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Resource Monitoring and Control Guide and Reference

AIX



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AIX

Software

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About This Book

This book describes how to use the monitoring function of the Reliable Scalable Cluster Technology (RSCT) Resource Monitoring and Control application for AIX®. It also provides reference material about the RSCT application, including a summary of components, messages, and predefined monitoring functions.

Who Should Use This Book

System administrators, operators, and information system professionals who would like to know about the features and functionality provided by IBM Reliable Scalable Cluster Technology as demonstrated in the Resource Monitoring and Control application should read this book.

How to Use This Book

This book contains information on how to use the Monitoring application, which is available through the Web-based System Manager user interface. This information is provided in the first two chapters. Thereafter, the book contains reference information that describes the underlying system, diagnostic information, commands and scripts, and tables of predefined conditions, expressions, and responses that are packaged with the application.

Highlighting

The following highlighting conventions are used in this book:

Bold	Identifies commands, subroutines, keywords, files, structures, directories, and other items whose names are predefined by the system. Also identifies graphical objects such as buttons, labels, and icons that the user selects.
<i>Italic</i>	Identifies parameters whose actual names or values are to be supplied by the user.
monospace	Identifies examples of specific data values, examples of text similar to what you might see displayed, examples of portions of program code similar to what you might write as a programmer, messages from the system, or information you should actually type.

ISO 9000

ISO 9000 registered quality systems were used in the development and manufacturing of this product.

32-Bit and 64-Bit Support for the UNIX98 Specification

Beginning with Version 4.3, the operating system is designed to support The Open Group's UNIX98 Specification for portability of UNIX-based operating systems. Many new interfaces, and some current ones, have been added or enhanced to meet this specification, making Version 4.3 even more open and portable for applications.

At the same time, compatibility with previous releases of the operating system is preserved. This is accomplished by the creation of a new environment variable, which can be used to set the system environment on a per-system, per-user, or per-process basis.

To determine the proper way to develop a UNIX98-portable application, you may need to refer to The Open Group's UNIX98 Specification, which can be obtained on a CD-ROM by ordering *Go Solo 2: The Authorized Guide to Version 2 of the Single UNIX® Specification*, ISBN: 0-13-575689-8, a book which includes The Open Group's UNIX98 Specification on a CD-ROM.

Related Publications

AIX Commands and Technical References, System Management Concepts: Operating System and Devices, and Web-based System Management Administration Guide, available at <http://www.ibm.com/servers/aix/library> and on your product installation CD.

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Chapter 1. Overview of RSCT Resource Monitoring and Control

The RSCT Resource Monitoring and Control (RMC) application is part of Reliable Scalable Cluster Technology (RSCT). It provides consistent comprehensive monitoring of system resources. By monitoring conditions of interest and providing automated responses when these conditions occur, RSCT Resource Monitoring and Control helps maintain system availability. RSCT Resource Monitoring and Control is installed as part of the base operating system and is administered by means of the easy-to-use Web-based System Manager graphical user interface or the command line.

You can set up monitoring easily through the Web-based System Manager user interface or you can use the command line. See “Chapter 2. Using the Monitoring Application” on page 7 for more details.

The Monitoring application offers a comprehensive set of monitoring and response capabilities that lets you detect, and in many cases correct, system resource problems such as a critical filesystem becoming full. You can monitor virtually all aspects of your system resources and specify a wide range of actions to be taken when a problem occurs, from simple notification by e-mail to recovery that runs a user-written script. You can specify an unlimited number of actions to be taken in response to an event.

As system administrator, you have a great deal of flexibility in responding to events. You can respond to an event in different ways based on the day of the week and time of day. The following are some examples of how you can use monitoring:

- You can be alerted by e-mail if /tmp is unmounted during working hours, but you can have the problem logged if /tmp is unmounted during nonworking hours.
- You can be notified by e-mail when /var is 80% full.
- You can configure your paging software to notify you if a critical file system goes offline.
- You can have a user-written script run automatically to delete the oldest unnecessary files when /tmp is 90% full.

Monitoring Concepts

Monitoring lets you detect conditions of interest in your machine and its associated resources, and automatically take action when those conditions occur. The key elements in monitoring are conditions and responses.

A condition identifies one or more resources you want to monitor, such as the /var file system, and the specific resource state you are interested in, such as /var > 90% full.

A response specifies one or more actions to be taken when the condition is found to be true. Actions can include notification, running commands, and logging.

About Conditions

To understand and use conditions, you need to know about the following:

- Resource class
- Monitored resource
- Monitored property
- Event expression
- Rearm expression

System resources that you can monitor are organized into general categories called *resource classes*. Examples of resource classes include Processor, File System, Physical Volume, and Ethernet Device.

Each resource class includes individual system resources that belong to the class. For example, the File System resource class might include these resources:

- /tmp
- /var
- /usr
- /home

When a resource is specified for use in a condition, it is called a *monitored resource*.

Each resource class also has a set of properties that you can monitor. For example, the File System resource class has the following properties available for monitoring:

- OpState - the operational state of the file system (online or offline).
- PercentTotUsed - the percentage of total file system space that is in use.
- PercentINodeUsed - the percentage of i-nodes in use for the file system.

When a resource property is specified for use in a condition, it is called a *monitored property*. (In the underlying subsystems, a monitored property is referred to as a *dynamic attribute*.)

In the condition, you specify the monitored property in a logical expression that defines the threshold or state of the monitored resources. The logical expression is the *event expression* of the condition. Event expressions are typically used to monitor potential problems and significant changes in the system. For example, the event expression for a /var space used condition might be PercentTotUsed > 90. When the logical expression is evaluated to be true, an event is generated.

The *rearm expression* of a condition is optional. A rearm expression typically indicates when the monitored resource has returned to an acceptable state. When the rearm expression is met, monitoring for the condition resumes.

If a rearm event is not specified, when the event expression becomes true an event is generated for certain properties every time the monitored property is evaluated.

If a rearm expression is specified, evaluation of the rearm expression starts once the event expression becomes true. When the rearm expression becomes true, a rearm event is generated; then the evaluation of the event expression starts again. For example, if the event expression for a /var space used condition is 90% full and the rearm expression is PercentTotUsed < 80, then an event is generated when /var is more than 90% full. The next time the condition is evaluated, the rearm expression is used. When /var is less than 80% full, an event is generated indicating that the condition has been reset, and the event expression is used again to evaluate the condition.

See “Using Expressions” on page 13 for more information about data types and operators that you can use in an event expression or a rearm expression.

Predefined conditions are provided with the Monitoring application. To create a new condition you will need to set the following condition components:

Condition Component	Description	Example
Condition name	The name you want to give the condition.	/var space used
Resource class	The resource class to be monitored.	FileSystem
Monitored property	The property of the resource class to be monitored.	PercentTotUsed
Monitored resources	The specific resources in the resource class that are to be monitored.	/var

Condition Component	Description	Example
Event expression	A logical expression defining the value or state of the monitored property that is to generate an event.	PercentTotUsed > 90
Event description	A text description of the event expression.	An event occurs when /var is more than 90% full.
Rearm expression	When a rearm expression is specified, the rearm expression is evaluated when the event expression becomes true. When the rearm expression becomes true, the event expression is used for evaluation again.	PercentTotUsed < 80
Rearm description	A text description of the rearm expression.	A rearm event occurs when /var is less than 80% full.
Severity	The severity of the condition: Informational, Warning, or Critical.	Critical

About Responses

A response consists of one or more actions to be performed by the system when an event or rearm event occurs for a condition. In the Monitoring application you can use the predefined responses or create new responses, and associate them with conditions as needed. You can associate multiple responses with one condition, and associate a single response with multiple conditions.

The responses for a condition remain deactivated until you start monitoring for that condition. When you select a condition to start monitoring, you need to activate at least one of its responses. The responses that are not active remain available to be used at another time. This allows you to use different responses for a condition as needed, without having to redefine them.

Predefined responses are provided with the Monitoring application. To create a new response you will need to set the following response and action components:

Response Component	Description	Example
Response name	The name you want to give the response.	Response for critical conditions
Actions	One or more actions to be taken as part of the response.	Log events to a file

Action Component	Description	Example
Action name	The name of an action to be taken as part of the response.	Send e-mail to the operator
When in effect	The days and times when this action is to be used to respond to the condition.	08:00 - 17:00 Monday-Friday
Use for event, rearm event, or both	Whether the action is to be used to respond to an event, a rearm event, or both.	Event
Command	The command to be run when an event or rearm event occurs.	A recovery script

You can associate multiple responses with a condition if you want to define different responses based on when the event occurs. For example, you might have a work day response and a weekend response, each containing one or more actions. Consider how you might respond to a /var space used condition with

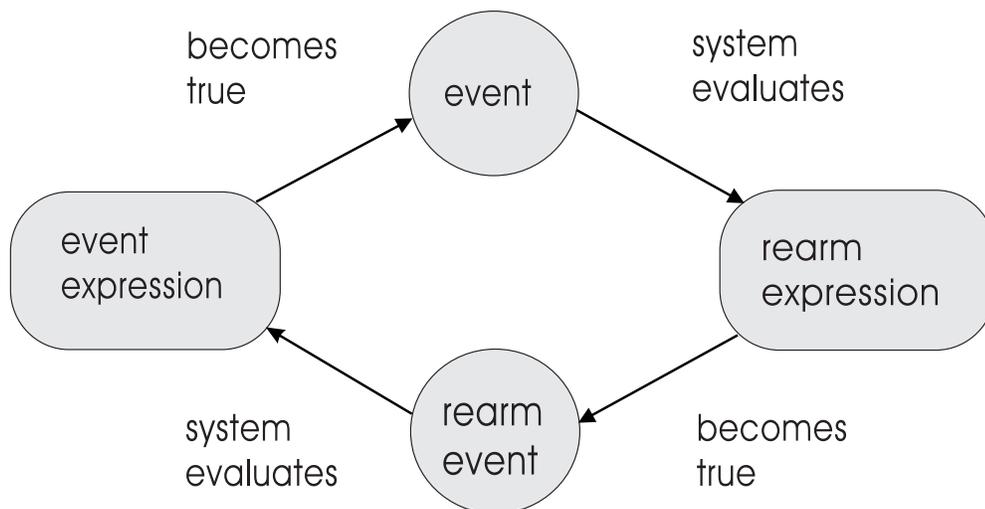
the following responses. During working hours, you might want to e-mail the operator, run a command, and broadcast a message to users who are logged on. During weekend hours, you might want to e-mail the system administrator and log a message to a file.

How Conditions and Responses Work Together

Once monitoring for the condition begins, the system evaluates the event expression to see if it is true. When the event expression becomes true, an *event* occurs that automatically notifies all of the associated event responses, which causes each event response to run its defined actions.

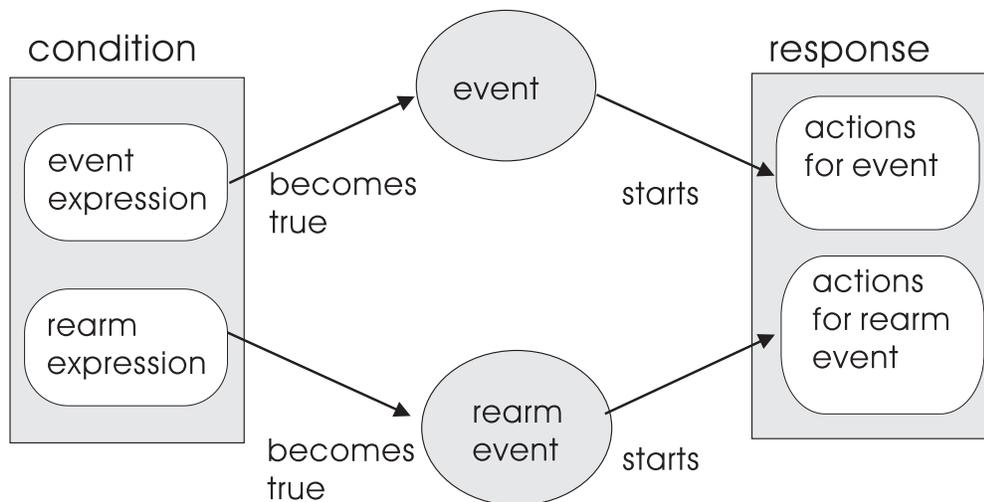
The event expression and the rearm expression work together as follows when a condition is monitored. First, the event expression is evaluated. When the event expression becomes true, an event occurs, and the specified actions are taken. When the event expression becomes true, the system begins evaluating the rearm expression. When the rearm expression becomes true, the *rearm event* occurs, which automatically starts the actions defined for the rearm event. When the rearm event occurs, the system returns to evaluating the event expression.

The following illustration shows this cycle:



When an event occurs for the monitored condition, the actions for the event are automatically taken. If the condition has a rearm expression, a rearm event causes the rearm actions to be taken.

The following illustration shows these interactions:



Security Considerations

A root user can perform all Monitoring tasks:

- Create, view, modify, or delete conditions.
- Create, view, modify, or delete responses. (The **Display in Events plug-in** response cannot be modified or deleted.)
- Add or remove responses to a condition.
- Start or stop monitoring for a condition.
- View events.
- View and edit the audit log.

A non-root user can perform only the following Monitoring tasks:

- View conditions.
- Start monitoring for a condition using the **Display in Events plug-in** response from Web-based System Manager.
- Stop monitoring for a condition using the **Display in Events plug-in** response from Web-based System Manager.
- View responses.
- View events.

For a complete description of the underlying components of the RSCT Resource Monitoring and Control application, see “Chapter 3. Components Provided for Monitoring” on page 21.

Chapter 2. Using the Monitoring Application

This chapter describes planning for monitoring your system, tracking system events, and using and modifying the predefined scripts, expressions, commands, and responses packaged with this application. These predefined elements and how to use them are described in detail in “Chapter 3. Components Provided for Monitoring” on page 21.

Planning What to Monitor in Your System

First, select conditions to monitor that would have a severe impact on your system. These conditions might include:

- /var space used
- Percentage of free paging space

When you have determined the resource problems you want to monitor, review the predefined conditions and identify the conditions you want to use. They can be displayed in the Monitoring application in the **Conditions** plug-in. See “Getting Started with the Monitoring Application” on page 8 and “Chapter 3. Components Provided for Monitoring” on page 21 for more information. Use the **Iscondition** command to view all conditions from the command line.

If a predefined condition deviates from your requirements in some way, you can edit it, use it as a template to create your own customized condition, or create your own condition.

Once you have selected conditions for monitoring, you need to plan one or more responses to be taken for the event and the optional rearm event.

Planning How to Respond to Detected Conditions

A set of predefined responses comes installed with your system (see “Predefined Responses” on page 44). Each response has one or more actions associated with it. Each action can be activated or deactivated to fit your particular work environment and schedule.

The **Responses** plug-in’s **Response Properties** dialog has an **Add Action** option where you can choose predefined actions for responding to an event or rearm event. You can also specify a command or a script to be run as an action.

The predefined actions are:

- Sending e-mail to a particular user (See the **notifyevent** man page for information on the command.)
- Logging to a user-specified log file (See the **logevent** man page for information on the command.)
- Broadcasting a message to all users who are currently logged on (See the **wallevent** man page for information on the command.)

You can also write your own commands to correct or mitigate conditions using the **Run program** option.

You might specify different actions based on when the monitored condition occurs. For example, you could have one set of actions to respond to a condition during working hours and another set to respond to a condition on nights and weekends. To be notified of events when you are away from your terminal, your actions must include e-mail, broadcasting, or logging. You can also view events in the **Events** plug-in.

Getting Started with the Monitoring Application

This section describes how to start using the Monitoring application. You can use the Web-based System Manager or the command line to do the following:

- Start monitoring your system.
- Associate a response with a condition.
- View events that may have occurred on your system.
- Stop monitoring.

Note: See the Monitoring online help for detailed task information.

How to Start Monitoring Your System

The following scenario demonstrates how to start monitoring your system using the Web-based System Manager user interface. Once you are familiar with the procedure, you can create customized conditions and responses, and take advantage of the more advanced Monitoring features.

1. Start the Web-based System Manager graphical user interface by entering **wsm** on the command line.
2. In the **Navigation Area**, select the host machine you want to monitor.
3. In the **Contents Area**, double-click the **Monitoring** icon. The contents area of the Monitoring application displays the following plug-ins:
 - **Overview and Tasks**
 - **Conditions**
 - **Responses**
 - **Events**
4. To view predefined conditions and select a condition for monitoring, double-click the **Conditions** icon.
5. Click the **Details** toolbar icon to show each predefined condition in detail.
6. Select a condition and click the **Start Monitoring** toolbar icon.
7. In the **Edit Responses to Start Monitoring** dialog, select a response from **Other available responses**.
8. Click the left arrow.
9. Click **OK**.
10. A message displays that monitoring has been started. Click **OK**.

How to Associate a Response with a Condition

To associate a response with a condition using the Web-based System Manager, do the following:

1. Select the condition, click the **Properties** tool bar icon, and click **Responses to Condition...**
2. In the **Edit Responses to Condition** dialog, select the response you want to use from **Other available responses**.
3. Click the left arrow. Monitoring will start if any of the responses are checked.
4. Click **OK**.

To associate a response with a condition from the command line, use the following commands (see the man pages or the AIX Commands Reference for detailed usage information):

1. Use the **lsresponse** command to list all responses.
2. Use the **mkcondresp** command to associate a condition with a response without starting monitoring. Use the **startcondresp** command to associate a condition with a response and begin monitoring immediately.

How to View Events

To view events in the Web-based System Manager, select the **Events** plug-in. You can also view and sort events using the **Audit Log**.

To view events from the command line, use the **lsaudrec** command to view the audit log. You can use the **notifyevents** predefined script to log events to a file.

How to Stop Monitoring

To stop monitoring from Web-based System Manager, select the condition and click the **Stop Monitoring** toolbar icon.

To stop monitoring from the command line, use the **stopcondresp** command.

How to Monitor Your System Using the Command Line Interface

The following scenarios demonstrate most frequently performed monitoring tasks from the command line interface. See the AIX Commands Reference at <http://www.ibm.com/servers/aix/library> or the command man pages for detailed usage information.

1. To list the conditions in your system, enter **lscondition**. Output is similar to:

```
Name                               Monitoring Status
"/tmp space used"                  "Not monitored"
"var space used"                   "Monitored"
(more conditions listed...)
```

2. To list the responses available in the system, enter **lsresponse**. Output is similar to:

```
Name
"Critical notification"
"Warning notification"
"Informational notification"
"Remove unwanted files"
(more responses listed...)
```

3. To list responses associated with a condition, use the **lscondresp** command. For example, to list the responses associated with the condition `"/tmp space used"`, enter **lscondresp `"/tmp space used"`**. Output is similar to:

```
Condition      Response                               State
"/tmp space used"  "Broadcast event on-shift"           Active
"/tmp space used"  "E-mail root anytime"                Not Active
```

4. To start monitoring a condition, one or more responses need to be specified for the condition. For example, to start monitoring the condition `"/tmp space used"` using the response `"critical notification"` and `"remove unwanted files,"` enter:

```
startcondresp "/tmp space used" "critical notification" "remove unwanted files"
```

5. You can either stop monitoring a condition completely, or stop monitoring a condition with specific responses. To stop monitoring the condition `"/tmp space used"` completely, enter:

```
stopcondresp "/tmp space used"
```

To stop monitoring the condition `"/tmp space used"` with a specific response, `"critical notification,"` enter:

```
stopcondresp "/tmp space used" "critical notification"
```

6. You can copy a condition to use as a template for a new condition. For example, to create a new condition `"my test condition"` from an existing condition `"/tmp space used,"` enter:

```
mkcondition -c "/tmp space used" "my test condition"
```

7. To view events or the actions taken in response to the events, enter:

```
lsaudrec
```

For a complete list of predefined commands, scripts, and utilities, see “Predefined Commands, Scripts, Utilities, and Files” on page 45.

Tracking Monitoring Activity

For viewing information about monitoring events, rearm events, actions, and errors that have occurred, see the following table:

Available Information	How to Find It
The Monitoring application’s Events plug-in lets you view a list of all the events, rearm events, and error events that have occurred during the current Web-based System Manager session.	To view events for your current session: <ol style="list-style-type: none"> 1. In Web-based System Manager, select Monitoring. 2. In the Events plug-in, select the All Events toolbar icon.
You can view a list of current events, which are the most recent events that are currently true for their respective monitored conditions. Note: In the current events view, you only see the latest event that is true for each monitored condition.	To view current events for your current session: <ol style="list-style-type: none"> 1. In Web-based System Manager, select Monitoring. 2. In the Events plug-in, select the Current Events toolbar icon.
If you have specified a notification mechanism such as logging as an action for an event, the log file will receive an entry each time that action is taken. Entries are logged during the entire period in which the condition is monitored, whether or not Web-based System Manager is running. You can browse the log file without running Web-based System Manager.	To view your log file use the alog command.
The Web-based System Manager Session Log contains all Monitoring messages issued during the current Web-based System Manager session that did not require a user response.	To view the Session Log: <ol style="list-style-type: none"> 1. In Web-based System Manager, select Console from the menu bar. 2. Select Session Log.
The audit log is a system-wide facility for recording information about the operation of the system. It can include information about normal operation as well as errors. Logging activity occurs independent of Web-based System Manager and continues whether or not a session is active.	To view the Audit Log in Web-based System Manager, <ol style="list-style-type: none"> 1. In Web-based System Manager, select Monitoring. 2. In the Events plug-in, select the Audit Log toolbar icon. To view the Audit Log from a command line, issue Isaudrec .

Using the Audit Log to Track Monitoring Activity

Audit log records include the following:

- Instances of starting and stopping monitoring
- Events and rearm events
- Actions taken in response to events and rearm events
- Results (success or failure) of actions taken in response to events and rearm events
- Subsystem errors or monitoring errors

The administrator can use the audit log to track activity that may not be visible otherwise because the activity is related to subsystems running in the background. The audit log is accessible from Web-based System Manager or the command line.

To list audit log records, use the **Audit Log** toolbar icon in the **Events plug-in** or the **Isaudrec** command. To remove records use the **Audit Log** toolbar icon in the **Events plug-in** or the **rmaudrec** command. For

details see the Monitoring application online help or the command man pages. Commands are also documented in the AIX Commands Reference at <http://www.ibm.com/servers/aix/library>.

Writing Your Own Scripts

You can write your own scripts to use as actions for responses. The AIX Commands Reference contains information about predefined scripts that are provided with the Event Response resource manager. The following scripts are provided: **logevent**, **notifyevent**, and **wallevent** (You can also use existing operating system commands and user-written scripts in the definition of an action.)

Using Predefined Response Scripts

The **logevent**, **notifyevent**, and **wallevent** scripts are examples of the types of actions that system administrators can use to respond to events. The **logevent** script appends a formatted string containing the specifics of an event to a user-specified file. Only the latest 65536 bytes are kept in the file. When the file size reaches its maximum, the oldest logged event is overwritten by the newest event. The **alog** command is used to read the user-specified log file. The **notifyevent** script captures the event information and sends the event information via UNIX mail to a specified userid. The **wallevent** script broadcasts a message to all users who are logged in.

For a full description of these scripts, see the man pages or the AIX Commands Reference.

You can use these scripts as-is or treat them as templates by copying and modifying them to create new scripts that suit your needs. For example, to use the **wallevent** script as a template for a page event command, do the following:

1. Copy the **wallevent** script at **/usr/sbin/rsct/bin/wallevent** to a new script file and rename it, for example, to **pageevent**.
2. Replace the **wall** command with the program for your pager.

Note: These predefined scripts are in the **/usr/sbin/rsct/bin** directory. Because the Monitoring application relies on these scripts, do not modify the original scripts.

For a command to run in response to an event or a rearm event defined by a condition, the command must be included as an action in an Event Response resource. When an Event Response resource is defined, specify the entire path name for a script that is used within an action.

This is set up implicitly for you when you use the Monitoring application as follows:

1. In the **Responses** plug-in, select a response and click the **Properties** toolbar icon.
2. In the **Response Properties** dialog, click the **Add** button to display the **Add Action** dialog.
3. Select the **Run program** option.
4. Enter the fully qualified name of the script.

Test any scripts or commands that you have created or modified before you use them as actions in production.

Using Event Response Environment Variables

Once the Event Response resource manager (ERRM) has subscribed to RMC to monitor a condition and that condition occurs, the ERRM executes commands in the user's operating system environment. The Event Response resource contains a list of commands to be executed. Before each command is run, the following environment variables are established for the command to use (see "Event Response Resource Manager" on page 23 for a detailed description of the ERRM):

- **ERRM_COND_HANDLE** - The Condition resource handle (six hexadecimal integers that are separated by spaces and written as a string) that caused the event.

- **ERRM_COND_NAME** - The name of the Condition resource (enclosed within double quotation marks) that caused the event.
- **ERRM_COND_SEVERITY** - The significance of the Condition resource that caused the event. For the severity attribute values of 0, 1, and 2, this environment variable has the following values respectively: informational, warning, critical. All other Condition resource severity attribute values are represented in this environment variable as a decimal string.
- **ERRM_ER_HANDLE** - The Event Response resource handle (six hexadecimal integers that are separated by spaces and written as a string) for this event.
- **ERRM_ER_NAME** - The name of the Event Response resource (enclosed within double quotation marks) that is executing this command.
- **ERRM_RSRC_HANDLE** - The resource handle of the resource whose state change caused the generation of this event (written as a string of six hexadecimal integers that are separated by spaces).
- **ERRM_RSRC_NAME** - The name of the resource (enclosed within double quotation marks) whose dynamic attribute changed to cause this event.
- **ERRM_RSRC_CLASS_NAME** - The name of the resource class of the dynamic attribute (enclosed within double quotation marks) that caused the event to occur.
- **ERRM_TIME** - The time the event occurred written as a decimal string that represents the time since midnight January 1, 1970 in seconds, followed by a comma and the number of microseconds.
- **ERRM_TYPE** - The type of event that occurred. The two possible values for this environment variable are: event or rearm event.
- **ERRM_EXPR** - The expression that was evaluated which caused the generation of this event. This could be either the event or rearm expression, depending on the type of event that occurred. This can be determined by the value of ERRM_TYPE.
- **ERRM_ATTR_NAME** - The programmatic name of the dynamic attribute used in the expression that caused this event to occur. (A variable name is restricted to include only 7-bit ASCII characters that are alphanumeric (a-z, A-Z, 0-9) or the underscore character (_). The name must begin with an alphabetic character.)
- **ERRM_DATA_TYPE** - RMC ct_data_type_t of the dynamic attribute that changed to cause this event. The following is a list of valid values for this environment variable: CT_INT32, CT_UINT32, CT_INT64, CT_UINT64, CT_FLOAT32, CT_FLOAT64, CT_CHAR_PTR, CT_BINARY_PTR, and CT_SD_PTR. For all data types except CT_NONE, the ERRM_VALUE of the environment variable is defined with the value of the dynamic attribute.
- **ERRM_VALUE** - The value of the dynamic attribute that caused the event to occur for all dynamic attributes except those with a data type of CT_NONE.
The following data types are represented with this environment variable as a decimal string: CT_INT32, CT_UINT32, CT_INT64, CT_UINT64, CT_FLOAT32, and CT_FLOAT64.
CT_CHAR_PTR is represented as a string for this environment variable.
CT_BINARY_PTR is represented as a hexadecimal string separated by spaces.
CT_SD_PTR is enclosed in square brackets and has individual entries within the SD that are separated by commas. Arrays within an SD are enclosed within braces {}. For example, ["My Resource Name",{1,5,7},{0,9000,20000},{7000,11000,25000}] See the definition of ERRM_SD_DATA_TYPES for an explanation of the data types that these values represent.
- **ERRM_SD_DATA_TYPES** - The data type for each element within the structured data (SD) variable separated by commas. This environment variable is only defined when ERRM_DATA_TYPE is CT_SD_PTR. For example: CT_CHAR_PTR, CT_UINT32_ARRAY, CT_UINT32_ARRAY, CT_UINT32_ARRAY

(See "Resource Handle" on page 15 for a definition and an example of a resource handle.)

Using Expressions

The information in this section is for advanced users who want to:

- modify predefined expressions
- select resources
- filter audit log records by compiling and executing a complex mathematical expression against a set of values

Permissible data types and operators are described and the order of precedence for the operators is included. RMC uses these functions to match a selection string against the persistent attributes of a resource and to implement the evaluation of an event expression or a rearm expression.

An expression is similar to a C language statement or the WHERE clause of a SQL query. It is composed of variables, operators, and constants. The C and SQL syntax styles may be intermixed within a single expression. The following table relates the SQL terminology to RMC terminology:

RMC	SQL
attribute name	column name
select string	WHERE clause
operators	predicates, logical connectives
resource class	table

SQL Restrictions

For SQL syntax, the following restrictions apply:

- Only a single table may be referenced in an expression.
- Queries may not be nested.
- The IS NULL predicate is not supported because there is no concept of a NULL value.
- The period (.) operator is not a table separator (for example, table.column). Rather, in this context, the period (.) operator is used to separate a field name from its containing structure name.
- The pound sign (#) is hard coded as the escape character within SQL pattern strings.
- All column names are case sensitive.
- All literal strings must be enclosed in either single or double quotation marks. Bare literal strings are not supported because they cannot be distinguished from column and attribute names.

Supported Base Data Types

The term variable is used in this context to mean the column name or attribute name in an expression. Variables and constants in an expression may be one of the following data types that are supported by the RMC subsystem:

Symbolic Name	Description
CT_INT32	Signed 32-bit integer
CT_UINT32	Unsigned 32-bit integer
CT_INT64	Signed 64-bit integer
CT_UINT64	Unsigned 64-bit integer
CT_FLOAT32	32-bit floating point
CT_FLOAT64	64-bit floating point
CT_CHAR_PTR	Null-terminated string
CT_BINARY_PTR	Binary data – arbitrary-length block of data

Symbolic Name	Description
CT_RSRC_HANDLE_PTR	Resource handle – an identifier for a resource that is unique over space and time (20 bytes)

Structured Data Types

In addition to the base data types, aggregates of the base data types may be used as well. The first aggregate data type is similar to a structure in C in that it can contain multiple fields of different data types. This aggregate data type is referred to as *structured data* (SD). The individual fields in the structured data are referred to as structured data *elements* or simply *elements*. Each element of a structured data type may have a different data type, which can be one of the base types in the preceding table or any of the array types discussed in the next section, except for the structured data array.

The second aggregate data type is an array. An array contains zero or more values of the same data type, such as an array of CT_INT32 values. Each of the array types has an associated enumeration value (CT_INT32_ARRAY, CT_UINT32_ARRAY). Structured data may also be defined as an array but is restricted to have the same elements in every entry of the array.

Data Types That Can Be Used for Literal Values

Literal values can be specified for each of the base data types as follows:

Array An array or list of values may be specified by enclosing variables or literal values, or both, within braces {} or parentheses () and separating each element of the list with a comma. For example: { 1, 2, 3, 4, 5 } or ("abc", "def", "ghi")

Entries of an array can be accessed by specifying a subscript as in the C programming language. The index corresponding to the first element of the array is always zero; for example, List [2] references the third element of the array named List. Only one subscript is allowed. It may be a variable, a constant, or an expression that produces an integer result. For example, if List is an integer array, then List[2]+4 produces the sum of 4 and the current value of the third entry of the array.

Binary Data

A binary constant is defined by a sequence of hexadecimal values, separated by white space. All hexadecimal values comprising the binary data constant are enclosed in double quotation marks. Each hexadecimal value includes an even number of hexadecimal digits, and each pair of hexadecimal digits represents a byte within the binary value. For example:

```
"0xabcd 0x01020304050607090a0b0c0d0e0f1011121314"
```

Character Strings

A string is specified by a sequence of characters surrounded by single or double quotation marks (you can have any number of characters, including none). Any character may be used within the string except the null '\0' character. Double quotation marks and backslashes may be included in strings by preceding them with the backslash character.

Floating Types

These types can be specified by the following syntax:

- A leading plus (+) or minus (-) sign
- One or more decimal digits
- A radix character, which at this time is the period (.) character
- An optional exponent specified by the following:
 - A plus (+) or minus (-) sign
 - The letter 'E' or 'e'
 - A sequence of decimal digits (0–9)

Integer Types

These types can be specified in decimal, octal, or hexadecimal format. Any value that begins with the digits 1–9 and is followed by zero or more decimal digits (0–9) is interpreted as a decimal value. A decimal value is negated by preceding it with the character '-'. Octal constants are specified by the digit 0 followed by 1 or more digits in the range 0–7. Hexadecimal constants are specified by a leading 0 followed by the letter x (uppercase or lowercase) and then followed by a sequence of one or more digits in the range 0–9 or characters in the range a-f (uppercase or lowercase).

Resource Handle

A fixed-size entity that consists of two 16-bit and four 32-bit words of data. A literal resource handle is specified by a group of six hexadecimal integers. The first two values represent 16-bit integers and the remaining four each represent a 32-bit word. Each of the six integers is separated by white space. The group is surrounded by double quotation marks. The following is an example of a resource handle:

```
"0x4018 0x0001 0x00000000 0x0069684c 0x00519686 0xaf7060fc"
```

Structured Data

Structured data values can be referenced only through variables. Nevertheless, the RMC command-line interface displays structured data (SD) values and accepts them as input when a resource is defined or changed. A literal SD is a sequence of literal values, as defined in “Data Types That Can Be Used for Literal Values” on page 14, that are separated by commas and enclosed in square brackets. For example, [‘abc’,1,{3,4,5}] specifies an SD that consists of three elements: (a) the string ‘abc’, (b) the integer value 1, and (c) the three-element array {3,4,5}.

Variable names refer to values that are not part of the expression but are accessed during the execution of the expression. For example, when RMC processes an expression, the variable names are replaced by the corresponding persistent or dynamic attributes of each resource.

Entries of an array may be accessed by specifying a subscript as in ‘C’. The index corresponding to the first element of the array is always 0 (for example, List[2] refers to the third element of the array named List). Only one subscript is allowed. It may be a variable, a constant, or an expression that produces an integer result. A subscripted value may be used wherever the base data type of the array is used. For example, if List is an integer array, then “List[2]+4” produces the sum of 4 and the current value of the third entry of the array.

The elements of a structured data value can be accessed by using the following syntax:

```
<variable name>.<element name>
```

For example, a.b

The variable name is the name of the table column or resource attribute, and the element name is the name of the element within the structured data value. Either or both names may be followed by a subscript if the name is an array. For example, a[10].b refers to the element named b of the 11th entry of the structured data array called a. Similarly, a[10].b[3] refers to the fourth element of the array that is an element called b within the same structured data array entry a[10].

How Variable Names Are Handled

Variable names refer to values that are not part of an expression but are accessed during the execution of the expression. When used to select a resource, the variable name is a persistent attribute. When used to generate an event, the variable name is a dynamic attribute. When used to select audit records, the variable name is the name of a field within the audit record.

A variable name is restricted to include only 7-bit ASCII characters that are alphanumeric (a-z, A-Z, 0-9) or the underscore character (_). The name must begin with an alphabetic character. When the expression is used by the RMC subsystem for an event or a rearm event, the name can have a suffix that is the ‘@’ character followed by ‘P’, which refers to the previous observation.

Operators That Can Be Used in Expressions

Constants and variables may be combined by an operator to produce a result that in turn may be used with another operator. The resulting data type or the expression must be a scalar integer or floating-point value. If the result is zero, the expression is considered to be FALSE; otherwise, it is TRUE.

Note: Blanks are optional around operators and operands unless their omission causes an ambiguity. An ambiguity typically occurs only with the word form of operator (that is, AND, OR, IN, LIKE, etc). With these operators, a blank or separator, such as a parenthesis or bracket, is required to distinguish the word operator from an operand. For example, aANDb is ambiguous. Is this intended to be the variable name aANDb or is it intended to be the variable names a, b combined with the operator AND? It is actually interpreted by the application as a single variable name aANDb. With non-word operators (for example, +, -, =, &&, etc.) this ambiguity does not exist, and therefore, blanks are optional.

The set of operators that can be used in strings is summarized in the following table:

Operator	Description	Left Data Types	Right Data Types	Example	Notes
+	Addition	Integer floats	Integer floats	"1+2" results in 3	None
-	Subtraction	Integer floats	Integer floats	"1.0-2.0" results in -1.0	None
*	Multiplication	Integer floats	Integer floats	"2*3" results in 6	None
/	Division	Integer floats	Integer floats	"2/3" results in 1	None
-	Unary minus	None	Integer floats	"-abc"	None
+	Unary plus	None	Integer floats	"+abc"	None
..	Range	Integers	Integers	"1..3" results in 1,2,3	Shorthand for all integers between and including the two values
%	Modulo	Integers	Integers	"10%2" results in 0	None
	Bitwise OR	Integers	Integers	"2 4" results in 6	None
&	Bitwise AND	Integers	Integers	"3&2" results in 2	None
~	Bitwise complement	None	Integers	~0x0000ffff results in 0xffff0000	None
^	Exclusive OR	Integers	Integers	0x0000aaaa ^ 0x0000ffff results in 0x00005555	None
>>	Right shift	Integers	Integers	0x0fff>>4 results in 0x00ff	None
<<	Left shift	Integers	Integers	"0x0fff<<4" results in 0xffff0	None
==	Equality	All but SDs	All but SDs	"2==2" results in 1	Result is true (1) or false (0)
=				"2=2" results in 1	
!=				"2!=2" results in 0	
<>	Inequality	All but SDs	All but SDs	"2<>2" results in 0	Result is true (1) or false (0)
>				"2>3" results in 0	
>=	Greater than or equal	Integer floats	Integer floats	"4>=3"=1	Result is true (1) or false (0)

Operator	Description	Left Data Types	Right Data Types	Example	Notes
<	Less than	Integer floats	Integer floats	"4<3" results in 0	Result is true (1) or false (0)
<=	Less than or equal	Integer floats	Integer floats	"2<=3" results in 1	Result is true (1) or false (0)
=~	Pattern match	Strings	Strings	"abc"=~ "a.*" results in 1	Right operand is interpreted as an extended regular expression
!~	Not pattern match	Strings	Strings	"abc"!~ "a.*" results in 0	Right operand is interpreted as an extended regular expression
=? LIKE like	SQL pattern match	Strings	Strings	"abc"=? "a%" results in 1	Right operand is interpreted as a SQL pattern
!? NOT LIKE not like	Not SQL pattern match	Strings	Strings	"abc"!? "a%" results in 0	Right operand is interpreted as a SQL pattern
< IN in	Contains any	All but SDs	All but SDs	"{1..5} <{2,10}" results in 1	Result is true (1) if left operand contains any value from right operand
>< NOT IN not in	Contains none	All but SDs	All but SDs	"{1..5}><{2,10}" results in 1	Result is true (1) if left operand contains no value from right operand
&<	Contains all	All but SDs	All but SDs	"{1..5}&<{2,10}" results in 0	Result is true (1) if left operand contains all values from right operand
 OR or	Logical OR	Integers	Integers	"(1<2) (2>4)" results in 1	Result is true (1) or false (0)
&& AND and	Logical AND	Integers	Integers	"(1<2)&& (2>4)" results in 0	Result is true (1) or false (0)

Operator	Description	Left Data Types	Right Data Types	Example	Notes
! NOT not	Logical NOT	None	Integers	"!(2==4)" results in 1	Result is true (1) or false (0)

When integers of different signs or size are operands of an operator, standard C style casting is implicitly performed. When an expression with multiple operators is evaluated, the operations are performed in the order defined by the precedence of the operator. The default precedence can be overridden by enclosing the portion or portions of the expression to be evaluated first in parentheses (). For example, in the expression "1+2*3", multiplication is normally performed before addition to produce a result of 7. To evaluate the addition operator first, use parentheses as follows: "(1+2)*3". This produces a result of 9. The default precedence rules are shown in the following table. All operators in the same table cell have the same or equal precedence.

Operators	Description
.	Structured data element separator
~	Bitwise complement
! NOT not	Logical not
-	Unary minus
+	Unary plus
*	Multiplication
/	Division
%	Modulo
+	Addition
-	Subtraction
-	Subtraction
<<	Left shift
>>	Right shift
<	Less than
<=	Less than or equal
>	Greater than
>=	Greater than or equal
==	Equality
!=	Inequality
=? LIKE like	SQL match
!?	SQL not match
=~	Reg expr match
!~	Reg expr not match
?=	Reg expr match (compat)

Operators	Description
< IN in	Contains any
>< NOT IN not in	Contains none
&<	Contains all
&	Bitwise AND
^	Bitwise exclusive OR
	Bitwise inclusive OR
&&	Logical AND
	Logical OR
,	List separator

Pattern Matching

Two types of pattern matching are supported; extended regular expressions and that which is compatible with the standard SQL LIKE predicate. This type of pattern may include the following special characters:

- The percentage sign (%) matches zero or more characters.
- The underscore (_) matches exactly one character.
- All other characters are directly matched.
- The special meaning for the percentage sign and the underscore character in the pattern may be overridden by preceding these characters with an escape character, which is the pound sign (#) in this implementation.

Examples of Expressions

Some examples of the types of expressions that can be constructed follow:

1. The following expressions match all rows or resources that have a name which begins with 'tr' and ends with '0', where 'Name' indicates the column or attribute that is to be used in the evaluation:

```
Name = 'tr.*0'
```

```
Name LIKE 'tr%0'
```

2. The following expressions evaluated to TRUE for all rows or resources that contain 1, 3, 5, 6, or 7 in the column or attribute that is called IntList, which is an array:

```
IntList|<{1,3,5..7}
```

```
IntList in (1,3,5..7)
```

3. The following expression combines the previous two so that all rows and resources that have a name beginning with 'tr' and ending with '0' and have 1, 3, 5, 6, or 7 in the IntList column or attribute will match:

```
(Name LIKE "tr%0")&&(IntList|<(1,3,5..7))
```

```
(Name='tr.*0') AND (IntList IN {1,3,5..7})
```

Chapter 3. Components Provided for Monitoring

Resources have identifiable attributes (also called *properties* in Web-based System Manager) that can be expressed so that certain conditions of interest to the system administrator can be observed. Predefined thresholds can be set for conditions, and responses can be defined and associated with these conditions. When these thresholds are met, an event is generated, and the actions associated with the condition are run. Predefined conditions and responses can be used as is or as templates for defining the conditions most appropriate for your installation.

The major components of RSCT Resource Monitoring and Control are the Resource Monitoring and Control (RMC) subsystem and certain resource managers. These are described in the following sections.

Note: Monitoring currently takes place on a single system. Commands that cause changes can only be executed by root.

Resource Monitoring and Control Subsystem

The Resource Monitoring and Control subsystem (RMC subsystem) monitors and queries resources. The RMC daemon manages an RMC session and recovers from communications failures.

The RMC subsystem is used by its clients to monitor the state of system resources and to send commands to resource managers. The RMC subsystem acts as a broker between the client processes that use it and the resource manager processes that control resources.

Resource Managers

A resource manager is a process that maps resource and resource-class abstractions into calls and commands for one or more specific types of resources. A resource manager is a stand-alone daemon. The resource manager contains definitions of all resource classes that the resource manager supports. A resource class definition includes a description of all attributes, actions, and other characteristics of a resource class.

These resource classes are accessible and their properties can be manipulated by the user through Web-based System Manager or through the command line.

See the RMC and ERRM commands to access the resource classes and manipulate their attributes through the command line interface.

Note: Attributes and characteristics of a resource class are referred to as *properties* in Web-based System Manager.

The following resource managers are provided:

- Audit Log resource manager (IBM.AuditRM)
Provides a system-wide facility for recording information about the system's operation, which is particularly useful for tracking subsystems running in the background.
(See "Audit Log Resource Manager" on page 22 for details.)
- Event Response resource manager (IBM.ERRM)
Provides the ability to take actions in response to conditions occurring on the system.
(See "Event Response Resource Manager" on page 23 for details.)
- File System resource manager (IBM.FSRM)
Monitors file systems.
(See "File System Resource Manager" on page 24 for details.)

- Host resource manager (IBM.HostRM)
Monitors resources related to an individual machine. The types of values that are provided relate to load (processes, paging space, and memory usage) and status of the operating system. It also monitors program activity from initiation until termination.
(See “Host Resource Manager” on page 25 for details.)

Audit Log Resource Manager

The Audit Log subsystem is implemented as a resource manager within the RMC subsystem. It has two resource classes, IBM.AuditLog for subsystem definitions and IBM.AuditLogTemplate for audit-log-template definitions. Entries in the audit log are called records. Records can be added, retrieved, and removed through actions on a specific subsystem or on the subsystem class. The template definition class contains a description of each record type that a subsystem can add to the audit log. The template definition contains the data type, a descriptive message, and other information for each subsystem-specific field within the record.

There are typically two types of clients for the audit-log subsystem, subsystems that need to add records to the audit log, and users who extract records from the audit log via the command line or the Web-based System Manager interface.

The formatted message for each record provides a concise description of the situation and allows a user to easily see at a high level what has been happening on the system.

Audit Log Resource Class

Each resource of this class represents a subsystem that will be adding records to the audit log. A resource of this class must be added before the subsystem can add records to the audit log. The resource can be added as part of the installation of the subsystem or at runtime.

The following properties can be monitored for this resource class:

RecordsAdded

Reflects the current number of records in the audit log. Whenever records are added to the audit log, this value is updated.

RecordsRemoved

Conveys which records have been removed. The following data elements comprise the value of this attribute:

RecordCount

Reflects the total number of records in the audit log after the records identified by SeqNumRanges have been removed.

SeqNumCount

Reflects the total number of elements in the SeqNumRanges array. The number of ranges in that array is actually SeqNumCount/2.

SeqNumRanges

Each consecutive pair of CT_INT64 integers defines an inclusive range of sequence numbers of records that have been deleted.

AuditLogSize

Reflects the amount of disk space in bytes that the audit log uses.

Audit Log Template Resource Class

This resource class holds all audit log templates. An audit log template describes the information that exists in each audit log record that is based on the template. In addition, an audit log template contains

information on how to present records that use the template to an end user. Each template corresponds to a resource within this class. The attributes of this resource class are internal.

Event Response Resource Manager

The system administrator interacts with the Event Response resource manager (ERRM) through the Web-based System Manager or through the ERRM command-line interface.

When an event occurs, ERRM runs user-configured commands, which can include scripts provided by RSCT. A command and its attributes are a type of action, and many actions can be configured for a single Event Response resource. An action consists of a name, a command to be run, and other variables. You specify the range of times when the command is run (day, start time, and end time). If the condition occurs at a time outside the specified time ranges, the command is not run, and if all of the actions within this Event Response resource have the same time ranges, none of the commands are run. If no time ranges are specified, the command is always run. There are also event and rearm event flags that specify the events for which the command is run. Three options are allowable; only event set, only rearm event set, or both flags set.

The Event Response Resource Manager (ERRM) is automatically started when the RMC subsystem is started.

Although performance is important, ensuring that no events are lost and that the user's commands are executed is of greater importance. Other factors outside the control of ERRM may affect performance as well (for example, network load, system load, and the performance of other required subsystems).

The only userid that can define, undefine, and modify ERRM resources is root. All other users have read access to ERRM resources. Security is governed by the RMC daemon, which authenticates clients and performs authorization checks. No security audits are generated, and no encryption mechanisms are used. ERRM communicates only with other local subsystems on the same node.

Information is handled as follows:

- Files that contain internal trace output which is useful to a software service organization in resolving problems are written to ***/var/ct/IW/log/mc/IBM.ERRM/trace***.
- Persistent attributes and other information are stored in tables under a directory that corresponds to the resource class.
- Core files are written to the ***/var/ct/IW/run/mc/IBM.ERRM*** directory.
- The Audit Log facility records events and the actions taken by ERRM in response to those events, such as changes in the registration of Conditions with RMC.

There are three **Event Response** resource classes:

1. **Condition**

The Condition resource class contains the necessary information (event expression and rearm expression) for the ERRM to register with the RMC for event notifications that the administrator deems important. Conditions contain essential information such as: the resource attributes of the resource to be monitored, the event expression, and the optional rearm expression.

Note: *Resource attributes* are called *properties* in Web-based System Manager terminology.)

Configuration of ERRM begins with the definition of a set of Condition resources. A Condition resource is registered with the RMC subsystem when the Condition resource is used in the definition of an active Association resource.

Note: Registration with RMC is necessary for monitoring to take place. Registration does not occur when a new Condition resource is defined but rather when the resource is used in the definition of an active association resource.

2. Event Response

An Event Response resource is configured by defining one or more actions. Each action contains the name of the action, a command, and other fields within the action attribute. The Event Response resource runs any number of configured commands when an event with an active association occurs. When an event occurs, all of the actions associated with its Event Response resource are evaluated to determine whether they should be run.

Predefined responses are available to use and to serve as templates for your own responses. For a description of predefined responses and how to use them, see “Predefined Responses” on page 44. Scripts for notification and logging of events and for broadcasting messages to logged-in user consoles also are provided in the AIX Commands Reference.

Note: Commands are run in parallel.

See “Getting Started with the Monitoring Application” on page 8 for specific task information on how to configure actions for Event Response resources and Event Response resources for Conditions.

3. Association

The Association resource class joins the Condition resource class together with the Event Response resource class. It contains a flag that indicates whether the association between the condition and the event response is active. Event Responses and Conditions are separate entities, but for monitoring to take place, they need to be associated. An event cannot occur unless at least one Event Response is associated with a Condition. You can configure one or more actions for an Event Response, and one or more Event Responses for a Condition.

See “Getting Started with the Monitoring Application” on page 8 for information on how to get started using the capabilities of the Event Response resource manager to monitor your system.

File System Resource Manager

The File System resource manager (FSRM) manages file systems. It can provide the following information:

- List all file systems within the system.
- List only the file systems that match certain criteria.
- Obtain the status of a file system (mounted or unmounted).
- Obtain the values of the persistent attributes of the file system.
- Monitor the percentage of disk space used for the file system.
- Monitor the percentage of i-nodes used for the file system.

There is one File System resource manager (FSRM) on a node. It is started implicitly by the RMC subsystem.

To enforce security, only root can start the FSRM resource manager (although it is strongly recommended that the FSRM resource manager not be started manually). Security is governed by the RMC daemon, which authenticates clients and performs authorization checks. No security audits are generated, and no encryption mechanisms are used. The FSRM communicates only with other local subsystems on the same node and with the RMC subsystem. The FSRM has no direct contact with clients.

Information is handled as follows:

- Files that contain internal trace output which is useful to a software service organization in resolving problems are written to **/var/ct/IW/log/mc/IBM.FSRM**.
- Persistent attributes and other information are stored in tables under a directory that corresponds to the resource class.

- Core files are written to the `/var/ct/IW/run/mc/IBM.FSRM` directory.

These properties of a file system resource can be monitored:

OpState

Monitors whether the current file system operational state is online (mounted) or offline (unmounted).

PercentTotUsed

Represents the percentage of space that is used in a specific filesystem so that preventative action can be taken if the amount available is approaching a predefined threshold. For example, `/tmp PercentTotUsed`, `/var PercentTotUsed`.

PercentINodeUsed

Represents the percentage of i-nodes that are in use for a specific file system; for example, `/tmp PercentINodeUsed`.

Predefined Conditions for Monitoring File Systems

The following table shows the predefined conditions and examples of expressions that are used to monitor the file system:

Condition Name	Event Expression	Event Description	Rearm Expression	Rearm Expression	Monitored Resources
File system state	<code>OpState != 1</code>	An event is generated when any file system goes offline.	<code>OpState == 1</code>	The event is rearmed when any file system comes back online.	all
File system i-nodes used	<code>PercentINodeUsed > 90</code>	An event is generated when more than 90% of the total i-nodes in any file system are in use.	<code>PercentINodeUsed < 85</code>	The event is rearmed when the percentage of i-nodes used in the file system falls below 85%.	all
File system space used	<code>PercentTotUsed > 90</code>	An event is generated when more than 90% of the total space of any file system is in use.	<code>PercentTotUsed < 85</code>	The event is rearmed when the space used in the file system falls below 85%.	all
<code>/tmp</code> space used	<code>PercentTotUsed > 90</code>	An event is generated when more than 90% of the total space in the <code>/tmp</code> file system is in use.	<code>PercentTotUsed < 85</code>	The event is rearmed when the space used in the <code>/tmp</code> file system falls below 85%.	<code>/tmp</code>
<code>/var</code> space used	<code>PercentTotUsed > 90</code>	An event is generated when more than 90% of the total space in the <code>/var</code> file system is in use.	<code>PercentTotUsed < 85</code>	The event is rearmed when the space used in the <code>/var</code> file system falls below 85%.	<code>/var</code>

Host Resource Manager

The Host resource manager allows system resources for an individual machine to be monitored, particularly resources related to operating-system load and status.

The Host resource manager is started implicitly by the RMC subsystem only when a property of a Host resource class is first monitored (thus cutting down on performance overhead).

Security is governed by the RMC daemon, which authenticates clients and performs authorization checks. The Host resource manager runs as root. No security audits are generated, no encryption mechanisms are used, and there is no communication outside the node. The RMC daemon detects any authentication or authorization failures. All interprocess communication is accomplished through pipes and shared memory.

Information is handled as follows:

- Files that contain internal trace output which is useful to a software service organization in resolving problems are written to ***/var/ct/IW/log/mc/IBM.HostRM***.
- Persistent attributes and other information are stored in tables under a directory that corresponds to the resource class.
- Core files are written to the ***/var/ct/IW/run/mc/IBM.HostRM*** directory.

The Host resource manager consumes minimal system resources during normal operation. This is because the following approaches have been implemented:

1. Memory, CPU, and other system resources are not consumed for properties that are not monitored. If no properties are monitored, the Host resource manager is not started.
2. To minimize disk access, information is maintained in memory as much as possible.
3. The sampling of property values is aligned as much as possible to minimize the sampling overhead, in particular, thread or process context swaps.

The Host resource manager has the following resource classes that you can use to monitor system resources:

Host (IBM.Host)

This resource class externalizes the properties of a machine that is running a single copy of an operating system. Primarily the properties included are those that are advantageous in predicting or indicating when corrective action needs to be taken. See “Host” on page 27 for more details.

Paging Device (IBM.PagingDevice)

This resource class externalizes the properties of paging devices. See “Paging Device” on page 37 for more details.

Physical Volume (IBM.PhysicalVolume)

This resource class externalizes many properties of disks, such as the number of I/Os, wait time, etc. See “Physical Volume” on page 39 for more details.

Processor (IBM.Processor)

This resource class externalizes the properties of individual processors, such as idle time and time spent in the kernel. See “Processor” on page 37 for more details.

Program (IBM.Program)

This resource class allows a client to monitor properties of a program that is executing on a host. The program to monitor is identified by properties such as program name, arguments, etc. The resource class does not monitor processes as such because processes are very transient and therefore inefficient to monitor individually. See “Program” on page 42 for more details.

Each type of adapter that is supported has its own resource class as follows:

ATM Device (IBM.ATMDevice)

All ATM adapters installed in a node are externalized through this resource manager. See “ATM Device” on page 40 for more details.

Ethernet Device (IBM.EthernetDevice)

All Ethernet adapters installed in a node are externalized through this resource manager. See “Ethernet Device” on page 40 for more details.

FDDI Device (IBM.FDDIDevice)

All FDDI adapters installed in a node are externalized through this resource manager. See “FDDI Device” on page 42 for more details.

Token-Ring Device (IBM.TokenRingDevice)

All Token-Ring adapters installed in a node are externalized through this resource manager. See “Token-Ring Device” on page 42 for more details.

Host

The program name of this resource class is IBM.Host. It allows the following resources of a host system to be monitored:

1. Processes in the run queue of the operating system scheduler (see “Monitoring the Operating System Scheduler”).
2. Global state of active paging spaces (see “Monitoring the Global State of Active Paging Space” on page 28).
3. Total processor utilization across all active processors in the system (see “Monitoring Processor Utilization” on page 29).
4. Real, virtual, and kernel memory utilization (see “Memory Management” on page 30).

Monitoring the Operating System Scheduler

The operating system scheduler maintains a run queue of all of the processes that are ready to be dispatched. Each second, the process table is scanned to determine which processes are ready to run. If one or more processes are ready, they are placed on the run queue, and a counter is incremented. The counter is used to compute the value of the **ProcRunQueue** variable as the average number of ready-to-run processes. The scheduler also scans the process table for processes that are inactive because they are waiting to be paged in. A swapped process may (or may not) have some or all of its pages moved to the swap (page) device. As with the **ProcRunQueue** variable, the system increments a counter for swapped processes, which is used to compute the value of the **ProcSwapQueue** variable as the average number of processes swapped out. A process must be paged in and marked non-swapped before it can be placed on the run queue for execution. These properties can be monitored:

ProcRunQueue

Average number of processes that are waiting for the processor

ProcSwapQueue

Average number of processes that are waiting to be paged in.

Predefined Conditions for Monitoring the Operating System Scheduler: The following table shows the predefined conditions that are available for monitoring the operating system scheduler, and example expressions:

Condition Name	Event Expression	Event Description	Rearm Expression	Rearm Description
Processes in run queue	$(\text{ProcRunQueue} - \text{ProcRunQueue} @P) \geq (\text{ProcRunQueue} @P * 0.5)$	An event is generated each time the average number of processes on the run queue has increased by 50% or more between observations.	$\text{ProcRunQueue} < 50$	The event is rearmed when the run queue length drops below 50.
Processes in swap queue	$(\text{ProcSwapQueue} > 50)$ && $(\text{ProcSwapQueue}@P > 50)$	An event is generated each time two consecutive observations find 50 processes or more in the swap queue.	$(\text{ProcSwapQueue} < 40)$ && $(\text{ProcSwapQueue}@P < 40)$	The event is rearmed when the number of processes in the swap queue drops below 40 for two consecutive observations.

Monitoring the Global State of Active Paging Space

A paging space is fixed disk storage for information that is resident in virtual memory but is not currently being accessed. A paging space, or swap space, is a logical volume with the attribute type equal to paging. When the amount of free real memory in the system is low, programs or data that have not been used recently are moved from real memory to paging space to release real memory for other processes. The amount of paging space required depends upon the types of activities performed on the system. If paging space runs low, processes may be lost, and if paging space runs out, the system may panic. Paging-space shortage may cause memory performance degradation, and thrashing can occur (if VMM memory load control is turned off).

The system monitors the number of free paging-space blocks and detects when a paging-space shortage exists. When the number of free paging-space blocks falls below a threshold known as the paging-space warning level, the system informs all processes except kernel processes (kprocs) of this condition by sending the SIGDANGER signal. If the shortage continues and falls below a second threshold known as the paging-space terminate level, the system sends the SIGKILL signal to processes that are the major users of paging space and that do not have a signal handler for the SIGDANGER signal.

The warning-level and terminate-level thresholds can be obtained and altered by the command **vmtune** (*npswarn* and *npskill* parameters respectively). Processes executing in the early allocation environment avoid receiving the SIGKILL signal if a low paging space condition occurs. If the PSALLOC environment variable is set to early when a program starts, paging space is reserved at the time the process makes a memory request. If there is insufficient paging space, the early allocation algorithm used by the operating system causes the memory request to be unsuccessful. If the PSALLOC environment is not set, or is set to any value other than early, the operating system uses a late allocation algorithm for memory and paging-space allocation. Late allocation does not reserve paging space at the time the memory is requested but defers the reservation until the pages are touched.

Note: The VMM is a complex system, and paging-space requirements depend on a number of factors, including the paging-space allocation policy used, amount of real memory, and type of activities performed on the system. A thorough understanding of system paging requirements and operating system memory management is recommended before attempting to alter VMM operating parameters.

These properties monitor the global state of all active paging spaces defined in the system (including NFS-mounted paging spaces):

TotalPgSpSize

Holds the total size of all active paging-space devices in the system

TotalPgSpFree

Represents the size (in 4KB pages) of available paging space for all active paging space devices in the system

PctTotalPgSpUsed

Represents the percentage of paging space in use for all active paging space devices in the system

PctTotalPgSpFree

Represents the percentage of free paging space available for all paging space devices in the system.

Predefined Conditions for Monitoring Global State of Active Paging Space: The following table shows the predefined conditions that are available for monitoring paging space, and example expressions:

Condition Name	Event Expression	Event Description	Rearm Expression	Rearm Description
Paging active space	TotalPgSpSize != TotalPgSpSize @P	An event is generated whenever the total amount of active paging space changes.	None	None
Paging free space	TotalPgSpFree <= 2560	An event is generated when the VMM is within 2MB (512 4KB pages) of reaching the paging space warning level.	TotalPgSpFree > 2560	The event is rearmed when the free paging space total becomes greater than the same threshold.
Paging percent space used	PctTotalPgSpUsed > 90	An event is generated when more than 90% of the total paging space is in use.	PctTotalPgSpUsed < 85	The event is rearmed when the percentage falls below 85%.
Paging percent space free	PctTotalPgSpFree < 10	An event is generated when the total amount of free paging space falls below 10%.	PctTotalPgSpFree > 15	The event is rearmed when the free paging space increases to 15%.

Monitoring Processor Utilization

The values represented for this attribute reflect total processor utilization across all of the active processors in a system.

The idle and wait states of a processor are monitored, and the time spent running in protection mode is monitored. At each clock tick, an array of counters is incremented to reflect processor activity based on the state of the current running processes. The **PctTotalTimeKernel**, **PctTotalTimeUser**, **PctTotalTimeWait**, and **PctTotalTimeIdle** properties provide the approximate average percentage of time all active processors are currently spending in each state. Therefore, the sum of these values is 100 at any given observation.

There are two protection modes that processes run in, kernel (or system) level and user level. Processes running in kernel mode run with kernel privileges and have access to kernel data. These processes include kernel processes (kprocs) and services (such as system calls and device drivers).

Processes running in user mode are normal applications with user level privileges and run in their own unique process space. When a user level process invokes a kernel service, for example, by making a system call, a mode switch occurs that causes the process to run in kernel mode while the service is running.

When the current running process makes a request that cannot be immediately satisfied, such as an I/O operation, the process is put into wait state. A processor is considered idle when the current running process is the *wait* process. The wait process is a kernel process (kproc) that is dispatched when no other processes are ready to run.

These properties can be monitored:

PctTotalTimeIdle

Represents the system-wide percentage of time that the processors are idle

PctTotalTimeKernel

Represents the system-wide percentage of time that the processors are running in kernel mode

PctTotalTimeUser

Represents the system-wide percentage of time that the processors are running in user mode

PctTotalTimeWait

Represents the system-wide percentage of time that the processors are in wait state.

Predefined Conditions for Monitoring Processor Utilization: The following table shows the predefined conditions that are available for monitoring system-wide processor idle time, and example expressions:

Condition Name	Event Expression	Event Description	Rearm Expression	Rearm Description
Processor idle time	PctTotalTimeIdle >= 70	An event is generated when the average time all processors are idle at least 70% of the time.	PctTotalTimeIdle < 10	The event is rearmed when the idle time decreases below 10%.
Processor kernel time	PctTotalTimeKernel >= 70	An event is generated when the average time all processors are executing in kernel mode is at least 70% of the time.	PctTotalTimeKernel < 10	The event is rearmed when the kernel time decreases below 10%.
Processor user time	PctTotalTimeUser >= 70	An event is generated when the average time all processors are executing in user mode is at least 70% of the time.	PctTotalTimeUser < 10	The event is rearmed when the user time decreases below 10%.
Processor wait time	PctTotalTimeWait >= 50	An event is generated when the average time all processors are waiting on I/O is at least 50% of the time.	PctTotalTimeWait < 10	The event is rearmed when the wait time decreases below 10%.

Memory Management

The VMM (Virtual Memory Manager) manages the allocation of real memory page frames, resolves references to virtual memory pages that are not currently in real memory (or do not yet exist), and manages the reading and writing of pages to disk storage.

The VMM maintains a list of free page frames that it uses to accommodate page faults. A page fault occurs when a page that is not in real memory is referenced. In most environments, the VMM must occasionally add to the free list by reassigning some page frames owned by running processes. The virtual-memory pages whose page frames are to be reassigned are selected by the VMM's page-replacement algorithm, which takes into consideration the segment type, statistics regarding rate of reoccurring page faults, and user-tunable thresholds. The number of frames reassigned to the free list is also determined by VMM thresholds.

Memory regions defined in either system or user space may be pinned. Pinning a memory region prohibits the pager from stealing pages from the pages backing the pinned memory region. After a memory region is pinned, accessing that region does not result in a page fault until the region is subsequently unpinned. While a portion of the kernel remains pinned, many regions are pageable and are only pinned while being accessed.

Thresholds used by the VMM include the minimum and maximum number of pages to be maintained on the free list (*minfree* and *maxfree*). These thresholds are used to determine when the VMM should start or stop stealing pages to replenish the free list. There is also a maximum percentage of real memory that may be pinned. The values of these thresholds may be queried or altered using the system command **vmtune**.

Virtual memory is partitioned into fixed-size units called pages. Each page may be in real memory (RAM) or stored on disk until needed. Real memory is partitioned into units that are equal in size to virtual pages and are referred to as page frames. To accommodate a large virtual memory space with a limited real memory space, the system uses real memory for work space and maps inactive data and programs to disk.

Pages of a virtual address space are considered to be persistent or working. Persistent pages have permanent storage locations on disk. Data files or executable programs are mapped to persistent pages. Since persistent pages have a permanent storage location, the VMM can write a changed page back to its permanent location or simply free the page frame if it was not altered and re-read the page on a subsequent request.

Working pages are transitory and exist only during their use by a process. Examples are process stack and data regions, kernel and kernel-extension text regions, and shared-library text and data regions. Working pages also require disk storage locations when they cannot be kept in real memory. Disk paging space is used for this purpose.

The operating system provides routines used by the kernel and by services executing at system level for allocating memory in kernel space. Counters are maintained in the kernel to track requests and use of kernel memory, based on the type of data structure or service. These properties can be used to monitor the number and size and the state of requests for buffers allocated in kernel memory. The types of kernel memory available are:

- Mbuf (network data buffer)
- Socket (kernel socket structure)
- Protcb (protocol control block)
- OtherIP (other buffers used by IP)
- Mblk (stream header and data)
- Streams (other streams-related memory)
- Other (other kernel memory).

The following properties are available for monitoring real and virtual memory and kernel memory. The <x> in the names below refers to the type of kernel memory allocation as shown in the preceding bulleted list (28 possible monitors).

PctRealMemFree

Represents the percentage of real page frames that are currently available on the VMM free list.

PctRealMemPinned

Represents the percentage of real page frames that are currently pinned and cannot be paged out.

RealMemFramesFree

Represents the number of real page frames that are currently available on the VMM free list.

VMPgInRate

Represents the rate (in pages per second) that the VMM is reading both persistent and working pages from disk storage.

VMPgOutRate

Represents the rate (in pages per second) that the VMM is writing both persistent and working pages to disk storage.

VMPgFaultRate

Represents the average rate of page faults that occur per second.

VMPgSpInRate

Represents the rate (in pages per second) that the VMM is reading working pages from paging-space disk storage.

VMPgSpOutRate

Represents the rate (in pages per second) that the VMM is writing working pages to paging-space disk storage.

KMemReq<x>Rate

Represents the rate of requests per second for a kernel memory buffer of type <x>.

KMemFail<x>Rate

Represents the rate of requests per second for a kernel memory buffer of type <x> that were unsuccessful.

KMemNum<x>

Represents the number of kernel memory buffers of type <x> that are currently in use.

KMemSize<x>

Represents the amount, in bytes, of kernel memory buffers of type <x> that are currently in use.

Predefined Conditions for Memory Management: The following table shows the predefined conditions that are available for monitoring memory management, and example expressions:

Condition Name	Event Expression	Event Description	Rearm Expression	Rearm Description
Real memory free	PctRealMemFree < 5	An event is generated when the percentage of real page frames that are free falls below 5%.	PctRealMemFree > 10	The event is rearmed when the percentage of free frames exceeds 10%.
Real memory pinned	PctRealMemPinned > 75	An event is generated when the percentage of real page frames that are pinned exceeds 75%.	PctRealMemPinned < 70	The event is rearmed when the percentage falls below 70%.
Real memory free frames	PctMemFramesFree < 120	An event is generated when the number of free real page frames falls below 120.	PctMemFramesFree > 150	The event is rearmed when the number free exceeds 150.
Page in rate	VMPgInRate > 500	An event is generated when the rate of pages read by the VMM for both persistent and working pages exceeds 500 per second.	VMPgInRate < 400	The event is rearmed when the rate drops below 400.
Page out rate	VMPgOutRate > 500	An event is generated when the rate of pages written by the VMM for both persistent and working pages exceeds 500 per second.	VMPgOutRate < 400	The event is rearmed when the rate drops below 400.
Page fault rate	VMPgFaultRate > 500	An event is generated when there are more than 500 page faults per second.	VMPgFaultRate < 400	The event is rearmed when the rate drops to less than 400 pages per second.

Condition Name	Event Expression	Event Description	Rearm Expression	Rearm Description
Page space in rate	VMPgSpInRate > 500	An event is generated when more than 500 pages per second are read by the VMM from paging space devices (working pages only).	VMPgSpInRate < 400	The event is rearmed when the rate drops to less than 400 pages per second.
Page space out rate	VMPgSpOutRate > 500	An event is generated when more than 500 pages per second are written by the VMM to paging space devices (working pages only).	VMPgSpOutRate < 400	The event is rearmed when the rate drops to less than 400 pages per second.
Kernel Mbuf rate	KMemReqMbufRate > 5000	An event is generated when the number of requests for a kernel buffer of type <Mbuf> (network data buffer) exceeds 5000 per second.	KMemReqMbufRate < 4000	The event is rearmed when the rate falls below 4000 per second.
Kernel socket buffer rate	KMemReqSockRate > 5000	An event is generated when the number of requests for a kernel buffer of type <Socket> (kernel socket structure) exceeds 5000 per second.	KMemReqSockRate < 4000	The event is rearmed when the rate falls below 4000 per second.
Kernel protocol CB rate	KMemReqProtcbRate > 5000	An event is generated when the number of requests for a kernel buffer of type <Protcb> (Protocol Control Block) exceeds 5000 per second.	KMemReqProtcbRate < 4000	The event is rearmed when the rate falls below 4000 per second.
Kernel other IP CB rate	KMemReqOtherIPRate > 5000	An event is generated when the number of requests for a kernel buffer of type <OtherIP> (other buffers used by IP) exceeds 5000 per second.	KMemReqOtherIPRate < 4000	The event is rearmed when the rate falls below 4000 per second.
Kernel Mblk rate	KMemReqMblkRate > 5000	An event is generated when the number of requests for a kernel buffer of type <Mblk> (stream header and data) exceeds 5000 per second.	KMemReqMblkRate < 4000	The event is rearmed when the rate falls below 4000 per second.

Condition Name	Event Expression	Event Description	Rearm Expression	Rearm Description
Kernel streams buffer rate	KMemReqStreamsRate > 5000	An event is generated when the number of requests for a kernel buffer of type <Streams> (other streams related memory) exceeds 5000 per second.	KMemReqStreamsRate < 4000	The event is rearmed when the rate falls below 4000 per second.
Kernel other memory rate	KMemReqOtherRate > 5000	An event is generated when the number of requests for a kernel buffer of type <Other> (other kernel memory) exceeds 5000 per second.	KMemReqOtherRate < 4000	The event is rearmed when the rate falls below 4000 per second.
Kernel Mbuf failed rate	KMemFailMbufRate > 10	An event is generated when the number of failures of requests for a kernel buffer of type <Mbuf> (network data buffer) exceeds 10 per second.	KMemFailMbufRate < 5	The event is rearmed when the rate falls below 5 per second.
Kernel socket buffer failed rate	KMemFailSockRate > 10	An event is generated when the number of failures of requests for a kernel buffer of type <Socket> (kernel socket structure) exceeds 10 per second.	KMemFailSockRate < 5	The event is rearmed when the rate falls below 5 per second.
Kernel protocol CB failed rate	KMemFailProtcbRate > 10	An event is generated when the number of failures of requests for a kernel buffer of type <Protcb> (Protocol Control Block) exceeds 10 per second.	KMemFailProtcbRate < 5	The event is rearmed when the rate falls below 5 per second.
Kernel other IP CB failed rate	KMemFailOtherIPRate > 10	An event is generated when the number of failures of requests for a kernel buffer of type <OtherIP> (other buffers used by IP) exceeds 10 per second.	KMemFailOtherIPRate < 5	The event is rearmed when the rate falls below 5 per second.
Kernel Mblk failed rate	KMemFailMblkRate > 10	An event is generated when the number of failures of requests for a kernel buffer of type <Mblk> (stream header and data) exceeds 10 per second.	KMemFailMblkRate < 5	The event is rearmed when the rate falls below 5 per second.

Condition Name	Event Expression	Event Description	Rearm Expression	Rearm Description
Kernel streams buffer failed rate	KMemFailStreamsRate> 10	An event is generated when the number of failures of requests for a kernel buffer of type <Streams> (other stream related memory) exceeds 10 per second.	KMemFailStreamsRate < 5	The event is rearmed when the rate falls below 5 per second.
Kernel other memory failed rate	KMemFailOtherRate> 10	An event is generated when the number of failures of requests for a kernel buffer of type <Other> (other kernel memory) exceeds 10 per second.	KMemFailOtherRate < 5	The event is rearmed when the rate falls below 5 per second.
Kernel Mbufs	KMemNumMbuf > 10000	An event is generated when the allocated number of kernel buffers of type <Mbuf> (network data buffer) exceeds 10000.	KMemNumMbuf < 9000	The event is rearmed when the number falls below 9000.
Kernel socket buffers	KMemNumSock > 10000	An event is generated when the allocated number of kernel buffers of type <Socket> (kernel socket structure) exceeds 10000.	KMemNumSock < 9000	The event is rearmed when the number falls below 9000.
Kernel protocol CBs	KMemNumProtcb> 10000	An event is generated when the allocated number of kernel buffers of type <Protcb> (Protocol Control Block) exceeds 10000.	KMemNumProtcb< 9000	The event is rearmed when the number falls below 9000.
Kernel other IP CBs	KMemNumOtherIP> 10000	An event is generated when the allocated number of kernel buffers of type <OtherIP> (other buffers used by IP) exceeds 10000.	KMemNumOtherIP< 9000	The event is rearmed when the number falls below 9000.
Kernel Mblk buffers	KMemNumMblk> 10000	An event is generated when the allocated number of kernel buffers of type <Mblk> (stream header and data) exceeds 10000.	KMemNumMblk < 9000	The event is rearmed when the number falls below 9000.

Condition Name	Event Expression	Event Description	Rearm Expression	Rearm Description
Kernel stream buffers	KMemNumStreams > 10000	An event is generated when the allocated number of kernel buffers of type <Streams> (other streams related memory) exceeds 10000.	KMemNumStreams < 9000	The event is rearmed when the number falls below 9000.
Kernel other memory	KMemNumOther > 10000	An event is generated when the allocated number of kernel buffers of type <Other> (other kernel memory) exceeds 10000.	KMemNumOther < 9000	The event is rearmed when the number falls below 9000.
Kernel Mbufs size	KMemSizeMbuf > 0x4000000	An event is generated when the total space occupied by kernel buffers of type <Mbuf> (network data buffer) exceeds 64MB.	KMemSizeMbuf < 0x2000000	The event is rearmed when the allocated amount drops below 32MB.
Kernel socket buffers size	KMemSizeSock > 0x4000000	An event is generated when the total space occupied by kernel buffers of type <Socket> (kernel socket structure) exceeds 64MB.	KMemSizeSock < 0x2000000	The event is rearmed when the allocated amount drops below 32MB.
Kernel protocol CBs size	KMemSizeProtcb > 0x4000000	An event is generated when the total space occupied by kernel buffers of type <Protcb> (Protocol Control Block) exceeds 64MB.	KMemSizeProtcb < 0x2000000	The event is rearmed when the allocated amount drops below 32MB.
Kernel other IP CBs size	KMemSizeOtherIP > 0x4000000	An event is generated when the total space occupied by kernel buffers of type <OtherIP> (other buffers used by IP) exceeds 64MB.	KMemSizeOtherIP < 0x2000000	The event is rearmed when the allocated amount drops below 32MB.
Kernel Mblks size	KMemSizeMblk > 0x4000000	An event is generated when the total space occupied by kernel buffers of type <Mblk> (stream header and data) exceeds 64MB.	KMemSizeMblk < 0x2000000	The event is rearmed when the allocated amount drops below 32MB.
Kernel streams buffers size	KMemSizeStreams > 0x4000000	An event is generated when the total space occupied by kernel buffers of type <Streams> (other streams related memory) exceeds 64MB.	KMemSizeStreams < 0x2000000	The event rearmed when the allocated amount drops below 32MB.

Condition Name	Event Expression	Event Description	Rearm Expression	Rearm Description
Kernel other memory size	KMemSizeOther > 0x4000000	An event is generated when the total space occupied by kernel buffers of type <Other> (other kernel memory) exceeds 64MB.	KMemSizeOther < 0x2000000	The event is rearmed when the allocated amount drops below 32MB.

Paging Device

The program name of this resource class is IBM.PagingDevice. It can be used to monitor devices that are used by the operating system for paging. Each host may have one or more paging devices. On the operating system, the paging device is a logical volume.

Monitoring Amount of Free Paging Space for Device

These attributes can be monitored:

OpState

Monitors whether the current operational state of the page device is online or offline.

PctFree

Represents the percentage of free paging space available for a specific paging space device.

Predefined Conditions for Monitoring Paging Space for a Specific Device

The following table shows the predefined conditions and examples of expressions that are available for monitoring paging space for a specific device:

Condition Name	Event Expression	Event Description	Rearm Expression	Rearm Description
Paging device state	OpState != 1	An event is generated when the paging space device goes offline.	OpState == 1	The event is rearmed when the device comes back online.
Paging device percent free	PctFree < 20	An event is generated when less than 20% of the paging device is free.	PctFree > 25	The event is rearmed when the amount of free paging space on the device exceeds 25%.

Processor

The program name of this resource class is IBM.Processor.

Because the system tracks the amount of time each processor spends idle, in wait state, and running in kernel and user modes, this resource class can be used to monitor these processor activities. At each clock tick, an array of counters is incremented to reflect the processor activity based on the state of the current running process. The processor user, kernel, wait, and idle resource properties provide the approximate percentage of time that a specific processor is currently spending in each state. Therefore, the sum of these properties is 100 at any given observation.

There are two protection modes that processes run in, kernel (or system) level and user level. Processes executing in kernel mode run with kernel privileges and have access to kernel data. These processes include kernel processes (kprocs), and services (such as system calls and device drivers).

Processes running in user mode are normal applications with user level privileges and run in their own unique process space. When a user level process invokes a kernel service, for example, by making a system call, a mode switch occurs that causes the process to run in kernel mode while the service is executing.

When the current running process makes a request that cannot be immediately satisfied, such as an I/O operation, the process is put into wait state.

Monitoring Utilization of a Single Processor

The following properties can be monitored:

OpState

Monitors whether the current operational state of the processor is online or offline.

PctTimeIdle

Represents the percentage of time the processor is in the idle state.

PctTimeKernel

Represents the percentage of time the processor is running in kernel mode.

PctTimeUser

Represents the percentage of time the processor is running in user mode.

PctTimeWait

Represents the percentage of time the processor is running in wait state.

Predefined Conditions for Monitoring a Processor

This resource class represents the characteristics of the processors within a host. There is one instance of this resource for each processor installed in a host regardless of whether it is active or not. The following table shows the predefined conditions and examples of expressions that are available for monitoring a processor:

Condition Name	Event Expression	Event Description	Rearm Expression	Rearm Description
Processor state	OpState !=1	An event is generated when the processor goes offline.	OpState == 1	The event is rearmed when the processor returns online.
Processor idle time	(PctTimeIdle >= 80) && (PctTimeIdle @P >= 80)	An event is generated each time the processor is idle at least 80% of the time for two consecutive observations.	(PctTimeIdle < 50) (PctTimeIdle @P < 50)	The event is rearmed when the idle time for the processor is below 50% for two consecutive observations.
Processor wait time	(PctTimeWait >= 50) && (PctTimeWait @P >= 50)	An event is generated when the average time the processor is in wait state is at least 50% for two consecutive observations.	(PctTimeWait < 30) && (PctTimeWait @P < 30)	The event is rearmed when the processor is in wait state at most 30% of the time for two consecutive observations.
Processor kernel time	(PctTimeKernel >= 70) && (PctTimeKernel @P >= 70)	An event is generated when the average time the processor is in kernel mode for two consecutive observations is 80%.	(PctTimeKernel < 20) && (PctTimeKernel @P < 20)	The event is rearmed when the kernel mode time for the processor is below 20% for two consecutive observations.
Processor user time	(PctTimeUser >= 80) && (PctTimeUser @P > 80)	An event is generated when the average time the processor is in user mode for two consecutive observations is 80%.	(PctTimeUser < 50) && (PctTimeUser @P < 50)	The event is rearmed when the user mode time for the processor is below 50% for two consecutive observations.

Physical Volume

The program name of this resource class is IBM.Physical Volume. After a disk is added to the system, it must first be designated as a physical volume before it can be added to a volume group and used to contain a file system or paging space. A physical volume has certain configuration and identification information written on it. When a disk becomes a physical volume, it is divided into 512-byte physical blocks. Physical volumes have a unique name (typically **hdiskx** where **x** is a unique number on the system), which is permanently associated with the disk until it is undefined.

Monitoring Physical Disks

These properties, which reflect the basic performance of a physical disk, can be monitored:

PctBusy

Average percentage of time the disk is busy from one observation of the value to the next.

RdBkRate

Average rate at which blocks are read from disk. The rate is calculated as the difference in total blocks read from the disk between two observations, divided by the time between observations.

WrBkRate

Average rate at which blocks are written to disk. The rate is calculated as the difference in total blocks written to the disk between two consecutive observations, divided by the time between observations.

XferRate

Average rate of transfers per second that were issued to the physical disk. A transfer is an I/O request to the physical disk. Multiple logical requests can be combined into a single I/O request to the disk. A transfer is of indeterminate size. The rate is calculated as the difference in total transfers between two consecutive observations, divided by the time between observations.

Predefined Conditions for Monitoring Physical Disks

Each instance of this resource class represents a physical volume that has been defined to the system. All resources are monitored. The following table shows the predefined condition and examples of expressions that are available for monitoring physical disks:

Condition Name	Event Expression	Event Description	Rearm Expression	Rearm Description
Disk percent busy	(PctBusy >= 90) && (PctBusy@P >=90)	An event is generated when the disk has been busy at least 90% of the time for two consecutive observations.	PctBusy <80	The event is rearmed when the value decreases below 80%.
Disk read rate	RdBkRate < 50	An event is generated when the rate per second of 512-byte blocks read from the disk is less than 50.	RdBkRate > 100	The event is rearmed when the rate exceeds 100.
Disk write rate	WrBkRate < 50	An event is generated when the rate per second of 512-byte blocks written to disk is less than 50.	WrBkRate > 100	The event is rearmed when the rate exceeds 100.
Disk transfer rate	(XferRate > XferRate@P) && ((XferRate - XferRate@P) > (XferRate@P * 0.5))	An event is generated each time the rate of transfer to disk has increased 50%.	None	None

Adapters

The following adapters are supported, each by its own resource class:

ATM Device (IBM.ATMDevice)

All ATM adapters installed in a node are externalized through this resource manager. See “ATM Device” for more details.

Ethernet Device (IBM.EthernetDevice)

All Ethernet adapters installed in a node are externalized through this resource manager. See “Ethernet Device” for more details.

FDDI Device (IBM.FDDIDevice)

All FDDI adapters installed in a node are externalized through this resource manager. See “FDDI Device” on page 42 for more details.

Token-Ring Device (IBM.TokenRingDevice)

All Token-Ring adapters installed in a node are externalized through this resource manager. See “Token-Ring Device” on page 42 for more details.

See “Ethernet Device” for details on what can be monitored for an adapter. The other adapters have the same types of attributes. Only the adapter name is different.

ATM Device

The program name of this resource class is IBM.ATMDevice. The details of this class are identical to those of the IBM.EthernetDevice class except that the display name of the resource class is “ATM Device.” See the description of “Ethernet Device” for details that also apply to this device.

Ethernet Device

The program name of this resource class is IBM.EthernetDevice. This resource class allows attributes of all Ethernet adapters that are installed in a system to be monitored. The network interfaces that may be defined on the adapters are not represented.

A network adapter card is the hardware that is physically attached to the network cabling. It is responsible for receiving and transmitting data at the physical level. The network adapter card is controlled by the network adapter device driver. A machine must have one network adapter card (or connection) for each network (not network type) to which it connects. For instance, if a host attaches to two Token-Ring networks, it must have two network adapter cards. When a new network adapter is physically installed in the system, the operating system assigns it a logical name. Some examples are: tok0 for a Token-Ring adapter, ent0 for an Ethernet adapter, or atm0 for an ATM adapter. The trailing number assigned, creates a unique logical number. For example, a second Token-ring adapter would have the logical name, tok1. The **lsdev** command can be used to display information about network adapters.

Messages received by a LAN adapter, referred to as frames, are encapsulated within destination, header, and trailer information added by the various network protocol layers. A counter, maintained for each adapter, tracks the number of frame-receive errors at the adapter device level that caused unsuccessful reception due to hardware or network errors. This counter is the raw value for **RecErrorRate**.

When frames are received by an adapter, they are transferred from the adapter into a device-managed receive queue. The number of packets accepted but dropped by the device driver level for any reason (for example, queue buffer shortage) is tracked by a counter, which provides the raw value of the **RecDropRate** property.

Messages and data sent by an application to a LAN adapter for transmission are broken up into packets and appended with address, header, and trailer information by the various network protocol layers. At the adapter device driver level, packets are placed in buffers on a transmit queue. The packets are appended with a network interface header, then transmitted as frames by the adapter device.

Counters are maintained for each adapter to track the number of transmission errors at the device level (due to hardware or network errors), number of transmission queue overflows at the device driver level (due to buffer shortage), and the number of packets dropped (packets not passed to the device by the driver for any reason). These counters provide the raw values for **XmitErrorRate**, **XmitOverflowRate**, and **XmitDropRate**, respectively.

Monitoring Device Performance

The following properties can be monitored:

RecErrorRate

Represents the number of receive errors per second that occurred at the adapter level.

RecDropRate

Represents the number of receive packets per second that were dropped by the adapter device driver.

XmitDropRate

Represents the number of outbound packets per second that were dropped by the adapter device driver.

XmitErrorRate

Represents the number of transmit errors per second that were detected at the adapter level.

XmitOverflowRate

Represents the number of transmit queue overflows per second that were detected by the adapter.

Predefined Conditions for Monitoring Device Performance

This resource class externalizes the characteristics of all Ethernet adapters that are installed in a system. It is important to note that this class does not represent the network interfaces that may be defined on the adapters. This class represents the actual adapters (i.e. ent0, etc.).

The characteristics are limited to a small set in the first release that are compatible with what is available through Event Management's aixos resource monitor.

The following table shows the predefined conditions and examples of expressions that are available for monitoring device performance. All resources are monitored.

Condition Name	Event Expression	Event Description	Rearm Expression	Rearm Description
Ethernet receive error rate	RecErrorRate > 1	An event is generated when the number of receive errors exceeds 1 per second.	(RecErrorRate == 0) && (RecErrorRate@P == 0)	The event is rearmed when the receive error rate is 0 for two consecutive observations.
Ethernet receive drop rate	RecDropRate > 10	An event is generated when the number of receive packets dropped exceeds 10 per second.	RecDropRate < 5	The event is rearmed when the number of dropped packets goes below 5 per second.
Ethernet transmit drop rate	XmitDropRate > 10	An event is generated when the number of outbound packets dropped exceeds 10 per second.	XmitDropRate < 5	The event is rearmed when the number of dropped packets goes below 5 per second.

Condition Name	Event Expression	Event Description	Rearm Expression	Rearm Description
Ethernet transmit error rate	XmitErrorRate > 1	An event is generated when the number of transmit errors exceeds 1 per second.	(XmitErrorRate == 0) && (XmitErrorRate@P == 0)	The event is rearmed when the transmit error rate is 0 for two consecutive observations.
Ethernet transmit overflow rate	XmitOverflowRate > 10	An event is generated when the number of transmit queue overflows exceeds 10 per second.	XmitOverflowRate < 2	The event is rearmed when the number of overflows goes below 2 per second.

FDDI Device

The program name of this resource class is IBM.FDDIDevice. The details of this class are identical to those of the IBM.EthernetDevice class except that the display name of the resource class is "FDDI Device." See the description of "Ethernet Device" on page 40 for details that also apply to this device.

Token-Ring Device

The program name of this class is IBM.TokenRingDevice. The details of this class are identical to those of the IBM.EthernetDevice class except that the display name of the resource class is "Token-Ring Device." See the description of "Ethernet Device" on page 40 for details that also apply to this device.

Program

The program name of this resource class is IBM.Program resource class. This resource class can monitor a set of processes that are running a specific program or command whose attributes match a filter criterion. The filter criterion includes the real or effective user name of the process, arguments that the process was started with, etc. The primary aspect of a program resource that can be monitored is the set of processes that meet the program definition. A client can be informed when processes with the properties that meet the program definition are initiated and when they are terminated. This resource class typically is used to detect when a required subsystem fails so that recovery actions can be performed, or the administrator can be notified, or both.

Program Definition

A program definition requires the program name and the user name of the owner of the program. The program should be identified by user name in addition to program name to avoid confusion when two or more programs have the same name. These persistent attributes are defined as follows:

ProgramName

Identifies the name of the command or program to be monitored. The program name is the base name of the file containing the program. This name is displayed by the **ps** command when the **-l** flag or **-o comm** is specified. Note that the program name displayed by **ps** when the **-f** flag or **-o args** is specified may not be the same as the base name of the file containing the program.

Filter Specifies a filter that selects a subset of all processes executing the program identified by the persistent attribute **ProgramName**. For example, the filter may limit the process set to those processes that are running **ProgramName** under the user name **foo**.

Note: Process IDs are not used to specify programs because they are transient and have no prior correlation with the program being run, nor can the restart of a program be detected because there is no way to anticipate the process ID that would be assigned to the restarted application.

In order for a process to match a program definition and thus be considered to be running the program, its executable name must match the ProgramName persistent attribute value. In addition, the expression

defined by the Filter persistent attribute must evaluate to TRUE by using the properties of the process. The Filter attribute is a string that consists of the names of various properties of a process, comparison operators, and literal values. For example, a value of `user==greg` restricts the process set to those processes that run ProgramName under the userid **greg**. The syntax for the Filter value is the same as for a string.

For more information on selection strings, see “Using Expressions” on page 13.

Processes must have a minimum duration (approximately 15 seconds) to be monitored by the IBM.Program resource class. (If a program runs for only a few seconds, all processes that run the program may not be detected.)

This property can be monitored: **Processes**

These elements of **Processes** can be monitored:

CurPidCount

Represents the number of processes that currently match the program definition and thus are considered to be running the program.

PrevPidCount

Represents the number of processes that matched the program definition at the last state change (previous value of **CurPidCount**).

CurrentList

Contains a list of IDs for the processes that currently match the program definition and thus are considered to be running the program.

ChangeList

Contains a list of IDs for the processes that were added to or removed from the **CurrentList** since the last state change. Whether the list represents additions or deletions can be determined by comparing **CurPidCount** and **PrevPidCount**. If **CurPidCount** is greater, this list contains additions; otherwise, it contains deletions. Additions and deletions are not combined in the same state change.

For example, assume the six processes shown in the following **ps** output are running the **biod** program on node 1:

```
ps -e -o "ruser,pid,ppid,comm" | grep biod
root 7786 8040 biod
root 8040 5624 biod
root 8300 8040 biod
root 8558 8040 biod
root 8816 8040 biod
root 9074 8040 biod
```

To be informed when the number of processes running the specified program changes, you can define this event expression:

```
Processes.CurPidCount!=Processes.PrevPidCount
```

To be informed when no processes are running the specified program, you can define this event expression:

```
Processes.CurPidCount==0
```

Predefined Conditions for Monitoring Programs

This resource class is typically used to detect when a required subsystem fails so that some recovery action can be performed or an administrator can be notified. The following table shows the predefined conditions and examples of expression that are available for monitoring programs.

Condition Name	Event Expression	Event Description	Rearm Expression	Rearm Description	Monitored Resources
sendmail daemon state	Processes .CurPidCount <=0	An event is generated whenever the sendmail daemon is not running.	Processes .CurPidCount > 1	The event is rearmed when the sendmail daemon is running.	sendmail
inetd daemon state	Processes .CurPidCount <=0	An event is generated whenever the inetd daemon is not running.	Processes .CurPidCount > 1	The event is rearmed when the inetd daemon is running.	inetd

Predefined Responses

The following predefined responses are shipped as templates or as starting points for monitoring.

Use the Web-based System Manager online help or the ERRM commands (particularly, the **chresponse** command) to customize these predefined responses.

See “Using Expressions” on page 13 for a summary of the data types and operators that you can use in selection strings for a customized response.

Response Name	Action	Command
Critical notification	Name: log critical event <ul style="list-style-type: none"> Log an entry to /tmp/criticalEvents whenever an event or a rearm event occurs. 	<ul style="list-style-type: none"> /usr/sbin/rsct/bin/logevent /tmp/criticalEvents When in effect: All day everyday.
	Name: e-mail root <ul style="list-style-type: none"> Send an e-mail to root whenever an event or a rearm event occurs. 	<ul style="list-style-type: none"> /usr/sbin/rsct/bin/notifyevent root When in effect: All day everyday.
	Name: broadcast message <ul style="list-style-type: none"> Broadcast the event or the rearm event to all logged-in users. 	<ul style="list-style-type: none"> /usr/sbin/rsct/bin/wallevent When in effect: All day everyday.
Warning notification	Name: log warning event <ul style="list-style-type: none"> Log an entry to /tmp/warningEvents whenever an event or a rearm event occurs. 	<ul style="list-style-type: none"> /usr/sbin/rsct/bin/logevent /tmp/warningEvents When in effect: All day everyday.
	Name: e-mail root <ul style="list-style-type: none"> Send an e-mail to root whenever an event or a rearm event occurs. 	<ul style="list-style-type: none"> /usr/sbin/rsct/bin/notifyevent root When in effect: All day everyday.

Response Name	Action	Command
Informational notification	Name: log info event <ul style="list-style-type: none"> Log an entry to /tmp/infoEvents whenever an event or a rearm event occurs. 	<ul style="list-style-type: none"> /usr/sbin/rsct/bin/logevent /tmp/warningEvents When in effect: All day everyday.
	Name: e-mail root <ul style="list-style-type: none"> Send e-mail to root when an event or a rearm event occurs during working hours. 	<ul style="list-style-type: none"> /usr/sbin/rsct/bin/notifyevent root When in effect: 8AM-5PM Monday to Friday.
Log event anytime	Name: log event <ul style="list-style-type: none"> Log an entry to /tmp/systemEvents whenever an event or a rearm event occurs. 	<ul style="list-style-type: none"> /usr/sbin/rsct/bin/logevent /tmp/systemEvents When in effect: All day everyday.
Send e-mail to root anytime	Name: e-mail root <ul style="list-style-type: none"> Send an e-mail to root whenever an event or a rearm event occurs. 	<ul style="list-style-type: none"> /usr/sbin/rsct/bin/notifyevent root When in effect: All day everyday.
Send e-mail to root off-shift	Name: e-mail root <ul style="list-style-type: none"> Send an e-mail to root whenever an event or a rearm event occurs during non-working hours. 	<ul style="list-style-type: none"> /usr/sbin/rsct/bin/notifyevent root When in effect: 5PM-12AM Monday to Friday; 12AM-8AM Monday to Friday; all day Saturday and Sunday.
Broadcast event anytime	Name: broadcast message <ul style="list-style-type: none"> Broadcast an event or rearm event to all users that log in to the host. 	<ul style="list-style-type: none"> /usr/sbin/rsct/bin/wallevent When in effect: All day everyday.
Display in Events plug-in	Display an event in the Events plug-in.	Available from Web-based System Manager only. This is the only response that can be used by a non-root user.

Predefined Commands, Scripts, Utilities, and Files

As an alternative to the Monitoring GUI, you can use the following scripts, utilities, commands, and files to control Monitoring on your system. See the man pages or AIX Commands Reference for detailed usage information.

ERRM commands

chcondition

Changes any of the attributes of a defined condition.

lscondition

Lists information about one or more conditions.

mkcondition

Creates a new condition definition which can be monitored.

rmcondition

Removes a condition.

chresponse

Adds or deletes the actions of a response or renames a response.

lsresponse

Lists information about one or more responses.

mkresponse

Creates a new response definition with one action.

rmresponse

Removes a response.

lscondresp

Lists information about a condition and its linked responses, if any.

mkcondresp

Creates a link between a condition and one or more responses.

rmcondresp

Deletes a link between a condition and one or more responses.

startcondresp

Starts monitoring a condition that has one or more linked responses.

stopcondresp

Stops monitoring a condition that has one or more linked responses.

RMC Commands

chsrc

Changes the persistent attribute values of a resource or resource class.

lsactdef

Lists (displays) action definitions of a resource or resource class.

lsrsrc Lists (displays) resources or a resource class.

lsrsrcdef

Lists a resource or resource class definition.

mksrc

Defines a new resource.

refsrc

Refreshes the resources within the specified resource class.

rmrsrc

Removes a defined resource.

Scripts and Utilities

ctsnap

Gathers configuration, log, and trace information for the Reliable Scalable Cluster Technology (RSCT) product.

logevent

Logs event information generated by the Event Response resource manager to a specified log file.

lsaudrec

Lists records from the audit log.

notifyevent

E-mails event information generated by the Event Response resource manager to a specified userid.

rmaudrec

Removes records from the audit log.

rmcctrl

Manages the Resource Monitoring and Control (RMC) subsystem.

wallevent

Broadcasts an event or a rearm event to all users who are logged in.

Files

Resource Data Input File

Defines resources and persistent attribute values of a resource or resource class.

rmccli General Information File

Contains information global to the RMC command line interface.

Chapter 4. Diagnostic Information

Files are created in the */var/ct/IW/log/mc/ Resource Manager* directory to contain internal trace output that is useful to a software service organization for resolving problems. An internal trace utility tracks the activity of the resource manager daemon. Multiple levels of detail may be available for diagnosing problems. Some minimal level of tracing is on at all times. Full tracing can be activated with the command:

```
traceson -s IBM.HostRM
```

Minimal tracing can be activated with the command:

```
tracesoff -s IBM.HostRM
```

where **IBM.HostRM** is used as an example of a resource manager.

Resource Manager Diagnostic Files

All trace files are written by the trace utility to the */var/ct/IW/log/mc/Resource Manager* directory. Each file in this directory that is named **trace<.n>** corresponds to a separate run of the resource manager. The latest file that corresponds to the current run of the resource manager is called **trace**. Trace files from earlier runs have a suffix of *.n*, where *n* starts at 0 and increases for older runs.

Use the **rpitr** command to view these files. Records can be viewed as they are added for an active process by adding the **-f** option to the **rpitr** command.

Any core files that result from a program error are written by the trace utility to the */var/ct/IW/run/mc/Resource Manager* directory. Like the trace files, older core files have a *.n* suffix that increases with age. Core files and trace files with the same suffix correspond to the same run instance.

The **log** and **run** directories have a default limit of 10MB. The resource managers ensure that the total amount of disk space used is less than this limit. Trace files without corresponding core files are removed first when the resource manager is over the limit. Then pairs of core and trace files are removed, starting with the oldest. At least one pair of core and trace files is always retained.

Recovering from RMC and Resource Manager Problems

This section describes the tools that you can use to recover from infrastructure problems. It tells you how to determine if the components of the monitoring system are running and what to do if the RMC subsystem or one of the resource managers should abnormally stop. Common troubleshooting problems and solutions are also described.

The Audit Log, Event Response, File System, and Host resource managers recover from most errors because they have few dependencies. In some cases, the recovery consists of terminating and restarting the appropriate daemon. These resource managers can recover from at least the following errors:

1. Losing connection to the RMC daemon, probably caused by the terminating of the RMC daemon or another system problem.
2. Programming errors that cause the process to abnormally terminate. In this case, the SRC subsystem restarts the daemon. This includes errors such as invalid memory references and memory leaks.
3. The **/var** or **/tmp** directories filling up. When this happens, core and trace files cannot be captured.

In addition, all parameters received from the RMC subsystem are verified to avoid impacting other clients that may be using the same resource manager.

The following tools are described:

1. **ctsnap** command
2. SRC-controlled commands
3. **rmcctrl** command for the RMC subsystem
4. Audit log

ctsnap Command

For debugging purposes, the **ctsnap** command can be used to **tar** the RSCT and resource-manager programs and send them to the software service organization. The **ctsnap** command gathers system configuration information and compresses the information into a **tar** file, which can then be downloaded to disk or tape and transmitted to a remote system. The information gathered with the **ctsnap** command may be required to identify and resolve system problems. See the man page for the **ctsnap** command for more information.

SRC-Controlled Commands

The RMC subsystem and the resource managers are controlled by the System Resource Controller (SRC). They can be viewed and manipulated by SRC commands. For example:

To see the status of all resource managers, enter:

```
lssrc -g rsct_rm
```

To see the status of an individual resource manager, enter:

```
lssrc -s rmname
```

where *rmname* can be:

- IBM.AuditRM
- IBM.ERRM
- IBM.FSRM
- IBM.HostRM

To see the status of all SRC-controlled subsystems on the local machine, enter:

```
lssrc -a
```

To see the status of a particular subsystem, for example, the RMC subsystem, which is known to SRC as **ctrmc**, enter:

```
lssrc -s ctrmc
```

The SRC has these commands:

- **lssrc**
- **startsrc**
- **stopsrc**
- **traceson**
- **tracesoff**

For more information, see the command man pages or *AIX Commands and Technical References*.

To find out more about SRC, see *System Management Concepts: Operating System and Devices*.

Recovery Support for RMC Using rmcctrl

The RMC command **rmcctrl** controls the operation of the RMC subsystem and the RSCT resource managers. It is not normally run from the command line, but it can be used in some diagnostic

environments; for example, it can be used to add, start, stop, or delete an RMC subsystem. See the **rmcctrl** command in the AIX Commands Reference, which is available at <http://www.ibm.com/servers/aix/library>.

Tracking ERRM Events with the Audit Log

The audit log is a system-wide facility for recording information about the system's operation. It can include information about the normal operation of the system as well as system problems and errors. It is meant to augment error log functionality by conveying the relationship of the error relative to other system activities. All detailed information about system problems is still written to the operating system error log.

Records are created in the audit log by subsystems that have been instrumented to do that. For example, the Event Response subsystem runs in the background to monitor conditions defined by the administrator and then invokes one or more actions when a condition becomes true. Because this subsystem runs in the background, it is difficult for the operator or administrator to understand the total set of events that occurred and the results of any actions that were taken in response to an event. Because the Event Response subsystem records its activity in the audit log, the administrator can easily view Event Response subsystem activity as well as that of other subsystems through the **lsaudrec** command.

Troubleshooting Problems and Solutions

See the Web-based System Manager online help for common RMC troubleshooting problems and solutions.

Appendix A. RSCT Messages

General Information About RSCT Messages

This book contains the following message identifiers for RSCT messages. It is organized in numerical order by message identifier.

2610-<i>nnn</i>	Resource Monitoring and Control (RMC) Messages. See page 53.
2612-<i>nnn</i>	Resource Monitoring and Control (RMC) Commands Messages. See page 70.
2619-<i>nnn</i>	Cluster Technology Command Utilities Messages. See page 75.
2634-<i>nnn</i>	HostRM Messages. See page 77.
2636-<i>nnn</i>	Event Response Messages. See page 79.
2637-<i>nnn</i>	File System RM Messages. See page 83.
2639-<i>nnn</i>	Auditlog resource manager messages. See page 84.
2641-<i>nnn</i>	RM Utilities Messages. See page 89.
2645-<i>nnn</i>	RM Framework Messages. See page 91.

Note that not all RSCT messages are included in this book.

- **Informational** messages that provide status or usage information are not included here.
- **Error** messages indicate that a possible problem or error has occurred. They require further explanation to help you understand the cause and recover from the situation. Many error messages are preceded by the name of the program that issued the message.

2610 - Resource Monitoring and Control (RMC) Messages

2610-201 **The peer daemon on node *node_number* is not responding to Group Services.**

Explanation: The Resource Monitoring and Control daemon on the specified node has not answered a Group Services responsiveness request within 120 seconds.

User Response: The Resource Monitoring and Control daemon on the specified node should eventually terminate and then be restarted. If it does not, the administrator must terminate the non-responsive daemon using the **kill** command. The process ID of the daemon can be determined by issuing the command **lssrc -s ctrmc**.

Until the daemon on the specified node is stopped or restarted, no other Resource Monitoring and Control daemon can join the RMC peer group and provide services.

2610-202 **The system call *system_call_name* returned the error (*error_number*) *error_string*.**

Explanation: The specified system call failed with the specified error. The RMC continues to run.

User Response: Record the above information and contact your software service organization.

2610-203 **The socket connection type *socket_type* rejected. There are too many open descriptors.**

Explanation: The Resource Monitoring and Control daemon rejected a socket connection of the indicated type due to insufficient available file descriptors:

- Type 'C': connection from client
- Type 'R': connection from or to a resource manager

User Response: Terminate unnecessary Resource Monitoring and Control client applications. Refer to *IBM RSCT 2.2 Resource Monitoring and Control Guide and Reference*.

2610-204 **The client connection is closed due to incorrect message (*incorrect message code*).**

Explanation: The Resource Monitoring and Control daemon closed a client connection as the result of receiving an incorrect message. The value of the incorrect message code indicates what was wrong with the message:

1. Incorrect protocol version number
2. Incorrect magic number
3. Incorrect protocol version number and magic number
4. Incorrect message type
5. Incorrect message type and protocol version number
6. Incorrect message type and magic number

7. Incorrect protocol version number, magic number and message type

The most likely cause of this problem is a process connecting to the Resource Monitoring and Control subsystem, without using the RMC API. This may indicate an attempt to breach the security of the system.

User Response: Verify that no applications are attempting to connect to the RMC daemon without using the RMC API.

2610-205 **Cannot get the user ID for the user name *user_name* that is specified for the resource manager *resource_manager_name*, the error is (*error_number*) *error_string*.**

Explanation: The Resource Monitoring and Control daemon could not obtain the user ID for the indicated user name that is associated with the specified resource manager. The error number and error string indicate the error, which was returned by the `getpwnam()` subroutine.

As a result of this error, the RMC daemon could not issue the **start** command for the specified resource manager.

User Response: Attempt to correct the problem indicated by the error number. If it cannot be corrected, record the above information and contact your software service organization.

2610-206 **Cannot get the group name associated with the user name *user_name* that is specified for the resource manager *resource_manager_name*, the error is (*error_number*) *error_string*.**

Explanation: This is an obsolete message.

User Response: Record the above information and contact your software service organization.

2610-207 **Cannot get the group ID for the group name *group_name* that is associated with the resource manager *resource_manager_name*, the error is (*error_number*) *error_string*.**

Explanation: This is an obsolete message.

User Response: Record the above information and contact your software service organization.

2610-208 **The *system_call_name* system call is unsuccessful when operating on the *directory_path* directory, the error is (*error_number*) *error_string*.**

Explanation: The Resource Monitoring and Control daemon could not successfully run the indicated system

call using the specified directory. The error number and error string indicate the error.

User Response: Attempt to correct the problem indicated by the error number. If it cannot be corrected, record the above information and contact your software service organization.

2610-209 **The *system_call_name* system call is unsuccessful with error *error_number* - *error_message* when loading *load_module_name*. Additional error information: *additional error information*.**

Explanation: The indicated system call failed when attempting to load the specified load module. Additional error information may follow.

User Response: Attempt to correct the problem indicated by the error number. If it cannot be corrected, record the above information and contact your software service organization.

2610-210 **Output from the Resource Manager *resource_manager_name* start command: *command_output*.**

Explanation: The specified resource manager's **start** command returned the listed output.

User Response: If the **start** command output indicates an error, correct it. Otherwise, this output is informational only.

2610-211 **Incomplete Resource Manager ID notification is detected.**

Explanation: A resource manager connected to the Resource Monitoring and Control daemon but did not send a complete Resource Manager ID notification before disconnecting.

User Response: Check all configured resource managers for errors. If no errors are found, record the above information and contact your software service organization.

2610-212 **Incorrect Resource Manager ID notification is detected (*additional error information*).**

Explanation: A resource manager connected to the Resource Monitoring and Control daemon and sent an incorrect Resource Manager ID notification.

User Response: Check all configured resource managers for errors. If no errors are found, record the above information and contact your software service organization.

2610-213 **Cannot connect to resource manager**
resource_manager_name, error is
(error_number) error_message.

Explanation: The Resource Monitor and Control daemon could not connect to the specified resource manager.

User Response: Contact the IBM Support Center if the named resource manager is supplied by IBM. Otherwise, contact the vendor that supplied the resource manager. Also, examine the error log for any error messages from the named resource manager.

2610-214 **An incorrect message was received from the resource manager**
resource_manager_name. Error is
(error_index) error_code. Message dump
file is message_dump_file_name.

Explanation: The specified resource manager sent a message to the Resource Monitoring and Control daemon that contained incorrect data. A dump of the message was placed in the named file.

User Response: Check the named resource manager for errors. If no errors are found, record the above information and contact the IBM Support Center if the named resource manager is supplied by IBM. Otherwise, contact the supplier of the resource manager.

2610-215 **The error 0xerror_code was received when getting the resource persistent attribute specified by the ID**
resource_attribute_ID, class class_name,
resource manager
resource_manager_name.

Explanation: The Resource Monitor and Control daemon received the specified error code when attempting to get the persistent resource attribute value from the named resource manager for the indicated attribute of the specified class.

User Response: Examine the documentation for the named resource manager for the returned error code. Also, examine the error log for any error messages from the named resource manager.

2610-216 **The error 0xerror_code was received when getting the class persistent attribute specified by the ID**
class_attribute_ID, class class_name,
resource manager
resource_manager_name.

Explanation: The Resource Monitor and Control daemon received the specified error code when attempting to get the persistent class attribute value from the named resource manager for the indicated attribute of the specified class.

User Response: Examine the documentation for the named resource manager for the returned error code. Also, examine the error log for any error messages from the named resource manager.

2610-217 **Received count of unrecognized messages unrecognized messages in the last time minutes. Service is**
service_name.

Explanation: The RMC daemon has received the specified number of unrecognized messages within the specified time interval. These messages were received on the UDP port, indicated by the specified service name, used for communication among RMC daemons. The most likely cause of this error is that this port number is being used by another application.

User Response: Validate that the port number configured for use by the Resource Monitoring and Control daemon is only being used by the RMC daemon.

2610-218 **Internal error. Error data**
error_data_value error_data_value
error_data_value.

Explanation: The RMC daemon has detected an internal error but continues processing.

User Response: Record the above information and contact your software support organization.

2610-300 **This command is correctly specified, but another command in the ordered command group is not.**

Explanation: The command is correctly specified, but it is part of an ordered command group and another command in the group is incorrectly specified. If any command in an ordered command group is not correctly specified, no commands in the group can be run.

User Response: Correct the command in error and invoke the command group again.

2610-301 **The resource class name**
resource_class_name is not defined.

Explanation: The specified resource class name is not defined.

User Response: Issue the RMC API command again, with a defined resource class name.

2610-315 **The following select string does not contain any node numbers within the range 1-4096: select_string.**

Explanation: The specified select string implies the values of node numbers for which the select string may

be true, but none of these values are within the range 1 through 4096, inclusive.

User Response: Invoke the RMCAPAPI command again, with a valid node number value.

2610-318 **The following select string contains a node number that is not an integral value:** *select_string*.

Explanation: The specified select string contains a persistent attribute that is a locator and is being compared to a constant that is not an integer value. Locator persistent attributes may only be compared to integer values, since these values are interpreted as node numbers.

User Response: Invoke the RMCAPAPI command again, with node number values that are integer constants.

2610-330 **The resource class name is not specified in the command.**

Explanation: The resource class name is not specified in the command. The resource class name is a required command parameter.

User Response: Invoke the RMCAPAPI command again, with a valid resource class name.

2610-336 **The class *class_name* does not support the specified command.**

Explanation: The named class does not support this command.

User Response: Application program specific.

2610-337 **The attribute array contains a duplicate attribute name at index *array_index*:** *duplicate_attribute_name*.

Explanation: The attribute array specified in the command contains a duplicate attribute name at the indicated index into the array.

User Response: Invoke the RMCAPAPI command again, with a valid attribute array.

2610-338 **The following expression does not contain a dynamic attribute name:** *expression*.

Explanation: The expression or rearm expression specified in the register event command does not contain a dynamic attribute name.

User Response: Invoke the RMCAPAPI command again, with a valid expression.

2610-339 **The register event command does not specify an expression.**

Explanation: An expression has not been specified in the register event command or the expression is a NULL string.

User Response: Invoke the RMCAPAPI command again, with a valid expression.

2610-340 **The register event command has specified a NULL rearm expression.**

Explanation: The rearm expression specified in the register event command is a NULL string.

User Response: Invoke the RMCAPAPI command again, with a valid rearm expression.

2610-341 **An expression and its associated rearm expression specify different dynamic attribute names:** *attribute_name* from *expression* and *attribute_name* from *rearm expression*.

Explanation: The expression in the register event command and its associated rearm expression specify different dynamic attribute names.

User Response: Invoke the RMCAPAPI command again, with an expression and rearm expression that specify the same dynamic attribute names.

2610-342 **The attribute array contains either a NULL pointer or a NULL attribute name at index *array_index*.**

Explanation: The attribute array specified in the command contains either a NULL pointer or a NULL attribute name at the indicated index into the array.

User Response: Invoke the RMCAPAPI command again, with a valid attribute array.

2610-343 **The attribute array contains an undefined attribute name at index *array_index*:** *undefined_attribute_name*.

Explanation: The attribute array specified in the command contains an undefined attribute name at the indicated index into the array.

User Response: Invoke the RMCAPAPI command again, with a valid attribute array.

2610-344 **The event was not registered since only a validity check was requested.**

Explanation: The application requested that an event not be registered. Instead, a validity check on the command input was successfully performed.

User Response: None.

2610-345 The specified registration ID does not match a registered event.

Explanation: The application requested that an event be unregistered, but the specified registration ID did not match that of any events registered in the session specified in the command.

User Response: Specify a registration ID for an event that is registered.

2610-346 There are no persistent attributes defined for the resource class *resource_class_name*.

Explanation: The application requested the definitions of the persistent attributes of the specified resource class, but the class has no persistent attributes defined.

User Response: None.

2610-347 There are no dynamic attributes defined for the resource class *resource_class_name*.

Explanation: The application requested the definitions of the dynamic attributes of the specified resource class, but the class has no dynamic attributes defined.

User Response: None.

2610-348 There are no class persistent attributes defined for the resource class *resource_class_name*.

Explanation: The application requested the definitions of the persistent attributes of the specified resource class itself, but the class itself has no persistent attributes defined.

User Response: None.

2610-349 There are no class dynamic attributes defined for the resource class *resource_class_name*.

Explanation: The application requested the definitions of the dynamic attributes of the specified resource class itself, but the class itself has no dynamic attributes defined.

User Response: None.

2610-350 The specified resource handle is incorrect.

Explanation: The resource handle specified in the command is incorrect. Either the entire resource handle is incorrect, it is an out-of-date resource handle, or it is a resource handle from another cluster.

User Response: Invoke the RMCAP command again, with a valid resource handle for this cluster.

2610-351 The locator attribute *attribute_name* was not included in the Define Resource command for the class *class_name*.

Explanation: When defining a resource of the named resource class, the specified locator attribute must be included in the command.

User Response: Invoke the RMCAP command again, and include the locator attribute.

2610-352 The attribute array contains an incorrect type for the attribute *attribute_name* at index *array_index*.

Explanation: The attribute array specified in the command contains an incorrect type for the attribute name at the indicated index into the array.

User Response: Invoke the RMCAP command again, with a valid attribute array.

2610-353 The command specified one or more resources but the class *class name* does not support resources.

Explanation: Since the named class does not support resources, this command cannot be run.

User Response: Application program specific.

2610-354 The following expression contains more than a single attribute name: *expression*.

Explanation: The specified expression contains a dynamic attribute that is a Quantum variable type, but the expression has more tokens than just a single name. When a dynamic attribute is a Quantum variable type, the expression must consist of only one token: the attribute name.

User Response: Invoke the RMCAP command again, with an expression that contains only a dynamic attribute name.

2610-355 The following rearm expression is specified with a Quantum variable: *expression*.

Explanation: The specified rearm expression contains a dynamic attribute that is a Quantum variable type. A register event command that specifies a dynamic attribute that is a Quantum variable cannot also specify a rearm expression.

User Response: Invoke the RMCAP command again, without a rearm expression.

2610-356 A query dynamic attribute command specified a quantum dynamic attribute name at index *array_index*: *quantum_attribute_name*.

Explanation: The attribute array specified in the command names a dynamic attribute, at the indicated index into the array. The attribute array is of Quantum variable type. Since Quantum variable types have no data value, a query dynamic attribute command may not specify a dynamic attribute that is a Quantum.

User Response: Invoke the RMCAPi command again without specifying a Quantum dynamic attribute.

2610-357 A query dynamic attribute command requested all dynamic attributes but all are Quantum. The class is *class_name*.

Explanation: A query dynamic attribute command, specifying either one or more resources or the resource class itself, requested that all dynamic attributes be returned. However, all dynamic attributes, for either a resource or the class, are of Quantum variable type. Since Quantum variable types have no data value, a query dynamic attribute command is not permitted in this particular case.

User Response: Application program specific.

2610-358 No attributes are specified in the command. The class is *class_name*.

Explanation: The command did not specify any attributes, but this command requires that at least one attribute be specified.

User Response: Issue the RMCAPi command again, with at least one attribute.

2610-359 The persistent attributes of the class *class_name* cannot be set since the class is *MtypDivided*.

Explanation: The specified class uses the Subdivided management style, which prohibits the setting of persistent attribute values on the class itself.

User Response: Application program specific.

2610-360 This command could not be validated since a previous command in the ordered command group was incorrectly specified.

Explanation: The command is part of an ordered command group but its specification could not be validated since a previous command in the group is incorrectly specified. If a command in an ordered command group is not correctly specified, any commands that follow it in the group cannot be validated.

User Response: Correct the command in error and run the command group again.

2610-361 An incorrect *sd_use* argument was specified.

Explanation: The *sd_use* command parameter specifies an incorrect value.

User Response: Invoke the RMCAPi command again with a valid parameter.

2610-362 An incorrect name count was specified in the command.

Explanation: A nonzero name count was specified in the command, but the remaining command parameters require that the count be zero.

User Response: Invoke the RMCAPi command again, with a name count of zero.

2610-363 No Structured Data for the specified use are defined for class *class_name*.

Explanation: No Structured Data formats for the use specified in the command are defined for the indicated class.

User Response: Application program specific.

2610-364 The attribute array contains an attribute name at index *array_index* that is not a Structured Data type: *attribute_name*.

Explanation: The attribute array specified in the command contains an attribute name at the indicated index into the array that is not an SD data type.

User Response: Invoke the RMCAPi command again, with a valid attribute array.

2610-365 The action array contains either a NULL pointer or a NULL action name at index *array_index*.

Explanation: The action array specified in the command contains either a NULL pointer, or a NULL action name at the indicated index into the array.

User Response: Invoke the RMCAPi command again, with a valid action array.

2610-366 The action array contains an undefined action name at index *array_index*: *undefined_action_name*.

Explanation: The action array specified in the command contains an undefined action name at the indicated index into the array.

User Response: Invoke the RMCAPi command again with a valid action array.

2610-367 **The action array contains an action name at index *array_index* that does not have a defined Structured Data input: *action_name*.**

Explanation: The action array specified in the command contains an action name at the indicated index into the array that does not have a defined SD input.

User Response: Invoke the RMCAPi command again, with a valid action array.

2610-368 **The action array contains an action name at index *array_index* that does not have a defined Structured Data response: *action_name*.**

Explanation: The action array specified in the command contains an action name at the indicated index into the array that does not have a defined SD response.

User Response: Invoke the RMCAPi command again, with a valid action array.

2610-369 **An incorrect *vv_use* argument was specified.**

Explanation: The *vv_use* command parameter specifies an incorrect value.

User Response: Invoke the RMCAPi command again, with a valid parameter.

2610-370 **No attributes, action inputs or command arguments for the specified use are defined for class *class_name*.**

Explanation: No attributes, actions with defined inputs, or commands with defined parameters for the use specified in the command, are defined for the indicated class.

User Response: Application program specific.

2610-371 **The security function *security_function_name* returned the error value *error_value*.**

Explanation: The specified security function returned the indicated error value.

User Response: Application program specific.

2610-374 **The value of the locator attribute *attribute_name* must be an array with one element.**

Explanation: When defining a resource with the specified locator attribute, the attribute value must be an array with exactly one element.

User Response: Invoke the RMCAPi command again with the proper attribute value.

2610-375 **The following select string contains attributes that cannot select any resources: *select_string*.**

Explanation: Each resource specifies an attribute with the name Variety. The value of this attribute is the variety of the resource. Other attributes of the resource are defined in the resource only if Variety has a particular value. The specified select string contains attributes that are not all defined for the same value of Variety.

User Response: Invoke the RMCAPi command again with a select string that contains attributes that are all defined for at least one value of Variety.

2610-400 **Resource not defined.**

Explanation: The resource handle specified in the response does not represent a defined resource.

User Response: Application program specific.

2610-401 **Resource has been undefined.**

Explanation: The resource indicated by the resource handle specified in the response has been undefined.

User Response: Application program specific.

2610-402 **Shared memory is damaged.**

Explanation: The shared memory used to monitor the resource indicated by the resource handle specified in the response has become damaged.

User Response: Record the above information and contact your software service organization.

2610-403 **The resource is stale.**

Explanation: The resource indicated by the resource handle in the response is stale; the resource manager supplying the resource has terminated. The remaining data in the response represents the last known values of the resource that was specified in the command for which this is a response.

User Response: Application program specific.

2610-404 Error number *evaluation_error_number* was detected while evaluating an expression using the *dynamic_attribute_program_name* attribute.

Explanation: The evaluation of the named dynamic attribute of the resource specified by the resource handle resulted in an error. The possible error numbers and their explanations are:

Evaluation Error Number	Explanation
1	Divide by zero
2	Incorrect SD array index
3	Array index is out of bounds
4	SD element ID is greater than the number of elements present
5	The ".." operator is used with a left operand that is greater than the right operand
Greater than 100	Unexpected evaluation error

User Response: Application program specific.

2610-405 Cannot obtain values for *attribute_count* persistent attributes.

Explanation: The specified number of persistent attribute values could not be obtained from either the resource indicated by the resource handle in the response, or from the resource class indicated by the class name in the response. The count in the response indicates how many attribute values are actually returned.

User Response: The FFDC ID in the response can be used to find the error information for each attribute value that could not be returned.

2610-406 Cannot execute the command on node *node_number*. The node is not currently in the cluster.

Explanation: The command for the resource or resource class specified in the response could not be issued on the indicated node, which is not currently in the cluster. Either the command specified a resource on the node, explicitly or implicitly, or the command specified a resource class which required the command to be sent to the node. If the command specified a resource class, additional responses may be returned, with or without error.

User Response: Validate that the specified node is, in fact, a defined cluster node. If so, retry the command

after the node has rejoined the cluster.

2610-407 No resources found.

Explanation: No resource were found that matched the select string in the command.

User Response: Application specific.

2610-408 Resource selection could not be performed.

Explanation: Resource selection could not be performed using the select string in the command. Either no resource managers that support the resource class specified in the command are currently running in the cluster, or the select string implicitly specified nodes that are not currently in the cluster.

User Response: Application specific.

2610-409 Cannot execute the command on node *node_number*. The resource manager *resource_manager_name* is not available.

Explanation: The command for the resource or resource class specified in the response could not be issued on the indicated node because the named resource manager is not available. If the command specified a resource class, additional responses may be returned, with or without error.

User Response: Examine the AIX Error Log, or the resource manager specific logs to determine why the named resource manager is not available.

2610-410 Cannot complete the command on node *node_number*. The resource manager *resource_manager_name* has terminated.

Explanation: The command for the resource or resource class specified in the response could not be completed on the indicated node because the named resource manager terminated. A partial response for this command was previously returned. If the command specified a resource class, additional responses may be returned, with or without error.

User Response: Examine the AIX Error Log, or the resource manager specific logs, to determine why the named resource manager has terminated.

2610-411 No response from the resource manager *resource_manager_name* on node *node_number*. The resource manager has terminated.

Explanation: The command for the resource or resource class specified in the response could not be completed on the indicated node, because the named

resource manager terminated. While no response was returned from the resource manager, the command may have run prior to resource manager termination. If the command specified a resource class, additional responses may be returned, with or without error.

User Response: Examine the AIX Error Log, or the resource manager specific logs, to determine why the named resource manager has terminated.

2610-412 A Resource Manager terminated while attempting to enumerate resources for this command.

Explanation: While attempting to enumerate resources for this command, either a Resource Manager terminated, or a node on which a Resource Manager was running has left the peer group.

This command may still complete normally, with additional responses, for resources obtained from other Resource Managers that support the resource class specified in the command.

User Response: Application specific.

2610-413 While attempting to enumerate resources for this command, an enumerate error was detected.

Explanation: While attempting to enumerate resources for this command, an enumerate command error was detected. This command may still complete normally, with additional responses, for resources obtained from other Resource Managers that support the resource class specified in the command.

User Response: Application specific.

2610-414 Descriptions are not available for the resource class *resource_class_name*.

Explanation: When attempting to query definitions for the specified resource class, no descriptions could be found. All other requested information is returned in the response.

User Response: Application specific.

2610-415 Cannot execute the command. The resource manager *resource_manager_name* is not available.

Explanation: The command for the resource or resource class specified in the response could not be run because the named resource manager is not available.

User Response: Examine the AIX Error Log, or the resource manager specific logs, to determine why the named resource manager is not available.

2610-416 Cannot complete the command. The resource manager *resource_manager_name* has terminated.

Explanation: The command for the resource or resource class specified in the response could not be completed because the named resource manager terminated. A partial response for this command was previously returned.

User Response: Examine the AIX Error Log, or the resource manager specific logs, to determine why the named resource manager has terminated.

2610-417 No response from the resource manager *resource_manager_name*. The resource manager has terminated.

Explanation: The command for the resource or resource class specified in the response could not be completed because the named resource manager terminated. While no response was returned from the resource manager, the command may have been run by the resource manager prior to its termination.

User Response: Examine the AIX Error Log, or the resource manager specific logs, to determine why the named resource manager has terminated.

2610-418 Permission is denied to access the resources or resource class specified in this command.

Explanation: The application must be running with an effective user ID of 0, to invoke the command for these resources or resource class.

User Response: Application specific.

2610-419 The resource or resource class on node *node_number* is no longer available. The node has left the cluster.

Explanation: The resource or resource class specified in the response is no longer available on the indicated node since the node has left the cluster.

User Response: Application specific.

2610-420 The dynamic attribute is not supported.

Explanation: The dynamic attribute specified in the expression supplied in the event registration command is not supported either in the resource indicated by the resource handle in the response, or in the resource class indicated by the class name in the response.

User Response: Application specific.

2610-421 **Cannot obtain values for *attribute_count* dynamic attributes.**

Explanation: The specified number of dynamic attribute values could not be obtained from either the resource indicated by the resource handle in the response, or from the resource class indicated by the class name in the response. The missing attributes are not supported in the resource or class. The count in the response indicates how many attribute values are actually returned.

User Response: Application specific.

2610-500 ***daemon_file_name* is not executable.**

Explanation: *daemon_file_name* must be an executable file to allow the subsystem being installed by the specified command name to operate. *daemon_file_name* may also not exist.

User Response: As **root**, run **chmod +x *daemon_file_name***, and retry the command. Or, rerun **installp** of the RSCT package to reinstall the subsystem.

2610-501 **The *subsystem_name* subsystem must be stopped.**

Explanation: The *subsystem_name* must be stopped to allow the specified command name to operate on it.

User Response: As **root**, run **stopsrc -s *subsystem_name***, and retry the command.

2610-502 **Could not add *subsystem_name* to *resource_controller*.**

Explanation: The specified command name failed in defining *subsystem_name* to *resource_controller*. If *resource_controller* is **SRC**, the command **mkssys -s *subsystem_name*** failed. If *resource_controller* is **inittab**, the command **mkitab *subsystem_name*** failed.

User Response: Correct whatever caused the resource controller command listed above to fail, and retry the command.

2610-503 **Cannot copy the Configuration Database.**

Explanation: The specified command name failed in copying the Resource Monitoring and Control Configuration Database.

User Response: The file **/var/ct/IW/rmc.cp** contains a **cp** command error message. Correct the problem indicated by this error message. Refer to the man page for this command for more information.

2610-601 **A severe library or system error occurred in *source_file_name*, *version_string*, at line *line_number*.**

Explanation: An unexpected severe error occurred in the RMC API.

User Response: Record the above information and contact your software service organization.

2610-602 **A session could not be established with the RMC subsystem.**

Explanation: A session could not be established with the RMC subsystem.

User Response: The application should try again later.

2610-603 **The session with the RMC subsystem has been interrupted.**

Explanation: The session with the RMC subsystem has been interrupted.

User Response: The application should try again later.

2610-604 **The session with the RMC subsystem has been ended.**

Explanation: The session with the RMC subsystem has been ended.

User Response: The application could try to establish another session with the RMC subsystem.

2610-605 **The specified session handle is not valid.**

Explanation: The specified session handle is not valid.

User Response: The application specified a session handle that is not valid. A session handle remains valid once returned by a successful call to **mc_start_session()**, until after a successful call to **mc_end_session()** for that session. Check the program logic of the RMC API client.

2610-606 **The RMC API could not obtain a session descriptor.**

Explanation: The RMC API could not obtain a session descriptor. Either the system does not currently have the resources required to create another file descriptor, or the number of open file descriptors for the process has been exceeded.

User Response: Change the client program to open fewer file descriptors, or try again later.

2610-607 **The specified file descriptor, *session_file_descriptor*, is not the session descriptor.**

Explanation: The specified file descriptor is not the session descriptor. The RMCAPi client specified a descriptor that is not valid on a call to **mc_free_descriptor()**.

User Response: Change the client program.

2610-608 **The specified command group handle is not valid.**

Explanation: The specified command group handle is not valid.

User Response: The application specified a command group handle that is not valid. A command group handle remains valid once returned by a successful call to **mc_start_cmd_grp()**, until after a successful call to **mc_cancel_cmd_grp()**, **mc_send_cmd_grp()**, or **mc_send_cmd_grp_wait()** for that command group. Check the program logic of the RMCAPi client.

2610-609 **The command group contains no commands.**

Explanation: An attempt was made to send a command group with no commands.

User Response: Check the program logic of the RMCAPi client.

2610-610 **The command group has been sent, but the session ended before all responses could be received.**

Explanation: The command group has been sent, but the session ended before all responses could be received.

User Response: If pointer response was selected for any commands in the command group, check the appropriate array count for any responses. If callback response was selected for any commands in the command group, the callbacks were invoked for any responses received.

2610-611 **The command group has been sent, but the session was interrupted before all responses could be received.**

Explanation: The command group has been sent, but the session was interrupted before any responses could be received.

User Response: If pointer response was selected for any commands in the command group, check the appropriate array count for any responses. If callback response was selected for any commands in the command group, the callbacks were invoked for any responses received.

2610-612 **The specified pointer does not point to a response or event notification.**

Explanation: The pointer specified on a call to **mc_free_response()** does not point to a response or event notification.

User Response: Check the program logic of the RMCAPi client.

2610-613 **The session already contains the maximum number, *maximum_number*, of active command groups.**

Explanation: The session already contains the maximum number of active command groups.

User Response: Check the program logic of the RMCAPi client.

2610-614 **The command group already contains the maximum number, *maximum_number*, of commands.**

Explanation: The command group already contains the maximum number of commands.

User Response: Check the program logic of the RMCAPi client.

2610-615 **The specified event registration ID is not valid.**

Explanation: The specified event registration ID is not valid.

User Response: The application specified an event registration ID that is not valid. Check the program logic of the RMCAPi client.

2610-616 **The specified option is not valid.**

Explanation: The specified option is not valid.

User Response: The application specified an option that is not valid. Check the program logic of the RMCAPi client.

2610-617 **A descriptor has already been allocated to the specified session.**

Explanation: A descriptor has already been allocated to the specified session. Only one session descriptor can be allocated for a session at a time.

User Response: Check the program logic of the RMCAPi client. Check for multiple calls to **mc_get_descriptor()** for the same session, without an intervening call to **mc_free_descriptor()**.

2610-618 **The RMCAPi could not allocate required memory to satisfy the request.**

Explanation: The RMCAPi could not allocate required memory to satisfy the request.

User Response: Check the program logic of the RMCAPi client. Check for memory leaks.

2610-619 **The RMCAPi could not allocate some required system resource.**

Explanation: The RMCAPi could not allocate some required resource.

User Response: The application should try again later.

2610-620 **The specified callback routine is not valid.**

Explanation: The specified callback routine is not valid.

User Response: Check the program logic of the RMCAPi client.

2610-621 **The specified response pointer is not valid.**

Explanation: The specified response pointer is not valid.

User Response: Check the program logic of the RMCAPi client.

2610-622 **The specified response count pointer is not valid.**

Explanation: The specified response count pointer is not valid.

User Response: Check the program logic of the RMCAPi client.

2610-623 **The specified resource handle count is not greater than zero.**

Explanation: The specified resource handle count is not greater than zero.

User Response: Check the program logic of the RMCAPi client.

2610-624 **A command group has become too large.**

Explanation: A command group has become too large.

User Response: Check the program logic of the RMCAPi client.

2610-625 **The RMCAPi could not allocate required memory; the session is unusable.**

Explanation: The RMCAPi could not allocate required memory; the session is unusable.

User Response: Check the program logic of the RMCAPi client. Check for memory leaks.

2610-626 **An attempt was made to add a command to an ordered command group.**

Explanation: An attempt was made to add a command to an ordered command group that is not permitted in an ordered command group.

User Response: Check the program logic of the RMCAPi client.

2610-627 **An attempt was made to add a command to an ordered command group targeted to a different resource, or set of resources.**

Explanation: An attempt was made to add a command to an ordered command group. However, this command was targeted to a resource or set of resources that was not targeted by the ordered command group.

User Response: Check the program logic of the RMCAPi client.

2610-628 **The data type specified for *value_name*, *data_type*, is not valid.**

Explanation: The data type specified for the named value was not valid.

User Response: Check the program logic of the RMCAPi client.

2610-629 **The pointer specified for *value_name*, *data_type* *data_type*, is not valid.**

Explanation: The pointer to the specified data type for the specified value was not valid.

User Response: Check the program logic of the RMCAPi client.

2610-630 **The value for *value_name* is a structured byte string whose length is not valid.**

Explanation: The length of the specified SBS is not valid.

User Response: Check the program logic of the RMCAPi client.

2610-631 *value_name* is structured data that includes a subtype that is not allowed.

Explanation: The specified value is structured data that includes a subtype that is not allowed. Structured data may not include structured byte strings or other structured data.

User Response: Check the program logic of the RMCAPAPI client.

2610-632 The specified contact type is not valid.

Explanation: The specified contact type is not valid.

User Response: Check the program logic of the RMCAPAPI client.

2610-633 *name_of_routine* is not a supported routine.

Explanation: The specified routine is not supported by the RMCAPAPI.

User Response: Change your program to not call the specified routine.

2610-634 Possible deadlock detected.

Explanation: The `mc_send_cmd_grp_wait()`, `mc_unreg_event_bp()`, or `mc_unreg_event_bc()` routine was called to unregister an event and wait for completion. The thread on which this routine was called is running an event notification callback. This is not allowed, because a deadlock could occur.

User Response: Change your program to not call the specified routine to unregister an event and wait for its completion, while an event notification callback routine is running on the same thread.

2610-635 The specified contact point name is not valid.

Explanation: A contact name specified in a call to `mc_start_session()` was a NULL pointer or null string.

User Response: Change your program to specify non-null contact names.

2610-636 A string was provided that is not valid in the current locale.

Explanation: The string is not valid in the current locale of the process.

User Response: Check the source of the string.

2610-637 The security library routine *security_routine_name* returned error *security_error_number*: *security_error_message*.

Explanation: An unexpected error occurred in a call to the security library.

User Response: Record the above information and contact your software service organization.

2610-638 The security library routine *security_routine_name* returned error *security_error_number* to the RMC daemon.

Explanation: An unexpected error occurred in a call to the security library.

User Response: Record the above information and contact your software service organization.

2610-639 The user could not be authenticated by the RMC subsystem.

Explanation: The user could not be authenticated by the RMC subsystem.

User Response: Record the above information and contact your software service organization.

2610-640 The user is not authorized to use the RMC subsystem.

Explanation: The user is not authorized to use the RMC subsystem.

User Response: Record the above information and contact your software service organization.

2610-641 The RMC subsystem could not be authenticated by the RMCAPAPI.

Explanation: The RMC subsystem could not be authenticated by the RMCAPAPI.

User Response: Record the above information and contact your software service organization.

2610-800 The requested service is not available.

Explanation: The requested operation is not supported or is currently unavailable.

User Response: Refer to the documentation of the resource manager for information regarding support of the requested operation.

2610-801 **An attempt to allocate memory was unsuccessful.**

Explanation: The resource manager was unable to allocate enough memory to process the requested operation.

User Response: Make sure that there are enough system resources available. If the problem persists, record the error message and contact your software service organization.

2610-804 **The limit on the number of resources allowed would be exceeded.**

Explanation: An attempt to define a new resource failed because a limit on the number of resources allowed for the specified resource class would be exceeded.

User Response: Refer to documentation of the resource manager and resource class for information regarding limits on the number of resources allowed.

2610-805 **The value of the specified attribute is read-only, and cannot be set.**

Explanation: An attempt was made to modify an attribute value that cannot be changed.

User Response: Do not attempt to modify this attribute.

2610-806 **The specified attribute identifier is not a valid value.**

Explanation: The attribute identifier number does not represent an attribute of the resource or resource class.

User Response: Change the attribute identifier to a number which is valid for the resource or resource class. If you are attempting to represent an attribute of a resource, make sure that the attribute number is valid for the variety of the resource.

2610-807 **The resource class identifier was not a valid value.**

Explanation: The resource class identifier number does not represent a defined resource class.

User Response: Change the identifier number to match a defined resource class.

2610-808 **The specified resource class or resource handle was not valid.**

Explanation: The resource class or resource handle specified does not match a defined class or resource.

User Response: Change the value to match a defined resource class or resource.

2610-809 **The resource class name specified is not a valid class name.**

Explanation: The resource class name specified does not match any defined classes for this resource manager.

User Response: Change the value to match a defined resource class name.

2610-810 **The specified resource handle does not correspond to an existing resource.**

Explanation: The resource handle specified does not match a currently defined resource. The value may have been improperly specified, or may specify a resource that no longer exists.

User Response: Change the resource handle value to match a defined resource.

2610-812 **The resource class does not support creation of new resources.**

Explanation: The define resource operation is not supported by the resource class.

User Response: Do not attempt to define new instances of this resource class.

2610-813 **The resource class does not support the undefine operation.**

Explanation: The undefine resource operation is not supported by the resource class.

User Response: Do not attempt to undefine instances of this resource class.

2610-814 **The requested action is not supported.**

Explanation: The specified action is not supported by the resource or resource class.

User Response: Do not invoke this action on the resource or resource class.

2610-815 **The data provided is not correct for the requested operation.**

Explanation: The data provided for processing the operation was not correct.

User Response: Refer to the documentation of the resource manager and resource class for information regarding the correct data and format required for the requested operation.

2610-816 Control operations are not supported for the specified resource.

Explanation: The requested control operation is not supported for the resource.

User Response: Do not request this control operation for the specified resource.

2610-818 The resource targeted for the operation has been undefined.

Explanation: The operation could not be performed because the target resource has been undefined.

User Response: Do not invoke operations on undefined resources.

2610-819 The command was not processed because a prior command in the group was unsuccessful.

Explanation: The command was not processed because it was a member of a command group in which a prior command had failed.

User Response: This error can occur if the command group is specified to stop processing if a command in the group fails. Following the failure, subsequent commands in the group are not processed and instead they return this error.

2610-820 The data type of a value was not valid or not the expected type.

Explanation: A data type provided to perform an operation was unknown or not the required type.

User Response: Correct the data type required for the operation and resubmit the request.

2610-900 The Resource Manager Library has already been initialized by the calling process.

Explanation: The `rm_init()` routine was already successfully invoked by the process.

User Response: Check the program logic of the resource manager. The `rm_init()` routine should be called only once to initialize the library.

2610-901 The Resource Manager Library has not been initialized by the calling process.

Explanation: The `rm_init()` routine was not called by the process.

User Response: Check the program logic of the resource manager. The `rm_init()` routine must be called before invoking other library routines.

2610-902 The calling process does not have the required authority to use the Resource Manager Library.

Explanation: The calling process did not pass an authorization check.

User Response: Correct the calling process.

2610-903 Another process has initialized the Resource Manager Library for resource manager, *resource_manager_name*.

Explanation: The Resource Manager Library was unable to obtain an exclusive lock on the local node for *resource_manager_name*.

User Response: Check the program logic of the resource manager. Only one instance of a resource manager may initialize the library at a given time.

2610-904 The Resource Manager Library has been quiesced.

Explanation: The library has completed clean-up processing initiated by a call to `rm_quiesce()`.

User Response: Check the program logic of the resource manager. The `rm_quiesce()` routine should be called only once. When all threads invoking `DispatchRequests()` have returned the `RM_EQUIESCED` value, the `rm_term()` routine should be called.

2610-905 The Resource Manager Library has not completed quiesce.

Explanation: The library has not completed quiesce processing initiated by a call to `rm_quiesce()`. This message is issued if the resource manager attempts to call `rm_term()` before the library has completed quiescing.

User Response: The resource manager must not call `rm_term()` until all threads invoking the `DispatchRequests()` method return with the error number, `RM_EQUIESCED`.

2610-906 The Resource Manager Library encountered an internal error at line *line_number* in file *file_name*, version *file_version*.

Explanation: An unexpected internal error occurred in the library at the specified location.

User Response: Record the above information and contact your software service organization.

2610-907 **The version of the Configuration Database in use by the Resource Manager Library does not match the version in use by the RMC subsystem.**

Explanation: The version of the Configuration Database (CDB) loaded by the library when `rm_init()` was called, does not match the version being used by the RMC subsystem.

User Response: Quiesce and terminate use of the library, then reinitialize the library to obtain the correct CDB version.

2610-908 **The resource class name requested is too long for the buffer provided.**

Explanation: The resource manager requested the library to copy the name of a resource class to a buffer, but the buffer was not large enough to accommodate the name.

User Response: Increase the size of the name buffer.

2610-909 **An error was detected while attempting to load the local Configuration Database.**

Explanation: The library encountered an unexpected error and was unable to load the Configuration Database (CDB). This error implies the problem was with the CDB itself, such as a checksum error or unexpected value in the file.

User Response: Record the above information and contact your software service organization.

2610-910 **A parameter passed to a Resource Manager Library routine was not a valid value.**

Explanation: The value of a option or pointer parameter passed to a library routine was not a valid value.

User Response: Check the program logic of the resource manager. Ensure that all option parameters to the library routine are correct and valid values, and that all required pointer parameters are non-NULL and reference valid objects.

2610-911 **The library token passed to the Resource Manager Library routine was not a valid token.**

Explanation: A library token passed to the library was not valid. The token was either expired due to an unbind operation, or was not a value supplied to the resource manager by the library.

User Response: Check the program logic of the resource manager. Ensure all library tokens are valid

values supplied by the library, and are tokens representing bound objects.

2610-912 **The resource manager name, *resource_manager_name*, was not found in the local Configuration Database.**

Explanation: The resource manager name specified on the call to `rm_init()`, was not found in the Configuration Database (CDB).

User Response: Check that the resource manager is configured, and is passing the name correctly on the call to `rm_init()`.

2610-913 **The response object passed to the Resource Manager Library routine was not a valid object.**

Explanation: A pointer to a response object passed to a library response routine was not valid. The pointer did not reference a response object supplied by the library.

User Response: Check the program logic of the resource manager. Ensure that when invoking a library response routine, only the response object supplied by the library is passed as the response object parameter.

2610-914 **A file descriptor has already been provided by a previous call to the `GetDescriptor()` routine.**

Explanation: A duplicate call was made to the `GetDescriptor()` routine.

User Response: Check the program logic of the resource manager. The `GetDescriptor()` routine should be called only once per library initialization to obtain a descriptor.

2610-915 **The file descriptor parameter, *file_descriptor*, was not a valid value.**

Explanation: The *file_descriptor* passed to the Resource Manager Library routine was not the descriptor value given to the resource manager by a previous call to `GetDescriptor()`.

User Response: Check the program logic of the resource manager. Ensure the file descriptor value passed to library routines matches the value returned by the library by `GetDescriptor()`.

2610-916 **The Resource Manager Library does not currently have an active connection to the RMC subsystem.**

Explanation: The library does not currently have an active connection to the RMC subsystem for passing peer messages.

User Response: Retry the command after the

ConnectionChanged() method indicates that RMC is connected.

2610-917 **The system call, *system_call_name*, returned the error: (*error_number*) *error_string*.**

Explanation: The indicated system call returned an error. Additional error information may follow.

User Response: Attempt to correct the problem indicated by the error number. If it cannot be corrected, record the above information and contact your software service organization.

2610-918 **The object or attribute specified to a response method was not requested in the originating method call.**

Explanation: The object handle or attribute identifier passed to a response routine was not an object or attribute which was requested.

User Response: Check the program logic of the resource manager. Methods which target specific objects or attributes (such as Bind/Unbind/Monitor/...) must only be responded to with the objects or attributes which were requested.

2610-919 **The response object contains more data than was requested.**

Explanation: A method was invoked by the library which implied a specific amount of response data. The resource manager overflowed the response object by calling the response method too many times.

User Response: Check the program logic of the resource manager. Methods which request a specific number of sub-responses (such as Bind/Unbind/Monitor/...) must not invoke the response method more times than requested before completing the response.

2610-920 **The response method(s) were not called before attempting to complete or send the response.**

Explanation: The resource manager attempted to send or complete an empty response.

User Response: Check the program logic of the resource manager. Methods which require the resource manager to respond before completing the response object (such as Bind/Unbind/Monitor/...) must not attempt to complete an empty response.

2610-921 **The response method called is not valid for the type of response object provided.**

Explanation: The response object passed to a library response routine was not a valid object for that routine.

User Response: Check the program logic of the resource manager. Only the response routines passed to the resource manager when the library invokes a method, may be used to complete the response. The routines in a response object provided by the library are only valid for the method they are passed to, and only until that response is completed.

2610-922 **The object handle passed to a method did not match the value previously given to the Resource Manager Library.**

Explanation: When an object is bound, the library provides a token which it associates to the object handle supplied by the resource manager. On a call to a library routine which requires both the object handle and library token, the handle value was not correct for the given token. A possible cause would be using an old library token for an object that was unbound, but later bound again.

User Response: Check the program logic of the resource manager.

2610-923 **The routine is not valid for dynamic attributes which are not being monitored.**

Explanation: The resource manager attempted to call a library routine which takes as an input parameter dynamic attributes which are being monitored. However, one or more of the attributes were not being monitored.

User Response: Check the program logic of the resource manager. Ensure that the routine is only called with attributes which are being monitored.

2610-924 **The routine is not valid for persistent attributes which are not enabled for notification.**

Explanation: The resource manager attempted to call a library routine which takes as an input parameter persistent attributes which are enabled for notification. However, one or more of the attributes have not been enabled.

User Response: Check the program logic of the resource manager. Ensure that the routine is only called with attributes which have been enabled for notification.

2610-925 Only one of a matched pair of methods was overridden.

Explanation: Certain object methods are paired such that if the resource manager overrides one default, the other must also be overridden. This error is returned when the resource manager provides a set of methods to the library which contain one or more unmatched overrides.

User Response: Check that for all matched method pairs, either both or neither method in the pair are the default method. Methods which must be matched are: Bind/Unbind (RCCP and RCP,) Start/Stop monitor of dynamic attributes, Enable/Disable persistent attribute notification, and Start/Stop match set monitoring.

2610-926 A pointer in the specified attribute value was not valid.

Explanation: A pointer field in the attribute value was not a valid pointer.

User Response: Check the program logic of the resource manager.

2610-927 The structured data value includes a subtype which is not allowed.

Explanation: The specified attribute value is structured data that includes a subtype that is not allowed. Structured data may not include structured byte strings or other structured data.

User Response: Check the program logic of the resource manager.

2612 - RMC Commands Messages

2612-001 Not a recognized flag: *flag*.

Explanation: An unsupported flag or an incorrect combination of flags was specified.

User Response: Refer to the Usage statement which lists the valid flag. Correct and re-enter the command.

2612-002 Not a recognized operand: *operand*.

Explanation: An unsupported operand or incorrect combination of operands was specified.

User Response: Refer to the Usage statement which lists the valid operand. Correct and re-enter the command.

2612-003 The combination of *flag* and *flag* or *operand* is not allowed.

Explanation: The combination of the specified flags or flag and operand is not allowed.

User Response: Either choose a different flag or do not enter the operand. Refer to the Usage statement

2610-928 The response was not complete.

Explanation: Certain methods (such as Bind/Unbind/Monitor/...) require a set number of calls to the response method before it can be completed. For example, the start monitor method requests the resource manager to begin monitoring -N- dynamic attributes. The resource manager must respond for each of the attributes in the requested before it can complete the response.

User Response: Check the program logic of the resource manager. Ensure that the requirements of the response are satisfied as documented.

2610-929 The specified locale category, *category_value*, is not a valid value.

Explanation: A value passed to the library for specifying a locale category was not valid.

User Response: Check the program logic of the resource manager. Make sure that when specifying a locale category to the library, the value is one defined in **locale.h** (for example, LC_COLLATE, LC_CTYPE, LC_MONETARY, ...).

2610-999 The Resource Manager Library encountered an unknown internal error.

Explanation: Default message for an unknown internal error condition.

User Response: Record the above information and contact your software service organization.

which lists the valid flags, operands, and flag-operand combinations.

2612-004 A resource handle must be entered using the following format: "0x0000 0x0000 0x00000000 0x00000000 0x00000000 0x00000000" instead of: *resource_handle operand*.

Explanation: A resource handle was expected. What was entered was not in the required resource handle format. A resource handle must be enclosed in double quotation marks and have the format:

```
"0x0000 0x0000 0x00000000 0x00000000 0x00000000\
0x00000000"
```

User Response: Re-enter the command with either the correct flag or a correctly formatted resource handle.

2612-005 A resource class name must be entered.

Explanation: This command requires a resource class name to be entered as an operand to this command.

User Response: Re-enter the command and specify a resource class name, or use the correct flag and operand combination as specified in the Usage statement for the command.

2612-006 A resource handle must be entered.

Explanation: This command requires a resource handle as an operand.

User Response: Re-enter the command and specify a resource handle, or use the correct flag and operand combination as specified in the Usage statement for this command. A resource handle is enclosed within double quotation marks and has the following format:

```
"0x##### 0x##### 0x##### 0x#####\n0x#####"
```

where # is any valid hexadecimal character
0-9,a,b,c,d,e,f.

2612-007 Invalid command format-too many operands were entered.

Explanation: Too many operands were specified.

User Response: Examine Usage statement for this command, and re-enter the command correctly.

2612-008 The -s Selection_string flag is required.

Explanation: The specified command requires a -s "Selection_string".

User Response: Examine Usage statement for this command, and re-enter the command correctly.

**2612-009 Unexpected error when the underlying RMC function
underlying_RMC_function_name was
issued and produced a return code of
return_code.**

Explanation: The command called an underlying RMC function that gave a non-zero return code.

User Response: See *IBM RSCT 2.2 Resource Monitoring and Control Guide and Reference* for diagnostic information.

2612-010 Resource class class_name is not defined.

Explanation: The resource class name must be defined.

User Response: Re-run this command and specify a valid resource class name. To find a list of valid resource class names, run the lsrsrc command with no flags and no operands specified.

**2612-011 Was not able to get a list of resource handles for Resource class
class_name.**

Explanation: The resource class name must be defined.

User Response: Re-run this command and specify a valid resource class name. To find a list of valid resource class names, run the lsrsrc command with no flags and no operands specified.

**2612-012 Was not able to query the definition of the structured data for resource
resource.**

Explanation: Unexpected failure invoking mc_qdef_sd_bp.

User Response: Re-run this command. Ensure that the resource name is defined. Make sure that RMC is working.

2612-013 error_exit received an unexpected return code return_code.

Explanation: All RMC return codes should be converted to an appropriate RMC command line interface return code.

User Response: This is an internal script error and should not occur. If this message is issued, an error did occur. The actual return code for the underlying RMC function or other internal subroutine is displayed. This is a severe error, and processing of the command stops. Report the command name, and this message, to your software-service organization.

**2612-014 Error processing attribute
attribute_name value value.**

Explanation: The value for this particular attribute is not valid. See the preceding error message for additional details.

User Response: Verify the data type for this particular attribute using the lsrsrdef command. Verify and correctly specify the value so that it is appropriate for this data type. For example, if the data type is an array, the values must be enclosed within curly braces { }. See the appropriate command man page and the man page for the Resource Data Input File for valid syntax values.

**2612-015 Error processing SD element
element_name value value**

Explanation: The value for this particular element is not valid. See the preceding error message for additional details.

User Response: Verify the data type for this particular attribute using the lsrsrdef or lsactdef command. Verify and correctly specify the value so that it is

appropriate for this data type. For example, if the data type is an array, the values must be enclosed within curly braces { }. See the appropriate command man page, and the man page for the Resource Data Input File for valid syntax values.

2612-016 An action name must be entered.

Explanation: This command requires an action name to be entered as an operand.

User Response: Re-enter the command and specify an action name. Run the **lsactdef** command for a list of action names that are associated with the specified resource class.

2612-017 An internal program error occurred while attempting to display the invalid attribute *attribute_name* in *title*.

Explanation: An internal program error has been detected by the `MC_cli_display_utils set_print_array` function. This function should not be called if there are incorrect attribute names.

User Response: Rerun the command with the `-V` (Verbose) flag turned on, and report the error to your software-service organization.

2612-018 Attribute name *attribute_name* is not a valid attribute name.

Explanation: The specified attribute name is not valid. It has not been defined as either a persistent or a dynamic attribute for the specified resource class.

User Response: Run the `lsrsrdef` command to determine what attribute names are defined for a specific resource class. Then rerun the command, specifying a correct attribute name.

2612-019 The selection string specified with the `-s` flag contains invalid syntax.

Explanation: The specified selection string contains syntax that is not valid. Only persistent attribute names can be specified in the selection string. The immediately following error message contains more detail regarding the incorrect syntax. Refer to *IBM RSCT 2.2 Resource Monitoring and Control Guide and Reference* for detail on correct selection string syntax.

User Response: Correct the selection string and rerun this command.

2612-041 Resource class *class_name* could not be displayed.

Explanation: An unexpected problem occurred that prevented the displaying of the specified resource definition.

User Response: Examine the return code, make

certain that RMC is running, or take other appropriate diagnostic action based on the return code.

2612-061 Resource class *class_name* could not be displayed.

Explanation: An unexpected problem occurred with that prevented the displaying of the specified resource.

User Response: Examine the return code, make certain that RMC is running, or take other appropriate diagnostic action based on the return code.

2612-081 Do not specify attribute *attribute* when you define the resource *resource_class resource_def*.

Explanation: When defining a resource, the user must supply only valid `Attr=value` pairs. The `Attr` must match a persistent resource attribute that is already defined and has a property that requires it to be set on `define`, or is optional for the `define`. The specified attribute name is either not defined as being a persistent attribute for this resource, or the properties of this attribute do not allow it to be set on a `define`.

User Response: Re-enter a valid persistent resource attribute name. Issue the command **mkrsrc -e 2 Resource** to see which attributes can be set on a `define`.

2612-082 Attribute *attribute* is required when defining resource *resource*.

Explanation: When a resource is defined, all attributes with the property `MC_RSRC_PATTR_REQD_FOR_DEFINE` must be defined.

User Response: Re-enter the command with the missing attribute and a proper value.

2612-083 Error processing file *file_name* for input.

Explanation: The Resource Input Data File that was specified as input to the **mkrsrc** command using the flag `-f Resource_data_input_file` could not be processed.

User Response: The previous message should contain more information regarding why this file could not be processed. Possibilities are: the file name as specified could not be found, the file could not be read, or the format of the data inside the file is not correct. Take corrective action based on previous error message and re-enter the command.

2612-084 Error processing the command line operand2... for Attr=value pairs.

Explanation: Operand 2, Operand 3, and so forth are expected to be Attr=value pairs. An Attr is a valid attribute name for the resource class that was specified as Operand 1. The value should be a valid value for the data type of this attribute. For example, if this Attr data type is a char_ptr, the value should be a valid string. If the string includes spaces or tabs or is null, it must be enclosed within double quotation marks.

User Response: The previous message should contain more information regarding why this command line could not be processed. Re-enter the command using correct syntax for the Attr=value pairs.

2612-085 Resource *resource* could not be defined.

Explanation: An unexpected problem occurred with RMC, which prevented the defining of the specified resource.

User Response: Examine the return code, make certain RMC is running, or take other appropriate diagnostic action based on the return code.

2612-086 The required NLSTranslation Stanza keyword *keyword*: is missing from file *file*.

Explanation: The NLSTranslation stanza in the Resource Data Input File requires three keywords and respective data. See the man page for the Resource Data Input File for details on the required keywords.

User Response: The NLSTranslation stanza is optional and only needs to be specified in your resource data input file if you require certain attribute values to be translated. Add the required keyword = value or remove the NLSTranslation stanza from this file and rerun the command.

2612-087 The keyword *keyword* which appears in the NLSTranslation Stanza in file *file* is not a valid keyword.

Explanation: The NLSTranslation stanza in the Resource Data Input File requires three keywords and respective data. See the man page for the Resource Data Input File for details on the required keywords. The keyword appearing in this stanza was not one of the required keywords.

User Response: The NLSTranslation stanza is optional and only needs to be specified in your resource data input file if you require certain attribute values to be translated. Remove the keyword that is not required and make certain all of the required keywords are specified before rerunning this command.

2612-088 Attribute *attribute* specified in the NLSTranslation Stanza in file *file_name* is not a defined persistent resource attribute for this resource class or does not have a data type of ct_char_ptr.

Explanation: The persistent attributes listed in the NLSTranslation stanza with the PersistentResourceAttributes keyword must have a data type of ct_char_ptr. Only persistent attributes that are of data type ct_char_ptr can be translated using this mechanism.

User Response: The NLSTranslation stanza is optional and needs to be specified in your resource data input file only if you require certain attribute values to be translated. Only persistent attributes with a ct_char_ptr data type can be translated using this mechanism. Use the lsrsrdef command to get a list of defined persistent resource attributes and their data types. Correct the PersistentResourceAttributes value in the NLSTranslation Stanza and rerun this command.

2612-089 Error translating attribute *attribute_name = value*, message map *MessageMap*, message catalogue *MessageCat*.

Explanation: An attempt was made to translate the persistent resource attribute specified using the message mnemonic that should have been specified as its value using the MessageMapPath and MessageCat as specified in the NLSTranslation stanza.

User Response: The NLSTranslation stanza is optional and only needs to be specified in your resource data input file if you require certain attribute values to be translated. Correct the attribute value using a mnemonic that is specified in the Message Map and translated in the Message Catalogue.

2612-101 Failure removing resource, bad resource handle: *resource_handle*.

Explanation: To remove a resource, a valid resource handle must be supplied.

User Response: Re-run this command, specifying a valid resource handle. Run **lsrsrc** with the **-r**, **-ap**, and other flags as appropriate to get a list of valid resource handles.

2612-102 Failure removing resource *resource*.

Explanation: An error occurred when running the **rmrsrc** command.

User Response: The preceding error message should contain more information regarding why the **rmrsrc** command failed. Resolve that error and re-enter this command.

2612-121 Resource class *resource* could not be refreshed.

Explanation: An unexpected problem occurred, which prevented the refreshing of the specified resource class.

User Response: Examine the return code, make certain that RMC is running, or take other appropriate RMC diagnostic action based on the return code.

2612-141 Error processing file *file_name* for input.

Explanation: The Resource Data Input File that was specified as input to the **chrsrc** command using the flag **-f Resource_data_input_file** could not be processed.

User Response: The previous message should contain more information regarding why this file could not be processed. Possibilities are: the file name as specified could not be found, the file could not be read, or the format of the data inside the file is not correct. Take corrective action based on previous error message and re-enter the command.

2612-142 Error processing the command line *operand2... for Attr=value pairs*.

Explanation: Operand 2, operand 3, and so forth are expected to be Attr=value pairs. An Attr is a valid attribute name for the resource class that was specified as Operand 1. The value should be a valid value for the data type of this attribute. For example, if this Attr data type is a char_ptr, the value should be a valid string. If the string includes spaces or tabs or is null, it must be enclosed within double quotation marks.

User Response: The previous message should contain more information regarding why this command line could not be processed. Re-enter the command using correct syntax for the Attr=value pairs.

2612-143 Do not specify attribute *attribute* when changing resource *resource_class resource_def*.

Explanation: When changing a resource, the user must supply only valid Attr=value pairs. The Attr must match a persistent resource attribute that is already defined, and has a property that allows it to be set. It cannot have a property of "Read Only". The specified attribute name is either not defined as being a persistent attribute for this resource, or the properties of the attribute do not allow it to be set.

User Response: Re-enter a valid persistent resource attribute name. Run: **lsrsrcdef -ap Resource_class** to see a list of persistent attributes with their properties for the specified resource.

2612-144 Resource *resource* could not be changed.

Explanation: An unexpected problem occurred that prevented the changing of the specified resource attributes.

User Response: Examine the return code, make certain RMC is running, or take other appropriate diagnostic action based on the return code.

2612-145 Resource *resource* attribute *attribute* could not be changed.

Explanation: The resource manager that controls the specified resource class would not allow you to change the specified attribute.

User Response: Examine the message following this one for more details about why this attribute could not be changed. It is possible that the value is not acceptable or that the underlying resource manager does not allow you to modify this attribute.

2612-146 Failure changing resource, bad resource handle.

Explanation: To change a resource a valid resource handle must be supplied.

User Response: Re-run this command, specifying a valid resource handle. Run **lsrsrc** with the **-r, -ap**, and other flags as appropriate to get a list of valid resource handles.

2612-161 Resource *class_name* action definition could not be displayed.

Explanation: An unexpected problem occurred that prevented the display of the specified resource action definition.

User Response: Examine the return code, make certain that RMC is running, or take other appropriate diagnostic action based on the return code.

2612-181 Error processing file *file_name* for input.

Explanation: The Resource Data Input File that was specified as input to the **runact** command using the **-f Resource_data_input_file** could not be processed.

User Response: The previous message should contain more information regarding why this file could not be processed. Possibilities are: the file name as specified could not be found, the file could not be read, or the format of the data inside the file is not correct. Take corrective action based on previous error message and re-enter the command.

2612-182 Error processing the command line operand2... for Attr=value pairs.

Explanation: Operand 2, operand 3, and so forth are expected to be Attr=value pairs. An Attr is a valid attribute name for the resource class that was specified as Operand 1. The value should be a valid value for the data type of the attribute. For example, if this Attr data type is a char_ptr, the value should be a valid string. If the string includes spaces or tabs or is null, it must be enclosed within double quotation marks.

User Response: The previous message should contain more information regarding why this command line could not be processed. Re enter the command using correct syntax for the Attr=value pairs.

2612-183 SD Element *element_name*, resource *resource* action *action* line *line* is not a valid element name for this SD.

Explanation: Enter only valid element=value pairs. The element should be a valid element name for action input of this resource.

User Response: Run **Isactdef -si *Resource_class* *Action*** to see the list of element names and data types expected as input for this action.

2612-184 Action *action* SD Element *element_name* invalid data type *invalid_data_type*.

Explanation: Enter only valid element=value pairs. The element data type is not valid. A structured data

cannot contain another structured data.

User Response: Run **Isactdef -si *Resource_class* *Action*** to see the list of element names and data types expected as input for this action.

2612-185 Required SD Element *element_name* on action *action* must be specified.

Explanation: All elements within the input structured data for this action must be specified.

User Response: Run **Isactdef -si *Resource_class* *Action*** to see the list of element names and data types expected as input for this action.

2612-186 Action *action* could not be invoked.

Explanation: An unexpected problem occurred that prevented the defining of the specified resource.

User Response: Examine the return code, make certain RMC is running, or take other appropriate diagnostic action based on the return code.

2619 - Cluster Technology Command Utilities Messages

2619-001 Invalid format for resource handle.

Explanation: Resource handles are composed of up to five groups of eight bits each. One or more segments of an input resource handle had more than eight characters or more than five sets of bits.

User Response: Check the syntax of the resource handle. A resource handle is enclosed in double quotation marks and has this format:

```
"0x#### 0x#### 0x##### 0x##### 0x#####\n 0x#####"
```

where # is any valid hexadecimal character 0-9,a,b,c,d,e,f. For example:

```
"0x4018 0x0001 0x00000000 0x069684c 0x00519686\ 0xaf7060fc"
```

2619-002 Invalid hexadecimal number: *hexadecimal_number*.

Explanation: Hexadecimal numbers must be valid for input to the command line interface. (Note: Binary data is entered using hexadecimal digits in general for the Cluster Technology components.) One or more

hexadecimal (or binary) input values was found to contain non-hexadecimal digits.

User Response: See *IBM RSCT 2.2 Resource Monitoring and Control Guide and Reference* for detailed information.

2619-003 Input file *input_file_name* not found.

Explanation: The input file name given to enter data to the command line interface could not be found in order to open.

User Response: Verify the path name used for the input file. Use an absolute instead of a relative path name. Refer to the Usage statement for the calling command for the correct syntax before resubmitting the command.

2619-004 *target* not found in input file *input_file_name*.

Explanation: The target line given to locate in the input file was not found.

User Response: Verify the spelling of the target given

on the command line. Also verify that the target exists in the input file. Refer to the Usage statement for the calling command for the correct syntax before resubmitting the command.

2619-005 Error in input line *input_file_name*
input_file_line.

Explanation: The line listed in the error description has an incorrect format.

User Response: Refer to the man page for the calling program for the correct syntax for file input.

2619-006 Invalid display type *display_type.*

Explanation: The display type given to the subroutine was not valid for the command line interface print facility.

User Response: Refer to the man page for the calling program for a list of valid display types.

2619-007 No data found on command line.

Explanation: The command line given to be parsed contained no data. Data is required for the calling command.

User Response: Verify the syntax for the command being run by consulting the man page. Verify the command line syntax for input of data to the components by referring to their individual man page sections.

2619-008 Invalid data type *data_type.*

Explanation: The data type given on the command line was not a valid type.

User Response: Verify the current list of valid data types by checking the man page of the calling command.

2619-009 Invalid signed or unsigned 64-bit integer: *value.*

Explanation: A 64-bit number was expected. The 64-bit number provided via the command line or input file contained characters other than digits.

User Response: Verify the format of the 64-bit signed or unsigned integers in the input data before rerunning the command.

2619-010 Invalid unsigned number found:
invalid_unsigned_number.

Explanation: A value passed in to the calling program was expected to be an unsigned number, but it was found to be negative. This might be a typographical error on the command line.

User Response: Verify the format for entering data for the calling command by referring to the man page for that command.

2619-011 No data found in input file
input_file_name.

Explanation: No valid input data was found in the input file given. This might be a typographical error in the input file.

User Response: Verify the format for the input file by referring to the appropriate command man page and the Resource Data Input File man page.

2619-012 Nested arrays not allowed in input:
invalid_input_string.

Explanation: Nested arrays are not allowed in the input. This might be a typographical error in the input file or command line.

User Response: Verify the format for the input file by referring to the appropriate command man page and the Resource Data Input File man page.

2619-013 Structured data cannot contain structured data: *invalid_input_string.*

Explanation: Structured data cannot contain structured data. This might be a typographical error in the input file.

User Response: Verify the format for the input file by referring to the appropriate command man page and the Resource Data Input File man page. Verify the rules for structured data by referring to *IBM RSCT 2.2 Resource Monitoring and Control Guide and Reference*.

2619-014 Missing closing brace (}) for array:
invalid_input_string.

Explanation: An array in the input file is not valid, perhaps because there was no closing brace found for a given array. This might be a typographical error in the input file.

User Response: Verify the format for the input file by referring to the appropriate command man page and the Resource Data Input File man page. Verify the rules for structured data by referring to *IBM RSCT 2.2 Resource Monitoring and Control Guide and Reference*.

2619-015 Missing closing bracket] for structured data: *invalid_input_string.*

Explanation: Structured data in the input file has a format that is not valid, perhaps because there was no closing bracket for a given structured data set. This is most likely due to a typographical error in the input file.

User Response: Verify the format for the input file by referring to the appropriate command man page and the

Resource Data Input File man page. Verify the rules for structured data by referring to *IBM RSCT 2.2 Resource Monitoring and Control Guide and Reference*.

2619-016 Missing closing quote:

Explanation: A quoted string was not valid, perhaps because there was no closing quotation mark. This might be a typographical error in the input file.

User Response: Verify the format for the input file by referring to the appropriate command man page and the Resource Data Input File man page. Verify the rules for structured data by referring to *IBM RSCT 2.2 Resource Monitoring and Control Guide and Reference*.

2619-017 Empty data stanza prior to line *next stanza heading*.

Explanation: Two stanza headers in a row were found in the input file, indicating that data is missing the first stanza. This might be a typographical error in the input file.

User Response: Verify the format for the input file by referring to the appropriate command man page and the Resource Data Input File man page.

2619-018 Incorrect stanza header *bad stanza heading found in input file*.

Explanation: A stanza header was found in the input file where one should not exist. This happens when the initial data in a section has no stanza header, but a stanza header is used before the end of the data in the file. This might be a typographical error in the input file.

User Response: Verify the format for the input file by referring to the appropriate command man page and the Resource Data Input File man page.

2619-019 Data missing.

Explanation: A stanza header was found in the input file with no associated data. This might be a typographical error in the input file.

User Response: Verify the format for the input file by referring to the appropriate command man page and the Resource Data Input File man page.

2619-020 Possible missing open brace {:

Explanation: An input line may have a missing opening brace. This occurs if a closing brace is

discovered with no matching opening brace. This might be a typographical error in the input file.

User Response: Verify the format for the input file by referring to the appropriate command man page and the Resource Data Input File man page.

2619-021 Possible missing open bracket [:

Explanation: An input line might have a missing opening bracket. This message occurs when a closing bracket is discovered without a matching opening bracket. This might be a typographical error in the input file.

User Response: Verify the format for the input file by referring to the appropriate command man page and the Resource Data Input File man page.

2619-022 Possible missing structured data entry:

Explanation: The last entry in a structured data segment is a comma. This might imply that a value is missing from the structured data, or it might be a typographical error in the input file.

User Response: Verify the format for the input file by referring to the appropriate command man page and the Resource Data Input File man page.

2619-023 Possible missing array entry:

Explanation: The last entry in an array is a comma. This might imply that a value is missing from the array, or it might be a typographical error in the input file.

User Response: Verify the format for the input file by referring to the appropriate command man page and the Resource Data Input File man page.

2619-024 Unescaped brace or bracket in quote:

Explanation: Braces and brackets inside quotation marks must be escaped. A brace or bracket was found inside a quote unescaped. This might be a typographical error in the input file.

User Response: Braces and brackets must be escaped by preceding them with the backslash (\) character. Verify the format for the input file by referring to the appropriate command man page and the Resource Data Input File man page.

2634 - HostRM Messages

2634-000 Attribute identifier is not valid.

Explanation: The number submitted as an attribute identifier does not represent an attribute for this class.

User Response: Change the attribute identifier to a valid attribute number for this class.

2634-002 **Attribute *attribute_name* cannot be specified when defining a new resource.**

Explanation: When defining a new resource, the user specified an attribute whose value is automatically generated and therefore is not valid.

User Response: Remove this attribute from the define resource call.

2634-003 **The Resource Handle specified does not exist.**

Explanation: The user supplied a ResourceHandle that does not match a resource that is currently defined.

User Response: Change the specified ResourceHandle to match a resource that is defined.

2634-004 **Error *error_code* returned from registry function *function_name*.**

Explanation: The registry is unable to successfully complete the specified request due to the indicated error.

User Response: Locate the RSCT registry documentation and follow the corrective actions described for the function and return code displayed in this message.

2634-005 **Attribute *attribute_name* is read-only and cannot be set.**

Explanation: The user attempted to modify an attribute value that cannot be changed.

User Response: Do not attempt to modify this attribute.

2634-006 **Attribute *attribute_name* appears in request more than once.**

Explanation: The user has supplied the same attribute for a single request more than one time.

User Response: Remove multiple copies of the same attribute within a single request.

2634-007 **The value specified for attribute *attribute_name* has the wrong data type.**

Explanation: The user has specified an attribute value with a data type that does not match the definition of the attribute. For example, the attribute is defined as a string but the user supplied an integer instead.

User Response: Correct the data type specified for the attribute named in the error message and resubmit the request.

2634-008 **Resource class name *Resource_class_name* is not recognized by this resource manager.**

Explanation: The Host Resource Manager does not recognize the named resource class as belonging to it. This is either an internal error or indicates a damaged RMC configuration.

User Response: Record the above information and contact your software service organization.

2634-009 **The control point for resource class *Resource_class_name* cannot be initialized.**

Explanation: The Host Resource Manager was unable to initialize itself for the named resource class.

User Response: Make sure the system has plenty of resources (paging space, available */var* file system space, and so on). If this does not resolve the problem, record the above information and contact your software service organization.

2634-010 **The control point for the target resource cannot be initialized.**

Explanation: The Host Resource Manager was unable to initialize itself for handling a resource.

User Response: Make sure the system has plenty of resources (paging space, available file system space, and so on). If this does not resolve the problem, record the above information and contact your software service organization.

2634-011 **An unexpected exception *exception_name* was caught with error code *error_code*.**

Explanation: A C++ exception was caught that indicates an internal error situation.

User Response: Record this error message and contact your software service organization.

2634-012 **An unexpected exception *exception_name* was caught.**

Explanation: A C++ exception was caught that indicates an internal error situation.

User Response: Record this error message and contact your software service organization.

2634-013 **Attribute *Resource_attribute_name* must be specified when a new resource is defined.**

Explanation: A required attribute was not specified when the user attempted to define a new resource.

User Response: The user must add the missing attribute and try the define operation again.

2634-014 The values for the NodeList attribute must be less than or equal to 4096.

Explanation: A value was specified for the NodeList attribute that is not in the valid range (0-4096).

2636 - Event Response Messages

2636-000 Attribute identifier is not valid.

Explanation: The number submitted as an attribute identifier does not represent an attribute for this class.

User Response: Change the attribute identifier to a valid attribute number for this class.

2636-001 Error from registry call
registry_function_called, rc=
error_return_code.

Explanation: The registry is unable to complete a request from ERRM.

User Response: Locate the RSCT registry documentation and follow the corrective actions described for the function and return code displayed in this message.

2636-002 The attribute *resource_attribute_name* cannot be specified as part of the definition of a new resource but is otherwise valid.

Explanation: The user attempted to define a resource attribute that is not under the control of the user when resources are defined.

User Response: The user must remove this attribute from the define resource call.

2636-003 The ResourceHandle specified as an attribute does not exist.

Explanation: The user supplied a ResourceHandle attribute that does not match a resource that is currently defined.

User Response: Change the specified ResourceHandle to match a resource that is defined.

2636-005 Attribute *attribute_name* is read-only and cannot be set.

Explanation: The user is attempting to modify an attribute that cannot be modified by this user.

User Response: Do not attempt to modify this attribute.

User Response: Correct the value for the NodeList attribute to be in the valid range.

2636-006 Attribute *attribute_name* appears in request more than once.

Explanation: The user has supplied the same attribute for a single request more than one time.

User Response: Remove multiple copies of the same attribute within a single request.

2636-007 Value specified for attribute *attribute_name* is wrong data type.

Explanation: The user has specified an attribute with a data type that does not match the data type of the definition of the attribute. For example, the attribute is defined as a string but the user supplied an integer instead.

User Response: Correct the data type specified for the attribute named in the error message and resubmit the request.

2636-008 Class name *resource_class_name* is not recognized by this resource manager.

Explanation: The Event Response Resource Manager does not recognize the named resource class as belonging to this resource manager.

User Response: Locate the RSCT documentation on the RMC and try rebuilding the CBD. If that does not fix the problem, record the above information and contact your software service organization.

2636-009 Control point for class *resource_class_name* cannot be initialized.

Explanation: The Event Response Resource Manager was unable to create a RCCP object.

User Response: Make sure the system has plenty of resources (paging space, available file system space, and so on). If the problem persists, record the above information and contact your software service organization.

2636-010 Control point for resource cannot be initialized.

Explanation: The Event Response Resource Manager was unable to create a RCP object.

User Response: Make sure the system has plenty of resources (paging space, available file system space, and so on). If the problem persists, record the above information and contact your software service organization.

2636-013 **Attribute *resource_attribute_name* must be specified when defining a new resource.**

Explanation: A required attribute was not specified when the user attempted to define a new resource.

User Response: The user must add the missing attribute and try the define function again.

2636-017 **The *EventResponse* resource name *value_of_the_attribute_Name* already exists.**

Explanation: There is a resource already defined with the same value for the attribute Name supplied by the user for this request.

User Response: Select another value for Name that is unique.

2636-018 **There must be at least one Structured Data within the *Actions* attribute for the *EventResponse* class.**

Explanation: Within the *Actions* attribute, there is no data.

User Response: Add at least one Structured Data within the *SDarray* for attribute *Actions*.

2636-019 **Structured Data number *starting with 0*, the *element_number* of the structured data within the array of *SDs* within the *Actions* attribute for the *EventResponse* class has too many fields.**

Explanation: The structured data element number displayed has too many fields within that structured data.

User Response: Remove the fields that are not supported for the displayed structured data element.

2636-020 **Structured Data number *starting with 0*, the *element number* of the structured data within the array of *SDs* within the *Actions* attribute for the *EventResponse* class does not have enough fields.**

Explanation: The structured data element number displayed has too few fields within that structured data.

User Response: Add the missing fields that are supported for the displayed structured data element.

2636-021 **Structured Data number *starting with 0*, the *element number* of the structured data within the array of *SDs* within the *Actions* attribute has the wrong data type for field *name* of structured data field.**

Explanation: Within the structured data element number displayed, the field displayed has the wrong data type supplied by the user.

User Response: Correct the data type for the field and *SD* displayed and resubmit the request.

2636-022 **Internal *EventResponse* Error: *Actions* attribute has *number of fields* supplied by the user **fields and number of fields** that *ERRM* expects and therefore were checked for correctness **fields were validated**.**

Explanation: The definition of the *Actions* *SD* must have changed, however all of the code within the *ERRM* was not changed to check for all of the new fields within the *SD*.

User Response: Record the above information and contact your software service organization.

2636-023 **The *ActionName* name supplied by the user to describe this *SD* for **Structured Data number *starting with 0***, the *element number* of the structured data within the array of *SDs* is not unique within this **Actions** attribute.**

Explanation: The name supplied by the user to describe this *SD* is the same name used by the user to describe another *SD* within this *Actions* *SD* array.

User Response: Select a unique name within this *Actions* *SD* array to describe the displayed *SD* element number.

2636-024 **Structured Data number *starting with 0*, the *element number* of the structured data within the array of *SDs* does not have the same number of elements within the **WeekDay** and **StartTime** arrays.**

Explanation: Within a the same *SD*, the number of elements for array *WeekDay* and array *StartTime* must be the same.

User Response: Make both of the fields *WeekDay* and *StartTime* have the same number of elements within the displayed *SD*.

2636-025 **Structured Data number** *starting with 0, the element number of the structured data within the array of SDs* **does not have the same number of elements within the StartTime and EndTime arrays.**

Explanation: Within a the same SD, the number of elements for array StartTime and array EndTime must be the same.

User Response: Make both of the fields StartTime and EntTime have the same number of elements within the displayed SD.

2636-026 **Structured Data number** *starting with 0, the element number of the structured data within the array of SDs* **for array field name of the SD field within the Actions attribute, element number** *element number of the field* **has an out-of-range value of value that is out-of-range.**

Explanation: The user has supplied a value for an array element that is not in the valid range.

User Response: Change the value of the array field element and submit the request again.

2636-027 **Structured Data number** *starting with 0, the element number of the structured data within the array of SDs* **for field name of the SD field within the Actions attribute has an out-of-range value of value that is out-of-range.**

Explanation: The user has supplied a value for a field that is not in the valid range.

User Response: Change the value of the displayed field and submit the request again.

2636-028 **Structured Data number** *starting with 0, the element number of the structured data within the array of SDs* **for array field StartTime element number** *starting with 0, the element number of the StartTime array* **is greater than the array field EndTime element number** *starting with 0, the element number of the EndTime array.*

Explanation: Within the same SD, the value of each StartTime element must be less than or equal to each corresponding EndTime element.

User Response: Make the StartTime element less than or equal to the corresponding EntTime element.

2636-050 **The Condition resource name** *condition_resource_name* **already exists.**

Explanation: When defining or changing a Condition resource, the user supplies a resource name that is the same within an existing Condition resource.

User Response: Supply a different Condition resource name.

2636-051 **The Condition resource handle is not valid.**

Explanation: When defining or changing an Association resource, the user supplied a value for the ConditionHandle attribute that is not associated with an existing Condition resource.

User Response: Supply a Condition resource handle value for an existing Condition resource.

2636-052 **The EventResponse resource handle is invalid.**

Explanation: When defining or changing an Association resource, the user supplied a value for the EventResponseHandle attribute that is not associated with an existing EventResponse resource.

User Response: Supply an EventResponse resource handle value for an existing EventResponse resource.

2636-053 **The ConditionRccp control point cannot be obtained.**

Explanation: The Event Response Resource Manager cannot obtain the ConditionRccp control point to perform functions within the CoditionRccp.

User Response: Make sure the system has plenty of resources (paging space, available file system space, and so on). If the problem persists, record the above information and contact your software service organization.

2636-054 **The AssociationRccp control point cannot be obtained.**

Explanation: The Event Response Resource Manager cannot obtain the AssociationRccp control point to perform functions within the AssociationRccp.

User Response: Make sure the system has plenty of resources (paging space, available file system space, and so on). If the problem persists, record the above information and contact your software service organization.

2636-055 Error from RMC
RMCAPI_function_name, rc=value returned by the RMCAPI function, mc_errnum = 0x error number generated from the RMCAPI function., mc_error_msg is error message generated from the RMCAPI function.

Explanation: The Event Response Resource Manager invokes a RMCAPI function. If this RMCAPI function cannot be successfully completed, the error number and error message are generated and returned to the user.

User Response: Locate the RSCT documentation on the RMC and follow the recovery actions described for the error. If you cannot resolve the problem, record the above information and contact your software service organization.

2636-056 Value for Condition ImmediateEvaluate attribute must be 0 or 1.

Explanation: When defining or changing a Condition resource, the user supplied a value for Condition ImmediateEvaluate attribute that is not 0 or 1.

User Response: Change the value of the ImmediateEvaluate attribute to either a 0 or 1 and resubmit the request.

2636-057 Value for Condition Severity attribute must be 0, 1 or 2.

Explanation: When defining or changing a Condition resource, the user supplied a value for Condition Severity attribute that is not 0, 1, or 2.

User Response: Change the value of the Severity attribute to either a 0, 1 or 2 and resubmit the request.

2636-058 Value for Association ActiveFlag attribute must be 0 or 1.

Explanation: When defining or changing an Association resource, the user supplied a value for ActiveFlag attribute that is not 0 or 1.

User Response: Change the value of the ActiveFlag attribute to either a 0 or 1, and resubmit the request.

2636-059 A Condition resource handle and an EventResponse resource handle with the same values already exist in an Association resource.

Explanation: When defining or changing an Association resource, the user supplied values for the ConditionHandle attribute and EventResponseHandle attribute that are the same within an existing Association resource.

User Response: Select a different combination of an EventResponse resource handle and a Condition

resource handle and resubmit the request.

2636-060 The DynamicAttribute value does not match the value in the EventExpression.

Explanation: When defining or changing a Condition resource, the user supplied a value for DynamicAttribute attribute that does not match the dynamic attribute value that is specified in EventExpression attribute.

User Response: Modify either the DynamicAttribute or the EventExpression so that they agree, and resubmit the request.

2636-061 This attribute was not changed because of an error in another attribute in the group to be changed.

Explanation: When changing multiple attributes with a single RMCAPI call, all of the attributes must be valid for the attributes to be changed. If there is an error with any of the attributes in the group to be changed, none of the attributes specified in the group are changed. A valid attribute value cannot be changed because an error in another attribute was detected.

User Response: Correct the error and resubmit the request.

2636-062 The EventResponseRCCP control point cannot be obtained.

Explanation: The Event Response Resource Manager cannot obtain the EventResponseRCCP control point to perform functions within the EventResponseRCCP.

User Response: Make sure the system has plenty of resources (paging space, available file system space, and so on). If the problem persists, record the above information and contact your software service organization.

2636-063 RMC Error: error message generated from RMC..

Explanation: The Event Response Resource Manager invokes a RMC function. If this RMC function cannot be successfully completed, the error message is generated and returned to the user.

User Response: Locate the RSCT documentation on the RMC and follow the recovery actions described for the error. If you cannot resolve the problem, record the above information and contact your software service organization.

2636-064 Action identifier *action_identifier* is not valid for class *resource_class_name*.

Explanation: The specified action is not supported by the resource class.

User Response: The user must not invoke the action on this resource class.

2636-065 **The number of parameters passed to the action is not valid.**

Explanation: A client program attempted to invoke an action, but the number of parameters specified is not valid.

User Response: The client program must provide the correct number of parameters and resubmit.

2636-066 **The data type of one or more parameters passed to the action is not valid.**

Explanation: A client program attempted to invoke an action but specified the wrong type of parameters.

User Response: The client must provide the correct type of parameters and resubmit.

2636-067 **A Condition name cannot be a NULL string or contain all spaces.**

Explanation: A client program provided a Condition name that is a NULL string or that contains only spaces

2637 - File System RM Messages

2637-000 **Attribute identifier is not valid.**

Explanation: The number submitted as an attribute identifier does not represent an attribute for this class.

User Response: Change the attribute identifier to a valid attribute number for this class.

2637-001 **Error from registry call**
registry_function_called, rc=
error_return_code.

Explanation: The registry is unable to complete a request from FSRM.

User Response: Locate the RSCT registry documentation and follow the corrective actions described for the function and return code displayed in this message.

2637-002 **Attribute *resource_attribute_name* cannot be specified as part of the definition of a new resource, but is otherwise valid.**

Explanation: The user attempted to define a resource attribute that is not under the control of the user when resources are defined.

User Response: Remove this attribute from the define resource call.

when the client attempted to define a Condition or set a Condition name.

User Response: The client program must provide a non-NULL string that contains at least one character other than a space for the Condition name and resubmit.

2636-068 **An EventResponse name cannot be a NULL string or contain all spaces.**

Explanation: A client program provided an EventResponse name that is a NULL string or that contains all spaces when the client attempted to define an EventResponse or set an EventResponse name attribute.

User Response: The client program must provide a non-NULL string that contains at least one character other than a space for the EventResponse name and resubmit.

2637-003 **Resource handle specified does not exist.**

Explanation: The user supplied a ResourceHandle attribute that does not match a resource that is currently defined.

User Response: Change the specified ResourceHandle to match a resource that is defined.

2637-004 **Error *error_code* returned from registry function *function_name*.**

Explanation: The registry function failed.

User Response: Record the above information and contact your software service organization.

2637-005 **Attribute *read-only_attribute_name* is read-only and cannot be set.**

Explanation: The user is attempting to modify an attribute that cannot be modified by this user.

User Response: Do not attempt to modify this attribute.

2637-006 **Attribute *attribute_name* appears in request more than once.**

Explanation: The user has supplied the same attribute for a single request more than one time.

User Response: Remove multiple copies of the same attribute within a single request.

2637-007 **The value specified for attribute *attribute_name* has the wrong data type.**

Explanation: The user has specified an attribute with a data type that does not match the data type of the definition of the attribute. For example, the attribute is defined as a string but the user supplied an integer instead.

User Response: Correct the data type specified for the attribute named in the error message and resubmit the request.

2637-008 **Resource class name *resource_class_name* is not recognized by this resource manager.**

Explanation: The File System Resource Manager does not recognize the named resource class as belonging to this resource manager.

User Response: Locate the RSCT documentation on the RMC and try rebuilding the CBD. If that does not correct the problem, record the above information and contact your software service organization.

2637-009 **The control point for resource class *resource_class_name* cannot be initialized.**

Explanation: The File System Resource Manager was unable to create an RCP object.

User Response: Make sure that the system has plenty of resources (paging space, available file system space, and so on). If the problem persists, record the above information and contact your software service organization.

2637-010 **The control point for the target resource cannot not be initialized.**

Explanation: The File System Resource Manager was unable to create an RCP object.

User Response: Make sure that the system has plenty of resources (paging space, available file system space, and so on). If the problem persists, record the above information and contact your software service organization.

2637-011 **An unexpected exception *exception_name* was caught with error code *error_code*.**

Explanation: An internal error has occurred.

User Response: Record the above information and

contact your software service organization.

2637-012 **An unexpected exception *exception_name* was caught.**

Explanation: An internal error has occurred.

User Response: Record the above information and contact your software service organization.

2637-013 **Attribute *attribute_name* must be specified when a new resource is defined.**

Explanation: The user forgot to include this attribute when defining a new resource.

User Response: Specify this attribute on the resource definition.

2637-014 **The values for the NodeList attribute must be less than or equal to 4096.**

Explanation: The user specified a NodeList attribute greater than 4096.

User Response: Check with the System Administrator and choose a NodeList attribute less than or equal to 4096.

2637-015 **The value for the ManualMode attribute must be 0 or 1.**

Explanation: The user specified a ManualMode attribute other than 0 or 1. This attribute is currently ignored.

User Response: Specify a ManualMode attribute of 0 or 1.

2637-016 **Action identifier *action_identifier* is invalid for class *resource_class_name*.**

Explanation: The user specified an action identifier that is not valid for *resource_class_name*.

User Response: Specify another action identifier.

2639 - AuditLog Resource Manager Messages

2639-000 **Attribute identifier is invalid.**

Explanation: The number attribute identifier specified does not represent an attribute for this class.

User Response: Change the attribute identifier to a valid attribute number for this class.

2639-001 **Error from registry call *registry_function*, *rc=error_return_code*.**

Explanation: The registry is unable to complete a request from AuditRM.

User Response: Locate the RSCT registry documentation and follow the corrective actions described for the function and return code displayed in this message.

2639-002 **Attribute *resource_attribute_name* cannot be specified when defining a new resource.**

Explanation: When defining a new resource, the user specified an attribute whose value is automatically generated and therefore is not valid.

User Response: Remove this attribute from the define resource call.

2639-003 **The ResourceHandle specified does not exist.**

Explanation: The user supplied a ResourceHandle that does not match a resource that is currently defined.

User Response: Change the specified ResourceHandle to match a resource that is defined.

2639-005 **Attribute *read-only attribute name* is read-only and cannot be set.**

Explanation: The user attempted to modify an attribute value that cannot be changed.

User Response: Do not attempt to modify this attribute.

2639-006 **Attribute *attribute_name* appears in request more than once.**

Explanation: The user has supplied the same attribute for a single request more than one time.

User Response: Remove multiple copies of the same attribute within a single request.

2639-007 **The value specified for attribute *attribute_name* has the wrong data type.**

Explanation: The user has specified an attribute value with a data type that does not match the definition of the attribute. For example, the attribute is defined as a

string but the user supplied an integer instead.

User Response: Correct the data type specified for the attribute named in the error message and resubmit the request.

2639-008 **Resource class name *resource_class_name* is not recognized by this resource manager.**

Explanation: The Audit Log Resource Manager does not recognize the named resource class as belonging to it. This is either an internal error, or indicates a damaged RMC configuration.

User Response: Record the above information and contact your software service organization.

2639-009 **The control point for resource class *resource_class_name* could not be initialized.**

Explanation: The Audit Log Resource Manager was unable to initialize itself for the named resource class.

User Response: Make sure the system has plenty of resources (paging space, available */var* file system space, and so on). If this does not resolve the problem, record the above information and contact your software service organization.

2639-010 **The control point for the target resource cannot not be initialized.**

Explanation: The Audit Log Resource Manager was unable to initialize itself for handling a resource.

User Response: Make sure the system has plenty of resources (paging space, available file system space, and so on). If this does not resolve the problem, record the above information and contact your software service organization.

2639-013 **Attribute *resource_attribute_name* must be specified when a new resource is defined.**

Explanation: A required attribute was not specified when the user attempted to define a new resource.

User Response: Add the missing attribute and try the define operation again.

2639-016 **Action identifier *action_identifier* is not valid for class *resource_class_name*.**

Explanation: The specified action is not supported by the resource class.

User Response: Do not invoke the action on this resource class.

2639-017 **The number of elements in template field definition is not correct.**

Explanation: The user did not specify all of the characteristics required to define a field in an Audit Log template.

User Response: Correct the request to provide all of the required characteristics and resubmit the request.

2639-018 **The data type of an element of a field definition is not valid.**

Explanation: The user specified the wrong data type for a characteristic of a field definition in an Audit Log Template resource.

User Response: Correct the data type in the request and resubmit.

2639-019 **Unknown subsystem name *subsystem_name* specified in template definition.**

Explanation: The user attempted to define a new Audit Log Template for a subsystem that has not been defined.

User Response: Either correct the request to refer to a subsystem that has been defined, or create an Audit Log resource for the subsystem and resubmit the request.

2639-020 **The name of a template field *index of the template field within the template definition* is either empty or contains characters which are not valid.**

Explanation: The user did not specify a valid name for a field of an Audit Log Template.

User Response: Correct the request to specify a valid name for every field of the Audit Log Template.

2639-021 **The data type of field *name of the template field* is not valid.**

Explanation: The user specified a data type for a template field that is not valid.

User Response: Correct the field definition to use a valid data type and resubmit.

2639-022 **The properties for field *name of the template field* are not valid.**

Explanation: The user specified a property for a template field that is not valid.

User Response: Correct the field definition to use supported properties and resubmit the request.

2639-023 **Field name *name of the template field* has characteristics which are not consistent with uses in other templates.**

Explanation: The user has attempted to use the same field name in multiple templates for one subsystem but the characteristics are not the same in all of them.

User Response: Correct the template definitions to ensure that all fields of the same name within a subsystem have the same characteristics.

2639-024 **The specified subsystem name is either empty or contains characters that are not valid.**

Explanation: The user attempted to define a subsystem with a name that is not valid.

User Response: Correct the request to provide a valid subsystem name.

2639-025 **The specified catalog name is either empty or contains characters which are not valid.**

Explanation: The user has attempted to define a subsystem to the Audit Log Resource Manager but has omitted a message catalog name.

User Response: Resubmit the request, specifying a valid message catalog name.

2639-026 **The subsystem *name of the subsystem* cannot be deleted until all of its templates are deleted.**

Explanation: The user attempted to remove a subsystem definition prior to deleting all of its template definitions (AuditLogTemplate resources).

User Response: Remove all templates for a subsystem prior to deleting it.

2639-027 **The specified template id is larger than the maximum of 65535.**

Explanation: The user attempted to define an audit log template with an id larger than the maximum supported.

User Response: Choose a template id less than 65535 and resubmit the request.

2639-028 **The specified template id is already defined.**

Explanation: The user attempted to define a template with the same identifier as one that already exists.

User Response: Choose a template id that is not already defined and resubmit the request.

2639-029 **Subsystem name** *name of the subsystem is already defined.*

Explanation: The user has attempted to define a new subsystem to the Audit Log Resource Manager but the specified subsystem name is already defined.

User Response: Either choose a different name for the new subsystem or remove the existing subsystem prior to resubmitting the request.

2639-030 **Incorrect number of fields in record for subsystem** *name of the subsystem.*

Explanation: The specified subsystem attempted to create an audit log record that has an incorrect number of fields.

User Response: This is most likely an internal error in the specified subsystem. Please refer to the documentation for that subsystem.

2639-031 **The data type of a common field within an audit log record for subsystem** *name of the subsystem is not correct.*

Explanation: The specified subsystem attempted to create an audit log record that has an incorrect data type for one of the common fields.

User Response: This is most likely an internal error in the specified subsystem. Please refer to the documentation for that subsystem.

2639-032 **Template id** *nonexistent template id of subsystem name of the subsystem is not defined.*

Explanation: The specified subsystem attempted to create an audit log record that refers to a template that has not been defined.

User Response: This is most likely an internal error in the specified subsystem. Please refer to the documentation for that subsystem.

2639-033 **Wrong data type in record field** *index of the field of template id id of the template that the request refers to for subsystem name of the subsystem.*

Explanation: The specified subsystem attempted to create an audit log record that has the wrong data type for the indicated field.

User Response: This is most likely an internal error in the specified subsystem. Please refer to the documentation for that subsystem.

2639-034 **There is no room in the AuditLog file to contain the new record.**

Explanation: A request has been received to add a new record to the audit log, but there is no more space available.

User Response: The administrator must remove records from the audit log. For example, use the **rmaudrec** command or modify the pruning controls to enable the Audit Log Resource Manager to automatically remove records from the audit log when needed.

2639-035 **The number of parameters passed to the retrieve records request is not valid.**

Explanation: A client program attempted to retrieve records from the audit log, but the number of parameters specified is not valid.

User Response: Correct the client program to provide the correct number of parameters, and resubmit the request.

2639-036 **The data type of one or more parameters on the retrieve records request is not valid.**

Explanation: A client program attempted to retrieve records from the audit log, but specified the wrong data type for one or more parameters.

User Response: Correct the client program to provide the correct type of parameters, and resubmit the request.

2639-037 **The value of the detail parameter in a request to retrieve records from the audit log is not 0 or 1.**

Explanation: A client program attempted to retrieve records from the audit log, but specified a value for the detail parameter that is not valid.

User Response: Correct the client program to provide a valid value for the detail parameter, and resubmit the request.

2639-038 **The number of parameters passed to the delete records request is not valid. It must be one.**

Explanation: A client program attempted to delete records from the audit log, but the number of parameters specified in the request is not valid.

User Response: Correct the client program to provide the correct number of parameters, and resubmit the request.

2639-039 **The data type of one or more parameters for the delete records request is not valid.**

Explanation: A client program attempted to delete records from the audit log, but specified the wrong data type for one or more parameters.

User Response: Correct the client program to provide the correct type of parameters, and resubmit the request.

2639-040 **The format string for the template is missing.**

Explanation: A client program attempted to define a template, but the format string attribute is missing.

User Response: Correct the client program to provide the format string, and resubmit the request.

2639-041 **The format string for the template contains substitution specifiers which are not valid.**

Explanation: A client program attempted to define a template, but the format string attribute contains substitution specifiers (for example, %1\$s) which are not valid.

User Response: Correct the client program to provide a valid format string, and resubmit the request.

2639-100 *name of the command* : **The following error was detected when issuing the RMC API function** *name of the api function* : *error message from RMC.*

Explanation: The RMC subsystem encountered a problem in processing a call from one of the audit log commands.

User Response: Refer to the RMC publications for further information.

2639-102 *name of the command*: **The date and time specification must be an even number of decimal characters.**

Explanation: A time and date value was encountered in a record selection string that does not have an even number of characters.

User Response: Refer to the man page for the **Isaudrec** or **rmaudrec** command, and correct the selection string.

2639-103 *name of the command*: **Unexpected error returned from** *name of a function.*

Explanation: The indicated function returned an error that was not expected.

User Response: Record the above information and contact your software service organization.

2639-104 *name of the command*: **The specified absolute or relative time is not valid.**

Explanation: A time value was specified in a selection string that is not valid.

User Response: Refer to the **Isaudrec** or **rmaudrec** man page and correct the selection string.

2639-105 *name of the command*: **The following error was returned from the RMC subsystem:** *error message from RMC.*

Explanation: The RMC subsystem encountered the listed error while processing a request.

User Response: Refer to the RMC publications for further information.

2639-106 *name of the command*: **invalid_operand is not a valid operand. It must be one of the common field names.**

Explanation: A record field name was specified as an operand that is not one of the fields that is common to all records.

User Response: Refer to the man page for **Isaudrec** for a list of the available field names.

2639-107 *name of the command* : **A record was retrieved from the audit log that has a format that is not valid and therefore cannot be displayed.**

Explanation: This is typically an internal error that indicates the audit log may be damaged.

User Response: Delete the audit log record. If the problem persists, record the above information and contact your software service organization.

2639-108 *command_name*: **The specified subsystem** *subsystem name that is not recognized.* **does not exist.**

Explanation: The value specified with the **-n** flag is not a recognized subsystem name.

User Response: Determine the list of defined subsystems and try the command again.

2641 - RM Utilities Messages

2641-000 **Failure allocating** *allocation request size bytes of memory.*

Explanation: A request to allocate memory failed.

User Response: Attempt to restart the failing component or process that made the request. Either the requesting process has a memory leak or has reached its maximum memory size. By restarting the requesting component or process, any memory leaks are cleaned up.

2641-001 **Binary constant does not have an even number of characters near** *substring of expression.*

Explanation: The expression or selection string contains a binary constant that does not have an even number of characters.

User Response: Correct the binary constant in the expression.

2641-002 **Error in resource handle constant near** *substring of expression. A value starting with either 0x or 0X was expected.*

Explanation: The expression or selection string contains a resource handle constant which has incorrect syntax. A resource handle constant must consist of five integer constants enclosed in double or single quotes.

User Response: Correct the resource handle constant in the expression.

2641-003 **The hex value specified near** *substring of expression in resource handle constant is not valid.*

Explanation: The expression or selection string contains a resource handle constant which has incorrect syntax. A resource handle constant must consist of five integer constants enclosed in double or single quotes.

User Response: Correct the resource handle constant in the expression.

2641-004 **Too few values specified for resource handle constant near** *substring of expression near the syntax error.*

Explanation: The expression or selection string contains a resource handle constant which has incorrect syntax. A resource handle constant must consist of five integer constants enclosed in double or single quotes.

User Response: Correct the resource handle constant in the expression.

2641-005 **The variable name** *variable_name* **is not recognized.**

Explanation: The expression or selection string contains a variable name which is not defined.

User Response: Correct the expression to reference valid variable names.

2641-006 **Internal error. Constant contains a character that is not valid at offset** *offset in expression of syntax error.*

Explanation: An incorrect character was detected while parsing a numeric constant. This problem should not occur and indicates an internal error in the expression utilities.

User Response: Record the specific error message and the original expression string, then contact your software service organization.

2641-007 **The left operand for operator . is not valid.**

Explanation: The left operand for the field separator operator is not a variable of type structured data.

User Response: Correct the expression syntax.

2641-008 **The left operand data type is not valid for the** *operator that has an invalid left operand operator.*

Explanation: The left operand for the specified operator does not have a compatible data type.

User Response: Correct the operand or operator in the expression to be compatible.

2641-009 **The right operand data type is not valid for the** *operator that has an invalid right operand operator.*

Explanation: The right operand for the specified operator does not have a compatible data type.

User Response: Correct the operand or operator in the expression to be compatible.

2641-010 **The operands are incompatible for** *operator operator that has incompatible operands.*

Explanation: The data types of the operands are not compatible with the specified operator.

User Response: Correct the operands or operator in the expression to be compatible.

2641-011 **The character *erroneous_character* near offset *offset* in expression is not a valid operator.**

Explanation: The expression or selection string contains an incorrect operator.

User Response: Change the expression to use valid operators.

2641-012 **The multi-character operator near offset *offset* of invalid operator is not a valid operator.**

Explanation: The expression or selection string contains an incorrect operator.

User Response: Change the expression to use valid operators.

2641-013 **Syntax error. Too few operands for operator *operator* that has the wrong number of operands.**

Explanation: The expression or selection string contains the wrong number of operands for the specified operator.

User Response: Change the expression to use valid operands.

2641-014 **Syntax error. Missing operators or operands.**

Explanation: The expression or selection string is missing an operator or operand.

User Response: Change the expression to correct the syntax error.

2641-015 **Syntax error. Unmatched *unmatched_character* near offset *offset* in expression.**

Explanation: The expression or selection string is missing the closing character of a matched pair. Parentheses, square brackets and braces are examples of characters that are in this category.

User Response: Change the expression so that all delimiters are properly paired.

2641-016 **Expression has too many operators to be processed.**

Explanation: The expression or selection string contains more operators than the evaluation utility can handle.

User Response: Reduce the number of operands in the expression.

2641-017 **Expression has too many operands to be processed.**

Explanation: The expression or selection string contains more operands than the evaluation utility can handle.

User Response: Reduce the number of operands in the expression.

2641-018 **Expression has no operators, or the data type of the expression result is not valid.**

Explanation: The expression or selection string does not contain any operators or the result of the expression is not a scalar numeric value.

User Response: Change the expression so that the final result is a numeric value.

2641-019 **The compiled expression is not valid or is missing.**

Explanation: The pointer to the compiled expression is either NULL or points to an area of memory which does not contain a compiled expression.

User Response: Make sure that the call to `cu_comp_expr()` that produced the compiled expression returned a successful return code. Otherwise, verify that the correct pointer to a previously compiled expression is provided.

2641-020 **A value for a required variable could not be obtained.**

Explanation: The expression utility could not get a value for a variable in an expression or selection string. The component that called the expression utility must have encountered an error, since it provides the values for each variable in the expression.

User Response: If it is your component that called the expression utility, make sure that you are providing values for all variables in the expression. If some other component is the one that called the expression utility, contact your software service organization.

2641-021 **Evaluation of expression results in a division by 0.**

Explanation: The expression or selection string contains a division operation in which the divisor is 0.

User Response: Correct the expression to avoid dividing by zero.

2641-022 **Operands have incompatible data types near offset** *offset in expression.*

Explanation: The expression or selection string contains an operation whose operands are not compatible.

User Response: Correct the expression so the operation has compatible operands.

2641-023 **Error in binary constant. A value of either 0x or 0X was expected.**

Explanation: The expression or selection string contains a binary constant that is incorrect. A binary constant must be a sequence of 0xhh... or 0Xhh... enclosed in single or double quotes. 'hh' refers to an even number of hex characters (0-9,a-f,A-F).

User Response: Change the binary constant in the expression to be valid.

2641-024 **A character was encountered in the binary constant near** *substring of expression that is not valid.*

Explanation: The expression or selection string contains a binary constant that is incorrect. A binary constant must be a sequence of 0xhh... or 0Xhh... enclosed in single or double quotes. 'hh' refers to an even number of hex characters (0-9,a-f,A-F).

User Response: Change the binary constant in the expression to be valid.

2641-025 **Constant near offset** *offset in the expression where the error was detected is out of range.*

Explanation: The expression or selection string contains a numeric constant that is too large or too small to be represented.

User Response: Change the constant in the expression to be within the representable range for integers or floats.

2641-026 **The right operand for the . operator is not valid.**

Explanation: The expression or selection string contains a field separator operator with a right operand which is not a variable name.

User Response: Change the expression to correct the error.

2641-027 **Unrecognized option specified.**

Explanation: One of the options passed to `cu_comp_expr()` is not valid.

User Response: Correct the options parameter that is passed to `cu_comp_expr()`.

2641-028 **A function pointer for the specified cu_mem_func_t structure is missing.**

Explanation: The caller of one of the expression utilities specified the option to pass a list of functions for memory allocation that the expression utility was to use. However, one of the provided function pointers is NULL.

User Response: Correct the parameters passed to the expression utility.

2641-029 **Syntax error near offset** *offset in expression.*

Explanation: A syntax error was detected in the expression or selection string.

User Response: Change the expression to correct the syntax error.

2641-031 **The provided value list does not contain enough values to execute the expression.**

Explanation: The list of values passed to `cu_exec_expr()` does not contain enough values. The compiled expression contains references to more variables.

User Response: Correct the list of values passed to `cu_exec_expr()`.

2641-032 **The range specification is not valid. The left operand must be less than or equal to the right operand.**

Explanation: The expression or selection string contains a range specification which is not valid. The value of the left operand is greater than the value of the right operand. For example, the range "1..0" would produce this error.

User Response: Change the expression to correct the range specification.

2641-033 **The regular expression is not valid, and the resulting error code from regcomp() is return_code.**

Explanation: The expression or selection string contains a regular expression operator and the provided pattern is not a valid regular expression.

User Response: Refer to the man pages for `regcomp()` to determine the meaning of the specified error code and correct the pattern.

2645 - RM Framework Messages

2645-000 **Operation failed due to error *error_code* returned from *name of function*.**

Explanation: The specified function returned the indicated error code.

User Response: Refer to the man page for the specified function to determine the meaning of the error code.

2645-001 **No function pointer was specified for the operation.**

Explanation: A pointer to a notification function was not provided to `RMSchedule::addOperation()`.

User Response: Correct the parameter list passed to `RMSchedule::addOperation()`.

2645-002 **No operation name was specified.**

Explanation: A name for the operation was not provided to `RMSchedule::addOperation()`.

User Response: Correct the parameter list passed to `RMSchedule::addOperation()`.

2645-003 **The specified period *time_period (sec)* between operations is not valid.**

Explanation: The period parameter passed to `RMSchedule::addOperation()` must have a value greater than zero.

User Response: Correct the period parameter so that its value is greater than zero.

2645-004 **Operation failed due to exception *exception_name* from *name of failed function*.**

Explanation: The specified function failed due to the indicated exception.

User Response: Refer to the man page for the specified function to determine the meaning of the error.

2645-005 **A class name must be specified to create an `Rccp`.**

Explanation: The resource class name passed to the constructor for class `RMRccp` is empty or `NULL`.

User Response: Correct the resource class name parameter that is passed to the constructor.

2645-006 **Operation failed due to exception *exception_name* from *name of function* with error code *error_code*.**

Explanation: The operation failed due to an error being returned from the specified function.

User Response: Refer to the man page or other

documentation for the indicated function to determine the meaning of the specified error code.

2645-007 **A new thread cannot be started because the maximum number are already running.**

Explanation: `RMRmcp::startCallbackThread()` cannot create a new thread because it has reached the maximum number that it was designed to handle.

User Response: Avoid using more than 16 callback threads.

2645-008 **A non-fatal error was encountered in *function_name* with error code *error_code*.**

Explanation: The indicated error code was returned from the specified function but the operation continued.

User Response: This is most likely an internal error. Contact your software support organization and convey this error information.

2645-009 **An unexpected exception *exception_name* was caught with error code *error_code*.**

Explanation: An error situation was encountered in which the named C++ exception was caught.

User Response: The name of the exception and error code should convey the reason for the error.

2645-010 **An unexpected exception *exception_name* was caught.**

Explanation: An error situation was encountered in which the named C++ exception was caught.

User Response: The name of the exception indicates the cause of the error. If this is not clear, contact your software support organization.

2645-011 **Too many substitution parameters were specified for selecting or deleting rows.**

Explanation: A selection string was specified which has more than 20 substitution parameters which is the maximum supported.

User Response: Reduce the number of substitution parameters in the selection string.

2645-012 **Registry table cannot be created because it already exists.**

Explanation: The request to create a new registry table failed because the named table already exists.

User Response: This is normally not an error, and the

application continues using the existing table. If this is unexpected, remove the registry table prior to attempting to create it.

2645-013 A table name was specified that is not valid.

Explanation: The table name used to create a new table is not valid. The table name must specify an absolute path within the registry directory hierarchy.

User Response: Correct the table name and try to create the table again.

2645-014 The specified pointer does not identify an existing table.

Explanation: The parameter that should be a pointer to a table object does not refer to a valid table object.

User Response: Correct the table pointer parameter.

2645-015 At least one table must be specified.

Explanation: The request to obtain a lock on a set of registry tables failed since no tables were specified in the request.

User Response: Correct the list of tables so that there is at least one table in the list to be locked.

2645-016 Global lock scope is not currently supported.

Explanation: The request to obtain a global lock on a set of registry tables failed since the global lock scope is not currently supported.

User Response: Do not attempt to use the global lock scope.

2645-017 A table is present in both the shared and exclusive lists for the lock request.

Explanation: The request to obtain a lock on a group of tables failed, since at least one table exists in both the shared and exclusive lock lists.

User Response: Correct the lists of tables that are passed to the lock request.

2645-018 A lock set is already active for the calling thread.

Explanation: To avoid deadlock, each thread is restricted to only hold one lock set at a time.

User Response: Do not request more than one lock set at a time on each thread.

2645-019 The specified lock set identifier does not identify an existing lock set.

Explanation: An incorrect lock set identifier was specified on the request.

User Response: Correct the request to reference a valid lock set identifier.

2645-020 The lock set can only be referenced by the owning thread.

Explanation: The request cannot be completed since the calling thread is not the thread that obtained the lock set.

User Response: Modify the request so that it is issued from the thread that obtained the lock set.

2645-021 A transaction is currently in progress.

Explanation: The request to unlock tables failed because there is a transaction in progress.

User Response: Commit or cancel the transaction prior to releasing the lock set.

2645-022 A transaction cannot be started because there are no tables locked for exclusive access.

Explanation: For a transaction to begin, an exclusive lock must be held on at least one table.

User Response: Lock the tables prior to beginning a transaction.

2645-023 Local tables cannot be included in a transaction.

Explanation: Tables in memory (that is, local tables) cannot be part of a transaction.

User Response: If a transaction is to be started, do not obtain exclusive locks on local tables.

2645-024 Transactions are not currently supported.

Explanation: Transactions are not currently supported.

User Response: Avoid using transactions until they are supported.

2645-025 Internal error. Metadata cannot be retrieved because table is not open.

Explanation: An attempt was made to reload the meta-data for a table from persistent storage, and the request failed because the persistent table is not open. This should not occur and indicates an internal error.

User Response: Contact your software service organization with the above information.

2645-026 Table cannot be opened because it does not exist.

Explanation: An attempt to open a table failed since the table does not exist.

User Response: Make sure that the table exists prior to opening it, or create the table instead of opening it.

2645-027 Exclusive lock cannot be obtained while shared lock is held.

Explanation: An attempt was made to obtain an exclusive lock on a table while the calling thread held a shared lock on the same table. This is not allowed.

User Response: Do not attempt to obtain an exclusive lock on a table which is already locked by the calling thread.

2645-028 Internal error. Requested lock mode is not valid.

Explanation: While processing a request on a table, an internal state was determined to be incorrect. This indicates that the specified table is not valid or that memory holding the table has been overlaid.

User Response: Contact your software service organization with the above information.

2645-029 No transaction is active.

Explanation: A request to commit or cancel a transaction failed since there was no active transaction.

User Response: Make sure that a transaction is active prior to attempting to commit or cancel it.

2645-030 Internal error. Attempt to unlock a table by a thread that does not hold a lock.

Explanation: This error indicates an internal problem in which an attempt was made to release a read/write lock on a table by a thread that does not currently hold the lock.

User Response: Contact your software service organization with the above information.

Appendix B. Installation and Configuration

The RSCT Resource Monitoring and Control application is part of the installation of the base operating system and does not need any special post-installation or other steps. When a monitoring request is directed for a resource class provided by an inactive resource manager, the resource manager is implicitly started by the Resource Monitoring and Control (RMC) subsystem. To determine whether RSCT Resource Monitoring and Control is present on your system, issue the **lssrc** command (for example: `lssrc -a`) and look for the following:

1. **IBM.AuditRM** (Audit Log resource manager)
2. **IBM.ERRM** (Event Response resource manager)
3. **IBM.FSRM** (File System resource manager)
4. **IBM.HostRM** (Host resource manager)
5. **ctrmc** (Resource Monitoring and Control subsystem)

Note: Always review the READ THIS FIRST document that accompanies the RSCT installation media for the latest information (`/usr/sbin/rsct/README/rsct.core.README`).

RSCT Resource Monitoring and Control Files

The RSCT Resource Monitoring and Control application is contained in the following file sets:

- **rsct.core**
 1. **rsct.core.utils**
 2. **rsct.core.sr**
 3. **rsct.core.rmc**
 4. **rsct.core.auditrm**
 5. **rsct.core.errm**
 6. **rsct.core.fsr**
 7. **rsct.core.gui**
 8. **rsct.core.hostrm**
 9. **rsct.core.sec**

Executables for RMC and the resource managers are stored in the `/usr/sbin/rsct` directory.

Log files for RMC and the resource managers are in the `/var/ct/IW/log/mc/` directory.

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Glossary

action. The part of the Event Response resource that contains a command and other information concerning the command.

Condition. A state of a resource as defined by the Event Response resource manager that is of interest to a client. It is defined by means of a logical expression called an event expression. Conditions apply to resource classes unless a specific resource is designated.

event. Occurs when the event expression of a condition evaluates to true. An evaluation occurs each time an instance of a dynamic attribute is observed.

event expression. A definition of the specific state when an event is true.

Event Response. One or more actions as defined by the Event Response resource manager that take place in response to an event or a rearm event.

FFDC. First Failure Data Capture provides a way to track problems back to their origination even though the source problem may have occurred in other layers or subsystems than the layer or subsystem with which the end user is interacting. FFDC provides a correlator called an `ffdc_id` for any error that it writes to the AIX error log. This correlator can be used to link related events together to form a chain.

rearm event. Occurs when the rearm expression for a condition evaluates to true.

rearm expression. An expression that generates an event which alternates with an original event in the following way: the event expression is used until it is true; then, the rearm expression is used until it is true; then, the event expression is used. The rearm expression is commonly the inverse of the event expression. It can also be used with the event expression to define an upper and lower boundary for a condition of interest.

resource. An entity in the system that provides a set of services. Examples of hardware entities are processors, disk drives, memory, and adapters. Examples of software entities are database applications, processes, and file systems. Each resource in the system has one or more attributes that define the state of the resource. (Note that in Web-based System Manager, attributes are referred to as properties.)

resource class. Broad category of system resource; for example, node, file system, adapter. Each resource class has a container that holds the functions, information, dynamic attributes, and conditions that

apply to that resource class. For instance, the `/tmp` space used condition applies to a File System resource class.

resource manager. A process that maps resource and resource-class abstractions into calls and commands for one or more specific types of resources. A resource manager can be a standalone daemon, or it can be integrated into an application or subsystem directly.

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