



Linux® OS Version 2.1 Release Notes

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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 2.1.

1.1 Product Description

RedHawk Linux is a real-time version of the open source Linux operating system. Modifications are made to standard Linux version 2.6 to support the functionality and the performance required by complex real-time applications. RedHawk uses a single kernel design to support a single programming environment that directly controls all system operation. This design allows deterministic program execution and response to interrupts while simultaneously providing high I/O throughput and deterministic file, networking, and graphics I/O operations. RedHawk is the ideal Linux environment for the deterministic applications found in simulation, data acquisition, industrial control and medical imaging systems.

Included with RedHawk is the popular Red Hat® Enterprise Linux distribution. The RedHawk installation CDs provide additional real-time kernels and libraries for accessing RedHawk specific kernel features. Optionally, the NightStar™ development tool set is available for developing real-time applications, and the Frequency-Based Scheduler and Performance Monitor can be used for monitoring performance.

The RedHawk kernel integrates both open source patches and Concurrent developed features derived from the real-time UNIX® implementations that Concurrent has supported in its over 35 years experience developing real-time operating systems.

RedHawk Linux is available on Xeon™ and Opteron™ based platforms. RedHawk is included with each iHawk™ Series 860 system, Concurrent's Xeon based symmetric multiprocessor system available in a variety of configurations. The Opteron version of RedHawk is a full 64-bit operating system that executes both 32-bit and 64-bit applications in native mode on the Opteron processor. The RedHawk installation script installs the kernels appropriate to the architecture on which it is being installed.

Support for symmetric multiprocessors is highly optimized. A unique concept known as "shielded CPUs" allows a subset of processors to be dedicated to tasks that require the most deterministic performance. Individual CPUs can be shielded from interrupt processing, kernel daemons, interrupt bottom halves, and other Linux tasks. Processor shielding provides a highly deterministic execution environment where interrupt response of less than 30 microseconds is guaranteed.

RedHawk Linux has the same level of POSIX conformance as other Linux distributions based on the 2.6 series of kernels. Linux on the Intel x86 architecture has defined a defacto 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.

NightStar is Concurrent's powerful real-time tool set that provides a robust graphic interface for non-intrusive control, monitoring, analysis, and debugging of real-time multiprocessing applications. All tools can be run natively on the same system as the application or remotely for less intrusive application control. The NightStar tools include the following:

- NightView™ source-level debugger – allows multi-language, multi-processor, multi-program and multi-thread monitoring and debugging from a single graphical interface.
- NightTrace™ run-time analyzer – used to analyze the dynamic behavior of a running application.

- NightSim™ periodic scheduler – allows the user to easily schedule applications that require periodic execution.
- NightProbe™ data monitor – used to sample, record or modify program data in multiple running programs.

1.2 Product Media

The following CDs are delivered with RedHawk Linux Version 2.1:

Label on Disc		Qty
Red Hat Enterprise Linux Version 3		9
Red Hat Enterprise Linux 3.0 Updates	LXUPDATE Version 2.1 WA9086-J	1
RedHawk Linux OS	WA9086-J Version 2.1	1
RedHawk Linux Documentation CD	LXDOCKIT Version 2.1 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 2.1	1
RedHawk Linux PCI-to-VME Bridge Software Library	WU-HS630-LIB Version 2.1	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.

1.3 Version Numbers

All RedHawk Linux version numbers take the following form:

major . minor [. update]

where:

major is the product's major version number
minor is the product's minor version number
update is the update's incremental version number

For example, 2.0 is the initial release of major version 2, and 2.1 is a subsequent release to version 2.0. Both 2.0 and 2.1 constitute complete product releases and do not require a previous release to be currently installed on the system; both are available on CD from Software Distribution.

Individual updates available via the RedHawk Updates website (see the “System Updates” section below) are not a complete product and can only be installed as an update to the matching *major.minor* release. For example; a 1.3.1 kernel update can only be installed on a system currently running RedHawk Linux version 1.3.

1.4 System Updates

As RedHawk Linux updates are issued, they are made available for downloading from Concurrent’s RedHawk Updates website.

NOTE

Concurrent does not recommend downloading Red Hat updates.

The RedHawk Linux kernel replaces the standard Red Hat kernel and is likely to work with any version of the Red Hat distribution. However, installing upgrades, especially to **gcc** and **glibc**, from sources other than Concurrent may destabilize the system and is not recommended. Security updates from outside sources may be installed if desired.

Instructions for downloading updates from the website are included with the installation and update instructions in this Release Notes and are provided in the section “Software Updates and Support” on page 30.

1.5 Syntax Notation

The following notation is used throughout this document:

<i>italic</i>	Books, reference cards, and items that the user must specify appear in <i>italic</i> type. Special terms may also appear in <i>italic</i> .
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. Documentation

2.1 RedHawk Linux Documentation

Table 2-1 lists the documentation provided by Concurrent as PDF files on the RedHawk Linux documentation CD. After installing the RedHawk Linux Documentation CD, the PDF files are available for viewing by clicking on the “Documents” icon on the desktop.

Table 2-1 RedHawk Linux Documentation

RedHawk Linux Operating System Documentation	Document Number
<i>RedHawk Linux Online Documentation Roadmap</i>	0898002-410
<i>RedHawk Linux OS Version 2.1 Release Notes</i>	0898003-2.1
<i>RedHawk Linux User’s Guide</i>	0898004-410
<i>Frequency-Based Scheduler (FBS) User’s Guide</i>	0898005-210
<i>Real-Time Clock & Interrupt Module (RCIM) PCI Form Factor User’s Guide</i>	0898007-210
<i>RedHawk Linux FAQ</i>	N/A
Partner Documentation	
<i>SBS Technologies Model 1003 Linux Support Software</i>	85221990
<i>SBS Technologies Model 618-3 Adapter Hardware</i>	85851150

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 and Documentation Updates” on page 30 for more information. Documentation is also available from Concurrent’s web site at www.ccur.com. Printed copies can be ordered by contacting the Concurrent Software Support Center. Refer to “Direct Software Support” on page 30 for details.

2.2 Vendor Documentation

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

Documentation for the SBS Model 618-3 PCI-to-VME Bridge adapter is included with the RedHawk Linux documentation.

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.

3.0. Prerequisites

3.1 Software

No previously installed software is required in order to install RedHawk Linux. The following software comprises the full RedHawk Linux installation:

- Red Hat Enterprise Linux Version 3 with updates
- RedHawk Linux operating system Version 2.1
- NightStar tools (optional)
- Frequency-Based Scheduler (FBS) (optional)
- SBS Technologies PCI-to-VME bridge software (optional)

3.2 Hardware

- Any iHawk Series 860 system or AMD Opteron processor
- Real-Time Clock and Interrupt Module (RCIM)

4.0. Changes in this Release

This section describes enhancements and other changes introduced in Version 2.1.

4.1 Enhancements

4.1.1 Priority Inheritance

Semaphores used as sleepy-wait mutual exclusion mechanisms can introduce the problem of priority inversion. Priority inversion occurs when one or more low-priority processes executing in a critical section prevent the progress of one or more high-priority processes. Priority inheritance involves temporarily raising the priority of the low priority processes executing in the critical section to that of the highest priority waiting process. This ensures that the processes executing in the critical section have sufficient priority to continue execution until they leave the critical section. The current implementation of priority inheritance involves semaphores used by kernel services.

This feature is configured by default into each of the pre-built RedHawk Linux kernels. It can be disabled on any system. This might be desirable when individual systems are set up to handle only non-critical tasks and any overhead associated with priority inheritance is unnecessary. To disable priority inheritance on a system, turn off the `CONFIG_PRIO_INHERIT` and `CONFIG_RWSEM_PRIO_INHERIT` tunables accessible through the General Setup selection of the Kernel Configuration GUI.

4.1.2 PCI Base Address Register (BAR) File System and Interface

A base address register (BAR) file system has been added under `/proc/bus/pci`. This file system contains a file representing each device resource that can be memory mapped for each PCI device on the system. These files, called BAR files, provide access to the device without having to know its physical address.

PCI devices are dynamically configured in the system at boot time. Changes such as physically plugging a board into a different slot on the system can change the bus/slot/function numbers that the `/proc` and BAR file systems use to locate a device; however, the vendor and device IDs remain fixed. A library interface provides easy-to-use tools for accessing a PCI device using the fixed vendor and device IDs.

Refer to the Device Drivers chapter of the *RedHawk Linux User's Guide* and the `bar_scan_open(3)` man page for details. The file `/usr/share/doc/ccur/examples/pci_barscan.c` is a sample program illustrating how these functions can be used.

4.1.3 Binding a Shared Memory Segment to I/O Space

A system call, `shmbind(2)`, and a utility, `shmconfig(1)`, have been added to RedHawk Linux for binding a shared memory segment to a region of I/O space.

When using `shmbind`, the PCI BAR routines (see the previous section) can be used to obtain the physical address of the I/O region to bind to. The `shmconfig(1)` utility can be used to bind a segment at command level.

Refer to the man pages and the “Interprocess Communication” chapter of the *RedHawk Linux User's Guide* for more information.

4.1.4 PCI-to-VME Bridge Support

Support for the Model 618-3 PCI-to-VMEbus adapter by SBS Technologies has been added to RedHawk Linux. This allows connection between the iHawk and VME based systems. With this support, you can use **mmap(2)**, **read(2)** and **write(2)** to access VME space.

A device driver and user interface are provided, as well as example programs to aid with adapter and system configuration. The ability to bind multiple buffers of various sizes, an enhancement over the supplied software package from SBS Technologies, allows each driver to allocate its own bind buffer and enables use of the full VMEbus window space.

The bridge is configured as a module by default in the pre-defined RedHawk kernels for iHawk systems that are based on the Xeon processor. Documentation from SBS Technologies is included with iHawk systems that are purchased with the SBS Technologies board. In addition, Chapter 14 in the *RedHawk Linux User's Guide* describes this support.

4.1.5 kgdb Support

The **kgdb** debugger is configured in the pre-built “debug” kernel for Opteron processors. **kgdb** uses **gdb** from a separate system to debug the kernel.

Note that some modifications have been made to **gdb** for RedHawk Linux:

- To successfully perform stack trace backs, set the following option:

```
gdb> set backtrace switch-stacks on
```

- To specify a list of functions which should be skipped when picking a frame to display in an “info thread” command, set the following option:

```
gdb> set skip-frame thread_return,schedule_timeout
```

4.1.6 Sample Kernel-level Device Driver

A fully-commented sample kernel-level driver has been added to RedHawk Linux. This driver illustrates how to attach a signal to the occurrence of a device interrupt and the code for the interrupt service routine which will then trigger the signal. This driver and related files are located in **/usr/share/doc/ccur/examples/driver**. You can use the sample driver, **sample_mod**, as a template for writing a simple kernel-level driver that handles an interrupt and sends a signal to a user-level process. The mechanism described can be used to replace code that utilized user-level interrupts in the PowerMAX OS.

Refer to the “Device Drivers” chapter of the *RedHawk Linux User's Guide* for complete details.

4.1.7 Online Access and Documentation Enhancements

The RedHawk Linux Documentation CD now installs the RedHawk documentation PDF files into `/usr/share/doc/ccur`. It also adds icons to the desktop that you can use to access the documents and connect to Concurrent's home page and RedHawk Updates web site.



Documents

This icon launches Adobe® Reader® and displays the RedHawk Linux Documentation Roadmap listing the available RedHawk documents. Click on the item in the Roadmap to access it.



Updates

This icon launches your web browser and accesses the RedHawk Updates web site, redhawk.ccur.com. For more information about this site and how to download software and documentation updates, see “Software and Documentation Updates” on page 30.



Concurrent

This icon launches your web browser and displays Concurrent's home page, www.ccur.com.

In addition to the RedHawk Release Notes and User's Guides for RedHawk, FBS and RCIM, a RedHawk FAQ and the SBS Technologies documents for the PCI-to-VME bridge are now included with the RedHawk documentation.

The following sections have been added to the *RedHawk Linux User's Guide*:

- Chapter 14 – PCI-to-VME Support
This chapter describes support for a PCI-to-VME bridge.
- Appendix B – Kernel Tunables for RedHawk Linux Features
This appendix contains a listing of the kernel tunables that control the unique RedHawk Linux features and their default values in pre-built RedHawk kernels.
- Appendix C – Capabilities in RedHawk Linux
This is a list of the capabilities provided under RedHawk Linux and the permissions provided by each. This includes functionality unique to RedHawk as well as standard Linux.
- Appendix D – Kernel Trace Events
This is a list of pre-defined kernel trace points and methods for defining and logging custom events within kernel modules.
- Appendix E – Migrating 32-bit Code to 64-bit Code
This appendix provides information needed to migrate 32-bit code to 64-bit processing on the AMD Opteron processor.
- Appendix F – Kernel-level Daemons on Shielded CPUs
This appendix discusses the impact of kernel-level daemons on shielded CPUs.
- Appendix G – Cross Processor Interrupts on Shielded CPUs
This appendix discusses the impact of cross processor interrupts on shielded CPUs.

4.2 Modifications

4.2.1 cpuset_t Object Enforcement

The **cpuset (3)** facility has been changed to enforce transparency of the `cpuset_t` object. Code that directly created and manipulated `cpuset_t` objects will no longer compile without modification.

In previous releases of Red Hawk, the documentation explicitly warned against creating `cpuset_t` objects directly. Instead, the **`cpuset_alloc()`** and **`cpuset_free()`** routines should be called to allocate and free `cpuset` objects, and the `cpuset` objects should only be manipulated via the provided `cpuset` APIs.

This abstraction is necessary due to the volatility of the internal details of the `cpuset_t` implementation; different existing platforms (and future large-scale multiprocessing systems) require different internal representations for holding sets of CPUs.

Code that incorrectly creates `cpuset_t` objects can still be made to work on existing platforms by including the **`cpuset.h`** header file in the following manner:

```
#define CPuset_PRIVATE
typedef unsigned long cpuset_t;
#include <cpuset.h>
```

However, although this temporary workaround is compatible with the current implementation of the `cpuset_t` object, it is not guaranteed to be compatible in the future. In addition, binaries compiled using this workaround for iHawks will not be compatible with Opteron systems.

5.0. Installation Procedures

Follow the instructions in this section to install RedHawk Linux Version 2.1 on a system.

NOTE

There is no “upgrade” path available between Versions 1.x and 2.1. To install Version 2.1 on a system currently running 1.x, refer to “Filesystem Backup Recommendations” on page 25 before following the steps in this section to install Version 2.1 on your system.

Review the following points before installing the software:

- 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.

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

5.1 Installing Red Hat Software

The Red Hat Enterprise 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 Enterprise Linux Installation Disc 1 of 4 in the CD-ROM drive and power down the system.
3. Power on the system with the installation disc installed in order to boot from the disc. If you wish to check the Red Hat media, type `linux mediacheck` at the `boot :` prompt. To start the installation, press ENTER.

At the Welcome screen, click Next.

- At the Language Selection screen:
Choose English language. Click Next.
- At the Keyboard screen:
Accept keyboard defaults. Click Next.
- At the Mouse Configuration screen:
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 Disk Partitioning Setup screen:
Choose “Manually Partition with Disk Druid” and click Next to partition the disk manually and create the partition sizes as shown in Table 5-1 below. Note that this table shows recommended partition sizes for a 36 GB disk or larger.

Note

All partitions on SCSI drives must be placed on **/dev/sda**; all partitions on IDE drives must be placed on **/dev/hda**. 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 screen, 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 box at the bottom of each partition setup page. Click OK to continue to set up the next partition.

Table 5-1 Recommended Disk Partition Sizes

Mount Point	Type	Filesystem Type	Partition Size
/boot	primary	ext3	500 MB
/	primary	ext3	16384 MB (16 GB)
swap (See Note below)	primary	swap	Size of system’s main memory plus 5 percent additional. (See Table 7-2 on page 26 for suggested swap sizes)
/home	primary	ext3	Fill to maximum allowable size
Note: Select File System Type on the Add Partition screen to select the swap file system. Enter the recommended size.			

- Click Next when finished with partitioning.

- At the **Boot Loader Configuration** screen:
Accept GRUB boot loader defaults. Enter a GRUB password if desired (not recommended). Click **Next**.
- At the **Network Configuration** screen:
Configure networking as appropriate (fixed network numbers are recommended - you will need address information if using fixed numbers). Select the network device and click **Edit** to configure networking. Refer to Online Help for additional instructions. Click **Next** after completion.
- At the **Firewall** screen:
Choose “No firewall”, then click **Next**.
- At the **Additional Language Support** screen:
Choose any additional languages as necessary. Click **Next** at completion.
- At the **Time Zone Selection** screen:
Select the appropriate time zone, then click **Next**.
- At the **Set Root Password** screen:
Enter root password and confirmation, then click **Next**.
- At the **Package Defaults** screen:
Select “Customize the set of packages to be installed”, then click **Next**.
- At the **Package Group Selections** screen:
Scroll down to the bottom of the 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 Installation disc 1 will be installed. When disc 1 is completed, you will be prompted to insert disc 2. Remove disc 1 and insert disc 2, then click **OK**. Take the same action when prompted for discs 3 and 4 and finally disc 1 again.

- At the **Graphical Interface (X) Configuration** screen:
Accept defaults, click **Next**.
 - At the **Monitor Configuration** screen:
Accept monitor defaults, click **Next**.
 - At the **Customize Graphical Configuration** screen:
Provide the Color Depth and Screen Resolution values for your monitor, then click **Next**.
4. Remove the disc from the drive to prevent booting the installation disc again and store appropriately.
 5. At the next window prompt, press **Exit** to reboot the system. Verify that Red Hat boots up properly.

6. Once the system boots up successfully, proceed as follows:
 - At the **Welcome** screen:
Click **Next** to continue.
 - At the **License Agreement** screen:
Click “Yes, I agree to the License Agreement”, then click **Next**.
 - At the **Date and Time** screen:
Set the appropriate date and time. Enable NTP if desired. Click **Next** to continue.
 - At the **User Account** screen:
Enter a username and password for each account you wish to set up at this time (this can be done after the full installation). Click **Next** to continue.
 - If your system has a sound card installed, the **Sound Card** screen will appear. At the **Sound Card** screen:
Click **Play test sound** if desired. Click **Next**.
 - At the **Red Hat Network** screen:
Select “No, I do not want to register my system.” Click **Next** to continue.
 - At the **Install Additional CDs** screen:
Three choices appear for installing additional Red Hat CDs. If you wish to install any of them now, click on the **Install** button for the desired CD and follow the instructions that display. Click **Next** to continue.
 - At the **Finished Setup!** screen:
Click **Next** 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 5.2 to install Red Hat software updates.

5.2 Installing Red Hat Software Updates

The disc labeled “Red Hat Enterprise Linux Update CD for RedHawk Linux Version 2.1” 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 Enterprise Linux Update CD for RedHawk Linux Version 2.1” and insert it 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. When the installation completes, 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 Red Hat kernel boots. Continue with the steps in the next section to install RedHawk Linux.

5.3 Installing RedHawk Linux

After installing Red Hat 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 2.1” and insert it 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
```

NOTE: Special instructions are displayed during the installation that may require appropriate action, such as video card installation and configuration.

5. When the installation completes, execute the following commands:

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

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

7. Locate the disc labeled “RedHawk Linux Documentation CD Version 2.1” and insert it into the CD-ROM drive. Use **mount** as described above if needed to mount the cdrom device.

8. Execute the following commands to install RedHawk Linux documentation:

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

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

9. When the installation completes, execute the following commands:

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

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

5.4 Installing RedHawk Linux 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 using your browser or by clicking on the “Updates” desktop icon.
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 time it takes to install will vary depending on the number of updates being installed.

6. When complete, exit single-user mode (^D). Reboot the system* choosing the new RedHawk kernel and verify that the system boots properly. Continue with section 5.5 if an RCIM is to be installed or section 5.6 to install FBS.

* **Note:** If this system is a model 868 8-way iHawk, disable hyper-threading through the BIOS, or on the GRUB boot command line by specifying “noht”.

5.5 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 iHawk system, it should be installed now. See the *Real-Time Clock and Interrupt Module (RCIM) PCI Form Factor User's Guide* for complete details.

5.5.1 Quick Hardware Installation Checklist

1. Before installing the RCIM, decide what mode the RCIM will run in (see "RCIM Connection Modes" on page 26) and if you will be using the RCIM to accept external interrupts.
2. Verify that the `ccur-rcim` RPM has been installed by executing the command `rpm -q ccur-rcim`. The system will inform you if it is not installed.
3. Power down the system and remove all power cords.
4. 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.

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

5.5.2 Verifying 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 that shown below:

```
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
```

5.6 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 2.1 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 2.1” and insert it 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. When the installation completes, 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.

5.7 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 time it takes to install will vary depending on the number of updates being installed.

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

5.8 Installing the PCI-to-VME Bridge

If you are using the PCI-to-VME bridge supplied by Concurrent to connect your iHawk Series 860 system with a VME system, it can be installed at this time. If you are not installing this feature, skip to section 5.9

5.8.1 Installing the Hardware

The hardware consists of a PCI adapter, a VMEbus adapter and a fiber optic cable.

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.

1. To configure the jumpers on the VMEbus adapter card correctly, refer to Chapter 10 of the *SBS Technologies Model 618-3 Hardware Manual* included with the RedHawk Linux documentation.
2. To install the PCI adapter in your iHawk system:
 - a. Power down the system.
 - b. Locate a vacant PCI card slot in the chassis that supports a bus master.
 - c. Remove the metal plate that covers the cable exit at the rear of the chassis.
 - d. Insert the PCI adapter card into the connector.
 - e. Fasten the adapter card in place with the mounting screw.
 - f. Replace the cover.
3. To install the VMEbus adapter card:
 - a. Ensure that the VMEbus chassis is powered down.
 - b. Decide whether the VMEbus adapter card is the system controller. If so, it must be installed in slot 1. If not, locate an unoccupied 6U slot in the card cage for the adapter.
 - c. Insert the card into the connector of the selected slot.
4. To install the fiber optic cable:
 - a. Ensure that both systems are powered down.

- b. Remove the rubber boots on the fiber-optic transceivers as well as the ones on the fiber-optic cables. Be sure to replace these boots when cables are not in use.
- c. Plug one end of the fiber-optic cable into the PCI adapter card's transceiver.
- d. Plug the other end of the cable into the VMEbus adapter card's transceiver.
- e. Power on both systems.
- f. Ensure that the READY LEDs on both adapter cards are lit.

5.8.2 Installing the Software

1. With RedHawk Linux Version 2.1 or later running on the iHawk 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 PCI-to-VME Bridge Software Library" and insert it 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-sbsvme
```

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

5. When the installation completes, 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).

Refer to the "PCI-to-VME Support" chapter of the *RedHawk Linux User's Guide* for configuration and usage information.

5.9 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.

6.0. NVIDIA Graphics Configuration

This section addresses graphics display configurations on iHawk 860 graphics systems only.

The NVIDIA Linux Display Driver (version 1.0-5336) 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. It should be possible to mix and match as many PCI cards as there are PCI slots, and PCI cards with AGP. Systems designed with AGP are usually limited to two physical CPUs. If more than two physical processors are needed in your system, utilize PCI adapters. 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 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`.
6. To test the success of the installation, run the following command:

```
startx
```

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.

7. 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 Information

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

7.1 Installation/Configuration Options

7.1.1 Filesystem Backup Recommendations

All filesystems should be archived or preserved prior to commencing a re-installation. This can be accomplished using normal backup methods. Concurrent recommends obtaining a new disk while keeping the original disk to ensure minimal data loss.

Below is a list of configuration files that may be useful in configuring a newly installed RedHawk system to match an existing configuration. It is not an all inclusive list, and there may be others in a given configuration. Note that not all files are meant to be copied intact to a new system.

Table 7-1 Files Recommended for Backup

Path	Comments
/etc/hosts	Preserve hostnames on file.
/etc/fstab	Maintain existing mounts. Will not preserve mount points.
/etc/sysconfig/network	Network information.
/etc/sysconfig/network-scripts/ifcfg-*	Network device configuration.
/etc/resolv.conf	DNS configuration info.
/etc/nsswitch.conf	NIS/DNS configuration info.
/etc/ntp.conf	NTP configuration. See ntpd(1).
/etc/ntp/step-tickers /etc/rc.local /etc/rhosts	Startup info.
/etc/X11/XF86Config	X11 server/device/screen configuration data.
/etc/modules.conf	For reference and comparison.
/etc/security/capability.conf	PAM configuration.
/etc/ssh/*	To keep same host keys.
/etc/inittab	For reference and comparison.
/etc/xinetd.d/	For reference and comparison. Capture any file customizations.
/var/spool/cron/	Preserve user crontab entries.
/sbin/chkconfig --list > <save_file_name>	For reference to configure new system.

In addition to the above, check for any customized `/etc/*.conf`, `/etc/sysconfig/*`, and `/etc/pam.d/*` files which may need to move to the new system. Check also for rpm files installed after the previous system installation that need to move forward to the new system. Use `/bin/rpm -qal --last | more` to aid in identifying the latest rpms installed.

7.1.1 File System Swap Size Guidelines

Table 7-2 supplies the recommended swap partition sizes for various sizes of main memory. 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 7-2 Swap Partition Size Guidelines

Main Memory Size (MB)	Recommended Swap Partition Size (MB)
256	269
1024	1075
2048	2150
3072	3225
4096	4300
5120	5376
6144	6451
7168	7526
8192	8601

7.1.3 RCIM Connection Modes

Before installing an RCIM on an iHawk system, 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 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.

7.2 Considerations

7.2.1 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.

7.2.2 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**.

7.2.3 Hyper-thread Activation

Hyper-threading is configured by default in each of the standard RedHawk Linux kernels running on iHawk systems. 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. The setting in the BIOS will supercede any configuration of this feature in the kernel. 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 supported for the model 868 8-way iHawk system and should be disabled prior to booting a Version 2.1 RedHawk Linux kernel on this type of system.

7.2.4 Binary Compatibility Between Versions 1.4 and 2.1

Programs that are dynamically linked to the **ccur_rt** and **ccur_fbsched** libraries on RedHawk 1.4 systems will not be binary compatible with RedHawk 2.1.

If having a single application binary that will run on RedHawk 1.4 and 2.1 systems is required, download the RedHawk 1.4.1 update from the RedHawk Updates web site (see “Software Updates and Support” on page 30) and relink the applications to the new **ccur_rt** library (and **ccur_fbsched** if applicable) included with the update. The resulting binaries will run on both systems.

If binary compatibility between these two systems is not required, no special action is needed. Applications linked to the 1.4 libraries will continue to run on 1.4 systems, and applications compiled on 2.1 will run on 2.1 systems.

8.0. Known Issues

Special consideration should be given to the following areas.

Networking Issues

- 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.
- NFS mounts of large partitions will sporadically have problems in seeing all of the files that should be mounted in the partition.

Linux Test Project

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/>

BIOS “Console Redirection”

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.

NMI Button

Using the NMI button on the processor enters **kdb** on the console when configured. It cannot be used, however, to step repeatedly through an error condition.

USB Keyboards with kdb

Using USB keyboards with the **kdb** kernel debugger is not supported.

PAM Capabilities

- 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
```

- Currently, commands run with **rexec(1)** on a RedHawk target fail to inherit capabilities even when the appropriate **pam_capability.so** entry is made in the `/etc/pam.d/rexec` file. Use the **rsh** facility instead.

sadc(8) Issue

When a system configuration change is made that affects the number of CPUs (for example when booting with a uniprocessor kernel or changing hyper-threading configuration), 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.

Model 868 8-way iHawk Restrictions

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 on this system.

lspci(8) Output

Under earlier versions of RedHawk Linux, output from `lspci(8)` displays the RCIM peripheral as “PLX Technology, Inc.: Unknown device.” To correct this so that the RCIM is correctly identified, update `/usr/share/hwdata/pci.ids` with the version of this file supplied in the RedHawk kernel tree. Contact Concurrent Software Support (see page 30 for details) if you require assistance.

irqbalance

The `irqbalance` feature is disabled on RedHawk Linux. This Red Hat feature is meant to distribute interrupts equally across CPUs. It does not honor the IRQ affinity masks set up in `/proc/irq/irq#/smp_affinity` and therefore will cause interrupts to be routed to shielded CPUs.

This feature can be enabled/disabled at boot time with:

```
chkconfig irqbalance {on|off}
```

as well as started/stopped while the system is running with:

```
service irqbalance {start|stop}
```

9.0. Software Updates and Support

9.1 Direct Software Support

For answers to basic RedHawk Linux questions, check out the FAQ included with the RedHawk Linux documentation.

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.

9.2 Software and Documentation Updates

Available updates to RedHawk Linux software and documentation can be downloaded from the RedHawk Updates web site. Follow these steps:

1. Access the RedHawk Updates web site, redhawk.ccur.com. This site can be accessed by clicking on the “Updates” icon on the desktop once the RedHawk Linux Documentation CD has been installed. Accessing this web site displays the following screen:



2. Click on the Login button to display the login screen below.



3. Fill in your login ID and password, then click on the Login button. The login ID and password can be found in the shipping documents accompanying your system.
4. 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`).
5. 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`.
6. To install the newly downloaded packages, change directory to the location of the updates and issue the following command:

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

The time it takes to install will vary depending on the number of updates being installed.

7. When complete, exit single-user mode (`^D`).

If you have problems, please contact the Concurrent Software Support Center (see “Direct Software Support” on page 30 for further information).

