

NightTrace

Version 5.5 Release Notes (Linux)

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1.0. Introduction

NightTrace™ is used for debugging and analyzing applications and their interaction with the operating system. While useful for simple programs, NightTrace can be used to analyze complex multiprocess or multiprocessor programs with time-critical or real-time constraints.

The NightTrace toolset consists of an interactive debugging and performance analysis tool, trace data collection daemons, an Application Programming Interface (API) allowing user applications to log data values, and an API allowing user applications to subsequently analyze data that has been collected.

NightTrace APIs libraries and include files for use in user applications that log trace events to shared memory

Libraries and include files for use in user applications that want to analyze data collected from user or kernel daemons

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

2.0. Documentation

Table 2-1 lists the NightTrace 5.5 documentation available from Concurrent.

Table 2-1. NightTrace Version 5.5 Documentation

Manual Name	Pub. Number
<i>NightTrace User's Guide</i>	0890398-130
<i>NightTrace Version 5.5 Release Notes (Linux)</i>	0898398-5.5

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 5.5 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
<code>ccur-HyperHelp</code> <code>ccur-HyperHelp-scripts</code> <code>ccur-elanlm</code>	<code>ccur-HyperHelp-scripts-6.4.2-002</code> <code>ccur-x11progs-6.4.2-009</code> <code>ccur-elanlm-5.0-9</code>

3.1.2. Hardware

- an Intel®-based PC - 800MHz or higher (recommended minimum configuration)

* This product has been extensively tested on RedHawk Linux 1.4, 2.1, Red Hat Linux 8.0, 9.0 and Enterprise Linux 3.0. 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 or 870 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 5.5 is:

ccur-ntrace

and the file associated with this rpm is:

ccur-ntrace-5.5-000.i386.rpm (*Intel*)

or

ccur-ntrace-5.5-000.x86_64.rpm (*AMD64*)

which can be found in the **RPM/i386** or **RPM/x86_64** 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 i386/ccur-ntrace-5.5-000.i386.rpm (Intel)
```

or

```
rpm -Uvh i386/ccur-ntrace-5.5-000.x86_64.rpm (AMD64)
```

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	<code>ccur-ntracelog-5.5-000.i386.rpm</code> (<i>Intel</i>) <code>ccur-ntracelog-5.5-000.x86_64.rpm</code> (<i>AMD64</i>)
NightTrace Analysis API	<code>ccur-ntraceapi-5.5-000.i386.rpm</code> (<i>Intel</i>) <code>ccur-ntraceapi-5.5-000.x86_64.rpm</code> (<i>AMD64</i>)
NightStar daemon	<code>ccur-nstar-1.3-001.i386.rpm</code> (<i>Intel</i>) <code>ccur-nstar-1.3-001.x86_64.rpm</code> (<i>AMD64</i>)
Élan License Manager	<code>ccur-elanlm-5.0-9.i386.rpm</code> (<i>Intel</i>) <code>ccur-elanlm-5.0-9.x86_64.rpm</code> (<i>AMD64</i>)

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/i386` and `RPM/x86_64` subdirectories 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	<code>ntracelog</code>	5.5 or later
NightTrace Analysis API	<code>ntraceapi</code>	5.5 or later
NightStar daemon	<code>nstar</code>	1.2-007 or later

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 5.5

NightTrace 5.5 is primarily a maintenance release. It includes all patches released to NightTrace 5.4 as well as additional bug fixes and the enhancements described below.

5.1. Kernel Event Naming Conventions

In previous releases, the names of kernel events used for RedHawk kernel data were a mixture of two namespaces:

- Linux kernel enumerations (e.g. `TRACE_EV_PROCESS`), as per `/usr/include/linux/tracer.h`
- PowerMAX OS names; e.g. `TR_INTERRUPT_ENTRY`

NightTrace 5.5 has separated the two namespaces.

5.1.1. RedHawk Kernel Data

For RedHawk kernel data, the kernel event names are derived directly from the Linux kernel namespace -- the `TRACE_EV_` prefix is stripped off of each enumeration constant as defined in `/usr/include/linux/tracer.h`. Kernel events that previously were referenced by the PowerMAX OS namespace have been changed to the corresponding RedHawk kernel event name. In some instances, new event names were added to the RedHawk kernel namespace, but were not added to the `/usr/include/linux/tracer.h` header file.

The following table describes kernel event name changes:

Previous Name	New Name
<code>TR_EVENT_LOST</code>	<code>EVENT_LOST</code>
<code>TR_EXCEPTION_ENTRY</code>	<code>TRAP_ENTRY</code>
<code>TR_EXCEPTION_EXIT</code>	<code>TRAP_EXIT</code>
<code>TR_EXCEPTION_SUSPEND</code>	<code>TRAP_SUSPEND</code>
<code>TR_EXCEPTION_RESUME</code>	<code>TRAP_RESUME</code>
<code>TR_INTERRUPT_ENTRY</code>	<code>IRQ_ENTRY</code>
<code>TR_INTERRUPT_EXIT</code>	<code>IRQ_EXIT</code>
<code>TR_SWITCHIN</code>	<code>SCHEDCHANGE</code>
<code>TR_SYSCALL_ENTRY</code>	<code>SYSCALL_ENTRY</code>
<code>TR_SYSCALL_EXIT</code>	<code>SYSCALL_EXIT</code>
<code>TR_SYSCALL_RESUME</code>	<code>SYSCALL_RESUME</code>
<code>TR_SYSCALL_SUSPEND</code>	<code>SYSCALL_SUSPEND</code>

For compatibility, **ntrace** automatically detects uses of the old names and translates them accordingly. Thus user-customized display pages and expressions saved in session files will still function. However, strict use of the new event names and values is highly recommended, as the compatibility mode may be removed in a future release.

Users of the Analysis API should change their programs to reference the new names and event values when processing kernel data captured with NightTrace 5.5.

You can use NightTrace to automatically transform kernel data files captured in older releases to use the new event values by opening the old files in **ntrace** and saving the data segments. This will allow an API program that references the new kernel names and values to process newly captured kernel data files as well as old kernel data files that have been translated.

5.1.2. PowerMAX OS Kernel Data

No changes have been made to the kernel event names or values associated with PowerMAX OS kernel data.

5.2. Process-Specific Kernel Display Pages

The Pages menu of the main NightTrace window has been enhanced with a Process-Specific Page menu item which allows you to select individual processes from a list of current processes associated with kernel trace data. A new display page is constructed which provides kernel-style event and state graphs filtered to include only the processes you selected. See the section titled “Process-Specific Page” in the *NightTrace User’s Guide (0890398)* for more information.

5.3. Additional Operations on Active Segments

NightTrace 5.5 allows the following operations on data segments associated with actively streaming daemons:

- Data can be trimmed from an active segment
- Data associated with a stopped or closed daemon can now be closed even if other daemons are active

6.0. Common Problems and Limitations

6.1. Privileges and Capabilities

Some of the locking policies recommended for use with NightTrace daemons and the NightTrace API require special privileges.

A common problem when using the NightTrace API is that the `trace_begin()` (or `trace_start()`) call may fail if the user lacks sufficient privileges to lock pages or utilize appropriate spin lock protection. If these calls fail due to lack of privilege, subsequent API calls will fail to log events.

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.

Either root access or user registration in a privileged capabilities role is required when page locking or rescheduling variables are used (the `--lock` and `--resched` options to `ntraceud` and the `ntc_lock_pages` and `ntc_use_resched` fields of an `ntconfig_t` structure passed to `trace_begin()`).

Have your system administrator register you as a NightTrace user according to the following instructions:

1. Add the following line to the `/etc/pam.d/rsh` and `/etc/pam.d/login` files:

```
session required /lib/security/pam_capability.so
```

NOTE

For those users that log into their system directly from the Gnome or KDE graphical desktop environment, it is necessary to add the above line to `/etc/pam.d/gdm` or `/etc/pam.d/kde`, respectively. In addition, you must restart your X server or reboot your system before these changes will take effect.

2. Add the following line to the ROLES section of the `/etc/security/capability.conf` file:

```
role traceuser cap_sys_nice cap_sys_rawio cap_sys_lock
```

3. Add the following line to the bottom of the `/etc/security/capability.conf` file:

```
user user traceuser
```

where *user* is the login name of the desired user.

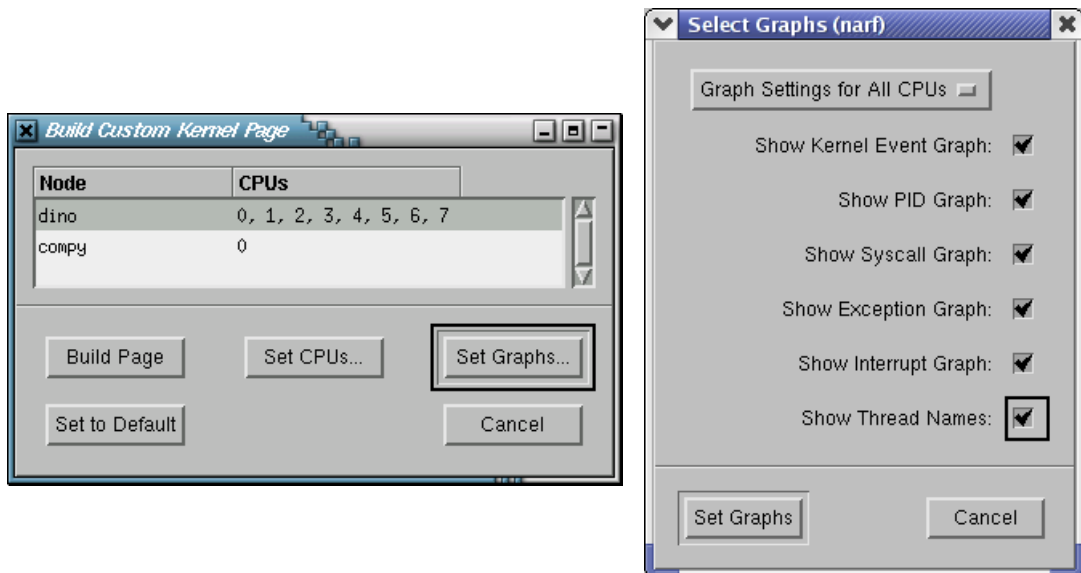
After these activities are complete, you must log off and log back onto the RedHawk system

6.2. Multithreaded Programs and the NightTrace API

The NightTrace API has been changed to provide enhanced functionality with multi-threaded user programs.

The following improvements have been made in this release, subject to limitations and API changes as described below:

- *Rescheduling Variables* can be selected as the *Locking Policy*, ensuring efficient and correct execution of critical sections in API calls.
- Multiple threads can make `trace_open_thread()` calls in the same application. This allows individual threads to be identified by name during data analysis.
- The thread associated with kernel trace events can be identified by name during data analysis if user and kernel data is included in the same analysis session.
- Kernel display pages have been enhanced to optionally display both the program name and thread name. From the **Pages** menu of the main window and click on **Custom Kernel Page...**



Click on **Set Graphs...** to bring up the **Select Graphs** dialog and click on **Show Thread Names**. Thread names on kernel events are only available for threads which have user trace data in the same NightTrace session.

- Textual descriptions from **ntrace** have been changed. The `tid=` description has been replaced by a `thr=` description, which is the name of the thread associated with the event or the value of the thread ID in decimal when a name cannot be located. On RedHawk 2.1 systems, the thread ID values are the those returned from the `gettid(2)` system call which uniquely identifies a thread system-wide. On RedHawk 1.4 systems, the thread ID values are those returned from the `get-pid(2)` system call.

In order to effectively use these enhancements, the user must link with an alternative NightTrace API library and must replace POSIX thread creation calls:

- Link with `-lntrace_thr` instead of `-lntrace`
- Replace `pthread_create()` thread creation calls in your user application with `Pthread_create()`; this is a simple string change operation -- the function profile and POSIX

threads semantics are otherwise identical. Threads created using `pthread_create()` will fail all subsequent NightTrace API calls.

- Include `<ntrace_thr.h>` instead of `<ntrace.h>` (provides declaration of `Pthread_create()`)

In order to properly and efficiently protect critical sections within the NightTrace API, the Locking Policy should be set to use rescheduling variables using the following mechanisms:

- Select the **Rescheduling Variables** option from the **Locking Policies** section of the **User Trace** tab in the **Daemon Definition** dialog when launching daemons from the graphical user program.
- Select the `--resched` option when launching daemons using the command-line utility `ntraceud`
- Set `ntc_use_resched` to `TRUE` when specifying `ntconfig_t` records as passed to the `trace_begin` API function. This is not necessary if the user application will always be launched after a user daemon has been initiated, however, it is highly recommended to ensure consistent results (in case the user daemon is accidentally launched after the application).

Limitations if `-lntrace_thr` is not used:

- Use of rescheduling variables is prohibited. Use of the NightTrace API in threaded programs without specifying rescheduling variables as the locking policy can cause API calls to spin indefinitely and have a dramatic performance impact on the system.
- Individual threads cannot be reliably located by thread name
- Kernel events cannot be reliably associated with thread names
- Only one call to `trace_open_thread()` is allowed per program

In either case, when multithreaded applications and the NightTrace API are used with RedHawk 1.4, the process ID logged with threaded programs may produce unexpected results, since threads do not share the same process ID under RedHawk 1.4. Under RedHawk 2.1, the PID value is shared between all threads in a program.

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.

