the items that were selected in the sub-sections as follows.

**Edit the Configuration and Select/Edit Chassis File**

(Switch) The Edit Config and Select/Edit Chassis File selection will permit the chassis, ports, and FastFabric configuration files to be edited.
• When placed in the editor for opafastfabric.conf, review the settings.

  — Especially review the FF_CHASSIS_LOGIN_METHOD and
    FF_CHASSIS_ADMIN_PASSWORD. Refer to "Configuration Files for FastFabric"
    section of the Intel® Omni-Path Fabric Suite FastFabric User Guide for more
    information about the opafastfabric.conf file.

  Note: FastFabric will provide the opportunity to enter the chassis password
  interactively when needed. It is not necessary to place it within
  opafastfabric.conf. If the Intel chassis admin password is placed in
  opafastfabric.conf, change the opafastfabric.conf
  permissions to be 0x600 (root-only access).

  Note: All versions of Intel® Omni-Path Chassis 100 Family firmware permit ssh
  keys to be configured within the chassis for secure password-less login. There
  is no need to configure a FF_CHASSIS_ADMIN_PASSWORD, and
  FF_CHASSIS_LOGIN_METHOD can be set to ssh (the default) when
  using the newer versions of the chassis firmware.

• Select the location for the result files from FastFabric with the FF_RESULT_DIR
  parameter. The default is the directory from which a given session of FastFabric is
  invoked. Alternatively, it can be set to a directory relative to your home directory.
  For example:

  ```
  export FF_RESULT_DIR=${FF_RESULT_DIR:-$HOME/
  fastfabric_results}
  ```

  Note: Refer to "Configuration Files for FastFabric" section of the Intel® Omni-Path
  Fabric Suite FastFabric User Guide for more information about the
  opafastfabric.conf file.

• When placed in the editor for ports, review the file. For typical single-subnet
  clusters, the default of "0:0" may be used. This will use the first active port on the
  Fabric Management Node to access the fabric. For more information on configuring
  a cluster with multiple subnets, see Multi-Subnet Fabrics on page 101. For further
  details about the file format, refer to the Intel® Omni-Path Fabric Suite FastFabric
  Command Line Interface Reference Guide.

• When placed in the editor for chassis, create the file with a list of the chassis
  names (the TCP/IP Ethernet management port names assigned) or IP addresses
  (use of names is recommended). Enter one chassis name or IP address per line.
  For example:

  ```
  Chassis1
  Chassis2
  ```

  Note: Refer to Generate or Update Switch File on page 48 to generate a list of the
  externally managed switches presently in the fabric.

  Note: Do not list externally managed switches in this file. Those will be covered in section
  Configure Firmware on the Externally Managed Intel® Omni-Path Switches on page
  46.

  For further details about the file format refer to the Intel® Omni-Path Fabric Suite
Verify Chassis via Ethernet Ping

(Switch) The Verify Chassis via Ethernet Ping selection will ping each selected chassis over the management network. If all chassis were found, continue to the next step. If some chassis were not found, exit the menu and review the following list for those chassis which were not found:

- Is chassis powered on and booted?
- Is chassis connected to management network?
- Are chassis IP address and network settings consistent with DNS or /etc/hosts?
- Is Management node connected to the management network?
- Are Management node IP address and network settings correct?
- Is management network itself up (switches, routers, etc)?
- Is correct set of chassis listed in the chassis file (the previous step may be repeated to review and edit the file as needed)?

Update Chassis Firmware

(Switch) The Update Chassis Firmware selection will permit the chassis firmware version to be verified and updated as needed.

Notes: Before continuing, refer to the relevant switch release notes for any prerequisites:

- Intel® Omni-Path Fabric Managed Switches Release Notes
- Intel® Omni-Path Fabric Externally-Managed Switches Release Notes

1. When this procedure is started, the following system prompt will be displayed:

   Multiple Firmware files and/or Directories may be space separated
   Shell wildcards may be used
   For Directories all .spkg files in the directory tree will be used
   Enter Files/Directories to use (or none):

2. Specify the directory where the relevant firmware files have been stored and press Enter.
   This can be the mount point of the CD or the directory to which the files were copied in a previous step.
   System prompts:
   Would you like to run the firmware now? [n]:

3. Type y and press Enter.
   FastFabric will ensure that all chassis are running the firmware level provided, and will install and/or reboot each chassis as needed.
   If any chassis fails to be updated, use the View opachassismain result files option to review the result files from the update. Refer to the Intel® Omni-Path Fabric Suite FastFabric Command Line Interface Reference Guide for more details.

Set Up Chassis Basic Configuration

(Switch) The Setup Chassis Basic Configuration will permit the typical chassis setup operations to be performed for all chassis.
Perform the following procedure:

1. When this procedure is started, the following system prompt will be displayed:

   Would you like to be prompted for chassis' password? [n]:

2. Press **Enter** to select default (n).

3. Press **Enter** to select default (y).

4. Enter the IP address of the syslog server that is to receive log messages from all chassis.

5. Press **Enter** to select default (n).

6. Press **Enter** to select default (n).

7. Press **Enter** to select default (n).

8. Press **Enter** to select default (y).

9. Enter the IP address of an NTP server that can supply a consistent time base for use by all chassis.

   Logging to the syslog can be configured in a Quiet Mode, where only user actionable events are logged. Otherwise, in Normal Mode, all events will be logged.

   Do you wish to configure Quiet Mode for syslog? [n]:

   Do you wish to configure an NTP server? [y]:

   Enter IP address for NTP server:

   Enter IP address for syslog server:

   Do you wish to configure timezone and DST information? [y]:

   Enter IP address for syslog server:
10. Press **Enter** to select default (y).
   
   **System prompts:**
   
   Do you want to use the local timezone information from the local server? [y]:

11. Press **Enter** to select default (y).
   
   This causes the time zone of the local server (e.g., the Fabric Management Node) to be replicated to all the chassis to specify their time zones.
   
   **System prompts:**
   
   Do you wish to configure the chassis maximum packet MTU size? [n]:

12. Press **Enter** to select default (n).
   
   This causes the default MTU of 2048 to be used for all chassis. If chassis have previously been manually configured for a different MTU size, this option will keep the previously configured MTU size. Refer to the *Intel® Omni-Path Fabric Host Software User Guide*, for detailed information.
   
   **System prompts:**
   
   Do you wish to configure the chassis VL Capability? [n]:

13. Press **Enter** to select default (n).
   
   This causes the default VL Capability of 1 to be used for all chassis. If chassis have previously been manually configured for a different VL Capability, this option will keep the previously configured VL Capability size. See the *Intel® Omni-Path Fabric Switches GUI User Guide* for more information.
   
   **System prompts:**
   
   Do you wish to configure the VL Credit Distribution? [n]:

   **Note:** Always select the default (n) for the question Do you wish to configure the VL Credit Distribution? unless instructed to do otherwise by Intel Technical Support.

14. Press **Enter** to select default (n).
   
   **System prompts:**
   
   Do you wish to configure the chassis link width? [n]:

15. Press **Enter** to select default (n).
   
   This causes the default link width supported value of 1x/4x/8x to be used for all ports on all chassis. If any chassis have been previously manually configured for a different link width supported, those setting will remain unchanged.
   
   **System prompts:**
   
   Do you wish to configure Switch Desc to match ethernet chassis name? [y]:

16. Press **Enter** to select default (y).
This causes the chassis name entered in the `/etc/sysconfig/opa/chassis` file to be used as the Switch Description for the chassis, making the management network and OPA network names for the chassis consistent.

If the `/etc/sysconfig/opa/chassis` file has IP addresses instead of names, enter `n` to this question.

System prompts:

**Do you wish to configure Switch Desc Format? [y]:**

17. Press **Enter** to select default (y).

System prompts:

**Do you wish to use concise Switch Desc format? [y]:**

18. Press **Enter** to select default (y).

This causes the chassis Switch Descriptions to use concise naming for the Leafs and Spines such as L01 or S01A (as opposed to “Leaf 1” or “Spine 1, Chip A”).

System prompts:

**Do you wish to configure the port counter auto-clear feature? [n]:**

<table>
<thead>
<tr>
<th>If</th>
<th>Then</th>
</tr>
</thead>
<tbody>
<tr>
<td>You are not using <code>opatop</code>.</td>
<td>Continue with 19 on page 36</td>
</tr>
<tr>
<td>You will be using <code>opatop</code>.</td>
<td>Skip to 20 on page 36</td>
</tr>
</tbody>
</table>

19. Press **Enter** to select default (n).

Selecting the default will leave the auto clear feature as previously configured.

Skip to 21 on page 36.

20. Press **Y** to select to disable this feature.

This causes the port counter auto-clear feature to be disabled on all chassis.

21. Continue with **Setup Password-less ssh/scp** on page 36.

**Setup Password-less ssh/scp**

*(Switch)* The **Setup Password-less ssh/scp** selection will set up secure password-less ssh, such that the Fabric Management Node can securely log into all the chassis as `admin` through the management network, without requiring a password.

**Reboot Chassis**

*(Switch)* The **Reboot Chassis** selection will reboot all the selected chassis and ensure they reboot fully (as verified through ping over the management network). When the chassis come back up following the reboot, they will be running with all the new configuration settings.
Get Basic Chassis Configuration

(Switch) The Get Basic Chassis Configuration selection will retrieve basic information from chassis such as syslog, NTP configuration, timezone info, MTU Capability, VL Capability, VL Credit Distribution, Link Width, and node description. The following is an example of the output from this selection:

```
Performing Chassis Admin: Get basic Chassis configuration
Executing: /usr/sbin/opachassisadmin -F /etc/sysconfig/opa/chassis getconfig
Executing getconfig Test Suite (getconfig) day mmm dd hh:mm:ss timezone yyyy ...
Executing TEST SUITE getconfig CASE (getconfig.xx.xx.xx.xx.getconfig) get
xx.xx.xx.xx ...
TEST SUITE getconfig CASE (getconfig.xx.xx.xx.xx.getconfig) get
xx.xx.xx.xx
Firmware Active        : xx.xx.xx.xx
Firmware Primary       : xx.xx.xx.xx
Syslog Configuration   : Syslog host set to: 0.0.0.0 port 514 facility 22
NTP                    : Configured to use the local clock
Time Zone              : Time zone offset has not been configured
LinkWidth Support      : 4X
Node Description       :
Link CRC Mode          : 48b_or_14b_or_16b
PASSED
TEST SUITE getconfig: 1 Cases; 1 PASSED
TEST SUITE getconfig PASSED
Done getconfig Test Suite day mmm dd hh:mm:ss timezone yyyy
```

Configure Chassis Fabric Manager (FM)

(Switch) The Configure Chassis Fabric Manager (FM) selection will assist in configuring the Fabric Manager for any Intel® Omni-Path Chassis 100 Family.

System prompts:

```
Performing Chassis Admin: Configure Chassis Fabric Manager
Enter FM Config file to use (or none or generate):

1. Enter generate.
   This will perform the config_generate operation to guide you through selecting FM configuration options. See the Intel® Omni-Path Fabric Suite Fabric Manager User Guide for more information about config_generate.

2. After responding to the prompts for config_generate, the following system prompt will display:
   You have selected to use: ./opafm.xml
   Syntax Checking ./opafm.xml...
   Executing: /opt/hfi/fm_tools/config_check -s -c ./opafm.xml
   Valid FM Config file: ./opafm.xml
   After push, the FM may be started/restarted
   Would you like to restart the FM? [n]:

3. Enter y.
   This causes the FM to be started with the new configuration.
```
4. **Refer to the following If/Then table:**

<table>
<thead>
<tr>
<th>If</th>
<th>Then</th>
</tr>
</thead>
<tbody>
<tr>
<td>Your fabric has a single chassis running the</td>
<td>Type y</td>
</tr>
<tr>
<td>Fabric Manager, you can run the Fabric Manager on the slave</td>
<td></td>
</tr>
<tr>
<td>management module (MM). This causes the Fabric Manager to be</td>
<td></td>
</tr>
<tr>
<td>started in the applicable chassis.</td>
<td></td>
</tr>
<tr>
<td>Your fabric has multiple chassis running the</td>
<td>Type n</td>
</tr>
<tr>
<td>Fabric Manager, Intel recommends to run Fabric Manager on the</td>
<td></td>
</tr>
<tr>
<td>master management module. This causes the Fabric Manager to be</td>
<td></td>
</tr>
<tr>
<td>started only on the master management module in the</td>
<td></td>
</tr>
<tr>
<td>applicable chassis.</td>
<td></td>
</tr>
</tbody>
</table>

5. **Press Enter to select the default option: y.**

Intel recommends doing the operation in parallel.

6. **Enter y.**

This causes the Fabric Manager to be started on all applicable chassis each time those chassis boot.

7. **Refer to the following If/Then table:**

<table>
<thead>
<tr>
<th>If</th>
<th>Then</th>
</tr>
</thead>
<tbody>
<tr>
<td>Your fabric has a single chassis running the</td>
<td>Type y</td>
</tr>
<tr>
<td>Fabric Manager, you can run the Fabric Manager on the slave</td>
<td></td>
</tr>
<tr>
<td>management module. This causes the Fabric Manager to be started</td>
<td></td>
</tr>
<tr>
<td>in the applicable chassis.</td>
<td></td>
</tr>
<tr>
<td>Your fabric has multiple chassis running the</td>
<td>Type n</td>
</tr>
<tr>
<td>Fabric Manager, Intel recommends to run Fabric Manager on the</td>
<td></td>
</tr>
<tr>
<td>master management module. This causes the Fabric Manager to only</td>
<td></td>
</tr>
<tr>
<td>be started on the master management module in the applicable</td>
<td></td>
</tr>
<tr>
<td>chassis.</td>
<td></td>
</tr>
</tbody>
</table>
System prompts:
Would you like to be prompted for chassis' password? [n]:

8. Press Enter to select the default n option.
System prompts:
Are you sure you want to proceed? [n]:

9. Enter y.
This updates the Fabric Manager.
System prompts:
Hit any key to continue (or ESC to abort)...

10. Press any key to complete this procedure

**Update Chassis FM Security Files**

*(Switch)* The Update Chassis FM Security Files selection runs the `opachassisadmin fmsecurityfiles` command to permit the chassis security files to be verified and updated as needed.

*Note:* The FM security files are the private key, public key, and certificate files required by the FM, in order to support secure socket connection via OpenSSL. Refer the Intel® Omni-Path Fabric Suite Fabric Manager User Guide for instructions in the administration tasks required to support these files.

Prompts will guide you through the options:
- **push** - Ensures given security files are pushed to each chassis

Additional options prompted for:
- selection of security files or directory containing pem files
- parallel vs serial update
- chassis password (default is to have password in fastfabric.conf or to use password-less ssh)

If any chassis fails to be updated, use the `View opachassisadmin results files` option to review the result files from the update. Refer to View `opachassisadmin result files` on page 40 for more information.


**Get Chassis FM Security Files**

*(Switch)* The Get Chassis FM Security Files selection runs the `opachassisadmin fmgetsecurityfiles` command to permit the chassis FM security files to be retrieved from the chassis.
Check OPA Fabric status

(All) The **Check OPA Fabric status** selection prompts you to:

- Perform a fabric error analysis,
- Clear the error counters after generating a report
- Perform a fabric link speed error analysis
- Check for links configured to run slower than supported
- Check for links connected with mismatched speed potential
- Enter a filename for the results or save the results to the default location (/root/ffres/linkanalysis.res

For more information refer to the *Intel® Omni-Path Fabric Suite FastFabric User Guide*.

Control Chassis Fabric Manager (FM)

(Switch) The **Control Chassis Fabric Manager (FM)** selection prompts you to:

- Restart the Fabric Manager
- Run the Fabric Manager on slave management modules
- Restart the Fabric Manager on all management modules
- Perform this operation in parallel
- Change the Fabric Manager boot state to enable the Fabric Manager to start at boot
- Enable Fabric Manager to start on slave management modules at boot
- Be prompted for chassis’ password

For more information, refer to the *Intel® Omni-Path Fabric Suite FastFabric User Guide*.

Generate all Chassis Problem Report Information

(Switch) The **Generate all Chassis Problem Report Info** selection generates the chassis problem report. For more information, refer to the *Intel® Omni-Path Fabric Suite FastFabric User Guide*.

Run a command on all chassis

(Switch) If there are any other operations that need to be performed on all chassis, they may be performed using the **Run a command on all chassis** option. Each time this is executed, a single chassis CLI command may be specified to be executed against all selected chassis. When using these commands, additional setup or verification of the chassis may be performed.

View opachassisadmin result files

(Switch) The **View opachassisadmin result files** selection opens the punchlist.csv, test.res, and test.log files to be viewed. For more information, refer to the *Intel® Omni-Path Fabric Suite FastFabric User Guide*. 
5.3 Configure Chassis Using CLI Commands

Prerequisites: Refer to Intel Chassis Configuration Pre-requisites on page 30 for pre-requisites to this procedure.

This procedure provides step-by-step information to configure the chassis.

1. (Optional) Edit or review the /etc/sysconfig/opa/opafastfabric.conf file.

2. (Optional) Edit or review the /etc/sysconfig/opa/ports file.
   For typical single-subnet clusters, the default of "0:0" may be used. This will use the first active port on the Fabric Management Node to access the fabric. For more information on configuring a cluster with multiple subnets, see Multi-Subnet Fabrics on page 101. For further details about the file format, refer to the Intel® Omni-Path Fabric Suite FastFabric Command Line Interface Reference Guide.

3. (Optional) Create, edit, or review the /etc/sysconfig/opa/chassis file.
   Create/review the file with a list of the chassis names (the TCP/IP Ethernet management port names assigned) or IP addresses (use of names is recommended). Enter one chassis name or IP address per line. For example:

<table>
<thead>
<tr>
<th>Chassis1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chassis2</td>
</tr>
</tbody>
</table>

   Note: Refer to Generate or Update Switch File on page 48 to generate a list of the externally managed switches presently in the fabric.

   Note: Do not list externally managed switches in this file. Those will be covered in the Configure Firmware on the Externally Managed Intel® Omni-Path Switches on page 46 section.

   For further details about the file format refer to the Intel® Omni-Path Fabric Suite FastFabric Command Line Interface Reference Guide.

4. Verify the chassis is accessible over the management network.
   opapingall -C -p -f /etc/sysconfig/opa/chassis

   If some chassis were not found review the following list for those chassis which were not found:
   - Is chassis powered on and booted?
   - Is chassis connected to management network?
   - Are chassis IP address and network settings consistent with DNS or /etc/hosts?
   - Is Management node connected to the management network?
   - Are Management node IP address and network settings correct?
   - Is the management network itself up (switches, routers, etc)?
   - Is correct set of chassis listed in the chassis file (the previous step may be repeated to review and edit the file as needed)?
5. Update the chassis firmware.
   Run the firmware update in parallel use:
   `opachassisadmin -S -F chassisfile -P package -a run upgrade`
   Run the firmware update in serial use:
   `FF_MAX_PARALLEL=0 opachassisadmin -S -F chassisfile -P package -a run upgrade`

   During run the following files are produced:
   - `test.res` - appended with summary results of run
   - `test.log` - appended with detailed results of run
   - `save_tmp/` - contains a directory per failed operation with detailed logs
   - `test_tmp/*` - intermediate result files while operation is running

   If any chassis fails to be updated, refer to the View opachassisadmin result files section to review the result files from the update.


6. Set up the chassis with the basic configuration settings.
   `opachassisadmin -S -F chassisfile configure`

   This wizard gives you the option of setting up the following items on the chassis:
   - Syslog server
   - NTP server
   - Timezone and DST information
   - Chassis maximum packet MTU size
   - Chassis VL Capability
   - VL Credit Distribution
   - Chassis link width
   - Configure Switch Desc to match ethernet chassis name
   - Configure Switch Desc Format
   - Use concise Switch Desc format
   - Configure the port counter auto-clear feature

   Follow the system prompts to select and configure the items required.

7. Set up secure password-less ssh, such that the Fabric Management Node can securely log into all the chassis as admin through the management network, without requiring a password.
   `opasetupssh -p -S -C -F chassisfile`

8. Reboot all the selected chassis and ensure they reboot fully (as verified through ping over the management network).
   `opachassisadmin -S -F chassisfile reboot`

   When the chassis come back up following the reboot, they will be running with all the new configuration settings.
9. Configure the Chassis Fabric Manager for any Intel® Omni-Path Chassis 100 Family chassis.
   To configure the Chassis Fabric Manager in parallel use:
   ```
   opachassisadmin -S -F chassisfile -P package -a run fmconfig
   ```
   To configure the Chassis Fabric Manager in serial use:
   ```
   FF_MAX_PARALLEL=0 opachassisadmin -S -F chassisfile -P package -a run fmconfig
   ```
10. Retrieve basic information from chassis such as syslog, NTP configuration, timezone info, MTU Capability, VL Capability, VL Credit Distribution, Link Width, and node description.
    ```
    opachassisadmin -F chassisfile getconfig
    ```

### 5.4 Verify Chassis Configuration Using CLI Commands

**Prerequisites:** Chassis has been configured.

This procedure provides step-by-step information to verify the chassis configuration and view the result files.

1. Check the OPA fabric status.
   ```
   opalinkanalysis -U -x snapshot_suffix reports verifyall > results_file 2>&1
   ```
   This step performs the following operations:
   - Perform a fabric error analysis
   - Clear the error counters after generating a report
   - Perform a fabric link speed error analysis
   - Check for links configured to run slower than supported
   - Check for links connected with mismatched speed potential
   - Enter a filename for the results or save the results to the default location (/root/ffres/linkanalysis.res)

2. To control the Chassis Fabric Manager you can perform any or all of the following steps:
   a. (optional) Restart all of the Chassis Fabric Managers.
      ```
      Note: Doing it serially may reduce disruption
      ```
      To restart all the Chassis Fabric Managers and run the Fabric Manager on the slave Management Module in parallel use:
      ```
      opachassisadmin -S -F chassisfile -a restartall fmcontrol
      ```
      To restart all the Chassis Fabric Managers and run the Fabric Manager on the slave Management Module in serial use:
      ```
      FF_MAX_PARALLEL=0 opachassisadmin -S -F chassisfile -a restartall fmcontrol
      ```
      There will be a disruption as FMs are restarted.
   b. (optional) Restart the master Chassis Fabric Manager and stopping the slaves.
      ```
      Note: Doing it serially may reduce disruption
      ```
To restart the Master Chassis Fabric Managers and stop the Fabric Manager on the slave Management Modules in parallel use:
```
opachassisadmin -S -F chassisfile -a restart fmcontrol
```
To restart all the Chassis Fabric Managers and stop the Fabric Manager on the slave Management Modules in serial use:
```
FF_MAX_PARALLEL=0 opachassisadmin -S -F chassisfile -a restart fmcontrol
```

c. (optional) Stop the Chassis Fabric Managers from running.
To stop the Master Chassis Fabric Managers from running in parallel use:
```
opachassisadmin -S -F chassisfile -a stop fmcontrol
```
To stop the Master Chassis Fabric Managers from running in serial use:
```
FF_MAX_PARALLEL=0 opachassisadmin -S -F chassisfile -a stop fmcontrol
```

d. (optional) Make sure all of the Chassis Fabric Managers are running.
To make sure all of the Chassis Fabric Managers are running including the slaves in parallel use:
```
opachassisadmin -S -F chassisfile -a runall fmcontrol
```
To make sure all of the Chassis Fabric Managers are running including the slaves in serial use:
```
FF_MAX_PARALLEL=0 opachassisadmin -S -F chassisfile -a runall fmcontrol
```

e. (optional) Make sure the Master Chassis Fabric Manager is running.
To make sure the Master Chassis Fabric Manager are running and the slaves are stopped in parallel use:
```
opachassisadmin -S -F chassisfile -a run fmcontrol
```
To make sure the Master Chassis Fabric Manager are running and the slaves are stopped in serial use:
```
FF_MAX_PARALLEL=0 opachassisadmin -S -F chassisfile -a run fmcontrol
```

f. (optional) Change the Fabric Manager boot state to enable the Master Chassis Fabric Manager to start at boot.
```
opachassisadmin -S -F chassisfile -l enable
```

g. (optional) Change the Fabric Manager boot state to enable the all of the Chassis Fabric Managers to start at boot.
```
opachassisadmin -S -F chassisfile -l enableall
```

```
opacaptureall -p -D 4 -f hostfile
```

4. Run a command on all chassis.
```
opacmdall -C -S -p -T timelimit -F chassisfile STDIN
```

5. View opachassisadmin result files
```
editor(for example vi) result_dir/result_file
```

The following default files are created:
• punchlist.csv
• test.res
• test.log
6.0 Configure Firmware on the Externally Managed Intel® Omni-Path Switches

If the fabric contains Intel® Omni-Path Switch 100 Family externally managed switches, Intel® Omni-Path Fabric Suite FastFabric is used to aid in the installation and configuration of the switches. If the fabric contains another vendor’s switches, please refer to the vendor’s documentation to configure the firmware on the externally managed switches.

6.1 Switch Configuration Pre-Requisites

Prior to using Intel® Omni-Path Fabric Suite FastFabric, the following minimal steps need to be performed:

1. **(Switch)** Select a unique name to be used for each switch. This name will be configured as the Switch Description for the switch in the following steps.
   
   *Note:* Externally managed switches do not have an Ethernet port and therefore will not have a TCP/IP name.

2. **(Switch)** Copy the relevant switch firmware files onto the Intel® Omni-Path Fabric Suite FastFabric management node. For the following steps, the *.emfw files will be used to upgrade the firmware on each switch.
   
   *Note:* When copying files, it is best to place all files at a given firmware level into a single directory whose name indicates the firmware revision number.

6.2 Configure Externally Managed Switches

Once the pre-requisites have been completed, configure the switches using Intel® Omni-Path Fabric Suite FastFabric in the following procedure.

1. **(Switch)** If the Intel FastFabric OPA Tools menu is not displayed, type `opafastfabric` at a command prompt and press Enter.

2. **(Switch)** Press 2 to display the FastFabric OPA Switch Setup/Admin Menu (Figure 1 on page 47).
3. **Switch** Select the items in the Setup section that are required or needed for your fabric

4. Press P.

5. Perform the items selected using the following sections.

### Edit Config and Select/Edit Switch File

**Switch** The Edit Config and Select/Edit Switch File selection will take you to edit mode, where you can edit the switches, ports, and FastFabric configuration files. While in the editor, review all the settings in opafastfabric.conf. Refer to Intel® Omni-Path Fabric Suite FastFabric User Guide Configuration Files section for more information about opafastfabric.conf.

When in the editor for ports, review the file. For typical single-subnet clusters, the default of "0:0" may be used. This will use the first active port on the Fabric Management Node to access all externally managed switches. For more information on configuring a cluster with multiple subnets, see Multi-Subnet Fabrics on page 101. For further details about the file format, refer to the Intel® Omni-Path FastFabric Command Line Interface Reference Guide.

When in the editor for switches, create the file with a list of the switch node GUID and required switch names. Enter one switch node GUID and required switch name per line. For example:

```
0x00066a00d9000138,edge1
0x00066a00d9000139,edge2
```

**Note:** Per the previous example, when typing a new name, do not use any spaces before or after the comma.

**Note:** The Generate or Update Switch File menu item or opagenswitches may be used to generate a list of the externally managed switches presently in the fabric. For example, when using the vi editor, the command :r ! opagenswitches may be used to add the output from this command to the file.
**Note:** Do not list internally managed chassis in this file. Those are covered in the Configure Intel Chassis section.

**Note:** Intel® Omni-Path Fabric Suite FastFabric is topology-aware when updating externally managed switch firmware or resetting the switches. The update or restart will start at the switches farthest from the FastFabric node and then work toward the FastFabric node. This way, switches that are rebooted will not be in the path between the FastFabric node and others that are being updated or reset.

For further details regarding the file format, refer to the Intel® Omni-Path Fabric Suite FastFabric Command Line Interface Reference Guide.

If needed, an SA query, such as the following, can be used to get a list of all switches. This includes both internally and externally managed switches. Consequently, the output must be edited to leave only the Intel externally managed switches:

```
opasaquery -t sw -o nodeguid
```

**Generate or Update Switch File**

(Switch) The Generate or Update Switch File selection generates or updates the switches file. It can also update switch names in the switches file by comparing the actual fabric to topology xml data.

**Test for Switch Presence**

(Switch) The Test for Switch Presence selection will verify that each Externally Managed Switch specified in the switches file can be accessed by the Fabric Management Node through the Fabric Network. If all switches were found, continue to the next step. If some switches were not found, exit the menu and review the following for those switches which were not found:

- Is switch powered on and booted?
- Is switch connected to Intel® Omni-Path Fabric?
- Is Subnet Manager running?
- Is Fabric Management node’s Port active?
- Is Fabric Management node connected to the correct Intel® Omni-Path Fabric?
- Is correct set of switches listed in the switches file (the previous step may be repeated to review and edit the file as needed)?

**Verify Switch Firmware**

(Switch) The Verify Switch Firmware selection will check that each externally managed switch is operational and that its firmware is valid and accessible.
**Update Switch Firmware**

*(Switch)* The **Update Switch Firmware** selection will permit the switch firmware version to be updated and the switch node name set. When this selection is performed, the following message will be displayed:

Multiple Firmware files and/or Directories may be space separated
Shell wildcards may be used
For Directories all .emfw files in the directory tree will be used
Enter Files/Directories to use (or none):

**Note:** Refer to the *Intel® Omni-Path Fabric Externally-Managed Switches Release Notes* to ensure that any prerequisites for the upgrade to the new firmware level have been met prior to performing the upgrade through FastFabric.

**Perform the following procedure:**

1. Specify the directory where the relevant firmware files have been stored. This can be the mount point of the CD or the directory to which the files were copied in a previous step.
   
   The following message will display:
   
   After upgrade, the switch may be optionally rebooted.
   Would you like to reboot the switch after the update? [n]:

2. Type *y*
   
   The following message will display:
   
   The firmware on the switch will be checked, and if the running version is the same as the version being used for the update, the update operation will be skipped.
   Would you like to override this check, and force the update to occur? [n]:

3. Press *Enter* to select default (n).

   The fabric is not yet operational.
   
   The following message will display:
   
   You have selected to update the switch firmware and reboot.
   There will be a disruption as switch or switches are rebooted.
   Doing the operation in parallel (on multiple switches) will finish the fastest.
   Doing it serially may reduce disruption.
   Would you like to do the operation in parallel? [y]:


Note: Because the Intel® Omni-Path Fabric itself is used to update externally managed switches, updating multiple switches with the reboot option may disrupt parallel update operations. If there are not any selected externally managed switches in the path from the Fabric Management node to any other externally managed switch (for example, if the Fabric Management node is connected directly to a core switch and externally managed switches are only at the edges), parallel operations can be established. To control the order of the rebooting of externally managed switches by FastFabric, see the discussion of the distance option for the switches file or command in the Intel® Omni-Path Fabric Suite FastFabric User Guide, Appendix A, “Externally Managed Switch List File” subsection.

4. Press Enter
   or
   Type n and press Enter if in doubt.

   Note: Be aware that non-parallel operation for a fabric with many externally managed switches could take a significant amount of time.

FastFabric will update the firmware on all switches and set the node names, as per the switches file created in a previous step. Each switch will then be rebooted.

If any switch fails to be updated, use the View opaswitchadmin result files option to review the result files from the update. Refer to the Intel® Omni-Path Fabric Suite FastFabric Command Line Interface Reference Guide for more details.

Set Up Switch Basic Configuration

(Switch) The Setup Switch Basic Configuration selection will permit the typical switch setup operations to be performed for all switches.

Perform the following procedure:

1. When this procedure is started, the following message will be displayed:

   Do you wish to configure the switch maximum MTU size? [n]:

2. Press ENTER to select default (n).

   This causes the default MTU of 8k to be used for all switches. If the switches have previously been manually configured for a different MTU size, this option will keep the previously configured MTU size. Refer to the Intel® Omni-Path Fabric Host Software User Guide, "Intel® Omni-Path Cluster Setup and Administration", "MTU Size" subsection for detailed information.

   The following message will display:

   Do you wish to configure the switch VL Capability? [n]:

3. Press ENTER to select default (n).

   This causes the default VL Capability of 1 data VL to be used for all switches. If switches have previously been manually configured for a different VL Capability, this option will keep the previously configured VL Capability. See the Intel® Omni-Path Fabric Switches GUI User Guide for more information.

   Note: This operation is only applicable to Intel® Omni-Path Switch 100 Family switches.
The following message will display:

Do you wish to configure the switch VL Credit Distribution Method? [n]:

4. Press ENTER to select default (n).

This causes the default VL Credit Distribution Method setting of 4 to be used for all switches. If switches have previously been manually configured for a different VL Credit Distribution Method setting, those settings will remain unchanged. See the Intel® Omni-Path Fabric Switches GUI User Guide for more information.

Note: This operation is only applicable to Intel® Omni-Path Switch 100 Family switches.

The following message will display:

Do you wish to configure the switch Link Width Options? [n]:

5. Press ENTER to select default (n).

This causes the default switch Link Width Options to be used for all switches. If switches have previously been manually configured for different switch Link Width Options, this option will keep the previously configured switch Link Width Options. See the Intel® Omni-Path Fabric Switches GUI User Guide for more information.

Selecting (y) will prompt for setting the switch link width supported setting for all ports on all switches.

Note: This operation is only applicable to Intel® Omni-Path Switch 100 Family switches.

The following message will display:

Do you wish to configure the switch Link Speed Options? [n]:

6. Press ENTER to select default (n).

This causes the default switch Link Speed Options to be used for all switches. If switches have previously been manually configured for different switch Link Speed Options, this option will keep the previously configured switch Link Speed Options. See the Intel® Omni-Path Fabric Switches GUI User Guide for more information.

Selecting (y) will prompt for setting the switch link speed supported setting for all ports on all switches.

Note: This operation is only applicable to Intel® Omni-Path Switch 100 Family switches.

The following message will display:

Do you wish to configure the switch Node Description as it is set in the switches file? [n]:

7. Press ENTER to select default (n).

This causes the default switch Node Description on each switch to be used. If the switches have previously been manually configured for a customized switch Node Description, this option will keep the previously configured switch Node Descriptions. See the Intel® Omni-Path Fabric Switches GUI User Guide for more information.
Selecting (y) causes the Node Description on each switch to be updated as specified by the switches file.

*Note:* Only node descriptions on Intel® Omni-Path Switch 100 Family switches can be changed in this step.

**Reboot Switch**

*(Switch)* The **Reboot Switch** selection will reboot all switches. This will ensure that all the configuration changes become effective and are discovered by the Intel® Omni-Path Fabric Suite Fabric Manager.

**Report Switch Firmware and Hardware Info**

*(Switch)* The **Report Switch Firmware and Hardware Info** selection will report the firmware and hardware versions for each switch, along with the Capability (QDR, DDR, or SDR), Fan Status, and Power Supply Status. Review the results against the expected models and firmware versions.

*(Switch)* If any Intel® Omni-Path Switch 100 Family switches were purposely skipped, these sections should be repeated for those switches. In this case, Intel recommends that you create a separate file with a name other than switches. The following is an example of the results:

```
Performing Switch Admin: Report Switch firmware & hardware info
Executing: /usr/sbin/opaswitchadmin -L /etc/sysconfig/opa/switches info
Executing report switch info Test Suite (switchinfo) day mmm dd hh:mm:ss timezone yyyy ...
Executing TEST SUITE report switch info CASE (switchinfo.
0x00117500ff513121,Node_Name.i2c.extmgd.switchinfo)
retrieve switch 0x00117500ff513121,Node_Name ...
TEST SUITE report switch info CASE (switchinfo.
0x00117500ff513121,Node_Name.i2c.extmgd.switchinfo)
retrieve switch 0x00117500ff513121,Node_Name
0x00117500ff513121,hdslswb8171:
Fan status:Normal/Normal/Normal/Normal/Normal PS1 Status:N/A PS2 Status:ONLINE
PASSED
TEST SUITE report switch info: 1 Cases; 1 PASSED
TEST SUITE report switch info PASSED
Done report switch info Test Suite day mmm dd hh:mm:ss timezone yyyy
```

**Get Basic Switch configuration**

*(Switch)* The **Get Basic Switch configuration** selection executes the command to get the switch configuration report (switchgetportconfig) for all of the ports. The results show the number of cases, how many of the cases passed, and how many of the cases failed. It also gives an overall summary of configuration and passed or failed, as shown in the following example:

```
Performing Switch Admin: Get basic Switch configuration
Executing: /usr/sbin/opaswitchadmin -L /etc/sysconfig/opa/switches getconfig
Executing report switch getconfig Test Suite (switchgetportconfig) day mmm dd hh:mm:ss timezone yyyy ...
Executing TEST SUITE report switch getconfig CASE (switchgetportconfig.
0x00117500ff513121,hdslswb8171.i2c
/extmgd.switchgetportconfig) retrieve switch 0x00117500ff513121,Node_Name ...
TEST SUITE report switch getconfig CASE (switchgetportconfig.
0x00117500ff513121,Node_Name.i2c
/extmgd.switchgetportconfig) retrieve switch 0x00117500ff513121,Node_Name
Link Width                          :  1,2,3,4
```
Configure Firmware on the Externally Managed Intel® Omni-Path Switches—Intel® Omni-Path Fabric

<table>
<thead>
<tr>
<th>Link Speed</th>
<th>25Gb</th>
</tr>
</thead>
<tbody>
<tr>
<td>FM Enabled</td>
<td>Yes</td>
</tr>
<tr>
<td>Link CRC Mode</td>
<td>14-bit,16-bit,48-bit</td>
</tr>
<tr>
<td>vCU</td>
<td>0</td>
</tr>
<tr>
<td>External Loopback Allowed</td>
<td>Yes</td>
</tr>
<tr>
<td>Node Description</td>
<td>Node_Name</td>
</tr>
</tbody>
</table>

PASSED
TEST SUITE report switch getconfig: 1 Cases; 1 PASSED
TEST SUITE report switch getconfig PASSED
Done report switch getconfig Test Suite day mmm dd hh:mm:ss timezone yyyy

Report Switch VPD Information

(Switch) The Report Switch VPD (vital product data) Information selection executes the report switch hardware VPD Test Suite command (opaswitchadmin) for all of the nodes listed in /etc/sysconfig/opa/switches. The results display the VPD hardware information as shown in the following example:

Performing Switch Admin: Report Switch VPD information
Executing: /usr/sbin/opaswitchadmin -l /etc/sysconfig/opa/switches hwvpd
Executing report switch hwvpd Test Suite (switchhwvpd) day mmm dd hh:mm:ss timezone yyyy ...
Executing TEST SUITE report switch hwvpd CASE (switchhwvpd.
0x00117500ff513121,Node_Name.i2c
.extmgd.switchhwvpd) retrieve switch 0x00117500ff513121,Node_Name ...
TEST SUITE report switch hwvpd CASE (switchhwvpd.0x00117500ff513121,Node_Name.i2c
extmgd.switchhwvpd) retrieve switch 0x00117500ff513121,Node_Name

0x00117500ff513121,hds1swb8171: H/W VPD serial number: USFU13150000D
0x00117500ff513121,hds1swb8171: H/W VPD part number : NNNNNN-NNN
0x00117500ff513121,hds1swb8171: H/W VPD model : 100SWE48QF2
0x00117500ff513121,hds1swb8171: H/W VPD h/w version : 004
0x00117500ff513121,hds1swb8171: H/W VPD manufacturer : Intel Corporation
0x00117500ff513121,hds1swb8171: H/W VPD prod desc : 100 OP Edge 48p Q7
forward 2PSU
0x00117500ff513121,hds1swb8171: H/W VPD mfg id : 001175
0x00117500ff513121,hds1swb8171: H/W VPD mfg date : m-dd-yyyy
0x00117500ff513121,hds1swb8171: H/W VPD mfg time : hh:mm
PASSED
TEST SUITE report switch hwvpd: 1 Cases; 1 PASSED
TEST SUITE report switch hwvpd PASSED
Done report switch hwvpd Test Suite day mmm dd hh:mm:ss timezone yyyy

View opaswitchadmin result files

(Switch) The View opaswitchadmin result files selection starts the editor to view opaswitchadmin result files. The three files that are opened in the editor are /root/punchlist.csv, /root/test.res, and /root/test.log.

When you exit the vi editor, the following question is displayed:

Would you like to remove test.res test.log test_tmp* and save_tmp in /root ? [n]:

After you answer the question it takes you back to the TUI.
7.0 **Install Host Software on the Remaining Hosts Using the FastFabric TUI**

In this procedure the Intel® Omni-Path Fabric Suite FastFabric is used to install and configure the remaining hosts with the Host Software and verify overall operation of the fabric.

*Note:* Intel® Omni-Path Fabric Suite FastFabric is also used to install the Intel® Omni-Path Fabric Stack Tools on the remaining hosts when using other variations of OFED. In this case, OFED must be installed on each host prior to installing the OPA software.

1. **(All)** If the **Intel FastFabric Tools** menu is not displayed, type `opafastfabric` at a command prompt and press `Enter`.
2. **(Linux)** Press 3 to select Host Setup.
   
   Displays the **FastFabric OPA Host Setup Menu**.

<table>
<thead>
<tr>
<th>FastFabric OPA Host Setup Menu</th>
<th>Host File: /etc/sysconfig/opa/hosts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Setup:</td>
<td></td>
</tr>
<tr>
<td>0) Edit Config and Select/Edit Host File</td>
<td>[Skip ]</td>
</tr>
<tr>
<td>1) Verify hosts pingable</td>
<td>[Skip ]</td>
</tr>
<tr>
<td>2) Setup Password-less ssh/scp</td>
<td>[Skip ]</td>
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<td>3) Copy /etc/hosts to all hosts</td>
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<td>[Skip ]</td>
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<td>[Skip ]</td>
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<td>[Skip ]</td>
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<td>Admin:</td>
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<td>9) Refresh ssh Known Hosts</td>
<td>[Skip ]</td>
</tr>
<tr>
<td>a) Rebuild MPI Library and Tools</td>
<td>[Skip ]</td>
</tr>
<tr>
<td>b) Run a command on all hosts</td>
<td>[Skip ]</td>
</tr>
<tr>
<td>c) Copy a file to all hosts</td>
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</tr>
<tr>
<td>Review:</td>
<td></td>
</tr>
<tr>
<td>d) View opahostadmin result files</td>
<td>[Skip ]</td>
</tr>
<tr>
<td>P) Perform the selected actions</td>
<td>N) Select None</td>
</tr>
<tr>
<td>X) Return to Previous Menu (or ESC)</td>
<td></td>
</tr>
</tbody>
</table>

3. **Select items 0 through 2 and 4 through 8.**
4. **Press P.**

   *Note:* If `/etc/hosts` will be used for name resolution (as opposed to using DNS), also select 3) Copy `/etc/hosts` to all hosts

5. **Perform the items selected using the descriptions in the following sections.**

   **Edit Config and Select/Edit Host File**

   **(All)** The **Edit Config and Select/Edit Host File** selection will permit the hosts and FastFabric configuration files to be edited. When placed in the editor for `opafastfabric.conf`, review all the settings. In particular:
• FF_IPOIB_SUFFIX
• FF_IPOIB_NETMASK
• FF_PRODUCT
• FF_PACKAGES
• FF_INSTALL_OPTIONS
• FF_UPGRADE_OPTIONS
• FF_ALL_ANALYSIS


**Note:**
During setup of password-less ssh, FastFabric will provide the opportunity to enter the host root password interactively when needed. Therefore, Intel recommends that you do not place it within the opafastfabric.conf file. If you are required to keep the root password for the hosts in the opafastfabric.conf file, Intel recommends that you change the opafastfabric.conf permissions to be 0x600 (root-only access).

When placed in the editor for hosts, create the file with a list of the hosts names (the TCP/IP management network names), *except the Fabric Management Node from which Intel® Omni-Path Fabric Suite FastFabric is presently being run*. Enter one host’s name per line. For example:

```
host1
host2
```

**Note:**
Do not list the Fabric management node itself (the node where Intel® Omni-Path Fabric Suite FastFabric is currently running).

If additional Fabric Management Nodes are to be used, they may be listed at this time, and Intel® Omni-Path Fabric Suite FastFabric can aid in their initial installation and verification.

For further details about the file format, refer to the Intel® Omni-Path Fabric Suite FastFabric Command Line Interface Reference Guide.

**Verify hosts pingable**

*(All)* The **Verify hosts pingable** selection will ping each selected host over the management network.

The following system prompt will be seen when you perform this selection:

```
Performing Host Setup: Verify hosts pingable
Would you like to verify hosts are ssh-able? [n]:
```

Press ENTER to select the default (n).

If all hosts were found, continue to the next step. If some hosts were not found, exit the menu and review the following for those hosts that were not found:

- Host powered on and booted?
- Host connected to management network?
• Host management network IP address and network settings consistent with DNS or /etc/hosts?
• Management node connected to the management network?
• Management node IP address and network settings correct?
• Management network itself up (switches, routers, etc)?
• Correct set of hosts listed in the hosts file (the previous step may be repeated to review and edit the file as needed)?

Setup Password-less ssh/scp

(Linux) The Setup Password-less ssh/scp selection will set up secure password-less ssh (root password) such that the Fabric Management Node can securely log in to all the other hosts as root through the management network without requiring a password.

The following system prompt will be seen when you perform this selection:

```
Performing Host Setup: Setup password-less ssh/scp
Executing: /usr/sbin/opasetupssh -S -p -i '' -f /etc/sysconfig/opa/hosts
Password for root on all hosts:
```

Type the password for root on all host and press ENTER

Password-less ssh is required by Intel® Omni-Path Fabric Suite FastFabric, MPI test applications, and most versions of MPI (including OpenMPI and MVAPICH2).

Copy /etc/hosts to all hosts

(Linux) The Copy /etc/hosts to all hosts selection will copy the /etc/hosts file on this host to all the other selected hosts.

Note: If DNS is being used, skip this step.

Note: Typically, /etc/resolv.conf is set up as part of OS installation for each host. However, if /etc/resolv.conf was not set up on all the hosts during OS installation, the FastFabric Copy a file to all hosts operation could be used at this time to copy /etc/resolv.conf from the Fabric Management Node to all the other nodes.

Show uname -a for all hosts

(Linux) The Show uname -a for all hosts selection will show the OS version on all the hosts. Review the results carefully to verify all the hosts have the expected OS version. In typical clusters, all hosts will be running the same OS and kernel version.

If any hosts are identified with an incorrect OS version, the OS on those hosts should be corrected at this time and operation of this sequence should be aborted when prompted. As necessary, all the preceding setup steps should then be repeated for those hosts (there is no harm in repeating them for all the hosts).
Install/Upgrade Intel OPA Software

(Host) The Install/Upgrade Intel OPA Software selection will install the Intel® Omni-Path Fabric Host Software on all the hosts. By default, it will look in the current directory for the IntelOPA-Basic.DISTRO.VERSION.tgz file. If the tarball is not found in the current directory, the installer application will prompt for input of a directory name where this file can be found.

Note: An initial installation will uninstall any existing OFED Delta or IFS software. Initial installs must be performed when installing on a clean system or on a system which has stock OFED installed. To upgrade the fabric, refer to Upgrade the Fabric Software on page 96.

Perform the following steps to install the selected hosts:

1. The Install/Upgrade Intel Software selection will start with the following system prompts:

   Performing Host Setup: Install/Upgrade Intel OPA Software
   Do you want to use ./IntelOPA-Basic.DISTRO.VERSION.tgz? [y]:

2. Press ENTER to accept the default (y).
   System prompts:
   Would you like to do an upgrade/reinstall? [y]:

3. Type n and press ENTER.
   System prompts:
   Would you like to do an initial installation? [n]:

4. Type y and press ENTER to proceed.
   System prompts:
   You have selected to perform an initial installation
   This will uninstall any existing Intel OPA software on the selected nodes
   Are you sure you want to proceed? [n]:

5. Type y and press ENTER to proceed.
   System prompts:
   Executing: /sbin/opahostadmin -f /etc/sysconfig/opa/hosts -d .. load
   .
   .
   Hit any key to continue (or ESC to abort)...

6. Press any key to proceed.
   Once the installation is complete on the selected hosts the FastFabric OPA Host Setup Menu appears.
   The installation is complete.
Note: If any hosts fail to be installed, for example:

```
TEST SUITE load: 1 Cases; 0 PASSED; 1 FAILED
TEST SUITE load FAILED
```

Use the View opahostadmin result files option to review the result files from the update. For more details, refer to the Intel® Omni-Path Fabric Suite FastFabric Command Line Interface Reference Guide.

**Configure IPoIB IP Address**

*(Host)* The Configure IPoIB IP Address selection will create the ifcfg-ib0 files on each host (previous non-OFED releases created the ifcfg-ib1 file). The file will be created with a statically assigned IPv4 address. The IPoIB IP address for each host will be determined by the resolver (Linux* host command). If not found through the resolver, /etc/hosts on the given host will be checked.

**Build Test Apps and Copy to Hosts**

*(Host)* The Build Test Apps and Copy to Hosts selection will build the MPI and/or SHMEM sample applications on the Fabric Management Node and copy the resulting object files to all the hosts. This is in preparation for execution of MPI and/or SHMEM performance tests and benchmarks in a later step.

Note: This option is only available when using the Intel® Omni-Path Fabric Host Software packaging (OFED Delta).

**Reboot Hosts**

*(Linux)* The Reboot Hosts selection will reboot all the selected hosts and ensure they fully reboot, (as verified through ping over the management network). When the hosts come back up, they will be running the newly installed Fabric software.

**Refresh ssh Known Hosts**

*(Linux)* The Refresh ssh Known Hosts will run the opasetupssh -U "" command to refresh the ssh known hosts list on this server for the Management Network. This may be used to update security for this host if hosts are replaced, reinstalled, renamed, or repaired.

**Rebuild MPI Library and Tools**

*(Host)* The Rebuild MPI Library and Tools will rebuild the MPI Library and related tools (such as mpirun), and install the resulting rpms on all the hosts. This will be performed using the do_build tool supplied with the MPI Source. When rebuilding MPI, do_build will prompt you for selection of which MPI (openmpi or mvapich2) to rebuild, and will provide choices as to which available compiler to use. Refer to (Intel® Omni-Path Host Fabric Interface Installation Guide) and Intel® Omni-Path Fabric Host Software User Guide for more information.

Note: This option is only available when using with the Intel® Omni-Path Fabric Host Software (OFED Delta).
Run a command on all hosts

(Linux) If there are any other setup operations that need to be performed on all hosts, they may be performed using the Run a command on all hosts option. Each time this is executed, a Linux* shell command (or sequence of commands separated by semicolons) may be specified to be executed against all selected hosts.

Note: Intel recommends that you run the date command on all hosts to verify that the date and time are consistent on all hosts. If needed, the Copy a file to all hosts option may be used to copy the appropriate files to all hosts in order to enable and configure NTP.

Copy a file to all hosts

(Linux) The Copy a file to all hosts selection will run the opascpall command. A file on the local host may be specified to be copied to all selected hosts.

View opahostadmin result files

(All) The View opahostadmin result file permits viewing of the test.log and test.res files that reflect the results from opahostadmin runs (such as for installing Fabric software or rebooting all hosts per Reboot Hosts selection described previously). You are also given the option to remove these files after viewing them. If not removed, subsequent runs of opachassisadmin, opahostadmin, or opaswitchadmin from within the current directory will continue to append to these files.
8.0 Install Host Software on the Remaining Hosts using CLI Commands

This procedure provides step-by-step information to install the Intel® Omni-Path Fabric Host Software on the remaining servers.

1. (Optional) Edit or review the `/etc/sysconfig/opa/opafastfabric.conf` file.
   Review the complete file. In particular review the following:
   - FF_IPOIB_SUFFIX
   - FF_IPOIB_NETMASK
   - FF_PRODUCT
   - FF_PACKAGES
   - FF_INSTALL_OPTIONS
   - FF_UPGRADE_OPTIONS
   - FF_ALL_ANALYSIS


   **Note:** During setup of password-less ssh, FastFabric will provide the opportunity to enter the host root password interactively when needed. Therefore, Intel recommends that you do not place it within the opafastfabric.conf file.

   If you are required to keep the root password for the hosts in the opafastfabric.conf file, Intel recommends that you change the opafastfabric.conf permissions to be 0x600 (root-only access).

2. (Optional) Create, Edit, or review the `/etc/sysconfig/opa/hosts` file.

   When placed in the editor for hosts, create the file with a list of the hosts names (the TCP/IP management network names), *except the Fabric Management Node* from which Intel® Omni-Path Fabric Suite FastFabric is presently being run. Enter one host's name per line. For example:

   ```
   host1
   host2
   ```

   **Note:** Do not list the Fabric management node itself (the node where Intel® Omni-Path Fabric Suite FastFabric is currently running).

   If additional Fabric Management Nodes are to be used, they may be listed at this time, and Intel® Omni-Path Fabric Suite FastFabric can aid in their initial installation and verification.

   For further details about the file format, refer to the Intel® Omni-Path Fabric Suite FastFabric Command Line Interface Reference Guide.

3. Verify the hosts is pingable over the management network.
opapingall -p
If all hosts were found, continue to the next step. If some hosts were not found, exit the menu and review the following for those hosts that were not found:

- Host powered on and booted?
- Host connected to management network?
- Host management network IP address and network settings consistent with DNS or /etc/hosts?
- Management node connected to the management network?
- Management node IP address and network settings correct?
- Management network itself up (switches, routers, etc)?
- Correct set of hosts listed in the hosts file (the previous step may be repeated to review and edit the file as needed)?

4. Set up secure password-less ssh, such that the Fabric Management Node can securely log into all the hosts as root through the management network, without requiring a password.

```
opasetupsssh -S -p -iipoib_suffix -f hostfile
```

5. (Optional) Copy the /etc/hosts file on this host to all the other selected hosts.

```
opascpall -p -f hostfile /etc/hosts /etc/hosts
```

*Note:* If DNS is being used, skip this step.

6. (Optional) Copy the /etc/resolv.conf file on this host to all the other selected hosts.

```
opascpall -p -f hostfile /etc/resolv.conf /etc/resolv.conf
```

7. Show the OS version on all the hosts.

```
opacmdall -T 60 -f hostfile 'uname -a'
```

8. Install the Intel® Omni-Path Fabric Host Software on all the hosts.

```
opahostadmin -f hostfile -d dir load
```

By default, it will look in the current directory for the IntelOPA-Basic.DISTRO.VERSION.tgz file.

*Note:* An initial installation will uninstall any existing OFED Delta or IFS software. Initial installs must be performed when installing on a clean system or on a system which has stock OFED installed. For additional details, refer to Upgrade the Fabric Software on page 96.

*Note:* If any hosts fail to be installed, for example:

```
TEST SUITE load: 1 Cases; 0 PASSED; 1 FAILED
TEST SUITE load FAILED
```

Use the View opahostadmin result files option to review the result files from the update. For more details, refer to the *Intel® Omni-Path Fabric Suite FastFabric Command Line Interface Reference Guide*.

9. Create the ifcfg-ib0 files on each host (previous non-OFED releases created the ifcfg-ib1 file).

```
opahostadmin -f hostfile configipoib
```
The file will be created with a statically assigned IPv4 address. The IPoIB IP address for each host will be determined by the resolver (Linux\* host command). If not found through the resolver, /etc/hosts on the given host will be checked.

10. Build the MPI and/or SHMEM sample applications on the Fabric Management Node and copy the resulting object files to all the hosts.

\texttt{opascpall -t -p -f hostfile source\_dir dest\_dir}

\textit{Note:} This is in preparation for execution of MPI and/or SHMEM performance tests and benchmarks in a later step.

\textit{Note:} This option is only available when using the Intel® Omni-Path Fabric Host Software packaging of OFED (OFED Delta).

11. Reboot all the selected hosts and ensure they fully reboot, (as verified through ping over the management network).

\texttt{opahostadmin -f hostfile reboot}

When the hosts come back up, they will be running the newly installed Fabric software.
9.0 Verify Intel® Omni-Path Fabric Host Software on the Remaining Servers

Upon completion of the preceding sections, the hosts are all booted, installed and operational. The subsequent steps will verify the operation of the hosts and fabric.

1. **(All)** If the FastFabric OPA Host Verification/Admin Menu is not displayed, type `opafastfabric` and press Enter.

2. **(All)** Press 4.
   - Displays the FastFabric OPA Host Verification/Admin Menu.

   **FastFabric OPA Host Verification/Admin Menu**
   - Host File: `/etc/sysconfig/opa/allhosts`
   - Validation:
     - 0) Edit Config and Select/Edit Host File [ Skip ]
     - 1) Summary of Fabric Components [ Skip ]
     - 2) Verify hosts pingable, sshable and active [ Skip ]
     - 3) Perform Single Host verification [ Skip ]
     - 4) Verify OPA Fabric status and topology [ Skip ]
     - 5) Verify Hosts see each other [ Skip ]
     - 6) Verify Hosts ping via IPoIB [ Skip ]
     - 7) Refresh ssh Known Hosts [ Skip ]
     - 8) Check MPI Performance [ Skip ]
     - 9) Check Overall Fabric Health [ Skip ]
     - a) Start or Stop Bit Error Rate Cable Test [ Skip ]
     - Admin:
       - b) Generate all Hosts Problem Report Info [ Skip ]
       - c) Run a command on all hosts [ Skip ]
     - Review:
       - d) View opahostadmin result files [ Skip ]
     - P) Perform the selected actions N) Select None
     - X) Return to Previous Menu (or ESC)

3. Select the items 0 through 8 in the Validation section of the menu.

4. Press P.

**Edit Config and Select/Edit Host File**

**(All)** The Edit Config and Select/Edit Host File section will permit the hosts, ports, and FastFabric configuration files to be edited. When placed in the editor for `opafastfabric.conf`, review all the settings. Especially review the settings for the following:

- FF_TOPOLOGY_FILE
- FF_IPOIB_SUFFIX

Refer to Intel® Omni-Path Fabric Suite FastFabric User Guide Configuration Files section for more information about `opafastfabric.conf`. 
If required, a FastFabric topology file may be created as /etc/sysconfig/opa/topology.0:0.xml to describe the intended topology of the fabric. The file can also augment assorted fabric reports with customer-specific information, such as cable labels and additional details about nodes, SMs, links, ports, and cables. Refer to the Intel® Omni-Path Fabric Suite FastFabric Command Line Interface Reference Guide for more information about topology verification files.

Review the following parameters which will be used for overall fabric health checks:

- FF_ANALYSIS_DIR
- FF_ALL_ANALYSIS
- FF_FABRIC_HEALTH
- FF_CHASSIS_CMDS
- FF_CHASSIS_HEALTH
- FF_ESM_CMDS

FF_ALL_ANALYSIS should be updated to reflect the type of SM (esm or hostsm).

When placed in the editor for ports, review the file. For typical single-subnet clusters, the default of 0:0 may be used. This will use the first active port on the Fabric Management node to access the fabric. For more information on configuring a cluster with multiple subnets, see Multi-Subnet Fabrics on page 101. For further details about the file format, refer to the "Selection of Ports" section in the Intel® Omni-Path Fabric Suite FastFabric Command Line Interface Reference Guide.

When placed in the editor for allhosts, create the file with the Fabric Management node's hosts names (the TCP/IP management network names) (shown as mgmthost for example) and include the hosts file previously created. Enter one per line. For example:

```
mgmthost
include /etc/sysconfig/opa/hosts
```

For further details about the file format, refer to the "Selection of Hosts" section in the Intel® Omni-Path Fabric Suite FastFabric Command Line Interface Reference Guide.

**Summary of Fabric Components**

(All) The Summary of Fabric Components selection will provide a brief summary of the counts of components in the fabric, including how many switch chips, hosts, and links are in the fabric. It will also indicate if any 1x links were found (which could indicate a poorly seated or bad cable). Review the results against the expected configuration of the cluster.

If components are missing or 1x links are found, they should be corrected. Subsequent steps will aid in locating any 1x links.

**Verify hosts pingable, sshable, and active**

(All) The Verify hosts pingable, sshable, and active selection will verify each host and provide a concise summary of the bad hosts found. Interactive prompts allow you to select ping, ssh, and port active verification. After completion of this test, you will have the option of using the resulting good hosts file for the remainder of the operations within this TUI session.
Perform Single Host verification

(All) The Perform Single Host verification uses the opaverifyhosts command to perform a single host test on all hosts. Refer to the Intel® Omni-Path Fabric Suite FastFabric Command Line Interface Reference Guide for information on opaverifyhosts.

Verify OPA Fabric status and topology

(All) The Verify OPA Fabric status and topology selection can run the following checks:
- Perform a fabric error analysis
- Clear error counters after generating the report
- Perform a fabric link speed error analysis
- Check for links that are configured to run slower than supported
- Check links that are connected with mismatched speed potential
- Verify the fabric topology
- Verify all aspects of the topology including links, nodes, and sms
- Include unexpected devices in the punch-list

Verify Hosts see each other

(Host) The Verify Hosts see each other selection will verify that each host can see all the others through queries to the Subnet Administrator.

Verify Hosts ping via IPoIB

(Host) The Verify Hosts ping via IPoIB selection will verify that IPoIB is properly configured and running on all the hosts. This is accomplished through the Fabric management node pinging each host through IPoIB.

Note: This operation requires that IPoIB is enabled on the Fabric Management Node as well as each host selected for verification.

1. The management host needs to have IPoIB configured.
2. Depending on the MTU of the fabric, this may not be successful.

Refresh ssh Known Hosts

(Linux) The Refresh ssh Known Hosts selection will refresh the ssh known_hosts file on the Fabric management node to include the IPoIB hostnames of all the hosts.

Note: This operation requires that IPoIB is enabled on the Fabric Management Node as well as each host selected for verification.

Check MPI Performance

(Host) The MPI Performance selection will do a quick check of PCIe and MPI performance through end-to-end latency and bandwidth tests.
1. When MPI Performance is selected, the following prompt is displayed:

   Test Latency and Bandwidth deviation between all hosts? [y]:

2. Press Enter to select default (y).

   The following prompt is displayed:

   View Load on hosts prior to test? [y]:

3. Press Enter to select default (y).

   This displays the results of pair-wise analysis of latency and bandwidth for the selected hosts and reports pairs outside an acceptable tolerance range. By default, performance is compared relative to other hosts in the fabric (with the assumption that all hosts selected for a given run should have comparable fabric performance). Failing hosts will be clearly indicated.

   The results are also written to the test.res file, which may be viewed through the View opahostadmin result files option. Refer to the Intel® Omni-Path Fabric Suite FastFabric Command Line Interface Reference Guide for more details.

   If any hosts fail, carefully examine the failing hosts to verify the HFI models, PCIe slot used, BIOS settings, and any motherboard jumpers related to devices on PCIe buses or slot speeds. Also verify the HFI and riser cards are properly seated.

Check Overall Fabric Health

(ALL) The Check Overall Fabric Health selection will permit the present fabric configuration to be base-lined for use in future fabric health checks. This should be performed after configuring any additional Fabric Management Nodes. Refer to Configure and Initialize Health Check Tools on page 74 for more information.

Start or Stop Bit Error Rate Cable Test

(ALL) The Start or Stop Bit Error Rate Cable Test selection performs host and/or ISL cable testing. The test allows for starting and stopping an extended Bit Error Rate test. Intel recommends that this test be run for seven hours for a thorough test.

Generate all Hosts Problem Report Info

(Host) The Generate all Hosts Problem Report Info will run the captureall command to collect configuration and status information from all hosts and generate a single *.tgz file which can be sent to the Support Representative.

Based on the answer to the following prompt, various levels of detail about the fabric can be included in the capture.

   Capture detail level (1-Normal, 2-Fabric, 3-Fabric+FDB, 4-Analysis):

The Detail levels are:

- **1-Normal** – Obtains local information from each host
- **2-Fabric** – In addition to “Normal”, also obtains basic fabric information by queries to the SM and fabric error analysis using iba_report.
• 3-Fabric+FDB – In addition to “Fabric”, also obtains all the switch forwarding tables and OPA multicast membership lists from the SM.

• 4-Analysis – In addition to “Fabric+FDB”, also obtains all_analysis results. If all_analysis has not yet been run, it is run as part of the capture.

*Note:* Detail levels 2-4 can be used when fabric operational problems occur. If the problem is most likely node specific, detail level 1 should be sufficient. Detail levels 2-4 require an operational Fabric Manager. Typically your support representative will request a given detail level. If a given detail level takes excessively long or fails to be gathered, try a lower detail level.

For detail levels 2-4, the additional information is only gathered on the node running the captureall command. The information is gathered for every fabric specified in the /etc/sysconfig/opa/ports file.

**Run a command on all hosts**

(*Linux*) The **Run a command on all hosts** will run the cmdall command. A Linux* shell command (or sequence of commands separated by semicolons) may be specified to be executed against all selected hosts.

**View opahostadmin result files**

(*All*) The **View opahostadmin result files** permits viewing of the test.log and test.res files, which reflect the results from opahostadmin runs (such as those for installing fabric software or rebooting all hosts). You are also given the option to remove these files after viewing them.

If not removed, subsequent runs of opachassisadmin, opahostadmin, or opaswitchadmin from within the current directory will continue to append to these files.
10.0 Verify Intel® Omni-Path Fabric Host Software is installed on the Remaining Servers using CLI Commands

**Prerequisites:** Installation of the Intel® Omni-Path Fabric Host Software has been completed on the remaining servers.

This procedure provides step-by-step information to verify that Intel® Omni-Path Fabric Host Software is installed and running on the remaining servers using CLI Commands.

1. (Optional) Edit or review the `/etc/sysconfig/opa/opafastfabric.conf` file.
   Review all of the settings. In particular review the following:
   - `FF_TOPOLOGY_FILE`
   - `FF_IPOIB_SUFFIX`
   - `ff_host_basename_to_ipoib`
   - `ff_host_basename`

2. (Optional) Edit, or review the `/etc/sysconfig/opa/ports` file.
   When placed in the editor for ports, review the file. For typical single-subnet clusters, the default of 0:0 may be used. This will use the first active port on the Fabric Management node to access the fabric. Enter one host's name per line. For further details about the file format, refer to the "Selection of Ports" section in the Intel® Omni-Path Fabric Suite FastFabric Command Line Interface Reference Guide.

3. (Optional) Edit, or review the `/etc/sysconfig/opa/allhosts` file.
   When placed in the editor for allhosts, review the file, it should include the Fabric Management node's hosts names (the TCP/IP management network names) (shown as mgmthost for example) and include the hosts file previously created. Enter one per line. For example:

   ```
   mgmthost
   include /etc/sysconfig/opa/hosts
   ```

   For further details about the file format, refer to the Selection of Hosts section in the Intel® Omni-Path Fabric Suite FastFabric Command Line Interface Reference Guide.

4. Provide a brief summary of the counts of components in the fabric, including how many switch chips, hosts, and links are in the fabric.
   `fabric_info`
It will also indicate if any 1x links were found (which could indicate a poorly seated or bad cable). Review the results against the expected configuration of the cluster. If components are missing or 1x links are found, they should be corrected. Subsequent steps will aid in locating any 1x links.

5. Verify each host is pingable.
   
   \texttt{opapingall -p -f hostfile}
   
   If all hosts were found, continue to the next step. If some hosts were not found, exit the menu and review the following for those hosts that were not found:
   
   - Host powered on and booted?
   - Host connected to management network?
   - Host management network IP address and network settings consistent with DNS or /etc/hosts?
   - Management node connected to the management network?
   - Management node IP address and network settings correct?
   - Management network itself up (switches, routers, etc)?
   - Correct set of hosts listed in the hosts file (the previous step may be repeated to review and edit the file as needed)?

6. Verify each host is pingable, ssh'able and active on the Intel® Omni-Path Fabric and produce a list of good hosts meeting all criteria.

   \texttt{opafindgood -R -A -Q -f hostfile}

   The following files are created in \texttt{opasorthosts} order with all duplicates removed in the \texttt{OPA_CONFIG_DIR/} directory:
   
   - good
   - alive
   - running
   - active
   - bad

   The resulting \texttt{good} file can then be used as input to create mpi_hosts files for use running mpi_apps and the HFI-SW cable test.

7. Perform a single host test on all hosts.

   \texttt{opaverifyhosts -k -c -u hostverify.res -T timelimit -f hostfile test}


   The results can be seen in the \texttt{$FF_RESULT_DIR/verifyhosts.res} file. A punch list of failures is also appended to the \texttt{$FF_RESULT_DIR/punchlist.csv} file.

8. Verify OPA Fabric status and topology.

   \texttt{opalinkanalysis -U -x snapshot_suffix all verifyall > $FF_RESULT_DIR/linkanalysis.res 2>&1}

   To clear error counters after generating the report add \texttt{clearerrors} and \texttt{clearhwerrors} options to the opalinkanalysis run.
The following items are verified:

- Perform a fabric error analysis
- Perform a fabric link speed error analysis
- Check for links that are configured to run slower than supported
- Check links that are connected with mismatched speed potential
- Verify the fabric topology
- Verify all aspects of the topology including links, nodes, and sms
- Include unexpected devices in the punch-list


The results can be seen in the `$FF_RESULT_DIR/linkanalysis.res` file. A punch list of issues is appended to the `$FF_RESULT_DIR/punchlist.csv` file.

9. Verify that each host can see all the others through queries to the Subnet Administrator.

   ```
   opahostadmin -f hostfile sacache
   ```

10. Verify that IPoIB is properly configured and running on all the hosts.

    ```
    opahostadmin -f hostfile ipoibping
    ```

    If this is unsuccessful, verify that
    - The management host has IPoIB configured.
    - The MTU of the fabric must be correct.

11. Refresh the `ssh known hosts` file on the Fabric Management Node to include the IPoIB hostnames of all the hosts.

    ```
    opasetupssh -p -U -f hostfile
    ```

12. Perform a quick check of PCIe and MPI performance through end-to-end latency and bandwidth tests.

    ```
    opahostadmin -f hostfile mpiperfdeviation
    ```

    This displays the results of pair-wise analysis of latency and bandwidth for the selected hosts and reports pairs outside an acceptable tolerance range. By default, performance is compared relative to other hosts in the fabric (with the assumption that all hosts selected for a given run should have comparable fabric performance). Failing hosts will be clearly indicated.

    The results can be seen in the `test.res` file.


    If any hosts fail, carefully examine the failing hosts to verify the HFI models, PCIe slot used, BIOS settings, and any motherboard jumpers related to devices on PCIe buses or slot speeds. Also verify the HFI and riser cards are properly seated.


    ```
    opaallanalysis -b
    ```

    This should be performed after configuring any additional Fabric Management Nodes. Refer to *Configure and Initialize Health Check Tools* on page 74 for more information.
14. Perform host and/or ISL cable testing.

        opacabletest stop -C -A -n numprocs -f hostfile start

The test allows for starting and stopping an extended Bit Error Rate test. Intel recommends that this test be run for seven hours for a thorough test.
11.0 Installation of Additional Fabric Management Nodes

If the fabric has more than one Fabric Management Node, use the procedures in this section to set up additional management nodes. Previous sections in this installation guide described how to perform basic software installation, setup and verification on the nodes in a fabric. This section describes how to install and configure the management software itself.

Note: The following steps assume a symmetrical configuration where all Fabric management nodes have the same connectivity and capabilities. In asymmetrical configurations where the Fabric management nodes are not all connected to the same set of management networks and subnets, the files copied to each management node may need to be slightly different. For example, configuration files for fabric analysis may indicate different port numbers, or host files used for FastFabric, and MPI may need to list different hosts. For multiple-subnet configurations, refer to Multi-Subnet Fabrics on page 101.

Repeat the following steps on each additional Fabric Management Node:

1. (All) Upgrade the software to add additional components using the procedure documented in Upgrade from IntelOPA-Basic to IntelOPA-IFS on page 99. The Fabric Management node must have at least Intel® Omni-Path Fabric Suite FastFabric, the Intel® Omni-Path Fabric Stack, and should have IPoIB installed and configured. For MPI clusters, the Fabric Management node should also include at least OFED openmpi or OFED mvapich2. If you plan to rebuild MPI, the Intel® Omni-Path Fabric Host Software Fabric Development package and MPI Source packages will also be required.

   Note: Do not uninstall or replace existing configuration files that were previously created, especially IPoIB-related configuration files.

2. (All) Copy the FastFabric configuration files from the initial Fabric Management Node. At a minimum, the following files should be copied:

   ```
   /etc/sysconfig/opa/opafastfabric.conf
   /etc/sysconfig/opa/ports
   /etc/sysconfig/opa/topology*.xml
   /etc/sysconfig/opa/hosts
   /etc/sysconfig/opa/allhosts
   /etc/sysconfig/opa/switches
   /etc/sysconfig/opa/chassis
   ```

   After copying the files, edit the hosts and allhosts files such that the file on each Fabric Management node omits itself from the hosts files (but lists all other Fabric Management nodes) and specifies itself in the allhosts file.

3. **(All)** Copy the Fabric Manager configuration file (/etc/sysconfig/opafm.xml) from the initial Fabric Management Node, if the Fabric Manager is also going to be run. After copying the file, edit the file on each Fabric Management node as needed.

Refer to the *Intel® Omni-Path Fabric Suite Fabric Manager User Guide* for more information on how to configure the Fabric Manager.

4. **(Linux)** Perform the **Setup Password-less ssh/scp** option in the **Host Setup via FastFabric** menu.

5. Perform the **Refresh ssh Known Hosts** option in the **Host Admin via FastFabric** menu.
12.0 Configure and Initialize Health Check Tools

For more information on the health check tools, see the detailed discussion in *Intel® Omni-Path Fabric Suite FastFabric Command Line Interface Reference Guide*. The health check tools may be run on one or more Fabric management nodes within the cluster. This procedure should be followed on each Fabric management node from which the health check tools will be used.

1. **(All)** Edit `opafastfabric.conf` and review the following parameters:
   - `FF_ANALYSIS_DIR`
   - `FF_ALL_ANALYSIS`
   - `FF_FABRIC_HEALTH`
   - `FF_CHASSIS_CMDS`
   - `FF_CHASSIS_HEALTH`
   - `FF_ESM_CMDS`

   `FF_ALL_ANALYSIS` should be updated to reflect the type of SM (esm or hsm).

   **Note:** If you are running in a back-to-back configuration, `FF_ALL_ANALYSIS` should not contain `chassis`.

2. **(All)** Create `/etc/sysconfig/opa/esm_chassis`, listing the chassis that are running SMs if using Embedded SM(s) in the Intel® Omni-Path Fabric Chassis. Create the file with a list of the chassis names using the assigned TCP/IP Ethernet management port names. IP addresses can also be used; however, Intel recommends that you use names instead. For example:

   ```
   Chassis1
   Chassis2
   ```

   For further details about the file format, refer to the *Intel® Omni-Path Fabric Suite FastFabric Command Line Interface Reference Guide*.

3. **(All)** Perform a health check using `opaallanalysis -e`. If any errors are encountered, resolve the errors and rerun `opaallanalysis -e` until a clean run occurs.

4. **(All)** Create a cluster configuration baseline using: `opaallanalysis -b`.

   **Note:** This may also be done using the FastFabric TUI menu by selecting **Check Overall Fabric Health** and press `y` to **Baseline present configuration? [n]:** question.

5. **(All)** If required, schedule regular runs of `opaallanalysis` through cron or other mechanisms. Refer to the Linux* OS documentation for more information on cron. Also refer to the *Intel® Omni-Path Fabric Suite FastFabric Command Line Interface Reference Guide* for more information about `opaallanalysis` and its automated use.
13.0 Running High Performance Linpack

A set of common MPI benchmarks are installed as part of the installation process. One of the more popular measures of overall performance is High Performance Linpack (HPL). This is the application used to rate systems on the Top 500 list. The following steps enable you to make initial runs of HPL and gather preliminary baseline numbers. The defaults provided should perform within 10 – 20% of optimal HPL results for the cluster. Tuning for that additional 10 – 20% is beyond the scope of this document.

1. **(Host)** To run HPL, first select a configuration file appropriate to your cluster. It is best to start with a small configuration to verify HPL has been properly compiled:

   ```
   cd /opt/opa/src/mpi_apps
   ./config_hpl 2t
   ```

   This command will configure a two process test run of HPL.

2. **(Host)** Create the file `/opt/opa/src/mpi_apps/mpi_hosts` listing the host names of all the hosts.

   *Note:* Use `mpi_hosts.sample` as a starting point for creating the `mpi_hosts` file.

3. **(Host)** Run HPL:

   ```
   ./run_hpl 2
   ```

   This initial run is a very small problem size to determine if the run will be successful. Performance of this run is expected to be low.

If the initial run was successful, you are ready to move onto full scale HPL runs.

Assorted sample HPL.dat files are provided in the `/opt/opa/src/mpi_apps/hpl-config` folder. These files are a good starting point for most clusters and should get within 10 – 20% of the optimal performance for the cluster. The problem sizes used assume a cluster with 1GB of physical memory per processor (e.g., for a 2 processor node, 2GB of node memory is assumed). For each cluster size, 4 files are provided:

- **t** – A very small test run (5000 problem size)
- **s** – A small problem size on the low end of optimal problem sizes
- **m** – A medium problem size
- **l** – A large problem size

The sample files can be selected using `config_hpl`. The following command displays the pre-configured problem sizes available:

```
./config_hpl
```

For example, to do a small run for a 256 processor cluster (i.e., 128 nodes of dual CPU systems):
1. Type `./config_hpl 256s` and press Enter.
2. Type `./run_hpl 256` and press Enter.

During these runs you should use the `top` command on a node to monitor memory and CPU usage. The xhpl should use 98 – 99% of the CPU. If any other processes are taking more than 1 – 2%, review the host configuration and stop these extra processes if possible. HPL is very sensitive to swapping. If a lot of swapping is seen, and xhpl is dropping below 97% for long durations, this may indicate a problem size that is too large for the memory and OS configuration.

You can continue to tune HPL to refine performance. Parameters in `HPL.dat` can all affect HPL performance. In addition, the selection of compiler and BLAS Math library may also significantly affect performance. The new `HPL.dat` files may be placed in `/opt/opa/src/mpi_apps/hpl-config`. Use `config_hpl` to select them and copy them to all nodes in the run. Alternately, `scpall` may be used to copy the file to all nodes. Refer to `Intel® Omni-Path Fabric Suite FastFabric Command Line Interface Reference Guide` for more information on `scpall`. 

14.0 Install Intel® Omni-Path Fabric Suite Fabric Manager GUI

This section provides the procedures to install the Fabric Manager GUI on both Windows* and Linux* platforms. Refer to the following sections:

- Windows* Installation
- Linux* Installation on page 81

14.1 Windows* Installation

14.1.1 System Requirements for a Windows* Environment

The minimum system requirements are as follows:

- Windows* operating system
  - Windows Vista* Service Pack 2 or higher
  - Windows* 7 Service Pack 1 or higher
  - Windows* 8.x
  - Windows Server* 2008 Service Pack 2 or higher
  - Windows Server* 2012
- x86 or x64 processor architecture
- Oracle* Java Runtime Environment (JRE) 1.7 or higher
- Ethernet card/local network access
- 2GB or greater of RAM
- 1280x800 resolution (65K color depth)

14.1.2 Download the Intel® Omni-Path Fabric Suite Fabric Manager GUI

2. Click the Download Center link.
3. In the search downloads box enter Fabric Manager GUI.

OR

- In the Find By Category section:
  - Select Network Connectivity.
  - Select Intel® Omni-Path Architecture.
  - Select Intel® Omni-Path Fabric Suite Fabric Manager.
14.1.3 Use the Installation Wizard to Install the Fabric Manager GUI

1. Double-click the IntelOPA-FMGUI-windows-\_\_x\_\_x\_\_x.exe file on the desktop, where \_\_x\_\_x\_\_x is the version number of the Fabric Manager GUI application being installed.

2. At the User Account Control prompt: Do you want to allow the following program to make changes to this computer? Click Yes.

3. Select the language to be used for the installation screens and then click OK.

- If this is a first-time installation, the Intel® Omni-Path Fabric Manager GUI Setup window opens and you see the following:
• If the Fabric Manager GUI is already installed on your system, the installer prompts you with the following dialog:

Select Yes to continue with the installation; the Fabric Manager GUI uninstaller will be invoked and then the installation procedure continues with the following screen:

Select Yes to uninstall the current Fabric Manager GUI. See Windows* Procedure on page 82 for instructions. After the uninstall is finished, the following screen appears:
4. Click **Next**.

The **License Agreement** window appears.
5. Accept the License Agreement by checking the I accept the terms of the License Agreement checkbox and then click Next.
   The Choose Install Location window appears.
   Note: Intel recommends that you use the default file location.

6. Click Install.
   The Installing window appears briefly.
   When the installation is complete, the Completing Fabric Manager GUI Setup window appears.

7. Click Finish.
   The Fabric Manager GUI is installed.

14.2 Linux* Installation

14.2.1 System Requirements for a Linux* Environment

The minimum system requirements for the Linux* installation are as follows:
- Linux* operating system
  - Red Hat* Enterprise Linux* 5.5 or higher
  - SUSE* Linux* Enterprise Server 10 or higher
- x86 or x64 processor architecture
- Oracle* Java* Runtime Environment (JRE) 1.7 or higher
- X Window System
- Ethernet card/local network access
- 2GB or greater of RAM
- 1280x800 resolution (65K color depth)

14.2.2 Download the Intel® Omni-Path Fabric Suite Fabric Manager GUI

2. Click the Download Center link.
3. In the search downloads box enter Fabric Manager GUI.

   OR

   In the Find By Category section:
   a. Select Network Connectivity.
   b. Select Intel® Omni-Path Architecture.
   c. Select Intel® Omni-Path Fabric Suite Fabric Manager.

14.2.3 Use RPM to Install the Fabric Manager GUI

1. Log in to the server where the Fabric Manager GUI will be installed, using a user with root access.
2. Open a Terminal window in X Windows.
3. Change directories to the directory where you downloaded the .rpm file.
4. Enter the following command:
   ```bash
   rpm -iv Intel0PA-FMGUI-linux-x_x_x_x_x.noarch.rpm
   ```
   where x_x_x_x_x is the version number of the Fabric Manager GUI application being installed.
5. Wait for the successful completion of the command.

   The Fabric Manager GUI is installed.

### 14.3 Start the Fabric Manager GUI Application

#### 14.3.1 Windows* Procedure

The following procedure provides the steps to start the Intel® Omni-Path Fabric Suite Fabric Manager GUI application.

1. From the Windows* Start menu, select All Programs
2. Select Intel>Omni-Path>Fabric Manager GUI
   
   The Fabric Manager GUI application starts.

#### 14.3.2 Linux* Procedure

The following procedure starts the Intel® Omni-Path Fabric Suite Fabric Manager GUI application from a terminal window on X Window.

1. Open a Terminal window in X Windows.
2. Type the following command:
   ```bash
   fmgui
   ```
   
   The Fabric Manager GUI application starts.

Alternatively, the following steps start the Fabric Manager GUI application from the K Desktop Environment (KDE).

1. From the K Menu, select Applications.
2. Select the Fabric folder.
3. Select Fabric Manager GUI.
   
   The Fabric Manager GUI application starts.

### 14.4 Configure Startup Options

*Note:* Intel recommends that you accept the default settings.

Refer to the Intel® Omni-Path Fabric Suite Fabric Manager GUI Online Help for procedures to set user preferences.
14.5 **Uninstall the Intel® Omni-Path Fabric Suite Fabric Manager GUI**

The Fabric Manager GUI must be closed for the uninstall to be successful. The uninstall program will not warn you if the application is open. Warnings may be received at the end of the uninstall process stating that certain files have not been removed or it might just fail.

14.5.1 **Windows* Procedure**

1. From the Windows* Start menu, select Control Panel.
2. Under the Programs category, select Uninstall a program.
3. In the program list, select Intel Fabric Manager GUI.
4. Click the Uninstall button at the top of the list.
5. Follow the instructions on the uninstall window.
   The Fabric Manager GUI is uninstalled.

14.5.2 **Linux* Procedure**

1. Log in to the server where Fabric Manager GUI is installed using a user with root access.
2. Open a Terminal window in X Windows.
3. Type the following command:
   ```sh
   # rpm -e IntelOPA-FMGUI-linux-x_x_x_x.noarch.rpm
   
   where x_x_x_x is the version number of the Fabric Manager GUI application being uninstalled.
   ```
4. Wait for the successful completion of the command.
   The Fabric Manager GUI is uninstalled.
15.0 Installation Verification and Additional Settings

This section provides instructions for verifying that the software has been properly installed, the Intel® Omni-Path Fabric drivers are loaded, and that the fabric is active and ready to use. Information on the Intel HFIs and Performance tuning is also provided.

15.1 LED Link and Data Indicators

For information on the LEDs function as link and data indicators refer to Intel® Omni-Path Fabric Switches Hardware Installation Guide and/or Intel® Omni-Path Host Fabric Interface Installation Guide.

15.2 Adapter and Other Settings

The following settings can be adjusted for better performance.

Note: This section is only applicable to clusters using Intel HFIs.

- **On the switch, use an OPA MTU of 8k bytes, if available, with the Intel® Omni-Path Host Fabric Interface.** 8K MTU is enabled in the Intel® Omni-Path driver by default. To change this setting for the driver, refer to the Intel® Omni-Path Fabric Host Software User Guide.

- **Use a PCIe Max Read Request size of at least 512 bytes with the Intel® Omni-Path Host Fabric Interface.** The Intel® Omni-Path Host Fabric Interface can support sizes from 128 bytes to 4096 bytes in powers of two. This value is typically set in the BIOS.

- **Use a PCIe MaxPayload size of 256, where available, with the Intel® Omni-Path Host Fabric Interface.** The Intel® Omni-Path Host Fabric Interface can support 128, 256, or 512 bytes. This value is typically set by the BIOS as the minimum value supported both by the PCIe card and the PCIe root complex.

- **Make sure that write combining is enabled.** The x86 Page Attribute Table (PAT) mechanism that allocates Write Combining (WC) mappings for the PIO buffers has been added and is now the default. If PAT is unavailable, or PAT initialization fails for some reason, the code will generate a message in the log and fall back to the MTRR mechanism. Refer to the Intel® Omni-Path Fabric Host Software User Guide.

15.3 ARP Neighbor Table Setup for Large Clusters

The ARP neighbor table may overflow and produce a neighbor table overflow message to /var/log/messages along with other effects such as ping failing. To resolve this issue, increase the threshold level for the network devices as follows:
1. Check the present threshold level 1 by entering the command:

```bash
cat /proc/sys/net/ipv4/neigh/default/gc_thresh1
```

It will return a value, such as 128, 256, or 512.

2. Increase the value to the next level. For example, if the value is 128, then set the thresh1 value to 256, set thresh2 to 512, and set thresh3 to 1024. The following is an example of the syntax to be used if the value is 128:

```bash
echo 256 > /proc/sys/net/ipv4/neigh/default/gc_thresh1
echo 512 > /proc/sys/net/ipv4/neigh/default/gc_thresh2
echo 1024 > /proc/sys/net/ipv4/neigh/default/gc_thresh3
```

This will stop the error messages that were received in the log file.

### 15.4 SM Loop Test

The SM Looptest is a diagnostic test facility in the Fabric Manager. As part of this test, the Subnet Manager stress tests inter-switch links (ISLs) by continuously passing traffic through them. Other tools, like FastFabric, can be used to monitor the links for signal integrity issues or other errors. The advantage of the Looptest is that it provides a guaranteed way to test all of the ISLs in the fabric, without the need for a large number of end hosts or applications. For information on the SM Loop Test and how to use the test, refer to the *Intel® Omni-Path Fabric Suite Fabric Manager User Guide*. 

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**Intel® Omni-Path Fabric Software**

*Installation Guide*

Order No.: H76467-1.0

November 2015
16.0 Configuration

Using advanced fabric features properly requires consistent configuration of multiple components in the fabric, as well as proper execution of jobs and applications.

This chapter summarizes the interdependencies of some of the advanced features. It can be used as a reminder and checklist to allow you to take full advantage of the features.

The configuration subjects discussed in this section are:

- Virtual Fabrics on page 86
- Congestion Analysis on page 89
- Adaptive Routing on page 90
- Adaptive Routing, Switch Configuration on page 90
- Dispersive Routing on page 90
- Distributed SA Provider on page 91

16.1 Virtual Fabrics

Virtual Fabrics (vFabrics) includes both security and quality of service (QOS) capabilities. vFabrics are configured within the Fabric Manager, either by directly editing the `opafm.xml` configuration file or through the Fabric Manager GUI. The configuration of the Fabric Manager must be consistent with the capabilities of the hardware and the usage of the fabric by the applications.

16.1.1 Virtual Fabrics, Switch Configuration

On the switches, the number of virtual lanes (VLs) and the maximum MTU must be configured. The recommended way to accomplish this is through FastFabric, during initial installation or reconfiguration of the fabric. See Install the Intel® Omni-Path Fabric Software on page 20. If required, the VL and MTU configuration can also be directly configured through the switch CLI. See the `ismChassisSetMtu` CLI command in the Intel® Omni-Path Fabric Switches Command Line Interface Reference Guide.

For Fat Tree topologies, 1 VL is used per QOS level. 1 QOS level is used per vFabric with QOS enabled (plus 1 more VL if there are additional vFabrics without QOS enabled).

16.1.2 Virtual Fabrics, Fabric Manager Configuration

The Fabric Manager sample configuration has a variety of sample Virtual Fabrics (vFabrics) that can be easily enabled. See the Virtual Fabrics section of the Intel® Omni-Path Fabric Suite Fabric Manager User Guide. The following table displays some useful combinations.
Table 1. Sample Fabric Manager vFabric Combinations

<table>
<thead>
<tr>
<th>Number of vFabrics</th>
<th>Typical Combinations</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Default</td>
<td>All traffic together.</td>
</tr>
<tr>
<td>2</td>
<td>Compute, AllOthersWithSA</td>
<td>Separate MPI from everything else.</td>
</tr>
<tr>
<td>2</td>
<td>Admin, AllOthers</td>
<td>Separate FM/FastFabric from everything else.</td>
</tr>
<tr>
<td>2</td>
<td>PSM_Compute_Control, AllOthersWithSA</td>
<td>Separate PSM control messages from everything else.</td>
</tr>
<tr>
<td>3</td>
<td>Networking, Compute, AllOthersWithSA</td>
<td>Separate Networking (and IPoIB based file systems), MPI, and everything else.</td>
</tr>
<tr>
<td>3</td>
<td>Networking, Compute, Admin</td>
<td>Separate Networking, MPI, and Admin. Assumes no other applications use fabric.</td>
</tr>
<tr>
<td>3</td>
<td>PSM_Compute_Control, PSM_Compute_Data, AllOthersWithSA</td>
<td>Separate PSM control messages from data and everything else.</td>
</tr>
<tr>
<td>4</td>
<td>Networking, Compute, AllOthers, Admin</td>
<td>Separate Networking, MPI, Fabric Manager/FastFabric, and everything else.</td>
</tr>
<tr>
<td>4</td>
<td>Networking, PSM_Compute_Control, AllOthers, Admin</td>
<td>Separate Networking, PSM Control, Fabric Manager/FastFabric, and everything else.</td>
</tr>
<tr>
<td>4</td>
<td>Networking, PSM_Compute_Control, PSM_Compute_Data, AllOthersWithSA</td>
<td>Separate PSM control and data, networking, and everything else.</td>
</tr>
<tr>
<td>4</td>
<td>Networking, PSM_Compute_Control, PSM_Compute_Data, Admin</td>
<td>Separate PSM control and data, networking, and FM/FastFabric. Assumes no other applications use the fabric.</td>
</tr>
</tbody>
</table>

Note: The vFabrics Default, Admin, and AllOthersWithSA are mutually exclusive; only one can be enabled at a time.

Note: Intel does not recommended using Default when configuring more than 1 Virtual Fabric. Either AllOthersWithSA or Admin is recommended.

16.1.3 Virtual Fabrics, Fabric Host Software Configuration

When using Virtual Fabrics in conjunction with Intel HFI and Performance Scaled Messaging (PSM) with PathRecord query enabled (MPI over PSM Configuration Using PathRecord Query on page 92), Intel recommends that you enable the Distributed SA Provider (DSAP) for autostart on all the compute nodes. This will simplify the operation of MPI jobs using PSM.

Enabling Distributed SA Provider

Enable the Distributed SA Provider (DSAP) for autostart on all the compute nodes. You can use any of the following methods:

- Select to Enable OFED IBACM (ibacm) in the Intel OPA Autostart Menu when installing, upgrading, or running the opaconfig command.

- Add -E dist_sa to the FF_INSTALL_OPTIONS and FF_UPGRADE_OPTIONS in opafastfabric.conf, and using FastFabric to install or upgrade all the compute nodes.
Use the opacmdall command or any other distributed shell to perform a opaconfig -E dist_sa operation on all nodes.

Refer to Intel® Omni-Path Fabric Host Software User Guide for more information about the Distributed SA Provider.

16.1.4 Virtual Fabrics, Application, and ULP Configuration

Virtual Fabrics operates using IBTA compliant mechanisms. One of the key requirements of Virtual Fabrics is that applications make SA PathRecord queries to obtain critical address information, such as PKey and SL.

When using Virtual Fabrics, applications must be properly assigned to the right vFabric. For applications that use PathRecord queries or use IB Multicast Groups, the Fabric Manager will use the ServiceID or MGI_ID respectively to look up the application and select an appropriate vFabric to use in response to the query.

MPI over PSM Configuration

Unlike Verbs MPIs, PSM provides a simple and consolidated way to assign jobs to Virtual Fabrics. For MPI jobs using PSM, this is most easily accomplished by using Path Record queries and the Distributed SA Provider.

Using PathRecord Query

Refer to the Intel® Omni-Path Fabric Host Software User Guide for how to specify PSM_PATH_REC=opp and how to configure that variable globally on the compute nodes. If multiple vFabrics are configured for PSM, with different sets of ServiceIDs in each, MPI jobs can be assigned to a specific ServiceID through PSM_IB_SERVICE_ID. For more information on this parameter, refer to the Intel® Omni-Path Fabric Host Software User Guide.

When using FastFabric to perform the opahostadmin mpiperf or opahostadmin mpiperdeviation verification steps, the PSM_PATH_REC option must be specified in opafastfabric.conf, in the FF_MPI_ENV setting. See Intel® Omni-Path Fabric Suite FastFabric User Guide Configuration Files section for the opafastfabric.conf file. Alternatively, it can be specified in the /opt/opa/src/mpi_apps/ofed.*.param files.

When using /opt/opa/src/mpi_apps/run_*.scripts to run sample MPI applications and benchmarks, the /opt/opa/src/mpi_apps/ofed.*.param files must be edited to uncomment the PSM_PATH_REC setting.

Directly Specifying vFabric or PKey and SL

When not using PathRecord query, vFabric addressing information must be directly supplied to the MPI job using mpirun command line options or environment variables. For more information on mpirun and environmental variables, refer to Intel® Omni-Path Fabric Host Software User Guide.

When using FastFabric or the /opt/opa/src/mpi_apps/run_*.scripts to run sample MPI applications and benchmarks, the /opt/opa/src/mpi_apps/ofed.*.param files must be edited.
MPI over Verbs Configuration

For historical reasons, most MPI implementations over Verbs do not interact with the SA, and instead hand construct address information using hardcoded PKey, SL, and other information. When using vFabrics with such MPIs, the vFabric addressing information must be directly supplied to the MPI job using `mpirun` command line options or environment variables. For more information on `mpirun` and environmental variables, refer to *Intel® Omni-Path Fabric Host Software User Guide*.

When using FastFabric or the `/opt/opa/src/mpi_apps/run_*` scripts to run sample MPI applications and benchmarks, the `/opt/opa/src/mpi_apps/ofed.*.param` files must be edited.

IPoIB Configuration

IPoIB will automatically use the first enabled vFabric in the FM configuration file. This will typically be Networking, Default, AllOthers, or AllOthersWithSA. The sample FM configuration file is set up for typical IPoIB operation, with the most common option is listed first.

If you need to create more than one IPoIB vFabric, then you need to configure additional pKeys into IPoIB. Refer to *Intel® Omni-Path Fabric Host Software User Guide* for more information about using SL and PKeys.

Other Applications and ULPs

Most applications will not require any special operational changes. This is because, with the exception of MPI, all other applications tend to use IBTA standard approaches for connection establishment. The Fabric Manager sample configuration file has application definitions for many popular applications and ULPs. Additional applications can be added as needed, or the Default, AllOthers, or AllOthersWithSA vFabric definitions can be used.

*Note:* Some applications make use of IPoIB for address resolutions. These applications may end up using the same vFabric as IPoIB.

16.1.5 Virtual Fabrics, Fabric Manager GUI Configuration

The Fabric Manager GUI may be used to configure the Virtual Fabrics for the Fabric Manager. Refer to the *Intel® Omni-Path Fabric Suite Fabric Manager GUI Online Help* for more information.

16.2 Congestion Analysis

Intel FastFabric provides Congestion Analysis capabilities for statistics gathering. These tools centralize the statistics monitoring in the PM. For proper operation of these tools, no other applications can be directly clearing the PMA counters in the fabric.

16.2.1 Congestion Analysis, Switch Configuration

Intel recommends using FastFabric to configure the switches in the fabric during the initial installation or reconfiguration of the fabric. Refer to *Configure Intel Chassis* or *Configure Externally Managed Switches* for configuration procedures.
16.2.2 Congestion Analysis, Fabric Manager Configuration

Enable PM monitoring by configuring the Pm.SweepInterval parameter. Refer to Configure Chassis Fabric Manager (FM) on page 37 and the Intel® Omni-Path Fabric Suite Fabric Manager User Guide for more information.

16.2.3 Congestion Analysis, Management Node Configuration

The Management Node configuration is accomplished by installing the IFS software and the FastFabric Toolkit. The opatop, opapaquery, and opareport tools will all detect and access the PM within the Fabric Manager. These tools, and related tools such as opaallanalysis, opafabricanalysis, opaextractperf, are all safe to use.

Avoid using tools that directly clear the counters, such as opareport --pmadirect.


16.3 Adaptive Routing

Adaptive Routing allows the Intel switches to dynamically adjust the fabric routes in real time. The adjustments occur in response to observed traffic patterns and fabric congestion. This permits more efficient fabric operation.

16.4 Adaptive Routing, Switch Configuration

Make sure the version of switch firmware being used supports Adaptive Routing. Refer to the appropriate release notes for more information:
- Intel® Omni-Path Fabric Managed Switches Release Notes
- Intel® Omni-Path Fabric Externally-Managed Switches Release Notes

Adaptive Routing, Fabric Manager Configuration

Adaptive routing is configured completely in the Fabric Manager. Refer to the Intel® Omni-Path Fabric Suite Fabric Manager User Guide for information on configuring adaptive routing.

Note: Adaptive Routing dynamic adjustments can cause packets from a particular source to arrive at the destination out of order, which may affect applications that utilize ordered traffic.

16.5 Dispersive Routing

Dispersive Routing allows MPIs using Intel PSM technology to spread their traffic across multiple routes. This allows more of the fabric routes to be used by each HFI, statistically improves the efficiency of the fabric, and reduces potential congestion and bottlenecks.
16.5.1 Dispersive Routing, Fabric Manager Configuration

Use of Dispersive Routing requires the Fabric Manager to configure more than one route to each HFI. This is accomplished by enabling the LMC capabilities of the Intel® Omni-Path architecture. To do this, set the \texttt{Lmc} configuration to one or more. This will cause up to $2^{\text{LMC}}$ alternate routes to be available per HFI port.

Within the Fabric Manager, the PathSelection option can affect how many paths are reported. Intel recommends that you use the default value of Minimal. For more information about LMC and Fabric Resiliency, refer to \textit{Intel® Omni-Path Fabric Suite Fabric Manager User Guide}.

16.5.2 Dispersive Routing, PSM Configuration

By default, PSM will detect and use the multiple LIDs for dispersive routing. Additional controls over the routes used are possible through:

- Using Distributed SA Provider and PathRecord queries in PSM - Refer to \textit{Distributed SA Provider} on page \textit{91}.
- Configuring PSM\_PATH\_SELECTION - Refer to \textit{Intel® Omni-Path Fabric Host Software User Guide}.

16.6 Distributed SA Provider

The Distributed SA Provider (DSAP) allows for a highly scalable way for applications to query the Fabric Manager's Subnet Administrator. This can help to improve flexibility of the fabric operation and configuration, especially when using Virtual Fabrics.

The implementation involves dist\_sa processes running on each compute node. The processes synchronize key PathRecord information with the Fabric Manager so it is always up to date and immediately available for rapid application startup.

16.6.1 Distributed SA Provider, Fabric Manager Configuration

Refer to the \textit{Intel® Omni-Path Fabric Suite Fabric Manager User Guide} for more information on configuring Distributed SA Provider in Fabric Manager.

16.6.2 Distributed SA, Fabric Host Software Configuration

Enable the Distributed SA Provider (DSAP) for autostart on all the compute nodes. Refer to \textit{Enabling Distributed SA Provider} on page \textit{87} for information on enabling Distributed SA Provider.

For more information on Distributed SA Provider, refer to the \textit{Intel® Omni-Path Fabric Host Software User Guide}.

16.6.3 Distributed SA Provider, Application and ULP Configuration

Distributed SA Provider is integrated with Intel PSM for use by MPI jobs. The default \texttt{/etc/sysconfig/opa/dist\_sa.conf} file matches the default \texttt{opafm.xml} configuration with regard to IB ServiceIDs used for PSM.
MPI over PSM Configuration Using PathRecord Query

Refer to the Intel® Omni-Path Fabric Host Software User Guide for information how to specify PSM_PATH_REC=opp, and how to configure that variable globally on the compute nodes.

When using FastFabric to perform the opahostadmin, mpiperf, or opahostadmin mpipever deviation verification steps, the PSM_PATH_REC option must be specified in the opafastfabric.conf file in the FF_MPI_ENV setting. Refer to Intel® Omni-Path Fabric Suite FastFabric User Guide Configuration Files section for information on opafastfabric.conf. Alternatively it can be specified in the /opt/opa/src/mpi_apps/ofed.*.param files.

When using /opt/opa/src/mpi_apps/run_* scripts to run sample MPI applications and benchmarks, the /opt/opa/src/mpi_apps/ofed.*.param files must be edited to uncomment the PSM_PATH_REC setting.

Other Applications and ULPs

At this time, no other applications will take advantage of the Distributed SA Provider. Other applications will continue to operate as they have in the past. Those which are IBTA compliant will interact directly with the centralized SA.
17.0 Upgrade the Management Node

This procedure provides discussion and step-by-step directions to upgrade an Fabric Management Node from a previous Intel® Omni-Path Fabric Suite (IFS) software version to the latest IFS software version.

17.1 Preinstallation

Prior to upgrading to IFS software, ensure the following items have been performed:

- Review the Release Notes for a list of compatible software.
- Uninstall all versions of 3rd party IB stacks.
- Back up the following configuration files in case the upgrade fails:
  - /etc/sysconfig/opafm.xml
  - /etc/sysconfig/opa/*
  - /var/opt/opa/analysis/baseline/*
  - Refer To the OS documentation for a list of any other OS-specific files that should be included in any backups.

Note: When managing a cluster where the IPoIB settings on the compute nodes are incompatible with the Fabric Management Node (for example when a 4K MTU is used on the compute nodes and a 2K MTU is used on the management nodes), Intel recommends that you not run IPoIB on the Fabric Management Nodes.

17.2 Intel® Omni-Path Fabric Suite Upgrade

Upgrading the IFS software on a Fabric Management Node with an existing IFS software is accomplished using the IntelOPA-IFS.DISTRO.VERSION.tgz package file.

1. Download and extract the installation packages following the Download and Extract Installation Packages section.

2. Change directory to IntelOPA-IFS.DISTRO.VERSION directory.

   cd IntelOPA-IFS.DISTRO.VERSION

3. Start the TUI installation.

   ./INSTALL

   The Intel OPA VERSION Software main menu is displayed.

   Intel OPA VERSION Software
   1) Install/Uninstall Software
   2) Reconfigure OFED IP over IB
   3) Reconfigure Driver Autostart
   4) Generate Supporting Information for Problem Report
4. Select 1) Install/Uninstall Software.

Screen 1 of 2 of the Intel OPA Install Menu is displayed.

Intel OPA Install (VERSION release) Menu

Please Select Install Action (screen 1 of 2):
0) OFED OPA Stack [ Upgrade ] [Available] VERSION
1) OFED IBACM [ Upgrade ] [Available] VERSION
2) Intel HFI Components [ Upgrade ] [Available] VERSION
3) OPA Tools [ Upgrade ] [Available] VERSION
4) OFED OPA Development [ Upgrade ] [Available] VERSION
5) FastFabric [ Upgrade ] [Available] VERSION
6) OFED IP over IB [ Upgrade ] [Available] VERSION
7) OPA FM [ Upgrade ] [Available] VERSION
8) MVAPICH2 (hfi,gcc) [ Upgrade ] [Available] VERSION
9) MVAPICH2 (hfi,Intel) [ Upgrade ] [Available] VERSION
a) MVAPICH2 (hfi,PGI) [ Upgrade ] [Available] VERSION
b) OpenMPI (hfi,gcc) [ Upgrade ] [Available] VERSION
c) OpenMPI (hfi,Intel) [ Upgrade ] [Available] VERSION
d) OpenMPI (hfi,PGI) [ Upgrade ] [Available] VERSION

N) Next Screen
F) Perform the selected actions I) Install All
R) Re-Install All U) Uninstall All
X) Return to Previous Menu (or ESC)

5. Review the items to be upgraded; the default value is in brackets (Upgrade or up To Date). To change a value, type the alphanumeric character associated with the item.

6. Press N to go to the next screen.

Screen 2 of 2 of the Intel OPA Install Menu is displayed.

Intel OPA Install (VERSION release) Menu

Please Select Install Action (screen 2 of 2):
0) GASNet (hfi,gcc) [ Upgrade ] [Available] VERSION
1) OpenSHMEM (hfi,gcc) [ Upgrade ] [Available] VERSION
2) MVAPICH2 (verbs,gcc) [ Upgrade ] [Available] VERSION
3) OpenMPI (verbs,gcc) [ Upgrade ] [Available] VERSION
4) MPI Source [ Upgrade ] [Available] VERSION
5) OFED Debug Info [Don't Install] [Available] VERSION

N) Next Screen
F) Perform the selected actions I) Install All
R) Re-Install All U) Uninstall All
X) Return to Previous Menu (or ESC)

7. Review the items to be upgraded; the default value is in brackets (Upgrade, Up To Date, or Don't Install).

To change a value, type the alphanumeric character associated with the item.

8. Press P to perform the selected actions from the two screens.

9. For each system prompt, select the default by pressing Enter.
The **Intel OPA Autostart Menu** is displayed.

<table>
<thead>
<tr>
<th>Intel OPA Autostart (VERSION release) Menu</th>
</tr>
</thead>
<tbody>
<tr>
<td>Please Select Autostart Option:</td>
</tr>
<tr>
<td>0) OFED OPA Stack ()</td>
</tr>
<tr>
<td>1) OFED IBACM (ibacm)</td>
</tr>
<tr>
<td>2) Intel HFI Components ()</td>
</tr>
<tr>
<td>3) OFED IP over IB ()</td>
</tr>
<tr>
<td>4) OPA FM (opafm)</td>
</tr>
<tr>
<td>P) Perform the autostart changes</td>
</tr>
<tr>
<td>S) Autostart All</td>
</tr>
<tr>
<td>X) Return to Previous Menu (or ESC)</td>
</tr>
</tbody>
</table>

10. Review the items for Autostart; the default value is in brackets (Enable or Disable). To change a value, type the alphanumeric character associated with the item.

   Intel recommends leaving all of the Autostart selections as default.

11. Press **P** to perform the selected actions from the screen.

   The system prompts:

   Hit any key to continue...

12. Press any key to proceed with the installation.

   The system prompts:

   A System Reboot is recommended to activate the software changes
   Hit any key to continue...

13. Press any key to complete the installation.

   The installation completes and returns to the main menu.

14. Press **X** to exit.

15. Reboot the server.

    reboot
18.0 Upgrade the Fabric Software

Upgrade Intel® Omni-Path Fabric Software

If an existing fabric needs to have the Intel® Omni-Path Fabric software upgraded, follow this procedure:

Note: On each Fabric Management Node, perform an upgrade installation of the IFS software using the procedure documented in the Upgrade the Management Node on page 93 section.

1. **(All)** Perform steps 1 and 2 in the Install Host Software on the Remaining Hosts Using the FastFabric TUI on page 54.

2. Select the following items to be performed in the menu:
   - (optional) The 1) Edit Config and Select/Edit Hosts Files option will permit the opafastfabric.conf and hosts files to be edited.
   - The 5) Install/Upgrade OPA Software option will upgrade the Intel® Omni-Path Fabric software on all the selected hosts. By default, it will look in the current directory for the FF_PRODUCT.$FF_PRODUCT_VERSION.tgz file. If it is not found in the current directory, you will be prompted to supply a directory name where this file can be found.
     Note: The upgrade installation will update any existing OFED Delta software, and is only valid for hosts that already have a previous version of OFED Delta software installed.

3. Press **P** to perform the upgrade.

<table>
<thead>
<tr>
<th>If</th>
<th>Then</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Edit Config and Select/Edit Hosts Files was selected</td>
<td>Continue with the next step.</td>
</tr>
<tr>
<td>1) Edit Config and Select/Edit Hosts Files was not selected</td>
<td>Skip to Step 6.</td>
</tr>
</tbody>
</table>

4. Press any key for the following system prompt:

   About to: vi /etc/sysconfig/opa/opafastfabric.conf
   nHit any key to continue (or ESC to abort)...

   The opafastfabric.conf file is opened in the editor, review all the settings. See Intel® Omni-Path Fabric Suite FastFabric User Guide Configuration Files section for more information about the opafastfabric.conf file.

5. When finished updating the opafastfabric.conf file, quit out of the editor.

   The system prompts:

   You should select a file which OMITS this host
   Select Host File to Use/Edit [/etc/sysconfig/opa/hosts]:
6. Select a hosts list file that lists all the hosts except the Fabric Management nodes. If necessary, create a new file at this time, potentially based on the existing /etc/sysconfig/opa/hosts file.

*Note:* Do not list any of the Fabric Management Nodes in the host file (for example, the nodes that have FastFabric installed).

*Note:* The file may list the Management Network or IPoIB hostnames for the selected hosts

The host file is opened in the editor, review all the information. See *Intel® Omni-Path Fabric Suite FastFabric User Guide* Configuration Files section for more information about the host file.

7. When finished updating the hosts file, quit out of the editor.

The system prompts:

Do you want to edit/review/change the files? [y]:

8. Press N to continue.

The system prompts:

Performing Host Setup: Install/Upgrade OPA Software
Hit any key to continue...

9. Press any key to continue.

The system displays prompts that require your response as it is going through the installation

10. Select the default by pressing Enter.

The *Intel OPA Autostart Menu* appears.

```
Please Select Autostart Option:
0) OFED OPA Stack () [Enable]
1) OFED IB ACM (ibacm) [] [Disable]
2) Intel HFI Components () [Enable]
3) WFR Lite driver () [Enable]
4) OFED IP over IB () [Enable]
5) Perform the autostart changes
S) Autostart All R) Autostart None
X) Return to Previous Menu (or ESC)
```

11. Press P to proceed.

When the selected hosts have completed rebooting, the *FastFabric OPA Host Setup Menu* is displayed. The upgrade is complete.

If any hosts fail to be updated, use the View opahostadmin result files option to review the result files from the update. Refer to the *Intel® Omni-Path Fabric Suite FastFabric Command Line Interface Reference Guide* for more details.

*Note:* When using the Intel® Omni-Path Fabric software, FastFabric may be used to upgrade the Intel® Omni-Path Fabric software stack (IntelOPA-Basic.DISTRO.VERSION.tgz) on the remaining hosts.
12. **(Linux)** If any other setup operations need to be performed on all hosts, use the **Run a command on all hosts** menu option. This option executes a the specified Linux* shell command (or sequence of commands separated by semicolons) against all selected hosts.

   *Note:* Check the relevant release notes for the new Intel® Omni-Path Fabric Host Software release being installed for any such additional required steps.

13. **(Linux)** **Reboot Hosts** will reboot all the selected hosts and ensure they go down and come back up properly (as verified through ping over the management network). When the hosts come back up, they will be running the installed Intel® Omni-Path Fabric Host Software.

14. Repeat the verification steps for the fabric as discussed in Install the Intel® Omni-Path Fabric Software on page 20.
19.0 Upgrade from IntelOPA-Basic to IntelOPA-IFS

If you upgrade the Intel® Omni-Path Software (Intel® OPA Software) from IntelOPA-Basic to IntelOPA-IFS, FastFabric and OPA_FM software are installed. This section provides step-by-step instructions for the upgrade, using the Install TUI menus. This installation procedure presumes that you are logged in and have completed all pre-installation requirements.

1. Download and extract the IntelOPA-IFS.DISTRO.VERSION.tgz package file as described in Download and Extract Installation Packages.

2. Change to the IntelOPA-IFS.DISTRO.VERSION directory with the command:

```
cd IntelOPA-IFS.DISTRO.VERSION
```

3. Start the Install TUI:

```
./INSTALL
```

The Intel OPA VERSION Software main menu appears.

Intel OPA VERSION Software

1) Install/Uninstall Software
2) Reconfigure OFED IP over IB
3) Reconfigure Driver Autostart
4) Generate Supporting Information for Problem Report
5) FastFabric (Host/Chassis/Switch Setup/Admin)
X) Exit

4. Select 1) Install/Uninstall Software.

Screen 1 of 2 of the Intel OPA Install Menu appears.

```
Intel OPA Install (VERSION release) Menu
Please Select Install Action (screen 1 of 2):
0) OFED OPA Stack | Up To Date | [Available] VERSION
1) OFED IBACM [ Up To Date ] [Available] VERSION
2) Intel HFI Components [ Up To Date ] [Available] VERSION
3) OPA Tools [ Up To Date ] [Available] VERSION
4) OFED OPA Development [ Up To Date ] [Available] VERSION
5) FastFabric [ Install | [Available] VERSION
6) OFED IP over IB [ Up To Date ] [Available] VERSION
7) OPA FM [ Install | [Available] VERSION
8) MVAPIC,H2 (hfi,gcc) [ Up To Date ] [Available] VERSION
9) MVAPIC,H2 (hfi,Intel) [ Up To Date ] [Available] VERSION
a) MVAPIC,H2 (hfi,PGI) [ Up To Date ] [Available] VERSION
b) OpenMPI (hfi,gcc) [ Up To Date ] [Available] VERSION
c) OpenMPI (hfi,Intel) [ Up To Date ] [Available] VERSION
d) OpenMPI (hfi,PGI) [ Up To Date ] [Available] VERSION
```

N) Next Screen
5. Review the items to ensure that FastFabric and OPA_FM show Install and all other selections show Up To Date.

6. Press P to perform the FastFabric and OPA_FM installation.

7. Follow the system prompts. For each prompt, select the default by pressing Enter.

The Intel OPA Autostart Menu appears.

Intel OPA Autostart (VERSION release) Menu

Please Select Autostart Option:
0) OFED OPA Stack () [Enable ]
1) OFED IBACM (ibacm) [Disable]
2) Intel HFI Components () [Enable ]
3) OFED IP over IB () [Enable ]
4) OPA FM (opafm) [Enable ]

P) Perform the autostart changes
S) Autostart All
R) Autostart None
X) Return to Previous Menu (or ESC)

8. Review the items for Autostart; the default value is in brackets (Enable or Disable). To change a value, type the alphanumeric character associated with the item.

Intel recommends leaving all of the Autostart selections set to the default values.

9. Press P to perform the selected actions from the screen.

The system prompts:

Hit any key to continue...

10. Press any key to proceed with the installation.

The system prompts:

Firmware Update unnecessary
Hit any key to continue...

11. Press any key to proceed with the installation.

The system prompts:

A System Reboot is recommended to activate the software changes
Hit any key to continue...

12. Press any key to proceed with the installation.

The installation completes and returns to the main menu.

13. Press X to exit.

14. Reboot the server.
Appendix A Multi-Subnet Fabrics


When operating a multi-subnet fabric, a subnet manager (SM) is required for each subnet. An SM may be run within switches within each subnet, or a host-based SM may be run. A host-based SM can manage multiple subnets (assuming the host server is connected to more than one subnet).

A number of combinations are possible for multi-subnet fabrics:

1. **All subnets are completely independent (except for any interconnecting routers)**: If a separate FastFabric node is being used per subnet, and servers are not installed in more than one subnet, the individual subnets can be treated completely separately. In this case, follow all the previous FastFabric instructions for each fabric.

2. **The subnets are primarily independent**: If the only components common to more than one subnet are the FastFabric nodes (and possibly SM nodes) and no servers are installed in more than one subnet, refer to the following instructions for Primarily Independent Subnets.

3. **The subnets are overlapping**: If multiple components are common to more than one subnet, such as FastFabric node(s), servers, etc., refer to the following instructions for Overlapping Subnets on page 103.

### A.1 Primarily Independent Subnets

If the FastFabric node (and possible SM nodes) is the only common server between subnets, FastFabric may be used to assist in server installation and fabric operation. Follow the installation instructions outlined in Install the Omni-Path Fabric Software with the following adjustments:

From **Design of the Fabric**, design the cabling such that the FastFabric node will be connected to each subnet it will manage. The FastFabric node must also have a management network path to all the nodes in all the subnets that it will manage. As part of the design, consider where routes between subnets are wanted between routers, IPoIB routers, etc.

**Design of the Fabric** can be performed as per the instructions. When installing the IFS software on the Fabric Management Node, IPoIB will need to be configured such that each subnet is an independent IPoIB network interface, typically with different IP subnets. Refer to the **Intel® Omni-Path Fabric Host Software User Guide** for more information on configuring IPoIB.

**Note:** When managing a cluster where the IPoIB settings on the compute nodes are incompatible with the Fabric Management Node (e.g., when a 4K MTU is used on the compute nodes and a 2K MTU is used on the Fabric Management Node), Intel recommends that you not run IPoIB on the Fabric Management Node(s).
Configure Intel® Omni-Path Chassis on page 30 can be performed as per the instructions. When creating the chassis file, list all Intel internally-managed switches in all subnets. If required, additional files may also be created per subnet that list only the Intel chassis in each subnet. When editing the ports file, list all the Fabric Management Node ports that access the managed fabrics. If required, additional files may be created per subnet that list only the Fabric Management Node port connected to the given managed fabric.

Configure Chassis Fabric Manager (FM) on page 37 can be performed as per the instructions. At least one subnet manager is required per subnet. Refer to the Intel® Omni-Path Fabric Suite Fabric Manager User Guide for more information on how to configure a host SM node to manage more than one subnet.

Configure Intel® Omni-Path Chassis on page 30 can be performed as per the instructions. When editing the ports file, list all the Fabric Management Node ports that access the managed fabrics. If required, additional files may be created per subnet that list only the Fabric Management Node port connected to the given managed fabric. If required the switches file may specify a hfi:port per switch. However, if hfi:port is not specified, all the hfi:port specified in the ports file will be searched to locate the given OPA Switch's Node GUID.

Install Intel Omni-Path Fabric Host Software on the Remaining Servers can be performed as per the instructions. When creating the hosts file, list the hosts in all subnets except the Fabric management node where FastFabric is being run. If required, additional files may be created per subnet that list the hosts in each subnet (except the Fabric Management Node).

Verify Intel Omni-Path Fabric Host Software on the Remaining Servers has the following adjustments from the instructions.

- **(All)**: Create the allhosts file as per the instructions. Next, create additional files per subnet that list all the hosts in each subnet including the Fabric Management Node. When editing the ports file, list all the Fabric Management Node ports that access the managed fabrics. If required, additional files may be created per subnet that list only the Fabric Management Node port connected to the given managed fabric.

- **(All)**: Summary of Fabric Components on page 64 can be performed as per the instructions.

- **(All)**: Verify hosts pingable, sshable, and active on page 64 can be performed as per the instructions.

- **(All)**: Verify OPA Fabric status and topology on page 65 can be performed as per the instructions.

- **(Host)**: Verify Hosts see each other on page 65 can be run for each subnet by using the allhosts files specific to each subnet (i.e., those listing only hosts in a single subnet).

- **(Host)**: Verify Hosts ping via IPoIB on page 65 may be run per the instructions.

- **(Host)**: Check MPI Performance on page 65 can be run for each subnet by using the allhosts files specific to each subnet (i.e., those listing only the hosts in a single subnet).

Installation of Additional Fabric Management Nodes can be performed as per the instructions. When copying FastFabric configuration files to the additional Fabric Management Nodes, be sure to also copy the additional hosts, chassis, and allhosts files that were created per subnet.
Note: In asymmetrical configurations where the Fabric Management Nodes are not all connected to the same set of subnets, the files copied to each management node may need to be slightly different. For example, configuration files for opafabricanalysis may indicate different port numbers or host files used for FastFabric, and MPI may need to list different hosts.

Configure and Initialize Health Check Tools can be performed as per the instructions. Additionally, make sure the /etc/sysconfig/opa/ports file lists each of the Fabric Management Node local HFIs and ports that are connected to a unique subnet. When running opareports, opafabricinfo, opafabricanalysis, or opaallanalysis, the default will be to use the ports file. If required, the -p and -t options or the PORTS/PRTS_FILE environment variables may be used to specify all the HFIs and ports on the Fabric Management Node such that all subnets are checked. Similarly, the esm_chasssis and chassis files used should list all relevant Intel chassis in all subnets.

Running High Performance Linpack can be run for each subnet by creating mpi_hosts files specific to each subnet (i.e., only listing hosts in a single subnet).

Upgrade the Management Node on page 93 can be performed as per the instructions.

A.2 Overlapping Subnets

If multiple components are common between subnets (in addition to the Fabric Management Nodes), FastFabric may be used to assist in server installation and fabric operation. Follow the installation instructions outlined in Install the Intel® Omni-Path Fabric Software on page 20 with the following adjustments:

From Design of the Fabric, design the cabling such that the FastFabric node will be connected to each subnet it will manage. The FastFabric node must also have a management network path to all the nodes in all the subnets it will manage. As part of the design, consider where routes between subnets are required, between routers, IPoIB routers, etc.

Set Up the Fabric can be performed as per the instructions. When installing the IFS software on the Fabric Management Node, IPoIB will need to be configured such that each subnet is an independent IPoIB network interface, typically with different IP subnets. Refer to the Intel® Omni-Path Fabric Host Software User Guide for more information on configuring IPoIB.

Note: When managing a cluster where the IPoIB settings on the compute nodes are incompatible with the Fabric Management Node (e.g., when a 4K MTU is used on the compute nodes and a 2K MTU is used on the management nodes), Intel recommends that you not run IPoIB on the Fabric Management Node(s).

Configure Intel® Omni-Path Chassis on page 30 can be performed as per the instructions. When creating the chassis file, list all Intel internally-managed switches in all subnets. If required, additional files may be created per subnet that list only the Intel chassis in each subnet. When editing the ports file, list all the Fabric Management Node ports that access the managed fabrics. If required, additional files may be created per subnet that list only the Fabric Management Node port connected to the given managed fabric.
Configure Chassis Fabric Manager (FM) on page 37 can be performed as per the instructions. At least one subnet manager is required per subnet. Refer to the Intel® Omni-Path Fabric Suite Fabric Manager User Guide for more information on how to configure a host-based SM node to manage more than one subnet.

Configure Intel® Omni-Path Chassis on page 30 can be performed as per the instructions. When editing the ports file, list all the Fabric Management Node ports that access the managed fabrics. If required, additional files may be created per subnet that list only the Fabric Management Node port connected to the given managed fabric. If required, the switches file may specify a `hfi:port` per switch. However, if `hfi:port` is not specified, all the `hfi:port` entries specified in the ports file will be searched to locate the given switch’s node GUID.

Install Intel Omni-Path Fabric Host Software on the Remaining Servers can be performed as per the instructions. When creating the hosts file, list all the hosts in all subnets except the Fabric Management Node where FastFabric is being run. If required, additional files may also be created per subnet that list the hosts in each subnet (except the Fabric Management Node).

For hosts that are connected to more than one subnet, IPoIB will need to be configured such that each subnet is an independent IPoIB network interface, typically with different IP subnets. Refer To the Intel® Omni-Path Fabric Host Software User Guide for more information on configuring IPoIB.

Verify Intel Omni-Path Fabric Host Software on the Remaining Servers has the following adjustments from the instructions.

- **(All)**: Create the `allhosts` file per the instructions. Next, create additional files per subnet that list all the hosts in each subnet including the Fabric Management Node. When editing the ports file, list all the Fabric Management Node ports which access the managed fabrics. If required, additional files may also be created per subnet that list only the Fabric Management Node port connected to the given managed fabric.

- **(All)**: **Summary of Fabric Components** on page 64 can be performed per the instructions.

- **(All)**: **Verify hosts pingable, sshable, and active** on page 64 can be performed as per the instructions.

- **(All)**: **Verify OPA Fabric status and topology** on page 65 can be performed as per the instructions.

- **(Host)**: **Verify Hosts see each other** on page 65 can be run for each subnet by using the `allhosts` files specific to each subnet (i.e., those only listing hosts in a single subnet).

- **(Host)**: **Verify Hosts ping via IPoIB** on page 65 may be run per the instructions.

- **(Linux)**: **Refresh ssh Known Hosts** on page 65 may be run per the instructions.

- **(Host)**: **Check MPI Performance** on page 65 can be run for each subnet by using the `allhosts` files specific to each subnet (i.e., those listing only the hosts in a single subnet). This is currently not available for OFED.

Installation of Additional Fabric Management Nodes can be performed as per the instructions. When copying FastFabric configuration files to the additional Fabric Management nodes, be sure to also copy the additional hosts, chassis, and `allhosts` files created per subnet.
In asymmetrical configurations, where the Fabric Management Nodes are not all connected to the same set of subnets, the files copied to each management node may need to be slightly different. For example, configuration files for opafabricanalysis indicating different port numbers or host files used for FastFabric and MPI may need to list different hosts.

**Configure and Initialize Health Check Tools** can be performed per the instructions. In addition, make sure the `/etc/sysconfig/opa/ports` file lists the Fabric Management Node local HFIs and ports that are connected to a unique subnet. When running opareport, opafabricinfo, opafabricanalysis, or opaallanalysis, the default is to use the ports file. If required, the `-p` and `-t` options or the `PORTS/PORTS_FILE` environment variable may be used to specify all the HFIs and ports on the Fabric Management Node, such that all subnets are checked. Similarly, the `esm_chasssis` and `chassis` files used should list all relevant Intel chassis in all subnets.

**Running High Performance Linpack** can be run for each subnet by creating ,`mpi_hosts` files specific to each subnet (i.e., only listing hosts in a single subnet).

**Upgrade the Management Node** on page 93 can be performed per the instructions.
Appendix B Client/Server Configuration to Boot Over Fabric

This section describes a possible configuration for a PXE server, and how to use Intel® Omni-Path Boot to download a kernel from that server.

Note: These steps were compiled using RHEL® 7. Server setup, such as installed packages, could change based on the server OS. For a full description of RHEL® 7 network configuration, see https://access.redhat.com/documentation/en-US/Red_Hat_Enterprise_Linux/7/html/Networking_Guide/part-Servers.html.

B.1 Server Configuration

Intel® Omni-Path Boot expects a standard PXE server with a few specific requirements. Those requirements are specific to the Intel® Omni-Path Fabric Suite Fabric Manager installation, the PXELINUX configuration file, and the kernel being downloaded remotely.

B.1.1 Configuring IFS

Refer to Intel® Omni-Path Fabric Suite documentation for the full description of how to install Intel® Omni-Path Fabric Suite on the server.

IFS contains the Intel® Omni-Path Host Fabric Interface driver and the required IP over IB software stack. It also optionally installs a Fabric Manager (FM). The FM should be installed for the Intel® Omni-Path Boot client to be fully initialized.

B.1.2 Installing a DHCP Server

Follow these steps to install a DHCP server.
1. Install the DHCP package:
   ```bash
   yum install dhcp
   ```
2. Add the DHCP configuration file.
   ```bash
   Example /etc/dhcp/dhcpd.conf:
   ```

   ```bash
   log-facility local7;
   option domain-name="localhost";
   default-lease-time 600;
   max-lease-time 1800;
   authoritative;
   subnet 192.168.1.0 netmask 255.255.255.0 {
      range 192.168.1.221 192.168.1.230;
      option subnet-mask 255.255.255.0;
      option broadcast-address 192.168.1.255;
      option routers 192.168.1.220;
   }
   ```
3. Start the DHCP server:
   
   service dhcp start

**B.1.3 Installing a TFTP Server**

Follow these steps to install a TFTP server.

1. Install the TFTP package:
   
   yum install tftp-server

2. Install the XINETD package:
   
   yum install xinetd

3. Add the TFTP configuration file.

   ```
   Example /etc/xinetd.d/tftp:
   ```

   ```
   service tftp
   {
       socket_type = dgram
       protocol = udp
       wait = yes
       user = root
       server = /usr/sbin/in.tftpd
       server_args = -s /var/lib/tftpboot
disable = no
       per_source = 11
       cps = 100 2
   }
   ```

4. Start the XINETD server:
   
   service xinetd start

**B.1.4 Installing a PXE Server**

The PXE Server is contained within a directory structure indicated by the `server_args` argument of the TFTP configuration file.

Follow these steps to install a PXE server.

1. Create the base directory structure:
   
   mkdir -p /var/lib/tftpboot

2. Add the PXELINUX configuration file:

   The PXELINUX configuration file is critical to the overall Intel® Omni-Path Boot. The client expects to have a label of "OPA" with a kernel and optional initrd. If these are not provided, Intel® Omni-Path Boot will fail.

   ```
   Example /var/lib/tftpboot/pxelinux/pxelinux.cfg/default:
   ```

   ```
   menu INCLUDE pxelinux.cfg/graphics.cfg
   DEFAULT vesamenu.c32
   NOESCAPE 1
   ALLOWOPTIONS 0
   boot label in /var/lib/tftpboot/pxelinux
   ```
The `rhel7/vmlinuz` and `rhel7/initramfs.img` files are a bootable kernel and initramfs stored, in this example, in `/var/lib/tftpboot/pxelinux/rhel7/`.

**Note:** The command line arguments passed to the PXE server kernel, in this case `rhel7/vmlinuz`, should be embedded in that kernel. Intel® Omni-Path Boot does not pass command line arguments to downloaded kernels.

**Note:** The downloaded kernel, in this case `rhel7/vmlinuz`, should be built as an EFI_STUB kernel, as it is executed in the EFI environment.

### B.2 Intel® Omni-Path Boot Client

First, the Intel® Omni-Path Boot EFI application must be flashed to the Intel® Omni-Path Host Fabric Interface (HFI) PCIe add-in card. In Intel® Xeon Phi™ F series and the 6th generation Intel® Core™ processor F series, this file should be provided as part of the UEFI BIOS release, and this section can be skipped.

**Note:** The HFI1 UEFI package is currently being integrated in IFS. After this integration is complete, it will be available as an RPM. Until that time, it will be released as a tarball. Please adjust the steps below accordingly.

1. Download and install the HFI1 UEFI RPM, which provides two files, `HfiPcieGen3.rom` and `fabric_boot.efi`:
   ```
   yum install hfi1_uefi
   ```
2. Flash the HFI Gen3 UEFI driver to the first 128k of the HFI EEPROM:
   ```
   hfi1_eprom -w -p 0 HfiPcieGen3.rom
   ```
3. Flash the Intel® Omni-Path Boot EFI application to the beginning of the second block in the HFI EEPROM:
   ```
   hfi1_eprom -w -p 1 fabric_boot.efi
   ```
4. Reboot the system.
5. In the UEFI BIOS boot options, select **UEFI Network**.
Appendix C  IFS Software Installation Checklist

The following sections provide a checklist to aid in tracking the steps as they are completed for Fabric Setup, Installation and Verification. Check off each step as its performed. Refer to Install the Omni-Path Fabric Software for a more detailed explanation of each step.

C.1  Pre-Installation

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
<th>Complete</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Ensure that hardware is installed, cabled, and powered. Refer to the Intel® Omni-Path Fabric Switches Hardware Installation Guide.</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Ensure that an HFI is installed in each server. Refer to the Intel® Omni-Path Host Fabric Interface Installation Guide.</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>The hardware configuration should be reviewed to ensure everything was installed and installed properly, according to the plan. Refer to the local hardware configuration plan.</td>
<td></td>
</tr>
</tbody>
</table>
| 4.   | Ensure that the required Operating System is installed on each server with the following options:  
  - Root user command prompt ends in "#" or "$".  
  
  Note: There must be a space after "#" or "$".  
  - TCL and Expect packages installed on all Fabric Management Nodes.  
  Refer to the Intel® Omni-Path Fabric Software Release Notes for supported Operating Systems. |          |
| 5.   | Ensure the capability of remote login as root enabled.  
  - SSH server enabled  
  - All servers configured with the same root password |          |
| 6.   | Ensure that there is a TCP/IP Host Name Resolution  
  - If using /etc/hosts update the /etc/hosts file on the Fabric Management Node  
  - If using DNS, all Management Network and IPoIB hostnames added to DNS  
  - /etc/resolv.conf file configured on Fabric Management Node. |          |
| 7.   | Ensure that an NTP server is setup. |          |
| 8.   | Proceed to the installation of the software using the installation checklist for your type of Installation:  
  - Install the Fabric Software on a Cluster Checklist |          |

C.2  Install the Intel® Omni-Path Fabric Software on a Cluster

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
<th>Complete</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Complete the Pre-Installation Requirements. Refer to Pre-Installation checklist.</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Download and extract the Fabric Software. Refer to Download and Extract Installation Packages</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Install Intel® Omni-Path Fabric software. Refer to Install the Omni-Path Fabric Software</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Configure and verify the Intel chassis. Refer to Configure Intel Chassis</td>
<td></td>
</tr>
</tbody>
</table>

continued...
<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
<th>Complete</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.</td>
<td>Install and configure the Fabric Manager. Refer to Install Intel® Omni-Path Fabric Suite Fabric Manager GUI on page 77</td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>Configure the firmware on the externally managed Intel switches. Refer to Configure Externally Managed Switches</td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>Install Intel® Omni-Path Software on the remaining servers. Refer to Install Intel Omni-Path Fabric Host Software on the Remaining Servers</td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>Verifying Intel® Omni-Path Software on the remaining servers. Refer to Verify Intel Omni-Path Fabric Host Software on the Remaining Servers</td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td>Install Intel® Omni-Path Fabric Suite on additional Fabric Management Nodes. Refer to Installation of Additional Fabric Management Nodes</td>
<td></td>
</tr>
<tr>
<td>10.</td>
<td>Configure and initialize health check tools. Refer to Configure and Initialize Health Check Tools</td>
<td></td>
</tr>
<tr>
<td>11.</td>
<td>Run the High Performance Linpack application. Refer to Running High Performance Linpack</td>
<td></td>
</tr>
</tbody>
</table>