RedHawk™ OpenFabrics Enterprise Distribution (OFED) Version 4.2 Installation Guide

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READ ME BEFORE INSTALLING THIS PRODUCT

concurrent

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1.0 Overview

This document provides release information and discusses how to install, configure and uninstall RedHawk™ OpenFabrics Enterprise Distribution (OFED), model number WA9020-L, Version 4.2 on a system running the RedHawk Linux® Version 4.2 operating system.

1.1 Product Description

RedHawk OpenFabrics Enterprise Distribution (OFED) is a collection of software components intended for use on a computer cluster constructed as an InfiniBand network.

InfiniBand (IB) is a low-latency, high-performance, serial I/O interconnect. Its serial bus is bidirectional, with 2.5Gbps single-data rate (SDR) throughput in each direction per connection. It also supports double-data rate (DDR) and quad-data rate (QDR) for 5Gbps and 10Gbps throughput. Aggregating links dramatically increases throughput. For example, a quad-rate 12X link can push data at 120Gbps. And InfiniBand can run across copper or fiber-optic cabling.

InfiniBand is deployed primarily in server clusters ranging from two to thousands of nodes. In addition to connecting servers, InfiniBand can also be used to connect communications and storage fabrics in data centers. The technology can also support block- or file-based transfers.

RedHawk OFED is based on the OFED 1.1 distribution, which is based on the 'gen2' version of the OpenIB/OpenFabrics InfiniBand stack.

NOTE

If you plan to upgrade the OFED package on your cluster, please upgrade all the nodes to this new version.

RedHawk OFED is an optional product that can be installed on systems running the corresponding version of the RedHawk Linux operating system; for example, RedHawk OFED Version 4.2 on a RedHawk 4.2 system.

Some of the main components that make up this distribution are:

- Support for Mellanox Host Controller Adapters (HCAs)

- Support for PathScale InfiniPath HCAs (x86_64 platforms only)

- Internet Protocol over InfiniBand

- SRP - Support for SCSI Remote Direct Memory Access (RDMA) Protocol Initiator over InfiniBand

- SDP - Support for Sockets Direct Protocol over InfiniBand
  NOTE: This support is Beta quality.

- OpenSM InfiniBand Subnet Manager

- OSU/MPICH Argonne National Laboratory Message Passing Interface (MPI) implementation

- Open MPI

- MPI Benchmark tests (OSU BW/LAT, Pallas, Presta)

- Diagnostic tools

- Performance tests

1.2   Documentation

1.2.1   OFED Documentation

After installation of RedHawk OFED, the following documentation files are located in the **/usr/local/ofed/docs** directory:

diags_release_notes.txt   Describes the diagnostic tools provided in the OFED 1.1 release.

ehca_release_notes.txt   Contains information about the IBM GX-based HCAs, which are ***not*** supported on RedHawk Linux systems.

HOWTO.build_ofed   Describes how to build OFED 1.1 from the original Subversion source-controlled source and kernel git-based source. This information is only for those customers that wish to build a version of the OFED release from scratch by pulling in the source code from locations across the internet.

ibutils_release_note.txt   Describes the tools provided in the ibutils rpm.

ipath_release_notes.txt   Provides information about QLogic HCAs.

ipoib_release_notes.txt   Provides information about the IP over InfiniBand (ipoib) support.

iser_release_notes.txt   Provides information about the iSER support and links to additional information. The iSER support is ***not*** available on RedHawk Linux systems.

MPI_README.txt   Documentation for both the MVAPICH and Open MPI support.

mthca_release_notes.txt   Provides information about the Mellanox Technologies HCAs.

OFED_Installation_Guide.txt
          Contains useful information about the overall OFED 1.1 distribution. Note, however, that the OFED 1.1 binary and source rpms have already been prepared for use on a RedHawk system, so the information in this file about how to download, build and install the OFED 1.1 distribution does not apply to the RedHawk release.

OFED_release_notes.txt   The OFED 1.1 release notes.

OFED_tips.txt   Contains tips on using the OFED utilities and locking user pages.

open_mpi_release_notes.txt
          Contains information about the Open MPI message passing interface support.

opensm_release_notes.txt

Contains information about the Open Subnet Manager for the OFED 1.1 distribution.

osu_mpi_release_notes.txt

Contains information about the OSU MPI MVAPICH support.

PERF_TEST_README.txt

Describes the performance tests provided in the OFED 1.1 release.

sdp_release_notes.txt   Contains information about the SDP Socket Direct Protocol support in the OFED 1.1 distribution.

srp_release_notes.txt   Contains information about the SCSI RDMA Protocol (SRP) Initiator support in the OFED 1.1 distribution.

uDAPL_release_notes.txt   Contains information about the User-level Direct Access Programming Library interface in OFED 1.1.

1.2.2   RedHawk Linux Documentation

The following table lists RedHawk Linux documentation. Click on the red entry to display the document PDF. These documents are also available by clicking on the "Documents" icon on the desktop and from Concurrent's web site at **www.ccur.com**.

RedHawk Linux Operating System Documentation	Pub No.
RedHawk Linux Release Notes Version x.x	0898003
RedHawk Linux User's Guide	0898004
RedHawk Linux Frequency-Based Scheduler (FBS) User's Guide	0898005
Real-Time Clock and Interrupt Module (RCIM) PCI Form Factor User's Guide	0898007
iHawk Optimization Guide	0898011
RedHawk Linux FAQ	N/A

where *x.x* = release version

1.3   Syntax Notation

The following notation is used throughout this document:

italic   Books, reference cards, and items that the user must specify appear in *italic* type. Special terms may also appear in *italic*.

list bold   User input appears in **list bold** type and must be entered exactly as shown. Names of directories, files, commands, options and man page references also appear in **list bold** type.

`list`	Operating system and program output such as prompts, messages and listings of files and programs appears in `list` type.
`[]`	Brackets enclose command options and arguments that are optional. You do not type the brackets if you choose to specify these options or arguments.
hypertext links	When viewing this document online, clicking on chapter, section, figure, table and page number references will display the corresponding text. Clicking on Internet URLs provided in **blue** type will launch your web browser and display the web site. Clicking on publication names and numbers in **red** type will display the corresponding manual PDF, if accessible.

2.0   Prerequisites

2.1   Software

- RedHawk Linux Version 4.2

2.2   Hardware

- Two or more Concurrent iHawk or ImaGen systems.

- A free x8 or x4 PCI Express slot and compatible Host Controller Adapter (HCA) card, or a free PCI-X slot and compatible HCA card.

  NOTE: It is highly recommended that you place an x8 HCA PCIe card only in an x8 PCIe slot. Placing an x8 HCA PCIe card in a x4 PCIe slot will result in lower InfiniBand throughput and may also cause the entire system to become sluggish under heavy InfiniBand traffic loads.

  The supported HCA cards for OFED 1.1 are:

Mellanox Device	Description	FW Versions
MT23108	InfiniHost	fw-23108 Rev. 3.5.000 (and later)
MT25204	InfiniHost III Lx	fw-25204 Rev. 1.1.000 (and later)
MT25208	InfiniHost III Ex (InfiniHost Mode)	fw-25208 Rev. 4.7.600 (and later)
MT25208	InfiniHost III Ex (MemFree Mode)	fw-25218 Rev. 5.1.400 (and later)

  QLogic/PathScale iPath Devices (x86_64 platforms only):

  QHT6040 (PathScale InfiniPath HT-460)
  QHT6140 (PathScale InfiniPath HT-465)
  QLE6140 (PathScale InfiniPath PE-880)

- You may connect two HCA cards together without using an InfiniBand switch, but an IB switch will be needed to connect more than two HCAs.

  The OFED 1.1 distribution was tested with switches and gateways provided by the following companies:

    - Cisco
    - Voltaire
    - SilverStorm
    - Flextronics

3.0   Installation

This section describes how to install RedHawk OFED on systems running RedHawk Linux 4.2.

3.1   Installing RedHawk OFED

To install RedHawk OFED, perform the following steps:

1. With RedHawk Linux Version 4.2 running, log in as root and take the system down to single-user mode:

    a. Right click on the desktop and select Open Terminal.

    b. At the system prompt, type **init 1**.

2. Insert the disc labeled "RedHawk OpenFabrics Enterprise Distribution" appropriate to your system's architecture into the CD-ROM drive.

3. To mount the cdrom device, execute the following command:

   mount /media/cdrom

4. To install, execute the following commands:

   cd /media/cdrom
   ./install-ofed

   Follow the on-screen instructions.

NOTE

The 1.0-1 version of OFED is part of Red Hat Enterprise RHEL4-U4, which was installed on your system before RedHawk Version 4.2. You should say 'yes' if prompted to uninstall this older 1.0-1 Red Hat version of OFED.

Near the end of installation, you will be asked whether you would like to configure your OFED setup. Note that you may (re)configure your OFED configuration at any time by either using the **/usr/local/ofed/bin/ofed_configure** script or by directly modifying the OFED configuration files.

5. When the installation completes, execute the following commands to unmount the device and remove the disc. If you wish to access the source RPMs that are also on this disc, refer to section 3.2 before executing these commands.

   cd /
   umount /media/cdrom
   eject

6. Remove the disc from the CD-ROM drive and store. Exit single-user mode (Ctrl-D).

NOTE

This procedure installs the **/etc/profile.d/ofed.[c]sh** file on your system. As a result, the PATH environment variable will now include the **/usr/local/ofed/bin** directory. This directory contains many of the InfiniBand utilities and commands that are part of the OFED release.

7. Access the RedHawk Updates web site at **http://redhawk.ccur.com** to determine if any updates to this product have been issued. If so, they can be downloaded at this time by following the directions supplied on the web site.

8. Proceed to section 4.0 to configure RedHawk OFED on your system.

3.2 OFED Software Source

Also located on the "RedHawk OpenFabrics Enterprise Distribution" disc is the original source used to build the OFED 1.1 binary RPMs. If you wish to access this source, follow the steps below.

1. Insert the disc and mount the cdrom device if not already done:

   mount /media/cdrom

2. List the directory contents where the source tarballs are located:

   ls /media/cdrom/.redhawk/source

   In this directory there are two source tarballs:

   OFED-1.1.tgz
   > This is the original OFED 1.1 release tarball source that was taken from the OpenIB web site, located at:
   > **http://www.openfabrics.org/downloads.htm**

   OFED-1.1-RedHawk.tgz
   > This is the version of the OFED 1.1 tarball that was modified for RedHawk 4.2 builds. Most of the changes in this version deal with removing the kernel source from the generated binary RPMs, since the RedHawk kernel source tree already contains the OFED 1.1 kernel source.

3. To examine the contents of either of the above tarballs, change directory to a location on a filesystem where you have write access, and then perform the following commands:

   cp /media/cdrom/.redhawk/source/OFED-1.1[-RedHawk].tgz .
   tar -xzf OFED-1.1[-RedHawk].tgz

   You may examine, for example, the openib source by unpacking the openib tarball located in this SOURCE directory:

   cd OFED-1.1/SOURCES
   tar -xzf openib-1.1.tgz
   cd openib-1.1

   In addition to the tarball source, there are also some source RPMs provided in the OFED tarball:

   cd OFED-1.1/SRPMS

   The source RPMs included in this directory are:

   ibutils   Contains the source for the InfiniBand network and path diagnostics.

   mpitests   Contains a set of popular MPI benchmarks.

ofed-docs Contains the OpenIB documentation

ofed-scripts

      Contains the `uninstall.sh`, `ofed_info` and `ofed_configure` scripts.

openib Contains most of the core OpenIB source.

      NOTE: While this RPM also contains the InfiniBand kernel module source, the IB kernel module source has already been merged into the RedHawk kernel source RPM and available as pre-built modules in the RedHawk kernel object RPMs.

openmpi Contains the source for the Open MPI support.

4.0   Configuration

4.1   Configuring the Kernel

The INFINIBAND kernel tunables are configured as modules by default in the pre-built RedHawk kernels.

To modify this support, access the `Device Drivers -> Infiniband support` selection of the Kernel Configuration GUI. For details on how to configure the RedHawk kernel, refer to the "Configuring and Building the Kernel" chapter of the *RedHawk Linux User's Guide*.

4.2   Updating Configuration Files

After installation, you must modify some of the system configuration files before starting up the InfiniBand system initialization script(s).

To update the configuration files, you may either make use of the interactive script **/usr/local/ofed/bin/ofed_configure**, or you may directly edit the following set of files that **ofed_configure** modifies.

NOTE

There are additional environment variables in the **/etc/opensm.conf** configuration file that are not modified by the **ofed_configure** script. If you wish to modify any of these additional OpenSM environment variables, then you must manually modify the **opensm.conf** file.

/etc/sysconfig/network-scripts/ifcfg-ib0
> This file contains the IP over InfiniBand (IPoIB) environment variables for using the IB HCA as a subnet interface. The **ofed_configure** script may be used to modify the environment variables in this file. Whenever you modify this file with **ofed_configure** or manually with a text editor, you must configure the HCA interface with a static IP address instead of the OFED-default DHCP-based IP address. The environment variables for this file are similar to those that are used for ethernet devices with static IP addresses. Additionally, the InfiniBand HCA interface(s) should be configured on subnet(s) that are separate from any ethernet interfaces that may be present on the system.

/etc/sysconfig/network-scripts/ifcfg-ib1
> If you have more than one InfiniBand HCA card, or an HCA card with multiple ports, you should also update any additional ifcfg-ib*N* files that are appropriate.

/etc/opensm.conf
> If you plan to use this system to run the Open Subnet Manager as either the master or standby, you should modify the OSM_HOSTS_LIST environment variable in this file.

The InfiniBand IP address(es) of those HCA/hosts that may act as the Subnet Manager should be added to this list.

If you decide to run opensm on your system and want it started automatically during system boot, set the ONBOOT environment variable to "yes". Alternatively, you can manually start opensm by issuing a "service opensmd start" command; the "service opensmd status" command will indicate whether or not opensm is currently running.

Additional OpenSM configuration parameters can be modified if the CACHE_OPTIONS parameter in this file is set to CACHE_OPTIONS="--cache-options". This causes the additional configuration parameters to be output into a file called **opensm.opts** in the directory defined by the OSM_CACHE_DIR environment variable (the default is the **/var/cache/osm** directory). After modifying the **opensm.opts** file, issue the "service opensmd restart" command for the changes to be used.

NOTE: In order for the InfiniBand network to function properly, there must be at least one subnet manager running within the network.

/etc/infiniBand/openib.conf

This file controls which InfiniBand kernel module support will be loaded when the **/etc/init.d/openibd** script is executed.

The following environment variables are currently defined in this file, and each variable should be set to either 'yes' or 'no':

ONBOOT   Controls whether the OpenIB/OFED modules are loaded automatically during system boot. If this environment variable is not set, you must manually start up the OFED environment after booting the system with a "service openibd start" command, and also a "service opensmd start" command if you are also running opensm on your system.

UCM_LOAD   Controls the loading of the 'ib_cm' Connection Management module.

RDMA_CM_LOAD   Controls the loading of the 'rdma_cm' generic RDMA CM agent module.

RDMA_UCM_LOAD   Controls the loading of the 'rdma_ucm' RDMA Userspace Connection Manager Access module.

RENICE_IB_MAD   Controls whether the ib_mad (InfiniBand Management Datagram) kernel daemon's scheduling priority is increased from the default value.

MTHCA_LOAD

> Controls the loading of the 'ib_mthca' Mellanox InfiniBand HCA low-level driver.

IPATH_LOAD

> Controls the loading of the 'ib_ipath' QLogic InfiniPath HCA driver (x86_64 only).

IPOIB_LOAD

> Controls the loading of the 'ib_ipoib' IP-over-InfiniBand network driver.

SDP_LOAD

> Controls the loading of the 'ib_sdp' Sockets Direct Protocol module.

SRP_LOAD

> Controls the loading of the 'ib_srp' SCSI RDMA Protocol initiator module.

IPOIBHA_ENABLE

> Controls whether the IP over InfiniBand's high availability user space daemon should be enabled (yes/no). (This is a Beta quality feature.)
>
> This feature is only for those systems with multiple HCA ports. If this support is enabled and the primary port goes down, IPoIB traffic will automatically be sent through the secondary HCA port, and the secondary port becomes the primary port.
>
> When this feature is enabled, the IPoIB High Availability daemon will configure the secondary IPoIB interface with the configuration parameters of the primary IPoIB interface (so that the secondary interface assumes the IP identity of the primary interface).

PRIMARY_IPOIB_DEV

> When IPOIBHA_ENABLE=yes, this environment variable may be used to denote the primary IPoIB device. For example, "PRIMARY_IPOIB_DEV=ib0" or "PRIMARY_IPOIB_DEV=ib1".
>
> If this prmary environment variable is not defined, the primary IPoIB device defaults to HCA port 'ib0'.

SECONDARY_IPOIB_DEV

> When IOPIBHA_ENABLE=yes, this environment variable may be used to denote the secondary/backup IPoIB device.
>
> If this environment variable is not defined, the secondary IPoIB device defaults to HCA port 'ib1'.

SRPHA_ENABLE Controls whether the SCSI RDMA Protocol Initiator high availability daemon should be enabled (yes/no). (This is a Beta quality feature.)

> This feature is *not* currently supported under RedHawk linux.

4.3   Enabling Support

Once you have updated the above configuration files, you may then reboot the system to enable the InfiniBand support, or issue the following commands:

/sbin/service openibd start
/sbin/service opensmd start   (if you are running opensm on your host)

5.0   Binary RPMs

The following binary rpms are included in the OFED 1.1 release:

dapl
Userspace DAT and Direct Access Programming Library (DAPL) API.
Along with the OpenIB kernel drivers, libdat and libdapl provides a userspace Remote Direct Memory Access (RDMA) API that supports the Direct Access Transport (DAT) 1.2 specification.

dapl-devel
Development files for the libdat and libdapl libraries.
Static libraries and header files for the libdat and libdapl library.

ibutils
OpenIB Mellanox InfiniBand Diagnostic Tools.
ibutils provides IB network and path diagnostics.

ipoibtools
The IP over IB High Availability daemon support.

kernel-ib
InfiniBand system configuration files.
Core, Hardware and User-Level Protocol configuration files.

NOTE: The IB kernel module pre-built object and module source are contained in the appropriate RedHawk kernel rpms. Therefore, this rpm only contains the system configuration files.

libibcm
Userspace InfiniBand Connection Manager (CM).
Along with the OpenIB kernel drivers, libibcm provides a userspace InfiniBand CM API.

libibcm-devel
Development files for the libibcm library.

libibcommon
OpenIB InfiniBand Management and Diagnostic Tools.
libibcommon provides common utility functions for the InfiniBand (IB) diagnostic and management tools.

libibcommon-devel
Development files for the libibcommon library.

libibmad
OpenIB InfiniBand Management and Diagnostic Tools.
libibmad provides low layer IB functions for use by the IB diagnostic and management programs. These include MAD, Subnet Administration (SA), Subnet Management Packet (SMP), and other basic IB functions.

libibmad-devel
Development files for the libibmad library.

libibumad
OpenIB InfiniBand Management and Diagnostic Tools.
libibumad provides the user Management Datagram (MAD) library functions which sit on top of the user MAD modules in the kernel. These are used by the IB diagnostic and management tools, including OpenSM (Open Subnet Manager).

libibumad-devel
Development libraries and header file for the libibumad library.

libibverbs	A library for direct userspace use of InfiniBand. libibverbs is a library that allows userspace processes to use InfiniBand "verbs" as described in the InfiniBand Architecture Specification. This includes direct hardware access for fast path operations.
libibverbs-devel	Development files for the libibverbs library. Static libraries and header files for the libibverbs verbs library.
libibverbs-utils	Useful libibverbs example programs such as ibv_devinfo, which displays information about InfiniBand devices.
libipathverbs	PathScale InfiniPath HCA Userspace Driver (x86_64 only). libipathverbs provides a device-specific userspace driver for PathScale HCAs. The InfiniPath QHT6000 Series and InfiniPath QLE6000 Series are currently supported.
libipathverbs-devel	Development files for the libipathverbs driver (x86_64 only). Static version of libipathverbs that may be linked directly to an application, which may be useful for debugging.
libmthca	Mellanox InfiniBand HCA Userspace Driver. libmthca provides a device-specific userspace driver for Mellanox HCAs for use with the libibverbs library. InfiniHost, InfiniHost III Ex (both memory and memfree), and InfiniHost III Lx are supported, including both SDR and DDR InfiniHost III families.
libmthca-devel	Development files for the libmthca driver. Static version of libmthca that may be linked directly to an application, which may be useful for debugging.
libopensm	The library for OpenSM.
libopensm-devel	Static libopensm component libraries and header files for OpenSM.
libosmcomp	The OS component library for OpenSM.
libosmcomp-devel	Static OS component libraries and header files for OpenSM.
libosmvendor	The vendor library for OpenSM.
libosmvendor-devel	Static vendor libraries and header files for OpenSM.
librdmacm	Remote Direct Memory Access (RDMA) Connection Manager (CM) library.
librdmacm-devel	Development files for the librdmacm library.
librdmacm-utils	Utilities for the librdmacm library.
libsdp	LD_PRELOAD-able library for using SDP. libsdp can be LD_PRELOAD-ed to have a sockets application use InfiniBand Sockets Direct Protocol (SDP) instead of TCP, transparently and without recompiling the application.

mpich_mlx_gcc Argonne National Laboratory MPI implementation.
MPICH is an open-source and portable implementation of the
Message-Passing Interface (MPI, **www.mpi-forum.org**). MPI is a
library for parallel programming, and is available on a wide range
of parallel machines, from single laptops to massively parallel
vector parallel processors. MPICH includes all of the routines in
MPI 1.2, along with the I/O routines from MPI-2 and some
additional routines from MPI-2, including those supporting MPI
Info and some of the additional datatype constructors. MPICH
was developed by Argonne National Laboratory. See
www.mcs.anl.gov/mpi/mpich for more information.

mpitests_mpich_mlx_gcc
MPI Benchmarks and tests.
Provides a set of popular MPI benchmarks for MPICH: IMB-2.3,
Presta-1.4.0 and OSU benchmarks version 2.2.

mpitests_openmpi_gcc
MPI Benchmarks and tests.
Provides a set of popular MPI benchmarks for Open MPI: IMB-
2.3, Presta-1.4.0 and OSU benchmarks version 2.2.

mstflint Burning Firmware Application.
This package contains a burning tool for Mellanox manufactured
HCA cards. It also provides access to the relevant source code.

ofed-docs OpenFabrics documentation.
Contains various installation and release notes for the various
components of the OFED release.

ofed-scripts OpenFabrics scripts.
This rpm contains an **uninstall.sh** script for removing all
OFED 1.1 binary rpms, an **ofed_configure** script, which may
be used to update the OFED system configuration files, and an
ofed_info script, which displays OFED revision information.

openib-diags OpenIB InfiniBand Diagnostic Tools.
diags provides IB diagnostic programs and scripts needed to
diagnose an IB subnet.

openmpi_gcc A powerful implementation of MPI.
Open MPI is a project combining technologies and resources from
several other projects (FT-MPI, LA-MPI, LAM/MPI, and PACX-
MPI) in order to build the best MPI library available. This rpm
contains all the tools necessary to compile, link, and run Open
MPI jobs.

opensm InfiniBand Subnet Manager (SM) and administration.
OpenSM provides an implementation for an InfiniBand Subnet
Manager and Administration. Such a software entity is required to
run in order to initialize the InfiniBand hardware (at least one per
each InfiniBand subnet).

perftest IB Performance tests.
InfiniBand OpenIB generation 2 (gen2) uverbs microbenchmarks.

srptools   Tools for SRP/IB.
          In conjunction with the kernel ib_srp driver, srptools allows you
          to discover and use SCSI devices via the SCSI RDMA Protocol
          over InfiniBand.

tvflash   Tool to manage Mellanox HCA firmware flash memory.
          tvflash is used to query and update the firmware flash memory
          attached to Mellanox InfiniBand HCAs.

6.0   Uninstall

To remove all of the RedHawk OFED software and rpms, perform the following steps:

1. Log in as root and take the system down to single user mode:

   init 1

2. Execute the following command to remove all RedHawk OFED support:

   /usr/local/ofed/uninstall.sh

3. Issue a "reboot" command to reboot your system:

   reboot

As an alternative, the following steps can be followed using the "RedHawk OpenFabrics Enterprise Distribution" installation disc:

1. Insert the disc and mount the cdrom device:

   mount /media/cdrom

2. To uninstall, execute the following commands:

   cd /media/cdrom
   ./uninstall-ofed

3. When complete, execute the following commands to unmount the device and remove the disc.

   cd /
   umount /media/cdrom
   eject

Uninstall