



# Linux® OS Version 1.4 Release Notes

January 12, 2004

0898003-1.4a

**READ ME BEFORE  
INSTALLING  
THIS PRODUCT**



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## 1.0. Introduction

This document provides release information and installation instructions for Concurrent Computer Corporation's RedHawk™ Linux® operating system Version 1.4.

RedHawk Linux is included with each Concurrent iHawk™ Series 860 system. RedHawk Linux, which includes the Red Hat® Linux distribution, is a unique Linux kernel that has been modified for deterministic real-time processing. For a complete discussion of the real-time enhancements included in this release of RedHawk Linux, see Table 8-1 on page 25.

The iHawk Series 860 features from one to eight Intel® Pentium® Xeon™ processors in a single rackmount or tower enclosure. The iHawk 860G is a one or two processor, high-performance AGP/PCI-based platform for real-time imaging applications. The iHawk systems offer leading-edge integrated circuit and packaging technology. iHawks are true symmetric multiprocessors (SMPs) that run a single copy of the RedHawk Linux real-time operating system. All CPUs in a system are linked by a high-speed front-side processor bus and have direct, cache-coherent access to all of main memory.

RedHawk Linux supports Concurrent's powerful set of NightStar™ development tools. Users can schedule, monitor, debug and analyze their real-time applications on iHawk multiprocessor systems or remotely from a desktop PC or laptop. Each tool runs on the iHawk target system non-intrusively, thus preserving the deterministic characteristics of the real-time application.

The following CDs are delivered with RedHawk Linux Version 1.4:

Label on Disc		Qty
Red Hat 8.0		6
Red Hat 8.0 Update CD for RedHawk Linux	LXUPDATE Version 1.4 WA9086-J	1
RedHawk Linux OS	WA9086-J Version 1.4	1
RedHawk Linux Documentation CD	LXDOCKIT Version 1.4 WA9086-J	1

The following optional CDs may also be provided:

Label on Disc		Qty
RedHawk Linux NightStar Tools	WU1220-LDV NightStar Tools Version <i>x.x</i> (where <i>x.x</i> = latest version)	1
RedHawk Linux Frequency-Based Scheduler	WU1210-JL Version 1.4	1

### Warning

While much of the software included on the RedHawk Linux CDs is licensed under the GNU GPL license, there are some components that are not released under this license. Therefore, these CDs cannot be freely copied.

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## 2.0. Documentation

### 2.1 RedHawk Linux Documentation

Table 2-1 lists the documentation provided by Concurrent as PDF files on the RedHawk Linux documentation CD.

NightStar Tools documentation is included as PDF files on the RedHawk Linux NightStar Tools CD.

Updates to Concurrent documentation as PDF files can be downloaded from the RedHawk Updates web site. Refer to *Software Updates and Support* on page 37 for more information. Documentation is also available from Concurrent's web site at <http://www.ccur.com>.

Note that printed copies of Concurrent documentation can be ordered by contacting the Concurrent Software Support Center. The toll-free number for calls within the continental United States is 1-800-245-6453. For calls outside the continental United States, the number is 1-954-283-1822.

**Table 2-1 RedHawk Linux Documentation**

Manual Name	Document Number
<i>RedHawk Linux Online Documentation Roadmap</i>	0898002-300
<i>RedHawk Linux OS Version 1.4 Release Notes</i>	0898003-1.4a
<i>RedHawk Linux User's Guide</i>	0898004-300
<i>Frequency-Based Scheduler (FBS) User's Guide</i>	0898005-110
<i>Real-Time Clock &amp; Interrupt Module (RCIM) PCI Form Factor User's Guide</i>	0898007-200

### 2.2 Vendor Documentation

Documentation provided by Red Hat is included on the Red Hat CDs delivered with RedHawk Linux.

Commercial off-the-shelf (COTS) documentation applicable to your iHawk Series 860 is included with the system. Contact your local Dell sales office to purchase additional copies.

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## 3.0. Prerequisites

### 3.1 Software

- Red Hat Linux Release 8.0
- RedHawk Linux operating system Version 1.4

### 3.2 Hardware

- Any iHawk Series 860 system
- Real-Time Clock and Interrupt Module (RCIM)

## 4.0. Version 1.4 Installation Procedures

iHawk systems are normally shipped fully installed. The installation procedures provided below need only be used in the event a system must be regenerated. **If you have a previous release of RedHawk installed and want to upgrade to Version 1.4, refer to *Upgrading from a Previous Release* on page 12 for detailed instructions.**

### Review the following points before installing the software:

- It is recommended that the installer first read through the entire installation procedure once before actually performing the installation.
- It is **strongly recommended** that installation and updates of software be performed in single-user mode to guard against the possibility of corrupting a running application.
- The installation media in use is accessed at various times and must be kept in the drive during the installation until you are instructed to install different media.
- Prior to installation, remove any floppy media that may have been left in the machine.
- Disc install times specified below may vary and are only provided as a guideline.

### Before you start:

- You need to know the system's main memory size in order to properly set up the file system swap size. If you are not sure of the main memory size, access the system's BIOS to ascertain this information.
- If you plan to configure networking using fixed numbers (recommended), you will need to have the following information for your system before beginning the installation:
  - IP address
  - netmask address
  - gateway address
  - primary and secondary DNS addresses

## 4.1 Installing Red Hat Software

The Red Hat Linux software must be installed on the system before RedHawk Linux. Complete the following steps to install and configure Red Hat. Refer to Online Help if needed.

1. Power on the system, if needed, to open the CD-ROM drawer.
2. Insert Red Hat 8.0 installation disc 1 of 3 in the CD-ROM drive and power down the system.
3. Power on the system with the Red Hat 8.0 disc 1 of 3 installed in order to boot from the disc. A full screen of choices is displayed. Only one item can be chosen. At the **boot:** prompt, choose "To Install or upgrade Red Hat Linux in graphical mode," then click ENTER.

You have the option to test the Red Hat media for errors. If you wish to do so, click OK, otherwise, select **Skip** and then click ENTER.

- At the **Welcome** sub-menu, click **Next**.



- At the **Language Selection** sub-menu:  
Choose English language. Click **Next**.
- At the **Keyboard** sub-menu:  
Accept keyboard defaults. Click **Next**.
- At the **Mouse Configuration** sub-menu:  
Select the appropriate mouse model.  
**Note:** Click the “Emulate 3 buttons” box at bottom of page if using a 2 button mouse. Click **Next**.
- At the **Installation Type** sub-menu:  
Choose the “Custom” install. Click **Next**.
- At the **Disk Partitioning Setup** sub-menu:  
Choose “Manually Partition with Disk Druid” and click **Next** to partition the disk manually and create the partition sizes as shown in Table 4-1 below. Note that this table shows recommended partition sizes for a 36 GB disk or larger.

#### **Note**

In the next step, all partitions must be placed on disk **/dev/sda**. If the system has multiple drives, you must un-select all other drives as shown in the “Allowable Drives:” section of the Add Partition setup menu.

- At the **Partitioning** sub-menu, first delete all existing partitions by highlighting each line and clicking **DELETE**. This must be done one partition at a time. To add partitions, highlight the disk drive and click **NEW**. Select the “Force to be primary partition” and “Check for bad blocks” boxes at the bottom of each partition setup page. Click **OK** to continue to set up the next partition.

**Table 4-1 Recommended Disk Partition Sizes**

Mount Point	Type	Filesystem Type	Partition Size
<b>/boot</b>	primary	ext3	100 MB
<b>/</b>	primary	ext3	16384 MB (16 GB)
<b>swap</b> (See Note below)	primary	swap	Size of system’s main memory <b>plus</b> 5 percent additional. (See Table 12-1 on page 36 for suggested swap sizes.)
<b>/home</b>	primary	ext3	Fill to maximum allowable size
<b>Note:</b> Select File System Type on the Add Partition menu to select the <b>swap</b> file system. Enter recommended size.			

- Click **Next** when finished with partitioning.

- At the **Boot Loader Configuration** sub-menu:  
Accept GRUB boot loader defaults. Enter grub password if desired (not recommended). Click **Next**.
- At the **Network Configuration** sub-menu:  
Configure networking as appropriate (fixed network numbers are recommended - you will need address information if using fixed numbers). Refer to Online Help for additional instructions. Click **Next** after completion.
- At the **Firewall Configuration** sub-menu:  
Choose “No firewall”, then click **Next**.
- At the **Additional Language Support** sub-menu:  
Choose any additional languages as necessary. Click **Next** at completion.
- At the **Time Zone Selection** sub-menu:  
Select appropriate time zone, then click **Next**.
- At the **Account Configuration** sub-menu:  
Enter root password, then click **Next**.
- At the **Authentication Configuration** sub-menu:  
Accept defaults, click **Next**.
- At the **Package Group Selection** sub-menu:  
Scroll down to bottom of list and select “Everything.” Click **Next**.
- At the **About to install** page, click **Next**.

At this point in the installation, the disk will format and packages on Red Hat 8.0 installation disc #1 will be installed. After approximately 20 minutes, you will be prompted to insert disc #2. Remove disc #1 and insert disc #2, then click **OK**. After another 20 minutes elapses (approximately) you will be prompted to insert disc #3. Remove disc #2 and insert disc #3, then click **OK**.

After approximately 15 minutes, you should get a pop-up mini-page stating the system is “Performing post installation configuration”.

- At the **Boot Disk Creation** sub-menu:  
Choose “Yes, I would like to create a boot disk”. Click **Next**. You will be prompted to insert a diskette. Insert diskette, and click “Make boot disk”. The system responds with “Creating boot disk...”.
  - At the **Graphical Interface (X) Configuration** sub-menu:  
Accept defaults, click **Next**.
  - At the **Monitor Configuration** sub-menu:  
Accept monitor defaults, click **Next**.
  - At the **Customize Graphical Configuration** sub-menu:  
Choose “Graphical” login, click **Next**.
4. At the next window prompt, click **Exit** to reboot the system. Verify that Red Hat boots up properly.

5. Remove any media from respective drives and store.
6. Once the system boots up successfully, proceed as follows:
  - At the **Welcome** sub-menu click **Forward** to continue.
  - At the **Date and Time Configuration** sub-menu:  
Set the appropriate date and time and click **Forward** to continue.
  - At the **Red Hat Update Agent** sub-menu:  
Select “No, I do not want to register my system.” Click **Forward** to continue.
  - At the **Install Additional Software** sub-menu:  
Three choices should appear. Read the instructions before proceeding. If you have any of the CDs referred to, you may install them now.
  - At the **Finished Setup!** sub-menu:  
Click **Forward** to continue.
7. Initial Red Hat installation is now complete. The login window should appear at this point. Remove any media from respective drives. Continue with the steps in section 4.2 to install Red Hat software updates.

## 4.2 Installing Red Hat Software Updates

The disc labeled “Red Hat 8.0 Update CD for RedHawk Linux Version 1.4” contains the latest updates released by Red Hat and validated against RedHawk Linux. These updates are important to the proper operation of RedHawk Linux.

To install the Red Hat software updates, perform the following steps.

1. Log in as root and take the system down to single-user mode:
  - a. Right click on the desktop and select **New Terminal**.
  - b. At the system prompt, type **init 1**.
2. Locate the disc labeled “Red Hat 8.0 Update CD for RedHawk Linux Version 1.4” and insert into the CD-ROM drive.
3. If the cdrom device does not mount automatically, execute the following command:

```
mount /mnt/cdrom
```

4. Execute the following commands to install the update software:

```
cd /mnt/cdrom  
./install-updates
```

Follow the on-screen instructions until the installation script completes. This will take some time to complete.

5. Upon completion of software installation, execute the following commands:

```
cd /  
umount /mnt/cdrom  
eject
```

6. Remove the disc from the CD-ROM drive and store.
7. **Perform this step ONLY if you are installing on a single processor system.** If installing on a multiprocessor system, skip to the next step.

Execute the following:

```
rpm -e kernel-smp
```

8. Exit single-user mode (**^D**), reboot and verify that the new kernel boots. Continue with the steps in the next section to install RedHawk Linux.

### 4.3 Installing RedHawk Linux

After installing Red Hat 8.0 and its updates, perform the following steps to install RedHawk Linux:

1. Log in as root and take the system down to single-user mode:
  - a. Right click on the desktop and select **New Terminal**.
  - b. At the system prompt, type **init 1**.

2. Locate the disc labeled “RedHawk Linux OS Version 1.4” and insert into the CD-ROM drive.

3. If the cdrom device does not mount automatically, execute the following command:

```
mount /mnt/cdrom
```

4. Execute the following commands to install RedHawk Linux:

```
cd /mnt/cdrom  
./install-redhawk
```

Follow the on-screen instructions until the installation script completes.

5. Upon completion of software installation, execute the following commands:

```
cd /  
umount /mnt/cdrom  
eject
```

6. Remove the disc from the CD-ROM drive and store. Exit single-user mode (**^D**). Check for RedHawk updates as outlined in the following section.

### 4.4 Installing RedHawk Updates

If there are any updates to this release available for downloading from Concurrent’s web site, they should be installed now. Follow these steps:

1. In multi-user mode, access the **redhawk.ccur.com** web site.
2. Log onto the site using the login and password provided by Concurrent.

3. A list of packages that you have not yet downloaded will display. Click on the packages to download them and save them in a suitable location (e.g. `/root/updates`).
4. Return to single-user mode as root.
5. To install the newly downloaded packages, change directory to the location of the updates and issue the following command:

```
rpm -Fvh *.rpm
```

The command should complete successfully, though it may take several minutes depending on the number of updates being installed.

6. Exit single-user mode (`^D`). Reboot the system\* choosing the new RedHawk kernel and verify that the system boots properly. Continue with section 4.5 if an RCIM is to be installed or section 4.6 to install FBS.

\* **Note:** If this system is a model 868 8-way iHawk, disable hyper-threading through the BIOS. Refer to the hardware documentation for the appropriate setting.

## 4.5 Installing the RCIM

The following serves as an installation checklist for installing a PCI RCIM in an iHawk system. If an RCIM is not installed in your system, it should be installed now. Refer to the *Real-Time Clock and Interrupt Module (RCIM) PCI Form Factor User's Guide* for complete details.

### 4.5.1 Quick Hardware Installation Checklist

1. Before installing the RCIM, decide what mode the RCIM will run in (see *RCIM Connection Modes* on page 36) and if you will be using the RCIM to accept external interrupts.
2. Verify that all pre-requisite software has been installed.
3. Verify that `ccur-rcim` RPM has been installed. To verify, execute the command `rpm -q ccur-rcim`. The system will inform you if it is not installed.
4. Power down the system and remove all power cords.
5. Open the case and identify a PCI slot for installation. (Refer to the chart on the case for help in identifying card slot types.)

#### Note

Concurrent Computer Corporation strongly recommends that you use an antistatic wrist strap and a conductive foam pad when installing and removing printed circuit boards.

6. Insert the RCIM into the selected PCI slot and lock it down.
7. Attach data chaining input cable if required (see the RCIM manual for complete details).
8. Close the case and reconnect all power cords.

9. Power up the system and verify the system boots up properly. Refer to the *Real-Time Clock and Interrupt Module (RCIM) PCI Form Factor User's Guide* for configuration options.

#### 4.5.2 Check RCIM Operation

1. To check that the RCIM is operating correctly, perform the following:

```
cat /proc/driver/rcim/status
```

You should see an output similar to the following:

```
Rcim board revision 1.
This is a standalone (isolated) rcim.
```

2. To view the current RCIM configuration, issue the following command:

```
cat /proc/driver/rcim/config
```

You should see an output similar to the following:

```
h/Not_Configured, sync, pig0 | out0, pig1 | out1, pig2 |
out2, pig3 | out3, none | di0, none | di1, none | di2, none |
di3, none | di4, none | di5, none | di6, none | di7, di0/f,
i1/f, di2/f, di3/f, di4/f, di5/f, di6/f, di7/f, eti0/f,
eti1/f, eti2/f, eti3/f
```

## 4.6 Installing Frequency-Based Scheduler (FBS) Software

FBS is an optional package to RedHawk Linux. If you will be using FBS, install it at this time by performing the following steps:

1. With RedHawk Linux Version 1.4 running, log in as root and take the system down to single-user mode:
  - a. Right click on the desktop and select **New Terminal**.
  - b. At the system prompt, type **init 1**.
2. Locate the disc labeled “RedHawk Linux Frequency-Based Scheduler Version 1.4” and insert into the CD-ROM drive.
3. To mount the cdrom device, execute the following command:

```
mount /mnt/cdrom
```

4. To install, execute the following commands:

```
cd /mnt/cdrom
./install-fbs
```

Follow the on-screen instructions until the installation script completes.

5. Upon completion of software installation, execute the following commands:

```
cd /
umount /mnt/cdrom
eject
```

6. Remove the disc from the CD-ROM drive and store. Exit single-user mode (^D). Check for FBS updates as outlined in the following section.

## 4.7 Installing FBS Updates

If there are any updates to this FBS release available for downloading from Concurrent's web site, they should be installed now. Follow these steps:

1. In multi-user mode, access the **redhawk.ccur.com** web site.
2. Log onto the site using the login and password provided by Concurrent.
3. A list of packages that you have not yet downloaded will display. Click on the packages to download them and save them in a suitable location (e.g., **/root/updates**).
4. Return to single-user mode as root.
5. To install the newly downloaded packages, change directory to the location of the updates and issue the following command:

```
rpm -Fvh *.rpm
```

The command should complete successfully, though it may take several minutes depending on the number of updates being installed.

6. Exit single-user mode (^D), reboot the system choosing the new RedHawk kernel and verify that the system boots properly.

## 4.8 Installing NightStar Tools

If you will be installing the NightStar toolset, do so now. Refer to the *RedHawk NightStar Tools Release Notes* for installation instructions.

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## 5.0. Upgrading from a Previous Release

This section contains the instructions for upgrading to RedHawk Linux Version 1.4 on a system currently running a previous version of RedHawk Linux.

Review the following points before upgrading the software:

- It is recommended that the installer first read through the entire procedure once before actually performing the upgrade.
- It is **strongly recommended** that installation and updates of software be performed in single-user mode to guard against the possibility of corrupting a running application.
- Install all available upgrades. No quality claims are made by Concurrent unless all appropriate version levels of all RedHawk Linux software are installed.
- The media in use is accessed at various times and must be kept in the drive during the installation until you are instructed to install different media.
- Prior to upgrade, remove any floppy media that may have been left in the machine.
- Disc upgrade times specified below may vary and are only provided as a guideline.
- The Red Hat kernel should be running when upgrading to RedHawk Linux Version 1.4.

*If you are upgrading from RedHawk Linux Versions 1.3 or 1.2*, proceed directly to Section 5.2, *Updating Red Hat Software*.

*If you are upgrading from RedHawk Linux Version 1.1*, follow all directions in this section beginning with Section 5.1 to upgrade to RedHawk Linux Version 1.4. This is necessary because RedHawk Linux 1.1 systems were built using the Red Hat 8.0 Beta distribution, and it is necessary to first upgrade to the official Red Hat 8.0 distribution before upgrading to RedHawk Linux Version 1.4. Upgrading Red Hat Linux 8.0 Beta will not delete any existing data (however, back-up is recommended). The installation program updates the modular kernel and all currently installed software packages.

### 5.1 Upgrading to Red Hat 8.0

Complete the following steps to install and configure Red Hat on the system (only required if upgrading from RedHawk Version 1.1). Refer to Online Help if needed.

1. Power on the system, if needed, to open the CD-ROM drawer.
2. Insert Red Hat 8.0 installation disc 1 of 3 in the CD-ROM drive and power down the system.
3. Power on the system with the disc 1 of 3 installed in order to boot from the disc. A full screen of choices is displayed. Only one item can be chosen. At the **boot:** prompt, choose "To Install or upgrade Red Hat Linux in graphical mode," then press ENTER.

You have the option to test the Red Hat media for errors. If you wish to do so, click OK, otherwise, select Skip and then click ENTER.

- At the Welcome sub-menu, click Next.



- At the **Language Selection** sub-menu:  
Choose English language. Click **Next**.
  - At the **Keyboard** sub-menu:  
Accept keyboard defaults. Click **Next**.
  - At the **Mouse Configuration** sub-menu:  
Select appropriate mouse model.  
**Note:** Click the “Emulate 3 buttons” box at bottom of page if using a 2 button mouse. Click **Next**.
  - At the **Installation Type** sub-menu:  
Select **Upgrade Existing System** button, then click **Next**.
  - At the **Upgrade Examine** sub-menu:  
Click **Next** to perform automated upgrade of your packages.
  - At the **Upgrade Boot Loader Configuration** sub-menu:  
Select “Update boot loader configuration.” click **Next**.
  - At the **About to Upgrade** sub-menu:  
Click **Next** to continue.
  - At the **Installing Packages** sub-menu:  
At this point no operator intervention is required. Packages are being upgraded. Time to install depends on how many packages need to be installed. Remove previous disc and insert new disc when requested to do so.
  - At the **Boot Disk Creation** sub-menu:  
Choose “Yes, I would like to create a boot disk”. Click **Next**.  
You will be prompted to insert a diskette. Insert diskette, and click **Next** to continue. System responds with “Creating boot disk...”.
4. Installation is complete. Click **Exit** to reboot the system. Verify that Red Hat boots up properly.
  5. Continue with the steps in section 5.2 to install Red Hat software updates. Remove any media from respective drives.

## 5.2 Updating Red Hat Software

The disc labeled “Red Hat 8.0 Update CD for RedHawk Linux Version 1.4” contains the latest updates released by Red Hat and validated against RedHawk Linux. These updates are important to the proper operation of RedHawk Linux.

To update the installed Red Hat software, perform the following steps.

1. If not already running Red Hat, boot the system with the Red Hat kernel.
2. Log in as root and take the system down to single-user mode:
  - a. Right click on the desktop and select **New Terminal**.
  - b. At the system prompt, type **init 1**.
3. Locate the disc labeled “Red Hat 8.0 Update CD for RedHawk Linux Version 1.4” and insert into the CD-ROM drive.

4. If the cdrom device does not mount automatically, execute the following command:

```
mount /mnt/cdrom
```

5. Execute the following commands to install the update software:

```
cd /mnt/cdrom  
./install-updates
```

Follow the on-screen instructions until the installation script completes. This will take some time to complete.

6. Upon completion of software installation, execute the following commands:

```
cd /  
umount /mnt/cdrom  
eject
```

7. Remove the disc from the CD-ROM drive and store.

8. **Perform this step ONLY if you are installing on a single processor system.** If installing on a multiprocessor system, skip to the next step.

Execute the following:

```
rpm -e kernel-smp
```

9. Exit single-user mode (^D). Reboot the system choosing the “Red Hat Linux (2.4.20-20.8)” kernel and verify that the new kernel boots. Continue with the steps in the following section.

### 5.3 Upgrading to RedHawk Linux Version 1.4

To upgrade to RedHawk Linux Version 1.4, perform the following steps:

1. With the above named Red Hat kernel running on the system, log in as root and take the system down to single-user mode:
  - a. Right click on the desktop and select **New Terminal**.
  - b. At the system prompt, type **init 1**.

2. Locate the disc labeled “RedHawk Linux OS Version 1.4” and insert into the CD-ROM drive.

3. If the cdrom device does not mount automatically, execute the following command:

```
mount /mnt/cdrom
```

4. Execute the following commands to install RedHawk Linux Version 1.4 upgrade software:

```
cd /mnt/cdrom  
./install-redhawk
```

Follow the on-screen instructions until the installation script completes.

5. Upon completion of software installation, execute the following commands:

```
cd /
umount /mnt/cdrom
eject
```

6. Remove the disc from the CD-ROM drive and store. Exit single-user mode (^D). Check for RedHawk updates as outlined in the following section.

## 5.4 Applying RedHawk Updates

If there are any updates to this release available for downloading from Concurrent's web site, they should be installed now. Follow these steps:

1. In multi-user mode, access the **redhawk.ccur.com** web site.
2. Log onto the site using the login and password provided by Concurrent.
3. A list of packages that you have not yet downloaded will display. Click on the packages to download them and save them in a suitable location (e.g., **/root/updates**).
4. Return to single-user mode as root.
5. To install the newly downloaded packages, change directory to the location of the updates and issue the following command:

```
rpm -Fvh *.rpm
```

The command should complete successfully, though it may take several minutes depending on the number of updates being installed.

6. Exit single-user mode (^D), reboot the system choosing the new RedHawk kernel and verify that the system boots properly. Continue to the next section.

## 5.5 Upgrading to Frequency-Based Scheduler (FBS) Version 1.4

If you are using FBS, upgrade to FBS Version 1.4 at this time by performing the following steps. If you are not using FBS, proceed to *Additional Requirements* on page 16.

1. With RedHawk Linux Version 1.4 running, log in as root and take the system down to single-user mode:
  - a. Right click on the desktop and select **New Terminal**.
  - b. At the system prompt, type **init 1**.
2. Locate the disc labeled "RedHawk Linux Frequency-Based Scheduler Version 1.4" and insert into the CD-ROM drive.
3. To mount cdrom device, execute the following command:

```
mount /mnt/cdrom
```

4. Execute the following commands to install the FBS software:

```
cd /mnt/cdrom
./install-fbs
```

Follow the on-screen instructions until the installation script completes.

5. Upon completion of software installation, execute the following commands:

```
cd /  
umount /mnt/cdrom  
eject
```

6. Remove the disc from the CD-ROM drive and store. Exit single-user mode (^D). Check for FBS updates as outlined in the following section.

## 5.6 Applying FBS Updates

If there are any updates to this FBS release available for downloading from Concurrent's web site, they should be installed now. Follow these steps:

1. In multi-user mode, access the **redhawk.ccur.com** web site.
2. Log onto the site using the login and password provided by Concurrent.
3. A list of packages that you have not yet downloaded will display. Click on the packages to download them and save them in a suitable location (e.g., **/root/updates**).
4. Return to single-user mode as root.
5. To install the newly downloaded packages, change directory to the location of the updates and issue the following command:

```
rpm -Fvh *.rpm
```

The command should complete successfully, though it may take several minutes depending on the number of updates being installed.

6. Exit single-user mode (^D), reboot the system choosing the new RedHawk kernel and verify that the system boots properly.

## 5.7 Additional Requirements

*If you are using custom drivers with a pre-defined RedHawk Linux kernel*, it will be necessary to run **ccur-config** after upgrading to a new release of RedHawk in order to configure the kernel source tree to match the currently running kernel. Follow these steps:

1. Change directory (**cd**) to **/usr/src/redhawk-release-directory**.
2. Run the **ccur-config(8)** tool as follows:

```
./ccur-config -n -c
```

Wait for on-screen messages to complete.

Refer to the man page or *RedHawk Linux User's Guide* for more details, if needed.

---

## 6.0. NVIDIA Graphics Display

The NVIDIA Linux Display Driver (version 1.0-4496) is included in the RedHawk Linux installation and built automatically for all pre-built and custom RedHawk Linux kernels.

Note that if you install an NVIDIA graphics card into your system after RedHawk Linux has been installed, you may need to install the user module, `ccur-nvidia-glx`, at that time. The RPM for this module can be found on the RedHawk Linux installation CD in the `nvidia` directory.

There are several options for configuring two or more displays. The upper limit on the number of displays that can be driven effectively is application dependent. Theoretically, you can configure as many displays as you have video adapters.

There is only one high performance AGP slot in an iHawk graphics system, so the maximum number of displays that can run off AGP depends on the number of heads on the installed card. Another option for adding more heads is to add additional PCI graphics cards. An iHawk system can support multiple PCI graphics cards. The graphics subsystem on an iHawk can also support both AGP and PCI graphics cards in the same system.

iHawk systems that have AGP are limited to two physical CPUs. If more than two physical processors are required by the application then a non-AGP iHawk must be utilized with PCI graphics cards. To maximize throughput, place the cards in PCI slots that are not shared by other devices.

The following multiple display modes are available:

- One desktop spanned across two monitors.  
NVIDIA calls this TwinView. In this mode, the workspace size is twice as large as with a single monitor display. Windows can be dragged across displays, which can be positioned either vertically or horizontally. Switching between workspaces affects both displays simultaneously so it's easy to switch between data views that are linked together, for example, during demos and presentations. Multiple workspaces can be configured.
- Separate desktops.  
This mode provides two or more separate desktops that act independently, for example a NightView debugger on one monitor and an application running on another. Because the monitors work independently, displays are not synchronized as in TwinView mode and you cannot drag windows across monitors; however, it allows you more combinations for viewing data.

The mode in use depends upon the settings in the X server configuration file when the X server is booted. You can easily switch between modes by maintaining more than one configuration file and copying the one you want to use to `/etc/X11/XF86Config` before starting the X server.

Along with the original `XF86Config` configuration file located in `/etc/X11`, there are additional sample configuration files. These samples illustrate configurations for TwinView, dual desktop and quad desktop. Use these as a reference when creating configuration files for use at your site.

To configure and boot your system for multiple displays, follow the steps in the next section.

## 6.1 Configuring Multiple Display Capability

If you think you will utilize more than one display mode, create a configuration file for each mode you intend to use. Configuration settings are read from `/etc/X11/XF86Config` when the X server is booted. Have the desired configuration file saved to that path before booting the X server.

### Note

Parameters required for the multiple display modes are discussed below, but other fields in the configuration file may need to be modified depending upon other factors at your site. For complete information about the `XF86Config` file, see the `XF86Config(5x)` man page. Additionally, you can download the README file from the [www.nvidia.com](http://www.nvidia.com) web site.

You will need to know the following information for each monitor (consult the documentation provided with the monitors):

- the range of possible refresh rates
- supported resolutions
- supported color depths

### Configuration for One Desktop Across Two Monitors

To create a virtual desktop that displays across two monitors (for example, NVIDIA's TwinView) you need to provide appropriate settings in the "Screen" section of the configuration file. The display mode and monitor characteristics are defined as "Options." Refresh rates and resolutions for each monitor and the location (orientation) of the second monitor used as the extended desktop are supplied. "TwinViewOrientation" can be "LeftOf", "RightOf", "Above" or "Below" to represent where the second monitor will be positioned relative to the first.

Following is an example of the "Screen" section of the configuration file with possible settings for TwinView mode.

```
Section "Screen"
    Identifier "Screen0"
    Device "Videocard0"
    Monitor "Monitor0"
    DefaultDepth 24
    Option "TwinView"
    Option "SecondMonitorHorizSync" "30-97"
    Option "SecondMonitorVertRefresh" "50-180"
    Option "MetaModes" "1280x1024,1280x1024"
    Option "TwinViewOrientation" "LeftOf"
    SubSection "Display"
        Depth 16
        Modes "1280x1024" "1024x768" "800x600" "640x480"
    EndSubSection
    SubSection "Display"
        Depth 24
        Modes "1280x1024" "1024x768" "800x600" "640x480"
    EndSubSection
EndSection
```

## Configuration for Separate Desktops

For this mode, the Device, Screen, Monitor and ServerLayout sections in the configuration file are utilized. The number of displays available is limited only by hardware constraints. The examples below are for a dual display. For additional displays, add additional sections with appropriate designations (see **XF86Config.quaddesktop** for examples). Follow the steps below to modify the configuration file.

1. First, update the ServerLayout section to reflect the multiple display configuration. Each screen to be used will be listed here and defined in Screen sections later in the file.

```
Section "ServerLayout"
    Identifier "nvidia dualdesktop"
    Screen 0 "Screen0" 0 0
    Screen 1 "Screen1" LeftOf "Screen0"
    InputDevice "Mouse0" "CorePointer"
    InputDevice "Mouse1" "SendCoreEvents"
    InputDevice "Keyboard0" "CoreKeyboard"
EndSection
```

2. Then, create separate Device sections. In each section, provide the BusID (*bus:device:function*) of the graphics card associated with each display. This information displays when you `cat /proc/pci.` In the case of a dual head adapter, specify separate sections (one for each head) using the same BusID. **Caution:** BusIDs can change when PCI cards are added or removed.

The driver in each section in the example below is identified as "nvidia." A separate screen is assigned in each section.

```
Section "Device"
    Identifier "nvidia0"
    Driver "nvidia"
    BusID "PCI:1:0:0"
    Screen 0
EndSection
```

```
Section "Device"
    Identifier "nvidia1"
    Driver "nvidia"
    BusId "PCI:1:0:0"
    Screen 1
EndSection
```

- Next, create separate Screen sections, each using one of the devices identified in the Device sections; for example:

```
Section "Screen"
    Identifier "Screen0"
    Device      "nvidia0"
    Monitor     "Monitor0"
    DefaultDepth 24
    Subsection "Display"
        Depth 24
        Modes "1600x1200" "1024x768" "800x600" "640x480"
    EndSubsection
EndSection
```

```
Section "Screen"
    Identifier "Screen1"
    Device      "nvidia1"
    Monitor     "Monitor1"
    DefaultDepth 24
    Subsection "Display"
        Depth 24
        Modes "1600x1200" "1024x768" "800x600" "640x480"
    EndSubsection
EndSection
```

- Finally, create separate Monitor sections, each describing the characteristics of one of the monitors to be used; for example:

```
Section "Monitor"
    Identifier "Monitor0"
    VendorName "Viewsonic"
    ModelName  "G90f"
    DisplaySize 370 270
    HorizSync 30.0 - 97.0
    VertRefresh 50.0 - 180.0
    Option     "dpms"
EndSection
```

## 6.2 Connecting the Monitors and Booting the System

The graphics adapter card identifies multiple outputs as head 1, head 2, etc. With multiple monitors, the console output goes to head 1 during boot or when X is not running. The monitors on subsequent heads only display when X is running.

- Connect monitor 1 to head 1 of the adapter, monitor 2 to head 2 of the adapter, etc.
- To allow a recovery if there is a problem during the installation, set the system's default run level to enable the system to boot to console instead of starting up X.

- Edit **/etc/inittab**:

```
vi /etc/inittab
```

- Locate the following line:

```
id:5:initdefault
```



- c. Change the 5 to 3, save and exit.
  - d. Reboot the system with `init 3`.
3. If you will be using separate desktops and wish to use **gnome**, edit `/etc/X11/gdm/gdm.conf` and uncomment the following line:

```
1=Standard
```

Note that **kde** works without modifications.

4. Make a backup copy of the original configuration file, then copy the file you wish to use to `/etc/X11/XF86Config`; for example:

```
cp XF86Config XF86Config.orig
cp XF86Config.mydual XF86Config
```

5. Startup X with `init 5`.

If successful, you will see the NVIDIA logo and then the desktop appears. Reset the system's default run level back to run level 5 (X11 startup mode).

- a. Using **vi** to edit `/etc/inittab`, locate the line reading:  

```
id:3:initdefault
```

 Change the 3 to 5, save and exit.
- b. Execute the command `init 6`.

If unsuccessful, the problem may be due to a misconfigured `XF86Config` file. Review the `/var/log/XFree86*.log` files along with the NVIDIA README document to debug your `/etc/X11/XF86Config` file.

6. If you want to test the 3D performance of your card, perform the following:

```
glxgears
```

This should bring up three gears rotating at high speed with frames per second displayed in the associated window.

If the setup is incorrect, you may get the following on-screen messages:

```
Xlib: extension "GLX" missing on display ":0.0".
Error: couldn't get an RGB, Double-buffered visual
```

Refer to the NVIDIA README document for troubleshooting tips.

## 7.0. Additional Considerations

This section contains helpful information about issues that may be applicable at your site.

### 7.1 Compiler Requirements

If you plan to build a kernel from source residing on your iHawk system on a different system, that system must be using **gcc-2.96-98** or later.

### 7.2 Hyper-thread Activation

Hyper-threading is configured by default in each of the standard RedHawk Linux kernels. It can be disabled at system boot time by specifying the “noht” option, and it can be disabled on a per-CPU basis using the **cpu (1)** command. However, hyper-threading is also defined in the system BIOS. Therefore, if hyper-threading is turned off in the BIOS, it will not be available on your system even if it is configured in the kernel.

If your system is not behaving as expected in regards to hyper-threading based on kernel configuration, check the BIOS setting and modify it as needed. Refer to your hardware documentation to determine which BIOS setting is involved.

Note that hyper-threading is not included in this initial support for the model 868 8-way iHawk system and must be disabled prior to booting a Version 1.4 RedHawk Linux kernel on this type of system.

### 7.3 NightView Accessibility

A possible result of upgrading Red Hat software during a RedHawk Linux upgrade is a break in the symbolic link for the NightView debugger (**nview**) making it unavailable. The RedHawk Linux install script will re-establish this link and no further action should be necessary. If you encounter a problem accessing **nview**, ensure that a symbolic link is established linking **/usr/bin/nview** to the current NightView installation; e.g, **/usr/opt/ccur-NightView-5.6-913/usr/bin/nview**.

---

## 8.0. Information on Version 1.4

### 8.1 General

The RedHawk Linux operating system is based on the Red Hat Linux distribution. A standard set of Red Hat Linux CDs is included with each iHawk system. Except for the kernel, all Red Hat components operate in their standard fashion. The unmodified Red Hat components that are included in the RedHawk Linux offering include the Linux utilities, libraries, compilers, tools and installer.

The components in the RedHawk distribution that are unique to RedHawk include a modified Linux kernel, some additional user-level libraries and commands and optionally, the NightStar real-time application development tools. The RedHawk Linux kernel is based on the kernel maintained by Linus Torvalds and utilizes the 2.4.21 version.

There are three classes of changes that have been applied to the Linux kernel:

- new kernel features added by Concurrent based on features in the real-time operating systems that Concurrent has been deploying for many years
- open source real-time patches that have not been accepted into standard Linux and which supply features or performance benefits for real-time applications
- performance improvements developed by Concurrent to improve worst-case process dispatch latency or to improve determinism in process execution

These kernel enhancements provide the support needed for developing complex real-time applications. The additional user-level libraries in RedHawk provide interfaces to some of the real-time features present in the Red Hat Linux kernel.

#### **Note**

It is NOT recommended that the user download Red Hat updates.

Most user-level components on RedHawk Linux are provided by the Red Hat Linux 8.0 distribution. The RedHawk Linux kernel replaces the standard Red Hat kernel. While the RedHawk Linux kernel is likely to work with any version of the Red Hat 8.0 distribution, it is not recommended that the user download additional Red Hat updates as these could potentially destabilize the system. Red Hat updates will be made available to RedHawk Linux users as those updates are validated against the RedHawk Linux kernel.

Linux conforms to many of the interface standards that are defined by POSIX. However, Linux does not completely conform to these standards. Red Hat Linux has the same level of POSIX conformance as other Linux distributions that are based on the 2.4 series of kernels. Linux on the Intel x86 architecture has defined a binary standard of its own which allows shrink-wrapped applications that are designed to run on the Linux/Intel x86 platform to run on Concurrent's iHawk platform.

## 8.2 RedHawk Linux Kernels

There are three flavors of RedHawk Linux kernels installed on the iHawk system. The system administrator can select which version of the RedHawk Linux kernel is loaded via the GRUB boot loader. The three flavors of pre-built RedHawk kernels are:

Kernel Name	Kernel Description
vmlinuz-2.4.21-RedHawk-1.4-trace	Default kernel with trace points but no debug checks
vmlinuz-2.4.21-RedHawk-1.4-debug	Kernel with both debug checks and kernel trace points
vmlinuz-2.4.21-RedHawk-1.4	Kernel with no trace points and no debug checks

The default RedHawk Linux trace kernel has been built with kernel trace points enabled. The kernel trace points allow the NightTrace™ tool to trace kernel activity.

The debug kernel has been built with both debugging checks and kernel trace points enabled. The debugging checks are extra sanity checks that allow kernel problems to be detected earlier than they might otherwise be detected. However, these checks do produce extra overhead. If you are measuring performance metrics on your iHawk system, this activity would be best performed using a non-debug version of the kernel.

## 8.3 Real-Time Features in RedHawk Linux

Refer to Table 8-1 (next page) for a brief description of the real-time features included in the RedHawk Linux operating system. This reflects features included in open source Linux patches applied to RedHawk Linux as well as new features and enhancements developed by Concurrent to meet the demands of Concurrent’s real-time customers.

**Table 8-1 Real-Time Features in RedHawk Linux**

Feature	Description
Processor Shielding	Enhancements to the scheduler and the <code>/proc</code> file system allow the user to dynamically shield a set of processors from interrupts and other background activity that can interfere with determinism in an application's execution time. Shielded processors provide the best possible environment for guaranteeing that a real-time application can meet its execution time deadlines. See the <i>RedHawk Linux User's Guide</i> and the <code>shield(5)</code> man page for complete details.
Processor Affinity	In a real-time application where multiple processes execute on multiple CPUs, it is desirable to have explicit control over the CPU assignments of all processes in the system. This capability is supplied by Concurrent through the <code>mpadvise(3)</code> library routine and the <code>run(1)</code> command. See the <i>RedHawk Linux User's Guide</i> and the man pages for more details.
Real-Time Scheduler	This patch provides fixed-length context switch times regardless of how many processes are active in the system. It also provides a true real-time scheduling class that operates on a symmetric multiprocessor. This patch is known by the name of the open source developer who created it - Ingo Molnar.
Low Latency Patches	In order to protect shared data structures used by the kernel, the kernel protects code paths that access these shared data structures with spin locks and semaphores. The locking of a spin lock requires that interrupts and preemption be disabled while the spin lock is held. A study was made which identified the worst-case interrupt off times. The low latency patches modify the algorithms in the identified worst-case interrupt off scenarios to provide better interrupt response times.
Kernel Preemption	The ability for a high priority process to preempt a lower priority process that is currently executing inside the kernel is provided in RedHawk Linux. Under standard Linux the lower priority process would continue running until it exited from the kernel, creating longer worst case process dispatch latency. Data structure protection mechanisms are built into the kernel to support symmetric multiprocessing.
User-level Preemption Control	When an application has multiple processes that can run on multiple CPUs and those processes operate on data shared between them, access to the shared data must be protected to prevent corruption from simultaneous access by more than one process. The most efficient mechanism for protecting shared data is a spin lock; however, spin locks cannot be effectively used by an application if there is a possibility that the application can be preempted while holding the spin lock. To remain effective, RedHawk provides a mechanism that allows the application to quickly disable preemption. See the <i>RedHawk Linux User's Guide</i> and the <code>resched_cntl(2)</code> man page for more information about user-level preemption control.

**Table 8-1 Real-Time Features in RedHawk Linux (Continued)**

Feature	Description
User-level Spin Locks	RedHawk Linux busy-wait mutual exclusion tools include a low-overhead busy-wait mutual exclusion variable (a spin lock) and a corresponding set of macros that allow you to initialize, lock, unlock and query spin locks. To be effective, user-level spin locks must be used with user-level preemption control. Refer to the <i>RedHawk Linux User's Guide</i> for details.
Fast Block/Wake Services	Many real-time applications are composed of multiple cooperating processes. These applications require efficient means for doing inter-process synchronization. The fast block/wake services developed by Concurrent allow a process to quickly suspend itself awaiting a wakeup notification from another cooperating process. See the <i>RedHawk Linux User's Guide</i> and the <code>postwait(2)</code> and <code>server_block(3)</code> man pages for more details.
Hyper-threading	Hyper-threading is a feature of the Intel Pentium Xeon processor that allows for a single physical processor to appear to the operating system as two logical processors. Two program counters run simultaneously within each CPU chip so that in effect, each chip is a dual-CPU SMP. With hyper-threading, physical CPUs can run multiple tasks "in parallel" by utilizing fast hardware-based context-switching between the two register sets upon things like cache-misses or special instructions. RedHawk Linux includes support for hyper-threading and supplies it as the default mode of operation. Refer to the <i>RedHawk Linux User's Guide</i> for more information on how to effectively use this feature in a real-time environment.
<code>usermap(3)</code> and <code>/proc mmap(2)</code>	The <code>usermap(3)</code> library routine has been added to RedHawk Linux, which lets a process map portions of another process' address space into its own address space utilizing the <code>/proc</code> filesystem <code>mmap(2)</code> . Thus, monitoring and modifying other executing programs becomes simple CPU reads and writes within the application's own address space, without incurring the overhead of <code>/proc</code> filesystem <code>read(2)</code> and <code>write(2)</code> system service calls. Refer to the <i>RedHawk Linux User's Guide</i> for more information.
POSIX Timers (high-resolution)	Support for high-resolution POSIX clocks and timers is included in RedHawk Linux. There are four system-wide POSIX clocks that can be used for such purposes as time stamping or measuring the length of code segments. POSIX timers allow applications to use relative or absolute time based on a high resolution clock and to schedule events on a one-shot or periodic basis. Applications can create multiple timers for each process. In addition, high-resolution sleep mechanisms are provided which can be used to put a process to sleep for a very short time quantum and specify which clock should be used for measuring the duration of the sleep. See the <i>RedHawk Linux User's Guide</i> for more information on POSIX timers.

**Table 8-1 Real-Time Features in RedHawk Linux (Continued)**

Feature	Description
POSIX Message Queues	POSIX message passing facilities based on IEEE Standard 1003.1b-1993 are included in RedHawk Linux, implemented as a file system. POSIX message queue library routines allow a process to create, open, query and destroy a message queue, send and receive messages from a message queue, associate a priority with a message to be sent, and request asynchronous notification when a message arrives. POSIX message queues operate independently of System V IPC messaging, which is also available under RedHawk Linux. See the <i>RedHawk Linux User's Guide</i> for more information.
XFS Journaling File System	Support for the XFS journaling file system from SGI is included in RedHawk Linux. Journaling file systems use a journal (log) to record transactions. This drastically cuts the complexity of a file system check, reducing recovery time. XFS is a multithreaded, 64-bit file system capable of handling large files and large filesystems, extended attributes, variable block sizes, is extent based and makes extensive use of Btrees (directories, extents, free space) to aid both performance and scalability. Both user and group quotas are supported. See the <i>RedHawk Linux User's Guide</i> for more information.
High Resolution Timing	In the standard Linux kernel, the system accounts for a process' CPU execution times using a very coarse-grained mechanism. This means that the amount of CPU time charged to a particular process can be very inaccurate. This patch provides a mechanism for very accurate CPU execution time accounting, allowing better performance monitoring of applications. See the <i>RedHawk Linux User's Guide</i> for more details.
/ <b>proc</b> Modifications	Modifications were made to the process address space support in <b>/proc</b> to allow a privileged process to read or write the values in another process' address space. This is for support of the NightProbe data monitoring tool and the NightView debugger.
Frequency-Based Scheduler	The Frequency-Based Scheduler (FBS) provides a mechanism for scheduling applications that run according to a predetermined cyclic execution pattern. The FBS also provides a very fast mechanism for waking a process when it is time for that process to execute. In addition, the FBS allows the performance of cyclical applications to be tracked, with various options available to the programmer when deadlines are not being met. The FBS is the kernel mechanism that underlies the NightSim GUI for scheduling cyclical applications. See the <i>NightSim User's Guide</i> and the <i>Frequency-Based Scheduler (FBS) User's Guide</i> for additional information.

**Table 8-1 Real-Time Features in RedHawk Linux (Continued)**

Feature	Description
RCIM Driver	<p>A driver was added for support of the Real-Time Clock and Interrupt Module (RCIM). This multi-purpose PCI card has the following functionality:</p> <ul style="list-style-type: none"> <li>- allows the connection of four external device interrupts</li> <li>- four real time clocks that can interrupt the system</li> <li>- four programmable interrupt generators which allow generation of an interrupt from an application program</li> </ul> <p>These functions can all generate local interrupts on the system where the RCIM card is installed. Multiple RedHawk Linux systems can be chained together, allowing up to eight of the local interrupts to be distributed to other RCIM-connected systems. This allows one timer, or one external interrupt or one application program to interrupt multiple RedHawk systems almost simultaneously to create synchronized actions. In addition, the RCIM contains a synchronized high-resolution clock so that multiple systems can share a common time base. See the <i>Real-Time Clock and Interrupt Module (RCIM) PCI Form Factor User's Guide</i> for additional information.</p>
Capabilities Support	<p>The Pluggable Authentication Modules (PAM) open source patch provides a mechanism to assign privilege to users. This allows a non-root user to run applications that require privileges that only root would normally be allowed. For example, the ability to lock pages in memory is provided by one predefined privilege that can be assigned to individual users or groups. See the <i>RedHawk Linux User's Guide</i> and the <code>pam_capability(8)</code> and <code>capability.conf(5)</code> man pages for more information about capabilities support.</p>
Kernel Trace Facility	<p>Support was added to RedHawk Linux to allow kernel activity to be traced. This includes mechanisms for inserting and enabling kernel trace points, reading trace memory buffers from the kernel, and managing trace buffers. The kernel trace facility is used by the NightTrace tool.</p>
ptrace Extensions	<p>The ptrace debugging interface has been extended to support the capabilities of the NightView debugger. Features added include:</p> <ul style="list-style-type: none"> <li>- the capability for a debugger process to read and write memory in a process not currently in the stopped state</li> <li>- the capability for a debugger to trace only a subset of the signals in a process being debugged</li> <li>- the capability for a debugger to efficiently resume execution at a new address within a process being debugged</li> <li>- the capability for a debugger process to automatically attach to all children of a process being debugged</li> </ul>



**Table 8-1 Real-Time Features in RedHawk Linux (Continued)**

Feature	Description
Kernel Debuggers	Two different kernel debuggers are supported. Each provides a different set of features. The <b>kdb</b> kernel debugger is linked with the kernel and can be run as a native kernel debugger. Using <b>kgdb</b> , the RedHawk Linux kernel can be debugged with <b>gdb</b> as if it were a user application. <b>gdb</b> runs on a separate system, communicating with the kernel being debugged through the console's serial port.
Kernel Core Dumps/ Crash Analysis	This open source patch provides the support for dumping physical memory contents to a file as well as support for utilities that do a post mortem analysis of a kernel core dump. See the <b>lcrash(1)</b> man page and the section entitled <i>Using the Linux Kernel Crash Dump (LKCD)</i> on page 34 of these notes for more information about crash dump analysis. In addition, see the <i>RedHawk Linux User's Guide</i> for additional information on LKCD.

## 8.4 NightStar Development Tools

Users can schedule, monitor, debug and analyze run time behavior of their real-time applications and the RedHawk Linux operating system kernel using the following NightStar tools:

- NightTrace Event Analyzer
- NightSim Periodic Scheduler
- NightProbe Data Monitor
- NightView Debugger

NightStar's non-intrusive operation ensures real-time determinism.

Refer to the *RedHawk Linux NightStar Tools Release Notes*, Pubs No. 0898008-*x.x* (where *x.x* = latest version) for additional information.

## 9.0. Changes in this Release

This section describes the enhancements and other changes introduced in Version 1.4.

### 9.1 Support for 8-Way iHawk Systems

RedHawk Linux support for symmetric multiprocessor systems (SMPs) is now expanded to include up to eight Pentium® Xeon™ processors in the new model 868 8-way iHawk system. The 8-way iHawk (HQ074) is a rackmount system with 8 cpus, 4 GB of main memory, up to 2 MB of cache per processor, six 100 MHz 64-bit PCI slots (one used for RCIM), a CD/DVD-ROM drive, 3.5" floppy, dual 10/100/1000Base T Ethernet, one serial port and integrated graphics controller. Note that kernel crash dumps and hyper-threading are not currently supported on an 8-way iHawk.

### 9.2 Support for MAXAda

Support for MAXAda™, introduced in RedHawk Version 1.3.1, has been enhanced in this release. MAXAda for RedHawk Linux is a toolset for the development of Ada95 programs.

### 9.3 Embedded NVIDIA Graphics Support

The NVIDIA Linux Display Driver (version 1.0-4496) is now included in the RedHawk Linux installation and built automatically for all pre-built and custom RedHawk Linux kernels.

Note that if you install an NVIDIA graphics card after system installation, you may need to install the user module, `ccur-nvidia-glx`, at that time. The RPM for this module can be found on the RedHawk Linux installation CD in the `nvidia` directory.

Sample `XF86Config` files are provided in `/etc/X11`. These samples illustrate configurations for some of the possible multiple display modes: TwinView, dual desktop and quad desktop. For more information about configuring multiple displays, see the section “Configuring Multiple Display Capability” on page 18.

### 9.4 Disabling Interrupts on a CPU

The `local_irq_disable(2)` system service has been added which allows a process to disable interrupts on the CPU on which it is executing. It is intended to allow a single process to utilize all execution cycles on a CPU.

The process that is disabling local interrupts should have all its pages locked in memory and be bound to that CPU. `local_irq_enable(2)` should be called at some point to re-enable the interrupts.

Note that if you wish to have all interrupts on all CPUs in the system disabled, the recommended procedure is to shield all CPUs except one, then call `local_irq_disable` on the unshielded CPU.

For more information on this service, refer to the `local_irq_disable(2)` man page.

## 9.5 Rescheduling Variable Enhancements

A new rescheduling variable implementation allows breakpoints to be set in sections of code where rescheduling variables are locked. Instead of aborting the rescheduling variable, it is now disabled and then re-enabled as soon as the process runs again.

Additionally, when a process that has a registered rescheduling variable clones a new thread, the rescheduling variable is no longer aborted.

## 9.6 New 'ls' Command for FBS rtcp

The real-time command processor (**rtcp**), which is part of the Frequency-Based Scheduler (FBS) software, has a new **ls** command that displays a line of information for each frequency-based scheduler configured on the system. The information includes the FBS process identifier, scheduler key, permissions, the owner's user and group ID, the current state of the scheduler and attached device file.

---

## 10.0. Known Issues

Special consideration should be given to the following areas:

1. There are sporadic problems with password files that are distributed to multiple systems via NIS. This can prevent valid users from logging into the system when their accounts are made known to that system via NIS.
2. NFS mounts of large partitions will sporadically have problems in seeing all of the files that should be mounted in the partition.
3. When running the Linux Test Project test suite LTP-2002(\*), the user must remove the **Fork07** test case prior to building the test suite to prevent a system hang on RedHawk systems with greater than 1GB of memory. This is a known bug in the official Linux kernel. For more information, refer to the Linux Test Project web site at <http://ltp.sourceforge.net/>
4. The “Console Redirection” BIOS feature, when enabled, has been observed to interfere with the proper operation of the integrated VGA video and the XFree86 X server with some iHawk platforms, such as the Dell PowerEdge™ 6650.
5. Users of `pw_wait(2)`, `pw_post(2)` and `pw_postv(2)` may have to make slight changes to their code, as shown below.

**pw\_wait(2) changes:**

```
old: int pw_wait(struct timespec *, void *);
new: int pw_wait(struct timespec *, struct resched_var *);
```

**pw\_post(2) changes:**

```
old: int pw_post(ukid_t, void *);
new: int pw_post(ukid_t, struct resched_var *);
old: int pw_post(ukid_t, void *);
new: int pw_post(ukid_t, struct resched_var *);
```

**pw\_postv changes:**

```
old: int pw_postv(int, ukid_t *[], int *[], void *);
new: int pw_postv(int, ukid_t[], int [], struct resched_var *);
```

6. Using the NMI button on the processor enters **kdb** on the console. It cannot be used, however, to step repeatedly through an error condition.
7. Note that in order to use the `pam_capability(8)` feature with `ssh`, the `/etc/ssh/sshd_config` file must have the following option set:

```
UsePrivilegeSeparation no
```

8. When a system configuration change is made that affects the number of CPUs (for example when booting with a uniprocessor kernel or with hyper-threading disabled), the **sadc (8)** (sar data collector) program cannot successfully write data in the daily data file **/var/log/sa/sa??** (?? is the day of the month). This results in **crond** sending an email every ten minutes to root@localhost with the following message:

```
Cannot append data to that file
```

To eliminate the email, remove or move the **/var/log/sa/sa??** file for the current date.

9. Using USB keyboards with the **kdb** kernel debugger is not supported.
10. Kernel crash dumps and hyper-threading are not currently supported on a model 868 8-way iHawk system. Hyper-threading should be disabled in the BIOS before booting RedHawk Linux.

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## 11.0. Using the Linux Kernel Crash Dump (LKCD)

LKCD contains kernel and user level code designed to:

- save the kernel memory image when the system dies due to a software failure
- recover the kernel memory image when the system is rebooted
- analyze the memory image to determine what happened when the failure occurred

The memory image is stored into a dump device, which is represented by one of the disk partitions on the system.

Note that kernel crash dumps are not currently supported on the model 868 8-way iHawk system.

### 11.1 Documentation

After LKCD has been installed on your system, the documents listed in Table 11-1 are available at `/usr/share/doc/lkcd`. The user should be familiar with the contents of these documents.

**Table 11-1 LKCD and Lcrash Documents**

File Name	Title of Document
lkcd_tutorial.pdf	LKCD Installation and Configuration
lcrash.pdf and lcrash.htm	Lcrash HOWTO

Additional information about LKCD and the LKCD project can be found at:

**<http://lkcd.sourceforge.net/>**

### 11.2 Installation/Configuration Details

The `lkcdutils` RPM is automatically installed as part of the RedHawk Linux installation. The default RedHawk kernel configurations include the LKCD kernel patch. Concurrent has added scripts to automatically patch the `/etc/rc.d/rc.sysinit` file to configure LKCD to take dumps and to save dumps at boot time. LKCD will automatically self-configure to use the swap partition as the dump device. This is done by creating the file `/dev/vmdump` as a symbolic link to the swap partition.

The dump is saved to a disk partition and then copied to the dump directory on reboot. The system administrator must set up the disk partitions so there is enough space in `/var/log/dump` and the swap partition.

The `/etc/sysconfig/dump` configuration file contains configuration details. This file may be edited by the user, for example to select compression types (GZIP compressed dumps are the default) or to change the directory where dumps are saved.

## 11.3 Forcing a Crash Dump on a Hung System

LKCD contains a Magic System Request (SysRq) option to force a dump. By default, Concurrent has configured the kernel with this option. To use SysRq, it must be enabled through the `/proc` filesystem as follows:

```
echo 1 >/proc/sys/kernel/sysrq
```

The configuration file `/etc/sysctl.conf` sets the default value.

Two methods to force a dump are described below. Use the method applicable to your configuration:

Using PC keyboard:	Use Alt+SysRq+C
Using serial console:	Break followed by C

An example of how you can send a Break using a serial console is illustrated below:

Using minicom as terminal emulator: Ctrl+A+F to send a Break, followed by C

Refer to the `lcrash` documentation for information on how to run `lcrash`. A dump is a set of files, for example:

```
# cd /var/log/dump
# ls
0 1 bounds

# cd 0
# ls
analysis.0 dump.0 kerntypes.0 lcrash.0 map.0

# lcrash -n 0

Please wait...
  Initializing vmdump access... Done.
  Loading system map... Done.
  Loading type info (Kerntypes)... Done.
  Initializing arch specific data... Done.
  Loading ksyms from dump..... Done.

>> stat | less
```

This should display information about when the dump was taken, the panic string and the kernel messages.

---

## 12.0. Useful Information

### 12.1 Man Pages

Man pages can be found online. Type **man** followed by a command or man page name to display information about the command.

### 12.2 RCIM Connection Modes

Before installing an RCIM, determine the connection mode. It is easier to connect the synchronization cable to the input connector before the RCIM is installed. An RCIM can be connected in one of the following modes:

Isolated mode	Neither the input nor output connector is used. There is no connection between this RCIM and other RCIMs.
Master mode	The RCIM is connected to one or more other RCIMs, and the RCIM is at the head of the chain. There is an output cable connection from a master RCIM but there is no input cable connection into it. The RCIM master is unique in that it controls the synchronized clocks. See Chapter 3 of the <i>Real-Time Clock and Interrupt Module (RCIM) PCI Form Factor User's Guide</i> for a discussion of synchronized clocks.
Pass-through Slave mode	The RCIM is connected to one or more other RCIMs but not at the head of the chain. There is an input cable connection into a pass-through slave RCIM and an output cable connection to another slave.
Final Slave mode	The RCIM is connected to one or more other RCIMs at the end of the chain. There is an input cable connection into a final slave RCIM but no output cable connection.

### 12.3 File System Swap Size Guidelines

The table below is intended to help you determine the partition size of the swap file system. The swap partition size is based on the size of the system's main memory plus an additional 5 percent. This swap space allocation should be adequate to accommodate system crash dumps.

Table 12-1 supplies the recommended swap partition sizes for various sizes of main memory.

**Table 12-1 Swap Partition Size Guidelines**

Main Memory Size	Recommended Swap Partition Size
256 MB	269 MB
1 GB	1076 MB
2 GB	2151 MB
4 GB	4301 MB



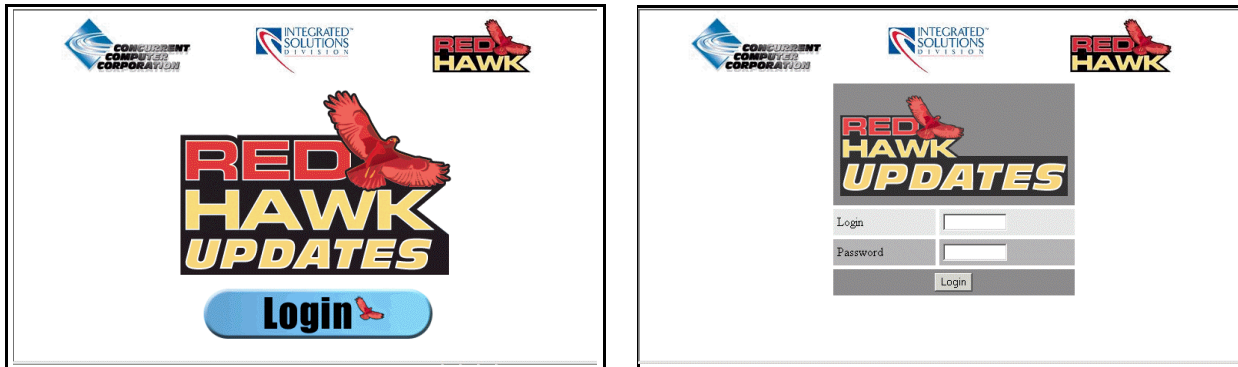
## 13.0. Software Updates and Support

### 13.1 General

Available updates to RedHawk Linux software products can be downloaded from: <http://redhawk.ccur.com>. This site also includes the most recent documentation available.

The site login windows are shown below.

Customer login ID and password can be found in the shipping documents accompanying the system.



### 13.2 How to Download and Install Updates

Upon login, you will see a list of packages that you have not yet downloaded. Click on the packages to download them and save them in a suitable location (e.g. `/root/updates`).

To install the newly downloaded packages, log in as root in single-user mode. Change directory to the location of the updates and issue the following command:

```
rpm -Fvh *.rpm
```

The command should complete successfully, though it may take several minutes depending on the number of updates being installed. When complete, exit single-user mode (`^D`).

If you have problems, please contact the Concurrent Software Support Center (see *Direct Software Support* on page 38 for further information).

## 14.0. Direct Software Support

For answers to basic RedHawk Linux questions, check out the FAQ posted on Concurrent's web site: <http://www.ccur.com>. Select Integrated Solutions Division -> Support -> FAQ.

If you need assistance or information about your system, please contact the Concurrent Software Support Center at our toll free number (1-800-245-6453). Our customers outside the continental United States can contact us directly at 1-954-283-1822. The Software Support Center operates Monday through Friday from 8 a.m. to 7 p.m., Eastern Standard Time.

Calling the Software Support Center gives you immediate access to a broad range of skilled personnel and guarantees you a prompt response from the person most qualified to assist you. If you have a question requiring on-site assistance or consultation, the Software Support Center staff will arrange for a field analyst to return your call and schedule a visit.

Concurrent provides a Software Action Request (SAR) form which our customers can fill out and submit to their local field analyst or the Software Support Center. This procedure ensures that your request is entered into our SAR database for follow-up and action.

To obtain copies of SAR forms, call the Software Support Center and request form number CSD1833B.



