

Oracle Trace™

Monitor User's Guide

Version 2.2

Part No. A38162-1

ORACLE®

Oracle Trace Monitor User's Guide

Version 2.2

Part No. A38162-1

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Preface

This manual describes how to use the online display capabilities of the Oracle Trace for OpenVMS Monitor Version 2.2.

The Oracle Trace Monitor is a windows application (based on the Motif interface) that displays charts showing resource use for the processes running on your system. You can monitor resource use interactively either as it takes place or after the fact.

Intended Audience

This manual is intended for application programmers, software performance analysts, and database administrators who want to interactively display event-based data online.

Prerequisite Software

You need the following software to run the Oracle Trace Monitor:

- OpenVMS VAX Version 5.4-3 or higher or OpenVMS Alpha Version 1.5 or higher
- DECwindows Motif Version 1.1 or higher
- Oracle Rdb Version 4.0B or higher

Prerequisite Hardware

You need a mouse to use the Oracle Trace Monitor software.

Document Structure

This manual has the following structure:

- Chapter 1 provides a brief description of Oracle Trace for OpenVMS. It also provides a description of the Monitor windows and the types of information displayed in each.
- Chapter 2 provides instructions on how to limit the monitor display to certain types of data. It also describes how to set thresholds and set up command procedures to execute when thresholds are exceeded.
- Chapter 3 provides instructions on how to change display characteristics of the monitor windows, such as color, size, and position.
- Appendix A provides format information for command procedures that you link to thresholds. It also provides the location of a sample command procedure.

Associated Documentation

The other manuals in the Oracle Trace documentation set are:

- *Oracle Trace Installation Guide Version 2.2* — Provides instructions for installing the Oracle Trace software on an OpenVMS system.
- *Oracle Trace Getting Started Version 2.2* — Provides an introduction to the Oracle Trace software and instructions for scheduling a collection and generating a report.
- *Oracle Trace Collector User's Guide Version 2.2* — Describes how to collect event-based data and instrument applications for collection.
- *Oracle Trace Reporter User's Guide Version 2.2* — Describes how to format and generate hardcopy reports from event-based data.

Conventions

The conventions used in this book are listed in Table 1.

Table 1 Conventions

Conventions	Meaning
Ctrl/x	A sequence such as Ctrl/x indicates that you must hold down the key labeled Ctrl while you press another key or a pointing device button; for example, Ctrl/C or Ctrl/Z.
[]	Brackets indicate optional elements.
...	Horizontal ellipsis indicate that you can enter additional parameters, values, or information.
\$	The dollar sign is used to indicate the DCL prompt. This prompt may be different on your system.

Getting Help on the Monitor

To receive basic help on the Monitor while you are using it, select the Tutorial option from the Help menu.

Once you select the Help facility, it remains enabled and automatically displays help for any new Monitor windows you open. To disable the automatic display of help, click on the Cancel button in any Help window.

1

Introduction

The Oracle Trace Monitor is a component of Oracle Trace for OpenVMS, which is a layered product that collects and reports event-based data from any combination of OpenVMS layered products and application programs containing Oracle Trace service routine calls. The Oracle Trace documentation set refers to application programs that contain Oracle Trace service routines as facilities. The following Oracle products are facilities:

- Oracle CODASYL DBMS
- Oracle RALLY
- Oracle Rdb
- Oracle Expert for Rdb

Oracle Trace provides Oracle Expert for Rdb with data that it uses for optimizing existing Oracle Rdb databases.

Additionally, the following products from Digital Equipment Corporation are also facilities:

- DEC ACMS
- ALL-IN-1
- DECforms

You can collect event-based data from existing facilities, and you can also add Oracle Trace service routines to your own applications to collect data from them. The process of adding Oracle Trace service routine calls to an application is called instrumenting an application. The documentation for instrumented products describe how the product is instrumented.

Oracle Trace software operates with minimal performance impact on the system. It can run with both the development and production versions of your application to give you information about the behavior of your application.

Several third-party, fourth-generation language (4GL) products contain Oracle Trace service routine calls and work with Oracle Trace and Oracle Expert for Rdb. Contact your 4GL vendor for more information.

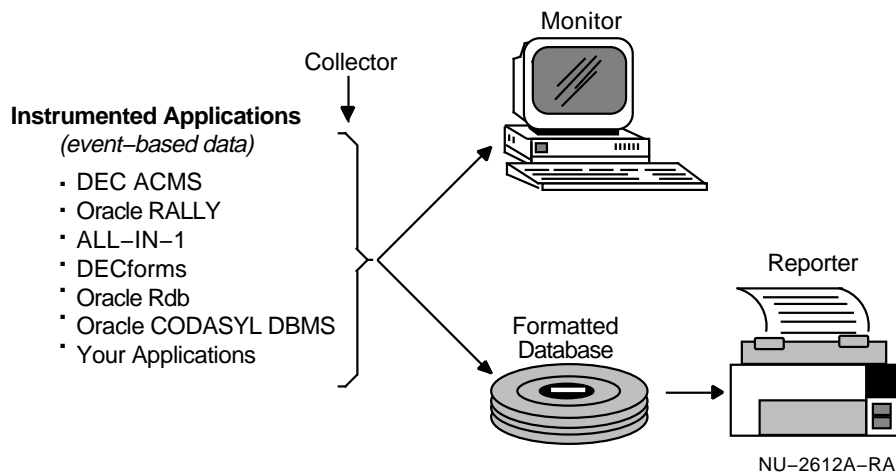
1.1 Oracle Trace Components

In addition to the Monitor component described in this manual, Oracle Trace has Collector and Reporter components. These components perform the following functions:

- **Collector** — Gathers event-based data from instrumented layered products and applications. With the Oracle Trace Collector, you can schedule, control, track, and cancel collections. You can also instrument your own applications using the Oracle Trace service routines.
- **Reporter** — The Reporter provides hardcopy reports from a formatted Oracle Trace database. These reports help you to gain an in-depth understanding of the resources your application uses.

The Oracle Trace components are interrelated, as shown in Figure 1-1.

Figure 1-1 Oracle Trace Components



For further information about the Collector and Reporter, refer to *Oracle Trace Collector User's Guide* and *Oracle Trace Reporter User's Guide*.

1.2 Before Using the Monitor

To use the Monitor, it is not necessary that you know how to instrument applications or set up collections. However, to understand and make maximum use of the data that the Monitor displays, you must be familiar enough with the application being monitored to know what the displayed items mean in relation to the application. Otherwise, many of the items displayed in the Monitor windows will make little sense to you.

For example, many of the sample screens in this manual show data collected from the Oracle Rdb facility. Items such as CPU and DIO may be immediately understandable, but to understand the significance of other items such as PC_CLIENT and REQ_HANDLE, you must have specific knowledge about Oracle Rdb.

If you are monitoring Oracle facilities, see the documentation for these facilities for information on how they are instrumented.

1.3 Controlling Monitor Displays

The Monitor provides you with the options of running in real-time or replay mode. If you are in replay mode, you can specify the replay speed. Whether you are running in real-time or replay mode, you have the option of pausing the data display at any point. Each of these options is described in the following sections.

1.3.1 Starting the Monitor

Real-time Mode To use the monitor in real-time, displaying data from an active data collection file, use the following command (replacing `sample_data.dat` with the name of your own data collection file):

```
$ COLLECT MONITOR sample_data.dat
```

Replay Mode To display information contained in a previously collected data collection file, use the `/REPLAY` qualifier of the `MONITOR` command, as shown in the following example (replace `sample_data.dat` with the name of your own data collection file):

```
$ COLLECT MONITOR/REPLAY sample_data.dat
```

You can replay a previously collected data collection file from a specific point within the file by using the `/SINCE` qualifier as shown in the following example:

```
$ COLLECT MONITOR/REPLAY/SINCE="30-DEC-1994 19:00" sample_data.dat
```

The Monitor displays information from the data collection file starting from 7 p.m. December 30, 1994.

Monitor Demo

If you do not have your own data collection to monitor you can use the Oracle Trace Monitor demonstration file by entering the following command:

```
$ COLLECT MONITOR/REPLAY EPC$EXAMPLES:DEMO_DATA.DAT
```

This command will start the Monitor in replay mode and display sample Oracle Trace data. The screen shots in this guide are from this demonstration.

Replay Speed

The Monitor provides a selection of speeds at which you can replay a data collection file. The default replay speed is 5:5. This means that the screen is updated every 5 seconds with the totals from the last 5 seconds of data collection.

To change the speed, select Replay Speed from the Options menu. For example, if you click on the 5:10 toggle button, the screen is updated every 5 seconds with the totals from the last 10 seconds of data collection.

This allows you to run through the replay more quickly without visually speeding up the replay on the screen or making the data appear to flash by more quickly. It simply consolidates a longer period of data collection into a shorter update interval.

Conversely, if you click on the 5:1 toggle button, you run through the replay more slowly. One second of data is displayed every 5 seconds. This is useful if you want to pinpoint exactly when and where an event occurred.

1.3.2 Pausing a Monitor Display

Occasionally you might want to pause a monitor display to study it more closely or to perform a screen capture. Select the Pause item from the Commands menu in any window to temporarily freeze the display.

Select Resume from the Commands menu to begin displaying monitor activity again. If you paused while you were viewing an active collection, it may take a while to "catch up" to real-time viewing when you select Resume. This is because the Monitor displays, at normal speed, all events that occurred during the Pause interval.

1.3.3 Stopping the Monitor

To stop the Monitor, select the EXIT option from the File menu at the top of the Process window (shown in Figure 1-2). If you stop the Monitor before the specified data collection period expires, data collection continues even after the Monitor is stopped.

1.4 Monitor Windows

The Monitor uses three main windows to progressively display resource use at the following levels:

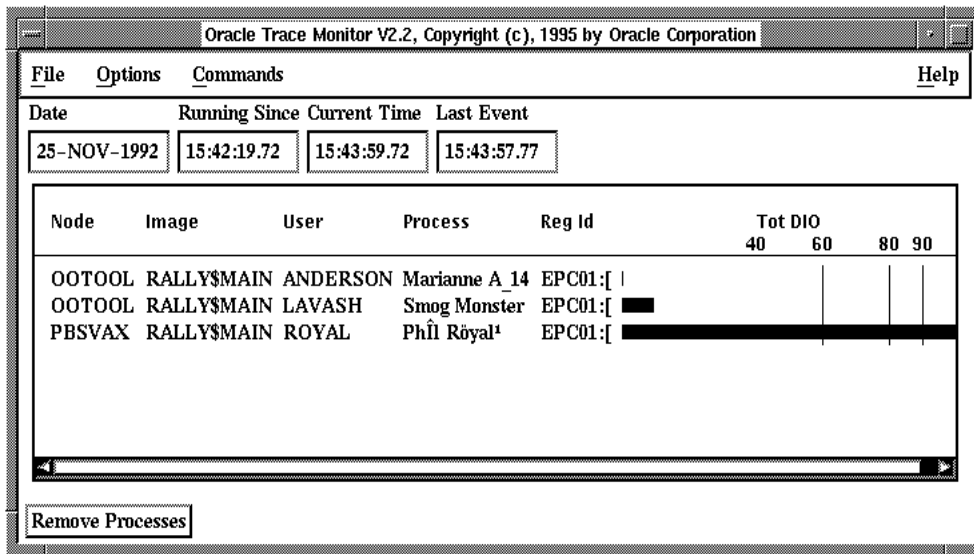
- Process
- Facility within a process
- Event within a facility
- Application-specific items within an event

The following sections describe how to use these windows to display data at each of these levels. For details on how to tailor the windows to display specific information, refer to Chapter 2.

1.5 Displaying Resource Use at the Process Level

When you start the monitor, the first window displayed is the Process window, similar to the one shown in Figure 1-2. By default, the Process window displays total DIO for currently running processes. To change the default item displayed, use the Select Item choice in the Options menu.

Figure 1–2 Process Window



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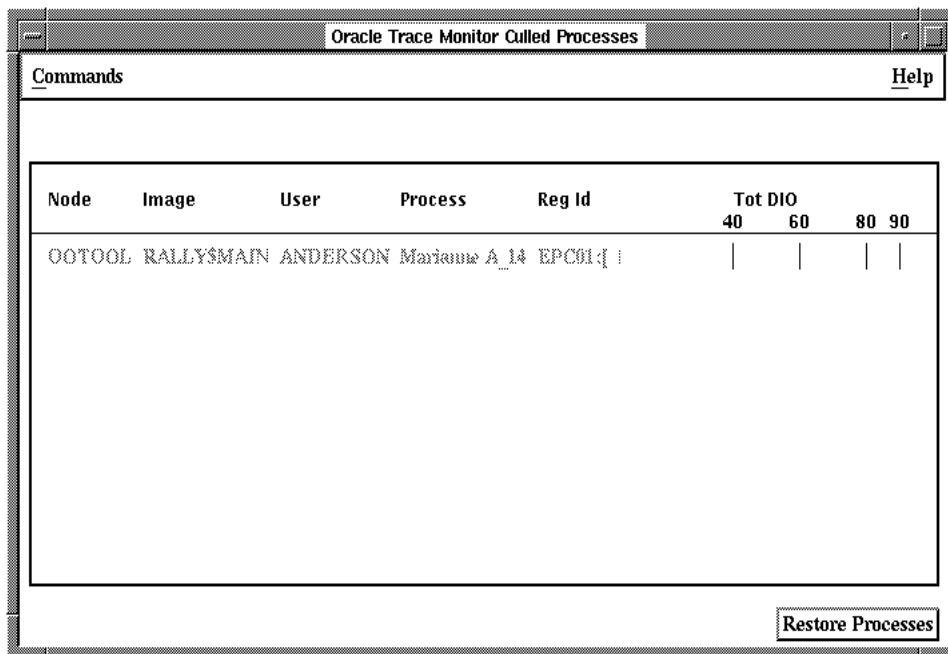
1.5.1 Removing and Restoring Process Names

If the Process window displays processes in which you are not interested, you can temporarily remove them. The Monitor continues to collect data for the removed process and creates a Culled Process window in which to display it.

Remove Process To remove processes from the Process window, click on the process name(s) and then click on the Remove Processes button.

The Monitor removes the processes from the Process window and displays them in a Culled Process window similar to the one shown in Figure 1–3.

Figure 1–3 Culled Process Window



NU-3126A-RA

Restore Process To redisplay processes, click on the process name(s) in the Culled Process window that you wish to redisplay. Then click on the Restore Processes button in the Culled Process window.

The Monitor removes the processes from the Culled Process window and redispays them in the Process window.

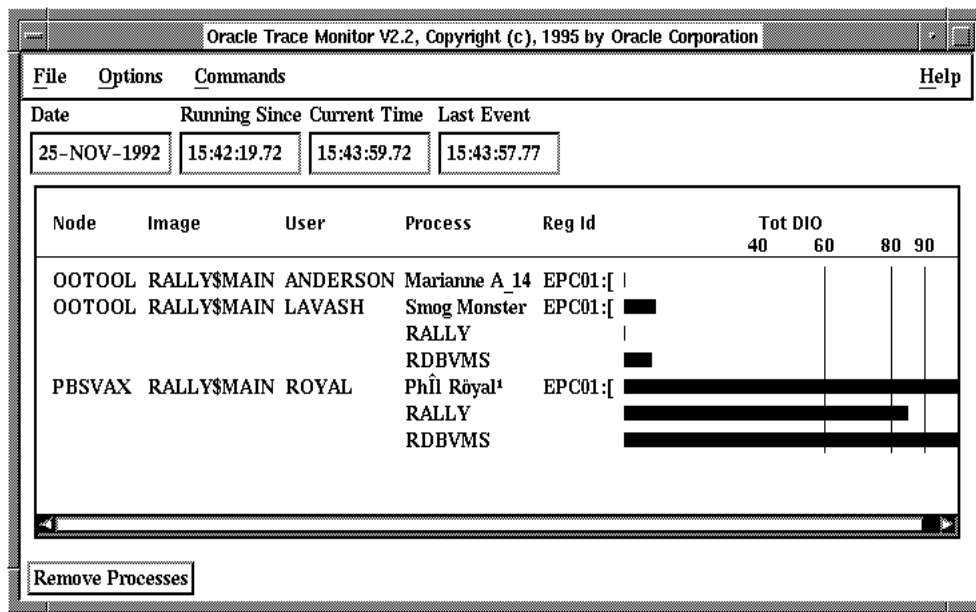
Note

If you find that you are consistently removing certain processes from the Process window, you can reduce overhead and improve Monitor performance by using the /REGISTRATION_ID qualifier on subsequent collections. In this way you can limit these collections to images or users of interest. For further details on this qualifier, refer to the description of the SCHEDULE COLLECTION command in the *Oracle Trace Collector User's Guide*.

1.6 Displaying Resource Use at the Facility Level

To display resource use for the facilities within a process, double-click on a process name in the Process window. This expands the information displayed for the process, by also showing the facilities within the process. The window display is similar to that shown in Figure 1–4.

Figure 1–4 Process Window with Facilities Displayed



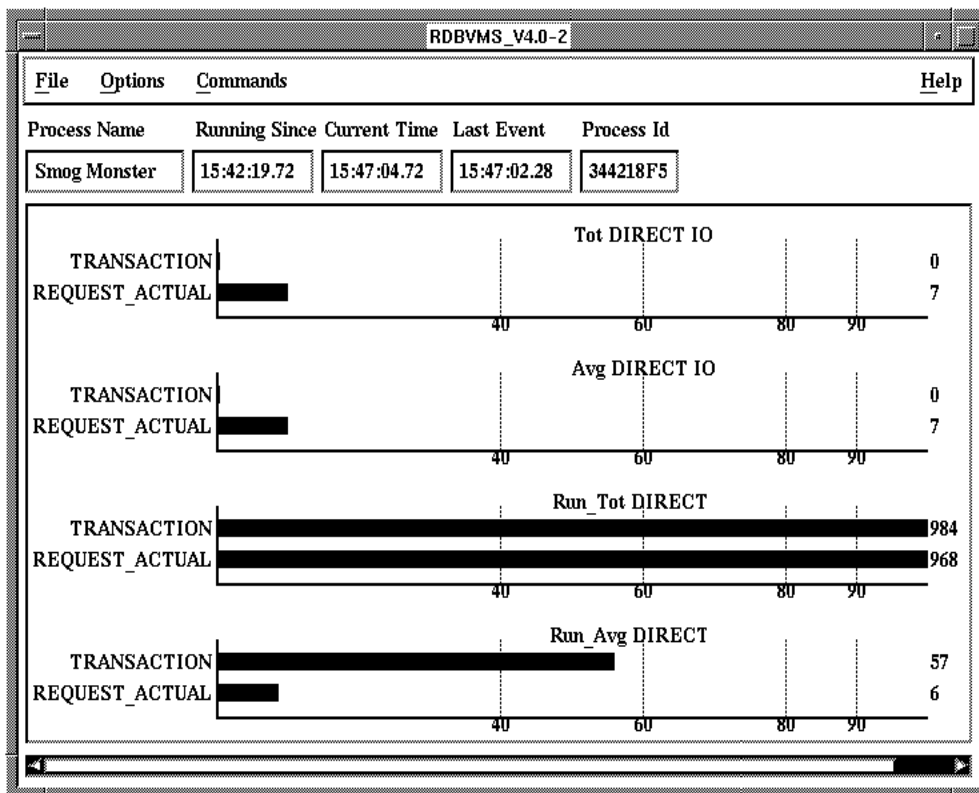
NU-3125A-RA

To collapse the facility names from the Process window, double-click again on the process name.

1.7 Displaying Resource Use at the Event Level

To display resource use for the events within a facility, double-click on the facility name in the Process window. The Monitor displays a Facility window similar to the one shown in Figure 1-5. The window is labeled at the top with the facility name. The events within the facility are listed in the left column of the window.

Figure 1-5 Facility Window

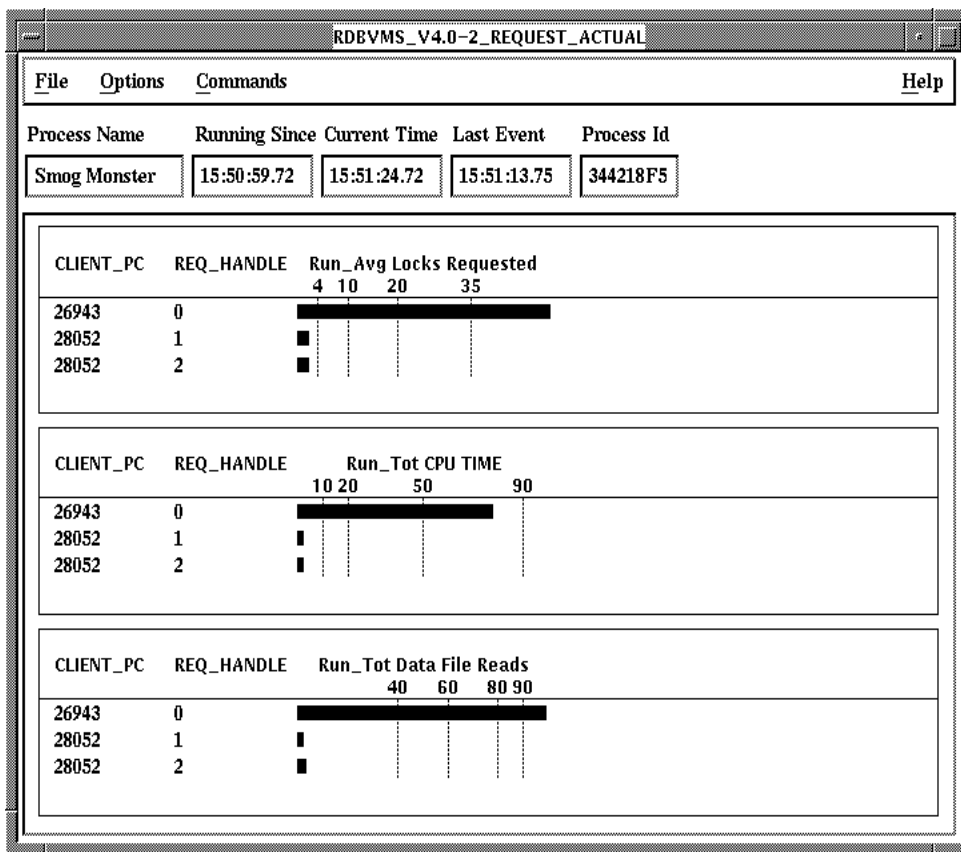


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1.8 Displaying Resource Use at the Item Level

To display information about resource use at the event level, grouped by application-specific items, double-click on an event name in the Facility window. The Monitor displays an Event-Item window labeled at the top with the name of the facility and the event. The window is similar to the one shown in Figure 1–6, but it will not contain any data until you specify items for display, as described in Section 2.5.

Figure 1–6 Event-Item Window



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Note that in the Event-Item window, the item label over the bar graph corresponds to the report headers specified in the facility definition.

To make optimal use of the data you can display in the Event-Item window, you need an understanding of the application being monitored and how it is instrumented. If you are monitoring Oracle facilities, refer to their documentation for information on how they are instrumented.

1.9 Window Timestamps

The Monitor displays the following timestamps at the top of each window (except for the Culled Process window):

- **Current Time** — determined by whether you are running the Monitor in real-time or replay mode. In real-time mode, the Current Time reflects the current time of day. In replay mode, the Current Time reflects the time at which the data was originally collected. In either case, the Monitor updates the Current Time in 5-second intervals.
- **Running Since** — starts out as either:
 - The time that you started running the monitor in real-time
 - The time in the data collection file, specified with the /SINCE qualifier, at which you started the monitor in replay modeIf you reset running statistics, the Running Since time reflects the time at which the reset took place. See Section 2.4 for further information.
- **Last Event** — the time at which the last event occurred that affected the display.

Selecting Data for Display

Since you may be interested in only certain data at certain times, the Monitor allows you to select specific items for display in each of the Monitor windows. In addition to allowing you to specify which items you want displayed, the Monitor allows you to specify:

- The statistic types to display for each item
- The threshold values associated with each item

In Oracle Trace, items are elements of data associated with each event. Items are classified as either Level, Counter, Percent, Text, or Private. Oracle Trace automatically collects data for the following items:

- Counter Items
 - BIO
 - DIO
 - PAGEFAULTS
 - PAGEFAULTS_IO
 - CPU
- Level Items
 - CURRENT_Prio
 - VIRTUAL_SIZE
 - WS_SIZE
 - WS_PRIVATE
 - WS_GLOBAL

Any other items that you see displayed in Monitor windows were user-specified when the facility definition was created. Refer to the *Oracle Trace Collector User's Guide* for more information on items and on creating facility definitions.

The following sections describe how to specify which data is displayed.

2.1 Selecting Items and Statistic Types

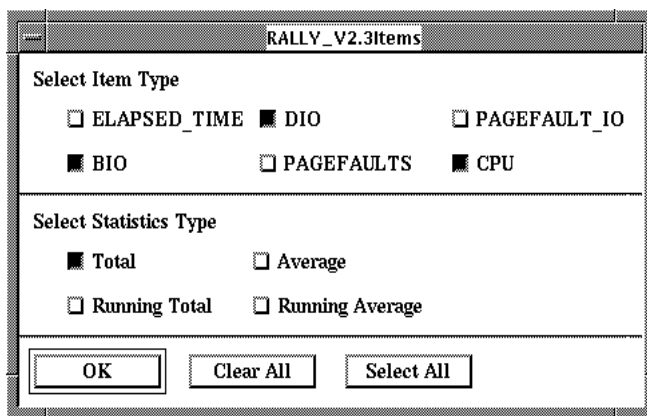
For each item you choose to display, you can choose up to four types of statistics. Although some statistic types make more sense when associated with specific items, Oracle Trace does allow you to associate any statistic type with any item.

Follow these steps to select items and statistic types. If you are working from the Process window, you can select only one statistic/item pair at a time. This provides you with an overview of one item at a time across all processes.

1. Choose Select Item from the Options menu.

The Monitor displays the Select Item dialog box, which contains a list of items for the current facility and the statistic types you can associate with them. Figure 2–1 shows a sample of the Select Item dialog box.

Figure 2–1 Select Item Dialog Box



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2. Select one or more statistic types by clicking on the Statistic type toggle buttons. Statistic types must be selected before Item types. (Remember that if you are working from the Process window, you are only allowed to select one statistic type at a time.)
3. Select items to pair with the selected statistic types by clicking on the Item toggle buttons. (Remember that if you are working from the Process window, you are only allowed to select one item type at a time.)

To select all items for the selected statistic types, click on the Select All button.

To deselect all previously selected items, click on the Clear All button.

Note

Since you can select only one statistic/item pair at a time from the Process window, the Select All and Clear All functions are not present at the process level.

4. The items and statistic types that you select are displayed in the window. If you select many of them, you can use the scroll bars to view all of them. Close the dialog box by clicking on the OK button.
5. *Optional Step:* If you want to save your choices to be the default display any time you open this window, select Save Current Settings from the Options menu.

2.2 Setting Threshold Values

Threshold values define limits of resource use according to the following levels: Low, Medium, High, Critical, and Severe. You can define the values associated with each level so that they meet the needs of your application.

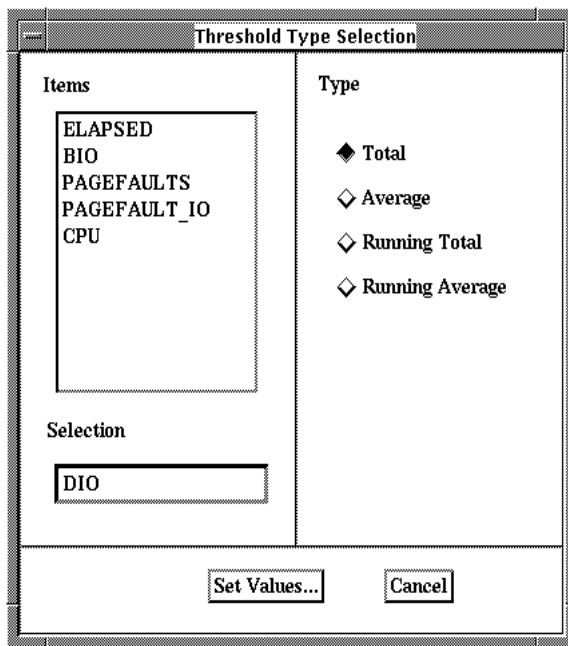
Threshold values are set for one statistic/item pair at a time.

Follow these steps to set threshold values:

1. Choose Select Threshold Values from the Options menu.

The Monitor displays the Threshold Type Selection dialog box, as shown in Figure 2-2.

Figure 2-2 Threshold Type Selection Dialog Box

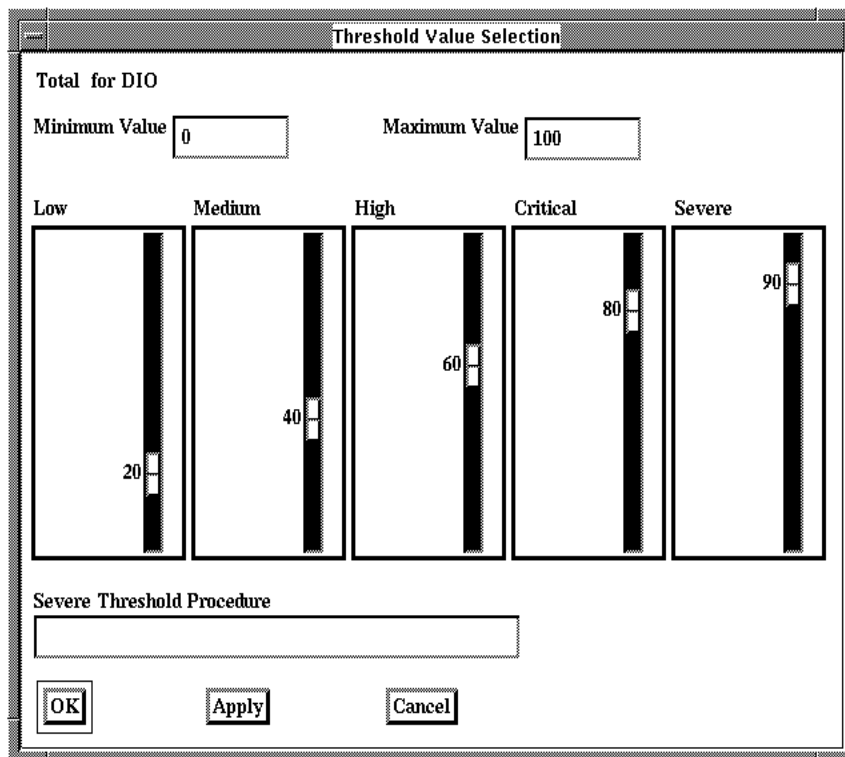


NU-3129A-RA

2. Select a statistic type by clicking on the appropriate toggle button.
3. Click on a name in the Items list and click again in the Selection field to place it there.
4. Click on the Set Values button.

The Monitor displays the Threshold Value Selection dialog box, as shown in Figure 2-3.

Figure 2-3 Threshold Value Selection Dialog Box



NU-3130A-RA

5. Specify minimum and maximum values by entering them in the appropriate fields. Specify Low, Medium, High, Critical, and Severe values by positioning the sliders appropriately.
6. If you have a command procedure that you want executed when severe thresholds are reached for the statistic/item pair, enter a file specification for the procedure in the Severe Threshold Procedure box. (See Appendix A for information on the required format for such a command procedure.)

If you do not want to enter a command procedure, proceed to step 7.

The file specification you enter cannot exceed 50 characters. You should create a logical name for the file if the file specifications is longer than 50 characters.

To change the name of a command procedure that you previously specified for this item and statistic type, enter the name of the new command procedure in the Severe Threshold Procedure text field.

*Linking to
Command
Procedures*

To permanently eliminate the link between an item and command procedure, delete the command procedure name from the Severe Threshold Procedure text field and then select Save Current Settings from the Options menu.

Although you can link severe thresholds with command procedures from any of the three Monitor windows, the window at which you specify a link determines how and when notification takes place. Specifically:

- If the command procedure is specified at the Process and Facility windows, it executes whenever resource use for any event in any process exceeds the item's severe threshold, whether or not the Monitor is currently displaying the item value.
- If the command procedure is specified at the Event-Item window, it executes only if the Monitor is displaying the item value when it exceeds the severe threshold. This is because in the Event-Item window, the Monitor only retains data while it is displayed.

Note

If you plan to use the threshold notification capability, Oracle recommends that you select values for the severe thresholds with care, because excessive execution of command procedures can degrade Monitor performance.

7. At this point you can still click on the Cancel button to cancel any changes you have made and close the Threshold Value Selection dialog box. Or you can apply the changes by going on to the next step.
8. Click on the OK or Apply button to see the new thresholds reflected in the bar graph. The Apply button keeps the Threshold Value Selection dialog box open; the OK button closes it.
9. Now you can either set threshold values for another statistic/item pair or you can finish setting threshold values.
To set values for another pair, return to the Threshold Type Selection dialog box (step 2).
To finish setting threshold values, close the Threshold Value Selection dialog box by clicking on the OK button. Then click on the Cancel button in the Threshold Type Selection dialog box to close that box.
10. *Optional step:* You can save the threshold values you have set as the defaults by selecting Save Current Settings from the Options menu.

2.3 Disabling Command Procedure Execution

To temporarily disable execution of the command procedures for all Monitor windows, select Threshold Notification from the Options menu and click on Disable.

To reinstate command procedure execution, select Threshold Notification from the Options menu and click on Enable.

2.4 Resetting Running Totals and Averages

The Monitor allows you to reset the values of running totals and running averages so that you can track resource use from a specific time. The Monitor displays the time of the reset in the Running Since timestamp.

The running values that get reset are determined by the window at which you select the Reset option. This is described further in Table 2-1.

Table 2-1 Resetting Running Values

To reset running values...	Do this...
At the process level	Select Reset-Totals from the Options menu in the Process window and click on Process.
For all items in all windows	Select Reset-Totals from the Options menu in the Process window and click on Select All.
For all events	Select Reset-Event-Totals from the Options menu in the Facility window.
For all items in the current Event-Item window	Select Reset-Event-Totals from the Options menu in the Event-Item window.

2.5 Displaying Resource Use Grouped by Item Value

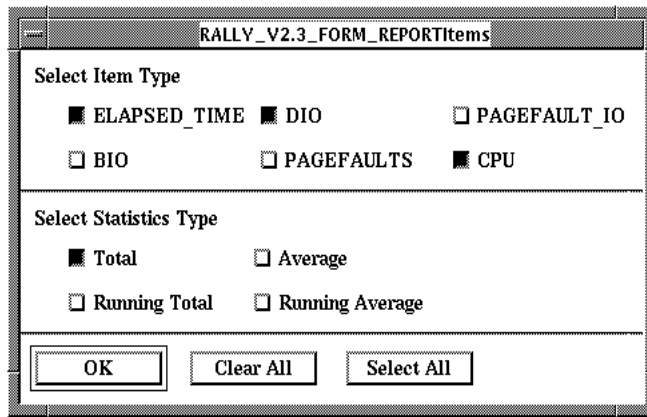
The Monitor allows you to display resource use for each event, grouped by the values of level and text items. This capability is similar to that provided by the /GROUP_BY qualifier in the Oracle Trace Reporter.

The following steps describe how to specify which items you want displayed in the Event-Item window and how you want them grouped.

1. From the Event-Item window, choose Select Items from the Options menu.

The Monitor displays the Item Selection dialog box, which contains statistic types and counter items associated with the event. Figure 2–4 shows a sample Item Selection box.

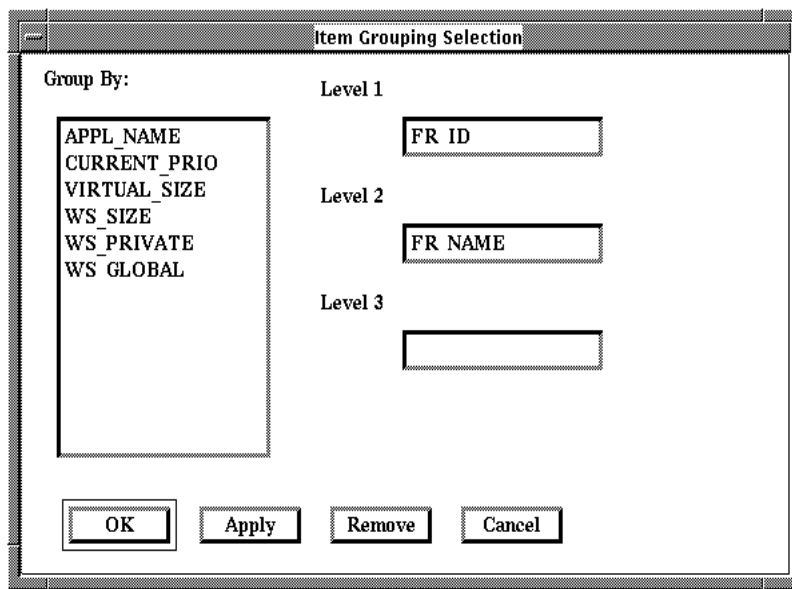
Figure 2–4 Event-Item Selection Dialog Box



NU-3131A-RA

2. Select one or more statistic types by clicking on the toggle buttons.
3. Perform the action associated with the result that you want:
 - To select an item for the selected statistic types, click on the toggle button for the item.
 - To select all items for the selected statistic types, click on the Select All button.
 - To deselect all previously selected items, click on the Clear All button.
4. From the Event-Item window, choose Group By from the Options menu. The Monitor displays the Item Grouping Selection dialog box, shown in Figure 2–5. This box displays the level and text items that were specified in the facility definition. See the *Oracle Trace Collector User's Guide* for information on creating facility definitions.

Figure 2-5 Item Grouping Selection Dialog Box



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5. To select the items by which you want to group the data, do the following:
 - a. Click on an item in the list labeled Group By. Then click in either the Level 1, Level 2, or Level 3 text field (items must be entered in order). The item is displayed in the text field. (You must select at least one item in order for any data to appear.)

Data is grouped first by Level 1, then by Level 2, and last by Level 3.

You can remove items from a text field by clicking on them and then clicking on the Remove button.
 - b. Click on the OK or Apply button to display event occurrences grouped according to the items you selected.

The Apply button keeps the Item Grouping Selection dialog box open; the OK button closes it.
 - c. *Optional step:* Select the Save Current Settings option from the Options menu to save these items as defaults.

If the Event-Item window is not wide enough to display all the information, you can widen it using the `Resize_screen` option in the Commands menu. You can also change the size of the scroll lists in this window by editing the `EPC_MONITOR.DAT` file. See Chapter 3 for further information on both of these features.

Customizing Monitor Displays

Oracle Trace allows you to customize your monitor displays by changing window colors and window size and position. Window size and position are changed from within the Monitor. Colors and other features such as the size of scroll lists and column characteristics are changed by editing the EPC_MONITOR.DAT file.

3.1 Changing Window Size and Position

If you need to change the size of Oracle Trace windows, use the following steps:

1. Change the window to the desired size and then click on the `Resize_screen` option in the Commands menu. The data displayed in the window is adjusted to fit within the new window dimensions. (`Resize_screen` is not available for the Process window.)
2. *Optional Step:* If you want the new size for this window to be in effect in subsequent sessions, click on `Save Current Settings` in the Options menu. Otherwise, the new size is in effect only for the current session.

You can also use `Save Current Settings` if you have moved a window and want to save the new position of the window for future sessions.

When you select `Save Current Settings`, a message is displayed that tells you the name of the file in which the settings have been saved. You should make a note of this file name in case you want to edit it in the future.

3.2 Changing Display Characteristics

Oracle Trace allows you to customize certain aspects of monitor displays such as colors, fonts, and column characteristics. To do this, you must edit the EPC_MONITOR.DAT file. The Monitor creates this file in your SYS\$LOGIN directory the first time you run the Monitor.

If you have not run the Monitor yet, you need to copy the file to the directory from which you plan to run the Monitor. Use the following command to do this:

```
$ COPY DECW$SYSTEM_DEFAULTS:EPC_MONITOR.DAT SYS$LOGIN:*.*
```

Edit the file and make the appropriate changes as described in Table 3–1.

Table 3–1 Customizations by Editing EPC_MONITOR.DAT

If You Want to Change . . .	Search for . . .	And . . .
the size of the scroll list in the event level windows	eveite_vlist_vframe.height:	change its value to the size (in font units) that you want for the event level windows.
threshold colors	the color that you want to change. Threshold colors are associated with process.xxxxx threshold names, for example process.high_color	replace it with the color you prefer. If you are running the Monitor on a black and white terminal, set all colors to black.
column positions or remove a column from the Process level window	process.xxxx_position, for example process.node_position	change values as appropriate: <ul style="list-style-type: none"> – Value 1 = the left-most column position – Value 5 = the right-most column position – Value 0 = do not display the column
column widths	process.xxxx_width, for example, process.node_width	change the value to the width (in characters) that you want for the column.
the direction in which the Monitor sorts Process window items	Sort_by_item	Change values as appropriate: <ul style="list-style-type: none"> – Value 1 = sorted from large to small resource item – Value 0 = sorted from small to large <p>The Monitor will re-sort the list for every refresh cycle.</p>
the font used for the event names and statistics	VHist.font:	change the font name and size.

(continued on next page)

Table 3–1 (Cont.) Customizations by Editing EPC_MONITOR.DAT

If You Want to Change . . .	Search for . . .	And . . .
the font used for process names (this also affects Event-item names and information in the Event-item window)	VList.fontTable:	change the font name and size.
the font used for display headers	VHeader.fontTable:	change the font name and size.
the font used for menu items, date, and time	fontList:	change the font name and size.
the Facility window to display complete Event names (if they are being cut off on the left side)	vhist_w.leftLabelWidth:	increase the value as necessary.
the Facility window to display complete bar graph on the right side	vhist_w.rightLabelWidth:	increase the value as necessary.

Since fonts can appear to look slightly different on different terminals, you may have to experiment with a few font/size combinations until you find one that suits you. The default font settings should work well for most terminals.

A

Command Procedure Format

The command procedures that you create for the Monitor to call when item values exceed severe threshold limits can be any size and can perform any actions. Oracle supplies a sample command procedure that you can use as an example when you write your own. The sample command procedure, found in `EPC$EXAMPLES:EPC_MON_THRESH.COM`, writes severe threshold notification messages to `EPC$MON_THRESH_ERR.LOG`.

When the Monitor calls your command procedures, it passes an argument in the form of a text string. The argument contains the following fields. Each field is delimited by the pound sign character (#).

Time the event occurred
Node Name
Process ID
Image Name — Trimmed to 32 characters, no disk or directory information
Process Name
Facility Number
Event Number
Item Number
Threshold type — 5 (to indicate the severe threshold)
Threshold statistic type

- 0 = totals
- 1 = average
- 2 = running totals
- 3 = running average

Threshold value — The value of the severe threshold
Item value — The item value that exceeded the threshold. If values exceed the threshold at the Event-Item window where the Monitor displays data sorted by item values, the argument also contains values of up to three sort keys. These fields are limited to 20 characters each.

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