NightTrace

Version 5.1.2 Release Notes (Linux)

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1.0. Introduction

NightTrace™ is used for debugging and analyzing multiprocess and multiprocess 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 in trace event file(s)
`ntraceud`	a daemon program that copies user applications' trace events from shared memory to trace event file(s)
`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 5.1.2 documentation available from Concurrent.

Table 2-1. NightTrace Version 5.1.2 Documentation

Manual Name	Pub. Number
NightTrace Manual	0890398-090
NightTrace Version 5.1.2 Release Notes (Linux)	0898398-5.1.2

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 documenation 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 5.1.2 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 or by the standard installation of the Red Hat or RedHawk Linux operating system. 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-5.0-5`
	`ccur-x11progs-6.4.2-004`

* This product has been extensively tested on RedHawk Linux 1.1 and Red Hat Linux 7.1, 7.2, and 7.3. 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.

- RedHawk Linux *or* Red Hat Linux

Capabilities	RPMs providing these capabilities
/bin/sh **ld-linux.so.2** **libX11.so.6** **libXext.so.6** **libc.so.6** **libm.so.6** **libnsl.so.1** **libresolv.so.2** **libstdc++-libc6.1-1.so.2** **libc.so.6(GLIBC_2.0)** **libc.so.6(GLIBC_2.1)** **libm.so.6(GLIBC_2.0)** **libm.so.6(GLIBC_2.1)**	*RedHawk 1.1:* **bash-2.05b-3** **compat-libstdc++-7.3-2.96.110** **glibc-2.2.90-24** **glibc-debug-2.2.90-24** **XFree86-libs-4.2.0-65** *Red Hat 7.3:* **bash-2.05a-13** **compat-glibc-6.2-2.1.3.2** **compat-libstdc++-6.2-2.9.0.16** **glibc-2.2.5-39** **glibc-debug-2.2.5-39** **XFree86-libs-4.2.0-8**

3.1.2. Hardware

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

3.2. Target Systems

3.2.1. RedHawk Systems

3.2.1.1. Software

- RedHawk Linux 1.1 or later
- Required RedHawk Linux RPMs (see “RedHawk Target Installation” on page 8 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 8 for more information)

3.2.2.2. Hardware

- Computer Systems:

  Power Hawk™ 620 and 640

  Power Hawk 710, 720 and 740

  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 8 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 5.1.2 is:

```
ccur-ntrace
```

and the file associated with this rpm is:

```
ccur-ntrace-5.1.2-000.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 -ivh ccur-ntrace-5.1.2-000.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-5.1.2-000.i386.rpm**
NightStar daemon	**ccur-nstar-1.1-000.i386.rpm**
Élan License Manager	**ccur-elanlm-5.0-5.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 6 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**	5.1.2 or later
NightStar daemon	**nstar**	1.1

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 5.1.2

5.1. Changes in This Release

5.1.1. Modification of Shared Memory Segment

The internal structure of the shared memory segment used to communicate between user applications and **`ntraceud`** has changed. Therefore, if you had linked your user applications with NightTrace 4.2 or earlier to include the statically linked version of **`libntrace`**, then you must relink your applications after installing the new version of NightTrace. Otherwise, the `trace_start()` API call will fail with `NTBADVERSION` and no trace events will be logged. Checking the return status from `trace_start()`is highly advised to avoid confusion in this situation.

5.2. Enhancements

5.2.1. NightTrace Session Management

NightTrace 5.1.2 allows users to manage user and kernel NightTrace daemons directly from its main window. It provides users with the ability to define a session consisting of one or more daemon definitions which can be saved for future use. These definitions include daemon collection modes and settings, daemon priorities and CPU bindings, and data output formats, as well as the trace event types that are logged by that particular daemon.

Using the session management features of NightTrace, users can manage multiple daemons simultaneously on multiple target systems from a central location.

NightTrace 5.1.2 offers the user the ability to start, stop, pause, and resume execution of any of the daemons under its management. The user may also view statistics as trace data is being gathered as well as dynamically enable and disable events while a particular daemon is executing.

5.2.2. NightTrace Session Overview

In addition to the session management features noted in “NightTrace Session Management” on page 10, NightTrace 5.1.2 displays all open files associated with displayed trace data in a Session Overview section of the NightTrace main window. This centralizes the location for basic NightTrace activities and provides more flexibility for opening and closing data, configuration, and eventmap files as well as for searching vectors files for system call names and interrupts.

5.2.3. Streaming

In addition to sending trace output to a file for later analysis, NightTrace also offers a streaming output method. When streaming, trace output is sent directly to the NightTrace display buffer for immediate analysis even while additional trace data is being collected.

5.2.4. Dynamic daemon coupling with user applications

NightTrace 5.1.2 now allows trace daemons to join user applications on-the-fly. Previously, users were required to first start the **`ntraceud`** daemon, then run their applications to completion, then stop **`ntraceud`**. NightTrace 5.1.2 allows you to start and stop **`ntraceud`** daemons at will, or use the new session management features of NightTrace (see “NightTrace Session Management” on page 10) to "peek" at trace data sets generated from your application when so desired.

5.2.5. trace_begin()

A new API routine, `trace_begin()`, has been provided which replaces the `trace_start()` routine. (`trace_start()` is still provided for backward compatibility but is now considered obsolete.)

In addition to the actions that `trace_start()` performed, `trace_begin()` allows the user to specify configuration settings that were previously only available when invoking **`ntraceud`** from the command line. This is especially important for applications that may run for long periods of time before a user daemon joins the application.

The `trace_begin()` routine performs the following operations:

- verifies that the version of the NightTrace library linked with the application is compatible with the version used by the user daemon (if already running)
- verifies that the supplied configuration settings are not in conflict with a pre-existing daemon or, if the user daemon does not yet exist, defines the configuration with these settings
- verifies that the RCIM synchronized tick clock (if selected as the timestamp source) is counting
- attaches the shared memory buffer (after creating it if necessary)
- initializes the preemption control mechanism
- locks critical NightTrace library routine pages in memory
- initializes tracing in the current process

5.2.6. Dynamic enabling and disabling of trace events

NightTrace 5.1.2 allows users to dynamically enable or disable selected trace event types while a particular daemon is running.

5.2.7. Reduced overhead for inactive trace_event() calls

NightTrace 5.1.2 significantly reduces the overhead for applications which make `trace_event()` API calls when no daemon is present. Most users will find the overhead so insignificant that `trace_event()` calls can be present in their applications during the entire development stage or even in final production.

5.2.8. Kernel display page improvement

In previous versions of NightTrace, kernel events for specific CPUs were discarded initially or after event loss until a context switch was seen so that the appropriate process ID/name could be displayed and so syscall, interrupt, and exception state graphs were accurate.

NightTrace 5.1.2 takes a different approach. For the initial state, and after any pause/resume or event loss, all kernel events are shown, even if no context switch has occurred. All syscall, interrupt, and exception states are considered inactive in the display until appropriate events which would start these states are seen. The process ID associated with events will indicate "unknown" until a context switch is seen.

This is especially useful for applications which consume an entire CPU and rarely context switch. Previously, no kernel events associated with these CPUs would be displayed. In NightTrace 5.1.2, all kernel events are shown.

5.2.9. Removing data-sets from the display

NightTrace 5.1.2 allows you to remove a specific data-set from the display buffer so that the associated events no longer appear in display pages.

This can be especially useful when occassionally streaming kernel data (taking several second snapshots over a period of time) as the data-set can drastically increase in size over time.

Select the data file in the Session Overview section of the NightTrace main window (see "NightTrace Session Overview" on page 10) and click the Close button.

NOTE

You can select all of the files in the Session Overview section and click the Close button and NightTrace will automatically reopen default pages appropriately when you start streaming again.

5.2.10. Additional spin lock protection mechanism

The NightTrace API and associated daemons use high-performance, low-intrusion spin locks to protect critical sections involved in logging and consuming trace events.

Instead of the system priority level (SPL) spin lock protection mechanism, rescheduling variables can now be used. This is sufficient for applications that do not log trace points from user-level interrupt handlers. See **`resched_cntl(2)`** for more information. In addition, see the section titled "Locking Policies" in the *NightTrace Manual* (0890398).

5.2.11. New resource settings

NightTrace now provides standard X11 resources to customize its behavior. The new resources for version 5.1.2 include:

- `TMPDIR` warning thresholds

  ```
  Ntsess.txt.firstThresholdWarnMB
  Ntsess.text.secondThresholdWarnMB
  Ntsess.text.thirdThresholdWarnMB
  ```

  These values represent three increasingly severe thresholds that cause NightTrace to warn about low disk space in `$TMPDIR`. Crossing the third threshold results in NightTrace refusing to stream data.

- Editor control

  ```
  *editorTalksX
  ```

  When opening eventmap or configuration files from the main window, NightTrace invokes the editor defined by the `EDITOR` environment variable. If the editor is an X client (e.g. **`emacs`**, **`gvim`**, etc.), set the value to `True`. For standard editors that should be invoked in an **`xterm`**, (**`vi`**, **`vim`**, **`emacs -nw`**), leave the value `False`.

- RedHawk Kernel Buffer Control

  On RedHawk Linux, you can control the number and size of kernel buffers used to hold kernel trace data (kernel memory).

  ```
  Ntsess.text.numKernelBuffers
  Ntsess.text.kernelBufferSize
  ```

  A negative number means the default values (4 and 250000, respectively) will be used. The units for the buffer size are in bytes.

  In a future release, the GUI will allow you to set these values.

- Streaming kernel buffer control

  For kernel streaming, it is critical that the stream buffer size associated with the kernel daemon is large enough to allow NightTrace to copy events to the display before all kernel buffers are filled. If the size of stream buffer is insufficient to handle the volume of kernel trace events, NightTrace will automatically pause kernel tracing and subsequently resume when appropriate. You may circumvent this situation by increasing the size of the stream buffer using the following resource:

  ```
  Ntsess.text.defaultKernelStreamBuffSz
  ```

  Units are in bytes.

  In addition, the GUI allows you to set this value in the Streaming tab of the Daemon Definition Dialog. Modifying the value in the Daemon Definition Dialog takes precedence over this resource setting.

5.3. Known Deficiencies

NightTrace 5.1.2 contains the following deficiencies:

- NightTrace offers a streaming output method. When streaming, trace data is sent directly to the NightTrace display buffer for immediate analysis even while additional trace data is being collected.

  In the current implementation, streaming relies heavily on temporary external files. These files are written to **`/tmp`** (or to the location specified by the `TMPDIR` environment variable) and are named:

  `stream`_*identifier*

  where *identifier* is a randomly-generated alphanumeric string.

  The name of this file is listed in the Session Overview section of the NightTrace main window when streaming is activated (see "NightTrace Session Overview" on page 10).

  When streaming kernel data, a vectors file of the form:

  `stream`_*identifier*`.vec`

  is generated in addition to the kernel trace event log file. This file also appears in the Session Overview section of the NightTrace main window.

  Data captured while streaming can be viewed on subsequent invocations of NightTrace by specifying the **`stream`**_*identifier* file as an argument.

  Note that for large amounts of data (or for streams left active for long periods of time), NightTrace may appear to be sluggish and utilize large amounts of disk space. A more efficient and flexible implementation is underway and will be available in a future release of NightTrace.

- Kernel bufferwrap mode is not supported for PowerMAX OS target systems.

  Kernel filewrap mode is supported, however, and can be used when extended trace periods are desired. It is anticipated that the required kernel support for bufferwrap will be available in a forthcoming PowerMAX OS patch at which time support will be activated within NightTrace.

- On PowerMAX OS 4.3 systems, some processes in kernel display pages will only have PID values and not symbolic names associated with them. This will be true for processes that start executing after kernel tracing has begun but exit before kernel tracing has terminated. This is especially common when using the streaming feature while capturing kernel data.

  This is not an issue on PowerMAX OS 5.1 systems or on RedHawk Linux systems.

6.0. Cautions

6.1. TCP High-Water Mark Settings (PowerMAX OS)

If you experience kernel event loss while streaming, it may be due to insufficient TCP high-water mark settings on your PowerMAX OS system. By default, the TCP high-water marks are ~36K, which is an extremely low value, and can cause delays during I/O read and write operations of significant sizes.

We recommend adding the following commands to the **`/etc/rc2.d/S69inet`** script to raise the high-water mark settings.

```
$NDD -set /dev/tcp tcp_recv_hiwater_def 4194304
$NDD -set /dev/tcp tcp_xmit_hiwater_def 4194304
```

Add the above lines to the script **after** the existing lines of the form:

```
$NDD -set /dev/tcp tcp_old_urp_interpretation 1
$NDD -set /dev/ip ip_respond_to_timestamp 1
$NDD -set /dev/ip ip_respond_to_timestamp_broadcast 1
```

7.0. 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.