NightTrace
Version 5.3 Release Notes (Linux)

December 2003

0898398-5.3

READ ME BEFORE INSTALLING THIS PRODUCT

CONCURRENT COMPUTER CORPORATION

Contents

1.0.   Introduction

NightTrace™ is used for debugging and analyzing multiprocess and multiprocessor real-time applications and their interaction with the operating system.

The NightTrace toolset consists of an interactive debugging and performance analysis tool, trace data collection daemons, and an Application Programming Interface (API) allowing user applications to log data values:

NightTrace API	libraries and include files for use in user applications that log trace events to shared memory
ntrace	a graphical tool that controls daemon sessions and displays user and kernel trace events from trace event files
ntraceud	a daemon program that copies user applications' trace events from shared memory to trace event files
ntracekd	a daemon program that copies operating system trace events from kernel memory to trace event files

NightTrace is flexible. As a user, you control:

- selection of user tracing of your application and/or kernel tracing

- selection of timestamp source

- trace-point placement within your application

- the source language of the trace application

- the number of processes and CPUs you gather data on

- the amounts and types of information you display

- trace event searches and summaries

2.0.   Documentation

Table 2-1 lists the NightTrace 5.3 documentation available from Concurrent.

Table 2-1. NightTrace Version 5.3 Documentation

Manual Name	Pub. Number
NightTrace User's Guide	0890398-110
NightTrace Version 5.3 Release Notes (Linux)	0898398-5.3

Copies of the 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 or 1-305-931-2408.

Additionally, the documentation listed above is available:

- online using the **nhelp** utility

- in PDF format in the **documentation** directory of the installation CD

- on the Concurrent Computer Corporation web site at www.ccur.com

3.0.   Prerequisites

Prerequisites for NightTrace Version 5.3 for both the host system and target systems are as follows:

3.1.   Host System

3.1.1.   Software

- RedHawk™ Linux *or* Red Hat® Linux[*]
- Required capabilities[**]

NOTE

The following capabilities are normally installed by the installation script on the CD containing the NightStar tools. The user will be notified if required capabilities do not exist on the Linux system.

- NightStar™ Tools

Capabilities	RPMs providing these capabilities

`ccur-HyperHelp`
`ccur-HyperHelp-scripts`
`ccur-elanlm`
	`ccur-HyperHelp-scripts-6.4.2-002`
	`ccur-elanlm-5.0-7`
	`ccur-x11progs-6.4.2-006`

3.1.2.   Hardware

- an Intel®-based PC - 300Mhz or higher (recommended minimum configuration)
- 64MB physical memory (recommended minimum configuration)

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[*] This product has been extensively tested on RedHawk Linux 1.4 and Red Hat Linux 8.0 and 9.0. However, this product has not been tested with versions of Linux supplied by other vendors.

[**] The "Capabilities" listed may be found in those versions of the RPMs listed under "RPMs providing these capabilities" or in later versions.

3.2.   Target Systems

3.2.1.   RedHawk Systems

3.2.1.1.   Software

- RedHawk Linux 1.4 or later
- Required RedHawk Linux RPMs (see "RedHawk Target Installation" on page 7 for more information)

3.2.1.2.   Hardware

- any iHawk Series 860 system

3.2.2.   PowerMAX Systems

3.2.2.1.   Software

- PowerMAX OS 4.3 or later
- Required PowerMAX OS packages (see "PowerMAX Target Installation" on page 7 for more information)

3.2.2.2.   Hardware

- Computer Systems:
    Power Hawk™ 620 and 640
    Power Hawk 710, 720 and 740
    Power Hawk 900 Series
    PowerStack™ II and III
    Night Hawk® Series 6000
    TurboHawk™
    PowerMAXION™
- Board-Level Products:
    Motorola® MVME2604
    Motorola MVME4604

4.0. System Installation

Installation of the host portion of NightTrace is normally done as part of the general installation of either the RedHawk NightStar Tools or the PowerWorks Linux Development Environment. A single command installs (or uninstalls) all required software components. See the *RedHawk NightStar Tools Release Notes* (0898008) or *PowerWorks Linux Development Environment Release Notes* (0898000) for more information.

The following section describes how to install (or uninstall) NightTrace independently for those rare cases when this is necessary.

NOTE

NightTrace requires that certain packages are installed on the target systems. See "Target Installation" on page 7 for more information.

4.1. Separate Host Installation

At times, it may be necessary to install (or uninstall) NightTrace independent of the installation of the software suite in which it is normally distributed. This may be done using the standard Linux product installation mechanism, **rpm** (see **rpm(8)**).

The RPM name associated with NightTrace 5.3 is:

ccur-ntrace

and the file associated with this rpm is:

ccur-ntrace-5.3-000.i386.rpm

which can be found in the **RPM** directory on the installation CD.

NOTE

The user must be root in order to use the **rpm** product installation mechanism on the Linux system.

To install the NightTrace RPM, issue the following commands on your Linux system:

1. Insert the installation CD in the CD-ROM drive

2. Mount the CD-ROM drive (assuming the standard mount entry for the CD-ROM device exists in **/etc/fstab**)

    mount /mnt/cdrom

3. Change the current working directory to the directory containing the NightTrace rpm

    cd /mnt/cdrom/RPM

4. Install the rpm

        rpm -Uvh ccur-ntrace-5.3-000.i386.rpm

    By default, the product is installed in **/usr/opt**.

5. Change the current working directory outside the **/mnt/cdrom** hierarchy

        cd /

6. Unmount the CD-ROM drive (otherwise, you will be unable to remove the installation CD from the CD-ROM drive)

        umount /mnt/cdrom

To uninstall the NightTrace RPM, use the following command:

    rpm -e ccur-ntrace

4.2.   Target Installation

4.2.1.   RedHawk Target Installation

When targeting a RedHawk Linux system, NightTrace requires that the following RPMs are installed on that target system:

NightStar Tool	RPM
NightTrace server	`ccur-ntracelog-5.3-000.i386.rpm`
NightStar daemon	`ccur-nstar-1.2-007.i386.rpm`
Élan License Manager	`ccur-elanlm-5.0-7.i386.rpm`

These RPMs may be installed on the target system by installing the RedHawk NightStar Tools on that system. However, the individual RPMs can be found in the **RPM** subdirectory on the installation CD and may be installed separately. See "Separate Host Installation" on page 5 for the procedure to install an individual RPM.

4.2.2.   PowerMAX Target Installation

When targeting a PowerMAX system, NightTrace requires that the following software packages are installed on that target system:

NightStar Tool	Package	Version
NightTrace	`ntracelog`	5.3 or later
NightStar daemon	`nstar`	1.2-007

These packages are normally installed during the installation of the corresponding NightStar tool on the PowerMAX OS system. However, the packages are also included on the PowerWorks Linux Development Environment Installation CD and may be installed by following the procedures below if the packages listed above have not been installed on the target system, or if the versions installed on the target system are not the same as those specified above.

NOTE

The versions of the required software packages installed on the PowerMAX OS target systems must be the same as those listed above. If this is not the case, follow the procedures below.

If your PowerMAX OS system has a CD-ROM device:

```
mkdir /mnt/tmp
mount -F cdfs /dev/dev_name /mnt/tmp
cd /mnt/tmp/powermax-ppc604
```

If your PowerMAX OS system does not have a CD-ROM device:

On the Linux system, insert the PowerWorks Linux Development Environment Installation CD in the CD-ROM drive, mount the CD-ROM drive, and use NFS to export it to the PowerMAX OS system:

```
mount /mnt/cdrom
exportfs powermax_os_system:/mnt/cdrom
```

On the PowerMAX OS system, mount the CD-ROM as an NFS filesystem:

```
mkdir /tmp/cdrom
mount -F nfs linux_system:/mnt/cdrom /tmp/cdrom
cd /tmp/cdrom/powermax-ppc604
```

On the PowerMAX OS system, install the target portions of the NightStar tools via the following commands:

```
cp ./nightstar.Z /tmp/nightstar.Z
zcat /tmp/nightstar.Z | pkgadd -d -
```

If your PowerMAX OS system has a CD-ROM device:

```
cd /
umount /mnt/tmp
```

If your PowerMAX OS system does not have a CD-ROM device:

On the PowerMAX OS system, unmount the NFS filesystem:

```
cd /
umount /tmp/cdrom
```

On the Linux system, unexport the NFS filesystem, and then unmount the CD-ROM:

```
cd /
exportfs -u powermax_os_system:/mnt/cdrom
umount /mnt/cdrom
```
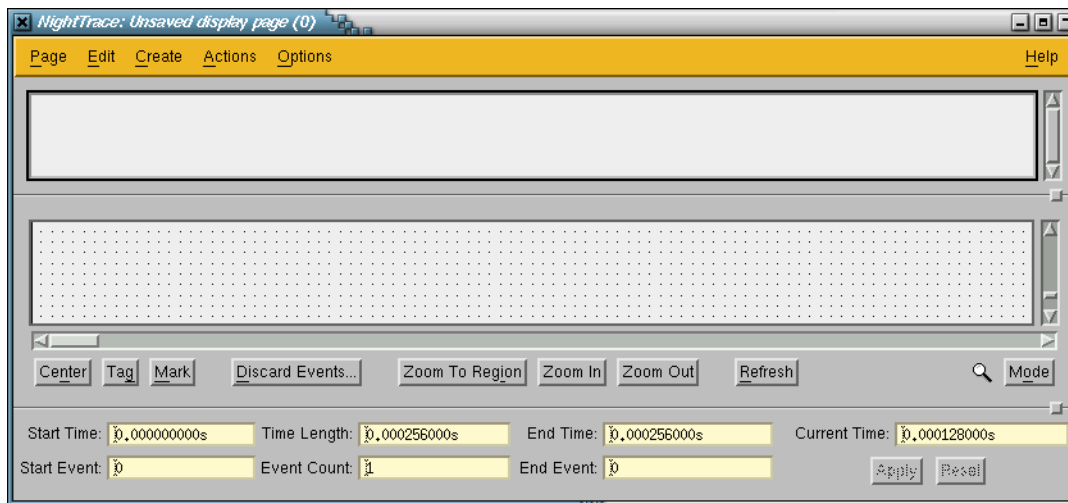
5.0. Overview of NightTrace 5.3

5.1. Changes in This Release

5.1.1. Enhanced Display Pages

NightTrace's display pages have been improved to provide more flexibility and to save screen space.

- The display grid area now has a vertical scroll bar for large displays

- The Zoom Factor and Increment settings have been moved to the Options menu to save a row on the display page.

- The text fields describing start time, start event, and intervals can be hidden with the vertical window pane to save space.

- A Tag button has been added.

- The Options menu has been added which includes the Zoom Factor and Increment settings as well as an option to automatically disambiguate process names for kernel display pages.

- The Edit and View radio boxes have been moved to a Mode button in the lower right-hand portion of the window.

- Grid Labels, Data Boxes, Event Graphs, State Graphs, and Data Graph display grid objects may now be copied and pasted into the display grid or column.

- When in edit mode, double-clicking the left mouse button on display objects launches the configuration dialog for that object. Note that the key sequence ctrl-C no longer activates the configuration dialog.

- When in view mode, double-clicking the left mouse button on a state graph automatically summarizes the state defined by the graph and displays the results in the scrollable text area at the top of the display page.

5.1.2. Enhanced Display Object Configuration Dialogs

The configuration dialogs used for Data Boxes, Event Graphs, State Graphs, and Data Graphs has been enhanced to provide drop-down menu lists and full customization using dialogs similar to those used for the definition of Qualified Expressions and Qualified States.

5.1.3. User-Defined Tags

Tags are associated with a specific timestamp in a data-set. The user can set a tag at the current time line by pressing the Tag button. Alternatively, you can associate a tag with the time of a specific event by clicking the right mouse button on an event in the display. Tags are indicated on the display Ruler as objects with a number. Tags can be given user-defined names for subsequent searching and analysis.

The Tags dialog indicates all current tags, their position, the difference in time between the tags themselves and the current timeline, as well as difference in time between two selected tags. Double-clicking the left mouse button on an tag entry in the list causes the current timeline to be moved to the associated tag.

Tags are persistent between NightTrace invocations as they are associated with NightTrace sessions.

5.1.4. Enhanced String Table Editing

String tables can now be easily manipulated through the NightTrace graphical user interface by double-clicking the left mouse button on the String Tables item in the Session Overview area of the main window. A variety of dialogs are presented to manage existing string tables or add new ones. String table changes made through these dialogs become part of the current NightTrace session.

5.1.5. Improvements to Data Trimming Operations

The Trim button has been replaced with the Discard Events... button which launches a dialog. The dialog allows the user to specify whether the selected region of events should be removed from the data set or whether all other events should be removed, thereby preserving only the events from the selected region.

Once data has been trimmed, a marker appears on the ruler indicated that the events were discarded. When chosing Discard Selected Events, the mark appears at the location of the first event that was removed. When chosing Discarded Unselected Events, the mark appears at the location of the last event that was not discarded. In either case, an internal event, NT_DISCARDED_DATA is logged at that location and its first argument indicates the number of events that were removed.

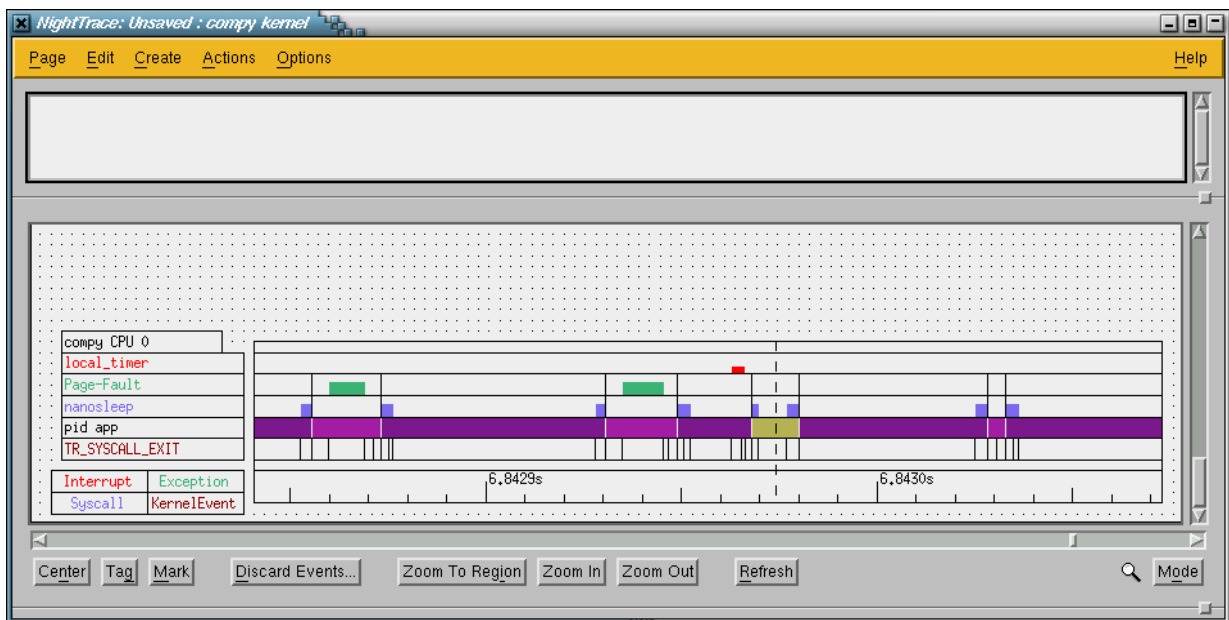## 5.1.6. Crash Dump Support for PowerMAX OS Targets

Support was added for extracting kernel trace data from PowerMAX OS kernel crash files. This is useful when kernel tracing is active but the system crashes or halts before the relevant data can be retrieved and written to disk or streamed to NightTrace. Invoke **ntrace** with the **vmcore** and **unix** images associated with the crash dump:

```
ntrace /var/crashfiles/vmcore.10 /var/crashfiles/unix.10
```

Currently, this support is only available when running **ntrace** on a PowerMAX OS system.

5.1.7. Enhanced Kernel Display Pages

An additional data graph was added to the default kernel display page.

A fourth row was added for each CPU which tracks the activity of processes on that CPU. A colored bar indicates that a process other than /idle is assigned to the CPU. Each process is automatically assigned a distinctive color and retains that color throughout the dataset.

The example above clearly indicates that a process represented by the deep purple color was context switched out four times in the displayed interval. The process name is displayed on the left hand side data box.

Processes with common process names can now be easily differentiated by selecting the Distinguish Processes item from the Options menu. When this option is selected, all process names have their process ID (PID) appended to their name.

5.1.8. Kernel Page Builder Wizard

The addition of the fourth row for the PID graph in kernel display pages increases the amount of display grid space required for a system. For systems with several processors, this may be undesirable. The Custom Kernel Page item from the Page menu on the main window launches a dialog which allows for customization of kernel display pages providing for selection of specific CPUs from specific systems and selection of the graphs to be displayed for each CPU.

5.1.9. Changes to Multiple Selection

Selection of multiple items from all dialogs and within NightTrace requires a combination of left mouse clicks with either the Shift or Ctrl key depressed.

5.1.10. Improved Data-Set and Session Management

In order to simplify the management of data sets and session files, new menu choices have been added. Selecting the Save Session Copy item from the NightTrace menu in the main window automatically creates a new session file and copies all data sets, configuration pages, string tables, and all session-related data to the new session. A new session name is automatically generated and is displayed in Session Configuration file title of the main window. The new session becomes active and the old session is closed and left unchanged.

This is especially useful when trimming or deleting events from data sets so that you can easily preserve the original data yet create a separate session with just the data of interest.

The semantics of the Save Session item have changed slightly. If no session was previously defined, a new session name is automatically generated and is displayed in Session Configuration file title of the main window. Select Save Session As if you wish to chose the name of a new session.

In order to exit NightTrace immediately and avoid any warning diagnostics about unsaved data, configuration, or session changes, select the Exit Immediately item from the NightTrace menu in the main window. All active daemons are terminated and all unsaved changes are discarded.

5.1.11. Improved Kernel Event Enabling

In the previous release, customized selection of individual kernel trace events did not properly function.

These problems have been corrected in both the **ntracekd** command line tool and the Events tab of the Daemons dialog in the main window.

ntracekd now allows for specification of a + or - sign with out any trailing event name or number, which enables or disables all events. This can be useful when wanting to enable just a few events. For example, the following command captures system call trace information but disables all other selectable trace events:

```
ntracekd --events=-,+schedchange,+syscall_entry,+syscall_exit ...
```

5.1.12. Accelerator Key Review

Accelerator keys were added in the previous release for ease and convenience on the NightTrace Main Window as well as the Display Pages. Some minor changes were made in this release. The following tables summarize accelerator key usage. Changes in this release are marked with an asterisk.

Main Window	
ctrl-d	new daemon dialog
ctrl-e	edit daemon
ctrl-f	flush daemon buffer
ctrl-l	launch daemon (previously start)
ctrl-h	halt daemon (previously stop)
ctrl-p	pause daemon
ctrl-q*	exit
ctrl-r	resume daemon
ctrl-s	save session
ctrl-y*	copy session
ctrl-w	close the NightTrace Main Window
alt-q*	exit immediately

Display Pages	
up-arrow	zoom out
down-arrow	zoom in
left-arrow	scroll left
right-arrow	scroll right
>	search forward with last criteria
<	search backward with last criteria
ctrl-a	select all
ctrl-c*	copy select grid object

Display Pages	
ctrl-d*	launch Discard Events dialog
ctrl-e	launch qualified expressions dialog
ctrl-g*	set Tag at current timeline
ctrl-i*	zoom to region
ctrl-m*	set the Mark to the current timeline
ctrl-n	center current timeline in interval
ctrl-o*	toggle edit/view mode
ctrl-r	refresh interval display
ctrl-t*	launch tags dialog
ctrl-v*	paste new grid object
ctrl-x	delete selected grid object
ctrl-z	open summary dialog
ctrl-w	close current display page

NOTE

It is not necessary to press the Shift key to use the > or <
accelerator.

5.2. Common Problems and Limitations

5.2.1. Privileges and Capabilities

A common problem when using the NightTrace API is that the `trace_begin()` (or `trace_start()`) call may fail if the lacks sufficient privileges to lock pages or utilize appropriate spin lock protection in which case no events are logged.

The application should be sure to check the return codes from `trace_begin()` (or `trace_start()`) and `trace_open_thread()` to ensure that subsequent `trace_event()` calls will actually log data.

5.2.2. Multithreaded programs and the NightTrace API

The NightTrace API now detects use by threaded programs and prevents use of rescheduling variables to protect critical sections. The API routines `trace_begin()` (and `trace_start()`) will fail with `NT_THREADS_NO_RESCHED` in this case. Threaded programs can still use the NightTrace API (with restrictions) if rescheduling variables are disabled.

Methods for disabling rescheduling variables:

- Select None for the Locking Policy on the User Trace tab in the Daemon Definition dialog.
- Invoke `trace_begin()` with a `ntconfig_t` structure which has `ntc_use_spl` and `ntc_use_resched` set to `FALSE`.

For threaded programs, the NightTrace API now logs the thread id (`pthread_self()`) with each trace-event. The "tid" value as displayed in NightTrace is constructed via the following: *main_pid'thread_id*, where *main_pid* is the process ID of the thread that called `trace_begin` (`trace_start`). Individual threads may be identified by using the *thread_id()* NightTrace function, e.g.

```
Condition: thread_id == 4
```

Kernel Data Limitations:

Currently, there is no automated mechanism which will allow you to identify a specific thread with kernel trace data. If you know the process ID of each thread, you can specify a pid table to NightTrace which defines the process->thread mapping. E.g.:

```
string_table (pid) = {
item = 3945, "thread1";
item = 3946, "thread2";
};
```

Such a table could be generated by a user application.

We anticipate improvements in this area with the release of RedHawk 2.0.

Configuration File Limitations:

Since the values returned by the *tid()* function include the process ID, it isn't the best choice for user-tailored configuration files, as the next data set will contain different process IDs.

Use of the *thread_id()* function is recommended, which returns the `pthread_self()` value, which (typically) is a predictable number.

Restrictions:

The RedHawk 1.4 operating system does not provide a mechanism for effective use of rescheduling variables by API libraries within threaded programs.

We anticipate improvements in this area with the release of RedHawk 2.0.

Therefore, the NightTrace API restricts their use from threaded programs. This means that a thread could be preempted while holding a spin_lock() during a NightTrace API call. If this occurs, and another thread (or the NightTrace daemon) takes over the CPU, it may spin waiting for the lock. This can have a detrimental affect on system performance. Exercise care in use of NightTrace API calls from threaded programs.

6.0. Direct Software Support

Software support is available from a central source. If you need assistance or information about your system, please contact the Concurrent Software Support Center at 1-800-245-6453. Our customers outside the continental United States can contact us directly at 1-954-283-1822 or 1-305-931-2408. 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.