



**EXPRESSCLUSTER X SingleServerSafe 4.3 for Linux
Configuration Guide**

Release 3

NEC Corporation

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PREFACE

1.1 Who Should Use This Guide

The *Configuration Guide* is intended for system engineers who intend to introduce a system and system administrators who will operate and maintain the introduced system.

1.2 How This Guide Is Organized

- *2. EXPRESSCLUSTER X SingleServerSafe*: Provides a product overview of EXPRESSCLUSTER X SingleServerSafe.
- *3. Creating configuration data*: Describes how to start the Cluster WebUI / WebManager and the procedures to create the configuration data with a sample configuration.
- *4. Checking the cluster system*: Verify if the system that you have configured operates successfully.
- *5. Group resource details*: Provides details on group resources, which are used as a unit for controlling an application by using EXPRESSCLUSTER X SingleServerSafe.
- *6. Monitor resource details*: Provides details on monitor resources, which are used as a unit when EXPRESSCLUSTER X SingleServerSafe executes monitoring.
- *7. Heartbeat resources*: Provides details on the heartbeat resource.
- *8. Details of other settings*: Provides details on other settings of EXPRESSCLUSTER X SingleServerSafe.
- *9. Monitoring details*: Provides details on how several types of errors are detected.
- *10. Notes and restrictions*: Describes known problems and how to prevent them.

1.3 Terms Used in This Guide

EXPRESSCLUSTER X SingleServerSafe, which is described in this guide, uses windows and commands common to those of the clustering software EXPRESSCLUSTER X to ensure high compatibility with EXPRESSCLUSTER X in terms of operation and other aspects. Therefore, cluster-related terms are used in parts of the guide.

The terms used in this guide are defined below.

Cluster, cluster system A single server system using EXPRESSCLUSTER X SingleServerSafe

Cluster shutdown, reboot Shutdown or reboot of a system using EXPRESSCLUSTER X SingleServerSafe

Cluster resource A resource used in EXPRESSCLUSTER X SingleServerSafe

Cluster object A resource object used in EXPRESSCLUSTER X SingleServerSafe

Failover group A group of group resources (such as applications and services) used in EXPRESSCLUSTER X SingleServerSafe

1.4 EXPRESSCLUSTER X SingleServerSafe Documentation Set

The EXPRESSCLUSTER X SingleServerSafe documentation consists of the four guides below. The title and purpose of each guide is described below:

EXPRESSCLUSTER X SingleServerSafe Installation Guide

This guide is intended for system engineers who intend to introduce a system using EXPRESSCLUSTER X SingleServerSafe and describes how to install EXPRESSCLUSTER X SingleServerSafe.

EXPRESSCLUSTER X SingleServerSafe Configuration Guide

This guide is intended for system engineers who intend to introduce a system using EXPRESSCLUSTER X SingleServerSafe and system administrators who will operate and maintain the introduced system. It describes how to set up EXPRESSCLUSTER X SingleServerSafe.

EXPRESSCLUSTER X SingleServerSafe Operation Guide

This guide is intended for system administrators who will operate and maintain an introduced system that uses EXPRESSCLUSTER X SingleServerSafe. It describes how to operate EXPRESSCLUSTER X SingleServerSafe.

EXPRESSCLUSTER X SingleServerSafe Legacy Feature Guide

This guide is intended for system engineers who want to introduce systems using EXPRESSCLUSTER X SingleServerSafe and describes EXPRESSCLUSTER X SingleServerSafe 4.0 WebManager and Builder.

1.5 Conventions

In this guide, **Note**, **Important**, and **See also** are used as follows:

Note: Used when the information given is important, but not related to the data loss and damage to the system and machine.

Important: Used when the information given is necessary to avoid the data loss and damage to the system and machine.

See also:

Used to describe the location of the information given at the reference destination.

The following conventions are used in this guide.

Convention	Usage	Example
Bold	Indicates graphical objects, such as fields, list boxes, menu selections, buttons, labels, icons, etc.	In User Name, type your name. On the File menu, click Open Database.
Angled bracket within the command line	Indicates that the value specified inside of the angled bracket can be omitted.	<code>clpstat -s [-h <i>host_name</i>]</code>
#	Prompt to indicate that a Linux user has logged in as root user.	<code># clpcl -s -a</code>
Monospace	Indicates path names, commands, system output (message, prompt, etc), directory, file names, functions and parameters.	<code>/Linux/4.3/en/server/</code>
bold	Indicates the value that a user actually enters from a command line.	Enter the following: clpcl -s -a
<i>italic</i>	Indicates that users should replace italicized part with values that they are actually working with.	<code>rpm -i expressclssss-<version_number> -<release_number>.x86_64.rpm</code>



In the figures of this guide, this icon represents EXPRESSCLUSTER X SingleServerSafe.

1.6 Contacting NEC

For the latest product information, visit our website below:

<https://www.nec.com/global/prod/expresscluster/>

EXPRESSCLUSTER X SINGLESERVERSAFE

This chapter outlines the functions of EXPRESSCLUSTER X SingleServerSafe and describes the types of errors that can be monitored.

This chapter covers:

- 2.1. *EXPRESSCLUSTER X SingleServerSafe*
- 2.2. *How an error is detected in EXPRESSCLUSTER X SingleServerSafe*

2.1 EXPRESSCLUSTER X SingleServerSafe

EXPRESSCLUSTER X SingleServerSafe is set up on a server. It monitors for application errors and hardware failures on the server and, upon detecting an error or failure, automatically restarts the failed application or reboots the server so as to ensure greater server availability.

With an ordinary server, if an application has ended abnormally, you need to restart it when you realize that it has ended abnormally.

There are also cases in which an application is not running stably but has not ended abnormally. Usually, such an error condition is not easy to identify.

For a hardware error, rebooting the server might achieve recovery if the error is temporary. However, hardware errors are difficult to notice. The abnormal behavior of an application often turns out to be due to a hardware error when the application is checked.

With EXPRESSCLUSTER X SingleServerSafe, specify the applications and hardware components to be monitored for automatic error detection. Upon detecting an error, EXPRESSCLUSTER X SingleServerSafe automatically restarts the application or server that caused the error to recover from the error.

Note: As indicated above, in many cases, a physical hardware failure cannot be recovered from just by rebooting the server. To protect against physical hardware failure, consider implementing hardware redundancy or introducing clustering software.

2.2 How an error is detected in EXPRESSCLUSTER X SingleServer-Safe

EXPRESSCLUSTER X SingleServerSafe performs several different types of monitoring to ensure quick and reliable error detection. The details of the monitoring functions are described below.

- Monitoring activation status of applications

An error can be detected by starting up an application by using an application-starting resource (called application resource and service resource) of EXPRESSCLUSTER and regularly checking whether the process is active or not by using application-monitoring resource (called application monitor resource and service monitor resource). It is effective when the factor for application to stop is due to error termination of an application.

Note: If an application started directly by EXPRESSCLUSTER X SingleServerSafe starts and then ends a resident process to be monitored, EXPRESSCLUSTER X SingleServerSafe cannot detect an error in that resident process.

Note: An internal application error (for example, application stalling and result error) cannot be detected.

- Monitoring applications and/or protocols to see if they are stalled or failed by using the monitoring option.

You can monitor for the stalling and failure of applications including specific databases (such as Oracle, DB2), protocols (such as FTP, HTTP), and application servers (such as WebSphere, WebLogic) by introducing optional monitoring products of EXPRESSCLUSTER X SingleServerSafe. For details, see "Monitor resource details."

- Resource monitoring

An error can be detected by monitoring the resources (applications, services, etc.) and LAN status by using the monitor resources of EXPRESSCLUSTER X SingleServerSafe. It is effective when the factor for application to stop is due to an error of a resource that is necessary for an application to operate.

2.2.1 Errors that can and cannot be monitored for

For EXPRESSCLUSTER X SingleServerSafe, some errors can be monitored for, and others cannot. It is important to know what can or cannot be monitored when building and operating a cluster system.

2.2.2 Errors that can be detected and those that cannot through application monitoring

Monitoring conditions: Termination of application with errors, continuous resource errors, disconnection of a path to the network devices.

- Example of errors that can be monitored:
 - Abnormal termination of an application
 - LAN NIC problem
- Example of errors that cannot be monitored:
 - Application stalling and resulting in error.

EXPRESSCLUSTER X SingleServerSafe cannot directly monitor for application stalling or resulting errors. However, it is possible to make EXPRESSCLUSTER X restart by creating an application monitoring program to make EXPRESSCLUSTER X terminate if an error is detected, running the program by using the EXEC resource, and monitoring by using a PID monitor resource.

CREATING CONFIGURATION DATA

In EXPRESSCLUSTER X SingleServerSafe, data describing how a system is set up is called configuration data. Configuration data is created by using the Cluster WebUI. This chapter describes how to start the Cluster WebUI and the procedure for creating configuration data with a sample cluster configuration.

This chapter covers:

- 3.1. *Checking the values to be specified*
- 3.2. *Starting up the Cluster WebUI*
- 3.3. *Creating the configuration data*
- 3.4. *Saving configuration data*
- 3.5. *Applying configuration data*

3.1 Checking the values to be specified

Before creating configuration data by using the Cluster WebUI, check the values you are going to specify as the configuration data. Write down the values to make sure there is no missing information.

3.1.1 Sample environment

Sample configuration data values are shown below. The following sections describe step-by-step procedures for creating configuration data based on these conditions. When actually specifying the values, you might need to modify them according to the cluster you intend to create. For details about how to decide on the values, see "[5. Group resource details](#)" and "[6. Monitor resource details](#)".

Sample values of configuration data

Target	Parameter	Value
Server information	Server Name	server1
	Monitor Resource Count	3
Group	Type	Failover
	Group Name	failover1
	Startup Server	server1
First group resource	Type	EXEC resource
	Group Resource Name	exec1
	Resident Type	Resident
	Start Path	Path of execution file
First monitor resource (created by default)	Type	User mode monitor
	Monitor Resource Name	userw1
Second monitor resources	Type	IP monitor
	Monitor Resource Name	ipw1
	Monitor IP Address	192.168.0.254 (gateway)
	Recovery Target	LocalServer
	Reactivation Threshold	-
	Final Action	Stop service and reboot OS
Third monitor resources	Type	PID monitor
	Monitor Resource Name	Pidw1
	Target Resource	Exec1
	Recovery Target	failover1
	Reactivation Threshold	3
	Final Action	Stop service and reboot OS

Note: "User mode monitor" is automatically specified for the first monitor resource.

3.2 Starting up the Cluster WebUI

The configuration data can be created by accessing the Cluster WebUI. This section describes the overview of the Cluster WebUI and how to create the configuration data.

3.2.1 What is Cluster WebUI?

The Cluster WebUI is a function for monitoring the server status, starting and stopping servers and groups, and collecting operation logs through a web browser. The overview of the Cluster WebUI is shown in the following figure.

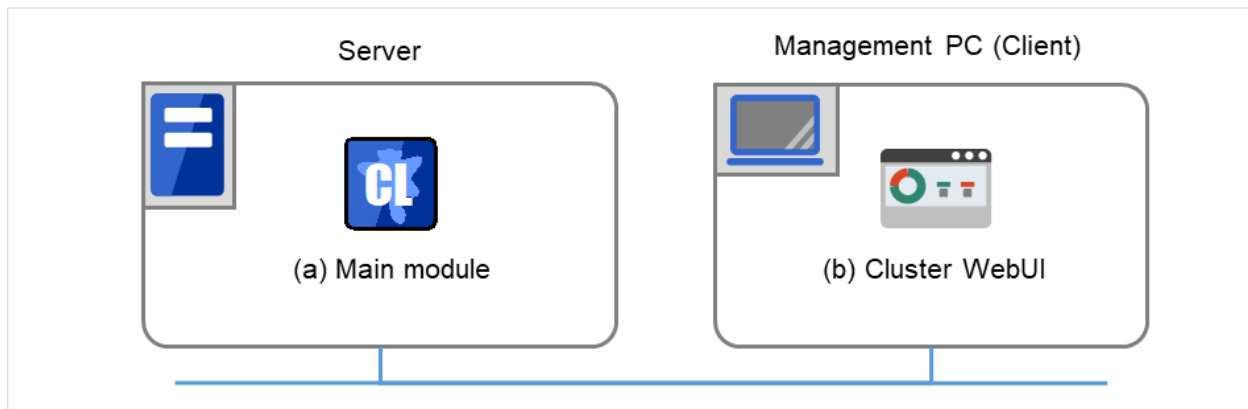


Fig. 3.1: Cluster WebUI

3.2.2 Starting the Cluster WebUI

The following describes how to start the Cluster WebUI.

1. Start your Web browser.

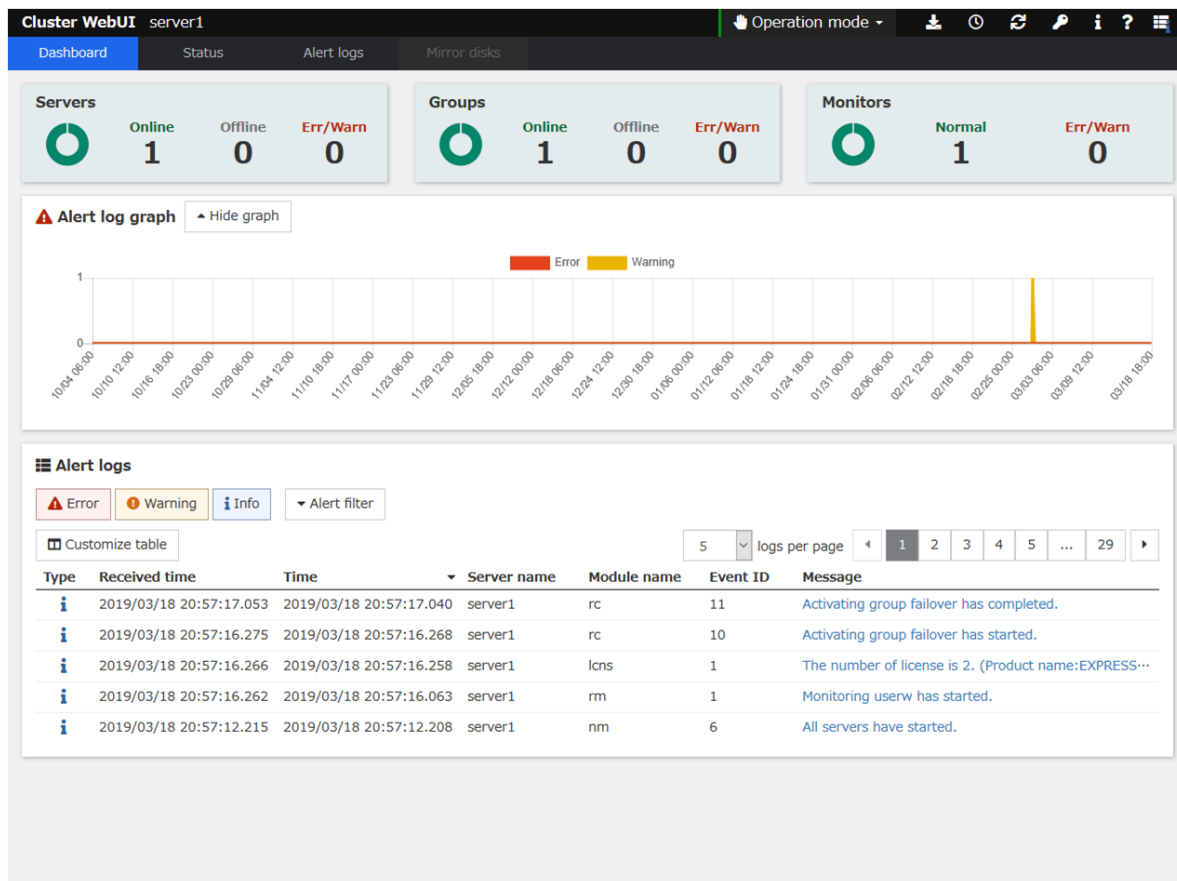
Enter the IP address and port number of the server where EXPRESSCLUSTER X SingleServerSafe is installed in the browser address bar.

`http://ip-address:port/`

ip-address Specify the IP address of a server where EXPRESSCLUSTER X SingleServerSafe is installed. In the case of a local server, a local host can be specified.

port Specify the same port number as that specified for WebManager at installation (default: 29003).

2. The Cluster WebUI starts.



- From the drop-down menu of the toolbar, select Config Mode to switch to the config mode.

See also:

To enable encrypted communication with EXPRESSCLUSTER Server, see "8.1.11. *WebManager tab*" in "8.1. *Cluster properties*" in "8. *Details of other settings*". Enter the following to perform encrypted communication.

`https://192.168.0.3:29003/`

3.3 Creating the configuration data

Creating the configuration data involves three steps: setting up the server, creating groups, and creating monitor resources. Use the cluster creation wizard to create new configuration data. The procedure is described below.

Note: Most of the created configuration data can be modified later by using the rename function or property viewing function.

- *3.3.1. 1. Setting up the server*

Set up the server on which to run EXPRESSCLUSTER X SingleServerSafe.

- *3.3.1. 1-1 Setting up the server*

Specify the server name to be configured.

- *3.3.2. 2. Setting up groups*

Set up groups. Starting and stopping an application is controlled by a group. Create as many groups as necessary. Generally, you need as many groups as the number of applications you want to control. However, when you use script resources, you can combine more than one application into a single group.

- *3.3.2. 2-1 Adding a group*

Add a group.

- *3.3.2. 2-2 Adding a group resource (EXEC resource)*

Add a resource that can start and stop an application.

- *3.3.3. 3. Setting up monitor resources*

Add a monitor resource that monitors the specified target.

Create a monitor resource for each monitoring target.

- *3.3.3. 3-1 Adding a monitor resource (IP monitor resource)*

Add a monitor resource that performs monitoring. (IP monitor resource)

- *3.3.3. 3-2 Adding a monitor resource (PID monitor resource)*

Add a monitor resource that performs monitoring. (IP monitor resource)

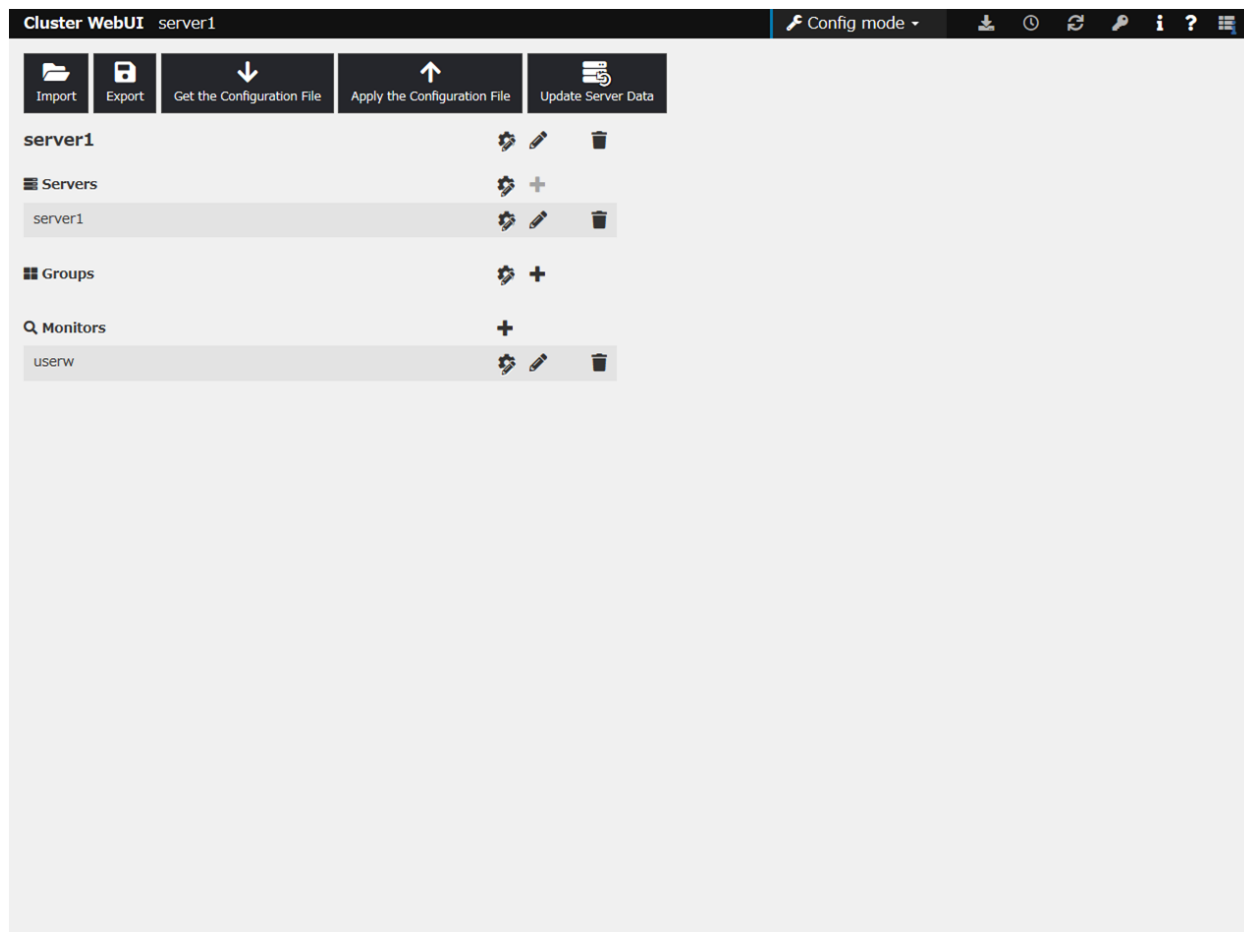
3.3.1 1. Setting up the server

Set up the server.

1-1 Setting up the server

The server settings are automatically created when you reboot the OS after installing EXPRESSCLUSTER X Single-ServerSafe. When you switch from the Cluster WebUI's operation mode window to the config mode window, you will see the created data.

The window is As follows:



3.3.2 2. Setting up groups

A group is a set of services and processes necessary to perform an independent operation in the system. The procedure for adding a group is described below.

2-1 Adding a group

Set up a group.

1. Click **Add group** in **Groups**.
2. The **Group Definition** dialog box is displayed.
Choose one of the types below.

Type:

- Failover
In general, specify this.
- Virtual machine
When using a virtual machine resource, specify this.

3. Make sure that the **Failover is possible on all servers** check box is selected, and then click **Next**.

Group Definition failover ✕

Basic Settings ✓ → **Startup Servers** → Group Attributes → Group Resource

Failover is possible at all servers ☒

Server

server1

i Select the server which can run the group and configure the priority of the servers.

In case that all the servers which are registered to the cluster can start the group, check "Failover is possible at all servers" on. The priority order is the order which was set when the server was registered to the cluster.

In case setting individually the server which can start the group, check "Failover is possible at all servers" off. Select the server which can start the group from the "Available Servers" list on the right side, and click "Add" to add the server to "Servers that can run the Group" list. Click "↑" or "↓" to change the priority order.

◀ Back
Next ▶
Cancel

4. This dialog box is used to specify the values of the group attributes. Click **Next** without specifying anything.
5. The **Group Resource Definitions** is displayed. Click **Finish** without specifying anything.

2-2 Adding a group resource (EXEC resource)

Add EXEC resource to start or stop the application by script.

1. Click **Add resource** of failover1.
2. The **Resource Definition of Group | failover** window is displayed.
Select the group resource type EXEC resource in the **Type** box, and then enter the group resource name exec1 in the **Name** box. Click **Next**.
3. A page for setting up a dependency is displayed. Click **Next**.
4. A page for setting up a recovery operation is displayed. Click **Next**.
5. Select **User Application**. Specify the path of the execution file for **Start Path**.
6. Click **Tuning** to open the dialog box. Next, click **Asynchronous** for **Start Script**, and then click **OK**.
7. Click **Finish**.

3.3.3 3. Setting up monitor resources

Add a monitor resource that monitors the specified target.

3-1 Adding a monitor resource (IP monitor resource)

1. Click **Add monitor resource** in **Monitors**. The **Monitor Resource Definitions** is displayed.
2. Select the monitor resource type **IP monitor** in the **Type** box, and enter the monitor resource name **ipw1** in the **Name** box. Click **Next**.

Note:

Monitor resources are displayed in **Type**. Select the resource you want to monitor.

If the licenses for optional products have not been installed, the resources and monitor resources corresponding to those licenses are not shown in the list on the Cluster WebUI.

3. Enter the monitoring settings. Click **Next without** changing the default value.
4. The **IP Addresses** is displayed. Click **Add**.
5. Enter the IP address to be monitored 192.168.0.254 in the **IP Address** box, and then click **OK**.

Note:

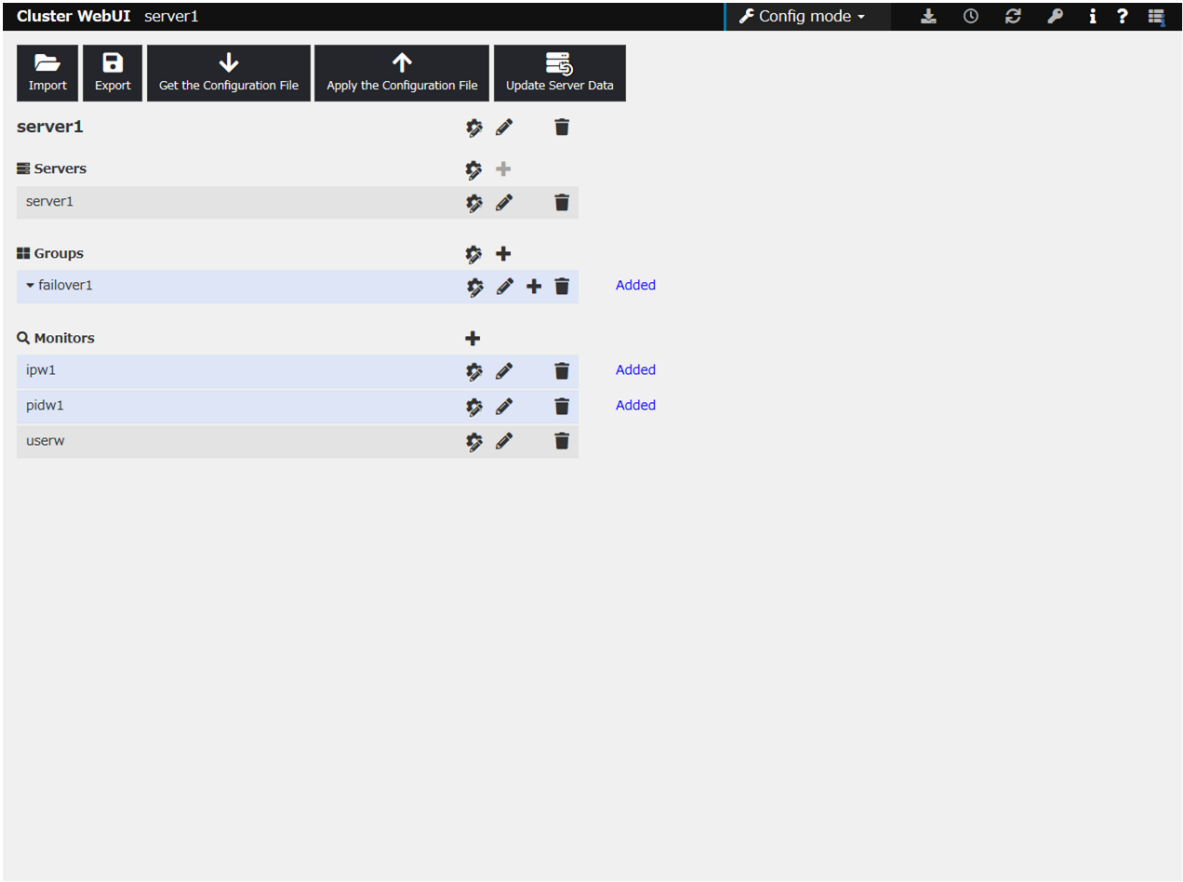
For the monitoring target of the IP monitor resource, specify the IP address of a device (such as a gateway) that is assumed to always be active on the LAN.

6. The entered IP address is set in the **IP Addresses**. Click **Next**.
7. Set **Recovery Target**. Select **LocalServer** on the tree view being displayed, and click **OK**. **LocalServer** is set to **Recovery Target**. Click **Browse**. click **Finish** without changing the default values.

3-2 Adding a monitor resource (PID monitor resource)

1. A monitor resource can be set up when the EXEC resource activation script type is set to **Asynchronous**.
2. Click **Add monitor resource** in **Monitors**. Select the monitor resource type **PID monitor** in the **Type** box, and then enter the monitor resource name **pidw1** in the **Name** box. Click **Next**.
3. Enter the monitoring settings. Click **Browse**.
4. Click **exec1** in the displayed tree view, and then click **OK**. **Exec1** is specified for **Target Resource**. Click **Next**.
5. Set the recovery target. Click **Browse**.
6. Click **failover1** in the displayed tree view. Click **OK**. **failover1** is set in the **Recovery Target**.
7. Click **Finish**.

After the settings are specified, the window appears as follows.



This concludes creating the configuration data. Proceed to the next section, "3.4. Saving configuration data"

3.4 Saving configuration data

The configuration data can be saved to a file system or to an external medium. You can apply the saved configuration data with Cluster WebUI to the servers for which the EXPRESSCLUSTER Server has been installed from the Cluster WebUI.

To save the configuration information, follow the procedure below:

1. Click **Export** in the config mode of Cluster WebUI.
2. Select a location to save the data and save it.

Note: One file (clp.conf) and one directory (scripts) are saved. If any of these are missing, the command does not run successfully. Make sure to treat these two as a set when moving the files. When new configuration data is edited, clp.conf.bak is created in addition to these two.

3.5 Applying configuration data

After creating configuration data by using the Cluster WebUI, apply the configuration data to the server.

To apply the configuration data, follow the procedure below.

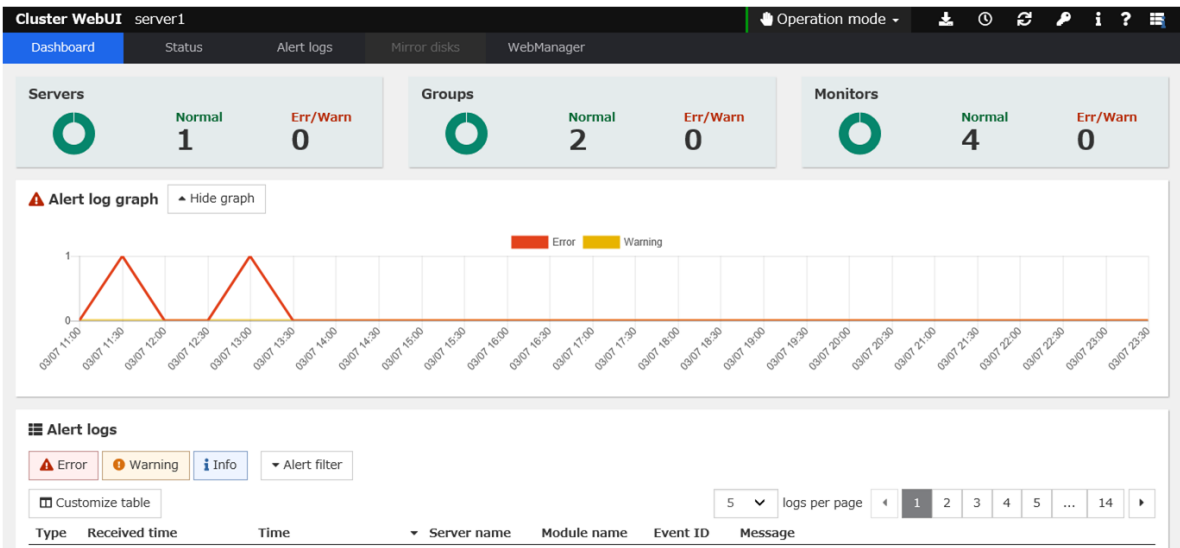
1. Click **Apply the Configuration File** in the Cluster WebUI config mode.
2. Depending on the difference between the existing configuration data and the configuration data you are applying, a pop-up window might be displayed to prompt you to check the operation necessary to apply the data.


If there is no problem with the operation, click **OK**.

When the upload ends successfully, a popup message saying "The application finished successfully." is displayed. Click **OK**.

If the upload fails, perform the operations by following the displayed message.

3. The status will be displayed on the Cluster WebUI.



For how to operate and check the Cluster WebUI, see the online manual from the  button on the upper right of the screen.

CHECKING THE CLUSTER SYSTEM

This chapter describes how you verify that the created system runs normally.

This chapter covers:

- 4.1. *Checking the operation by using the Cluster WebUI*
- 4.2. *Checking the server operation by using commands*

4.1 Checking the operation by using the Cluster WebUI

The Cluster WebUI or command line can be used to check the set up system operation. This section describes how to check the system operation by using the Cluster WebUI. The Cluster WebUI is installed at the time of the EXPRESSCLUSTER Server installation. Therefore, it is not necessary to install it separately. This section first provides a summary of the Cluster WebUI, and then describes how to access the Cluster WebUI and check the server status.

See also:

For details about the Cluster WebUI system requirements, refer to "Software" in "Checking system requirements for EXPRESSCLUSTER X SingleServerSafe" in "About EXPRESSCLUSTER X SingleServerSafe" in the "EXPRESSCLUSTER X SingleServerSafe Installation Guide".

Follow the steps below to check the operation after creation and connecting to the Cluster WebUI.

See also:

For how to operate Cluster WebUI, see the online manual.

1. Check heartbeat resources
Make sure that the status of the server is online in the Cluster WebUI.
Make sure that the heartbeat resource status of the server is normal.
2. Check monitor resources
Verify that the status of each monitor resource is normal on the Cluster WebUI.
3. Start a group
Starts a group.
Verify that the status of the group is online on the Cluster WebUI.
4. EXEC resource
Verify that an application is working on the server where the group having an EXEC resource is active.
5. Stop Group
Stops a group.
Verify that the status of the group is offline on the Cluster WebUI.
6. Start a group
Starts a group.
Verify on the Cluster WebUI that the group has been started.
7. Shut down the servers
Shuts down the server. Make sure that all the servers successfully shut down.

4.2 Checking the server operation by using commands

After creation, perform the following procedure to check the system status by using commands from a server.

See also:

For details about how to use commands, refer to "EXPRESSCLUSTER X SingleServerSafe command reference" in the "EXPRESSCLUSTER X SingleServerSafe Operation Guide".

1. Check monitor resources
Verify that the status of each monitor resource is normal by using the clpstat command.
2. Start a group
Start a group by using the clpgrp command.
Verify that the status of the group is online by using the clpstat command.
3. EXEC resource
Verify that an application is working on the server where the group having an EXEC resource is active.
4. Stop Group
Stop a group by using the clpgrp command.
Verify that the status of the group is offline by using the clpstat command.
5. Start a group
Start a group by using the clpgrp command.
Verify that the status of the group is online by using the clpstat command.
6. Shut down
Shut down the server by using the clpstdn command. Make sure that the server successfully shut down.

GROUP RESOURCE DETAILS

This chapter provides details about group resources.

EXPRESSCLUSTER X SingleServerSafe uses windows common to those of the clustering software EXPRESSCLUSTER X to ensure high compatibility with EXPRESSCLUSTER X in terms of operation and other aspects.

This chapter covers:

- *5.1. Group resources*
- *5.2. Setting up an EXEC resource*
- *5.3. Setting up VM resources*

5.1 Group resources

The following resources can be defined as group resources.

Group resource name	Function	Abbreviation
EXEC resource	Register applications and shell scripts executed upon activation or deactivation of the group.	exec
VM resource	Starts and stops a virtual machine.	vm

5.1.1 System requirements for VM resources

The versions of the virtualization platform that support VM resources are listed below.

Virtual Machine	Version	EXPRESSCLUSTER version	Remarks
vSphere	5.5	4.0.0-1 or later	Need management VM
	6.5	4.0.0-1 or later	Need management VM
XenServer	6.5 (x86_64)	4.0.0-1 or later	
KVM	Red Hat Enterprise Linux 6.9 (x86_64)	4.0.0-1 or later	
	Red Hat Enterprise Linux 7.4 (x86_64)	4.0.0-1 or later	

Note: The following functions do not work when EXPRESSCLUSTER X SingleServerSafe is installed in XenServer.

- User-mode monitor resources (keepalive/softdog method)
 - Shutdown monitoring (keepalive/softdog method)
-

5.2 Setting up an EXEC resource

EXPRESSCLUSTER allows registration of applications and shell scripts that are managed by EXPRESS-CLUSTER and executed upon activation or deactivation of the group. You can also possibly register your own programs and shell scripts in EXEC resources. You can write codes as required for respective application because shell scripts are in the same format as sh shell script.

5.2.1 Scripts used for the EXEC resource

Types of scripts

Start script and stop script are provided in EXEC resources. EXPRESSCLUSTER runs a script for each EXEC resource when the server needs to change its status. Activation, deactivation, and restoration procedures must be written in the scripts.

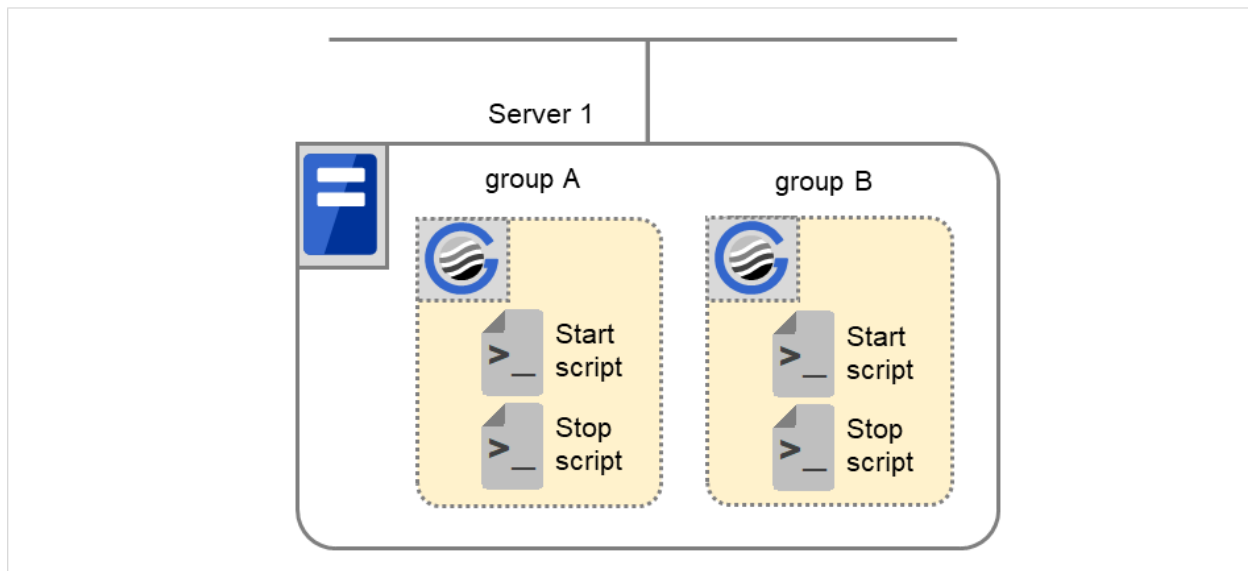


Fig. 5.1: Scripts executed with an EXE resource

Start: Start script

Stop: Stop script

5.2.2 Environment variables used in EXEC resource scripts

When EXPRESSCLUSTER runs a script, it records information such as condition when the script was run (script starting factor) in environment variables.

You can use the environment variables on the table below as branching condition to write code for your system operation.

The environment variable of a stop script returns the content of the start script that was run immediately before as a value. Start script does not set environment variables of CLP_FACTOR and CLP_PID.

The environment variable of CLP_LASTACTION is set only when the environment variable CLP_FACTOR is CLUSTERSHUTDOWN or SERVERSHUTDOWN.

Environment variable	Value of environment variable	Meaning
CLP_EVENT ...script starting factor	START	by starting a group; on the same server by restarting a group due to the detection of a monitor resource error; or on the same server by restarting a group resource due to the detection of a monitor resource error.
	FAILOVER	Not used.
CLP_FACTOR ...group stopping factor	CLUSTERSHUTDOWN	The group was stopped by stopping the server.
	SERVERSHUTDOWN	The group was stopped by stopping the server.
	GROUPSTOP	The group was stopped by stopping the group.
	GROUPMOVE	Not used.
	GROUPFAILOVER	Not used.
	GROUPRESTART	The group was restarted because an error was detected in monitor resource.
	RESTART	The group resource was restarted because an error was detected in monitor resource.
CLP_LASTACTION ...processing after stopping	REBOOT	In case of rebooting OS.
	HALT	In case of halting OS.
	NONE	No action was taken.
CLP_SERVER	HOME	Not used.
	OTHER	Not used.
CLP_DISK	SUCCESS	Not used.
	FAILURE	Not used.
CLP_PRIORITY	1 to the number of servers in the cluster	Not used.
CLP_GROUPNAME ...Group name	Group name	Represents the name of the group to which the script belongs.
CLP_RESOURCENAME ...Resource name	Resource Name:	Represents the name of the resource to which the script belongs.

Continued on next page



Table 5.3 – continued from previous page

Environment variable	Value of environment variable	Meaning
CLP_PID ...Process ID	Process ID	Represents the process ID of the start script when the properties of the start script are set to asynchronous. This environment variable is null when the start script is set to synchronous.
CLP_VERSION_FULL ...EXPRESSCLUSTER full version	EXPRESSCLUSTER X Single-ServerSafe full version	Represents the EXPRESSCLUSTER X SingleServerSafe full version. (Example) 4.1.0-1
CLP_VERSION_MAJOR ...EXPRESSCLUSTER major version	EXPRESSCLUSTER X SingleServerSafe major version	Represents the EXPRESSCLUSTER X SingleServerSafe major version. (Example) 4
CLP_PATH ...EXPRESSCLUSTER install path	EXPRESSCLUSTER X SingleServerSafe install path	Represents the path where EXPRESSCLUSTER X SingleServerSafe is installed. (Example) /opt/nec/clusterpro
CLP_OSNAME ...Server OS name	Server OS name	Represents the OS name of the server where the script was executed. (Example) (1) When the OS name could be acquired: Red Hat Enterprise Linux Server release 6.8 (Santiago) (2) When the OS name could not be acquired: Linux
CLP_OSVER ...Server OS version	Server OS version	Represents the OS version of the server where the script was executed. (Example) (1) When the OS version could be acquired: 6.8 (2) When the OS version could not be acquired: *Blank

Execution timing of EXEC resource scripts

The timings at which the start script and stop script are executed and how the environment variables are associated with the execution are described below with diagrams of status transitions.

- In the figure below, the server is in the following status:

Server	Server status
 Normal	Normal
 Stopped	Stopped

- (Example) Group A is running in Server 1 that is in a normal status.



- Group A and Group B are defined.

Status transitions

This diagram shows possible status transitions.

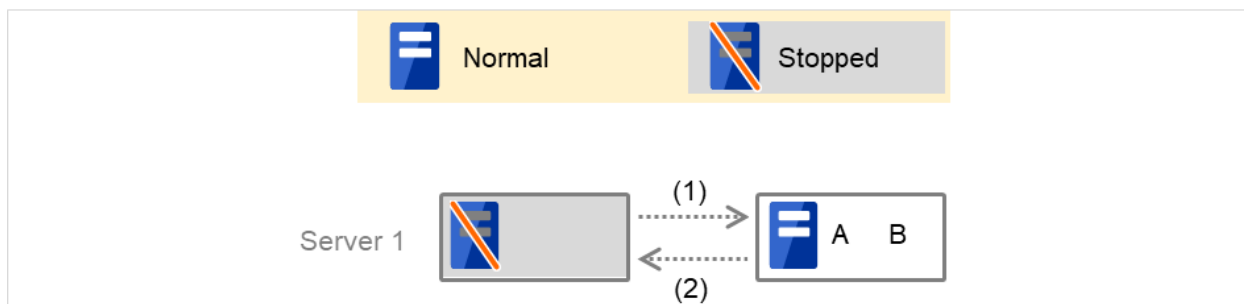


Fig. 5.2: State transition diagram

Numbers (1) and (2) in the diagram correspond to descriptions as follows.

(1) Normal startup

The normal startup in this context indicates when the start script is normally executed on the server.

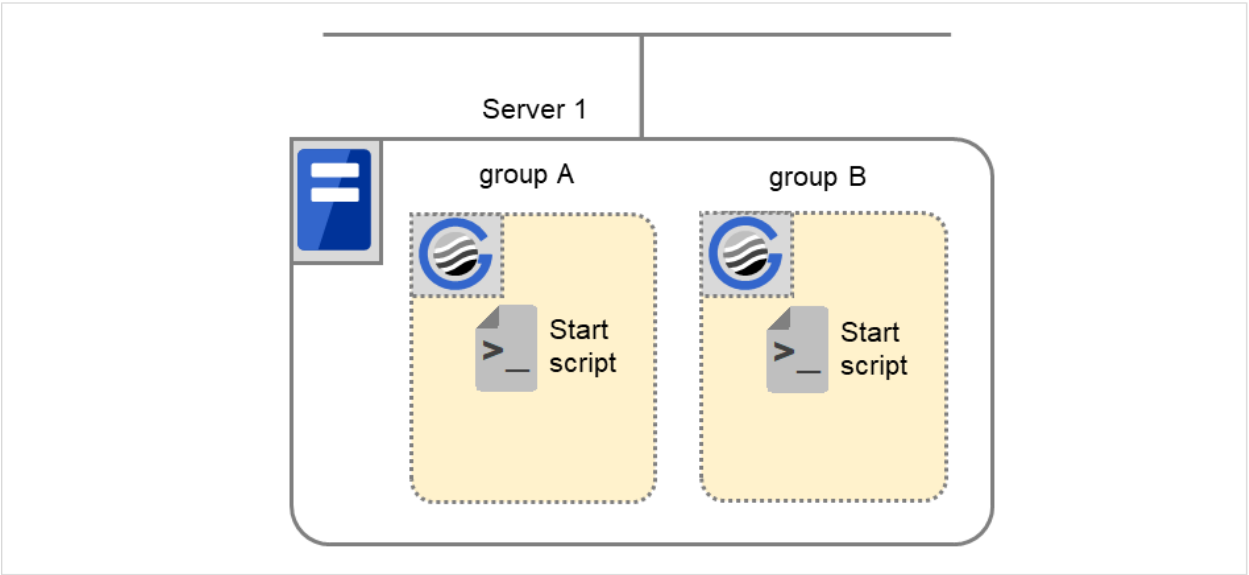


Fig. 5.3: The state and script execution (normal startup)

Environment variable for Start

	Group A	Group B
CLP_EVENT	START	START

(2) Normal shutdown

The normal shutdown in this context indicates the shutdown immediately after the start script corresponding to the stop script is executed for normal startup.

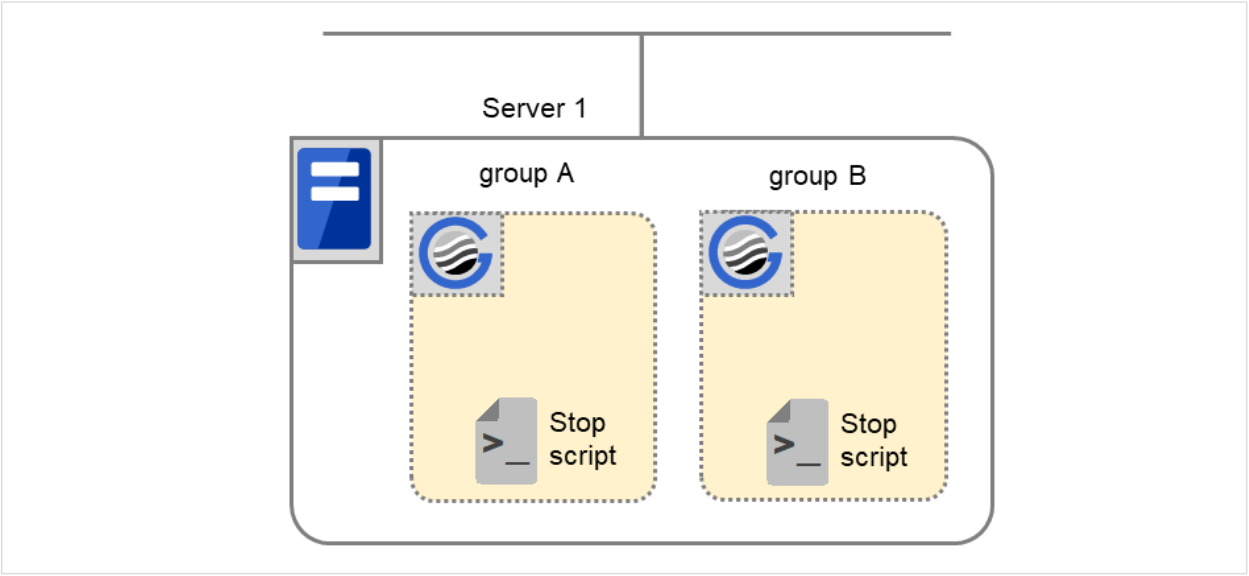


Fig. 5.4: The state and script execution (normal shutdown)

Environment variable for Stop

	Group A	Group B
CLP_EVENT	START	START

5.2.3 Writing EXEC resource scripts

This section describes how you actually write script codes in association with timing to run scripts as mentioned in the previous topic. Numbers in brackets "(number)" in the following example script code represent the actions described in "5.2.2. Execution timing of EXEC resource scripts".

Group A start script: A sample of start.sh

```
#!/bin/sh
# *****
# *                start.sh                *
# *****

# Allot a process by referencing environment variables for script starting_
↳factors.
if [ "$CLP_EVENT" = "START" ]
then
    # Write the normal startup process of the operation here.
    # This process is executed at the following timing:
    #
    # (1) Normal startup
    #
else
    # EXPRESSCLUSTER is not running.
fi

# If an exit code is 0, then the activation process of the EXEC resource is_
↳determined as successful.
# If an error occurs in the script, write the script by which a non-zero_
↳exit code is returned.
exit 0
```

Group A stop script: A sample of stop.sh

```
#!/bin/sh
# *****
# *                stop.sh                 *
# *****

# Allot a process by referencing environment variables for script starting_
↳factors.
if [ "$CLP_EVENT" = "START" ]
then
    # Write the normal shutdown process of an operation here. This process_
↳is executed at the following timing:
    #
    # (2) Normal shutdown
    #
else
    # EXPRESSCLUSTER is not running.
```

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```
fi  
  
exit 0
```

5.2.4 Tips for creating EXEC resource scripts

Note the following points when creating EXEC resource script.

- If your script has a command that requires some time to complete, it is recommended to configure command completion messages to be always produced. This message can be used to determine the error when a problem occurs. There are two ways to produce the message:
- Specify the EXEC resource log output path by writing the echo command in the script.
Trace results can be output to the standard output by using the echo command. Specify the log output path in the resource properties that contain the script.

The message is not logged by default. For the log output path setting, see "Maintenance tab" in "Tuning EXEC resource" in "5.2.6. *Details tab*". If the **Rotate Log** check box is not selected, pay attention to the available disk space of a file system because messages are sent to the file specified as the log output destination file regardless of the size of available disk space.

(Example: Sample script)

```
echo "appstart.."
appstart
echo "OK"
```

- Writing clplogcmd in the script
clplogcmd outputs messages to the alert log or OS syslog. For details about the clplogcmd command, refer to "Output messages (clplogcmd command)" in "EXPRESSCLUSTER X SingleServerSafe command reference" in the "EXPRESSCLUSTER X SingleServerSafe Operation Guide".

(Example: Sample script)

```
clplogcmd -m "appstart.."
appstart
clplogcmd -m "OK"
```

5.2.5 Notes on EXEC resources

- About the rotate log function of the script
When the Script Log Rotate function is enabled, a process is generated to mediate the log output. This intermediate process continues to work until the file descriptor is closed (i.e. until all the logs stop being output from the start and stop scripts and from a descendant process that takes over the standard output and/or the standard error output from the start and stop scripts). To exclude output from the descendant process from the log, redirect the standard output and/or the standard error output when the process is generated with the script.
- The start script and the stop script are executed by root user.
- To start an application dependent on an environment variable, the script must set the environment variable as needed.

5.2.6 Details tab

Resource Properties | exec1 exec X

Info Dependency Recovery Operation **Details**

☐ User Application
☒ Script created with this product

Edit View Replace

Scripts

Type	Name
Start Script	start.sh
Stop Script	stop.sh

Tuning

OK Cancel Apply

User Application

Select this option to use executable files (executable shell scripts and binary files) on your server as scripts. Specify the local disk path on the server for each executable file name.

The configuration data created by the Cluster WebUI does not contain these files. You cannot edit the script files using the Cluster WebUI.

Script created with this product

Use a script file which is prepared by the Cluster WebUI as a script. You can edit the script file with the Cluster WebUI if you need. The script file is included in the configuration data.

View

Click here to display the script file when you select **Script created with this product**.

Edit

Click here to edit the script file when you select **Script created with this product**. Click **Save** the script file to apply the change. You cannot modify the name of the script file.

With the **User Application** option selected, the **Enter application path** dialog box appears.

Enter application path

Specify an exec resource executable file name.

Enter application path

Enter the absolute path to the application.

Start*

Stop

OK Cancel

Start (Within 1023 bytes)

Enter an executable file name to be run when the exec resource starts. The name should begin with "/". Arguments can also be specified.

Stop (Within 1023 bytes)

Enter an executable file name to be run when the exec resource stops. The name should begin with "/". The stop script is optional.
For the executable file name, specify a full path name starting with "/" to a file on your cluster server. Arguments can also be specified.

Replace

Opens the **Open** dialog box with the **Script created with this product** option selected.

The content of the script file selected in the **Resource Property** is replaced with the one selected in the **Open** dialog box. You cannot replace the script file if it is currently displayed or edited. Select a script file only. Do not select binary files (applications), and so on.

Tuning

Opens the EXEC resource tuning properties dialog box. You can make advanced settings for the EXEC resource. If you want the PID monitor resource to monitor the EXEC resources, you have to set the start script to asynchronous.

EXEC resource tuning properties

Parameter tab

Common to all start scripts and stop scripts

Synchronous

Select this button to wait for a script to end when it is run. Select this option for executable files that are not resident (the process is returned immediately after the script completion).

Asynchronous

Does not wait for the script to end when it is run. Select this for resident executable files.

The script can be monitored by PID monitor resource if **Asynchronous** is selected.

Timeout (1 to 9,999)

When you want to wait for a script to end (when selecting **Synchronous**), specify how many seconds you want to wait before a timeout. The timeout can be specified only when **Synchronous** is selected. If the script does not complete within the specified time, it is determined as an error.

Maintenance tab

The screenshot shows a dialog box titled "Exec Resource Tuning Properties". It has two tabs: "Parameter" and "Maintenance". The "Maintenance" tab is selected. Inside the dialog, there is a "Log Output Path" text box, a "Rotate Log" checkbox (which is unchecked), and a "Rotation Size" text box containing the value "1000000" with the unit "byte" to its right. At the bottom right of the dialog are three buttons: "OK", "Cancel", and "Apply".

Log Output Path (within 1,023 bytes)

Specify the redirect destination path of standard output and standard error output for EXEC resource scripts and executable files. If this box is left blank, messages are directed to /dev/null. The name should begin with "/."

If the **Rotate Log** check box is off, note the amount of available disk space in the file system because no limit is imposed on message output.

If the **Rotate Log** check box is on, the log file to be output is rotated. Note the following items.

- You must specify a log output path within 1009 bytes. If you specify a path of 1010 bytes or more, the log is not output.
- You must specify a log file name within 31 bytes. If you specify a log file name of 32 bytes or more, the log is not output.
- When using multiple EXEC resources, the rotation size may not be normally recognized if you specify resources with the same file name, even if the paths differ. (ex. /home/foo01/log/exec.log, /home/foo02/log/exec.log)

Rotate Log

Clicking **Rotate Log** when the **Rotate Log** check box is not checked outputs the execution logs of the EXEC resource script and the executable file without imposing any limit on the file size. Clicking **Rotate Log** when the **Rotate Log** check box is selected rotates and outputs messages.

Rotation Size (1 to 999999999)

If the **Rotate Log** check box is selected, specify a rotation size.

The structures of the log files to be rotated and output are as follows:

File name	Description
file_name for the Log Output Path specification	Newest log
file_name.pre for the Log Output Path specification	Previously rotated log

5.3 Setting up VM resources

5.3.1 Dependencies of VM resources

By default, hybrid disk resources do not depend on any group resource type.

5.3.2 What is the VM resource?

A VM resource is used to control virtual machines (guest OSs) from the host OS on the virtual platform.

Starts and stops a virtual machine.

5.3.3 Notes on VM resources

- VM resources are enabled only when EXPRESSCLUSTER is installed in the host OS in the virtualization platform (vSphere, XenServer, KVM).
- A VM resource can be registered with a group for which the group type is virtual machine.
- Only one VM resource can be registered per group.

5.3.4 Details tab

In case of vSphere

Resource Properties | vm1

Info Dependency Recovery Operation Details

Common server1

Virtual Machine Type vSphere

Installation Destination of the Cluster Service* Host

Virtual Machine Name

Data Store Name datastore

VM Configuration File Path* /vm

IP Address of Host

UUID

Library Path

User Name user1

Password •••••••• Change

Use vCenter ☐

vCenter

User Name for vCenter

Password for vCenter •••••••• Change

Resource Pool Name

Tuning

OK Cancel Apply

Virtual Machine Type

Specify the type of the virtual platform.

Installation Destination of the Cluster Service

Specify the type of OS under which EXPRESSCLUSTER is installed. Selecting the guest OS automatically selects the **Use vCenter** check box.

Virtual Machine Name (within 255 bytes)

Enter the name of the virtual machine. This is omissible when the VM Configuration File Path is input. If the virtual machine name may be changed on the virtual platform side, set the VM Configuration File Path.

Data Store Name (within 255 bytes)

specify the name of data store containing the virtual machine configuration information.

VM Configuration File Path (within 1,023 bytes)

Specify the path storing information about the virtual machine configuration.

IP Address of Host

Specify the management IP address of the host. You must specify the IP address of host for each server, using individual server settings.

User Name (within 255 bytes)

Specify the user name used to activate the virtual machine.

Password (within 255 bytes)

Specify the password used to activate the virtual machine.

Use vCenter

Specify whether to use vCenter.

vCenter (within 1,023 bytes)

Specify the vCenter host name.

User Name for vCenter (within 255 bytes)

Specify the user name to connect with vCenter.

Password for vCenter (within 255 bytes)

Specify the password to connect with vCenter.

Resource Pool Name (within 255 bytes)

Specify the name of the resource pool to activate the virtual machine.

In case of XenServer

Resource Properties | vm1 vm X

Info Dependency Recovery Operation Details

Common server1

Virtual Machine Type XenServer

Installation Destination of the Cluster Service Host

Virtual Machine Name xen

Data Store Name

VM Configuration File Path

IP Address of Host

UUID

Library Path /usr/lib/libxenserver.so

User Name user1

Password Change

Use vCenter ☐

vCenter

User Name for vCenter

Password for vCenter Change

Resource Pool Name

Tuning

OK Cancel Apply

Virtual Machine Type

Specify the type of the virtual platform.

Virtual Machine Name (within 255 bytes)

Enter the name of the virtual machine. This is omissible when the UUID is set. If the virtual machine name may be changed on the virtual platform side, set the UUID.

UUID

Specify the UUID (Universally Unique Identifier) to identify the virtual machine.

Library Path (within 1,023 bytes)

Specify the library path to be used for control of XenServer.

User Name (within 255 bytes)

Specify the user name used to activate the virtual machine.

Password (within 255 bytes)

Specify the password used to activate the virtual machine.

In case of KVM

Resource Properties | vm1

Info Dependency Recovery Operation Details

Common server1

Virtual Machine Type KVM

Installation Destination of the Cluster Service Host

Virtual Machine Name kvm

Data Store Name

VM Configuration File Path

IP Address of Host

UUID

Library Path /usr/lib64/libvirt.so.0.6.3

User Name

Password Change

Use vCenter ☐

vCenter

User Name for vCenter

Password for vCenter Change

Resource Pool Name

Tuning

OK Cancel Apply

Virtual Machine Type

Specify the type of the virtual platform.

Virtual Machine Name (within 255 bytes)

Enter the name of the virtual machine. This is omissible when the UUID is set.

UUID

Specify the UUID (Universally Unique Identifier) to identify the virtual machine.

Library Path (within 1,023 bytes)

Specify the library path to be used for control of KVM.

Tuning

This displays the **VM Resource Tuning Properties** dialog box. Specify detailed settings for the VM resource.

VM resource tuning properties

Virtual Machine Resource Tuning Properties

Parameter

Request Timeout*	<input type="text" value="30"/>	sec
Virtual Machine Start Waiting Time*	<input type="text" value="0"/>	sec
Virtual Machine Stop Waiting Time*	<input type="text" value="240"/>	sec

Initialize

OK

Cancel

Apply

Request Timeout

Specify how long the system waits for completion of a request such as to start or stop a virtual machine.

If the request is not completed within this time, a timeout occurs and resource activation or deactivation fails.

Virtual Machine Start Waiting Time

The system definitely waits this time after requesting the virtual machine to startup.

Virtual Machine Stop Waiting Time

The maximum time to wait for the stop of the virtual machine. Deactivation completes at the timing the stop of the virtual machine.

MONITOR RESOURCE DETAILS

This chapter provides details about monitor resources. A monitor resource is the unit used when EXPRESSCLUSTER X SingleServerSafe performs monitoring.

EXPRESSCLUSTER X SingleServerSafe uses windows common to those of the clustering software EXPRESSCLUSTER X to ensure high compatibility with EXPRESSCLUSTER X in terms of operation and other aspects.

This chapter covers:

- 6.1. *Monitor Resources*
- 6.2. *Monitor resource properties*
- 6.3. *Setting up disk monitor resources*
- 6.4. *Setup example when READ (raw) is selected for the disk monitor resource*
- 6.5. *Setting up IP monitor resources*
- 6.6. *Setting up NIC Link Up/Down monitor resources*
- 6.7. *Setting up PID monitor resources*
- 6.8. *Setting up user-mode monitor resources*
- 6.9. *Setting up custom monitor resources*
- 6.10. *Setting up volume manager monitor resources*
- 6.11. *Setting up multi target monitor resources*
- 6.12. *Example multi target monitor resource configuration*
- 6.13. *Setting up software RAID monitor resources*
- 6.14. *Setting up VM monitor resources*
- 6.15. *Setting up message receive monitor resources*
- 6.16. *Setting up Process Name monitor resources*
- 6.17. *Setting up DB2 monitor resources*
- 6.18. *Setting up FTP monitor resources*
- 6.19. *Setting up HTTP monitor resources*
- 6.20. *Setting up IMAP4 monitor resources*
- 6.21. *Setting up MySQL monitor resources*
- 6.22. *Setting up NFS monitor resources*
- 6.23. *Setting up ODBC monitor resources*

- 6.24. *Setting up Oracle monitor resources*
- 6.25. *Setting up POP3 monitor resources*
- 6.26. *Setting up PostgreSQL monitor resources*
- 6.27. *Setting up Samba monitor resources*
- 6.28. *Setting up SMTP monitor resources*
- 6.29. *Setting up SQL Server monitor resources*
- 6.30. *Setting up Sybase monitor resources*
- 6.31. *Setting up Tuxedo monitor resources*
- 6.32. *Setting up WebLogic monitor resources*
- 6.33. *Setting up WebSphere monitor resources*
- 6.34. *Setting up WebOTX monitor resources*
- 6.35. *Setting up JVM monitor resources*
- 6.36. *Setting up System monitor resources*
- 6.37. *Setting up Process resource monitor resources*

6.1 Monitor Resources

The following resources can be defined as monitor resources:

Monitor resource name	Function	Monitor Timing: (Default values are shown in bold.)	Target Resource
Disk monitor resource	Monitors disk devices.	Always /When activated	All resources
IP monitor resource	Monitors IP addresses and communication paths by using the ping command and checking whether there is a response.	Always /When activated	All resources
NIC Link Up/Down monitor resource	Acquires the NIC link status to monitor whether the link is up or down.	Always /When activated	All resources
PID monitor resource	PID monitor resource monitors a successfully activated EXEC resource.	When activated (Fixed)	exec resource
User mode monitor resource	Determines a user space stall to be an error.	Always (Fixed)	-
Multi target monitor resource	Performs monitoring by using multiple monitor resources in combination.	When activated (Fixed)	All resources
Software RAID monitor resource	Monitors software RAID devices.	Always (Fixed)	None
Custom monitor resource	Performs monitoring by executing any script.	Always /When activated	All resources
Volume manager monitor resource	Provides a monitoring mechanism for multiple storage devices and disks.	Always/ When activated	All
VM monitor resource	Provides a mechanism for monitoring a virtual machine started by a VM resource.	Always (Fixed)	vm
Message receive monitor resource	Sets up error-handling actions executed on reception of an error message and displays error message in the Cluster WebUI.	Always (Fixed)	None
Process Name monitor resource	Monitors monitor the process of specified processes.	Always /When activated	All resources
DB2 monitor resource	Provides a mechanism for monitoring an IBM DB2 database.	When activated (Fixed)	All resources

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Table 6.1 – continued from previous page

Monitor resource name	Function	Monitor Timing: (Default values are shown in bold.)	Target Resource
FTP monitor resource	Provides a mechanism for monitoring an FTP server.	Always/ When activated	All resources
HTTP monitor resource	Provides a mechanism for monitoring an HTTP server.	Always/ When activated	All resources
IMAP4 monitor resource	Provides a mechanism for monitoring an IMAP server.	Always/ When activated	All resources
MySQL monitor resource	Provides a mechanism for monitoring a MySQL database.	When activated (Fixed)	All resources
NFS monitor resource	Provides a mechanism for monitoring an NFS file server.	Always /When activated	All resources
ODBC monitor resources	Provides a mechanism for monitoring a ODBC database.	When activated (Fixed)	All resources
Oracle monitor resource	Provides a mechanism for monitoring an Oracle database.	When activated (Fixed)	All resources
POP3 monitor resource	Provides a mechanism for monitoring a POP server.	Always/ When activated	All resources
PostgreSQL monitor resource	Provides a mechanism for monitoring a PostgreSQL database.	When activated (Fixed)	All resources
Samba monitor resource	Provides a mechanism for monitoring a samba file server.	Always /When activated	All resources
SMTP monitor resource	Provides a mechanism for monitoring an SMTP server.	Always/ When activated	All resources
SQL Server monitor resources	Provides a mechanism for monitoring a SQL Server database.	When activated (Fixed)	All resources
Sybase monitor resource	Provides a mechanism for monitoring a Sybase database.	When activated (Fixed)	All resources
Tuxedo monitor resources	Provides a mechanism for monitoring a Tuxedo application server.	Always/ When activated	All resources
WebLogic monitor resources	Provides a mechanism for monitoring a WebLogic application server.	Always/ When activated	All resources
WebSphere monitor resources	Provides a mechanism for monitoring a WebSphere application server.	Always/ When activated	All resources

Continued on next page

Table 6.1 – continued from previous page

Monitor resource name	Function	Monitor Timing: (Default values are shown in bold.)	Target Resource
WebOTX monitor resources	Provides a mechanism for monitoring a WebOTX application server.	Always/ When activated	All resources
JVM monitor resources	Provides a mechanism for monitoring a Java VM.	Always /When activated	exec resource
System monitor resources	Provides a mechanism for monitoring a System Resource.	Always (Fixed)	All resources
Process resource monitor resources	Provides a mechanism for monitoring a Process Resource.	Always (Fixed)	All resources

6.1.1 Status of monitor resources after monitoring starts

The status of some monitor resources might be "Caution" if there is a period of time following the start of monitoring in which monitoring of that resource is not yet ready.

Caution status is possible for the following monitor resources.

- Message Receive Monitor Resource
- Custom Monitor Resource (whose monitor type is **Asynchronous**)
- DB2 Monitor Resource
- System Monitor Resource
- Process Resource Monitor Resource
- JVM Monitor Resource
- MySQL Monitor Resource
- ODBC monitor resources
- Oracle Monitor Resource
- PostgreSQL Monitor Resource
- Process Name Monitor Resource
- SQL Server monitor resource
- Sybase Monitor Resource

6.1.2 Monitor timing of monitor resource

There are two types of monitoring by monitor resources; **Always** and **Active**.

The monitoring timing differs depending on monitor resources:

- a. Always:
Monitoring is performed by monitor resource all the time.
- b. Active:
Monitoring is performed by monitor resource while specified group resource is active.
Monitor resource does not monitor while group resource is not activated.

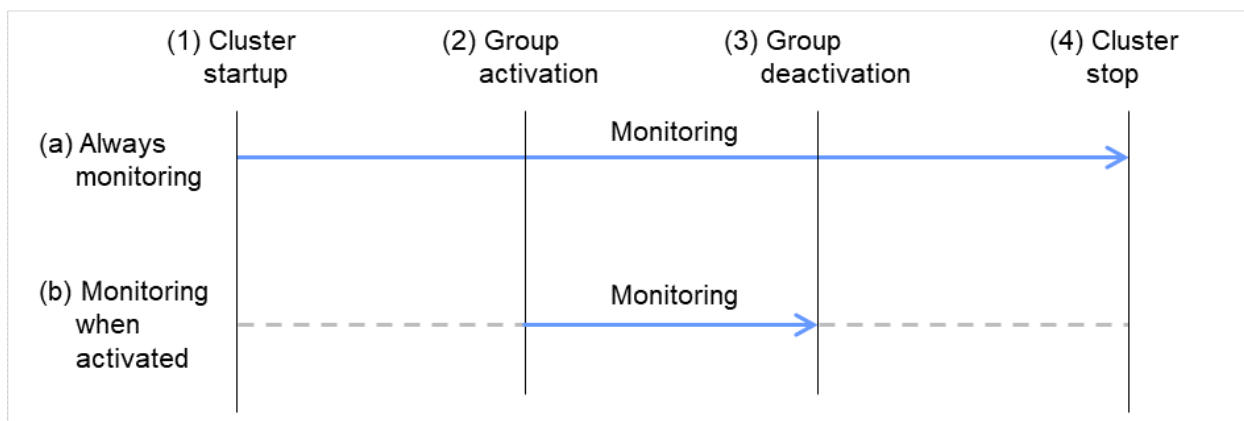


Fig. 6.1: Always monitor and Monitors while activated for a monitor resource

6.1.3 Suspending and resuming monitoring on monitor resources

Monitor resource can temporarily suspend monitoring and resume it.

Monitoring can be suspended and resumed by the following two methods:

- Operation on the Cluster WebUI
- Operation by the clpmonctrl command

The clpmonctrl command can control only monitor resources on the server where this command is run.

Some monitor resources can suspend and resume monitoring and others cannot. For details, see the list below.

Monitor Resource	Control
Disk Monitor Resource	Possible
IP Monitor Resource	Possible
User-mode Monitor Resource	Possible
NIC Link Up/Down Monitor Resource	Possible
PID Monitor Resource	Possible
Multi Target Monitor Resource	Possible
Custom Monitor Resource	Possible
DB2 Monitor Resource	Possible
Software RAID Monitor Resource	Possible
Process Name Monitor Resource	Possible

Continued on next page

Table 6.2 – continued from previous page

Monitor Resource	Control
DB2 Monitor resource	Possible
FTP Monitor Resource	Possible
HTTP Monitor Resource	Possible
IMAP4 Monitor Resource	Possible
MySQL Monitor Resource	Possible
NFS Monitor Resource	Possible
ODBC Monitor Resource	Possible
Oracle Monitor Resource	Possible
POP3 Monitor Resource	Possible
PostgreSQL Monitor Resource	Possible
Samba Monitor Resource	Possible
SMTP Monitor Resource	Possible
SQL Server Monitor Resource	Possible
Sybase Monitor Resource	Possible
Tuxedo Monitor Resource	Possible
WebLogic Monitor Resource	Possible
WebSphere Monitor Resource	Possible
WebOTX Monitor Resource	Possible
VM Monitor Resource	Possible
Message Receive Monitor Resource	Possible
JVM Monitor Resource	Possible
System Monitor Resource	Possible
Process Resource Monitor Resource	Possible

On the Cluster WebUI, right-click menus of the monitor resources which cannot control monitoring are disabled. The clpmonctrl command only controls the resources which can control monitoring. For monitor resources which cannot control monitoring, a warning message is displayed and controls are not performed.

Suspending monitoring on a monitor resource is disabled if one of the following operations is performed.

- Resume operation on Cluster WebUI
- Resume operation by using the clpmonctrl command
- Stop the cluster
- Suspend the cluster

6.1.4 Enabling and disabling dummy failure of monitor resources

You can enable and disable dummy failure of monitor resources.

Use one of the following methods to enable or disable dummy failure.

- Operation on Cluster WebUI (verification mode)
On the Cluster WebUI(verification mode), shortcut menus of the monitor resources which cannot control monitoring are disabled.
- Operation by using the clpmonctrl command
The clpmonctrl command can control only monitor resources on the server where this command is run. When the clpmonctrl command is executed on monitor resource which cannot be controlled, dummy failure is not enabled even though the command succeeds.

Some monitor resources can enable and disable dummy failure and others cannot.

For details, see "EXPRESSCLUSTER X SingleServerSafe command reference", "Controlling monitor resources (clpmonctrl command)" in the "EXPRESSCLUSTER X SingleServerSafe Operation Guide".

Dummy failure of a monitor resource is disabled if the following operations are performed.

- Dummy failure was disabled on Cluster WebUI (verification mode)
- "Yes" was selected from the dialog box displayed when the Cluster WebUI mode changes from verification mode to a different mode.
- -n was specified to enable dummy failure by using the clpmonctrl command
- Stop the cluster
- Suspend the cluster

6.1.5 Monitor priority of the monitor resources

To assign a higher priority for monitor resources to monitor when the operating system is heavily loaded, the nice value can be set to all monitor resources except the user space monitor resource.

- The nice value can be specified through minus 19 (low priority) to plus 20 (high priority). Detection of the monitor timeout can be controlled by setting a higher priority to the nice value.

6.2 Monitor resource properties

6.2.1 Info tab

The screenshot shows the 'Monitor Resource Properties' dialog box for resource 'ipw1'. The 'Info' tab is selected. It contains fields for 'Name' (ipw1) and 'Comment'. At the bottom right are 'OK', 'Cancel', and 'Apply' buttons.

Name

The monitor resource name is displayed.

Comment (Within 127 bytes)

Enter a comment for the monitor resource. Use only one-byte alphabets and numbers.

6.2.2 Monitor(common) tab

The screenshot shows the 'Monitor Resource Properties' dialog box for resource 'ipw' with the 'Monitor(common)' tab selected. It contains various configuration options for monitoring the resource.

Property	Value	Unit
Interval*	30	sec
Timeout*	30	sec
Collect the dump file of the monitor process at timeout occurrence	<input type="checkbox"/>	
Do Not Retry at Timeout Occurrence	<input type="checkbox"/>	
Action at Timeout Occurrence	Recover	
Retry Count*	0	time
Wait Time to Start Monitoring*	0	sec

Monitor Timing

☒ Always
☐ Active

Target Resource:

Nice Value:

Choose servers that execute monitoring:

Send polling time metrics: ☐

Buttons: OK, Cancel, Apply

Interval (1 to 999)

Specify the interval to check the status of monitor target.

Timeout (5 to 999¹)

When the normal status cannot be detected within the time specified here, the status is determined to be error.

Collect the dump file of the monitor process at timeout occurrence

In case that this function is enabled, the dump information of the timed out monitor resource is collected when the monitor resource times out. Dump information is collected up to 5 times.

Do Not Retry at Timeout Occurrence

When this function is enabled, recovery action is executed immediately if a monitor resource timeout occurs.

Do not Execute Recovery Action at Timeout Occurrence

When this function is enabled, recovery action is not executed if a monitor resource timeout occurs. This can be set only when the **Do Not Retry at Timeout Occurrence** function is enabled.

Note: For the following monitor resources, the **Do Not Retry at Timeout Occurrence** and **Do Not Execute Recovery Action at Timeout Occurrence** functions cannot be set.

- user-mode monitor resources
 - custom monitor resources (whose monitor type is **Asynchronous**)
 - multi target monitor resources
 - VM monitor resources
 - message receive monitor resources
 - JVM monitor resources
 - system monitor resources
 - process resource monitor resources
-

Retry Count (0 to 999)

Specify how many times an error should be detected in a row after the first one is detected before the status is determined as error. If this is set to zero (0), the status is determined as error at the first detection of an error.

Wait Time to Start Monitoring (0 to 9999)

Set the wait time to start monitoring.

Monitor Timing

Set the monitoring timing. Select the timing from:

- Always:
Monitoring is performed all the time.
- Active:
Monitoring is not started until the specified resource is activated.

¹ When ipmi is set as a monitoring method for the user-mode monitor resource, 255 or less should be specified.

Target Resource

The resource which will be monitored when activated is shown.

Browse

Click this button to open the dialog box to select the target resource. The group names and resource names that are registered in the LocalServer and cluster are shown in a tree view. Select the target resource and click **OK**.



Nice Value

Set the nice value of a process.

Send polling time metrics

Enable or disable sending metrics: data on the monitoring process time taken by the monitor resource.

- If the check box is checked:
The metrics are sent.
- If the check box is not checked:
The metrics are not sent.

Note:

For using the Amazon CloudWatch linkage function, enabling this option allows you to send data on the monitoring process time taken by any monitor resource.

Send polling time metrics cannot be set for the following monitor resources:

- user-mode monitor resources
 - custom monitor resources (whose monitor type is **Asynchronous**)
 - message receive monitor resource
 - VM monitor resource
 - JVM monitor resource
 - system monitor resource
 - process resource monitor resource
-

6.2.3 Monitor (special) tab

Some monitor resources require the parameters at the monitoring operation to be configured. The parameters are described in the explanation part about each resource.

6.2.4 Recovery Action tab

In this dialog box, you can configure the recovery target and an action to be taken at the time when an error is detected. By setting this, it allows restart of the group, restart of the resource, and restart of the server when an error is detected. However, recovery will not occur if the recovery target is not activated.

The screenshot shows the 'Monitor Resource Properties' dialog box for resource 'ipw1'. The 'Recovery Action' tab is selected. The dialog contains the following fields and controls:

- Recovery Action:** A dropdown menu set to 'Execute only the final action'.
- Recovery Target *:** A text field containing 'LocalServer' and a 'Browse' button.
- Recovery Script Execution Count:** A text field with '0' and a 'time' label.
- Execute Script before Reactivation:** An unchecked checkbox.
- Maximum Reactivation Count:** A text field with '0' and a 'time' label.
- Execute Script before Failover:** An unchecked checkbox.
- Execute migration before Failover:** An unchecked checkbox.
- Maximum Failover Count:** A text field with '0' and a 'time' label.
- Execute Script before Final Action:** An unchecked checkbox.
- Final Action:** A dropdown menu set to 'No operation'.
- Script Settings:** A button located below the 'Final Action' dropdown.
- OK, Cancel, Apply:** Three buttons at the bottom right of the dialog.

Recovery Action

Specify the operation to perform when an error is detected.

- **Restart the recovery target**
Reactivate the selected group or group resource as the recovery target. When reactivation fails or the same error is detected after reactivation, execute the selected action as the final action.
- **Execute only the final action**
Execute the selected action as the final action.
- **Custom setting**

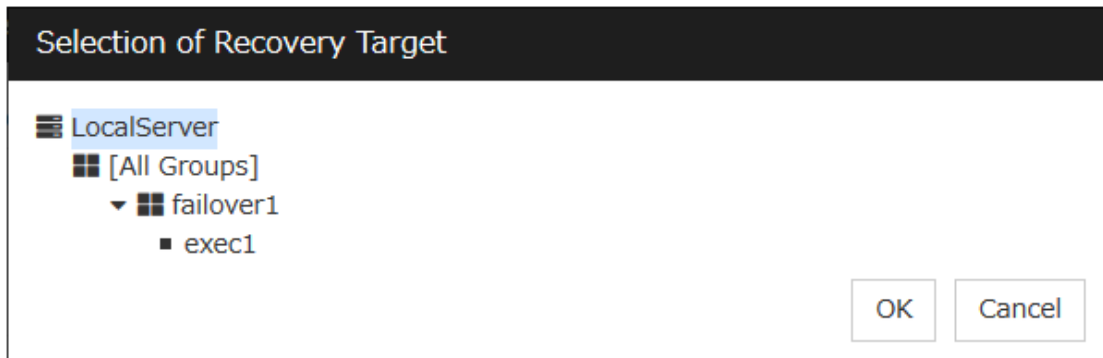
Execute the recovery script up until the maximum script execution count. If an error is continuously detected after script execution, reactivate the selected group or group resource as the recovery target up until the maximum reactivation count. If reactivation fails or the same error is continuously detected after reactivation, and the count reaches the maximum reactivation count, execute the selected action as the final action.

Recovery Target:

A target is shown, which is to be recovered when it is determined as a resource error.

Browse

Click this button to open the dialog box in which the target resource can be selected. The LocalServer, All Groups and group names and resource names that are registered in the cluster are shown in a tree view. Select the target resource and click **OK**.



Recovery Script Execution Count (0 to 99)

Specify the number of times to allow execution of the script configured by **Script Settings** when an error is detected. If this is set to zero (0), the script does not run.

Execute Script before Reactivation

- When selected:
A script/command is executed before reactivation. To configure the script/command setting, click **Script Settings**.
- When cleared:
Any script/command is not executed.

Maximum Reactivation Count (0 to 99)

Specify how many times you allow reactivation when an error is detected. If this is set to zero (0), no reactivation is executed. This is enabled when a group or group resource is selected as a recovery target.

Execute Script before Failover

Not used.

Execute migration before failing over

Not used.

Execute migration before failing over

Not used.

Maximum Failover Count

Not used.

Execute Script before Final Action

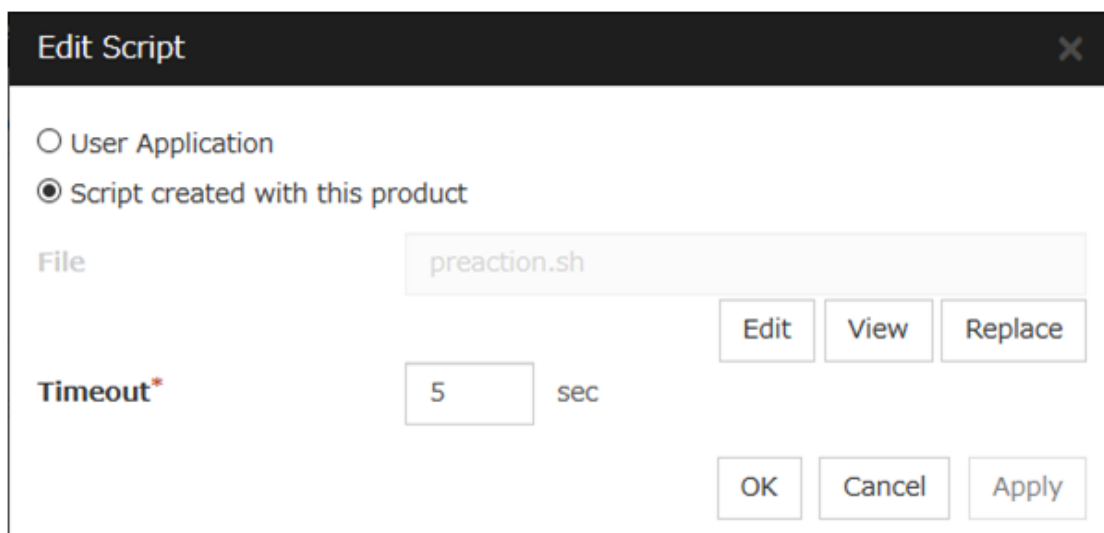
Select whether script is run or not before executing final action.

- When selected:
A script/command is run before executing final action. To configure the script/command setting, click **Script Settings**.
- When cleared:
Any script/command is not run.

When clicking **Script Settings** of **Execute Script before Final Action**, **Edit Script** dialog box is displayed. Set script or script file, and click **OK**.

Script Settings

Click here to display the **Edit Script** dialog box. Configure the recovery or pre-recovery action script or commands.



User Application

Use an executable file (executable shell script file or execution file) on the server as a script. For the file name, specify an absolute path or name of the executable file of the local disk on the server. If there is any blank in the absolute path or the file name, put them in double quotation marks (") as follows.

Example:

```
"/tmp/user application/script.sh"
```

These executable files are not included in the configuration data of the Cluster WebUI. As the files cannot be edited or uploaded, they are necessary to be prepared on the server.

Script created with this product

Use a script file which is prepared by the Cluster WebUI as a script. You can edit the script file with the Cluster WebUI if you need. The script file is included in the configuration data.

File (within 1,023 bytes)

Specify the script to be executed (executable shell script file or execution file) when selecting **User Application**.

View

Click here to display the script file when you select **Script created with this product**.

Edit

Click here to edit the script file when you select **Script created with this product**. Click **Save** to apply the change. You cannot modify the name of the script file.

Replace

Click here to replace the content of the script file with that of the script file you selected in the file selection dialog box, when **Script created with this product** is selected. You cannot replace the script file if it is currently displayed or edited. Select a script file only. Do not select binary files (applications), and so on.

Timeout (1 to 99)

Specify the maximum time to wait for completion of script to be executed. The default value is set as 5.

Final Action:

Select the recovery action to perform after a recovery attempt through reactivation fails.

Select the final action from the following:

- **No Operation**

No action is taken.

Note: Select **No Operation** only when temporarily canceling the final action, displaying only an alert when an error is detected, and executing the final action by multi target monitor resource.

- **Stop Resource**

When a group resource is selected as a recovery target, the selected group resource and group resources that depend on the selected group resource are stopped.

This option is disabled when "LocalServer", "All Groups", or a group is selected.

- **Stop Group**

When a group is selected as a recovery target, that group is stopped. When a group resource is selected as a recovery target, the group that the group resource belongs is stopped. When "All Groups" is selected, stop all the groups running on the server of which the monitor resource has detected errors. This option is disabled when a cluster is selected as a recovery target.

- **Stop cluster service**

EXPRESSCLUSTER X SingleServerSafe is stopped.

- **Stop cluster service and shut down OS**

EXPRESSCLUSTER X SingleServerSafe is stopped, and the OS is shut down.

- **Stop cluster service and reboot OS**

EXPRESSCLUSTER X SingleServerSafe is stopped, and the OS is rebooted.

- **sysrq Panic**

Performs the sysrq panic.

Note: If performing the sysrq panic fails, the OS is shut down.

- **Keepalive Reset**

Resets the OS using the clpkhb or clpka driver.

Note:

If resetting keepalive fails, the OS is shut down.

Do not select this action on the OS and kernel where the clpkhb and clpka drivers are not supported.

- **Keepalive Panic**

Performs the OS panic using the clpkhb or clpka driver.

Note:

If performing the keepalive panic fails, the OS is shut down.

Do not select this action on the OS and kernel where the clpkhb and clpka drivers are not supported.

- **BMC reset**

Perform hardware reset on the server by using the ipmi command.

Note:

If resetting BMC fails, the OS is shut down.

Do not select this action on the server where the OpenIPMI is not installed, or the ipmitool command does not run.

- **BMC power off**

Powers off the OS by using the ipmi command. OS shutdown may be performed due to the ACPI settings of the OS.

Note:

If powering off BMC fails, the OS is shut down.

Do not select this action on the server where the OpenIPMI is not installed, or the ipmitool command does not run.

- **BMC power cycle**

Performs the power cycle (powering on/off) of the server by using the ipmi command. OS shutdown may be performed due to the ACPI settings of the OS.

Note:

If performing the power cycle of BMC fails, the OS is shut down.

Do not select this action on the server where the OpenIPMI is not installed, or the ipmitool command does not run.

- **BMC NMI**

Uses the ipmi command to cause NMI occur on the server. The behavior after NMI is generated depends on the OS settings.

Note:

If BMC NMI fails, the OS shutdown is shut down.

Do not select this action on the server where the OpenIPMI is not installed, or the ipmitool command does not run.

6.3 Setting up disk monitor resources

Disk monitor resources monitor disk devices.

It is recommended to READ (O_DIRECT) for monitoring the disk that the disk monitor resource (TUR) cannot be used.

6.3.1 Monitor(special) tab

The screenshot shows the 'Monitor Resource Properties' dialog box for a resource named 'diskw1'. The 'Monitor(special)' tab is selected. The 'Common' section shows 'server1'. The 'Method' dropdown is set to 'READ(O_DIRECT)'. The 'Monitor Target' dropdown is set to '/dev/sdb2'. The 'Monitor Target RAW Device Name' field is empty. The 'I/O size' field is set to '2000000' with a unit of 'byte'. The 'Action When Diskfull Is Detected' dropdown is set to 'Recover'. At the bottom right are 'OK', 'Cancel', and 'Apply' buttons.

Method

Specify how you want to monitor a disk device from one of the following options.

- TUR
- TUR(generic)
- TUR(legacy)
- READ
- READ (O_DIRECT)
- WRITE (FILE)
- READ (RAW)
- READ (VXVM)

Monitor Target (within 1,023 bytes)

- When the monitoring method is WRITE (FILE):
Specify the path name of the file to be monitored. This must start with "/".
Specify the file name with the absolute path. If you specify the file name of an existing file, it is overwritten and the data in the file is lost.
- When the monitoring method is READ (O_DIRECT)
Specify the path name of the file to be monitored. This must start with "/".
Specify the file name with the absolute path. If you specify the file name of an existing file, it is overwritten and the data in the file is lost.
- When the monitoring method is READ (RAW)

The monitor target may be omitted. However, the monitor target raw device name must be specified. Specify this mode only when binding and monitoring the device. It is not possible to specify the device name for a partition device that has been mounted or will possibly be mounted for monitoring.

In addition, a whole device (whole disk) of a partition device that has been mounted or will possibly be mounted cannot be specified for monitoring. Allocate a partition dedicated to monitoring. (Allocate 10 MB or more to the monitoring partition). The partition must start with "/".

- When the monitoring method is READ (VXVM)
The fields are dim and not selectable.
- When the monitoring method is other than the above
When the monitoring method is other than the above: This must start with "/".

Monitor Target RAW Device Name (within 1,023 bytes)

This is specifiable only when the monitoring method is READ (RAW) or READ (VXVM).

- When the monitoring method is READ (RAW)
Enter a device name for raw accessing. Any raw device already registered with the **Disk I/F List** of the server properties is unregistrable. For a raw device of a VxVM volume, select READ (VXVM) for the monitoring method.
- When the monitoring method is READ (VXVM)
Set the VxVM volume raw device name. If the volume raw device file system is not vxfs, it cannot be monitored. This must start with "/".

I/O size (1 to 99,999,999)

Specify the size of I/O for reading or reading/writing when READ or WRITE (FILE) is selected as a monitoring method.

- When READ (RAW), READ(O_DIRECT) or READ (VXVM) is specified, the **I/O size** text box is dim. A single sector is read from the target device.
- If TUR, TUR (generic), or TUR (legacy) is specified, this setting is ignored.

Action When Diskfull is Detected

Select the action when diskfull (state in which the disk being monitored has no free space) is detected.

- Recover
The disk monitor resource recognizes an error upon the detection of disk full.
- Do not recover
The disk monitor resource recognizes a caution upon the detection of disk full.
 - If READ, READ (RAW), READ (VXVM), READ (O_DIRECT), TUR, TUR (generic), or TUR (legacy) is specified, the **Action when diskfull is detected** option is grayed out.

When a local disk is specified in **Target Device Name**, a local disk on the server can be monitored.

- Example of settings to monitor the local disk /dev/sdb by using the READ method, and to reboot the OS when an error is detected:

Setting item	Value	Remarks
Target Device Name:	/dev/sdb	SCSI disk in the second machine.
Monitor Method:	READ	READ method.
Recovery Target:	server	-
Final Action:	The service will be stopped and the OS will be restarted	Reboot the OS.

- Example of settings to monitor the local disk /dev/sdb by using the **TUR(generic) method** and select **No Op-**

eration (merely show an alert on the Cluster WebUI) when an error is detected:

Setting item	Value	Remarks
Target Device Name:	/dev/sdb	SCSI disk in the second machine.
Monitor Method:	TUR(generic)	SG_IO method
Final Action:	No Operation	

6.3.2 Monitoring by disk monitor resources

Two ways of monitoring are employed by the disk monitor resource: READ and TUR.

- Notes on TUR:
 - You cannot run the Test Unit Ready or SG_IO command of SCSI on a disk or disk interface (HBA) that does not support it.
Even if your hardware supports this command, consult the driver specifications because the driver may not support it.
 - ioctl may be incorrectly executed for an LVM logical volume (LV) device. Use READ for LV monitoring.
 - A TUR method cannot be used for the IDE interface disk.
 - In the case of the disk of S-ATA interface, it may be recognized as the IDE interface disk (hd) or as the SCSI interface disk (sd) depending on the type of a disk controller and the distribution to be used. When the disk is recognized as the IDE interface, no TUR methods can be used. If the disk is recognized as the SCSI interface, TUR (genetic) cannot be used but TUR (legacy) can be used.
 - Test Unit Ready, compared to Read, burdens OS and disks less.
 - In some cases, Test Unit Ready may not be able to detect actual errors in I/O to media.
 - You cannot use a partition on the disk by setting it as the target to be monitored. A whole device (whole disk) must be specified.
 - Some disk devices may temporarily return Unit Attention at TUR issue, depending on the device status. The temporary return of Unit Attention does not signify a problem. If the TUR retry count is set to 0, however, the above return is determined to be an error and the disk monitor resource becomes abnormal. To avoid this meaningless error detection, set the retry count to one or more.

TUR monitoring provides the following three choices.

- TUR
 - ioctl is used by the following steps and the status of the device is determined by the result of the command:
Run the ioctl (SG_GET_VERSION_NUM) command. The status is determined by the return value of ioctl and the version of SG driver.
If the ioctl command runs successfully and the version of SG driver is 3.0 or later, execute ioctl TUR (SG_IO) using the SG driver.
If the ioctl command fails or the version of SG driver is earlier than 3.0, execute ioctl TUR which is defined as a SCSI command.
- TUR(legacy)
 - Monitoring is performed by using ioctl (Test Unit Ready). Test Unit Ready (TUR) which is defined as a SCSI command is used against the specified device, and the status of the device is determined by the result of the command.
- TUR(generic)

- Monitoring is executed by using ioctl TUR (SG_IO). ioctl TUR (SG_IO) which is defined as a SCSI command is used against the specified device, and the status of the device is determined by the result of the command. Even with a SCSI disk, SG_IO may not work successfully depending on the OS or distribution.

READ monitoring is performed as described below.

- The specified size of the specified device (disk device or partition device) or file is read. Judgement is performed by the size that could be read.
- Dummy Read reads the specified size data on the specified device (disk device or partition device). Based on the result (the size of data actually read), the status is judged.
- Dummy Read is for determining if the specified size of data can be read. Validity of the data read is not judged.
- Burden of the load experienced by the OS and disk is proportional to the size of the data on the specified disk to be read.
- See "[6.3.3. I/O size when READ is selected for disk monitor resources](#)" to configure the read size.

READ (O_DIRECT) monitoring is performed as described below.

- A single sector on the specified device (disk device or partition device) or the file are read without using the cache (O_DIRECT mode), and the result (the size of the data successfully read) is used to make a judgment.
- Judgment is based on whether or not reading has been performed successfully. Validity of the read data is not judged.

READ (RAW) monitoring is performed as described below.

- Reading is monitored for the specified device without using the OS cache, in the same way as READ (O_DIRECT).
- Judgment is based on whether or not reading has been performed successfully. Validity of the read data is not judged.
- When the READ (raw) monitoring method is specified, partitions that have been or will possibly be mounted cannot be monitored. In addition, a whole device (whole disk) that includes partitions that have been or will possibly be mounted cannot be monitored. Allocate a partition dedicated to monitoring and specify it as the disk monitor resource. (Allocate 10 MB or more to the monitoring partition).

READ (VXVM) monitoring is performed as described below.

- Like the READ (O_DIRECT) monitoring method, the process to read the specified device is monitored without using the OS cache.
- Judgment is based on whether or not reading has been performed successfully. Validity of the read data is not judged.
- The READ (VXVM) monitoring method can be used only when the file system of the volume raw device is vxfs.

WRITE (FILE) monitoring is performed as described below.

- The file of the specified path is created, written, and deleted to be judged.
- Validity of the written data is not judged.

6.3.3 I/O size when READ is selected for disk monitor resources

Enter the size of data when READ is selected as a method of monitoring.

Depending on the shared disk and interfaces in your environment, various caches for reading may be implemented. Because of this, when the specified read size is too small, READ may hit in cache, and may not be able to detect read errors.

When you specify a READ I/O size, verify that READ can detect I/O errors on the disk with that size by intentionally creating I/O errors.

The following diagram shows two servers connected to a shared disk.

There is a cache in the interface adaptor (HBA in the figure) such as SCSI or Fibre Channel.

A cache exists on the RAID subsystem in the shared disk.

There are also caches on each disk drive within the array disk.

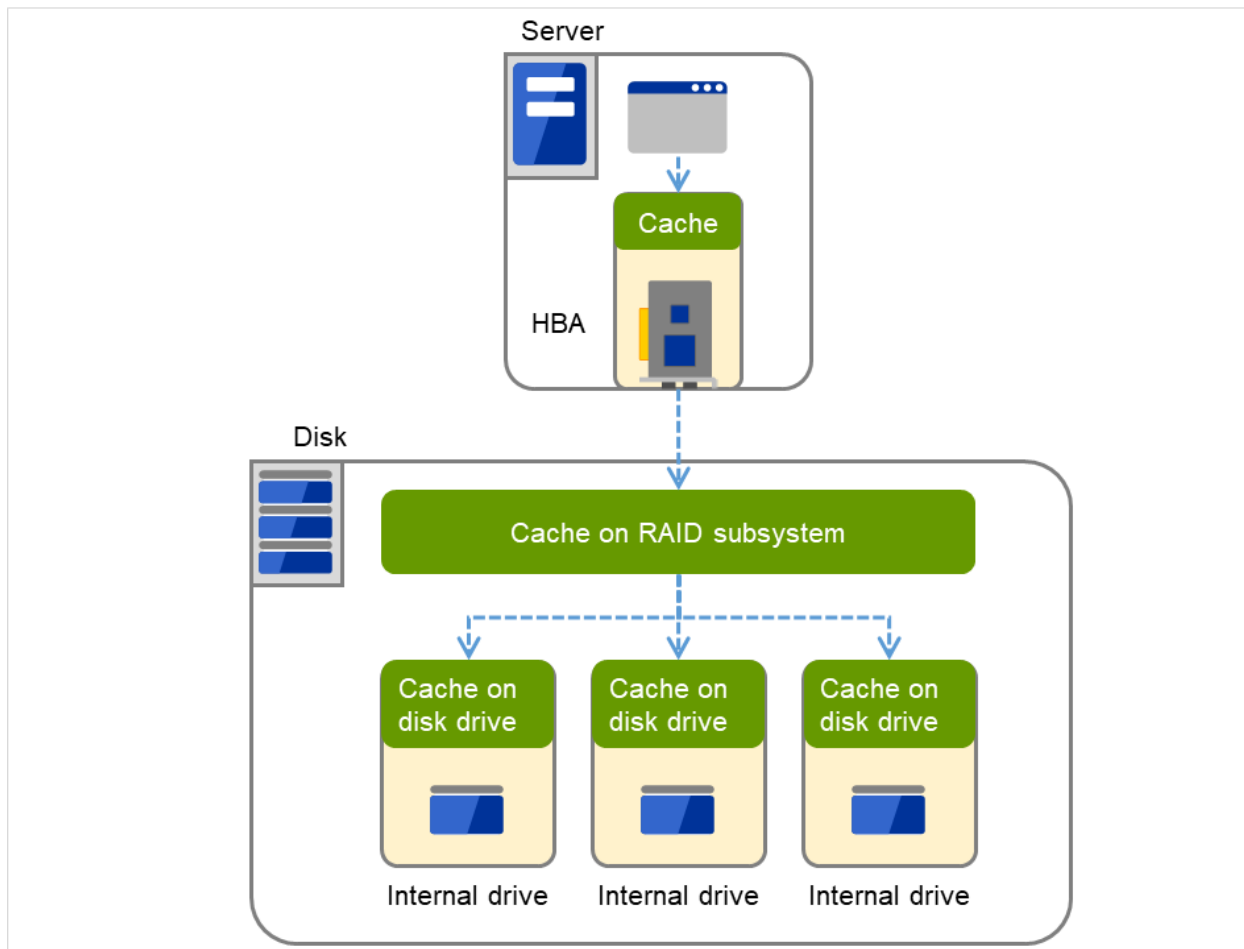


Fig. 6.2: Various caches

6.4 Setup example when READ (raw) is selected for the disk monitor resource

Example of disk monitor settings

- Disk monitor resource (internal HDD monitoring by READ (RAW))
- Disk monitor resource (shared disk monitoring by READ (RAW))

The following figure shows a server connected to disks. In the internal disk of Server 1, /dev/sda3 is specified as a Disk monitor.

Note:

Do not specify the partition used for the OS including swap.
Also, do not specify partitions already mounted or likely to be mounted, or a whole device.
Secure a partition dedicated to the Disk monitor resource.

In the externally connected disk, /dev/sdb3 is specified as a Disk monitor.

Note:

Do not specify partitions already mounted or likely to be mounted.
Also, do not specify partitions already mounted or a whole device for a partition likely to be mounted.
Secure a partition dedicated to the Disk monitor resource.

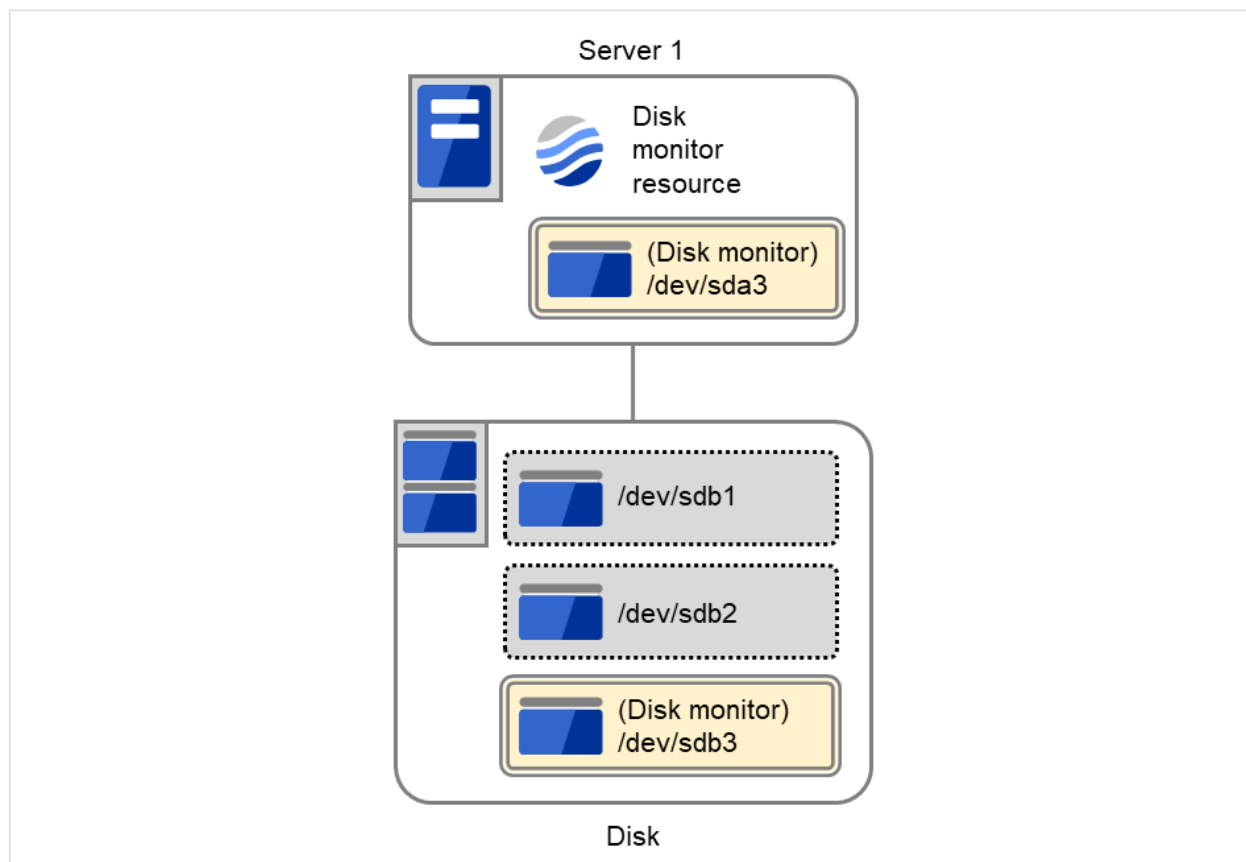


Fig. 6.3: A setting example of the disk monitors

6.5 Setting up IP monitor resources

IP monitor resource monitors IP addresses using the ping command.

6.5.1 Monitor(special) tab

IP addresses to be monitored are listed in **IP Addresses**.

The screenshot shows the 'Monitor Resource Properties' dialog box for 'ipw1'. It has four tabs: 'Info', 'Monitor(common)', 'Monitor(special)', and 'Recovery Action'. The 'Monitor(special)' tab is selected. Under the 'Common' section, 'server1' is listed. Below this are 'Edit', 'Add', and 'Remove' buttons. The 'IP Address List' section shows a table with one entry: '192.168.0.1'. At the bottom right are 'OK', 'Cancel', and 'Apply' buttons.

Add

Click **Add** to add an IP address to be monitored. Click **Edit** to display the **IP Address Settings** dialog box.

The screenshot shows the 'IP Address Settings' dialog box. It has a title bar 'IP Address Settings'. Inside, there is a label 'IP Address*' followed by a text input field. At the bottom right are 'OK' and 'Cancel' buttons.

IP Address (within 255 bytes)

Enter an IP address or a host name to be monitored in this field and click **OK**. The IP address or host name you enter here should be the one that exists on the public LAN. If you set the host name, set the name resolution to OS. (ex. By adding entry to /etc/hosts)

Remove

Click **Remove** to remove an IP address selected in **IP Addresses** from the list so that it will no longer be monitored.

Edit

Click **Edit** to display the **IP Address Settings** dialog box. The dialog box shows the IP address selected in **IP Addresses** on the **Parameter** tab. Edit the IP address and click **OK**.

6.5.2 Monitoring by IP monitor resources

IP monitor resource monitors specified IP addresses by using the ping command. If all IP addresses do not respond, the status is determined to be error.

- If you want to establish error when all of the multiple IP addresses have error, register all those IP addresses with one IP monitor resource.

The following figure is an example where all the IP addresses are registered with one IP monitor resource. If any one of the specified IP addresses is normal, IP monitor 1 is determined to be normal.

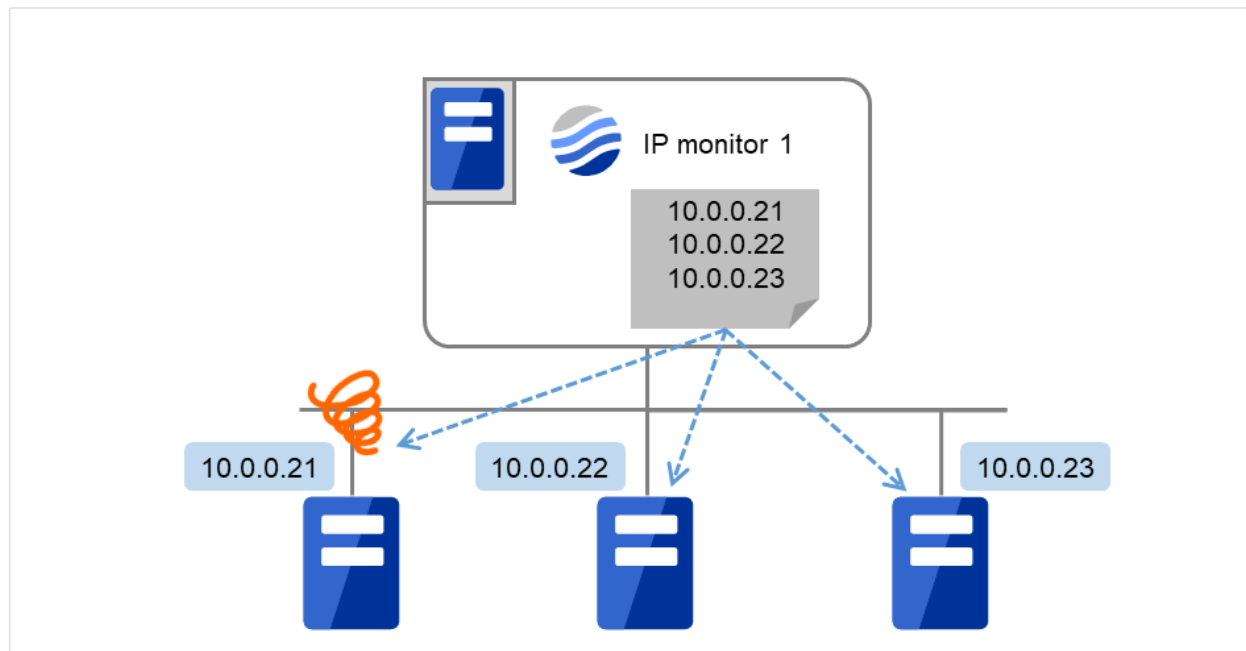


Fig. 6.4: Registering all the IP addresses with one IP monitor resource (in a normal case)

The following figure is an example where all the IP addresses are registered with one IP monitor resource. If all of the specified IP addresses have an error, IP monitor 1 is determined to have an error.

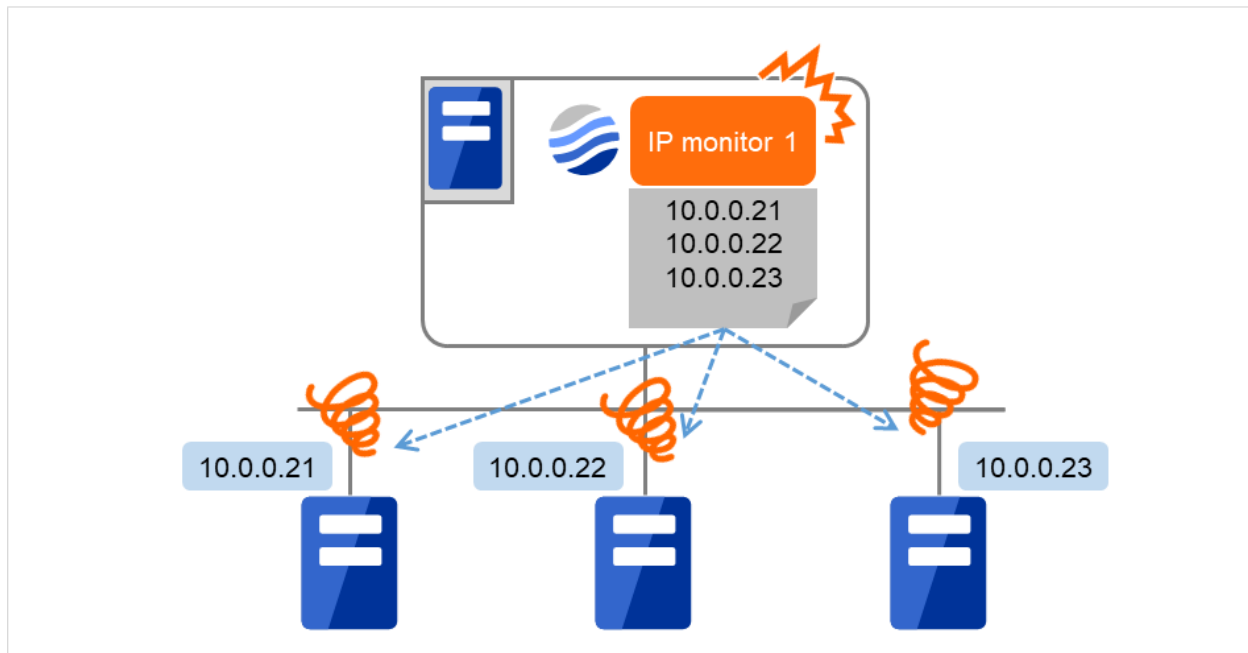


Fig. 6.5: Registering all the IP addresses with one IP monitor resource (when an error is detected)

- If you want to establish error when any one of IP addresses has an error, create one IP monitor resource for each IP address.

The following figure is an example where a different IP address is registered with each of the IP monitor resources. If the specified IP addresses have an error, the IP monitor (IP monitor 1 in the figure) is determined to have an error.

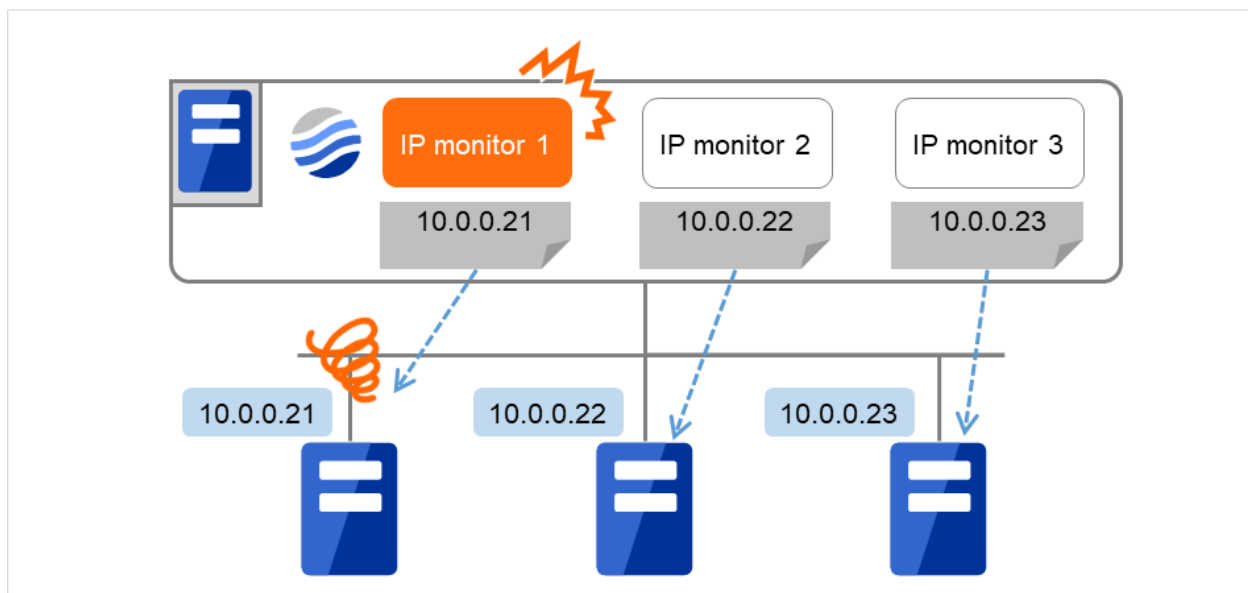
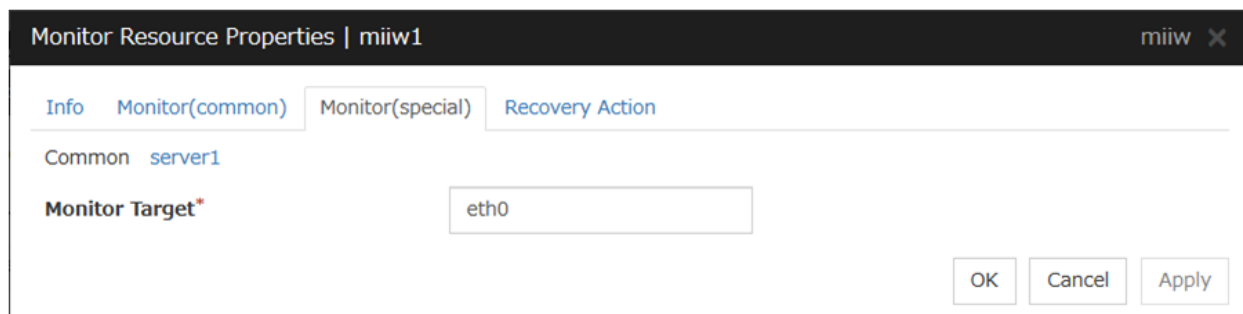


Fig. 6.6: Registering a different IP address with each of the IP monitor resources (when an error is detected)

6.6 Setting up NIC Link Up/Down monitor resources

NIC Link Up/Down monitor resource obtains the information on how the specified NIC is linked monitors the linkage is up or down.

6.6.1 Monitor(special) tab



Monitor Resource Properties | miiw1

Info Monitor(common) **Monitor(special)** Recovery Action

Common server1

Monitor Target*

OK Cancel Apply

Monitor Target (within 15 bytes)

Enter the name of the NIC interface you want to monitor. You can monitor Bond devices (e.g. bond.600) and team devices (e.g. team0). You can also monitor VLAN and tagVLAN (setting example: eth0.8).

6.6.2 System requirements for NIC Link Up/Down monitor resources

Network interfaces supporting NIC Link UP/Down monitor resource

NIC Link UP/Down monitor resource has been tested to work in the following network interfaces.

Ethernet Controller(Chip)	Bus	Driver version
Intel 82557/8/9	PCI	3.5.10-k2-NAPI
Intel 82546EB	PCI	7.2.9
Intel 82546GB	PCI	7.3.20-k2-NAPI
		7.2.9
Intel 82573L	PCI	7.3.20-k2-NAPI
Intel 80003ES2LAN	PCI	7.3.20-k2-NAPI
Broadcom BCM5721	PCI	7.3.20-k2-NAPI

6.6.3 Notes on NIC Link Up/Down monitor resources

Some NIC boards and drivers do not support required `ioctl()`.

The propriety of a NIC Link Up/Down monitor resource of operation can be checked by the `ethtool` command which each distributor offers.

```
ethtool eth0
Settings for eth0:
Supported ports: [ TP ]
Supported link modes: 10baseT/Half 10baseT/Full
100baseT/Half 100baseT/Full
```

(continues on next page)

(continued from previous page)

```
1000baseT/Full
Supports auto-negotiation: Yes
Advertised link modes: 10baseT/Half 10baseT/Full
100baseT/Half 100baseT/Full
1000baseT/Full
Advertised auto-negotiation: Yes
Speed: 1000Mb/s
Duplex: Full
Port: Twisted Pair
PHYAD: 0
Transceiver: internal
Auto-negotiation: on
Supports Wake-on: umbg
Wake-on: g
Current message level: 0x00000007 (7)
Link detected: yes
```

- When the LAN cable link status ("Link detected: yes") is not displayed as the result of the ethtool command:
 - It is highly likely that NIC Link Up/Down monitor resource of EXPRESSCLUSTER is not operable. Use IP monitor resource instead.
- When the LAN cable link status ("Link detected: yes") is displayed as the result of the ethtool command:
 - In most cases NIC Link Up/Down monitor resource of EXPRESSCLUSTER can be operated, but sometimes it cannot be operated.
 - Particularly in the following hardware, NIC Link Up/Down monitor resource of EXPRESSCLUSTER may not be operated. Use IP monitor resource instead.
 - When hardware is installed between the actual LAN connector and NIC chip such as a blade server

When you check if NIC Link Up/Down monitor resource can be used with the use of EXPRESSCLUSTER on a machine for production environment, follow the steps below.

1. Register NIC Link Up/Down monitor resource with the configuration data.
Select **No Operation** for the configuration of recovery operation of NIC Link Up/Down monitor resource upon error detection.
2. Start the server.
3. Check the status of NIC Link Up/Down monitor resource.
If the status of NIC Link Up/Down monitor resource is abnormal while LAN cable link status is normal, NIC Link Up/Down monitor resource cannot be used.
4. If NIC Link Up/Down monitor resource status becomes abnormal when LAN cable link status is made abnormal status (link down status), NIC Link Up/Down monitor resource can be used.
If the status remains to be normal, NIC Link Up/Down monitor resource cannot be used.

6.6.4 Configuration and range of NIC link up/down monitoring

An error detected by the NIC Link Up/Down monitoring can be caused by several factors. If an error occurs when a server and a network device are connected via a LAN cable, the cable may have come out of the server. On the contrary, the cable may have come out of the network device. Or, a power supply interruption of the network device may be a cause.

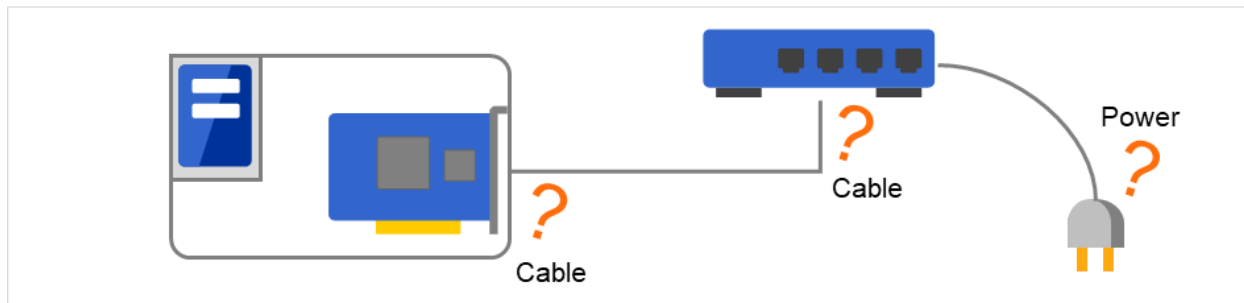


Fig. 6.7: NIC Link Up/Down monitoring and error occurrence factors

- The `ioctl()` to the NIC driver is used to find how the server is linked to the network.
(For the IP monitoring, the status is judged by the ping response from the specified IP address.)
- When you are monitoring any NIC directly connected to another server by using a LAN cable, an error is detected if the other server goes down (because a link cannot be established).
The recovery action to be taken at detection of error should be configured with the appropriate value.
For example, if you select **Stop cluster service and reboot OS**, the OS will be restarted an endless number of times.

When the network is employing bonding, both the slave interface (`eth0`, `eth1`...) and master interface (`bond0`...) may also be subject to monitoring, making the availability of bonding valid. In that case, the following settings are recommended.

- Slave interface
 - Recovery on error detection: Nothing
If only one cable (`eth0`) fails, EXPRESSCLUSTER does not perform a recovery action and just outputs an alert.
Network recovery is handled by bonding.
- Master interface
 - Recovery on error detection: Shutdown or another setting
If all slave interfaces fail (the master interface goes down), EXPRESSCLUSTER performs a recovery action.

In the figure below, slave interfaces `eth0` and `eth1` are combined by bonding to constitute a master interface `bond0`. If `eth0` is faulty, a bonding driver performs degeneration or switching.

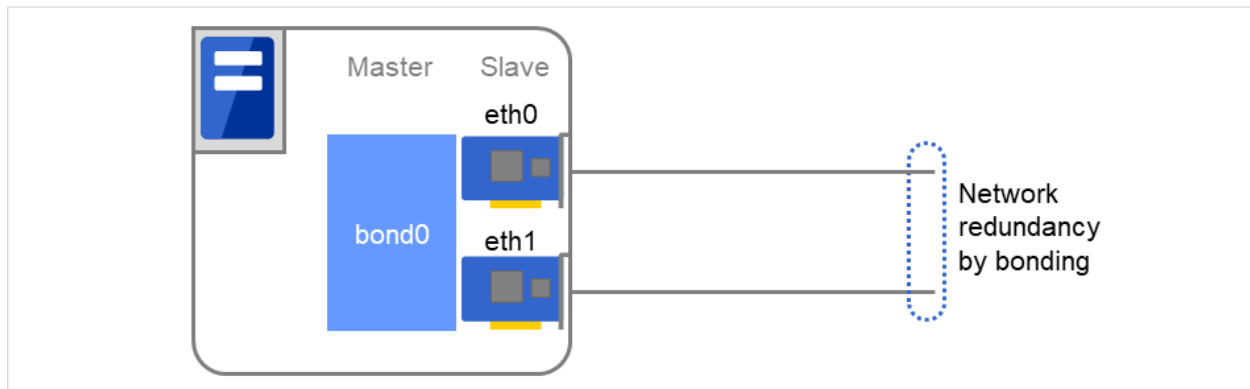


Fig. 6.8: An example of network bonding

6.7 Setting up PID monitor resources

PID monitor resource monitors a successfully activated EXEC resource. By monitoring the presence of process ID, an error is established when the process ID disappears.

The EXEC resource to be monitored is set according to the steps described in "Target Resource" of "[6.2. Monitor resource properties](#)". The EXEC resource can be monitored if its settings for activation are configured to **Asynchronous**. You cannot detect stalled status of the process.

Note: To monitor for the stalling of components such as databases, samba, apache, sendmail, purchase EXPRESS-CLUSTER monitoring options.

6.7.1 Notes on PID monitor resources

PID monitor resource monitors a successfully activated EXEC resource. The EXEC resource can be monitored if its settings for activation are configured to **Asynchronous**.

6.8 Setting up user-mode monitor resources

User-mode monitor resource considers stalling in user space as an error.

The resource is automatically registered. For the monitoring method, the user-mode monitor resource for softdog is automatically registered.

6.8.1 Monitor(special) tab

The screenshot shows the 'Monitor Resource Properties' dialog box for 'userw1'. The 'Monitor(special)' tab is selected. It contains the following settings:

- Use heartbeat interval and timeout:** ☐
- Method:**
- Operation at Timeout Detection:**
- Extended Monitor Settings:**
 - Open/Close Temporary File:** ☐
 - Write:** ☐
 - Size:** byte
 - Create Temporary Thread:** ☐

Buttons at the bottom: OK, Cancel, Apply.

Use heartbeat interval and timeout

Select this check box if you use heartbeat's interval and timeout for monitor's interval and timeout.

- When selected:
Heartbeat interval and timeout are used.
- When cleared:
Interval and timeout specified on the **Monitor** tab are used. You need to set a larger value for timeout than interval. When ipmi is specified as the monitoring method, the timeout time must be 255 or less.

Method

Choose how you want to monitor the user-mode monitor resource from the following. You can not select a method which has already been used for other user-mode monitor resource.

- softdog
The softdog driver is used.
- ipmi
The OpenIPMI is used.
- keepalive
The clpkhb and clpka drivers are used.
- none

Uses nothing.

Operation at Timeout Detection

Select the final action. This can be set only when the monitoring method is keepalive.

- **RESET**
Resets the server.
- **PANIC**
Performs a panic of the server.

Open/Close Temporary File

Select this check box if you want to **Open/Close Temporary File** at every interval when you execute monitoring.

- When selected:
A temporary file will be opened/closed.
- When cleared:
A temporary file will not be opened/closed.

Write:

Select this check box if you have chosen to **Open/Close Temporary File** and want to write in temporary data.

- When selected:
Temporary data is written into a temporary file.
- When cleared:
Temporary data is not written into a temporary file.

Size (1 to 9,999,999)

If you have chosen to write temporary data into a temporary file, specify the size to write in.

Create Temporary Thread

Select this check box if you want to create temporary thread when monitoring is performed.

- When selected:
Temporary thread will be created.
- When cleared:
Temporary thread will not be created.

6.8.2 Drivers user-mode monitor resources depend on

Monitor by: softdog

softdog

- This driver is necessary when softdog is used for monitoring.
- Configure a loadable module. Static driver cannot be used.
- Monitoring can not be started if the softdog driver is unable to use.

Monitor by: keepalive

- clpka

- clpkhb
- When keepalive is the monitoring method, the clpkhb and clpka drivers of EXPRESSCLUSTER are required.
- The clpka and clpkhb drivers are provided by EXPRESSCLUSTER. For the supported range, refer to "Supported distributions and kernel versions" in "Checking system requirements for EXPRESSCLUSTER X SingleServerSafe" in "About EXPRESSCLUSTER X SingleServerSafe" in the "EXPRESSCLUSTER X SingleServerSafe Installation Guide".
- If the clpkhb and clpka drivers cannot be used, monitoring cannot be started.

6.8.3 rpm the user-mode monitor resources depend on

Monitor method ipmi

OpenIPMI

- When the monitoring method is ipmi, the rpm must be installed.
- If the rpm is not installed, monitoring cannot be started.

6.8.4 How user-mode monitor resources perform monitoring

You can select how a user-mode monitor resource monitors its target from the following:

Monitor by: softdog

When the monitoring method of the user-mode monitor resource is softdog, the OS softdog driver is used.

Monitor by: ipmi

When the monitoring method is ipmi, OpenIPMI is used.

If OpenIPMI is not installed, OpenIPMI must be installed.

Monitor by: keepalive

When the monitoring method is keepalive, clpkhb and clpka drivers are used.

Note:

For the distributions and versions of the kernels valid for the clpkhb and clpka drivers, refer to "Supported distributions and kernel versions" in "Checking system requirements for EXPRESSCLUSTER X SingleServerSafe" in "About EXPRESSCLUSTER X SingleServerSafe" in the "EXPRESSCLUSTER X SingleServerSafe Installation Guide".

Also check this information before applying a security patch released by the distributor to a server already in operation (kernel upgrade).

Monitor by: none

"none" is a monitoring method is used for evaluation. This only executes operations of the advanced settings of the user-mode monitor resource. Do not use this in a production environment.

6.8.5 Advanced settings for user-mode monitor resources

Opening/closing of a temporary file, writing to a temporary file and creating a temporary thread are the configurations that allow advance user-mode monitor resource. If any of these configurations fail, the timer will not be updated. If a configuration continues to fail for the time period set for the timeout or heartbeat timeout, the OS is reset.

Open/Close Temporary File

A temporary file is created, opened, closed and then deleted at every monitoring interval repeatedly.

- When this advanced function is set and there is no free disk space, opening the temporary file fails and the OS is reset.

Write data into a dummy file

A specified size of data is written into a temporary file at every monitoring interval.

- This advanced function is not available unless opening/closing a temporary file is set.

Create dummy thread

A temporary thread is created at every monitoring interval.

6.8.6 User-mode monitor resource logic

The following sections describe how processes and features differ by ways of monitoring. For the shutdown monitoring, only Step 1 in each process overview is performed.

Monitor by: ipmi

- Process overview

Following steps below from 2 to 7 are repeated.

1. Set the IPMI timer
 2. Open() a dummy file
 3. Execute write() to the dummy file
 4. Execute fdatasync() to the dummy file
 5. Close() the dummy file
 6. Create a dummy thread
 7. Refresh the IPMI timer
- Steps 2 to 6 of the process overview are for advanced settings. To execute these steps, you need to configure each setting.
 - When a timeout does not occur (steps 2 to 7 above are performed without any problem):
No recovery action, including a reset, is performed.
 - When a timeout occurs (when any of steps 2 to 7 above is stopped or delayed):
A reset is performed by using BMC (the server's internal management function).
 - Advantages
 - * BMC (the server's internal management function) is used, so the kernel space is unlikely to fail and the possibility of a successful reset is high.
 - Disadvantages

- * Due to the dependency on the hardware, this method is unusable on a server that does not support IPMI or is unable to run OpenIPMI.
- * This method cannot be used on a server on which ESMPro/ServerAgent is used.
- * It might not be possible to use this method together with server monitoring software provided by another server vendor.

Monitor by: softdog

- Process overview

Following steps below from 2 to 7 are repeated.

1. Set up softdog
 2. Open() a dummy file
 3. Execute write() to the dummy file
 4. Execute fdatasync() to the dummy file
 5. Close() the dummy file
 6. Create a dummy thread
 7. Refresh the softdog timer
- Steps 2 to 6 of the process overview are for advanced settings. To execute these steps, you need to configure each setting.
 - When a timeout does not occur (steps 2 to 7 above are performed without any problem):
No recovery action, including a reset, is performed.
 - When a timeout occurs (when any of steps 2 to 7 above is stopped or delayed):
A reset is performed by softdog.ko.
- * Advantages
 - Because it does not depend on the hardware, this method can be used if the softdog kernel module is available.
(Some distributions do not include softdog by default, so check whether softdog exists before setting it up.)
 - * Disadvantages
 - Because softdog depends on the timer logic of the kernel space, a reset might not be performed if an error occurs in the kernel space.

Monitoring by: keepalive

- Process overview

Following steps below from 2 to 7 are repeated.

1. Set the keepalive timer
2. Open() a dummy file
3. Execute write() to the dummy file
4. Execute fdatasync() to the dummy file
5. Close() the dummy file
6. Create a dummy thread
7. Update the keepalive timer

Steps 2 to 6 of the process overview are for advanced settings. To execute these steps, you need to configure each setting.

- When a timeout does not occur (steps 2 to 7 above are performed without any problem):
No recovery action, including a reset, is performed.
- When a timeout occurs (i.e. any of Steps 2 to 7 is stopped or delayed):
- A reset or panic is generated by clpka.ko according to the action setting.
 - * Advantages
 - A panic can be specified as the action.
 - * Disadvantages
 - The distributions, architectures, and kernel versions (provided drivers) for which keepalive can operate are restricted.
 - Because clpka is dependent on the timer logic of the kernel space, reset may not be performed if an error occurs in the kernel space.

6.8.7 Checking whether ipmi can operate

To simply check for whether the server supports OpenIPMI, perform the following procedure.

1. Install the OpenIPMI rpm package.
2. Run `/usr/bin/ipmitool`.
3. Check the execution result.

When the result is displayed as shown below (the result of running `/usr/bin/ipmitool bmc watchdog get`)

(The following shows an example. The values may be different depending on the hardware.)

```
Watchdog Timer Use: SMS/OS (0x04)
Watchdog Timer Is: Stopped
Watchdog Timer Actions: No action (0x00)
Pre-timeout interval: 0 seconds
Timer Expiration Flags: 0x00
Initial Countdown: 300 sec
Present Countdown: 0 sec
```

OpenIPMI is usable. ipmi is selectable for the monitoring method.

6.8.8 Notes on user-mode monitor resources

Common notes on all the monitoring methods:

- When configuration information is created using the Cluster WebUI, a user-mode monitor resource is automatically created using the softdog monitoring method.
- User-mode monitor resources with different monitoring methods can be added. A user-mode monitor resource that was automatically created using the softdog monitoring method can be deleted.
- When a user-mode monitor resource fails to activate because, for example, the softdog driver of the OS does not exist, the clpkhb or clpka driver of EXPRESSCLUSTER does not exist, or the OpenIPMI rpm file has not been installed, the message "Monitor userw failed." is displayed in the Alert logs of the Cluster WebUI. In Cluster WebUI or information displayed by the clpstat command, **Normal** is displayed as the resource status and **Offline** is displayed as the server status.

Notes on monitoring by ipmi

- For notes on ipmi, see "IPMI command" in "Monitor resource" in "Monitor resource details" in the "Reference Guide" of EXPRESSCLUSTER X.

When server monitoring software provided by another server vendor such as ESMPRO/ServerAgent is used, do not select IPMI as the monitoring method.

Such server monitoring software and OpenIPMI both use BMC (Baseboard Management Controller) on the server, which causes a conflict and makes monitoring impossible.

6.9 Setting up custom monitor resources

Custom monitor resources monitor system by executing an arbitrary script.

6.9.1 Monitor(special) tab

Monitor Resource Properties | genw1 genw X

Info Monitor(common) **Monitor(special)** Recovery Action

☐ User Application
☒ Script created with this product

File genw.sh Edit View Replace

Monitor Type
☒ Synchronous
☐ Asynchronous

Wait a period of time for Application/Script monitor to start 0 sec

Log Output Path

Rotate Log ☐

Rotation Size 1000000 byte

Normal Return Value* 0

Wait for activation monitoring to stop before stopping the cluster ☐

OK Cancel Apply

User Application

Use an executable file (executable shell script file or execution file) on the server as a script. For the file name, specify an absolute path or name of the executable file of the local disk on the server.

These executable files are not included in the configuration data of the Cluster WebUI. They must be prepared on the server because they cannot be edited or uploaded by the Cluster WebUI.

Script created with this product

Use a script file which is prepared by the Cluster WebUI as a script. You can edit the script file with the Cluster WebUI if you need. The script file is included in the configuration data.

File (within 1,023 bytes)

Specify the script to be executed (executable shell script file or execution file) when you select **User Application** with its absolute path on the local disk of the server.

View

Click here to display the script file when you select **Script created with this product**.

Edit

Click here to edit the script file when you select **Script created with this product**. Click **Save** to apply the change. You cannot modify the name of the script file.

Replace

Click here to replace the content of the script file with that of the script file you selected in the file selection dialog box, when **Script created with this product** is selected. You cannot replace the script file if it is currently displayed or edited. Select a script file only. Do not select binary files (applications), and so on.

Monitor Type

Select a monitor type.

- Synchronous (default)
Custom monitor resources regularly run a script and detect errors from its error code.
- Asynchronous
Custom monitor resources run a script upon start monitoring and detect errors if the script process disappears.

Wait a period of time for Application/Script monitor to start (0 to 9999)

Specify the delay time from the start of the application/script and that of monitoring for the **Asynchronous** monitor type. This delay value must be set smaller than the timeout value specified under the **Monitor (common)** tab.

Note: The set value becomes valid next time you start the monitor.

Default value: 0

Log Output Path (within 1,023 bytes)

Specify log output path for the script of custom monitor resource.

Pay careful attention to the free space in the file system because the log is output without any limitations when the file name is specified and the Rotate Log check box is unchecked.

When the **Rotate Log** check box is checked, output log files are rotated.

Rotate Log

Turn this off to output execution logs of scripts and executable files with no limit on the file size. Turn it on to rotate and output the logs. In addition, note the following.

- Enter the log path in 1009 bytes or less in Log Output Path. If the path exceeds 1009 bytes, the logs are not output.
- The log file name must be 31 bytes or less. If the name exceeded 32 bytes, the logs are not output.
- If some custom monitor resources are configured to rotate logs, and the log file names are the same but the log paths are different, the Log Rotate Size may be incorrect.
(ex. /home/foo01/log/genw.log, /home/foo02/log/genw.log)

Rotation Size (1 to 9999999)

Specify a file size for rotating files when the **Rotate Log** check box is checked.

The log files that are rotated and output are configured as described below.

File name	Description
Log Output Path specified_file_name	Latest log file.
Log Output Path specified_file_name.pre	Former log file that has been rotated.

Normal Return Value (within 1,023 bytes)

When **Asynchronous** is selected for **Monitor Type**, set the values of script error code to be determined as normal. If you want to set two or more values here, separate them by commas like 0,2,3 or connect them with a hyphen to specify the range like 0-3.

Default value: 0

Wait for activation monitoring to stop before stopping the cluster

The cluster stop waits until the custom monitor resource is stopped. This is effective only when the monitoring timing is set to **Active**.

6.9.2 Notes on custom monitor resources

When the monitor type is **Asynchronous**, and the monitoring retry count is set to 1 or more, monitoring cannot be performed correctly. When you set the monitor type to **Asynchronous**, also specify 0 as the monitoring retry count. When the Script Log Rotate function is enabled, a process is generated to mediate the log output. This intermediate process continues to work until the file descriptor is closed (i.e. until all the logs stop being output from the start and stop scripts and from a descendant process that takes over the standard output and/or the standard error output from the start and stop scripts). To exclude output from the descendant process from the log, redirect the standard output and/or the standard error output when the process is generated with the script.

6.9.3 Monitoring by custom monitor resources

Custom monitor resources monitor system by an arbitrary script.

When **Monitor Type** is **Synchronous**, custom monitor resources regularly run a script and detect errors from its error code.

When **Monitor Type** is **Asynchronous**, custom monitor resources run a script upon start monitoring and detect errors if the script process disappears.

6.10 Setting up volume manager monitor resources

Volume manager monitor resources monitor logical disks managed by the volume manager.

6.10.1 Monitor(special) tab

The screenshot shows a window titled "Monitor Resource Properties | volmgrw1". It has four tabs: "Info", "Monitor(common)", "Monitor(special)", and "Recovery Action". The "Monitor(special)" tab is active. Inside this tab, there are two fields: "Volume Manager*" with a dropdown menu showing "lvm", and "Target Name*" with a text box containing "vg1". At the bottom right, there are three buttons: "OK", "Cancel", and "Apply".

Volume Manager

Specify the type of volume manager that manages the monitor target logical disks. The following volume managers are supported:

- lvm (LVM volume group)
- vxvm (VxVM daemon)
- zfspool (ZFS storage pool)

Target Name(within 1023 bytes)

Specify the name of the monitor target in the <VG name> format (only the target name is used).

When the volume manager is lvm, it's possible to control multiple volumes together.

More than one volume is delimited with an one-byte space.

When the volume manager is vxvm, this setting need not be entered.

6.10.2 Notes on volume manager monitor resources

When the volume manager is VxVM, volmgrw uses the daemon monitoring method. Therefore, registering multiple items in a single cluster is meaningless.

When specifying VxVM as the volume manager, do not specify the recovery target.

Volume manager monitor resources are configured with their default settings; change the settings as needed.

6.10.3 Monitoring by volume manager monitor resources

The monitoring method used by volume manager monitor resources depends on the type of volume manager that manages the target logical disks.

The following volume managers are supported:

- lvm (LVM volume group)
- vxvm (VxVM daemon)
- zfspool (ZFS storage pool)

6.11 Setting up multi target monitor resources

The multi target monitor resource monitors more than one monitor resources.

6.11.1 Monitor(special) tab

Monitor resources are grouped and the status of the group is monitored. You can register up to 64 monitor resources in the **Monitor Resources**.

When the only one monitor resource set in the **Monitor Resources** is deleted, the multi target monitor resource is deleted automatically.



Add

Click **Add** to add a selected monitor resource to **Monitor Resources**.

Remove

Click **Remove** to delete a selected monitor resource from **Monitor Resources**.

Tuning

Open **Multi Target Monitor Resource Tuning Properties** dialog box. Configure detailed settings for the multi target monitor resource.

Multi Target Monitor Resource Tuning Properties

Parameter tab

Detailed setting for parameter is displayed.

Error Threshold

Select the condition for multi target monitor resources to be determined as an error.

- Same as Number of Members
The status of multi target monitor resources becomes "Error" when all monitor resources specified to be under the multi target monitor resource are failed, or when "Error" and "Offline" co-exist.
The status of multi target monitor resources becomes "Normal" when the status of all monitor resources specified to be under the multi target monitor resource are "Offline."
- Specify Number
The status of multi target monitor resources becomes "Error" when the number of monitor resources specified in **Error Threshold** becomes "Error" or "Offline".
Specify how many of the monitor resources specified under the multi target monitor resource need to have the "Error" or "Offline" status before the status of the multi target monitor resource is judged to be "Error."
This can be set when **Specify Number** is selected for **Error Threshold**.

Warning Threshold

- When selected:
When the status of some monitor resources among those specified to be under the multi target monitor resource, specify how many monitor resources need to be "Error" or "Offline" to determine that the status of multi target monitor resource is "Caution."
- When cleared:
Multi target monitor resources do not display an alert.

Initialize

Used for initializing the value to the default value. Click **Initialize** to initialize all the items to their default values.

6.11.2 Notes on multi target monitor resources

The multi target monitor resources regard the offline status of registered monitor resources as being an error. For this reason, for a monitor resource that performs monitoring when the target is active is registered, the multi target monitor resource might detect an error even when an error is not detected by the monitor resource. Do not, therefore, register monitor resources that perform monitoring when the target is active.

6.11.3 Multi target monitor resource status

The status of the multi target monitor resource is determined by the status of registered monitor resources. The table below describes status of multi target monitor resource when the multi target monitor resource is configured as follows:

The number of registered monitor resources 2
Error threshold 2
Warning threshold 1

The table below describes status of a multi target monitor resource:

	Monitor resource1 status: normal (normal)	Monitor resource1 status: error (error)	Monitor resource1 status: Already stopped (offline)
Monitor resource2 status: normal (normal)	normal (normal)	caution (caution)	caution (caution)
Monitor resource2 status: error (error)	caution (caution)	error (error)	error (error)
Monitor resource2 status: Already stopped (offline)	caution (caution)	error (error)	normal (normal)

- Multi target monitor resource monitors status of registered monitor resources.
If the number of the monitor resources with the error status exceeds the error threshold, multi target monitor resource detects an error.
If the number of the monitor resources with the caution status exceeds the caution threshold, the status of the

multi target monitor resource becomes caution.

If all registered monitor resources are in the status of stopped (offline), the status of multi target monitor resource becomes normal.

Unless all the registered monitor resources are stopped (offline), the multi target monitor resource recognizes the stopped (offline) status of a monitor resource as error.

- If the status of a registered monitor resource becomes error, actions for the error of the monitor resource are not executed.

Actions for error of the multi target monitor resource are executed only when the status of the multi target monitor resource becomes error.

6.12 Example multi target monitor resource configuration

- Example of the disk path duplication driver usage
The status can be an error only if disk devices (such as /dev/sdb and /dev/sdc) fail at the same time.

In the figure below, a disk path is duplicated by using two HBAs and a disk path duplication driver. If one HBA is faulty, the disk path duplication driver performs degeneration or switching of the path.

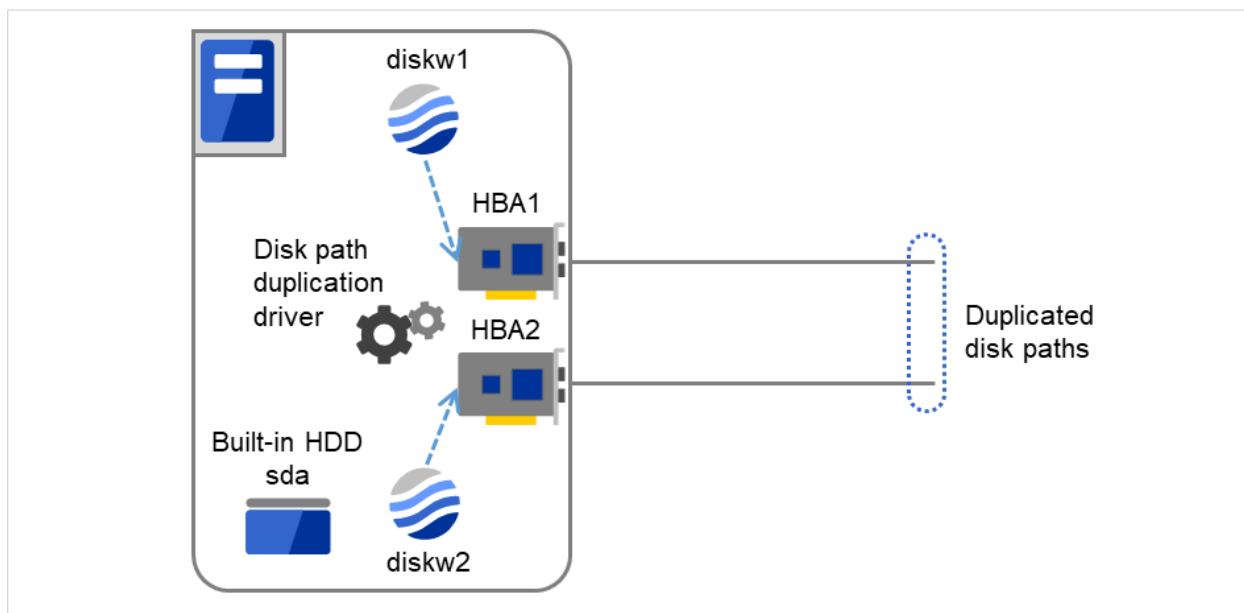


Fig. 6.9: An example of the disk path duplication driver

- Monitor **resources** to be registered with the multi target monitor resources (mtw1):
 - * diskw1
 - * diskw2
- Error Threshold and **Warning** Threshold of multi target monitor resource (mtw1)
 - * Error threshold 2
 - * Warning threshold 0
- Detailed settings of the monitor resource to be registered with the multi target monitor resource (mtw1)
 - * Disk monitor resource (diskw1)
 - Monitored device name /dev/sdb
 - Reactivation threshold 0
 - Failover threshold 0
 - Final action No Operation
 - * Disk monitor resource (diskw2)
 - Monitored device name /dev/sdc
 - Reactivation threshold 0

Failover threshold 0

Final action No Operation

- With the settings above, even if either of diskw1 and diskw2, which are registered as monitor resources of the multi target monitor resource detects an error, no actions for the monitor resource having the error are taken.
- Actions for an error set to the multi target monitor resource are executed when the status of both diskw1 and diskw2 become error, or when the status of two monitor resources become error and offline.

6.13 Setting up software RAID monitor resources

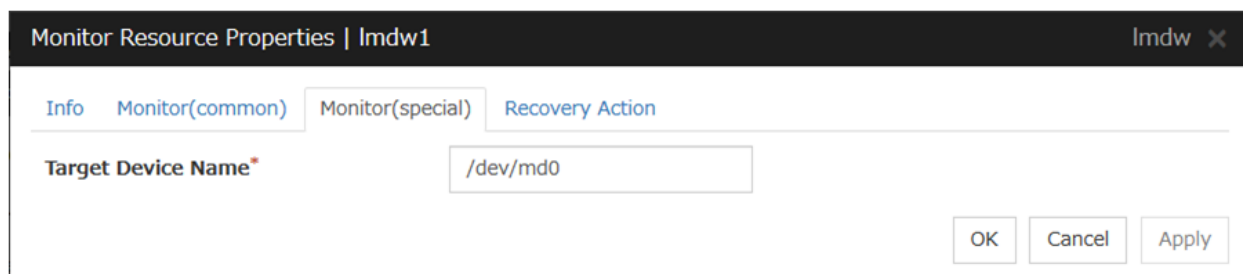
The software RAID monitor resource is to monitor software RAID devices.

6.13.1 Monitoring by software RAID monitor resources

The software RAID monitor resource is used to monitor software RAID devices by using the md driver. If either disk is faulty and software RAID is degraded, WARNING is issued.

Note: If both disks are faulty, any error cannot be detected; restore the disks when a notification about degradation is posted.

6.13.2 Monitor(special) tab



Monitor Resource Properties | lmdw1 lmdw ✕

Info Monitor(common) **Monitor(special)** Recovery Action

Target Device Name*

OK Cancel Apply

Target Device Name (within 1,023 bytes)

Specify the name of the md device to be monitored.

6.14 Setting up VM monitor resources

The VM monitor resource is used to check whether the virtual machine is alive.

6.14.1 Monitor(special) tab

The screenshot shows a window titled "Monitor Resource Properties | vmw1" with a close button (X) in the top right corner. Below the title bar are four tabs: "Info", "Monitor(common)", "Monitor(special)", and "Recovery Action". The "Monitor(special)" tab is currently selected. Inside this tab, there are two labeled input fields. The first is "Virtual Machine Resource*" with a dropdown menu showing "vm1". The second is "Wait Time When External Migration Occurs*" with a text input field containing "15" and a unit label "sec" to its right. At the bottom right of the dialog are three buttons: "OK", "Cancel", and "Apply".

Wait TimeWhen External Migration Occurs

Specify the time to wait for the completion of the migration.

6.14.2 Notes on VM monitor resources

- This resource is automatically registered when a virtual machine resource is added.
- Concerning the VM versions checked for the operation, refer to "Applications supported by the monitoring options" in "About EXPRESSCLUSTER X SingleServerSafe" in the "EXPRESSCLUSTER X SingleServerSafe Installation Guide".
- The times counter of the recovery action kept by the monitor resource is not reset even though the virtual machine monitor resource recovery is detected while recovery action is in transit, or after all the recovery action have completed. Execute either one of the following procedures when you want to reset the times counter of the recovery action.
 - Reset the times counter of the recovery action by the clpmonctrl command.
 - Execute cluster stop/start by clpcl command or Cluster WebUI.

6.14.3 Monitoring by VM monitor resources

The VM monitor resource performs monitoring as described below.

When the virtual machine is vSphere

VMware vSphere API is used to monitor the virtual machine.

As a result of monitoring, the following is considered as an error:

- (1) The VM status is POWEROFF/SHUTDOWN/SUSPENDED
- (2) The VM status could not be obtained

When the virtual machine is Xenserver

A general virtualization library is used to monitor the virtual machine.

As a result of monitoring, the following is considered as an error:

- (1) The VM status is HALTED/PAUSED/SUSPENDED
- (2) The VM status could not be obtained

When the virtual machine is Kvm

A general virtualization library is used to monitor the virtual machine.

As a result of monitoring, the following is considered as an error:

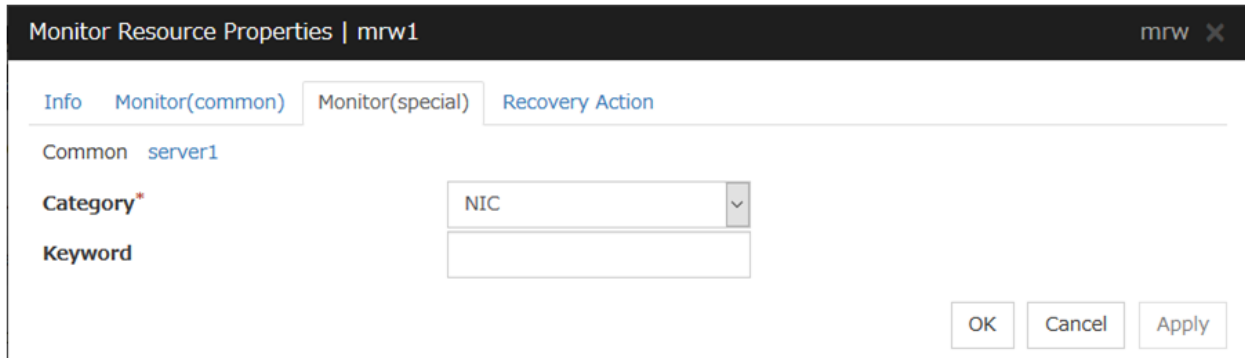
- (1) The VM status is BLOCKED/SHUTDOWN/PAUSED/SHUTOFF/CRASHED/NOSTATE
- (2) The VM status could not be obtained

6.15 Setting up message receive monitor resources

Message receive monitor resources are passive monitors. They do not perform monitoring by themselves.

When an error message is received from an outside of EXPRESSCLUSTER, the message receive monitor resources change their status and perform recovery from the error.

6.15.1 Monitor(special) tab



For **Category** and **Keyword**, specify a keyword passed using the -k parameter of the clprexec command. The keyword can be omitted.

Category (within 32 bytes)

Specify a monitor type.

You can select the default character string from the list box or specify any character string.

Keyword (within 1,023 bytes)

Specify a keyword passed using the -k parameter of the clprexec command.

6.15.2 Recovery Action tab

Specify the recovery target and the action upon detecting an error. For message receive monitor resources, select **Executing recovery script**, **Restart the recovery target**, or **Execute the final action** as the action to take when an error is detected. However, recovery will not occur if the recovery target is not activated.

The screenshot shows the 'Monitor Resource Properties' dialog box for resource 'mrw1'. The 'Recovery Action' tab is selected. The 'Recovery Action' dropdown is set to 'Execute the final action'. The 'Recovery Target' is '[All Groups]' with a 'Browse' button. Below this, there are two unchecked checkboxes: 'Execute migration before Failover' and 'Execute Failover to outside the Server Group'. The 'Final Action' dropdown is set to 'Stop the cluster service and reboot OS'. At the bottom, there is an unchecked checkbox for 'Execute Script before Recovery Action' and a 'Script Settings' button. The bottom right corner contains 'OK', 'Cancel', and 'Apply' buttons.

Recovery Action

Select the action to take when a monitor error is detected.

- **Executing the recovery script**
Execute the recovery script when a monitor error is detected.
- **Restart the recovery target**
Restart the group or group resource selected as the recovery target when a monitor error is detected.
- **Execute the final action**
Execute the selected final action when a monitor error is detected.

Execute Script before Recovery Action

Executes the script before the operation performed upon error detection selected as the recovery action.

- When selected
A script/command is executed before reactivation. To configure the script/command setting, click Settings.
- When cleared
Any script/command is not executed.

* For the settings of the items other than those mentioned above, see "6.2.4. *Recovery Action tab*" in "6.2. *Monitor resource properties*" in "6. *Monitor resource details*".

6.15.3 Monitoring by message reception monitor resources

- When an error message is received from an outside source, the resource recovers the message receive monitor resource whose Category and Keyword have been reported. (The Keyword can be omitted.)

If there are multiple message receive monitor resources whose monitor types and monitor targets have been reported, each monitor resource is recovered.

The following figure is an example of the configuration where a message receive monitor resource is used. The message receive monitor resource, when notified of the occurrence of an error, changes its status and executes the recovery action in response to error detection.

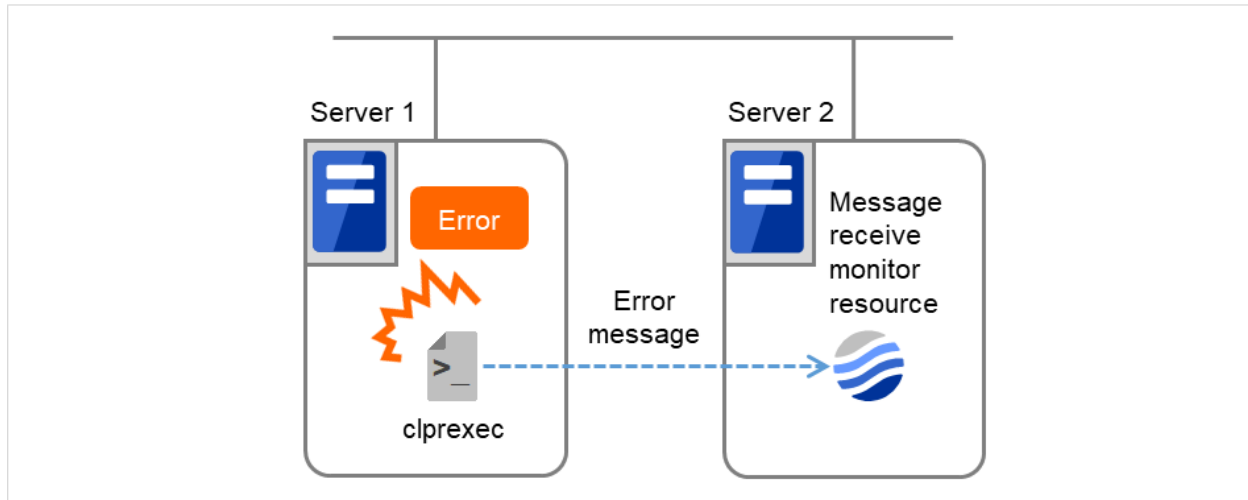


Fig. 6.10: A configuration where a message receive monitor resource is used

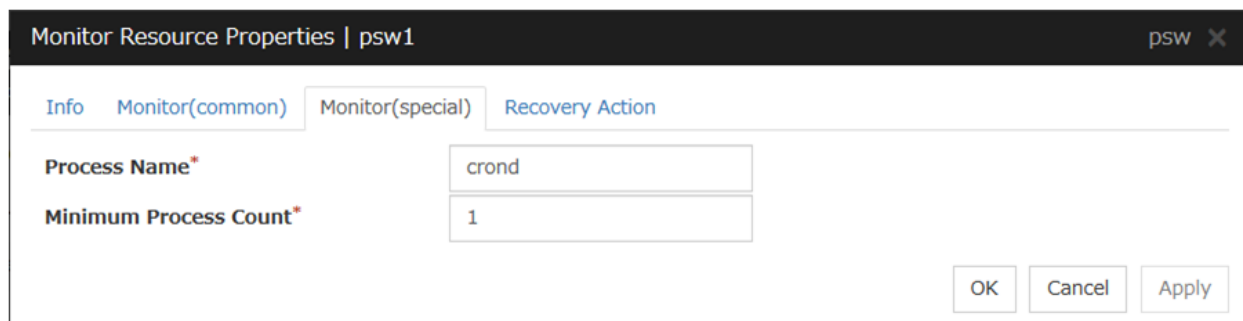
6.15.4 Notes on message reception monitor resources

- If a message receive monitor resource is paused when an error message is received from outside, error correction is not performed.
- If an error message is received from outside, the status of the message receive monitor resource becomes "error". The error status of the message receive monitor resource is not automatically restored to "normal". To restore the status to normal, use the clprexec command. For details about the clprexec command, see "EXPRESSCLUSTER X SingleServerSafe command reference" in the "EXPRESSCLUSTER X SingleServerSafe Operation Guide".
- If an error message is received when the message receive monitor resource is already in the error status due to a previous error message, recovery from the error is not performed.

6.16 Setting up Process Name monitor resources

Process name monitor resources monitor the process of specified processes. Process stalls cannot be detected.

6.16.1 Monitor(special) tab



Process Name (within 1,023 bytes)

Set the name of the target process. The process name can be obtained by using the ps(1) command.

Wild cards can be used to specify a process name by using one of the following three patterns. No other wild card pattern is permitted.

- [prefix search] <string included in the process name>*
- [suffix search] *<string included in the process name>
- [partial search] *<string included in the process name>*

Minimum Process Count (1 to 999)

Set the process count to be monitored for the monitor target process. If the number of processes having the specified monitor target process name falls short of the set value, an error is recognized.

6.16.2 Notes on process name monitor resources

If you set 1 for **Minimum Process Count**, and if there are two or more processes having the process name specified for the monitor target, only one process is selected under the following conditions and is subject to monitoring.

1. When the processes are in a parent-child relationship, the parent process is monitored.
2. When the processes are not in a parent-child relationship, the process having the earliest activation time is monitored.
3. When the processes are not in a parent-child relationship and their activation times are the same, the process having the lowest process ID is monitored.

If monitoring of the number of started processes is performed when there are multiple processes with the same name, specify the process count to be monitored for **Minimum Process Count**. If the number of processes with the same name falls short of the specified minimum count, an error is recognized. You can set 1 to 999 for **Minimum Process Count**. If you set 1, only one process is selected for monitoring.

Up to 1023 bytes can be specified for the monitor target process name. To specify a monitor target process with a name that exceeds 1023 bytes, use a wildcard (*).

If the name of the target process is 1023 bytes or longer, only the first 1023 bytes can be recognized as the process name. If you use a wild card (such as *) to specify a process name, specify a string containing the first 1023 or fewer bytes.

If the name of the target process is long, the latter part of the process name is omitted and output to the log.

If the name of the target process includes double quotations("") or a comma (,), the process name might not be correctly output to an alert message.

Check the monitor target process name which is actually running by ps(1) command, etc, and specify the monitor target process name.

execution result

```
# ps -eaf
UID          PID  PPID  C STIME TTY          TIME CMD
root           1      0  0 Sep12 ?        00:00:00 init [5]
:
root        5314      1  0 Sep12 ?        00:00:00 /usr/sbin/acpid
root        5325      1  0 Sep12 ?        00:00:00 /usr/sbin/sshd
htt         5481      1  0 Sep12 ?        00:00:00 /usr/sbin/htt -retryonerror 0
```

From the above command result, "/usr/sbin/htt -retryonerror 0" is specified as monitor target process name in the case of monitoring "/usr/sbin/htt".

The process name specified for the name of the target process specifies the target process, using the process arguments as part of the process name. To specify the name of the target process, specify the process name containing the arguments. To monitor only the process name with the arguments excluded, specify it with the wildcard (*) using right truncation or partial match excluding the arguments.

6.16.3 How process name monitor resources perform monitoring

The process name monitor resource monitors a process having the specified process name. If **Minimum Process Count** is set to 1, the process ID is identified from the process name and the deletion of the process ID is treated as an error. Process stalls cannot be detected.

If **Minimum Process Count** is set to a value greater than 1, the number of processes that have the specified process name are monitored. The number of processes to be monitored is calculated using the process name, and if the number falls below the minimum count, an error is recognized. Process stalls cannot be detected.

6.17 Setting up DB2 monitor resources

The DB2 monitor resource is used to monitor a DB2 database operating on a server.

6.17.1 Monitor(special) tab

Monitor Resource Properties | db2w1

db2w1 X

Info Monitor(common) Monitor(special) Recovery Action

Monitor Level* Level 2 (monitoring by update/select) ▼

Database Name* DB2DB

Instance* db2inst1

User Name* db2inst1

Password* ●●●●●●●● Change

Table* db2watch

Character Set* en_US.iso88591 ▼

Library Path* /opt/ibm/db2/V11.1/lib64/libdb2.so ▼

OK Cancel Apply

Monitor Level

Select one of the following levels. You cannot omit this level setting.

- Level 1 (monitoring by select)
Monitoring with only reference to the monitor table. SQL statements executed for the monitor table are of (select) type.
- Level 2 (monitoring by update/select)
Monitoring with reference to and update of the monitoring table. SQL statements executed for the monitor table are of (update/select) type.
If a monitor table is automatically created at the start of monitoring, the SQL statement (create/insert) is executed for the monitor table.
- Level 3 (create/drop table each time)
Creation/deletion of the monitor table by statement as well as update. SQL statements executed for the monitor table are of (create / insert / select / drop) type.

Default: Level 2 (monitoring by update/select)

Database Name (within 255 bytes)

Specify the database name to be monitored. Specifying this item cannot be omitted.

Default value: None

Instance (within 255bytes)

Specify the database instance name. Specifying this item cannot be omitted.

Default value: db2inst1

User Name (within 255 bytes)

Specify the user name to log on to the database. Specifying this item cannot be omitted.

Specify a DB2 user accessible to the specified database.

Default value: db2inst1

Password (within 255 bytes)

Specify the password to log on to the database. Specifying this item cannot be omitted.

Default value: None

Table (within 255 bytes)

Specify the name of a monitor table created on the database. Specifying this item cannot be omitted.

Make sure not to specify the same name as the table used for operation because a monitor table will be created and deleted. Be sure to set the name different from the reserved word in SQL statements.

Some characters cannot be used to specify a monitor table name according to the database specifications.

For details, refer to the database specifications.

Default value: db2watch

Character Set

Specify the character set of DB2. Specifying this item cannot be omitted.

Default value: None

Library Path (within 1,023 bytes)

Specify the home path to DB2. Specifying this item cannot be omitted.

Default value: /opt/ibm/db2/V11.1/lib64/libdb2.so

6.17.2 Notes on DB2 monitor resources

For the supported versions of DB2, see "Applications supported by the monitoring options" in "About EXPRESSCLUSTER X SingleServerSafe" in the "EXPRESSCLUSTER X SingleServerSafe Installation Guide".

This monitoring resource monitors DB2, using the CLI library of DB2. For this reason, it is required to execute "source instance user home/sqllib/db2profile" as root user. Write this in a start script.

To monitor a DB2 database that runs in the guest OS on a virtual machine controlled by a VM resource, specify the VM resource as the monitor target and specify enough wait time for the DB2 database to become accessible after the VM resource is activated for Wait Time to Start Monitoring. Also, set up the DB2 client on the host OS side, where monitor resources run, and register the database on the virtual machine to the database node directory.

If the code page of the database and the one of this monitor resource differ, this monitor resource cannot access to the DB2 database. Set an appropriate character code as necessary.

To check the code page of database, execute "db2 get db cfg for *Database_name*" For details, see DB2 manual.

If values of database name, instance name, user name and password specified by a parameter differ from the DB2 environment for monitoring, DB2 cannot be monitored. Error message is displayed. Check the environment.

Regarding the monitor levels described in the next section "[6.17.3. How DB2 monitor resources perform monitoring](#)", note the following:

At "Level 1", a monitor error occurs if there is no monitor table at the start of monitoring. Create a monitor table as shown below.

If there is no monitor table at the start of monitoring in "Level 2", EXPRESSCLUSTER automatically creates the monitor table. In this case, a message indicating that the Cluster WebUI Alert logs does not have the monitor table is displayed.

The load on the monitor at "Level 3" is higher than that at "Level 1" and "Level 2" because the monitor in "Level 3" creates or deletes monitor tables for each monitoring.

Selectable monitor level	Prior creation of a monitor table
Level 1 (monitoring by select)	Required
Level 2 (monitoring by update/select)	Optional
Level 3 (create/drop table each time)	Optional

Create a monitor table using either of the following methods:

Use SQL statements (in the following example, the monitor table is named db2watch)

```
sql> create table <user_name>.db2watch (num int not null primary key)
sql> insert into db2watch values(0)
sql> commit
```

Use EXPRESSCLUSTER command

As the prerequisite, setting up the monitor resource must be completed.

```
clp_db2w --createtable -n <DB2_monitor_resource_name>
```

To manually delete a monitor table, execute the following command:

```
clp_db2w --deletetable -n <DB2_monitor_resource_name>
```

6.17.3 How DB2 monitor resources perform monitoring

DB2 monitor resources perform monitoring according to the specified monitor level.

- Level 1 (monitoring by select)

Monitoring with only reference to the monitor table. SQL statements executed for the monitor table are of (select) type.

An error is recognized if:

- (1) An error message is sent in response to a database connection or SQL statement message

- Level 2 (monitoring by update/select)

Monitoring with reference to and update of the monitoring table. One SQL statement can read/write numerical data of up to 10 digits. SQL statements executed for the monitor table are of (update/select) type.

If a monitor table is automatically created at the start of monitoring, the SQL statement (create/insert) is executed for the monitor table.

An error is recognized if:

- (1) An error message is sent in response to a database connection or SQL statement message
- (2) The written data is not the same as the read data

- Level 3 (create/drop table each time)

Creation/deletion of the monitor table by statement as well as update. One SQL statement can read/write numerical data of up to 10 digits. SQL statements executed for the monitor table are of (create / insert / select / drop) type.

An error is recognized if:

- (1) An error message is sent in response to a database connection or SQL statement message
- (2) The written data is not the same as the read data

6.18 Setting up FTP monitor resources

The FTP monitor resource is to monitor the FTP service running on a server. FTP monitor resources monitor FTP protocol and they are not intended for monitoring specific applications. FTP monitor resources monitor various applications that use FTP protocol.

6.18.1 Monitor(special) tab

The screenshot shows a window titled "Monitor Resource Properties | ftpw1" with a close button (X) in the top right corner. Below the title bar are four tabs: "Info", "Monitor(common)", "Monitor(special)", and "Recovery Action". The "Monitor(special)" tab is currently selected. Inside this tab, there are four input fields: "IP Address*" with the value "127.0.0.1", "Port Number*" with the value "21", "User Name" (empty), and "Password" (masked with grey boxes). To the right of the "Password" field is a "Change" button. At the bottom right of the dialog are three buttons: "OK", "Cancel", and "Apply".

IP Address (within 79 bytes)

Specify the IP address of the FTP server to be monitored. Specifying this item cannot be omitted. If it is multi-directional standby server, specify FIP.

Usually, the FTP server running on the local server is connected, thus the loopback address (127.0.0.1) is to be configured. If accessible addresses are limited by the FTP server settings, specify an accessible address (e.g., floating IP address). To monitor an FTP server that runs in the guest OS on a virtual machine controlled by a VM resource, specify the IP address of the virtual machine.

Default value: 127.0.0.1

Port Number (1 to 65,535)

Specify the FTP port number to be monitored. Specifying this item cannot be omitted.

Default value: 21

User Name (within 255 bytes)

Specify the user name to log on to FTP.

Default value: None

Password (Within 255 bytes)

Specify the password to log on to FTP.

Default value: None

6.18.2 Notes on FTP monitor resources

Specify the EXEC resource that activates FTP for the target. Monitoring starts after target resource is activated. However, if FTP monitor resources cannot be started immediately after target resource is activated, adjust the time using **Wait Time to Start Monitoring**.

To monitor an FTP server that runs in the guest OS on a virtual machine controlled by a VM resource, specify the VM resource as the monitor target and specify enough wait time for the FTP server to become accessible after the VM resource is activated for **Wait Time to Start Monitoring**.

FTP service may produce operation logs for each monitoring. Configure FTP settings if this needs to be adjusted.

If a change is made to a default FTP message (such as a banner or welcome message) on the FTP server, it may be handled as an error.

6.18.3 Monitoring by FTP monitor resources

FTP monitor resources monitor the following:

FTP monitor resources connect to the FTP server and execute the command for acquiring the file list.

As a result of monitoring, the following is considered as an error:

- (1) When connection to the FTP service fails.
- (2) When an error is notified as a response to the FTP command.

6.19 Setting up HTTP monitor resources

The HTTP monitor resource is to monitor the HTTP daemon running on a server.

6.19.1 Monitor(special) tab

The screenshot shows the 'Monitor Resource Properties' dialog box for a resource named 'httpw1'. The 'Monitor(special)' tab is selected. The dialog contains the following fields and options:

- Connecting Destination***: A text box containing 'localhost'.
- Port***: A text box containing '80'.
- Request URI**: An empty text box.
- Protocol**: Radio buttons for 'HTTP' (selected) and 'HTTPS'.
- Request Type**: Radio buttons for 'HEAD' (selected) and 'GET'.
- User Name**: An empty text box.
- Password**: A masked text box with a 'Change' button next to it.

At the bottom right, there are three buttons: 'OK', 'Cancel', and 'Apply'.

Connecting Destination (within 255 bytes)

Specify the name of the HTTP server to be monitored. Specifying this item cannot be omitted.

Usually, specify the loopback address (127.0.0.1) to connect to the HTTP server that runs on the local server. If the addresses for which connection is possible are limited by HTTP server settings, specify an address for which connection is possible. To monitor an HTTP server that runs in the guest OS on a virtual machine controlled by a VM resource, specify the IP address of the virtual machine.

Default value: localhost

Port (1 to 65,535)

You must specify the port number of the HTTP to be monitored. Specifying this item cannot be omitted.

Default value: 80 (HTTP)

443 (HTTPS)

Request URI (within 255 bytes)

Configure the Request URI (e.g. "/index.html").

Default value: None

Protocol

Configure protocol used for communication with HTTP server. In general, HTTP is selected. If you need to connect with HTTP over SSL, select HTTPS.

Default value: HTTP

Note: Using HTTPS requires the OpenSSL library.

Request Type

Specify a type of HTTP request for accessing the HTTP server. Setting this parameter is mandatory.

Default value: HEAD

User Name (within 255 bytes)

Specify a user name for logging in to the HTTP server .

This specification is necessary only for basic authentication.

Default value: None

Password (within 255 bytes)

Specify a password for logging in to the HTTP server .

This specification is necessary only for basic authentication.

Default value: None

6.19.2 Notes on HTTP monitor resources

Concerning the HTTP versions checked for the operation, refer to "Applications supported by the monitoring options" in "About EXPRESSCLUSTER X SingleServerSafe" in the "EXPRESSCLUSTER X SingleServerSafe Installation Guide".

To monitor an HTTP server that runs in the guest OS on a virtual machine controlled by a VM resource, specify the VM resource as the monitor target and specify enough wait time for the HTTP server to become accessible after the VM resource is activated for **Wait Time to Start Monitoring**.

HTTP monitor resources do not support client authentication or digest authentication.

6.19.3 Monitoring by HTTP monitor resources

HTTP monitor resources monitor the following:

A connection is made with the HTTP daemon on the server and the HTTP request is issued to monitor the HTTP daemon.

As a result of monitoring, the following is considered as an error:

- (1) An error is posted for the connection with the HTTP daemon
- (2) The response message to the HTTP request issued does not begin with "HTTP/"
- (3) The status code of the response to the HTTP request issued is 400 to 499 or 500 to 599 (when a non-predefined URI is specified for the Request URI)

6.20 Setting up IMAP4 monitor resources

IMAP4 monitor resources monitor IMAP4 services that run on the server. IMAP4 monitor resources monitor IMAP4 protocol but they are not intended for monitoring specific applications. IMAP4 monitor resources monitor various applications that use IMAP4 protocol.

6.20.1 Monitor(special) tab

The screenshot shows a window titled "Monitor Resource Properties | imap4w1" with a close button "imap4w X". Inside, there are four tabs: "Info", "Monitor(common)", "Monitor(special)" (which is selected), and "Recovery Action". The "Monitor(special)" tab contains the following fields and controls:

- IP Address***: A text box containing "127.0.0.1".
- Port Number***: A text box containing "143".
- User Name**: An empty text box.
- Password**: A masked text box (gray) with a "Change" button to its right.
- Authentication Method**: Two radio buttons: ☒ AUTHENTICATE LOGIN and ☐ LOGIN.

At the bottom right of the dialog are three buttons: "OK", "Cancel", and "Apply".

IP Address (within 79 bytes)

Specify the IP address of the IMAP4 server to be monitored. Specifying this item cannot be omitted. If it is multi-directional standby server, specify FIP.

Usually, specify the loopback address (127.0.0.1) to connect to the IMAP4 server that runs on the local server. If the addresses for which connection is possible are limited by IMAP4 server settings, specify an address for which connection is possible. To monitor an IMAP4 server that runs in the guest OS on a virtual machine controlled by a VM resource, specify the IP address of the virtual machine.

Default value: 127.0.0.1

Port Number (1 to 65,535)

Specify the port number of the IMAP4 to be monitored. Specifying this item cannot be omitted.

Default value: 143

User Name (within 255 bytes)

Specify the user name to log on to IMAP4.

Default value: None

Password (within 189 bytes)

Specify the password to log on to IMAP4. Click **Change** and enter the password in the dialog box.

Default value: None

Authentication Method

Select the authentication method to log on to IMAP4. It must follow the settings of IMAP4 being used:

- AUTHENTICATE LOGIN (default value)

The encryption authentication method that uses the AUTHENTICATE LOGIN command.

- LOGIN

The plaintext method that uses the LOGIN command.

6.20.2 Notes on IMAP4 monitor resources

For the target to be monitored, specify the EXEC resource that starts the IMAP4 server. Monitoring starts after the target resource is activated. However, if the IMAP4 server cannot be started immediately after the target resource is activated, adjust the time by using **Wait Time to Start Monitoring**.

To monitor an IMAP4 server that runs in the guest OS on a virtual machine controlled by a VM resource, specify the VM resource as the monitor target and specify enough wait time for the IMAP4 server to become accessible after the VM resource is activated for **Wait Time to Start Monitoring**.

The IMAP4 server might output an operation log or other data for each monitoring operation. If this needs to be adjusted, specify the IMAP4 server settings as appropriate.

6.20.3 Monitoring by IMAP4 monitor resources

IMAP4 monitor resources monitor the following:

IMAP4 monitor resources connect to the IMAP4 server and execute the command to verify the operation.

As a result of monitoring, the following is considered as an error:

- (1) When connection to the IMAP4 server fails.
- (2) When an error is notified as a response to the command.

6.21 Setting up MySQL monitor resources

MySQL monitor resource monitors MySQL database that operates on servers.

6.21.1 Monitor(special) tab

Monitor Resource Properties | mysqlw1

mysqlw1 ✕

Info Monitor(common) **Monitor(special)** Recovery Action

Monitor Level* Level 2 (monitoring by update/select) ▼

Database Name* MYSQLDB

IP Address* 127.0.0.1

Port* 3306

User Name* user1

Password [masked] Change

Table* mysqlwatch

Storage Engine* InnoDB ▼

Library Path* /usr/lib64/mysql/libmysqlclient.so.20 ▼

OK Cancel Apply

Monitor Level

Select one of the following levels. You cannot omit this level setting.

- Level 1 (monitoring by select)
Monitoring with only reference to the monitor table. SQL statements executed for the monitor table are of (select) type.
- Level 2 (monitoring by update/select)
Monitoring with reference to and update of the monitoring table. SQL statements executed for the monitor table are of (update/select) type.
If a monitor table is automatically created at the start of monitoring, the SQL statement (create/insert) is executed for the monitor table.
- Level 3 (create/drop table each time)
Creation/deletion of the monitor table by statement as well as update. SQL statements executed for the monitor table are of (create / insert / select / drop) type.

Default: Level 2 (monitoring by update/select)

Database Name (within 255 bytes)

Specify the database name to be monitored. Specifying this item cannot be omitted.

Default value: None

IP Address (within 79 bytes)

Specify the IP address of the database server to be monitored. Specifying this item cannot be omitted.

Usually, a connection is made with the MySQL server running on the local server, thus the loopback address (127.0.0.1) is to be configured. If a MySQL database running on a guest OS of a virtual machine controlled by a VM resource is monitored, specify the IP address of the virtual machine.

Default value: 127.0.0.1

Port (1 to 65,535)

Specify the port number for connection. Specifying this item cannot be omitted.

Default value: 3,306

User Name (within 255 bytes)

Specify the user name to log on to the database. Specifying this item cannot be omitted.

Specify the MySQL user who can access the specified database.

Default value: None

Password (within 255 bytes)

Specify the password to log on to the database.

Default value: None

Table (within 255 bytes)

Specify the name of a monitor table created on the database. Specifying this item cannot be omitted. Make sure not to specify the same name as the table used for operation because a monitor table will be created and deleted. Be sure to set the name different from the reserved word in SQL statements.

Some characters cannot be used to specify a monitor table name according to the database specifications. For details, refer to the database specifications.

Default value: mysqlwatch

Storage Engine

Specify the storage engine to create monitoring tables. Specifying this item cannot be omitted.

Default value: InnoDB

Library Path (within 1,023 bytes)

Specify the library path to MySQL. Specifying this item cannot be omitted.

Default value: /usr/lib64/mysql/libmysqlclient.so.20

6.21.2 Notes on MySQL monitor resources

For the supported versions of MySQL, see "Applications supported by the monitoring options" in "About EXPRESS-CLUSTER X SingleServerSafe" in the "EXPRESSCLUSTER X SingleServerSafe Installation Guide".

This monitor resource monitors MySQL using the libmysqlclient library of MySQL.

If this monitor resource fails, check that "libmysqlclient.so.xx" exists in the installation directory of the MySQL library.

To monitor a MySQL database that runs in the guest OS on a virtual machine controlled by a VM resource, specify the VM resource as the monitor target and specify enough wait time for the MySQL database to become accessible after the VM resource is activated for Wait Time to Start Monitoring.

If a value specified by a parameter differs from the MySQL environment for monitoring, an error message is displayed on the Cluster WebUI Alertlogs. Check the environment.

Regarding the monitor levels described in the next section "6.21.3. *How MySQL monitor resources perform monitoring*", note the following:

At "Level 1", a monitor error occurs if there is no monitor table at the start of monitoring. Create a monitor table as shown below.

If there is no monitor table at the start of monitoring in "Level 2", EXPRESSCLUSTER automatically creates the monitor table. In this case, a message indicating that the Cluster WebUI Alert logs does not have the monitor table is displayed.

The load on the monitor at "Level 3" is higher than that at "Level 1" and "Level 2" because the monitor in "Level 3" creates or deletes monitor tables for each monitoring.

Selectable monitor level	Prior creation of a monitor table
Level 1 (monitoring by select)	Required
Level 2 (monitoring by update/select)	Optional
Level 3 (create/drop table each time)	Optional

Create a monitor table using either of the following methods:

Use SQL statements (in the following example, the monitor table is named mysqlwatch)

```
sql> create table mysqlwatch (num int not null primary key) ENGINE=<engine>;
sql> insert into mysqlwatch values(0);
sql> commit;
```

Use EXPRESSCLUSTER commands

As the prerequisite, setting up the monitor resource must be completed.

```
clp_mysqlw --createtable -n <MySQL_monitor_resource_name>
```

To manually delete a monitor table, execute the following command:

```
clp_mysqlw --deletetable -n <MySQL_monitor_resource_name>
```

6.21.3 How MySQL monitor resources perform monitoring

MySQL monitor resources perform monitoring according to the specified monitor level.

- Level 1 (monitoring by select)

Monitoring with only reference to the monitor table. SQL statements executed for the monitor table are of (select) type.

An error is recognized if:

- (1) An error message is sent in response to a database connection or SQL statement message

- Level 2 (monitoring by update/select)

Monitoring with reference to and update of the monitoring table. One SQL statement can read/write numerical data of up to 10 digits. SQL statements executed for the monitor table are of (update/select) type.

If a monitor table is automatically created at the start of monitoring, the SQL statement (create/insert) is executed for the monitor table.

An error is recognized if:

- (1) An error message is sent in response to a database connection or SQL statement message
- (2) The written data is not the same as the read data

- Level 3 (create/drop table each time)

Creation/deletion of the monitor table by statement as well as update. One SQL statement can read/write numerical data of up to 10 digits. SQL statements executed for the monitor table are of (create / insert / select / drop) type.

An error is recognized if:

- (1) An error message is sent in response to a database connection or SQL statement message
- (2) The written data is not the same as the read data

6.22 Setting up NFS monitor resources

NFS monitor resource monitors NFS file server that operates on servers.

6.22.1 Monitor(special) tab

Monitor Resource Properties | nfs1

Info Monitor(common) **Monitor(special)** Recovery Action

Share Directory* /usr/local/tomcat

NFS Server* 127.0.0.1

NFS Version* v4 ▼

OK Cancel Apply

Share Directory (within 1,023 bytes)

Specify a directory for sharing files. Specifying this item cannot be omitted.

Default value: None

NFS Server (within 255 bytes)

Specify an IP address of the server that monitors NFS. Specifying this item cannot be omitted.

Usually, a connection is made with the NFS file server running on the local server, thus the loopback address (127.0.0.1) is to be configured. If an NFS file server running on a guest OS of a virtual machine controlled by a VM resource is monitored, specify the IP address of the virtual machine.

Default value: 127.0.0.1

NFS Version

Select one NFS version for NFS monitoring, from the following choices. Be careful to set this NFS version. In RHEL 7, the NFS version v2 is not supported.

- v2
Monitors NFS version v2.
- v3
Monitors NFS version v3.
- v4
Monitors NFS version v4.

Default value: v4

6.22.2 System requirements for NFS monitor resource

The use of NFS monitor resources requires that the following already be started:

- nfs
- rpcbind
- nfslock (unnecessary for NFS v4)

6.22.3 Notes on NFS monitor resources

Concerning the NFS versions checked for the operation, refer to "Applications supported by the monitoring options" in "About EXPRESSCLUSTER X SingleServerSafe" in the "EXPRESSCLUSTER X SingleServerSafe Installation Guide".

Specify the exports file for the shared directory to be monitored to enable the connection from a local server.

To monitor an NFS file server running on a guest OS of a virtual machine controlled by a VM resource, specify the VM resource for the target of monitoring and set **Wait Time to Start Monitoring** with sufficient time to wait the NFS file server to be connectable after VM resource activation.

It is handled as an error that the deletion of nfsd with the version specified for **NFS version** of the **Monitor(special)** tab and mountd corresponding the nfsd is detected. The correspondence between nfsd versions and mountd versions is as follows.

nfsd version	mountd version
v2 (udp)	v1 (tcp) or v2 (tcp)
v3 (udp)	v3 (tcp)
v4 (tcp)	-

6.22.4 Monitoring by NFS monitor resources

NFS monitor resource monitors the following:

Connect to the NFS server and run **NFS** test command.

As a result of monitoring, the following is considered as an error:

- (1) Response to the NFS service request is invalid
- (2) mountd is deleted (excluding NFS v4)
- (3) nfsd is deleted
- (4) The rpcbind service is stopped
- (5) The export area is deleted (excluding NFS v4)

When an error is repeated the number of times set to retry count, it is considered as NFS error.

6.23 Setting up ODBC monitor resources

ODBC monitor resource monitors ODBC database that operates on servers.

6.23.1 Monitor(special) tab

The screenshot shows the 'Monitor Resource Properties' dialog box for 'odbcw1'. The 'Monitor(special)' tab is selected. The 'Monitor Level' is set to 'Level 2 (monitoring by update/select)'. The 'Data Source Name' is 'ODBC1'. The 'User Name' field is empty. The 'Password' field is masked with a grey box, and there is a 'Change' button next to it. The 'Monitor Table Name' is 'odbcwatch'. The 'Message Character Set' is 'UTF-8'. At the bottom right, there are 'OK', 'Cancel', and 'Apply' buttons.

Monitor Level

Select one of the following levels. You cannot omit this level setting.

- Level 1 (monitoring by select)
Monitoring with only reference to the monitor table. SQL statements executed for the monitor table are of (select) type.
- Level 2 (monitoring by update/select)
Monitoring with reference to and update of the monitoring table. SQL statements executed for the monitor table are of (update/select) type.
If a monitor table is automatically created at the start of monitoring, the SQL statement (create/insert) is executed for the monitor table.
- Level 3 (create/drop table each time)
Creation/deletion of the monitor table by statement as well as update. SQL statements executed for the monitor table are of (create / insert / select / drop) type.

Default: Level 2 (monitoring by update/select)

Data Source Name (Within 255 bytes)

Specify the data source name to be monitored. You must specify the name.

Default value: None

User Name (Within 255 bytes)

Specify the user name to log on to the database.

You do not have to specify if the user name is specified in the odbc.ini settings.

Default value: None

Password (Within 255 bytes)

Specify the password to log on to the database.

Default value: None

Monitor Table Name (Within 255 bytes)

Specify the name of a monitor table created in the database. You must specify the table name.

Make sure not to specify the same name as the table used for operation because a monitor table will be created and deleted. Be sure to set the name different from the reserved word in SQL statements.

Some characters cannot be used to specify a monitor table name according to the database specifications. For details, refer to the database specifications.

Default value: odbcwatch

Message Character Set

Specify the character code of database messages.

Default value: UTF-8

6.23.2 Notes on ODBC monitor resources

Since unixODBC Driver Manager is used for the monitoring process, installation of ODBC driver for the database to be monitored and settings for the data source on `odbc.ini` in advance.

To monitor a database that runs in the guest OS on a virtual machine controlled by a VM resource, specify the VM resource as the monitor target and specify enough wait time for the database to become accessible after the VM resource is activated for **Wait Time to Start Monitoring**.

If a value specified by a parameter differs from the database environment for monitoring, a message indicating an error is displayed on the Alert logs of the Cluster WebUI. Check the environment.

Regarding the monitor levels described in the next section "*How ODBC monitor resources perform monitoring*", note the following:

At "Level 1", a monitor error occurs if there is no monitor table at the start of monitoring. Create a monitor table as shown below.

If there is no monitor table at the start of monitoring in "Level 2", EXPRESSCLUSTER automatically creates the monitor table. In this case, a message indicating that the Cluster WebUI Alert logs does not have the monitor table is displayed.

The load on the monitor at "Level 3" is higher than that at "Level 1" and "Level 2" because the monitor in "Level 3" creates or deletes monitor tables for each monitoring.

Selectable monitor level	Prior creation of a monitor table
Level 1 (monitoring by select)	Required
Level 2 (monitoring by update/select)	Optional
Level 3 (create/drop table each time)	Optional

Create a monitor table using either of the following methods:

Alphanumeric characters and some symbols (such as underscores) can be used to specify a monitor table name.

(in the following example, the monitor table is named `odbcwatch`)

```
sql> create table odbctest (num int not null primary key);  
sql> insert into odbctest values(0);  
sql> commit;
```

Use EXPRESSCLUSTER command

As the prerequisite, setting up the monitor resource must be completed.

```
clp_odbctw --createtable -n <ODBC monitor_resource_name>
```

To manually delete a monitor table, execute the following command:

```
clp_odbctw --deletetable -n <ODBC monitor_resource_name>
```

6.23.3 How ODBC monitor resources perform monitoring

ODBC monitor resources perform monitoring according to the specified monitor level.

- Level 1 (monitoring by select)

Monitoring with only reference to the monitor table. SQL statements executed for the monitor table are of (select) type.

An error is recognized if:

- (1) An error message is sent in response to a database connection or SQL statement message

- Level 2 (monitoring by update/select)

Monitoring with reference to and update of the monitoring table. One SQL statement can read/write numerical data of up to 10 digits. SQL statements executed for the monitor table are of (update/select) type.

If a monitor table is automatically created at the start of monitoring, the SQL statement (create/insert) is executed for the monitor table.

An error is recognized if:

- (1) An error message is sent in response to a database connection or SQL statement message
- (2) The written data is not the same as the read data

- Level 3 (create/drop table each time)

Creation/deletion of the monitor table by statement as well as update. One SQL statement can read/write numerical data of up to 10 digits. SQL statements executed for the monitor table are of (create / insert / select / drop) type.

An error is recognized if:

- (1) An error message is sent in response to a database connection or SQL statement message
- (2) The written data is not the same as the read data

6.24 Setting up Oracle monitor resources

Oracle monitor resource monitors Oracle database that operates on servers.

6.24.1 Monitor(special) tab

Monitor Resource Properties | oraclew1

Info Monitor(common) **Monitor(special)** Recovery Action

Monitor Type* listener and instance monitor ▼

Monitor Level* Level 2 (monitoring by update/select) ▼

Connect Command* orcl

User Name sys

Password Change

Authority Method ☒ SYSDBA ☐ DEFAULT

Table* orawatch

ORACLE_HOME

Character Set* AMERICAN_AMERICA.UTF8 ▼

Library Path* /u01/app/oracle/product/12.2.0/dbhome_1/lib/libclntsh.so.12.1 ▼

Collect detailed application information at failure occurrence ☐

Collection Timeout 600 sec

Set error during Oracle initialization or shutdown ☐

OK Cancel Apply

Monitor Type

Select the Oracle features to be monitored.

- Monitor Listener and Instance (default)
According to the specified monitor level, database connection, reference, and update operations are monitored.
- Monitor Listener only
To check for the listener operation, use the `tnsping` Oracle command. For a monitor resource property, `ORACLE_HOME` must be set.
If `ORACLE_HOME` is not set, only connection operations for the items specified in the connect string are monitored. Use this to attempt recovery by restarting the Listener service upon a connection error.
Selecting this setting causes the monitor level setting to be ignored.
- Monitor Instance only

A direct (BEQ) connection to the database is established, bypassing the listener and, according to the specified monitor level, database connection, reference, and update operations are monitored. For a monitor resource property, ORACLE_HOME must be set. This is used for direct instance monitoring and recovery action setting without routing through the listener.

If ORACLE_HOME is not set, only the connection specified with the connect string is established, and any error in the connection operation is ignored. This is used to set the recovery action for a non-connection error together with an Oracle monitor resource for which **Monitor Listener only** is specified.

Monitor Level

Select one of the following levels. When the monitor type is set to Monitor Listener only, the monitor level setting is ignored.

- Level 0 (database status)
The Oracle management table (V\$INSTANCE table) is referenced to check the DB status (instance status). This level corresponds to simplified monitoring without SQL statements being executed for the monitor table.
- Level 1 (monitoring by select)
Monitoring with only reference to the monitor table. SQL statements executed for the monitor table are of (select) type.
- Level 2 (monitoring by update/select)
Monitoring with reference to and update of the monitoring table. SQL statements executed for the monitor table are of (update/select) type.
If a monitor table is automatically created at the start of monitoring, the SQL statement (create/insert) is executed for the monitor table.
- Level 3 (create/drop table each time)
Creation/deletion of the monitor table by statement as well as update. SQL statements executed for the monitor table are of (create / insert / select / drop) type.

Default: Level 2 (monitoring by update/select)

Connect Command (Within 255 bytes)

Specify the connect string for the database to be monitored. You must specify the connect string.

When **Monitor Type** is set to **Monitor Instance only**, set ORACLE_SID.

Monitor Type	ORACLE_HOME	Connect Command	Monitor Level
Monitor Listener and Instance	Need not be specified	Specify the connect string	As specified
Monitor Listener only	Monitoring dependent on Oracle command if specified	Specify the connect string	Ignored
	Check for connection to the instance through the listener if not specified	Specify the connect string	Ignored
Monitor Instance only	Check for the instance by BEQ connection if specified	Specify ORACLE_SID	As specified
	Check for the instance through the listener if not specified	Specify the connect string	As specified

Default value: None for the connect string

User Name (within 255 bytes)

Specify the user name to log on to the database. You must specify the name.

Specify the Oracle user who can access the specified database.

Default value: sys

Password (within 255 bytes)

Specify the password to log on to the database.

Default value: None

Authority Method

Specify the database user authentication.

Default value: SYSDBA

Table (within 255 bytes)

Specify the name of a monitor table created on the database. You must specify the name.

Make sure not to specify the same name as the table used for operation because a monitor table will be created and deleted. Be sure to set the name different from the reserved word in SQL statements. Some characters cannot be used to specify a monitor table name according to the database specifications. For details, refer to the database specifications.

Default value: orawatch

ORACLE_HOME (Within 255 bytes)

Specify the path name configured in ORACLE_HOME. Begin with [/]. This is used when **Monitor Type** is set to **Monitor Listener only** or **Monitor Instance only**.

Default: None

Character Set

Specify the character set of Oracle. Specifying this item cannot be omitted.

Default value: JAPANESE_JAPAN.JA16EUC

Library Path (within 1,023 bytes)

Specify the library path of Oracle Call Interface (OCI). Specifying this item cannot be omitted.

Default value: /u01/app/oracle/product/12.2.0/dbhome_1/lib/libclntsh.so.12.1

Collect detailed application information at failure occurrence

In case that this function is enabled, when Oracle monitor resource detects errors, the detailed Oracle information is collected. The detailed Oracle information is collected up to 5 times.

Note: In case of stopping the oracle service while collecting the information due to the cluster stop, correct information may not be collected.

Default value: Disabled

Collection Timeout

Specify the timeout value for collecting detailed information.

Default value: 600

Set error during Oracle initialization or shutdown

If this function is enabled, a monitor error occurs immediately when Oracle initialization or shutdown in progress is detected.

Disable this function when Oracle is automatically restarted during operation in cooperation with Oracle Clusterware or the like. Monitoring becomes normal even during Oracle initialization immediately or shutdown.

However, a monitor error occurs if Oracle initialization or shutdown continues for one hour or more.

Default value: Disabled

6.24.2 Notes on Oracle monitor resources

For the supported versions of Oracle, see "Applications supported by the monitoring options" in "About EXPRESSCLUSTER X SingleServerSafe" in the "EXPRESSCLUSTER X SingleServerSafe Installation Guide".

This monitor resource monitors Oracle with the Oracle interface (Oracle Call Interface). For this reason, the library for interface (libclntsh.so) needs to be installed on the server for monitoring.

To monitor an Oracle database that runs in the guest OS on a virtual machine controlled by a VM resource, specify the VM resource as the monitor target and specify enough wait time for the Oracle database to become accessible after the VM resource is activated for **Wait Time to Start Monitoring**. Also, set up the Oracle client on the host OS side, where monitor resources run, and specify the connection string for connecting to the Oracle database on the virtual machine.

A connection timeout is detected if 90% of the value set for timeout has passed and the Oracle monitor resource has not been able to connect to Oracle.

If values of a connection string, user name and password specified by a parameter are different from the Oracle environment for monitoring, Oracle monitoring cannot be done. Error message is displayed. Check the environment.

For the user specified with the user name parameter, the default is sys, but when a monitoring-dedicated user has been configured, for each monitor level the following access permissions must be provided for that user (if the sysdba permission is not provided):

Monitor level	Necessary permissions
Level 0 (database status)	SELECT permission for V\$INSTANCE
Level 1 (monitoring by select)	SELECT permission for a monitor table
Level 2 (monitoring by update/select)	CREATE TABLE / DROP ANY TABLE / INSERT permission for a monitor table / UPDATE permission for a monitor table /SELECT permission for a monitor table
Level 3 (create/drop table each time)	CREATE TABLE / DROP ANY TABLE / INSERT permission for a monitor table / UPDATE permission for a monitor table /SELECT permission for a monitor table

If the administrator user authentication method is only the OS authentication by setting "NONE" to "REMOTE_LOGIN_PASSWORDFILE" in the initialization parameter file, specify a database user without SYSDBA authority for the user name of the parameter.

When specifying a database user with SYSDBA authority, an error occurs when this monitor resource starts, causing the monitoring process not to be executed.

If sys is specified for the user name, an Oracle audit log may be output. If you do not want to output large audit logs, specify a user name other than sys.

Use the character set supported by OS when creating a database.

If Japanese is set to NLS_LANGUAGE in the Oracle initialization parameter file, specify English by NLS_LANG (environment variable of Oracle.) Specify the character set corresponds to the database.

Select the language displayed in the EXPRESSCLUSTER Cluster WebUI Alert logs and OS messages (syslog) for the character code of the monitor resource if an error message is generated from Oracle.

However, as for an error of when connecting to the database such as incorrect user name and alert message may not be displayed correctly.

For the NLS parameter and NLS_LANG settings, see the *Globalization Support Guide* by Oracle Corporation.

The character code settings have no effect on the operation of Oracle.

Regarding the monitor levels described in the next section "*How Oracle monitor resources perform monitoring*", note the following:

At "Level 1", a monitor error occurs if there is no monitor table at the start of monitoring. Create a monitor table as shown below.

If there is no monitor table at the start of monitoring in "Level 2", EXPRESSCLUSTER automatically creates the monitor table. In this case, a message indicating that the Cluster WebUI alert view does not have the monitor table is displayed.

Monitoring at "Level 3", involving the creation/deletion of monitor tables every time, makes the load heavier than monitoring at "Level 1" and "Level 2". In addition, the usage of Oracle resources continues to rise. Therefore, monitoring at "Level 3" is not recommended unless it is for periodically restarting the Oracle instance.

Selectable monitor level	Prior creation of a monitor table
Level 0 (database status)	Optional
Level 1 (monitoring by select)	Required
Level 2 (monitoring by update/select)	Optional
Level 3 (create/drop table each time)	Optional

Create a monitor table using either of the following methods:

```
sql> create table orawatch (num number(11,0) primary key);
sql> insert into orawatch values(0);
sql> commit;
```

*Create this in a schema for the user specified with the user name parameter.

When using EXPRESSCLUSTER commands

As the prerequisite, setting up the monitor resource must be completed.

```
clp_oraclew --createtable -n <Oracle monitor resource name>
```

***When the user other than sys is specified for the user name parameter and the sysdba permission is not provided for that user, CREATE TABLE permission is required for that user.**

When deleting the created monitor table manually, run the following command:

```
clp_oraclew --deletetable -n <Oracle monitor resource name>
```

6.24.3 How Oracle monitor resources perform monitoring

Oracle monitor resources perform monitoring according to the specified monitor level.

- Level 0 (database status)

The Oracle management table (V\$INSTANCE table) is referenced to check the DB status (instance status).

This level corresponds to simplified monitoring without SQL statements being executed for the monitor table.

An error is recognized if:

- (1) The Oracle management table (V\$INSTANCE table) status is in the inactive state (MOUNTED,STARTED)
- (2) The Oracle management table (V\$INSTANCE table) database_status is in the inactive state (SUSPENDED,INSTANCE RECOVERY)

- Level 1 (monitoring by select)

Monitoring with only reference to the monitor table. SQL statements executed for the monitor table are of (select) type.

An error is recognized if:

- (1) An error message is sent in response to a database connection or SQL statement message

- Level 2 (monitoring by update/select)

Monitoring with reference to and update of the monitoring table. One SQL statement can read/write numerical data of up to 11 digits. SQL statements executed for the monitor table are of (update/select) type.

If a monitor table is automatically created at the start of monitoring, the SQL statement (create/insert) is executed for the monitor table.

An error is recognized if:

- (1) An error message is sent in response to a database connection or SQL statement message
- (2) The written data is not the same as the read data

- Level 3 (create/drop table each time)

Creation/deletion of the monitor table by statement as well as update. One SQL statement can read/write numerical data of up to 11 digits. SQL statements executed for the monitor table are of (create / insert / select / drop) type.

An error is recognized if:

- (1) An error message is sent in response to a database connection or SQL statement message
- (2) The written data is not the same as the read data

For all monitor levels 0 to 3, a specific error (ORA-1033 Oracle Initialization or shutdown) is regarded as being the normal state.

6.25 Setting up POP3 monitor resources

The POP3 monitor resource is to monitor the POP3 service running on a server. POP3 monitor resources monitor POP3 protocol but they are not intended for monitoring specific applications. POP3 monitor resources monitor various applications that use POP3 protocol.

6.25.1 Monitor(special) tab

The screenshot shows a window titled "Monitor Resource Properties | pop3w1". It has four tabs: "Info", "Monitor(common)", "Monitor(special)" (which is selected), and "Recovery Action". The "Monitor(special)" tab contains the following fields and controls:

- IP Address***: A text box containing "127.0.0.1".
- Port Number***: A text box containing "110".
- User Name**: An empty text box.
- Password**: A text box with a grey background, followed by a "Change" button.
- Authentication Method**: Two radio buttons. The first is labeled "APOP" and is selected. The second is labeled "USER/PASS".

At the bottom right of the dialog are three buttons: "OK", "Cancel", and "Apply".

IP Address (within 79 bytes)

Specify the IP address of the POP3 server to be monitored. Specifying this item cannot be omitted. If it is multi-directional standby server, specify FIP.

Usually, the POP3 server running on the local server is connected, thus the loopback address (127.0.0.1) is to be configured. If accessible addresses are limited by the POP3 server settings, specify an accessible address (e.g., floating IP address). To monitor a POP3 server that runs in the guest OS on a virtual machine controlled by a VM resource, specify the IP address of the virtual machine.

Default value: 127.0.0.1

Port Number (1 to 65,535)

Specify the POP3 port number to be monitored. Specifying this item cannot be omitted.

Default value: 110

User Name (within 255 bytes)

Specify the user name to log on to POP3.

Default value: None

Password (within 255 bytes)

Specify the password to log on to POP3. Click **Change** and enter the password in the dialog box.

Default value: None

Authentication Method

Select the authentication method to log on to POP3. It must follow the settings of POP3 being used:

- APOP (Default value)

The encryption authentication method that uses the APOP command.

- USER/PASS

The plaintext method that uses the USER/PASS command.

6.25.2 Notes on POP3 monitor resources

For the target to be monitored, specify the EXEC resource that starts the POP3 server. Monitoring starts after target resource is activated. However, if POP3 services cannot be started immediately after target resource is activated, adjust the time using **Wait Time to Start Monitoring**.

To monitor a POP3 server that runs in the guest OS on a virtual machine controlled by a VM resource, specify the VM resource as the monitor target and specify enough wait time for the POP3 server to become accessible after the VM resource is activated for **Wait Time to Start Monitoring**.

POP3 services may produce operation logs for each monitoring. Configure the POP3 settings if this needs to be adjusted.

6.25.3 Monitoring by POP3 monitor resources

The POP3 monitor resource performs monitoring as described below.

POP3 monitor resources connect to the POP3 server and execute the command to verify the operation.

As a result of monitoring, the following is considered as an error:

- (1) When connection to the POP3 server fails.
- (2) When an error is notified as a response to the command.

6.26 Setting up PostgreSQL monitor resources

PostgreSQL monitor resource monitors PostgreSQL database that operates on servers.

6.26.1 Monitor(special) tab

Monitor Resource Properties | psqlw1

Info Monitor(common) **Monitor(special)** Recovery Action

Monitor Level* Level 2 (monitoring by update/select) ▼

Database Name* PSQldb

IP Address* 127.0.0.1

Port Number* 5432

User Name postgres

Password Change

Table* psqlwatch

Library Path* /opt/PostgreSQL/10/lib/libpq.so.5.10 ▼

Set error during PostgreSQL initialization or shutdown ☒

OK Cancel Apply

Monitor Level

Select one of the following levels. You cannot omit this level setting.

- Level 1 (monitoring by select)
Monitoring with only reference to the monitor table. SQL statements executed for the monitor table are of (select) type.
- Level 2 (monitoring by update/select)
Monitoring with reference to and update of the monitoring table. SQL statements executed for the monitor table are of (update / select / reindex / vacuum) type.
If a monitor table is automatically created at the start of monitoring, the SQL statement (create/insert) is executed for the monitor table.
- Level 3 (create/drop table each time)
Creation/deletion of the monitor table by statement as well as update. SQL statements executed for the monitor table are of (create / insert / select / reindex / drop / vacuum) type.

Default: Level 2 (monitoring by update/select)

Database Name (within 255 bytes)

Specify the database name to be monitored. Specifying this item cannot be omitted.

Default value: None

IP Address (within 79 bytes)

Specify the IP address of the server to connect. Specifying this item cannot be omitted.

Usually, specify the loopback address (127.0.0.1) to connect to the PostgreSQL server that runs on the local server. To monitor a PostgreSQL database that runs in the guest OS on a virtual machine controlled by a VM resource, specify the IP address of the virtual machine.

Default value: 127.0.0.1

Port (1 to 65,535)

Specify the port number for connection. Specifying this item cannot be omitted.

Default value: 5,432

User Name (within 255 bytes)

Specify the user name to log on to the database. Specifying this item cannot be omitted.

Specify the PostgreSQL user who can access the specified database.

Default value: postgres

Password (within 255 bytes)

Specify the password to log on to the database.

Default value: None

Table (within 255 bytes)

Specify the name of a monitor table created on the database. Specifying this item cannot be omitted.

Make sure not to specify the same name as the table used for operation because a monitor table will be created and deleted. Be sure to set the name different from the reserved word in SQL statements.

Some characters cannot be used to specify a monitor table name according to the database specifications. For details, refer to the database specifications.

Default value: psqlwatch

Library Path (within 1,023 bytes)

Specify the home path to PostgreSQL. Specifying this item cannot be omitted.

Default value: /opt/PostgreSQL/10/lib/libpq.so.5.10

Set error during PostgreSQL initialization or shutdown

When this function is enabled, a monitor error occurs immediately upon the detection of PostgreSQL initialization or shutdown in progress.

When this function is disabled, monitoring becomes normal even during PostgreSQL initialization or shutdown.

However, a monitor error occurs if PostgreSQL initialization or shutdown continues for one hour or more.

Default value: Enabled

6.26.2 Notes on PostgreSQL monitor resources

Concerning the PostgreSQL versions checked for the operation, refer to "Applications supported by the monitoring options" in "About EXPRESSCLUSTER X SingleServerSafe" in the "EXPRESSCLUSTER X SingleServerSafe Installation Guide".

This monitor resource uses the libpq library of PostgreSQL to monitor PostgreSQL.

If this monitor resource fails, set the application library path to the path where the libpq library of PostgreSQL exists.

To monitor a PostgreSQL database that runs in the guest OS on a virtual machine controlled by a VM resource, specify the VM resource as the monitor target and specify enough wait time for the PostgreSQL database to become accessible after the VM resource is activated for **Wait Time to Start Monitoring**.

If a value specified by a parameter differs from the PostgreSQL environment for monitoring, a message indicating an error is displayed on the Alert logs of the Cluster WebUI. Check the environment.

For client authentication, on this monitor resource, the following authentication methods that can be set to the "pg_hba.conf" file has been checked its operation.
trust, md5, password

When this monitor resource is used, messages like those shown below are output to a log on the PostgreSQL side. These messages are output by the monitor processing and do not indicate any problems.

```
YYYY-MM-DD hh:mm:ss JST moodle moodle LOG: statement: DROP TABLE psqlwatch
YYYY-MM-DD hh:mm:ssJST moodle moodle ERROR: table "psqlwatch" does not exist
YYYY-MM-DD hh:mm:ss JST moodle moodle STATEMENT: DROP TABLE psqlwatch
YYYY-MM-DD hh:mm:ss JST moodle moodle LOG: statement: CREATE TABLE psqlwatch_
↳ (num INTEGER NOT NULL PRIMARY KEY)
YYYY-MM-DD hh:mm:ss JST moodle moodle NOTICE: CREATE TABLE / PRIMARY KEY will_
↳ create implicit index "psqlwatch_pkey" for table "psql watch"
YYYY-MM-DD hh:mm:ss JST moodle moodle LOG: statement: DROP TABLE psqlwatch
```

Regarding the monitor levels described in the next section "*How PostgreSQL monitor resources perform monitoring*", note the following:

At "Level 1", a monitor error occurs if there is no monitor table at the start of monitoring. Create a monitor table as shown below.

If there is no monitor table at the start of monitoring in "Level 2", EXPRESSCLUSTER automatically creates the monitor table. In this case, a message indicating that the Cluster WebUI Alert logs does not have the monitor table is displayed.

The load on the monitor at "Level 3" is higher than that at "Level 1" and "Level 2" because the monitor in "Level 3" creates or deletes monitor tables for each monitoring.

Selectable monitor level	Prior creation of a monitor table
Level 1 (monitoring by select)	Required
Level 2 (monitoring by update/select)	Optional
Level 3 (create/drop table each time)	Optional

Create a monitor table using either of the following methods:

Use SQL statements (in the following example, the monitor table is named psqlwatch)

```
sql> CREATE TABLE psqlwatch ( num INTEGER NOT NULL PRIMARY KEY);  
sql> INSERT INTO psqlwatch VALUES(0) ;  
sql> COMMIT;
```

Use EXPRESSCLUSTER commands

As the prerequisite, setting up the monitor resource must be completed.

```
clp_psqlw --createtable -n <PostgreSQL_monitor_resource_name>
```

To manually delete a monitor table, execute the following command:

```
clp_psqlw --deletetable -n <PostgreSQL_monitor_resource_name>
```

6.26.3 How PostgreSQL monitor resources perform monitoring

PostgreSQL monitor resources perform monitoring according to the specified monitor level.

- Level 1 (monitoring by select)

Monitoring with only reference to the monitor table. SQL statements executed for the monitor table are of (select) type.

An error is recognized if:

- (1) An error message is sent in response to a database connection or SQL statement message

- Level 2 (monitoring by update/select)

Monitoring with reference to and update of the monitoring table. One SQL statement can read/write numerical data of up to 10 digits. SQL statements executed for the monitor table are of (update / select / reindex / vacuum) type.

If a monitor table is automatically created at the start of monitoring, the SQL statement (create/insert) is executed for the monitor table.

An error is recognized if:

- (1) An error message is sent in response to a database connection or SQL statement message
- (2) The written data is not the same as the read data

- Level 3 (create/drop table each time)

Creation/deletion of the monitor table by statement as well as update. One SQL statement can read/write numerical data of up to 10 digits. SQL statements executed for the monitor table are of (create / insert / select / reindex / drop / vacuum) type.

An error is recognized if:

- (1) An error message is sent in response to a database connection or SQL statement message
- (2) The written data is not the same as the read data

6.27 Setting up Samba monitor resources

Samba monitor resource monitors samba file server that operates on servers.

6.27.1 Monitor(special) tab

The screenshot shows a window titled "Monitor Resource Properties | sambaw1" with a close button "sambaw X". Inside, there are four tabs: "Info", "Monitor(common)", "Monitor(special)", and "Recovery Action". The "Monitor(special)" tab is selected. It contains the following fields and controls:

Share Name*	samba
IP Address*	127.0.0.1
Port*	139
User Name*	user1
Password	<input type="password"/> Change

At the bottom right, there are three buttons: "OK", "Cancel", and "Apply".

Share Name (within 255 bytes)

Specify the shared name of samba server to be monitored. Specifying this item cannot be omitted.

Default value: None

IP Address (within 79 bytes)

Specify the IP address of samba server. Specifying this item cannot be omitted.

Usually, a connection is made with the samba file server running on the local server, thus the loopback address (127.0.0.1) is to be configured. If a samba file server running on a guest OS of a virtual machine controlled by a VM resource is monitored, specify the IP address of the virtual machine.

Default value: 127.0.0.1

Port (1 to 65,535)

Specify the port number to be used by samba daemon. Specifying this item cannot be omitted. If the version of libsmbclient is 3 or earlier (e.g. libsmbclient.so provided with RHEL 6), the **Port** field can accept only 139 or 445. Specify the same value for smb ports of the smb.conf as well.

Default value: 139

User Name (within 255 bytes)

Specify the user name to log on to the samba service. Specifying this item cannot be omitted.

Default value: None

Password (within 255 bytes)

Specify the password to log on to the samba service.

Default value: None

6.27.2 Notes on Samba monitor resources

Concerning the samba versions checked for the operation, refer to "Applications supported by the monitoring options" in "About EXPRESSCLUSTER X SingleServerSafe" in the "EXPRESSCLUSTER X SingleServerSafe Installation Guide".

If this monitor resource fails, the parameter value and samba environment may not match. Check the samba environment.

Specify the smb.conf file for the shared name to be monitored to enable a connection from a local server. Allow guest connection when the security parameter of the smb.conf file is "share."

Samba functions except file sharing and print sharing are not monitored.

To monitor a samba file server running on a guest OS of a virtual machine controlled by a VM resource, specify the VM resource for the target of monitoring and set **Wait Time to Start Monitoring** with sufficient time to wait the samba file server to be connectable after VM resource activation.

If the smbmount command is run on the monitoring server when the samba authentication mode is "Domain" or "Server," it may be mounted as a user name specified by the parameter of this monitor resource.

6.27.3 Monitoring by Samba monitor resources

From internal version 4.1.0-1, Samba monitor resources use the shared library libsmbclient.so.0.

Samba monitor resource monitors the following:

By connecting to samba server and verify establishment of tree connection to resources of the samba server.

As a result of monitoring, the following is considered as an error:

- (1) A response to samba service request is invalid.

6.28 Setting up SMTP monitor resources

The SMTP monitor resource is to monitor the SMTP daemon running on a server.

6.28.1 Monitor(special) tab

The screenshot shows a window titled "Monitor Resource Properties | smtpw1" with a close button "smtpw X". Inside, there are four tabs: "Info", "Monitor(common)", "Monitor(special)", and "Recovery Action". The "Monitor(special)" tab is selected. It contains two input fields: "IP Address*" with the value "127.0.0.1" and "Port Number*" with the value "25". At the bottom right are three buttons: "OK", "Cancel", and "Apply".

IP Address (within 79 bytes)

Specify the IP address of the SMTP server to be monitored. Specifying this item cannot be omitted.

Usually, specify the loopback address (127.0.0.1) to connect to the SMTP server that runs on the local server. To monitor an SMTP server that runs in the guest OS on a virtual machine controlled by a VM resource, specify the IP address of the virtual machine.

Default value: 127.0.0.1

Port (1 to 65,535)

Specify the port number of the SMTP to be monitored. Specifying this item cannot be omitted.

Default value: 25

6.28.2 Notes on SMTP monitor resources

Concerning the SMTP versions checked for the operation, refer to "Applications supported by the monitoring options" in "About EXPRESSCLUSTER X SingleServerSafe" in the "EXPRESSCLUSTER X SingleServerSafe Installation Guide".

If the load average remains exceeding the value of RefuseLA configured in the sendmail.def file for a specified duration of time, the monitor resource may regard the phenomenon as an error.

To monitor an SMTP server that runs in the guest OS on a virtual machine controlled by a VM resource, specify the VM resource as the monitor target and specify enough wait time for the SMTP server to become accessible after the VM resource is activated for **Wait Time to Start Monitoring**.

6.28.3 Monitoring by SMTP monitor resources

SMTP monitor resources monitor the following:

A connection is made with the SMTP daemon on the server and the NOOP command is executed to monitor the SMTP daemon.

As a result of monitoring, the following is considered as an error:

- (1) An error is posted about the response to the connection with the SMTP daemon or NOOP command execution.

6.29 Setting up SQL Server monitor resources

SQL Server monitor resource monitors SQL Server database that operates on servers.

6.29.1 Monitor(special) tab

Monitor Resource Properties | sqlserverw1 sqlserverw ✕

Info Monitor(common) **Monitor(special)** Recovery Action

Monitor Level*

Level 2 (monitoring by update/select) ▼

Database Name*

SQLSVDB

Server Name*

localhost

User Name*

SA

Password

Change

Monitor Table Name*

sqlwatch

ODBC Driver Name

ODBC Driver 13 for SQL Se▼

OK

Cancel

Apply

Monitor Level

Select one of the following levels. You cannot omit this level setting.

- Level 0 (database status)
The SQL Server management table is referenced to check the DB status. This level corresponds to simplified monitoring without SQL statements being issued for the monitor table.
- Level 1 (monitoring by select)
Monitoring with only reference to the monitor table. SQL statements executed for the monitor table are of (select) type.
- Level 2 (monitoring by update/select)
Monitoring with reference to and update of the monitoring table. SQL statements executed for the monitor table are of (update/select) type.
If a monitor table is automatically created at the start of monitoring, the SQL statement (create/insert) is executed for the monitor table.
- Level 3 (create/drop table each time)
Creation/deletion of the monitor table by statement as well as update. SQL statements executed for the monitor table are of (create / insert / select / drop) type.

Default: Level 2 (monitoring by update/select)

Database Name (Within 255 bytes)

Specify the database to be monitored. You must specify the database.

Default value: None

Server Name (Within 255 bytes)

Specify the database server name to be monitored. You must specify the database server.

Default value: localhost

User Name (Within 255 bytes)

Specify the user name to log on to the database. You must specify the user name.

Specify the SQL Server user who can access the specified database.

Default value: SA

Password (Within 255 bytes)

Specify the password to log on to the database. You must specify the password.

Default value: None

Monitor Table Name (Within 255 bytes)

Specify the name of a monitor table created in the database. You must specify the name.

Make sure not to specify the same name as the table used for operation because a monitor table will be created and deleted. Make sure to set the name different from the reserved word in SQL statements.

Some characters cannot be used to specify a monitor table name according to the database specifications. For details, refer to the database.

Default value: sqlwatch

ODBC Driver Name (Within 255 bytes)

Specify the ODBC driver name to SQL Server. You must specify the path.

Default value: ODBC Driver 13 for SQL Server

6.29.2 Notes on SQL Server monitor resources

For the supported versions of SQL Server, see "Applications supported by the monitoring options" in "About EXPRESSCLUSTER X SingleServerSafe" in the "EXPRESSCLUSTER X SingleServerSafe Installation Guide".

This monitor resource monitors SQL Server using Microsoft ODBC Driver for SQL Server.

If a value specified by a parameter differs from the SQL Server environment for monitoring, an error message is displayed on the Cluster WebUI Alert logs. Check the environment.

Regarding the monitor levels described in the next section "*How SQL Server monitor resources perform monitoring*", note the following:

At "Level 1", a monitor error occurs if there is no monitor table at the start of monitoring. Create a monitor table as shown below.

If there is no monitor table at the start of monitoring in "Level 2", EXPRESSCLUSTER automatically creates the monitor table. In this case, a message indicating that the Cluster WebUI. Alert logs does not have the monitor table is displayed.

The load on the monitor at "Level 3" is higher than that at "Level 1" and "Level 2" because the monitor in "Level 3" creates or deletes monitor tables for each monitoring.

Selectable monitor level	Prior creation of a monitor table
Level 0 (database status)	Optional

Continued on next page

Table 6.16 – continued from previous page

Selectable monitor level	Prior creation of a monitor table
Level 1 (monitoring by select)	Required
Level 2 (monitoring by update/select)	Optional
Level 3 (create/drop table each time)	Optional

Create a monitor table using either of the following methods:

Alphanumeric characters and some symbols (such as underscores) can be used to specify a monitor table name.

Use SQL statements (in the following example, the monitor table is named sqlwatch)

- When SET IMPLICIT_TRANSACTIONS OFF

```
sql> CREATE TABLE sqlwatch (num INT NOT NULL PRIMARY KEY)
sql> GO
sql> INSERT INTO sqlwatch VALUES(0)
sql> GO
```

- When SET IMPLICIT_TRANSACTIONS ON

```
sql> CREATE TABLE sqlwatch (num INT NOT NULL PRIMARY KEY)
sql> GO
sql> INSERT INTO sqlwatch VALUES(0)
sql> GO
sql> COMMIT
sql> GO
```

Use EXPRESSCLUSTER command

As the prerequisite, setting up the monitor resource must be completed.

```
clp_sqlserverw --createtable -n <SQL Server monitor_resource_name>
```

To manually delete a monitor table, execute the following command:

```
clp_sqlserverw --deletetable -n <SQL Server monitor_resource_name>
```

6.29.3 How SQL Server monitor resources perform monitoring

SQL Server monitor resources perform monitoring according to the specified monitor level.

- Level 0 (database status)

The SQL Server management table is referenced to check the DB status. This level corresponds to simplified monitoring without SQL statements being issued for the monitor table.

An error is recognized if:

- (1) The database status is not online

- Level 1 (monitoring by select)

Monitoring with only reference to the monitor table. SQL statements executed for the monitor table are of (select) type.

An error is recognized if:

- (1) An error message is sent in response to a database connection or SQL statement message

- Level 2 (monitoring by update/select)

Monitoring with reference to and update of the monitoring table. One SQL statement can read/write numerical data of up to 10 digits. SQL statements executed for the monitor table are of (update/select) type.

If a monitor table is automatically created at the start of monitoring, the SQL statement (create/insert) is executed for the monitor table.

An error is recognized if:

- (1) An error message is sent in response to a database connection or SQL statement message
- (2) The written data is not the same as the read data

- Level 3 (create/drop table each time)

Creation/deletion of the monitor table by statement as well as update. One SQL statement can read/write numerical data of up to 10 digits. SQL statements executed for the monitor table are of (create / insert / select / drop) type.

An error is recognized if:

- (1) An error message is sent in response to a database connection or SQL statement message
- (2) The written data is not the same as the read data

6.30 Setting up Sybase monitor resources

The Sybase monitor resource is to monitor the Sybase database running on a server.

6.30.1 Monitor(special) tab

Monitor Resource Properties | sybasew1

sybasew X

Info Monitor(common) **Monitor(special)** Recovery Action

Monitor Level* Level 2 (monitoring by update/select) ▼

Database Name* SYBDB

Database Server Name* sybserver

User Name* sa

Password [masked] Change

Table* sybwatch

Library Path* /opt/sap/OCS-16_0/lib/libsybdb64.so ▼

OK Cancel Apply

Monitor Level

Select one of the following levels. You cannot omit this level setting.

- Level 0 (database status)
The Sybase management table (sys.sysdatabases) is referenced to check the DB status. This level corresponds to simplified monitoring without SQL statements being issued for the monitor table.
- Level 1 (monitoring by select)
Monitoring with only reference to the monitor table. SQL statements executed for the monitor table are of (select) type.
- Level 2 (monitoring by update/select)
Monitoring with reference to and update of the monitoring table. SQL statements executed for the monitor table are of (update/select) type.
If a monitor table is automatically created at the start of monitoring, the SQL statement (create/insert) is executed for the monitor table.
- Level 3 (create/drop table each time)
Creation/deletion of the monitor table by statement as well as update. SQL statements executed for the monitor table are of (create / insert / select / drop) type.

Default: Level 2 (monitoring by update/select)

Database Name (within 255 bytes)

Specify the database name to be monitored. Specifying this item cannot be omitted.

Default value: None

Database Server Name (within 255 bytes)

Specify the name of the database server to be monitored. Specifying this item cannot be omitted.

Default value: None

User Name (within 255 bytes)

Specify the user name to log on to the database. Specifying this item cannot be omitted.

Specify a Sybase user accessible to the specified database.

Default value: sa

Password (within 255 bytes)

Specify the password to log on to the database.

Default value: None

Table (within 255 bytes)

Specify the name of a monitor table created on the database. Specifying this item cannot be omitted.

Make sure not to specify the same name as the table used for operation because a monitor table will be created and deleted. Be sure to set the name different from the reserved word in SQL statements.

Some characters cannot be used to specify a monitor table name according to the database specifications. For details, refer to the database specifications.

Default value: sybwatch

Library Path (within 1,023 bytes)

Specify the library path of Sybase. Specifying this item cannot be omitted.

Default value: /opt/sap/OCS-16_0/lib/libsybdb64.so

6.30.2 Notes on Sybase monitor resources

For the supported versions of Sybase, see "Applications supported by the monitoring options" in "About EXPRESS-CLUSTER X SingleServerSafe" in the "EXPRESSCLUSTER X SingleServerSafe Installation Guide".

This monitor resource monitors ASE using Open Client DB-Library/C of ASE.

If a value specified by a parameter differs from the ASE environment for monitoring, an error message is displayed on the Cluster WebUI Alert logs. Check the environment.

Regarding the monitor levels described in the next section "*Monitoring by Sybase monitor resources*", note the following:

At "Level 1", a monitor error occurs if there is no monitor table at the start of monitoring. Create a monitor table as shown below.

If there is no monitor table at the start of monitoring in "Level 2", EXPRESSCLUSTER automatically creates the monitor table. In this case, a message indicating that the Cluster WebUI Alert logs does not have the monitor table is displayed.

The load on the monitor at "Level 3" is higher than that at "Level 1" and "Level 2" because the monitor in "Level 3" creates or deletes monitor tables for each monitoring.

Selectable monitor level	Prior creation of a monitor table
Level 0 (database status)	Optional
Level 1 (monitoring by select)	Required

Continued on next page

Table 6.17 – continued from previous page

Selectable monitor level	Prior creation of a monitor table
Level 2 (monitoring by update/select)	Optional
Level 3 (create/drop table each time)	Optional

Create a monitor table using either of the following methods:

Use SQL statements (in the following example, the monitor table is named sybwatch)

```
sql> CREATE TABLE sybwatch (num INT NOT NULL PRIMARY KEY)
sql> GO
sql> INSERT INTO sybwatch VALUES (0)
sql> GO
sql> COMMIT
sql> GO
```

Use EXPRESSCLUSTER commands

As the prerequisite, setting up the monitor resource must be completed.

```
clp_sybasew --createtable -n <Sybase_monitor_resource_name>
```

To manually delete a monitor table, execute the following command:

```
clp_sybasew --deletetable -n <Sybase_monitor_resource_name>
```

6.30.3 Monitoring by Sybase monitor resources

Sybase monitor resources perform monitoring according to the specified monitor level.

- **Level 0 (database status)**
The Sybase management table (sys.sysdatabases) is referenced to check the DB status. This level corresponds to simplified monitoring without SQL statements being issued for the monitor table.
An error is recognized if:
 - (1) The database status is in an unusable state, e.g., offline.
- **Level 1 (monitoring by select)**
Monitoring with only reference to the monitor table. SQL statements executed for the monitor table are of (select) type.
An error is recognized if:
 - (1) An error message is sent in response to a database connection or SQL statement message
- **Level 2 (monitoring by update/select)**
Monitoring with reference to and update of the monitoring table. One SQL statement can read/write numerical data of up to 10 digits. SQL statements executed for the monitor table are of (update/select) type.
If a monitor table is automatically created at the start of monitoring, the SQL statement (create/insert) is executed for the monitor table.
An error is recognized if:
 - (1) An error message is sent in response to a database connection or SQL statement message
 - (2) The written data is not the same as the read data
- **Level 3 (create/drop table each time)**
Creation/deletion of the monitor table by statement as well as update. One SQL statement can read/write numerical data of up to 10 digits. SQL statements executed for the monitor table are of (create / insert / select / drop) type.

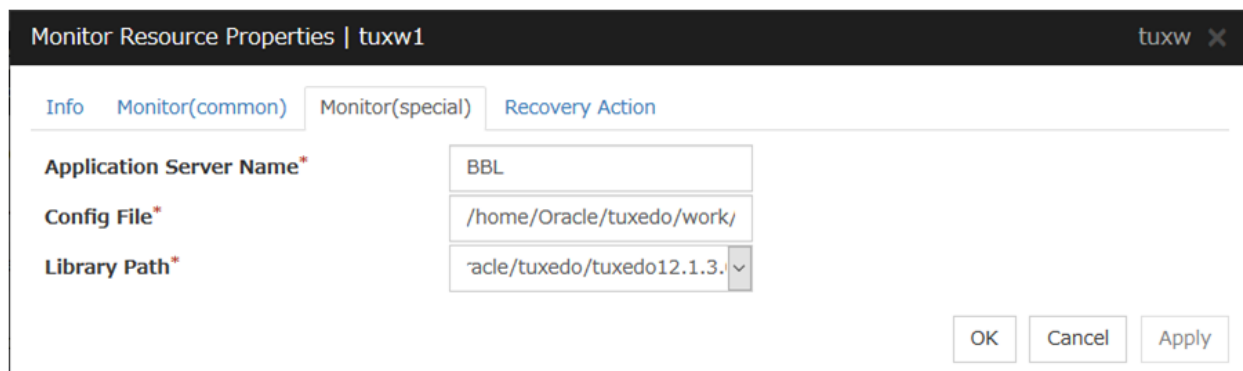
An error is recognized if:

- (1) An error message is sent in response to a database connection or SQL statement message
- (2) The written data is not the same as the read data

6.31 Setting up Tuxedo monitor resources

The Tuxedo monitor resource is to monitor Tuxedo running on a server.

6.31.1 Monitor(special) tab



Monitor Resource Properties | tuxw1

Info Monitor(common) **Monitor(special)** Recovery Action

Application Server Name* BBL

Config File* /home/Oracle/tuxedo/work/

Library Path* acle/tuxedo/tuxedo12.1.3. v

OK Cancel Apply

Application Server Name (within 255 bytes)

Specify the application server name to be monitored. Specifying this item cannot be omitted.

Default value: BBL

Config File (within 1,023 bytes)

Specify the placement file name of Tuxedo. Specifying this item cannot be omitted.

Default value: None

Library Path (within 1,023 bytes)

Specify the library path of Tuxedo. Specifying this item cannot be omitted.

Default value: /home/Oracle/tuxedo/tuxedo12.1.3.0.0/lib/libtux.so

6.31.2 Notes on Tuxedo monitor resources

Concerning the Tuxedo versions checked for the operation, refer to "Applications supported by the monitoring options" in "About EXPRESSCLUSTER X SingleServerSafe" in the "EXPRESSCLUSTER X SingleServerSafe Installation Guide".

If a Tuxedo library (such as libtux.so) does not exist, the monitor resource cannot perform monitoring.

6.31.3 Monitoring by Tuxedo monitor resources

The Tuxedo monitor resource performs monitoring as described below.

Tuxedo monitor resources connect to the Tuxedo and execute API to verify the operation.

As a result of monitoring, the following is considered as an error:

- (1) When an error is reported during the connection to the application server and/or the acquisition of the status.

6.32 Setting up WebLogic monitor resources

The WebLogic monitor resource is to monitor WebLogic running on a server.

6.32.1 Monitor(special) tab

Monitor Resource Properties | wlsw1 wlsw X

Info Monitor(common) **Monitor(special)** Recovery Action

IP Address*

127.0.0.1

Port Number*

7002

Monitor Type

☒ REST API

☐ WLST

Protocol

☒ HTTP

☐ HTTPS

User Name*

weblogic

Password

Change

Account Shadow

☐ On

Config File

Key File

User Name

Password

weblogic

Change

☒ Off

Authority Method

Authority Method

DemoTrust

Key Store File

Domain Environment File

/home/Oracle/product/Orac

Add command option

-Dwlst.offline.log=disable -D

OK

Cancel

Apply

IP Address (within 79 bytes)

Specify the IP address of the server to be monitored. Specifying this item cannot be omitted.

Default value: 127.0.0.1

Port (1 to 65,535)

Specify the port number used to connect to the server. Specifying this item cannot be omitted.

Default value: 7,002

Monitor Method

Specify the method of monitoring the server. Setting this parameter is mandatory.

Default value: RESTful API

Protocol

Specify the protocol of the server to be monitored. Setting this parameter is mandatory if RESTful API is selected in **Monitor Method**.

Default value: HTTP

Note: Specify HTTP for an RHEL8 environment.

User Name (Within 255 bytes)

Specify the name of the WebLogic user. Setting this parameter is mandatory if RESTful API is selected in **Monitor Method**.

Default value: weblogic

Password (Within 255 bytes)

Specify the password for WebLogic, if necessary, with RESTful API selected in **Monitor Method**.

Default value: None

Account Shadow

When you specify a user name and a password directly, select **Off**. If not, select **On**. Specifying this item cannot be omitted.

Default value: Off

Config File (within 1,023 bytes)

Specify the file in which the user information is saved. Specifying this item cannot be omitted if **Account Shadow** is **On**.

Default value: None

Key File (within 1,023 bytes)

Specify the file in which the password required to access to a config file path is saved. Specify the full path of the file. Specifying this item cannot be omitted if **Account Shadow** is **On**.

Default value: None

User Name (within 255 bytes)

Specify the user name of WebLogic. Specifying this item cannot be omitted if **Account Shadow** is **Off**.

Default value: weblogic

Password (within 255 bytes)

Specify the password of WebLogic.

Default value: None

Authority Method

Specify the authentication method when connecting to an application server. Specifying this item cannot be omitted.

Specify **DemoTrust** or **Custom Trust** for **Authority Method**, in order to execute monitoring by using the SSL communication.

It is determined whether to use **DemoTrust** or **CustomTrust**, according to the setting of WebLogic Administration Console.

When **Keystores** of WebLogic Administration Console is set to **Demo Identity and Demo Trust**, specify **Demo Trust**. In this case, you do not need to make settings for **Key Store File**.

When **Keystores** of WebLogic Administration Console is set to **Custom Identity and Custom Trust**, specify **Custom Trust**. In this case, you need to make settings for **Key Store File**.

Default value: DemoTrust

Key Store File (within 1,023 bytes)

Specify the authentication file when authenticating SSL. You must specify this when the **Authority Method** is **CustomTrust**. Set the file specified in **Custom Identity Key Store File** on WebLogic Administration Console.

Default value: None

Domain Environment File (within 1,023 bytes)

Specify the name of the WebLogic domain environment file. Specifying this item cannot be omitted.

Default value:

/home/Oracle/product/Oracle_Home/user_projects/domains/base_domain/bin/setDomainEnv.sh

Add command option (within 1,023 bytes)

Set this value when changing the option to be passed to the webLogic.WLST command.

Default value: -Dwlst.offline.log=disable -Duser.language=en_US

6.32.2 Notes on WebLogic monitor resources

Concerning the WebLogic versions checked for the operation, refer to "Applications supported by the monitoring options" in "About EXPRESSCLUSTER X SingleServerSafe" in the "EXPRESSCLUSTER X SingleServerSafe Installation Guide".

If the selected monitoring method is WLST for this monitor resource, the monitoring requires a JAVA environment. Since the JAVA functions are used by the application server system, a stall of JAVA (if any) may be recognized as an error.

If WebLogic monitor resources are not available at the startup of WebLogic, they will be judged as being abnormal. Adjust [Wait Time to Start Monitoring], or start WebLogic before the startup of the WebLogic monitor resources (for example, specify the EXEC resource for starting WebLogic as a monitor target resource).

If [RESTful API] is selected as a monitoring method for an RHEL8 environment, specify [HTTP] for a protocol.

6.32.3 Monitoring by WebLogic monitor resources

WebLogic monitor resource monitors the following:

- Monitoring method: if RESTful API is selected

WebLogic offers RESTful APIs called WebLogic RESTful management services.

The RESTful APIs allow you to monitor the application server.

As a result, an error is considered to be found if:

1. There is an error message in response to the RESTful API.

Note: Compared with the WLST monitoring method, RESTful API can reduce the CPU load of the application server under the monitoring.

- Monitoring method: if WLST is selected

Monitors the application server by performing connect with the "weblogic.WLST" command.

This monitor resource determines the following results as an error:

1. An error reporting as the response to the connect.

The operations are as follows, based on **Authentication Method**.

- DemoTrust: SSL authentication method using authentication files for demonstration of WebLogic
- CustomTrust: SSL authentication method using user-created authentication files
- Not Use SSL: SSL authentication method is not used.

6.33 Setting up WebSphere monitor resources

The WebSphere monitor resource is to monitor WebSphere running on a server.

6.33.1 Monitor(special) tab

Monitor Resource Properties | wasw1

Info Monitor(common) **Monitor(special)** Recovery Action

Application Server Name* server1

Profile Name* default

User Name* user1

Password Change

Install Path* /opt/IBM/WebSphere/AppS▼

OK Cancel Apply

Application Server Name (within 255 bytes)

Specify the application server name to be monitored. Specifying this item cannot be omitted.

Default value: server1

Profile Name (within 1,023 bytes)

Specify the name of the profile of the application server to be monitored. Specifying this item cannot be omitted.

Default value: default

User Name (within 255 bytes)

Specify the WebSphere user name. Specifying this item cannot be omitted.

Default value: None

Password (within 255 bytes)

Specify the WebSphere password.

Default value: None

Install Path (within 1,023 bytes)

Specify the WebSphere installation path. Specifying this item cannot be omitted.

Default value: /opt/IBM/WebSphere/AppServer

6.33.2 Notes on WebSphere monitor resources

Concerning the WebSphere versions checked for the operation, refer to "Applications supported by the monitoring options" in "About EXPRESSCLUSTER X SingleServerSafe" in the "EXPRESSCLUSTER X SingleServerSafe Installation Guide".

A Java environment is required to start monitoring with this command. The application server system uses Java functions. Therefore if Java stalls, it may be recognized as an error.

6.33.3 Monitoring by WebSphere monitor resource

The WebSphere monitor resource performs monitoring as described below.

WebSphere's serverStatus.sh command is employed for application server monitoring.

As a result of monitoring, the following is considered as an error:

- (1) When an error is reported with the state of the acquired application server.

6.34 Setting up WebOTX monitor resources

The WebOTX monitor resource is to monitor WebOTX running on a server.

6.34.1 Monitor(special) tab

Monitor Resource Properties | obxw1

Info Monitor(common) **Monitor(special)** Recovery Action

Connecting Destination* localhost

Port Number* 6212

User Name* user1

Password Change

Install Path* /opt/WebOTX

OK Cancel Apply

Connecting Destination (within 255 bytes)

Specify the server name of the server to be monitored. Specifying this item cannot be omitted.

Default value: localhost

Port (1 to 65,535)

Specify the port number used to connect to the server. Specifying this item cannot be omitted.

When monitoring a WebOTX user domain, specify the management port number for the WebOTX domain. The management port number is the number which was set for "domain.admin.port" of <domain_name>.properties when the domain was created. Refer to the WebOTX documents for details of <domain_name>.properties.

Default value: 6,212

User Name (within 255 bytes)

Specify the user name of WebOTX. Specifying this item cannot be omitted.

When monitoring a WebOTX user domain, specify the login user name for the WebOTX domain.

Default value:None

Password (within 255 bytes)

Specify the password of WebOTX.

Default value: None

Install Path (within 1,023 bytes)

Specify the WebOTX installation path. Specifying this item cannot be omitted.

Default value: /opt/WebOTX

6.34.2 Notes on WebOTX monitor resources

Concerning the WebOTX versions checked for the operation, refer to "Applications supported by the monitoring options" in "About EXPRESSCLUSTER X SingleServerSafe" in the "EXPRESSCLUSTER X SingleServerSafe Installation Guide".

A Java environment is required to start monitoring with this command. The application server system uses Java functions. Therefore if Java stalls, it may be recognized as an error.

6.34.3 Monitoring by WebOTX monitor resources

The WebOTX monitor resource performs monitoring as described below.

WebOTX's otxadmin.sh command is employed for application server monitoring.

As a result of monitoring, the following is considered as an error:

- (1) When an error is reported with the state of the acquired application server.

6.35 Setting up JVM monitor resources

JVM monitor resources monitor information about the utilization of resources that are used by Java VM or an application server running on a server.

6.35.1 Monitor(special) tab

The screenshot shows the 'Monitor Resource Properties' dialog box for a resource named 'jraw1'. The 'Monitor(special)' tab is selected. The dialog has four tabs: 'Info', 'Monitor(common)', 'Monitor(special)', and 'Recovery Action'. The 'Monitor(special)' tab contains the following fields and controls:

- Target:** A dropdown menu showing 'WebLogic Server'.
- JVM Type:** A dropdown menu showing 'Oracle Java'.
- Identifier*:** A text field containing 'Server-0'.
- Connection Port*:** A text field containing '10002'.
- Process Name:** An empty text field.
- User:** An empty text field.
- Password:** An empty text field with a 'Change' button to its right.
- Command:** An empty text field.
- Tuning:** A button located at the bottom left of the field area.

At the bottom right of the dialog are three buttons: 'OK', 'Cancel', and 'Apply'.

Target

Select the target to be monitored from the list. When monitoring WebSAM SVF for PDF, WebSAM Report Director Enterprise, or WebSAM Universal Connect/X, select **WebSAM SVF**. When monitoring a Java application that you created, select **Java Application**.

Select **JBoss** when monitoring the standalone mode of JBoss Enterprise Application Platform. Select **JBoss Domain Mode** when monitoring the domain mode of JBoss Enterprise Application Platform.

Default: None

JVM Type

Select the Java VM on which the target application to be monitored is running.

For Java 8 (or later) and OpenJDK 8 (or later), select **Oracle Java(usage monitoring)**. For Java 8, the following specification changes have been made.

- It has become impossible to acquire the maximum value of each memory in a non-heap area.
- Perm Gen has been changed to Metaspace.
- Compressed Class Space was added

For Java 8, therefore, the monitor items on the **Memory** tab have been changed as below.

- Monitoring for the use rate has been changed to monitoring for the amount used.

- **Perm Gen**, **Perm Gen[shared-ro]**, and **Perm Gen[shared-rw]** cannot be monitored. Clear the check box.
- **Metaspace** and **Compressed Class Space** can be monitored.

For Java 9, the following specification changes have been made.

- **Code Cache** has been divided.

For Java9, therefore, the monitor items on the **Memory** tab have been changed as below.

- **Code Cache** cannot be monitored. Clear the check box.
- **CodeHeap non-nmethods**, **CodeHeap profiled** and **CodeHeap non-profiled** can be monitored.

For each monitor target, the following are selectable.

- When the target is **WebLogic Server**
Oracle Java, **Oracle Java(usage monitoring)**, and **Oracle JRockit** are selectable.
- When the target is **Tomcat**
Oracle Java, **Oracle Java(usage monitoring)**, and **OpenJDK** are selectable.
- When the target is other than **WebLogic Server** and **Tomcat**
Oracle Java and **Oracle Java(usage monitoring)** are selectable.

Default: None

Identifier (within 255 bytes)

The identifier is set to differentiate the relevant JVM monitor resource from another JVM monitor resource when the information on the application to be monitored is output to the JVM operation log of the relevant JVM monitor resource. For this purpose, set a unique character string between JVM monitor resources. You must specify the identifier.

- When the target is **WebLogic Server**
Set the name of the server instance to be monitored, according to "Monitoring WebLogic Server", item 2.
- When the target is **WebOTX Process Group**
Specify the name of the process group.
- When the target is **WebOTX Domain Agent**
Specify the name of the domain.
- When the target is **JBoss** or **JBoss Domain Mode**
Specify this according to "6.35.28. *Monitoring JBoss*".
- When the target is **Tomcat**
Specify this according to "6.35.29. *Monitoring Tomcat*".
- When the target is **WebOTX ESB**
Same as for **WebOTX Process Group**.
- When the target is **WebSAM SVF**
Specify this according to "6.35.30. *Monitoring SVF*".
- When the target is **Java Application**
Specify a uniquely identifiable string for the monitored Java VM process.

Default: None

Connection Port (1024 to 65535)

Set the port number used by the JVM monitor resource when it establishes a JMX connection to the target Java VM. The JVM monitor resource obtains information by establishing a JMX connection to the target Java VM. Therefore, to register the JVM monitor resource, it is necessary to specify the setting by which the JMX connection port is opened for the target Java VM. You must specify the connection port. A value between 42424 and 61000 is not recommended.

- When the target is **WebLogic Server**
Set the connection port number according to "6.35.23. *Monitoring WebLogic Server*", item 6.
- When the target is **WebOTX Process Group**
Specify this according to "6.35.26. *Monitoring a Java process of a WebOTX process group*".
- When the target is **WebOTX Domain Agent**
Specify "domain.admin.port" of "(WebOTX_installation_path)/<domain_name>.properties".
- When the target is **JBoss**
Specify as described in "6.35.28. *Monitoring JBoss*".
- When the target is **JBoss Domain Mode**
It is unnecessary to set the port number.
- When the target is **Tomcat**
Specify as described in "6.35.29. *Monitoring Tomcat*".
- When the target is **WebOTX ESB**
Same as for **WebOTX Process Group**.
- When the target is **WebSAM SVF**
Specify this according to "6.35.30. *Monitoring SVF*".
- When the target is **Java Application**
Specify a uniquely identifiable string for the monitored Java VM process.

Default: None

Process Name (within 1024 bytes)

Set a **Process Name to identify** the target JVM monitor resource when JVM monitor resource is connecting the target Java VM via JMX. Therefore, be sure to specify a character string that is unique among JVM monitor resources.

- When the target is other than **JBoss Domain Mode**
This does not need to be configured because the monitor target Java VM can be identified by **Connection Port Number**. The internal version 3.3.5-1 or earlier required the process name to be specified since this parameter was used for the identification when the data of virtual memory usage amount was obtained or when the data of the monitor target was output to the JVM operation log. However, in and after the internal version 4.0.0-1, **Monitor Virtual Memory Usage** was deleted. Therefore, it cannot be specified.
- When the target is **JBoss Domain Mode**
Specify this according to "Monitoring JBoss".

Default: None

User (within 255 bytes)

Specify the name of the administrator who will be making a connection with the target Java VM.

- When **WebOTX Domain Agent** is selected as the target
Specify the "domain.admin.user" value of "/opt/WebOTX/<domain_name>.properties".
- When the target is other than **WebOTX Domain Agent**

This cannot be specified.

Default: None

Password (within 255 bytes)

Specify the password for the administrator who will be making a connection with the target Java VM.

- When **WebOTX Domain Agent** is selected as the target
Specify the "domain.admin.passwd" value of "/opt/WebOTX/<domain_name>.properties".
- When the target is other than **WebOTX Domain Agent**
This cannot be specified.

Default: None

Command (within 255 bytes)

Specify the commands that will be executed if errors in the monitor target Java VM are detected. A specific command and argument(s) can be specified for each error cause. Use an absolute path to specify each command. Place the executable file name in double quotes ("") to specify it.

Example: "/usr/local/bin/command" arg1 arg2

Specify the commands that will be executed if connection to the monitor target Java VM cannot be established or if an error is detected in the process for acquiring the amount of resource usage on the Java VM.

See "6.35.22. Executing a command corresponding to cause of each detected error"

Default: None

When you click Tuning, the following information is displayed in the pop-up dialog box. Make detailed settings according to the descriptions below.

6.35.2 Memory tab (when Oracle Java or OpenJDK is selected for JVM Type)

The screenshot shows a dialog box titled "JVM Monitor Resource Tuning Properties". It has five tabs: "Memory" (selected), "Thread", "GC", "WebLogic", and "Load Balancer Linkage". The "Memory" tab is active, displaying two columns of settings for monitoring heap and non-heap memory rates. Each setting has a checkbox, a name, a numeric input field, and a percentage sign. Below each column is a "Command" text box. At the bottom left is an "Initialize" button, and at the bottom right are "OK", "Cancel", and "Apply" buttons.

Monitor Heap Memory Rate				Monitor Non-Heap Memory Rate			
<input checked="" type="checkbox"/>	Total Usage	80	%	<input checked="" type="checkbox"/>	Total Usage	80	%
<input type="checkbox"/>	Eden Space	100	%	<input type="checkbox"/>	Code Cache	100	%
<input type="checkbox"/>	Survivor Space	100	%	<input checked="" type="checkbox"/>	Perm Gen	80	%
<input checked="" type="checkbox"/>	Tenured Gen	80	%	<input checked="" type="checkbox"/>	Perm Gen[shared-ro]	80	%
Command: <input type="text"/>				Command: <input type="text"/>			

Initialize [OK] [Cancel] [Apply]

Monitor Heap Memory Rate

Enables the monitoring of the usage rates of the Java heap areas used by the target Java VM.

- When selected (default):
Monitoring enabled
- When cleared:
Monitoring disabled

Total Usage (1 to 100)

Specify the threshold for the usage rate of the Java heap areas used by the target Java VM.

Default: 80[%]

Eden Space (1 to 100)

Specify the threshold for the usage rate of the Java Eden Space used by the target Java VM. If G1 GC is specified as the GC method, read it as G1 Eden Space.

Default: 100[%]

Survivor Space (1 to 100)

Specify the threshold for the usage rate of the Java Survivor Space used by the target Java VM. If G1 GC is specified as the GC method, read it as G1 Survivor Space.

Default: 100[%]

Tenured Gen (1 to 100)

Specify the threshold for the usage rate of the Java Tenured(Old) Gen area used by the target Java VM. If G1 GC is specified as the GC method, read it as G1 Survivor Space.

Default: 80[%]

Monitor Non-Heap Memory Rate

Enables the monitoring of the usage rates of the Java non-heap areas used by the target Java VM.

- When selected (default):
Monitoring enabled
- When cleared:
Monitoring disabled

Total Usage (1 to 100)

Specify the threshold for the usage rate of the Java non-heap areas used by the target Java VM.

Default: 80[%]

Code Cache (1 to 100)

Specify the threshold for the usage rate of the Java Code Cache area used by the target Java VM.

Default: 100[%]

Perm Gen (1 to 100)

Specify the threshold for the usage rate of the Java Perm Gen area used by the target Java VM.

Default: 80[%]

Perm Gen[shared-ro] (1 to 100)

Specify the threshold for the usage rate of the Java Perm Gen [shared-ro] area used by the target Java VM.

Default: 80[%]

Perm Gen[shared-rw] (1 to 100)

Specify the threshold for the usage rate of the Java Perm Gen [shared-rw] area used by the target Java VM.

Default: 80[%]

Command (within 255 bytes)

Specify the commands that will be executed if errors in the monitor target Java VM are detected. A specific command and argument(s) can be specified for each error cause. Use an absolute path to specify each command. Place the executable file name in double quotes (") to specify it. Example)

`"/usr/local/bin/command" arg1 arg2`

Specify the commands that will be executed if errors are detected in the process for checking the amount of the usage of the Java heap area and Java non-heap area in the monitor target Java VM.

See "6.35.22. Executing a command corresponding to cause of each detected error".

Default: None

Initialize

Click **Initialize** to initialize all the items to their default values.

6.35.3 Memory tab (when Oracle Java(usage monitoring) is selected for JVM Type)

The screenshot shows the 'JVM Monitor Resource Tuning Properties' dialog box with the 'Memory' tab selected. The dialog has five tabs: Memory, Thread, GC, WebLogic, and Load Balancer Linkage. The 'Memory' tab is active, showing two main sections: 'Monitor Heap Memory Usage' and 'Monitor Non-Heap Memory Usage'. Each section has a checkbox to enable monitoring and a list of memory areas with checkboxes and input fields for monitoring thresholds in MB. The 'Monitor Heap Memory Usage' section includes 'Total Usage' (checked, 0 MB), 'Eden Space' (unchecked, 0 MB), 'Survivor Space' (unchecked, 0 MB), and 'Tenured Gen(Old Gen)' (checked, 0 MB). The 'Monitor Non-Heap Memory Usage' section includes 'Total Usage' (checked, 0 MB), 'Code Cache' (unchecked, 0 MB), 'CodeHeap non-nmethods' (unchecked, 0 MB), 'CodeHeap profiled' (unchecked, 0 MB), 'CodeHeap non-profiled' (unchecked, 0 MB), 'Compressed Class Space' (unchecked, 0 MB), and 'Metaspace' (unchecked, 0 MB). Below each section is a 'Command' input field. At the bottom left is an 'Initialize' button, and at the bottom right are 'OK', 'Cancel', and 'Apply' buttons.

Section	Item	Checked	Value	Unit
Monitor Heap Memory Usage	Total Usage	Yes	0	MB
	Eden Space	No	0	MB
	Survivor Space	No	0	MB
	Tenured Gen(Old Gen)	Yes	0	MB
Monitor Non-Heap Memory Usage	Total Usage	Yes	0	MB
	Code Cache	No	0	MB
	CodeHeap non-nmethods	No	0	MB
	CodeHeap profiled	No	0	MB
	CodeHeap non-profiled	No	0	MB
	Compressed Class Space	No	0	MB
	Metaspace	No	0	MB

Monitor Heap Memory Usage

Enables the monitoring of the usage rates of the Java heap areas used by the target Java VM. If zero is specified, this item is not monitored.

- When the check box is selected:
Monitoring enabled
- When the check box is not selected (default):
Monitoring disabled

Total Usage (0 to 102400)

Specify the threshold for the usage rate of the Java heap areas used by the target Java VM. If zero is specified, this item is not monitored.

Default: 0[MB]

Eden Space (0 to 102400)

Specify the threshold for the usage rate of the Java Eden Space used by the target Java VM. If zero is specified, this item is not monitored. If G1 GC is specified as the GC method, read it as G1 Eden Space.

Default: 0[MB]

Survivor Space (0 to 102400)

Specify the threshold for the usage rate of the Java Survivor Space used by the target Java VM. If zero is specified, this item is not monitored. If G1 GC is specified as the GC method, read it as G1 Survivor Space.

Default: 0[MB]

Tenured Gen(Old Gen) (0 to 102400)

Specify the threshold for the usage rate of the Java Tenured(Old) Gen area used by the target Java VM. If zero is specified, this item is not monitored. If G1 GC is specified as the GC method, read it as G1 Old Gen.

Default: 0[MB]

Monitor Non-Heap Memory Usage

Enables the monitoring of the usage rates of the Java non-heap areas used by the target Java VM.

- When the check box is selected:
Monitoring enabled
- When the check box is not selected (default):
Monitoring disabled

Total Usage (0 to 102400)

Specify the threshold for the usage rate of the Java non-heap areas used by the target Java VM. If zero is specified, this item is not monitored.

Default: 0[MB]

Code Cache (0 to 102400)

Specify the threshold for the usage rate of the Java Code Cache area used by the target Java VM. If zero is specified, this item is not monitored.

Default: 0[MB]

CodeHeap non-nmethods(0 to 102400)

Specify the threshold for the usage rate of the Java CodeHeap non-nmethods area used by the target Java VM. If zero is specified, this item is not monitored.

Default: 0[MB]

CodeHeap profiled(0 to 102400)

Specify the threshold for the usage rate of the Java CodeHeap profiled nmethods area used by the target Java VM. If zero is specified, this item is not monitored.

Default: 0[MB]

CodeHeap non-profiled (0 to 102400)

Specify the threshold for the usage rate of the Java CodeHeap non-profiled nmethods area used by the target Java VM. If zero is specified, this item is not monitored.

Default: 0[MB]

Compressed Class Space(0 to 102400)

Specify the threshold for the usage rate of the Compressed Class Space area used by the target Java VM. If zero is specified, this item is not monitored.

Default: 0[MB]

Metaspace (0 to 102400)

Specify the threshold for the usage rate of the Metaspace area used by the target Java VM. If zero is specified, this item is not monitored.

Default: 0[MB]

Command (within 255 bytes)

Specify the commands that will be executed if errors in the monitor target Java VM are detected. A specific command and argument(s) can be specified for each error cause. Use an absolute path to specify each command. Place the executable file name in double quotes (") to specify it. Example)
"/usr/local/bin/command" arg1 arg2

Specify the commands that will be executed if errors are detected in the Java heap area and Java non-heap area of the target Java VM.

See also "6.35.22. *Executing a command corresponding to cause of each detected error*".

Default: None

Initialize

Click Initialize to **initialize** all the items to their default values.

6.35.4 Memory tab (when Oracle JRockit is selected)

JVM Monitor Resource Tuning Properties

Memory Thread GC WebLogic Load Balancer Linkage

☒ **Monitor Heap Memory Rate**

☒ **Total Usage** 80 %

☒ **Nursery Space** 80 %

☒ **Old Space** 80 %

Command

☒ **Monitor Non-Heap Memory Rate**

☒ **Total Usage** 80 %

☐ **Class Memory** 100 %

Command

Displayed only when **JRockit** is selected for **JVM Type**.

Monitor Heap Memory Rate

Enables the monitoring of the usage rates of the Java heap areas used by the target Java VM.

- When selected (default):
Monitoring enabled
- When cleared:
Monitoring disabled

Total Usage (1 to 100)

Specify the threshold for the usage rate of the Java heap areas used by the target Java VM.

Default: 80[%]

Nursery Space (1 to 100)

Specify the threshold for the usage rate of the Java Nursery Space used by the target JRockit JVM.

Default: 80[%]

Old Space (1 to 100)

Specify the threshold for the usage rate of the Java Old Space used by the target JRockit JVM.

Default: 80[%]

Monitor Non-Heap Memory Rate

Enables the monitoring of the usage rates of the Java non-heap areas used by the target Java VM.

- When selected (default):
Monitoring enabled
- When cleared:
Monitoring disabled

Total Usage (1 to 100)

Specify the threshold for the usage rate of the Java non-heap areas used by the target Java VM.

Default: 80[%]

Class Memory (1 to 100)

Specify the threshold for the usage rate of the Java Class Memory used by the target JRockit JVM.

Default: 100[%]

Command (within 255 bytes)

Specify the commands that will be executed if errors in the monitor target Java VM are detected. A specific command and argument(s) can be specified for each error cause. Use an absolute path to specify each command. Place the executable file name in double quotes (") to specify it. Example)

`"/usr/local/bin/command" arg1 arg2`

Specify the commands that will be executed if errors are detected in the process for checking the amount of the usage of the Java heap area and Java non-heap area in the monitor target Java VM.

See "6.35.22. *Executing a command corresponding to cause of each detected error*".

Default: None

Initialize

Click **Initialize** to initialize all the items to their default values.

6.35.5 Thread tab

The screenshot shows a dialog box titled "JVM Monitor Resource Tuning Properties". It has five tabs: "Memory", "Thread" (which is selected), "GC", "WebLogic", and "Load Balancer Linkage". In the "Thread" tab, there is a checkbox labeled "Monitor the number of Active Threads". To the right of this checkbox is a text input field containing the value "65535". Further to the right is the label "Thread". Below the checkbox and input field is a text input field labeled "Command". At the bottom left of the dialog is an "Initialize" button. At the bottom right are three buttons: "OK", "Cancel", and "Apply".

Monitor the number of Active Threads (1 to 65535)

Specify the upper limit threshold for the number of threads running on the monitor target Java VM.

Default: 65535 [threads]

Command (within 255 bytes)

Specify the commands that will be executed if errors in the monitor target Java VM are detected. A specific command and argument(s) can be specified for each error cause. Use an absolute path to specify each command. Place the executable file name in double quotes (") to specify it. Example)

`"/usr/local/bin/command" arg1 arg2`

Specify the commands that will be executed if errors are detected in the process for checking the number of active threads in the monitor target Java VM.

See "6.35.22. *Executing a command corresponding to cause of each detected error*".

Default: None

Initialize

Click **Initialize** to initialize all the items to their default values.

6.35.6 GC tab

The screenshot shows the 'JVM Monitor Resource Tuning Properties' dialog box with the 'GC' tab selected. The 'Memory' tab is also visible. The 'GC' tab contains the following options:

- ☐ Monitor the time in Full GC: A text box with the value '65535' and a unit dropdown set to 'msec'.
- ☒ Monitor the count of Full GC execution: A text box with the value '1' and a unit dropdown set to 'count'.
- Command: An empty text box.
- Initialize: A button.
- OK, Cancel, and Apply: Buttons at the bottom right.

Monitor the time in Full GC (1 to 65535)

Specify the threshold for the Full GC execution time since previous measurement on the target Java VM. The threshold for the Full GC execution time is the average obtained by dividing the Full GC execution time by the number of times Full GC occurs since the previous measurement.

To determine the case in which the Full GC execution time since the previous measurement is 3000 milliseconds and Full GC occurs three times as an error, specify 1000 milliseconds or less.

Default: 65535 [milliseconds]

Monitor the count of Full GC execution (1 to 65535)

Specify the threshold for the number of times Full GC occurs since previous measurement on the target Java VM.

Default: 1 (time)

Command (within 255 bytes)

Specify the commands that will be executed if errors in the monitor target Java VM are detected. A specific command and argument(s) can be specified for each error cause. Use an absolute path to specify each command. Place the executable file name in double quotes (") to specify it. Example)

`"/usr/local/bin/command" arg1 arg2`

Specify the commands that will be executed if errors are detected in the process for measuring time in Full GC and the count of Full GC execution in the monitor target Java VM.

See "6.35.22. Executing a command corresponding to cause of each detected error".

Default: None

Initialize

Click **Initialize** to initialize all the items to their default values.

6.35.7 WebLogic tab

JVM Monitor Resource Tuning Properties

Memory Thread GC WebLogic Load Balancer Linkage

Monitor the requests in Work Manager☐

Target Work Managers

Waiting Requests

☐ The number

65535

☐ Average

65535

☒ Increment from the last

80

%

Monitor the requests in Thread Pool☒

Waiting Requests

☐ The number

65535

☐ Average

65535

☒ Increment from the last

80

%

Executing Requests

☐ The number

65535

☐ Average

65535

☒ Increment from the last

80

%

Command

Initialize

OK

Cancel

Apply

Displayed only when **WebLogic Server** is selected for **Target**.

Monitor the requests in Work Manager

Enables the monitoring of the wait requests by Work Managers on the WebLogic Server.

- When selected:
Monitoring enabled
- When cleared (default):
Monitoring disabled

Target Work Managers

Specify the names of the Work Managers for the applications to be monitored on the target WebLogic Server. To monitor Work Managers, you must specify this setting.

App1[WM1,WM2, ...];App2[WM1,WM2, ...]; ...

For *App* and *WM*, only ASCII characters are valid (except Shift_JIS codes 0x005C and 0x00A1 to

0x00DF).

To specify an application that has an application archive version, specify "application_name#version" in *App*.

When the name of the application contains "[" and/or "]", prefix it with ¥¥.

(Ex.) When the application name is app[2], enter app¥¥[2¥¥].

Default: None

The number (1 to 65535)

Specify the threshold for the wait request count for the target WebLogic Server Work Manager(s).

Default: 65535

Average (1 to 65535)

Specify the threshold for the wait request count average for the target WebLogic Server Work Manager(s).

Default: 65535

Increment from the last (1 to 1024)

Specify the threshold for the wait request count increment since the previous measurement for the target WebLogic Server Work Manager(s).

Default: 80[%]

Monitor the requests in Thread Pool

In WebLogic Server thread pool to be monitored, the number of wait requests, and the monitoring settings of the number of executing request. The number of requests, HTTP requests and the number that was waiting to be processed and run inside WebLogic Server, and includes the number of requests of the processing performed by the internal EJB call and WebLogic Server. However, it can not judge an abnormal state to be increased. Please specify if you want to the collection of JVM statistics log.

- When selected (default):
Monitoring enabled
- When cleared:
Monitoring disabled

Waiting Requests The number (1 to 65535)

Specify the threshold for the wait request count.

Default: 65535

Waiting Requests Average (1 to 65535)

Specify the threshold for the wait request count average.

Default: 65535

Waiting Requests Increment from the last (1 to 1024)

Specify the threshold for the wait request count increment since the previous measurement.

Default: 80[%]

Executing Requests The number (1 to 65535)

Specify the threshold for the number of requests executed per unit of time.

Default: 65535

Executing Requests Average (1 to 65535)

Specify the threshold for the average count of requests executed per unit of time.

Default: 65535

Executing Requests Increment from the last (1 to 1024)

Specify the threshold for the increment of the number of requests executed per unit of time since the previous measurement.

Default: 80[%]

Command (within 255 bytes)

Specify the commands that will be executed if errors in the monitor target Java VM are detected. A specific command and argument(s) can be specified for each error cause. Use an absolute path to specify each command. Place the executable file name in double quotes (") to specify it. Example)

`"/usr/local/bin/command" arg1 arg2`

Specify the commands that will be executed if errors are detected in the process for executing requests in the Work Manager and Thread Pool of WebLogic Server.

See "6.35.22. *Executing a command corresponding to cause of each detected error*".

Default: None

Initialize

Click **Initialize** to initialize all the items to their default values.

6.35.8 Load Balancer Linkage tab

The screenshot shows a dialog box titled "JVM Monitor Resource Tuning Properties". It has five tabs: "Memory", "Thread", "GC", "WebLogic", and "Load Balancer Linkage". The "Load Balancer Linkage" tab is selected. Below the tabs, there is a section titled "Load calculation function of target Java VM". Under this section, there is a label "Memory Pool Monitor" followed by an unchecked checkbox. At the bottom left of the dialog is an "Initialize" button. At the bottom right are three buttons: "OK", "Cancel", and "Apply".

This screen appears when an item other than **BIG-IP LTM** is selected as the load balancer type.

Memory Pool Monitor

Enables the monitoring of the memory pool when notifying the load balancer of dynamic load information.

- When selected:
Monitoring enabled
- When cleared (default):
Monitoring disabled

Initialize

Click **Initialize** to initialize all the items to their default values.

6.35.9 Load Balancer Linkage tab (BIG-IP LTM)

The screenshot shows a dialog box titled "JVM Monitor Resource Tuning Properties". It has five tabs: "Memory", "Thread", "GC", "WebLogic", and "Load Balancer Linkage". The "Load Balancer Linkage" tab is selected. Below the tabs, there are three sections:

- Load calculation function of target Java VM**: Contains a checkbox for "Memory Pool Monitor" which is currently unchecked.
- Control of distributed nodes**: Contains a checkbox for "Cut off an obstacle node dynamically" which is currently unchecked.
- Restart Command**: A text input field.
- Timeout**: A text input field containing "3600" with a "sec" label to its right.

At the bottom left is an "Initialize" button. At the bottom right are "OK", "Cancel", and "Apply" buttons.

This screen appears when **BIG-IP LTM** is selected as the load balancer type.

Memory Pool Monitor

Enables the monitoring of the memory pool when notifying the load balancer of dynamic load information.

- When selected:
Monitoring enabled
- When cleared (default):
Monitoring disabled

Cut off an obstacle node dynamically

When the JVM monitor detects a monitor target failure (example: the collection information exceeds the configured threshold), it sets whether to update the status of the BIG-IP LTM distributed node from "enable" to "disable."

- When selected:
Update the status from enable to disable.
- When cleared (default):
Do not update.

Restart Command

Specify the absolute path of the command to be executed after waiting until the number of connections of the distributed node becomes 0. This function is effective when the monitor target is restarted when resident monitoring is performed and a monitor target failure is detected. Specify the same value between JVM monitor resources.

Timeout (0 to 2592000)

After updating the distributed node status from "enable" to "disable," the JVM monitor sets the timeout used when waiting until the number of connections of the distributed node falls to 0. If the timeout elapses, **[Restart Command]** is not executed.

Default: 3600 [sec]

Initialize

Click the **Initialize** button to set **Memory Pool Monitor**, **Cut off an obstacle node dynamically**, and **Timeout** to their default values.

Note: Linking with the BIG-IP Local Traffic Manager requires an OpenSSL library. However, OpenSSL 1.1.0 or later is not supported.

6.35.10 Notes on JVM monitor resources

The **Java install path** on the **JVM Monitor** tab of **Cluster Properties** must be set before adding JVM monitor resource.

For a target resource, specify an application server running on Java VM such as WebLogic Server or WebOTX. As soon as the JVM monitor resource has been activated, the Java Resource Agent starts monitoring, but if the target (WebLogic Server or WebOTX) cannot start running immediately after the activation of the JVM monitor resource, use **Wait Time to Start Monitoring** to compensate.

The setting of Monitor(common) tab-Retry Count is invalid. When you'd like to delay error detection, please change the setting of Cluster Properties-JVM monitor Tab-Resource Measurement Settings [Common]-Retry Count.

JBoss monitoring does not support Java 9 or higher.

6.35.11 How JVM monitor resources perform monitoring

JVM monitor resource monitors the following:

Monitors application server by using JMX (Java Management Extensions).

The monitor resource determines the following results as errors:

- Target Java VM or application server cannot be connected
- The value of the used amount of resources obtained for the Java VM or application server exceeds the user-specified threshold a specified number of times (error decision threshold) consecutively

As a result of monitoring, an error is regarded as having been solved if:

- The value falls below the threshold when restarting the monitoring after the recovery action.

Note: Collect Cluster Logs in the Cluster WebUI does not handle the configuration file and log files of the target (WebLogic Server or WebOTX).

The following figure shows the monitoring operation by the JVM monitor resource.

Monitoring of the target Java VM is started ... a). JMX (Java Management Extensions) is used for monitoring Java VM. Java Resource Agent periodically obtains the amount of used resources through JMX to check the status of Java VM.

When the status changes from normal to abnormal, Cluster WebUI indicates an error having been detected in Java VM, where its status and alert can be checked ... b). An error is notified to the syslog and JVM operation log ... c). If an alert service is used, a notification via an e-mail is available.

After a), if the status is changed from Error to Normal, Cluster WebUI indicates Java VM has been restored ... d). The restoration of Java VM is notified to the syslog and JVM operation log ... e).

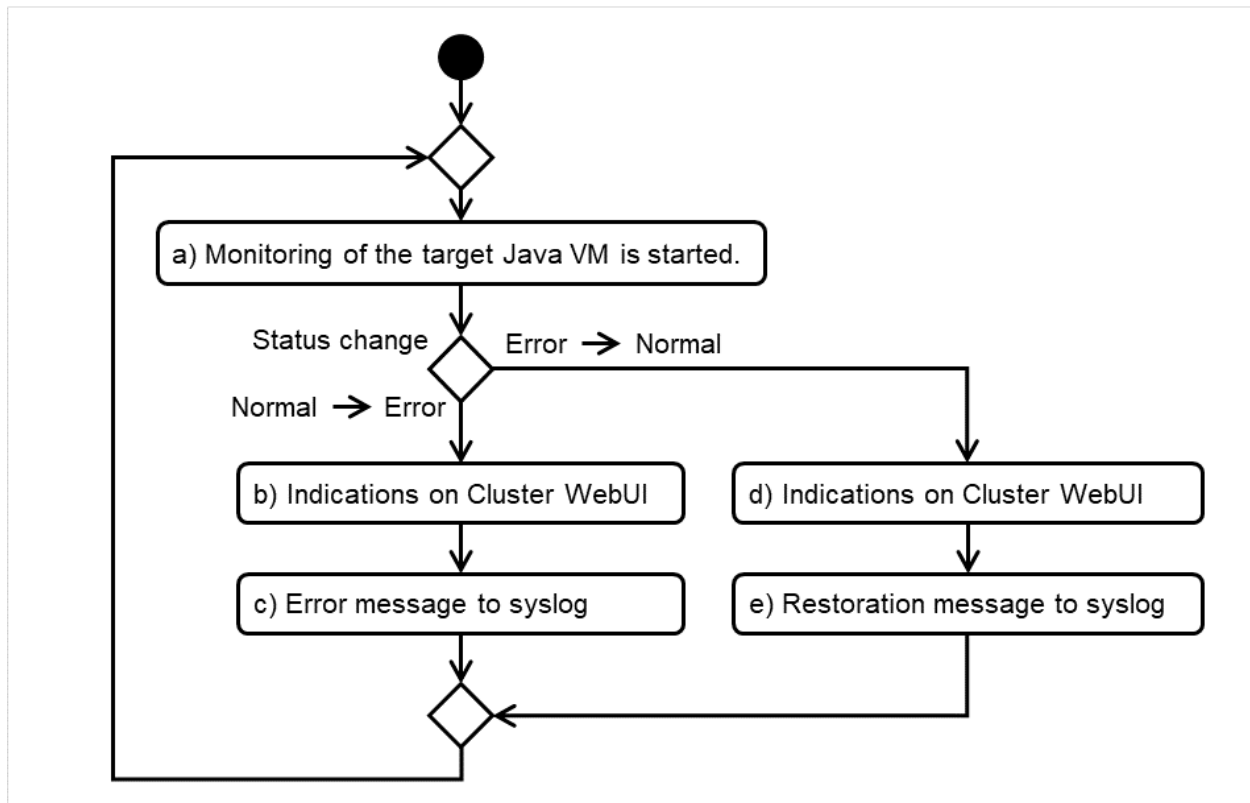


Fig. 6.11: Monitoring flow by the JVM monitor resource

The standard operations when the threshold is exceeded are as described below.

In the figure below, the horizontal axis shows the lapse of time, while the vertical axis shows whether the user-specified threshold is exceeded or not.

If the value consecutively exceeds the threshold the number of times of the error decision threshold (five times in this figure), it is determined as an error.

After judging as an error, if the value consecutively falls below the threshold the number of the error decision threshold, it is determined as normal.

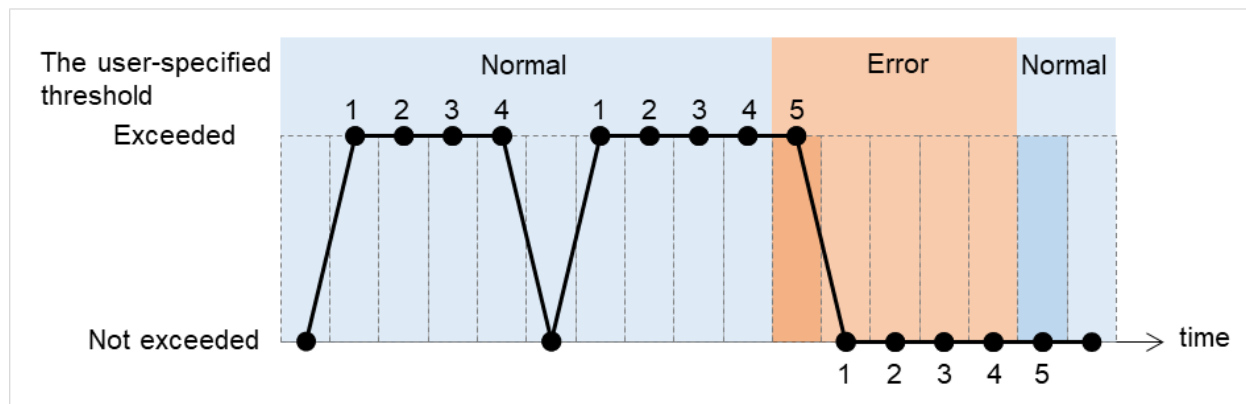


Fig. 6.12: Behavior with threshold exceeded

The operations performed if an error persists are as described below.

If the value consecutively exceeds the threshold the number of times of the error decision threshold, it is determined as an error.

After determining as an error, even if the value consecutively exceeds the number of times of the error decision threshold again, Cluster WebUI does not display an alert again.

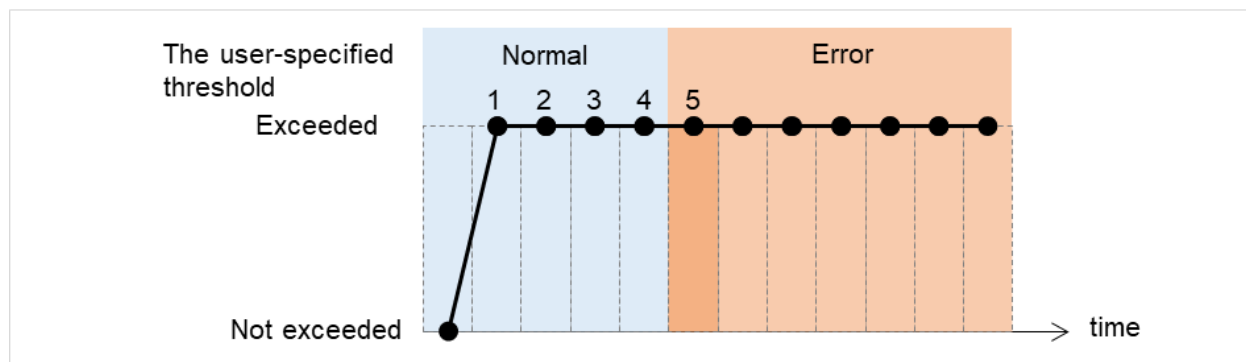


Fig. 6.13: Behavior with an error persistent

The following example describes the case of monitoring Full GC (Garbage Collection).

The horizontal axis in the figure shows the lapse of time. The upper part of the figure shows whether Full GC occurred or not, while the lower part shows how many times Full GC occurred consecutively. The JVM resource detects an error when Full GC consecutively occurs the number of times of the error judgment threshold. With the error decision threshold set at five times, the JVM resource detects an error when Full GC has been detected five times.

The JVM monitor resource recognizes a monitor error if Full GC is detected consecutively the number of times specified by the error threshold. In the following chart, * indicates that Full GC is detected by the JVM monitor resource when the error threshold is set to 5 (times).

Full GC has a significant influence on the system, thus the recommended error threshold is 1 time.

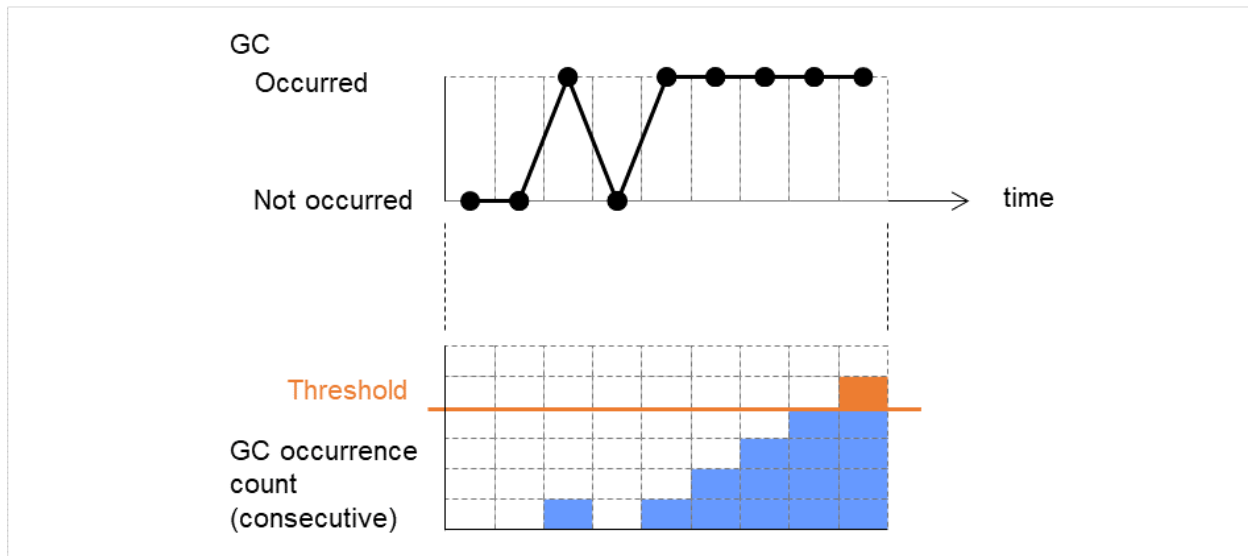


Fig. 6.14: Monitoring image (error decision threshold set at five times)

6.35.12 Linking with the load balancer (health check function)

Target load balancer: Load balancer with health check function for HTML files

JVM monitor resources can link with the load balancer. This section describes an example of linking when WebOTX is used as the application to be monitored. The load balancer linkage provides a health check function and target Java VM load calculation function. To link with the BIG-IP Local Traffic Manager, see "6.35.14. *Linking with the BIG-IP Local Traffic Manager*".

Distributed nodes are servers that are subject to load balancing, while the distributed node module is installed in the distributed nodes. The distributed node module is included in InterSec/LB400*.

To use the function, configure the settings through the Cluster WebUI **Cluster Property->JVM Monitor** tab->**Load Balancer Linkage Settings** dialog box; the health check function of the load balancer is linked.

When a load balancing system is configured with the load balancer on the server, the JVM monitor resource renames the HTML file specified by **HTML File Name** to the name specified by **HTML Renamed File Name** upon the detection of a WebOTX error (for example, exceeding the threshold for collected information).

The JVM monitor resource halts for the wait time, or 20 seconds, after renaming the HTML file. The wait time is intended to prevent WebOTX from being restarted before the load balancer finishes disconnecting the distributed node.

Once the JVM monitor resource detects the normality of WebOTX (e.g., the threshold specified for the collected information is not exceeded after reconnection) after WebOTX rebooting, the HTML file name set with **HTML Renamed File Name** is restored to that specified by **HTML File Name**.

The load balancer periodically health-checks the HTML file, and if a health check fails, the distributed node is determined to be not alive, so that the load balancer disconnects that distributed node. In the case of InterSec/LB400*, configure the health check interval, health check timeout, and retry count to determine the node down state by the health check with the health check (distributed node) interval parameter, HTTP health check timeout parameter, and health check (distributed node) count parameter, that are accessible from **ManagementConsole** for the load balancer->**LoadBalancer->System Information**.

Configure the parameters using the following as a reference.

20-second wait time \geq (health check (distributed node) interval + HTTP health check timeout) \times health check (distributed node) count

- Settings of the JVM monitor resource health check function for the load balancer:
 - Health check (distributed node) interval: 10 seconds
 - HTTP health check timeout value: 1 second
 - Health check (distributed node) count: 2 times

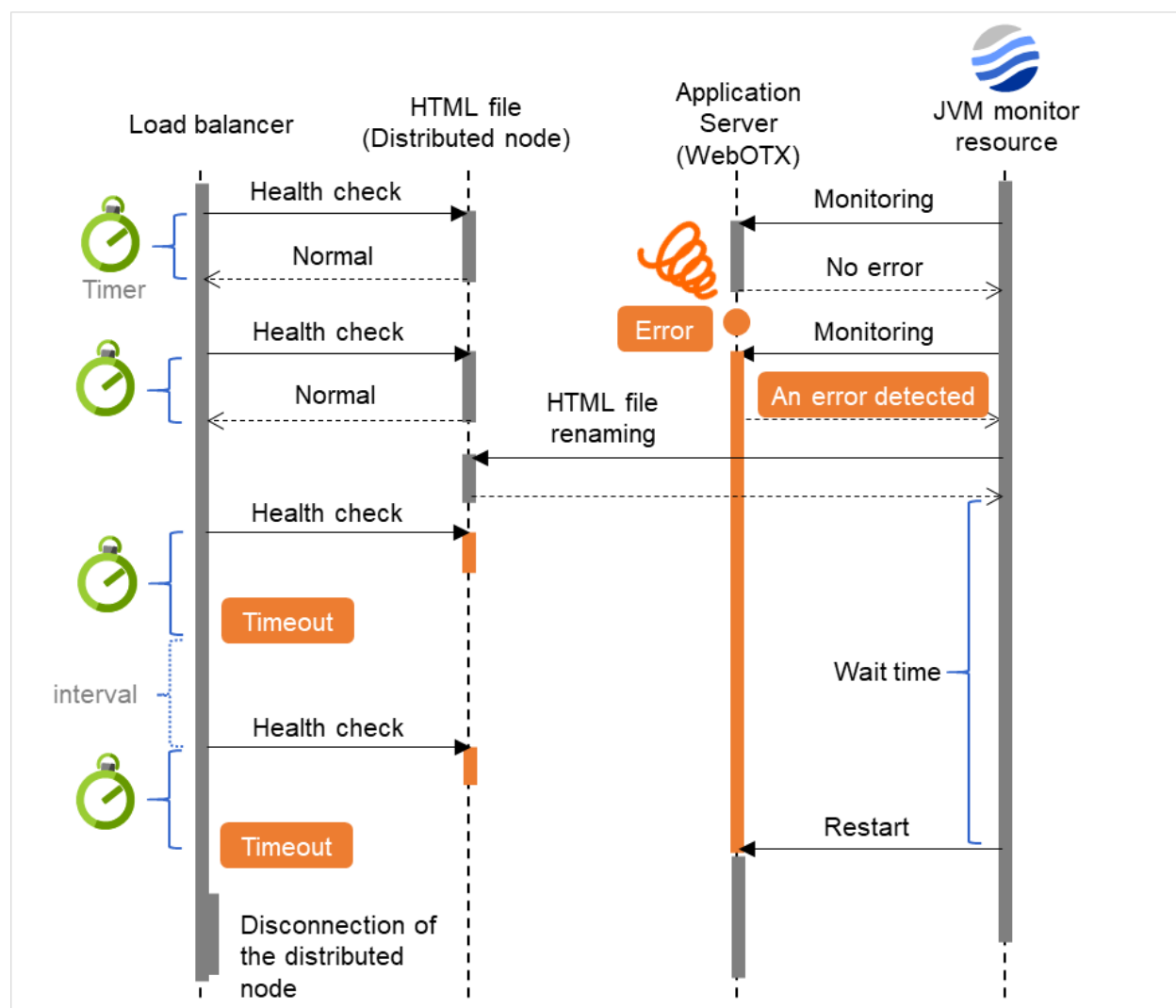


Fig. 6.15: JVM monitor resource health check function for the load balancer

6.35.13 Linking with the load balancer (target Java VM load calculation function)

Target load balancer: InterSec/LB400*

JVM monitor resources can link with the load balancer. This section describes an example of linking when WebOTX is used as the application to be monitored. The load balancer linkage provides a health check function and target Java VM load calculation function. To link with the BIG-IP Local Traffic Manager, see "6.35.14. *Linking with the BIG-IP Local Traffic Manager*".

Distributed nodes are servers that are subject to load balancing, while the distributed node module is installed in the distributed node. The distributed node module is included in InterSec/LB400*.

To use this function, the following settings are required. This function works together with the CPU load-dependent weighting function of the load balancer.

- **Properties - Monitor(special) tab -> Tuning property - Memory dialog box - Monitor Heap Memory Rate - Total Usage**
- **Properties - Monitor(special) tab -> Tuning property - Load Balancer Linkage dialog box - Memory Pool Monitor**

According to the following steps, first install the distributed node module on each server, and then execute the load balancer linkage setup command `clpjra_lbsetup.sh` to configure the distributed node modules.

Note: Execute the command from an account having the root privilege.

1. Execute `[EXPRESSCLUSTER_installation_folder]/ha/jra/bin/clpjra_lbsetup.sh`. The functions of the arguments are as described below.
 (Example)

```
clpjra_lbsetup.sh -e 1 -i 120 -t 180
```

Argument	Description	Value
-e	Enables or disables the function.	0 or 1 0: Disable 1: Enable
-i	Specify the execution interval for the target Java VM load calculation command, in seconds.	1 to 2147483646
-t	Specify the timeout for the target Java VM load calculation command, in seconds.	1 to 2147483646

The JVM monitor resource calculates the load on the target Java VM according to the information obtained about the Java memory. Obtain the Java VM load from the following expression. The threshold is the value obtained by multiplying the entire amount of the Java heap area by the use ratio set with the **Monitor(special) tab - Tuning property - Memory tab - Monitor Heap Memory Rate - Total Usage**.

Java VM load (%) = current memory usage (MB) x 100/threshold (MB)

For the distributed node module installed on a server on which JVM monitor resource is running, commands are periodically executed to compare the obtained target Java VM load with the CPU load obtained separately, and to notify the load balancer of the higher load value as a CPU load. The load balancer distributes the traffic (requests) to the appropriate servers according to the CPU load of the distributed node.

- Settings of the load calculation function for the distributed node module
 - Command execution interval: as set by the load balancer linkage setup command

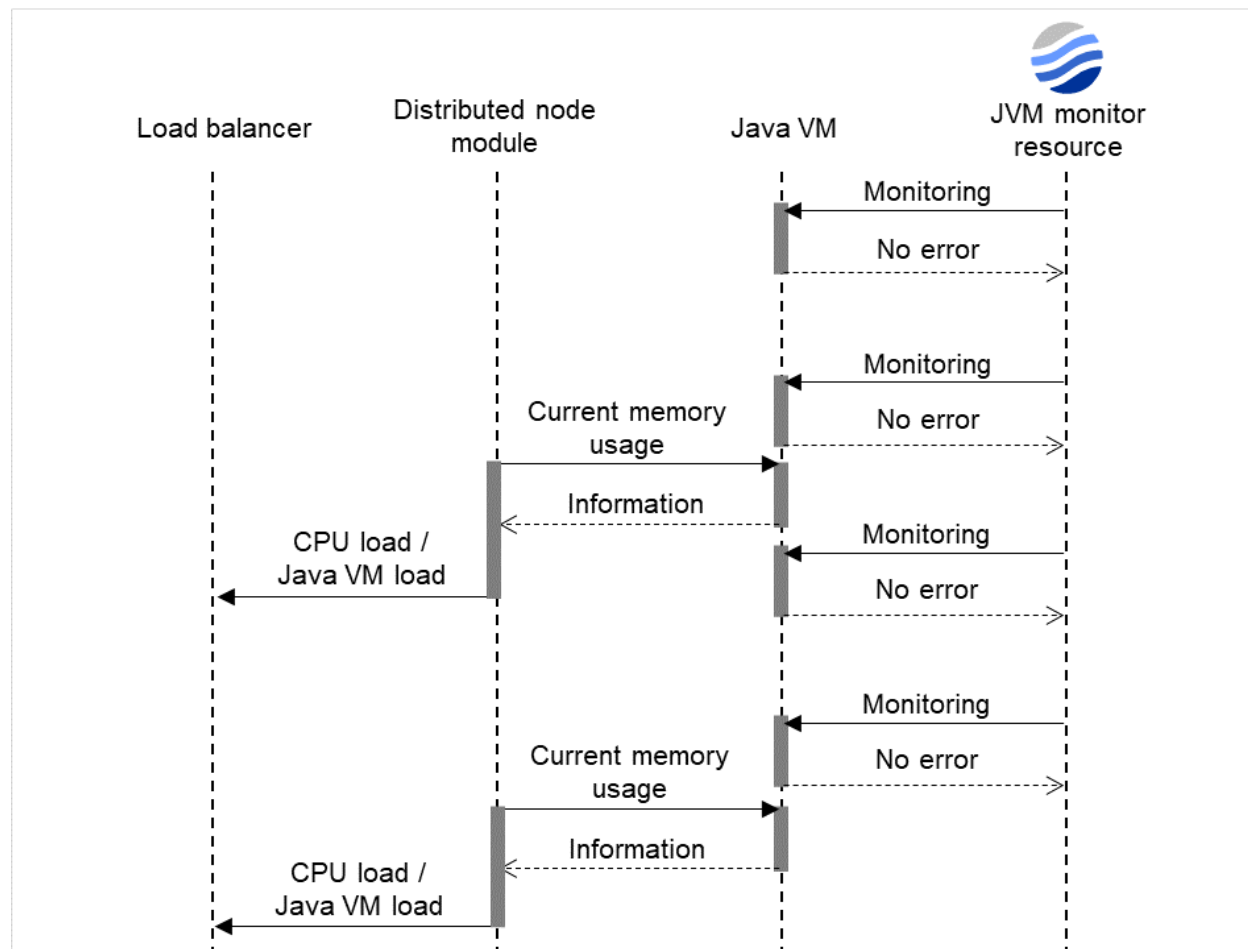


Fig. 6.16: Load calculation function for the distributed node module

6.35.14 Linking with the BIG-IP Local Traffic Manager

Target load balancer: BIG-IP Local Traffic Manager

The JVM monitor resource can link with BIG-IP LTM. Hereafter, the explanation assumes the use of Tomcat as the application server to be monitored. Linkage with BIG-IP LTM offers the distributed node control function and the target Java VM load calculation function.

The linkage between BIG-IP LTM and the JVM monitor resource is realized with the BIG-IP series API (iControl).

The distributed node is the load distribution server, and the linkage module is that which is installed in each distributed node. The linkage module is contained in Java Resource Agent.

To use the distributed node control function, specify the setting with Cluster WebUI **Cluster Properties** -> **JVM monitor** tab -> **Load Balancer Linkage Settings** dialog box, JVM monitor resource Properties **Properties - Monitor(special)** tab - **Tuning** property - **Load Balancer Linkage** tab.

To use the target Java VM load calculation function, specify the setting with Cluster WebUI **Cluster Properties** -> **JVM monitor** tab -> **Load Balancer Linkage Settings** dialog box.

The following BIG-IP LTM linkage error message is output to the "JVM operation log". For details, see "JVM monitor resource log output messages" For details, refer to "JVM monitor resource log output messages" in "Error messages" in the "Reference Guide".

Error: Failed to operate clpjra_bigip.[error code]

If the relevant server configures the BIG-IP LTM load distribution system, when the JVM monitor detects a Tomcat failure (for example: the amount of collection information exceeds the specified threshold), iControl is used to update the BIG-IP LTM distributed node status from "enable" to "disable."

After updating the status of the distributed node of BIG-IP LTM, the JVM monitor waits until the number of connections of the distributed node falls to 0. After waiting, it executes Restart Command specified on the JVM monitor resource Properties - Monitor(special) tab -> Tuning property - Load Balancer Linkage tab. It does not execute the action specified by Restart Command if the number of connections of the distributed node does not fall to 0, even if Timeout elapses, as specified on the JVM monitor resource Properties - Monitor(special) tab -> Tuning property - Load Balancer Linkage tab.

When the JVM monitor detects a Tomcat failure recovery, it uses iControl to update the status of the BIG-IP LTM distributed node from "disable" to "enable." In this case, it does not execute the action specified by Restart Command specified on the JVM monitor resource Properties - Monitor(special) tab -> Tuning property - Load Balancer Linkage tab.

If the distributed node status is "disable", BIG-IP LTM determines the distributed node to be down and therefore disconnects it. Use of the distributed node control function requires no related setting for BIG-IP LTM.

The distributed node status is updated by BIG-IP LTM when the JVM monitor detects a failure or failure recovery. Therefore, after the failover generated by an operation other than JVM monitoring, the distributed node status of BIG-IP LTM may be "enable".

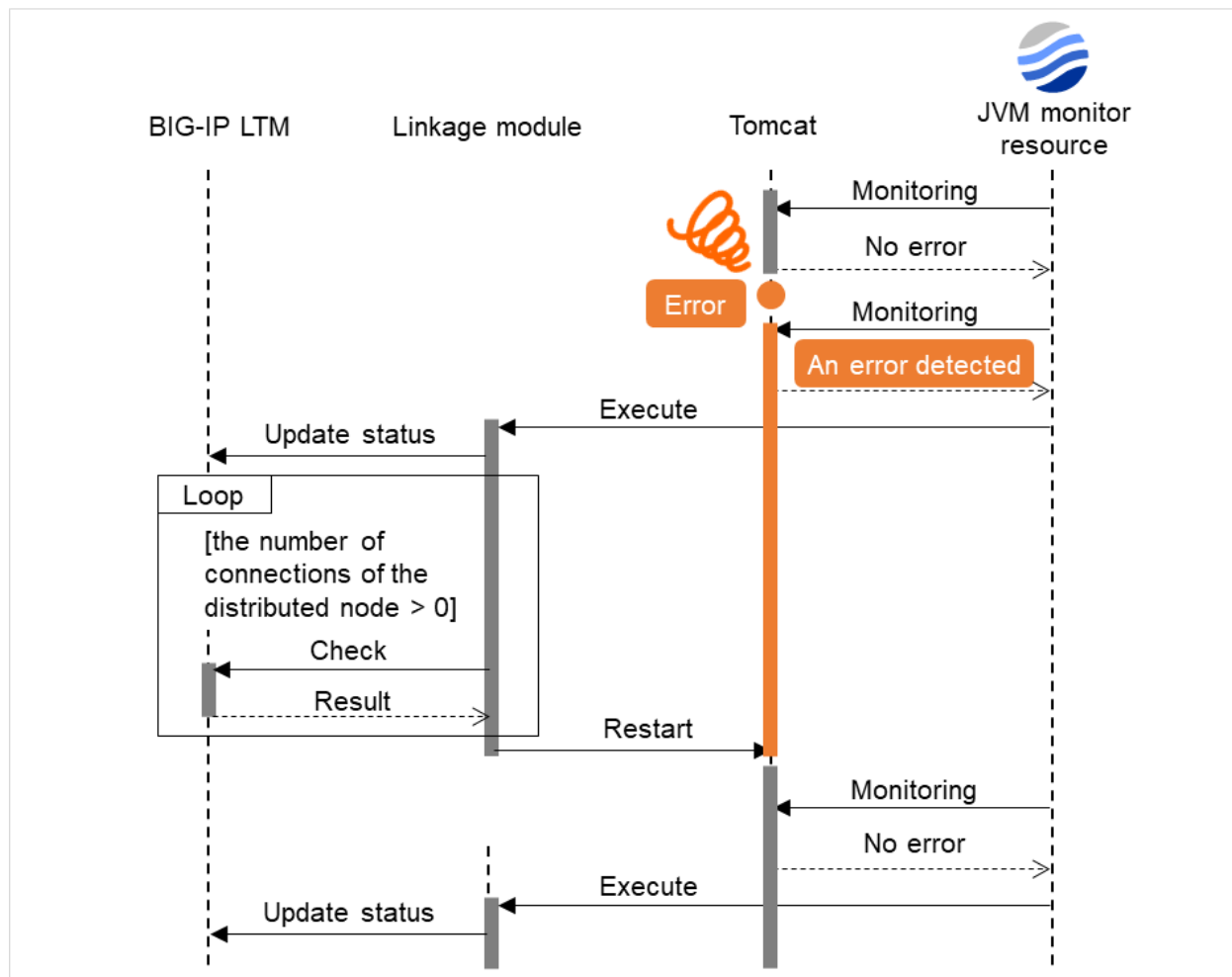


Fig. 6.17: Distributed node control function

The JVM monitoring calculates the load on the target Java VM according to the information obtained about the Java memory.

Obtain the Java VM load from the following expression. Java VM load(%) is the value obtained by multiplying the entire amount of the Java heap area by the use ratio set with **Monitor(special)** tab - **Tuning** property - **Memory** tab - **Monitor Heap Memory Rate - Total Usage**.

Java VM load (%) = current memory usage (MB) x 100/threshold (MB)

The linkage module installed on the server on which the JVM monitor runs executes a command at regular intervals, and reports the load collected on the target Java VM to BIG-IP LTM. BIG-IP LTM distributes the traffic (request) to the optimal server according to the load status of Java VM of the distributed node.

Set the following EXPRESSCLUSTER settings with the Cluster WebUI.

- JVM monitor resource

JVM Monitor Resource Tuning Properties

Memory Thread GC WebLogic **Load Balancer Linkage**

Load calculation function of target Java VM

Memory Pool Monitor ☒

Control of distributed nodes

Cut off an obstacle node dynamically ☐

Restart Command

Timeout 3600 sec

Initialize

OK Cancel Apply

Properties - Monitor(special) tab -> Tuning property - Load Balancer Linkage tab

Select the Memory Pool Monitor] check box.

- Custom monitor resource

Properties - Monitor(common) tab

Select the **Monitor Timing - Always** radio button.

Properties - Monitor(special) tab

Select **Script created with this product**.

Select File - Edit and then add the following boldfaced section.

```
#!/bin/sh
#*****
#* genw.sh *
#*****

ulimit -s unlimited ::
${CLP_PATH}/ha/jra/bin/clpjra_bigip weight
exit 0
```

Select the **Monitor Type - Synchronous** radio button.

In the BIG-IP LTM setting, specify **Ratio(node)** in **LocalTraffic - Pools:PoolList - Relevant pool - Members - LoadBalancing - Load Balancing Method** of BIG-IP Configuration Utility.

- Command execution interval: **Properties - Monitor(common) tab - Interval** (in seconds)

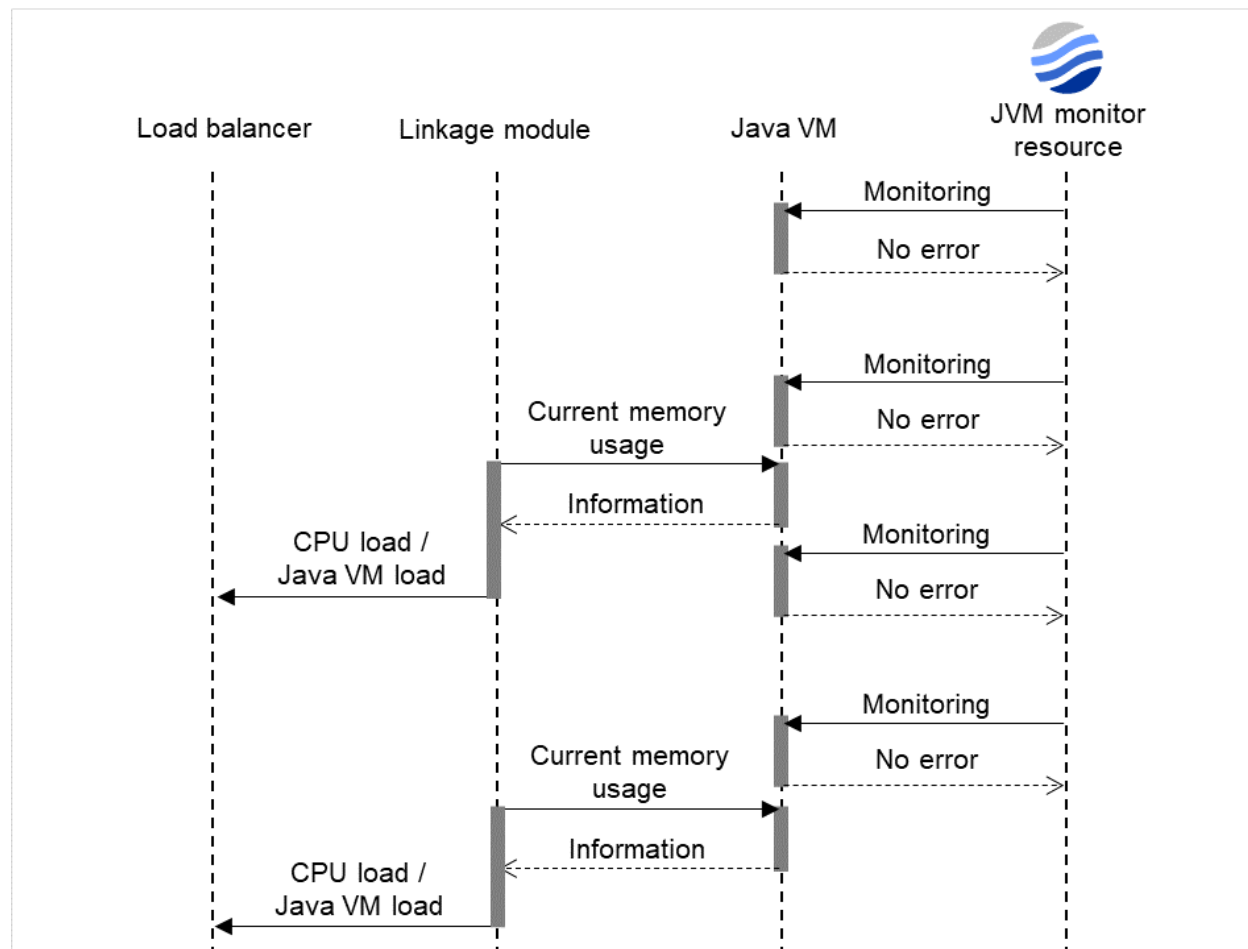


Fig. 6.18: Settings of the load calculation function

6.35.15 JVM statistics log

JVM monitor resources collect statistics information on the monitor target Java VM. The information is stored in CSV-format files, as JVM statistics logs. The file is created in the following location:

```
<EXPRESSCLUSTER install path>/log/ha/jra/*.stat
```

The following "monitor items" see the parameters on the [Monitor(special)] tab of [Properties] of the JVM monitor resources.

Statistical information is collected and output to its corresponding JVM statistical log when an item is selected and the threshold value is set for the item. If a monitor item is not selected, statistical information on the item will be neither collected nor output to its corresponding JVM statistical log.

The following table lists the monitor items and the corresponding JVM statistics logs.

Monitor items	Corresponding JVM statistics log
[Memory] tab - [Monitor Heap Memory Rate] [Memory] tab - [Monitor Non-Heap Memory Rate] [Memory] tab-[Monitor Heap Memory Usage] [Memory] tab -[Monitor Non-Heap Memory Usage]	jramemory.stat
[Thread] tab - [Monitor the number of Active Threads]	jrathread.stat
[GC] tab - [Monitor the time in Full GC] [GC] tab - [Monitor the count of Full GC execution]	jragc.stat
[WebLogic] tab - [Monitor the requests in Work Manager] [WebLogic] tab - [Monitor the requests in Thread Pool] When either of the above monitor items is checked, both of the logs, such as wlworkmanager.stat and wlthreadpool.stat, are output. No functions to output only one of the two logs are provided.	wlworkmanager.stat wlthreadpool.stat

6.35.16 Java memory area usage check on monitor target Java VM (jramemory.stat)

The jramemory.stat log file records the size of the Java memory area used by the monitor target Java VM. Its file name will be either of the following, depending on the Rotation Type selected in the Log Output Setting dialog box.

- When **Cluster Properties - JVM monitor tab - Log Output Setting - Rotation Type - File Capacity** is selected: jramemory<integer_starting_with_0>.stat
- When **Cluster Properties - JVM monitor tab - Log Output Setting - Rotation Type - Period** is selected: jramemory<YYYYMMDDhhmm>.stat

The data format is as follows.

No	Format	Description
1	yyyy/mm/dd hh:mm:ss.SSS	Date and time of log recording.
2	Half-size alphanumeric characters and symbols	Name of the monitor target Java VM; this is specified in [Properties] - [Monitor(special)] tab - [Identifier] in JVM monitor resources.
3	Half-size alphanumeric characters and symbols	Name of the Java memory pool; for details, refer to "Java memory pool name".

Continued on next page

Table 6.20 – continued from previous page

No	Format	Description
4	Half-size alphanumeric characters and symbols	Type of Java memory pool. Heap, Non-Heap
5	Half-size numeric characters	Memory size that the Java VM requests from the OS at startup; this is expressed in bytes. (init) At the startup of the monitor target Java VM, the size can be specified using the following Java VM startup options. - HEAP:-Xms - NON_HEAP permanent area (Perm Gen): -XX:PermSize - NON_HEAP code cache area (Code Cache): -XX:InitialCodeCacheSize
6	Half-size numeric characters	Memory size currently used by the Java VM; this is expressed in bytes. (used)
7	Half-size numeric characters	Memory size guaranteed for use by the operation of the Java VM; this is expressed in bytes. (committed) This size varies depending on the memory use; it is always equal to the value of "used" or larger but equal to or smaller than the value of "max".

Continued on next page

Table 6.20 – continued from previous page

No	Format	Description
8	Half-size numeric characters	<p>Maximum memory size that the Java VM can use; this is expressed in bytes. (max)</p> <p>The size can be specified using the following Java VM startup options.</p> <ul style="list-style-type: none"> - HEAP:-Xmx - NON_HEAP permanent area (Perm Gen): -XX:MaxPermSize - NON_HEAP code cache area (Code Cache): -XX:ReservedCodeCacheSize <p>Example)</p> <pre>java -XX:MaxPermSize=128m -XX:ReservedCodeCacheSize=128m javaAP</pre> <p>In this example, max of NON_HEAP becomes 128 m + 128 m = 256 m.</p> <p>(Note)</p> <p>When the same value is specified for -Xms and -Xmx, "init" may become larger than "max". This is because "max" of HEAP is determined by subtracting half the size of the Survivor Space from the area size determined by the specification of -Xmx.</p>
9	Half-size numeric characters	<p>Peak size of the memory used after startup of the measurement target Java VM; when the name of the Java memory pool is HEAP or NON_HEAP, this size becomes equal to that of the memory currently used by the Java VM (used). This is expressed in bytes.</p>
10	Half-size numeric characters	<p>Ignore this value when Oracle Java(usage monitoring) is selected for JVM Type.</p> <p>When the item other than Oracle Java(usage monitoring) for JVM Type, memory size equal to "max" (No. 8 field) * the threshold (%) when the Java memory pool type (No. 4 field) is HEAP; it is expressed in bytes.</p> <p>When the Java memory pool type is other than HEAP, it is 0.</p>

6.35.17 Thread operation status check on monitor target Java VM (jrathread.stat)

The jrathread.stat log file records the thread operation status of the monitor target Java VM. Its file name will be either of the following depending on the Rotation Type selected in the Log Output Setting dialog box.

- When **Cluster Properties - JVM monitor tab - Log Output Setting - Rotation Type - File Capacity** is selected: jrathread<integer_starting_with_0>.stat
- When **Cluster Properties - JVM monitor tab - Log Output Setting - Rotation Type - Period** is selected: jrathread<YYYYMMDDhhmm>.stat

The data format is as follows.

No	Format	Description
1	yyyy/mm/dd hh:mm:ss.SSS	Date and time of log recording.
2	Half-size alphanumeric characters and symbols	Name of the monitor target Java VM; this is specified in [Properties] - [Monitor(special)] tab - [Identifier] in JVM monitor resources.
3	Half-size alphanumeric characters and symbols	Number of active threads in the monitor target Java VM.
4	[Half-size numeric characters: half-size numeric characters:...]	Deadlocked thread ID in the monitor target Java VM; this contains the IDs of all the deadlocked threads, in order.
5	Half-size alphanumeric characters and symbols	Detailed information on deadlocked threads in the monitor target Java VM; it contains information on all the deadlocked threads, in order, in the following format. ThreadName, ThreadID, ThreadStatus, UserTime, CpuTime, WaitedCount, WaitedTime, isInNative, isSuspended <line feed> stacktrace<line feed> : stacktrace<line feed> stacktrace=ClassName, FileName, LineNumber, MethodName, isNativeMethod

6.35.18 GC operation status check on monitor target Java VM (jragc.stat)

The jragc.stat log file records the GC operation status of the monitor target Java VM. Its file name will be either of the following, depending on the Rotation Type selected in the Log Output Setting dialog box.

- When **Cluster Properties - JVM monitor tab - Log Output Setting - Rotation Type - File Capacity** is selected: jragc<integer_starting_with_0>.stat
- When **Cluster Properties - JVM monitor tab - Log Output Setting - Rotation Type - Period** is selected: jragc<YYYYMMDDhhmm>.stat

JVM monitor resources output two types of GC information: Copy GC and Full GC.

With Oracle Java, JVM monitor resources count the increment in the count of execution of the following GC as Full GC.

- MarkSweepCompact
- MarkSweepCompact
- PS MarkSweep
- ConcurrentMarkSweep

The data format is as follows.

No	Format	Description
1	yyyy/mm/dd hh:mm:ss.SSS	Date and time of log recording.
2	Half-size alphanumeric characters and symbols	Name of the monitor target Java VM; this is specified in [Properties] - [Monitor(special)] tab - [Identifier] in JVM monitor resources.
3	Half-size alphanumeric characters and symbols	<p>GC name of monitor target Java VM.</p> <p>When the monitor target Java VM is Oracle Java The GC name to be indicated is one of the following. Copy MarkSweepCompact MarkSweepCompact PS Scavenge PS MarkSweep ParNew ConcurrentMarkSweep</p> <p>When the monitor target Java VM is Oracle JRockit The GC name to be indicated is one of the following. Garbage collection optimized for throughput Old Collector Garbage collection optimized for short pausetimes Old Collector Garbage collection optimized for deterministic pausetimes Old Collector Static Collector Static Old Collector Garbage collection optimized for throughput Young Collector</p>

Continued on next page

Table 6.22 – continued from previous page

No	Format	Description
4	Half-size numeric characters	Count of GC execution during the period from startup of the monitor target Java VM to measurement; the count includes the GC executed before the JVM monitor resource starts monitoring.
5	Half-size numeric characters	Total time in GC execution during the period from startup of the monitor target Java VM to measurement; this is expressed in milliseconds. This includes the time taken for the GC executed before the JVM monitor resource starts monitoring.

6.35.19 Operation status check on Work Manager of WebLogic Server (wlworkmanager.stat)

The wlworkmanager.stat log file records the operation status of the Work Manager of the WebLogic Server. Its file name will be either of the following depending on the Rotation Type selected in the Log Output Setting dialog box.

- When **Cluster Properties - JVM monitor tab - Log Output Setting - Rotation Type - File Capacity** is selected: `wlworkmanager<integer_starting_with_0>.stat`
- When **Cluster Properties - JVM monitor tab - Log Output Setting - Rotation Type - Period** is selected: `wlworkmanager<YYYYMMDDhhmm>.stat`

The data format is as follows.

No	Format	Description
1	yyyy/mm/dd hh:mm:ss.SSS	Date and time of log recording.
2	Half-size alphanumeric characters and symbols	Name of the monitor target Java VM; this is specified in [Properties] - [Monitor(special)] tab - [Identifier] in JVM monitor resources.
3	Half-size alphanumeric characters and symbols	Application name.
4	Half-size alphanumeric characters and symbols	Work Manager name.
5	Half-size numeric characters	Request execution count.
6	Half-size numeric characters	Number of wait requests.

6.35.20 Operation status check on Thread Pool of WebLogic Server (wlthreadpool.stat)

The wlthreadpool.stat log file records the operation status of the thread pool of the WebLogic Server. Its file name will be either of the following depending on the Rotation Type selected in the Log Output Setting dialog box.

- When **Cluster Properties - JVM monitor tab - Log Output Setting - Rotation Type - File Capacity** is selected: `wlthreadpool<integer_starting_with_0>.stat`
- When **Cluster Properties - JVM monitor tab - Log Output Setting - Rotation Type - Period** is selected: `wlthreadpool<YYYYMMDDhhmm>.stat`

The data format is as follows.

No	Format	Description
1	yyyy/mm/dd hh:mm:ss.SSS	Date and time of log recording.
2	Half-size alphanumeric characters and symbols	Name of monitor target Java VM; this is specified in [Properties] - [Monitor(special)] tab - [Identifier] in JVM monitor resources.
3	Half-size numeric characters	Total request execution count.
4	Half-size numeric characters	Number of requests queued in the WebLogic Server.
5	Half-size numeric characters	Request execution per unit time count (seconds).
6	Half-size numeric characters	Number of threads for executing the application.
7	Half-size numeric characters	Number of threads in idle state.
8	Half-size numeric characters	Number of executing threads.
9	Half-size numeric characters	The number of threads in stand-by state.

6.35.21 Java memory pool name

This section describes the Java memory pool name output as `memory_name` in messages to the JVM operation log file. It also describes the Java memory pool name output to the JVM statistics log file, `jramemory.stat` log file.

The character strings of the Java memory pool names are not determined by the JVM monitor resources. Character strings received from the monitor target Java VM are output as Java memory pool names.

Their specifications are not open for Java VM, and accordingly, are subject to change without notice with any version upgrade of Java VM.

Therefore, we do not recommend monitoring Java memory pool names contained in messages.

The following monitor items see the parameters on the [Memory] tab of the [Monitor(special)] tab in [Properties] of the JVM monitor resources.

The following Java memory pool names have been confirmed on actual machines running Oracle Java and JRockit.

When [Oracle Java] is selected for [JVM Type] and "-XX:+UseSerialGC" is specified as a startup option for the monitor target Java VM, the No. 3 Java memory pool name in the `jramemory.stat` log file will be as follows.

Monitor item	Character string output as <code>memory_name</code>
[Monitor Heap Memory Rate] - [Total Usage]	HEAP
[Monitor Heap Memory Rate] - [Eden Space]	Eden Space
[Monitor Heap Memory Rate] - [Survivor Space]	Survivor Space
[Monitor Heap Memory Rate] - [Tenured Gen]	Tenured Gen
[Monitor Non-Heap Memory Rate] - [Total Usage]	NON_HEAP
[Monitor Non-Heap Memory Rate] - [Code Cache]	Code Cache
[Monitor Non-Heap Memory Rate] - [Perm Gen]	Perm Gen
[Monitor Non-Heap Memory Rate] - [Perm Gen[shared-ro]]	Perm Gen [shared-ro]
[Monitor Non-Heap Memory Rate] - [Perm Gen[shared-rw]]	Perm Gen [shared-rw]

When [Oracle Java] is selected for [JVM Type] and "-XX:+UseParallelGC" and "-XX:+UseParallelOldGC" are specified as the startup options for the monitor target Java VM, the No. 3 Java memory pool name in the `jramemory.stat` log file will be as follows.

Monitor item	Character string output as <code>memory_name</code>
[Monitor Heap Memory Rate] - [Total Usage]	HEAP
[Monitor Heap Memory Rate] - [Eden Space]	PS Eden Space

Continued on next page

Table 6.26 – continued from previous page

Monitor item	Character string output as memory_name
[Monitor Heap Memory Rate] - [Survivor Space]	PS Survivor Space
[Monitor Heap Memory Rate] - [Tenured Gen]	PS Old Gen
[Monitor Non-Heap Memory Rate] - [Total Usage]	NON_HEAP
[Monitor Non-Heap Memory Rate] - [Code Cache]	Code Cache
[Monitor Non-Heap Memory Rate] - [Perm Gen]	PS Perm Gen
[Monitor Non-Heap Memory Rate] - [Perm Gen[shared-ro]]	Perm Gen [shared-ro]
[Monitor Non-Heap Memory Rate] - [Perm Gen[shared-rw]]	Perm Gen [shared-rw]

When [Oracle Java] is selected for [JVM Type] and "-XX:+UseConcMarkSweepGC" is specified as a startup option for the monitor target Java VM, the No. 3 Java memory pool name in the jramemory.stat log file will be as follows.

Monitor item	Character string output as memory_name
[Monitor Heap Memory Rate] - [Total Usage]	HEAP
[Monitor Heap Memory Rate] - [Eden Space]	Par Eden Space
[Monitor Heap Memory Rate] - [Survivor Space]	Par Survivor Space
[Monitor Heap Memory Rate] - [Tenured Gen]	CMS Old Gen
[Monitor Non-Heap Memory Rate] - [Total Usage]	NON_HEAP
[Monitor Non-Heap Memory Rate] - [Code Cache]	Code Cache
[Monitor Non-Heap Memory Rate] - [Perm Gen]	CMS Perm Gen
[Monitor Non-Heap Memory Rate] - [Perm Gen[shared-ro]]	Perm Gen [shared-ro]
[Monitor Non-Heap Memory Rate] - [Perm Gen[shared-rw]]	Perm Gen [shared-rw]

When [Oracle Java(usage monitoring)] is selected for [JVM Type] and "-XX:+UseSerialGC" is specified as a startup option for the monitor target Java VM, the No. 3 Java memory pool name in the jramemory.stat file will be as follows.

Monitor item	Character string output as memory_name
[Monitor Heap Memory Usage]-[Total Usage]	HEAP
[Monitor Heap Memory Usage]-[Eden Space]	Eden Space
[Monitor Heap Memory Usage]-[Survivor Space]	Survivor Space
[Monitor Heap Memory Usage]-[Tenured Gen]	Tenured Gen
[Monitor Non-Heap Memory Usage]-[Total Usage]	NON_HEAP
[Monitor Non-Heap Memory Usage]-[Code Cache]	Code Cache (For Java 9 or later, no output)
[Monitor Non-Heap Memory Usage]-[Metaspace]	Metaspace
[Monitor Non-Heap Memory Usage]-[CodeHeap non-nmethods]	CodeHeap non-nmethods
[Monitor Non-Heap Memory Usage]-[CodeHeap profiled]	CodeHeap profiled nmethods
[Monitor Non-Heap Memory Usage]-[CodeHeap non-profiled]	CodeHeap non-profiled nmethods
[Monitor Non-Heap Memory Usage]-[Compressed Class Space]	Compressed Class Space

When [Oracle Java(usage monitoring)] is selected for [JVM Type] and "-XX:+UseParallelGC" and "-XX:+UseParallelOldGC" are specified as startup options for the monitor target Java VM, the No. 3 Java memory pool name in the jramemory.stat file will be as follows.

Monitor item	Character string output as memory_name
[Monitor Heap Memory Usage]-[Total Usage]	HEAP
[Monitor Heap Memory Usage]-[Eden Space]	PS Eden Space
[Monitor Heap Memory Usage]-[Survivor Space]	PS Survivor Space
[Monitor Heap Memory Usage]- [Tenured Gen]	PS Old Gen
[Monitor Non-Heap Memory Usage]-[Total Usage]	NON_HEAP

Continued on next page

Table 6.29 – continued from previous page

Monitor item	Character string output as memory_name
[Monitor Non-Heap Memory Usage]-[Code Cache]	Code Cache (For Java 9 or later, no output)
[Monitor Non-Heap Memory Usage]-[Metaspace]	Metaspace
[Monitor Non-Heap Memory Usage]-[CodeHeap non-nmethods]	CodeHeap non-nmethods
[Monitor Non-Heap Memory Usage]-[CodeHeap profiled]	CodeHeap profiled nmethods
[Monitor Non-Heap Memory Usage]-[CodeHeap non-profiled]	CodeHeap non-profiled nmethods
[Monitor Non-Heap Memory Usage]-[Compressed Class Space]	Compressed Class Space

When [Oracle Java(usage monitoring)] is selected for [JVM Type] and "-XX:+UseConcMarkSweepGC" is specified as a startup option for the monitor target Java VM, the No. 3 Java memory pool name in the jramemory.stat file will be as follows.

Monitor item	Character string output as memory_name
[Monitor Heap Memory Usage]-[Total Usage]	HEAP
[Monitor Heap Memory Usage]-[Eden Space]	Par Eden Space
[Monitor Heap Memory Usage]-[Survivor Space]	Par Survivor Space
[Monitor Heap Memory Usage]-[Tenured Gen]	CMS Old Gen
[Monitor Non-Heap Memory Usage]-[Total Usage]	NON_HEAP
[Monitor Non-Heap Memory Usage]-[Code Cache]	Code Cache (For Java 9 or later, no output)
[Monitor Non-Heap Memory Usage]-[Metaspace]	Metaspace
[Monitor Non-Heap Memory Usage]-[CodeHeap non-nmethods]	CodeHeap non-nmethods
[Monitor Non-Heap Memory Usage]-[CodeHeap profiled]	CodeHeap profiled nmethods
[Monitor Non-Heap Memory Usage]-[CodeHeap non-profiled]	CodeHeap non-profiled nmethods
[Monitor Non-Heap Memory Usage]-[Compressed Class Space]	Compressed Class Space

When [Oracle Java(usage monitoring)] is selected for [JVM Type] and "-XX:+UseParNewGC" is added as a startup option of the target Java VM, the No. 3 Java memory pool name in the jramemory.stat file will be as follows. For Java 9 or later, if -XX:+UseParNewGC is specified, the monitor target Java VM does not start.

Monitor item	Character string output as memory_name
[Monitor Heap Memory Usage]-[Total Usage]	HEAP
[Monitor Heap Memory Usage]-[Eden Space]	Par Eden Space
[Monitor Heap Memory Usage]-[Survivor Space]	Par Survivor Space
[Monitor Heap Memory Usage]-[Tenured Gen]	Tenured Gen
[Monitor Non-Heap Memory Usage]-[Total Usage]	NON_HEAP
[Monitor Non-Heap Memory Usage]-[Code Cache]	Code Cache
[Monitor Non-Heap Memory Usage]-[Metaspace]	Metaspace
[Monitor Non-Heap Memory Usage]-[CodeHeap non-nmethods]	CodeHeap non-nmethods
[Monitor Non-Heap Memory Usage]-[CodeHeap profiled]	CodeHeap profiled nmethods
[Monitor Non-Heap Memory Usage]-[CodeHeap non-profiled]	CodeHeap non-profiled nmethods
[Monitor Non-Heap Memory Usage]-[Compressed Class Space]	Compressed Class Space

When [Oracle Java(usage monitoring)] is selected for [JVM Type] and "-XX:+UseG1GC" is specified as a startup option for the monitor target Java VM the No. 3 Java memory pool name in the jramemory.stat file will be as follows.

Monitor item	Character string output as memory_name
[Monitor Heap Memory Usage]-[Total Usage]	HEAP
[Monitor Heap Memory Usage]-[Eden Space]	G1 Eden Space
[Monitor Heap Memory Usage]-[Survivor Space]	G1 Survivor Space

Continued on next page

Table 6.32 – continued from previous page

Monitor item	Character string output as memory_name
[Monitor Heap Memory Usage]-[Tenured Gen(Old Gen)]	G1 Old Gen
[Monitor Non-Heap Memory Usage]-[Total Usage]	NON_HEAP
[Monitor Non-Heap Memory Usage]-[Code Cache]	Code Cache (For Java 9 or later, no output)
[Monitor Non-Heap Memory Usage]-[Metaspace]	Metaspace
[Monitor Non-Heap Memory Usage]-[CodeHeap non-nmethods]	CodeHeap non-nmethods
[Monitor Non-Heap Memory Usage]-[CodeHeap profiled]	CodeHeap profiled nmethods
[Monitor Non-Heap Memory Usage]-[CodeHeap non-profiled]	CodeHeap non-profiled nmethods
[Monitor Non-Heap Memory Usage]-[Compressed Class Space]	Compressed Class Space

When the monitor target Java VM is Oracle JRockit (when [JRockit] is selected for [JVM Type]), the No. 3 Java memory pool name in the jramemory.stat log file will be as follows.

Monitor item	Character string output as memory_name
[Monitor Heap Memory Rate] - [Total Usage]	HEAP memory
[Monitor Heap Memory Rate] - [Nursery Space]	Nursery
[Monitor Heap Memory Rate] - [Old Space]	Old Space
[Monitor Non-Heap Memory Rate] - [Total Usage]	NON_HEAP
[Monitor Non-Heap Memory Rate] - [Class Memory]	Class Memory

Java memory pool names appearing in the jramemory.stat log file, a JVM statistics log file, correspond to the Java VM memory space as follows.

- For Oracle Java 7

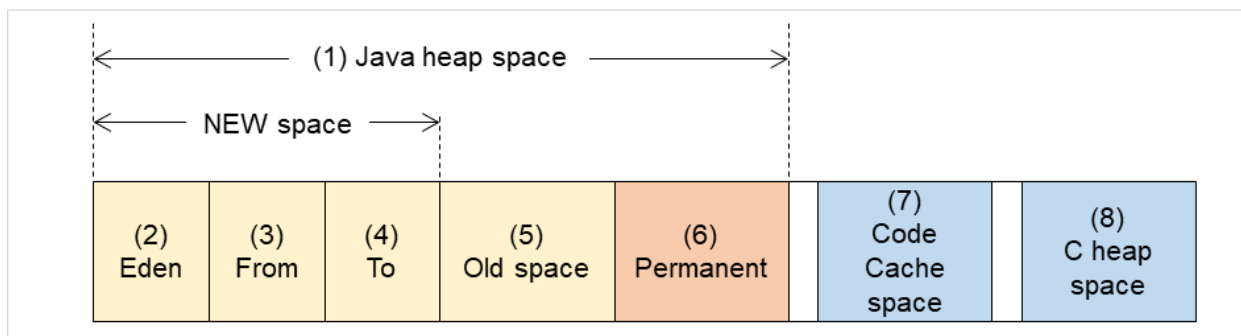


Fig. 6.19: Java VM memory space (Oracle Java 7)

No. in diagram	Monitor item	Java memory pool name in jramemory.stat log file
(1)	[Monitor Heap Memory Rate] - [Total Usage]	HEAP
(2)	[Monitor Heap Memory Rate] - [Eden Space]	EdenSpace PS Eden Space Par Eden Space

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Table 6.34 – continued from previous page

No. in diagram	Monitor item	Java memory pool name in jramemory.stat log file
(3)+(4)	[Monitor Heap Memory Rate] - [Survivor Space]	Survivor Space PS Survivor Space Par Survivor Space
(5)	[Monitor Heap Memory Rate] - [Tenured Gen]	Tenured Gen PS Old Gen CMS Old Gen
(6)	[Monitor Non-Heap Memory Rate] - [Perm Gen] [Monitor Non-Heap Memory Rate] - [Perm Gen[shared-ro]] [Monitor Non-Heap Memory Rate] - [Perm Gen[shared-rw]]	Perm Gen Perm Gen [shared-ro] Perm Gen [shared-rw] PS Perm Gen CMS Perm Gen
(7)	[Monitor Non-Heap Memory Rate] - [Code Cache]	Code Cache
(8)	-	-
(6)+(7)	[Monitor Non-Heap Memory Rate] - [Total Usage]	NON_HEAP * No stack trace is included.

- For Oracle Java 8/Oracle Java 9/Oracle Java 11

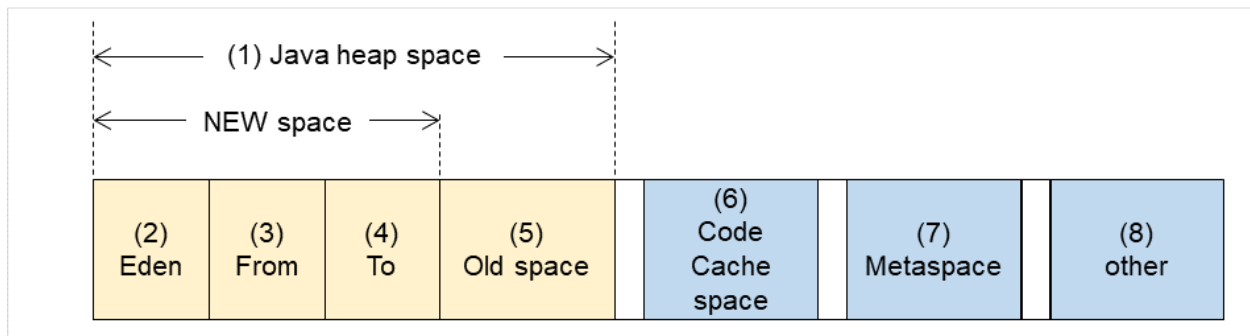


Fig. 6.20: Java VM memory space (Oracle Java 8/Oracle Java 9/Oracle Java 11)

Number in diagram	Monitor item	Java memory pool name in jramemory.stat log file
(1)	[Monitor Heap Memory Usage] - [Total Usage]	HEAP

Continued on next page

Table 6.35 – continued from previous page

Number in diagram	Monitor item	Java memory pool name in jramemory.stat log file
(2)	[Monitor Heap Memory Usage] - [Eden Space]	EdenSpace PS Eden Space Par Eden Space G1 Eden Space
(3)+(4)	[Monitor Heap Memory Usage] - [Survivor Space]	Survivor Space PS Survivor Space Par Survivor Space G1 Survivor Space
(5)	[Monitor Heap Memory Usage] - [Tenured Gen]	Tenured Gen PS Old Gen CMS Old Gen G1 Old Gen
(6)	[Monitor Non-Heap Memory Usage] - [Code Cache]	Code Cache(For Java 9 or later, no output)
(6)	[Monitor Non-Heap Memory Usage] - [CodeHeap non-nmethods]	CodeHeap non-nmethods(For Java 9 or later, output)
(6)	[Monitor Non-Heap Memory Usage] - [CodeHeap profiled]	CodeHeap profiled nmethods(For Java 9 or later, output)
(6)	[Monitor Non-Heap Memory Usage] - [CodeHeap non-profiled]	CodeHeap non-profiled nmethods(For Java 9 or later, output)
(7)	[Monitor Non-Heap Memory Usage] - [Metaspace]	Metaspace
(8)	[Monitor Non-Heap Memory Usage] - [Compressed Class Space]	Compressed Class Space
(6)+(7)+(8)	[Monitor Non-Heap Memory Usage] - [Total Usage]	NON_HEAP

- For Oracle JRockit

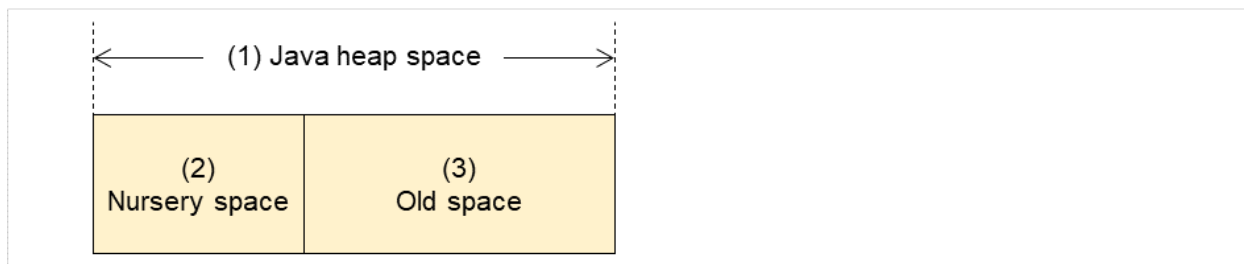


Fig. 6.21: Java VM memory space (Oracle JRockit)

No. in diagram	Monitor item	Java memory pool name in jramemory.stat log file
(1)	[Monitor Heap Memory Rate] - [Total Usage]	HEAP memory
(2)	[Monitor Heap Memory Rate]-[Nursery Space]	Nursery
(3) ² (Note)	[Monitor Heap Memory Rate]-[Old Space]	Old Space
-	[Monitor Non-Heap Memory Rate] - [Total Usage]	NON_HEAP
-	[Monitor Non-Heap Memory Rate] - [Class Memory]	Class Memory

6.35.22 Executing a command corresponding to cause of each detected error

EXPRESSCLUSTER does not provide a means for executing specific commands based on the causes of detected monitor resource errors.

JVM monitor resources can execute specific commands according to error causes. If an error is detected, JVM monitor resources will execute an appropriate command.

The following setting items specify the commands that will be executed according to the error cause.

Error cause	Setting item
<ul style="list-style-type: none"> - Failure in connection to the monitor target Java VM - Failure in resource measurement 	[Monitor(special)] tab - [Command]
<ul style="list-style-type: none"> - Heap memory rate - Non-heap memory rate - Heap memory usage - Non-heap memory usage 	[Monitor(special)] tab - [Tuning] properties - [Memory] tab - [Command]
<ul style="list-style-type: none"> • Number of active threads 	[Monitor(special)] tab - [Tuning] properties - [Thread] tab - [Command]
<ul style="list-style-type: none"> - Time in Full GC - Count of Full GC execution 	[Monitor(special)] tab - [Tuning] properties - [GC] tab - [Command]
<ul style="list-style-type: none"> - Requests in Work Manager of WebLogic - Requests in Thread Pool of WebLogic 	[Monitor(special)] tab - [Tuning] properties - [WebLogic] tab - [Command]

² "Old Space", a Java memory pool name in the jramemory.stat log file, does not indicate the value corresponding to the old space of the Heap but rather the value corresponding to the entire "Heap memory". Independent measurement of only (3) is not possible.

[Command] passes the details of an error cause as the arguments of a command with the arguments attached to the end of [Command]. A Command that is specialized for dealing with specific error causes can be defined by designing and specifying a script etc. for [Command]. The following character strings are passed as the arguments.

When multiple character strings are stated as possible arguments, one will be passed according to the GC type of the monitor target Java VM. For details about their differences, see "Java memory pool name".

The statements "(For Oracle Java)" and "(For Oracle JRockit)" suggest that different character strings are used according to the JVM type. When there is no such statement, the same character strings are used equally for all JVM types.

Details of error causes	Character string passed as argument
- Failure in connection to the monitor target Java VM - Failure in resource measurement	No character string defined
[Monitor(special)] tab - [Tuning] properties - [Memory] tab - [Monitor Memory Heap Rate] - [Total Usage] (For Oracle Java)	HEAP
[Memory] tab - [Monitor Memory Heap Rate] - [Eden Space] (For Oracle Java)	EdenSpace PSEdenSpace ParEdenSpace
[Memory] tab - [Monitor Memory Heap Rate] - [Survivor Space] (For Oracle Java)	SurvivorSpace PSSurvivorSpace ParSurvivorSpace
[Memory] tab - [Monitor Memory Heap Rate] - [Tenured Gen] (For Oracle Java)	TenuredGen PSOldGen CMSOldGen
[Memory] tab - [Monitor Non-Heap Memory Rate] - [Total Usage] (For Oracle Java)	NON_HEAP
[Memory] tab - [Monitor Memory Non-Heap Rate] - [Code Cache] (For Oracle Java)	CodeCache

Continued on next page

Table 6.38 – continued from previous page

Details of error causes	Character string passed as argument
[Memory] tab - [Monitor Memory Non-Heap Rate] - [Perm Gen] (For Oracle Java)	PermGen PSPermGen CMSPermGen
[Memory] tab - [Monitor Memory Non-Heap Rate] - [Perm Gen[shared-ro]] (For Oracle Java)	PermGen[shared-ro]
[Memory] tab - [Monitor Memory Non-Heap Rate] - [Perm Gen[shared-rw]] (For Oracle Java)	PermGen[shared-rw]
[Memory] tab - [Monitor Heap Memory Usage]-[Total Usage] (for Oracle Java(usage monitoring))	HEAP
[Memory] tab - [Monitor Heap Memory Usage]-[Eden Space] (for Oracle Java(usage monitoring))	EdenSpace PSEdenSpace ParEdenSpace G1EdenSpace
[Memory] tab - [Monitor Heap Memory Usage]-[Survivor Space] (for Oracle Java(usage monitoring))	SurvivorSpace PSSurvivorSpace ParSurvivorSpace G1SurvivorSpace
[Memory] tab - [Monitor Heap Memory Usage]-[Tenured Gen] (for Oracle Java(usage monitoring))	TenuredGen PSOldGen CMSOldGen G1OldGen
[Memory] tab - [Non-Heap Usage]-[Total Usage] (for Oracle Java(usage monitoring))	NON_HEAP
[Memory] tab - [Monitor Non-Heap Memory Usage]-[Code Cache] (for Oracle Java(usage monitoring))	CodeCache
[Memory] tab - [Monitor Non-Heap Memory Usage]-[Metaspace] (for Oracle Java(usage monitoring))	Metaspace
[Memory] tab - [Monitor Non-Heap Memory Usage]-[CodeHeap non-nmethods] (for Oracle Java(usage monitoring))	non-nmethods

Continued on next page

Table 6.38 – continued from previous page

Details of error causes	Character string passed as argument
[Memory] tab - [Monitor Non-Heap Memory Usage]-[CodeHeap profiled] (for Oracle Java(usage monitoring))	profilednmethods
[Memory] tab - [Monitor Non-Heap Memory Usage]-[CodeHeap non-profiled] (for Oracle Java(usage monitoring))	non-profilednmethods
[Memory] tab - [Monitor Non-Heap Memory Usage]-[Compressed Class Space] (for Oracle Java(usage monitoring))	CompressedClassSpace
[Memory] tab - [Monitor Memory Heap Rate] - [Total Usage] (For Oracle JRockit)	HEAP Heap
[Memory] tab - [Monitor Memory Heap Rate] - [Nursery Space] (For Oracle JRockit)	Nursery
[Memory] tab - [Monitor Memory Heap Rate] - [Old Space] (For Oracle JRockit)	OldSpace
[Memory] tab - [Monitor Memory Non-Heap Rate] - [Total Usage] (For Oracle JRockit)	NON_HEAP
[Memory] tab - [Monitor Memory Non-Heap Rate] - [Class Memory] (For Oracle JRockit)	ClassMemory
[Thread] tab - [Monitor the number of Active Threads]	Count
[GC] tab - [Monitor the time in Full GC]	Time
[GC] tab - [Monitor the count of Full GC execution]	Count
[WebLogic] tab - [Monitor the requests in Work Manager] - [Waiting Requests, The number]	WorkManager_PendingRequests
[WebLogic] tab - [Monitor the requests in Thread Pool] - [Waiting Requests, The number]	ThreadPool_PendingUserRequestCount
[WebLogic] tab - [Monitor the requests in Thread Pool] - [Executing Requests, The number]	ThreadPool_Throughput

The following are examples of execution.

Example 1)

Setting item	Setting information
[Monitor(special)] tab - [Tuning] properties - [GC] tab - [Command]	/usr/local/bin/downcmd
[Monitor(special)] tab - [Tuning] properties - [GC] tab - [Monitor the count of Full GC execution]	1
[Cluster] properties - [JVM monitor] tab - [Resource Measurement Setting] - [Common] tab - [Error Threshold]	3

If Full GC is executed as many times, in succession, as specified by the Error Threshold (three times), the JVM monitor resources will detect a monitor error and execute a command corresponding to "/usr/local/bin/downcmd Cont".

Example 2)

Setting item	Setting information
[Monitor(special)] tab - [Tuning] properties - [GC] tab - [Command]	"/usr/local/bin/downcmd" GC
[Monitor(special)] tab - [Tuning] properties - [GC] tab - [Monitor the time in Full GC]	65536
[Cluster] properties - [JVM monitor] tab - [Resource Measurement Setting] - [Common] tab - [Error Threshold]	3

If the time in Full GC exceeds 65535 milliseconds as many times, in succession, as specified by the Error Threshold (three times), the JVM monitor resources will detect a monitor error and execute a command corresponding to "/usr/local/bin/downcmd GC Time".

Example 3)

Setting item	Setting information
[Monitor(special)] tab - [Tuning] properties - [Memory] tab - [Command]	"/usr/local/bin/downcmd" memory
[Monitor(special)] tab - [Tuning] properties - [Memory] tab - [Monitor Heap Memory Rate]	On
[Monitor(special)] tab - [Tuning] properties - [Memory] tab - [Eden Space]	80
[Monitor(special)] tab - [Tuning] properties - [Memory] tab - [Survivor Space]	80
[Cluster] properties - [JVM monitor] tab - [Resource Measurement Setting] - [Common] tab - [Error Threshold]	3

If the usage rate of the Java Eden Space and that of the Java Survivor Space exceed 80% as many times, in succession, as specified by the Error Threshold (three times), the JVM monitor resources will detect a monitor error and execute a command corresponding to "/usr/local/bin/downcmd memory EdenSpace SurvivorSpace".

Timeout (seconds) for waiting for the completion of execution of the command specified by [Command] is set by specifying **Command Timeout** in the **JVM monitor** tab of the **Cluster Properties** window. The same value is applied to the timeout of [Command] of each of the above-mentioned tabs; the timeout cannot be specified for each [Command] separately.

If a timeout occurs, the system will not perform processing for forced termination of the [Command] process; the operator must perform post-processing (e.g. forced termination) of the [Command] process. When a timeout occurs, the following message is output to the JVM operation log:

action thread execution did not finish. action is alive = <command>.

Note the following.

- No [Command] is executed when restoration of the Java VM to normal operation (error -> normal operation) is detected.
- [Command] is executed upon the detection of an error in the Java VM (when threshold exceeding occurs as many times, in succession, as specified by the error threshold). It is not executed at each threshold exceeding.
- Note that specifying [Command] on multiple tabs allows multiple commands to be executed if multiple errors occur simultaneously, causing a large system load.
- [Command] may be executed twice simultaneously when the following two items are monitored: [Monitor(special)] tab - [Tuning] properties - [WebLogic] tab - [Monitor the requests in Work Manager] - [Waiting Requests, The Number]; [Monitor(special)] tab - [Tuning] properties - [WebLogic] tab - [Monitor the requests in Work Manager] - [Waiting Requests, Average]. This is because errors may be detected simultaneously for the following two items: [Cluster] properties - [JVM monitor] tab - [Resource Measurement Setting] - [WebLogic] tab - [Interval, The number of request]; [Cluster] properties - [JVM monitor] tab - [Resource Measurement Setting] - [WebLogic] tab - [Interval, The average number of the request]. To prevent this from occurring, specify only one of the two items as a monitor target. This applies to the following combinations of monitor items.
- [Monitor(special)] tab - [Tuning] properties - [WebLogic] tab - [Monitor the requests in Thread Pool] - [Waiting Requests, The Number] and [Monitor(special)] tab - [Tuning] properties - [WebLogic] tab - [Monitor the requests in Thread Pool] - [Waiting Requests, Average]
- [Monitor(special)] tab - [Tuning] properties - [WebLogic] tab - [Monitor the requests in Thread Pool] - [Executing Requests, The Number] and [Monitor(special)] tab - [Tuning] properties - [WebLogic] tab - [Monitor the requests in Thread Pool] - [Executing Requests, Average]

6.35.23 Monitoring WebLogic Server

For how to start the operation of the configured target WebLogic Server as an application server, see the manual for WebLogic Server.

This section describes only the settings required for monitoring by the JVM monitor resource.

1. Start WebLogic Server Administration Console.

For how to start WebLogic Server Administration Console, refer to "Overview of Administration Console" in the WebLogic Server manual.

Select **Domain Configuration-Domain-Configuration-General**. Make sure that **Enable Management Port** is **unchecked**.

2. Select **Domain Configuration-Server**, and then select the name of the server to be monitored. Set the selected server name as the identifier on the **Monitor (special)** tab from **Properties** that can be selected in the config

mode of Cluster WebUI. See "Understanding JVM monitor resources" in "Monitor resource details" in the "Reference Guide" of EXPRESSCLUSTER X**.

3. Regarding the target server, select **Configuration-General**, and then check the port number through which a management connection is established with **Listen Port**.
4. Stop WebLogic Server. For how to stop WebLogic Server, refer to "Starting and stopping WebLogic Server" in the WebLogic Server manual.
5. Start the management server start script of WebLogic Server (startWebLogic.sh).
6. Write the following instructions in the script.
 - When the target is the WebLogic Server managing server:

```
JAVA_OPTIONS="${JAVA_OPTIONS}"
-Dcom.sun.management.jmxremote.port=n
-Dcom.sun.management.jmxremote.ssl=false
-Dcom.sun.management.jmxremote.authenticate=false
-Djavax.management.builder.initial=weblogic.management.jmx.mbeanserver.
↪WLSMBeanServerBuilder"
```

*Write each line of coding on one line.

- When the target is a WebLogic Server managed server:

```
if [ "${SERVER_NAME}" = "SERVER_NAME" ]; then
    JAVA_OPTIONS="${JAVA_OPTIONS}"
    -Dcom.sun.management.jmxremote.port=n
    -Dcom.sun.management.jmxremote.ssl=false
    -Dcom.sun.management.jmxremote.authenticate=false
    -Djavax.management.builder.initial=weblogic.management.jmx.mbeanserver.
    ↪WLSMBeanServerBuilder"
fi
```

*Write all the if statement lines on one line.

Note: For *n*, specify the number of the port used for monitoring. The specified port number **must be different from that of the listen port for the target Java VM**. If there are other target WebLogic Server entities on the same machine, specify a port number different from those for the listening port and application ports of the other entities.

Note: For **SERVER_NAME**, specify the name of the target server confirmed by **Select Target Server**. If more than one server is targeted, change the server name on the settings (line 1 to 6) for each server.

Note: Place the above addition prior to the following coding:

```
${JAVA_HOME}/bin/java ${JAVA_VM} ${MEM_ARGS} ${JAVA_OPTIONS} -Dweblogic.Name=${SERVER_
↪NAME} -Djava.security.policy=${WL_HOME}/server/lib/weblogic.policy ${PROXY_SETTINGS}
↪ ${SERVER_CLASS}
```

* Write the above coding on one line.

* The above java arguments differ depending on the WebLogic version. There is no problem by specifying JAVA_OPTIONS before using java.

Note: For monitoring **Perm Gen[shared-ro]** or **Perm Gen[shared-rw]** on the **Memory** tab, add the following line:
-client -Xshare:on -XX:+UseSerialGC

7. If monitoring requests of work manager and thread pool, make the following settings.

Start WLST (wlst.sh) of the target WebLogic Server. On the console window displayed, execute the following commands:

```
> connect('USERNAME','PASSWORD','t3://SERVER_ADDRESS:SERVER_PORT')
> edit()
> startEdit()
> cd('JMX/DOMAIN_NAME')
> set('PlatformMBeanServerUsed','true')
> activate()
> exit()
```

Replace the **USERNAME**, **PASSWORD**, **SERVER_ADDRESS**, **SERVER_PORT**, and **DOMAIN_NAME** above with those for the domain environment.

8. Restart the target WebLogic Server.

6.35.24 Monitoring WebOTX

This section describes how to configure a target WebOTX to enable monitoring by the JVM monitor resource.

Start the WebOTX Administration Console. For how to start the WebOTX Administration Console, refer to "Starting and stopping administration tool" in the *WebOTX Operation (Web Administration Tool)*.

The settings differ depending on whether a Java process of the JMX agent running on WebOTX or the Java process of a process group is to be monitored. Configure the settings according to the target of monitoring.

6.35.25 Monitoring a Java process of the WebOTX domain agent

There is no need to specify any settings.

6.35.26 Monitoring a Java process of a WebOTX process group

1. Connect to the domain by using the administration tool.
2. In the tree view, select **<domain_name>-TP System-Application Group-<application_group_name>-Process Group-<process_group_name>**.
3. For the **Other Arguments** attributes on the **JVM Options** tab on the right, specify the following Java options on one line. For **n**, specify the port number. If there is more than one Java VM to be monitored on the same machine, specify a unique port number. The port number specified for the settings is specified with Cluster WebUI (**JVM Monitor Resource Name -> Property -> Monitor (special) tab -> Connection Port**).

```
-Dcom.sun.management.jmxremote.port=n
-Dcom.sun.management.jmxremote.ssl=false
-Dcom.sun.management.jmxremote.authenticate=false
-Djavax.management.builder.initial=com.nec.webotx.jmx.mbeanserver.
↪ JmxMBeanServerBuilder
```

* In the case of WebOTX V9.2 or later, it is unnecessary to specify -Djavax.management.builder.initial.

4. Then, click **Update**. After the configuration is completed, restart the process group.

These settings can be made by using **Java System Properties**, accessible from the **Java System Properties** tab of the WebOTX administration tool. When making these settings by using the tool, do not designate -D and set the strings prior to = in name and set the strings subsequent to = in value.

Tab name for setting	Item name	Setting value
Monitor(common)	Monitor Timing	Always
Recovery Action	Recovery Action	Execute only the final action
Recovery Action	Final Action	No operation

Note: If restart upon a process failure is configured as a function of the WebOTX process group, and when the process group is restarted as the recovery processing by EXPRESSCLUSTER, the WebOTX process group may fail to function correctly. For this reason, when monitoring the WebOTX process group, make the following settings for the JVM monitor resource by using the Cluster WebUI.

Linking with the load balancer is not supported for WebOTX process group monitoring.

6.35.27 Receiving WebOTX notifications

By registering a specific listener class, notification is issued when WebOTX detects a failure. The JVM monitor resource receives the notification and outputs the following message to the JVM operation log.

```
%1$s:Notification received. %2$s.
```

%1\$s and %2\$s each indicates the following:

```
%1$s: Monitored Java VM
%2$s: Message in the notification (ObjectName=,type=,message=)
```

At present, the following is the detailed information on MBean on the monitorable resource.

ObjectName	[domainname]:j2eeType=J2EEDomain,name=[domainname],category=runtime
notification type	nec.webotx.monitor.alivecheck.not-alive
Message	failed

6.35.28 Monitoring JBoss

The settings are different for monitoring standalone mode and for domain mode. Configure the settings according to the target of monitoring.

This section describes how to configure a target JBoss to be monitored by the JVM monitor resource.

Standalone mode

1. Stop JBoss, and then open (*JBoss_installation_path*)/bin/standalone.conf by using editor software.
2. In the configuration file, specify the following settings. For **n**, specify the port number. If there is more than one Java VM to be monitored on the same machine, specify a unique port number. The port number specified for the settings is specified with Cluster WebUI (**JVM Monitor Resource Name - Property - Monitor(special) tab - Connection Port**).

Add the following before "if ["x\$JBoss_MODULES_SYSTEM_PKGS" = "x"]; then".

```
JBoss_MODULES_SYSTEM_PKGS="org.jboss.logmanager"
```

Add the following after "if ["x\$JAVA_OPTS" = "x"]; then ... fi:".

```
JAVA_OPTS="$JAVA_OPTS -Xbootclasspath/p:$JBoss_HOME/modules/org/jboss/  
↪logmanager/main/jboss-logmanager-1.3.2.Final-redhat-1.jar"  
JAVA_OPTS="$JAVA_OPTS -Djava.util.logging.manager=org.jboss.logmanager.  
↪LogManager"  
JAVA_OPTS="$JAVA_OPTS -Dcom.sun.management.jmxremote.port=n -Dcom.sun.  
↪management.jmxremote.ssl=false -Dcom.sun.management.jmxremote.  
↪authenticate=false"
```

* The storage directory and file name of jboss-logmanager-*.jar differ depending on the JBoss version. Therefore, specify the path according to the installation environment.

3. Save the settings, and then start JBoss.
4. With Cluster WebUI (JVM Monitor Resource Name - **Property - Monitor(special)** tab - **Identifier**), specify a unique string that is different from those for the other monitor targets (e.g. JBoss).

Domain mode

1. With Cluster WebUI (JVM Monitor Resource Name - **Property - Monitor(special)** tab - **Identifier**), specify a unique string that is different from those for the other monitor targets (e.g. JBoss). With Cluster WebUI (JVM Monitor Resource Name - **Property - Monitor(special)** tab - **Process Name**), specify all the Java VM startup options so that JBoss can be uniquely identified.

6.35.29 Monitoring Tomcat

This section describes how to configure a target Tomcat to be monitored by the JVM monitor resource.

1. If Tomcat is installed from an rpm package, stop Tomcat and open /etc/sysconfig/tomcat6 or /etc/sysconfig/tomcat. If Tomcat is not installed from an rpm package, stop Tomcat and create (*Tomcat installation path*)/bin/setenv.sh.
2. In the configuration file, for the Java options, specify the following settings on one line. For **n**, specify the port number. If there is more than one Java VM to be monitored on the same machine, specify a unique port number. The port number specified for the settings is specified with Cluster WebUI (**JVM Monitor Resource Name - Property - Monitor (special)** tab - **Connection Port**).

```
CATALINA_OPTS="$ {CATALINA_OPTS}  
-Dcom.sun.management.jmxremote.port=n  
-Dcom.sun.management.jmxremote.ssl=false  
-Dcom.sun.management.jmxremote.authenticate=false"
```

3. Save the settings, and then start Tomcat.
4. With Cluster WebUI (**JVM Monitor Resource Name - Property - Monitor (special)** tab - **Identifier**), specify a unique string that is different from those for the other monitor targets (e.g., tomcat).

6.35.30 Monitoring SVF

This section describes how to configure a target SVF to be monitored by the JVM monitor resource.

If the monitor target is Tomcat:

Change the environment variables of the SVF user in the OS as follows. For **n**, specify the port number. If there is more than one Java VM to be monitored on the same machine, specify a unique port number. The port number specified here is also specified with the Builder (**JVM Monitor Resource Name -> Property -> Monitor (special) tab -> Connection Port**).

```
JAVA_OPTS="-Xms512m -Xmx512m -Dcom.sun.management.jmxremote.port=n -Dcom.sun.
↪management.jmxremote.ssl=false -Dcom.sun.management.jmxremote.
↪authenticate=false"
export JAVA_OPTS
```

If the monitor target is other than Tomcat:

1. Select a monitor target from the following, and then use an editor to open the corresponding script.

Monitor target	Script to be edited
Simple Httpd Service (for 8.x)	<SVF installation path>/bin/SimpleHttpd
Simple Httpd Service (for 9.x)	<SVF installation path>/bin/UCXServer
RDE Service	<SVF installation path>/rdjava/rdserver/rd_server_startup.sh
	<SVF installation path>/rdjava/rdserver/svf_server_startup.sh
RD Spool Balancer	<SVF installation path>/rdjava/rdbalancer/rd_balancer_startup.sh
SVF Print Spooler Service	<SVF installation path>/bin/spooler

2. In the configuration file, for the Java options, specify the following settings on one line. For **n**, specify the port number. If there is more than one Java VM to be monitored on the same machine, specify a unique port number. The port number specified here is also specified with the Cluster WebUI (**JVM Monitor Resource Name -> Property -> Monitor (special) tab -> Connection Port**).

```
JAVA_OPTIONS="${JAVA_OPTIONS} -Dcom.sun.management.jmxremote.port=n -Dcom.sun.
↪management.jmxremote.ssl=false -Dcom.sun.management.jmxremote.authenticate=false
↪"
```

3. If the monitor target is RDE Service, add `${JAVA_OPTIONS}` into the following startup path and `rd_balancer_startup.sh`.

```
java -Xmx256m -Xms256m -Djava.awt.headless=true ${JAVA_OPTIONS} -classpath
↪$CLASSPATH jp.co.fit.vfreport.RdSpoolPlayerServer &
```

6.35.31 Monitoring a Java application that you created

This section describes the procedure to configure Java application which is monitored by JVM monitor resource. Specify the following Java option in one row to the option for Java application startup while Java application (the monitor target) is stopped. In the configuration file, for the Java options, specify the following settings on one line. For **n**, specify the port number. If there is more than one Java VM to be monitored on the same machine, specify a unique port number. The port number specified here is also specified with the Cluster WebUI (**JVM Monitor Resource Name -> Property -> Monitor (special) tab -> Connection Port**).

```
-Dcom.sun.management.jmxremote.port=n
-Dcom.sun.management.jmxremote.ssl=false
-Dcom.sun.management.jmxremote.authenticate=false
```

Some Java applications require the following to be additionally specified.

-Djavax.management.builder.initial=<*class name of MBeanServerBuilder*>

6.36 Setting up System monitor resources

System monitor resources periodically collect statistical information about system resources analyze the information according to given knowledge data. System monitor resources serve to detect the exhaustion of resources early according to the results of analysis.

6.36.1 Monitor(special) tab

Monitor Resource Properties | sraw1 sraw X

[Info](#)
[Monitor\(common\)](#)
[Monitor\(special\)](#)
[Recovery Action](#)

Specify the system monitoring conditions for identifying abnormality

Monitoring CPU usage	<input checked="" type="checkbox"/>		
CPU usage*		<input type="text" value="90"/>	%
Duration Time*		<input type="text" value="60"/>	min
Monitoring total usage of memory	<input checked="" type="checkbox"/>		
Total usage of memory*		<input type="text" value="90"/>	%
Duration Time*		<input type="text" value="60"/>	min
Monitoring total usage of virtual memory	<input checked="" type="checkbox"/>		
Total usage of virtual memory*		<input type="text" value="90"/>	%
Duration Time*		<input type="text" value="60"/>	min
Monitoring total number of opening files	<input checked="" type="checkbox"/>		
Total number of opening files (in a ratio comparing with the system upper limit)*		<input type="text" value="90"/>	%
Duration Time*		<input type="text" value="60"/>	min
Monitoring total number of running threads	<input checked="" type="checkbox"/>		
Total number of running threads*		<input type="text" value="90"/>	%
Duration Time*		<input type="text" value="60"/>	min
Monitoring number of running process of each user	<input checked="" type="checkbox"/>		
Number of running process of each user*		<input type="text" value="90"/>	%
Duration Time*		<input type="text" value="60"/>	min

Condition of detecting failure
Warning:When exceeding level once
Notification:When continuously exceeding level over the duration

Monitoring target disk list

Mount Point	Warning(%)	Notification(%)	Duration Time(min)	Warning(MB)	Notification(MB)	Duration Time(min)
No monitoring target disks						

Monitoring CPU usage

Enables CPU usage monitoring.

- When selected:
Monitoring is enabled for the CPU usage.
- When cleared:
Monitoring is disabled for the CPU usage.

CPU usage (1 to 100)

Specify the threshold for the detection of the CPU usage.

Duration Time (1 to 1440)

Specify the duration for detecting the CPU usage.

If the threshold is continuously exceeded over the specified duration, the detection of an error is recognized.

Monitoring total usage of memory

Enables the monitoring of the total usage of memory.

- When selected:
Monitoring is enabled for the total usage of memory.
- When cleared:
Monitoring is disabled for the total usage of memory.

Total usage of memory (1 to 100)

Specify the threshold for the detection of a memory use amount error (percentage of the memory size implemented on the system).

Duration Time (1 to 1440)

Specify the duration for detecting a total memory usage error.

If the threshold is continuously exceeded over the specified duration, the detection of an error is recognized.

Monitoring total usage of virtual memory

Enables the monitoring of the total **usage of virtual memory**.

- When selected:
Monitoring is enabled for the total **usage of virtual memory**.
- When cleared:
Monitoring is disabled for the total **usage of virtual memory**.

Total usage of virtual memory (1 to 100)

Specify the threshold for the detection of a virtual memory usage error.

Duration Time (1 to 1440)

Specify the duration for detecting a total virtual memory usage error.

If the threshold is continuously exceeded over the specified duration, the detection of an error is recognized.

Monitoring total number of opening files

Enables the monitoring of the total number of opening files.

- When selected:
Monitoring is enabled for the total number of opening files.
- When cleared:

Monitoring is disabled for the total number of opening files.

Total number of opening files (in a ratio comparing with the system upper limit) (1 to 100)

Specify the threshold for the detection of an error related to the total number of opening files (percentage of the system upper limit).

Duration Time (1 to 1440)

Specify the duration for detecting an error with the total number of opening files.

If the threshold is continuously exceeded over the specified duration, the detection of an error is recognized.

Monitoring total number of running threads

Enables the monitoring of the total number of running threads.

- When selected:
Monitoring is enabled for the total number of running threads.
- When cleared:
Monitoring is disabled for the total number of running threads.

Total number of running threads (1 to 100)

Specify the threshold for the detection of an error related to the total number of running threads (percentage of the system upper limit).

Duration Time (1 to 1440)

Specify the duration for detecting an error with the total number of running threads.

If the threshold is continuously exceeded over the specified duration, the detection of an error is recognized.

Monitoring number of running processes of each user

Enables the monitoring of the number of processes being run **of each user**.

- When selected:
Monitoring is enabled for the number of processes being run **of each user**.
- When cleared:
Monitoring is disabled for the number of processes being run **of each user**.

Number of running processes of each user (1 to 100)

Specify the threshold for the detection of an error related to the number of processes being run **of each user** (percentage of the system upper limit).

Duration Time (1 to 1440)

Specify the duration for detecting an error with the number of processes being run **of each user**.

If the threshold is continuously exceeded over the specified duration, the detection of an error is recognized.

Add

Click this to add disks to be monitored. The **Input of watch condition** dialog box appears.

Configure the detailed monitoring conditions for error determination, according to the descriptions given in the **Input of watch condition** dialog box.

Remove

Click this to remove a disk selected in **Disk List** so that it will no longer be monitored.

Edit

Click this to display the **Input of watch condition** dialog box. The dialog box shows the monitoring conditions for the disk selected in **Disk List**. Edit the conditions and click **OK**.

Specify monitoring condition

Mount Point*

Monitor Type

Utilization rate

☒

Warning level*

90

%

Notice level*

80

%

Duration Time*

1440

min

Free space

☒

Warning level*

500

MB

Notice level*

1000

MB

Duration Time*

1440

min

Initialize

OK

Cancel

Mount point (within 1,024 bytes)

Set the mount to be monitored. The name must begin with a forward slash (/).

Utilization rate

Enables the monitoring of the disk usage.

- When selected:
Monitoring is enabled for the disk usage.
- When cleared:
Monitoring is disabled for the disk usage.

Warning level (1 to 100)

Specify the threshold for warning level error detection for disk usage.

Notice level (1 to 100)

Specify the threshold for notice level error detection for disk usage.

Duration Time (1 to 43200)

Specify the duration for detecting a notice level error of the disk usage rate.

If the threshold is continuously exceeded over the specified duration, the detection of an error is recognized.

Free space

Enables the monitoring of the free disk space.

- When selected:
Monitoring is enabled for the free disk space.
- When cleared:
Monitoring is disabled for the free disk space.

Warning level (1 to 4294967295)

Specify the amount of disk space (in megabytes) for which the detection of an free disk space error at the warning level is recognized.

Notice level (1 to 4294967295)

Specify the amount of disk space (in megabytes) for which the detection of an free disk space error at the notice level is recognized.

Duration Time (1 to 43200)

Specify the duration for detecting a notice level error related to the free disk space.

If the threshold is continuously exceeded over the specified duration, the detection of an error is recognized.

6.36.2 Notes on System monitor resource

To use a system monitor resource, zip and unzip packages must have been installed on the servers.

For the recovery target, specify the resource to which fail-over is performed upon the detection of an error in resource monitoring by System Resource Agent.

The use of the default System Resource Agent settings is recommended.

Errors in resource monitoring may be undetectable when:

- A value repeatedly exceeds and then falls below a threshold during whole system resource monitoring.

If the date or time of the OS has been changed while System Resource Agent is running, resource monitoring may operate incorrectly as described below since the timing of analysis which is normally done at 10 minute intervals may differ the first time after the date or time is changed.

If either of the following occur, suspend and resume cluster.

- No error is detected even after the specified duration for detecting errors has passed.
- An error is detected before the specified duration for detecting errors has elapsed.

Once the cluster has been suspended and resumed, the collection of information is started from that point of time.

For the SELinux setting, set permissive or disabled.

The enforcing setting may disable the communication needed by EXPRESSCLUSTER.

The amount of system resources used is analyzed at 10-minute intervals. Thus, an error may be detected up to 10 minutes after the monitoring session.

The amount of disk resources used is analyzed at 60-minute intervals. Thus, an error may be detected up to 60 minutes after the monitoring session.

Specify a value smaller than the actual disk size when specifying the disk size for free space monitoring of a disk resource. If a value is specified that is larger than the actual disk size, an error will be detected due to insufficient free space.

If the monitored disk has been replaced, analyzed information up until the time of the disk replacement will be cleared if one of the following items of information differs between the previous and current disks.

- Total disk capacity
- File system

Disk resource monitoring can only monitor disk devices.

For server for which no swap was allocated, uncheck the monitoring of total virtual memory usage.

Disk usage information collected by System Resource Agent is calculated by using the total disk space and free disk space. This value may slightly differ from the disk usage which `df(1)` command shows because it uses a different calculation method.

Up to 64 disk units can be simultaneously monitored by the disk resource monitoring function.

System monitor resource collected statistics information and analysis information, it outputs. When the number of these files reached following biggest number, it's eliminated from an old file.

(<data path> in following text is "<EXPRESSCLUSTER_install_path >/ha/sra/data/".)

- Statistical information data of system resources.
Path: <data path>/hasrm_monitor_list.xml.YYYYMMDDhhmmss.zip
Maximum number of a file: 1500
- Analyzed information data of system resources.
Path: <data path>/hasrm_analyze_list.xml.YYYYMMDDhhmmss.zip
Maximum number of a file: 3
- Statistical information data of disk resources.
Path: <data path>/hasrm_diskcapacity_monitor_list.xml.YYYYMMDDhhmmss.zip
Maximum number of a file: 10
- Analyzed information data of disk resources.
Path: <data path>/hasrm_diskcapacity_analyze_list.xml.YYYYMMDDhhmmss.zip
Maximum number of a file: 3

6.36.3 How System monitor resources perform monitoring

System monitor resources monitor the following:

Periodically collect the amounts of system resources and disk resources used and then analyze the amounts.

An error is recognized if the amount of a resource used exceeds a pre-set threshold.

When an error detected state persists for the monitoring duration, it is posted as an error detected during resource monitoring.

System resource monitoring with the default values reports an error found in resource monitoring 60 minutes later if the resource usage does not fall below 90%.

The following shows an example of error detection for the total memory usage in system resource monitoring with the default values.

- The total memory usage remains at the total memory usage threshold or higher as time passes, for at least a certain duration of time.

In the figure below, the total memory usage remains at the total memory usage threshold (90%) or higher for at least the monitoring duration (60 minutes) and thus an error in total memory usage is detected.

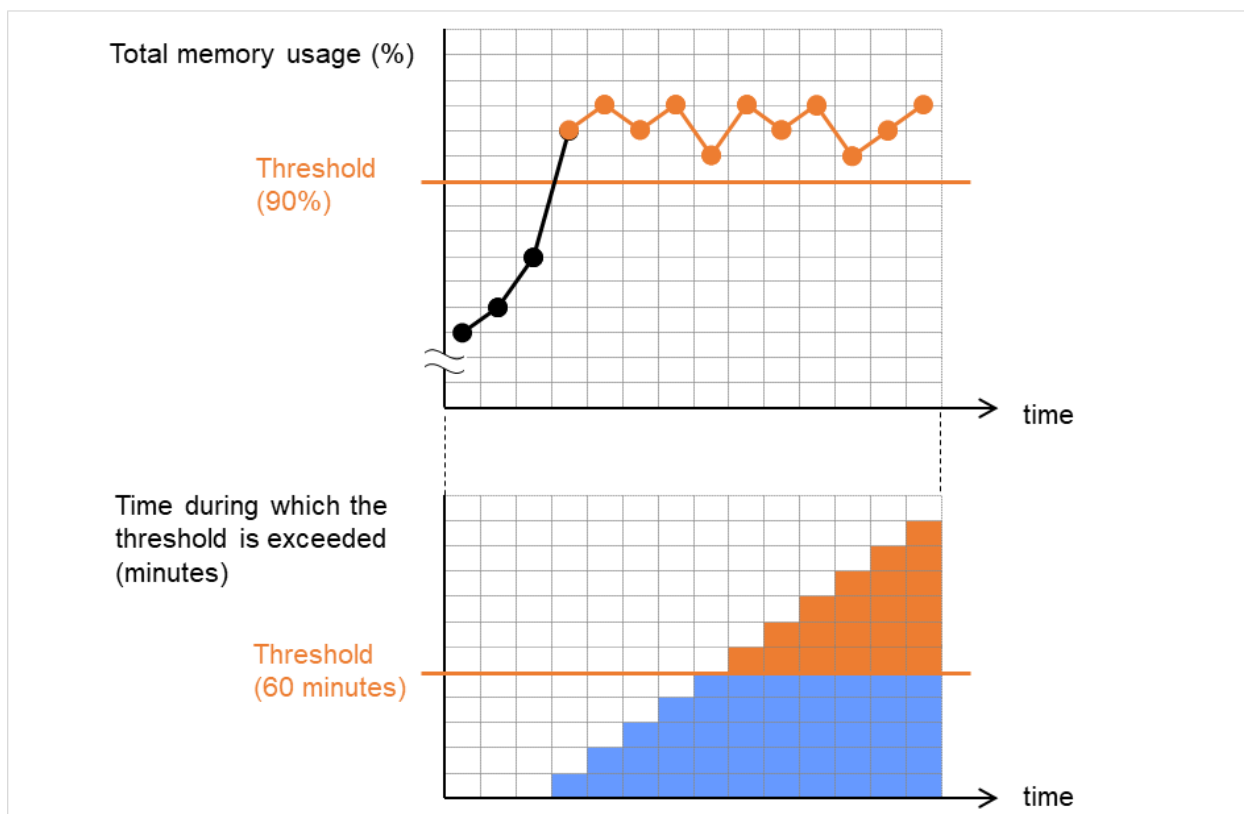


Fig. 6.22: The total memory usage remains at the total memory usage threshold or higher for a certain duration of time

- The total memory usage rises and falls in the vicinity of the total memory usage threshold as time passes, but always remains under that threshold.

The following figure shows the total memory usage temporarily exceeding the total memory usage threshold (90%). This state of exceeding the threshold, however, does not persist for the monitoring duration (60 minutes)

and thus an error in the total memory usage is not detected.

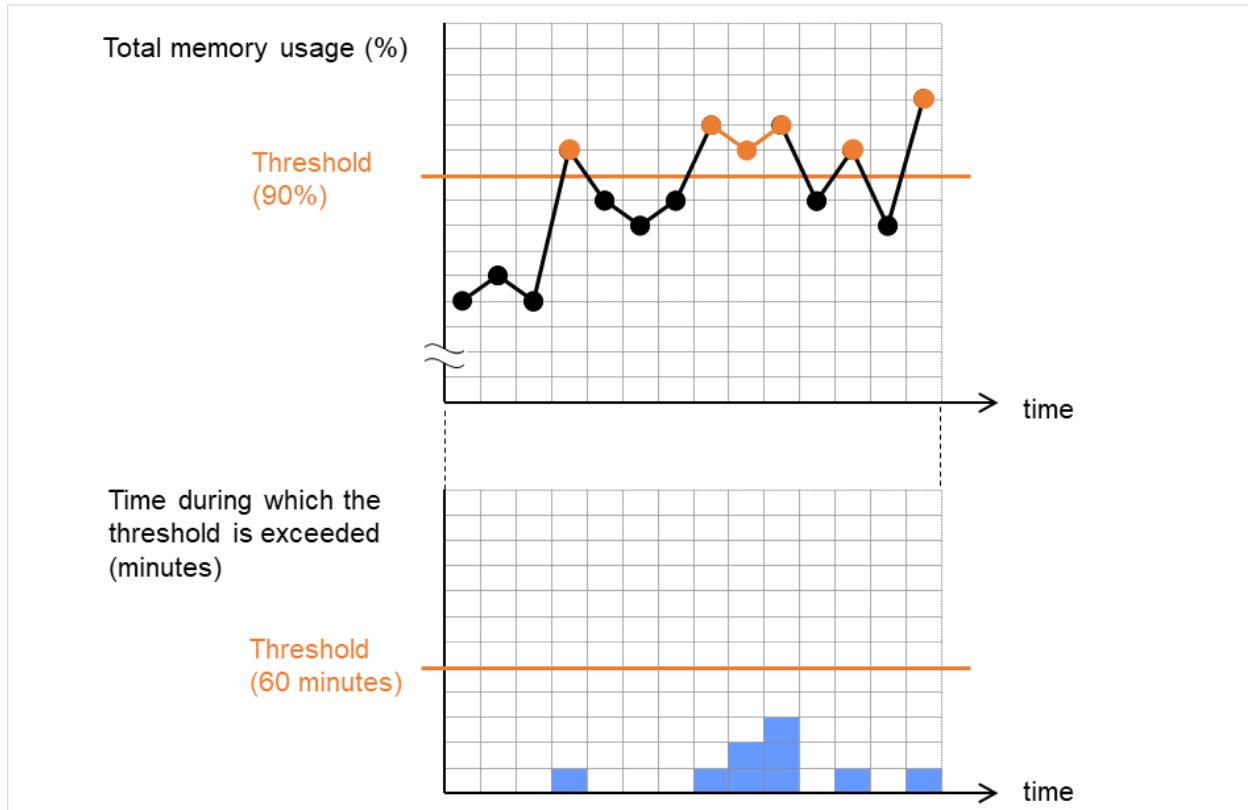


Fig. 6.23: The state of exceeding the total memory usage threshold does not persist for a certain duration of time (no error detected)

If disk resource monitoring operated under the default settings, it will report a notice level error after 24 hours.

The following chart describes how disk resource monitoring detects disk usage errors when operating under the default settings.

Monitoring disk usage by warning level

- In the following example, disk usage exceeds the threshold which is specified as the warning level upper limit.
Disk usage exceeds the warning level upper limit, which is determined as an error in monitoring the disk usage.

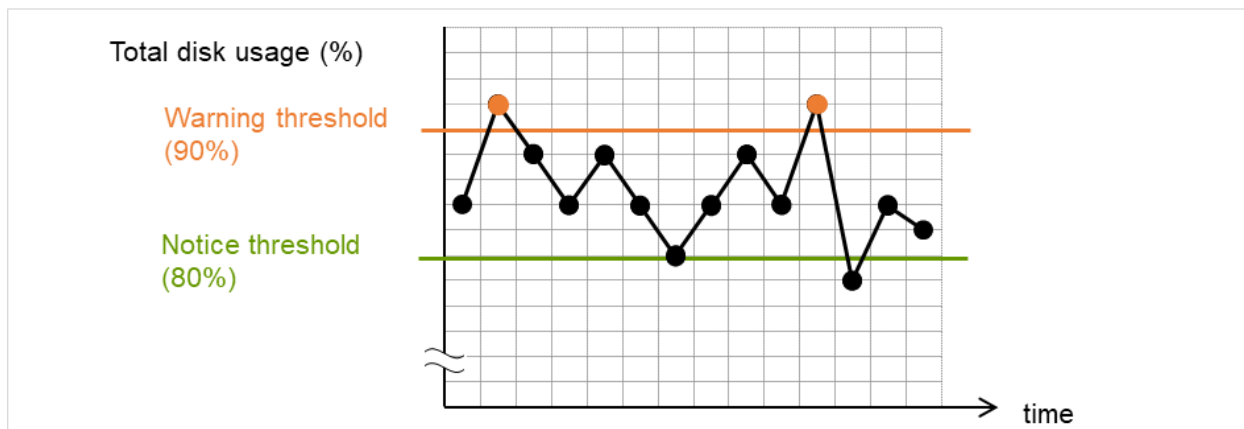


Fig. 6.24: Disk usage exceeds the warning level upper limit (an error detected)

- In the following example, disk usage increases and decreases within certain range, and does not exceed the threshold which is specified as the warning level upper limit.

Disk usage increases and decreases in a range where it does not exceed the warning level upper limit, which is not determined as an error in monitoring the disk usage.

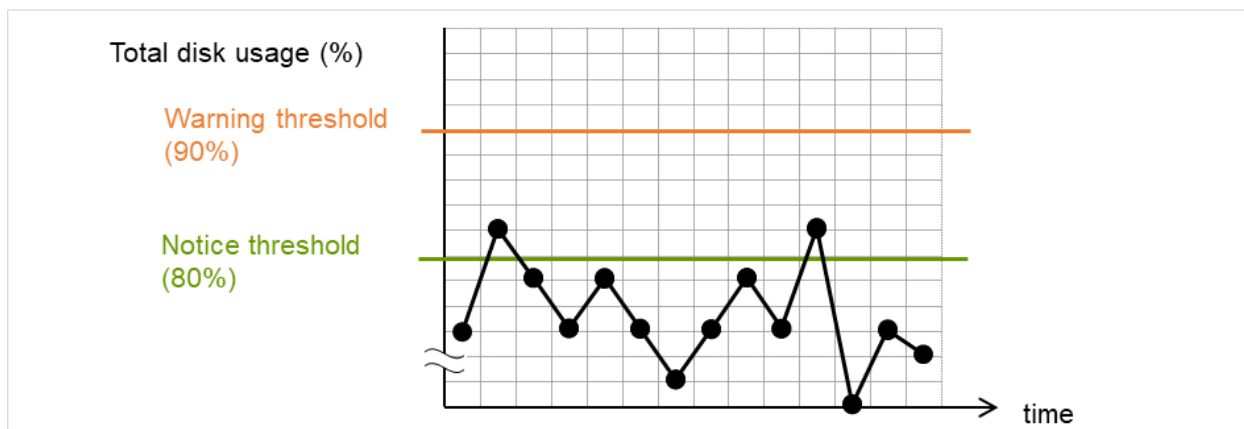


Fig. 6.25: Disk usage does not exceed the warning level upper limit (no error detected)

Monitoring disk usage by notice level

- In the following example, disk usage continuously exceeds the threshold specified as the notification level upper limit, and the duration exceeds the set length.

Disk usage continuously exceeds the notification level upper limit, which is determined as an error in monitoring the disk usage.

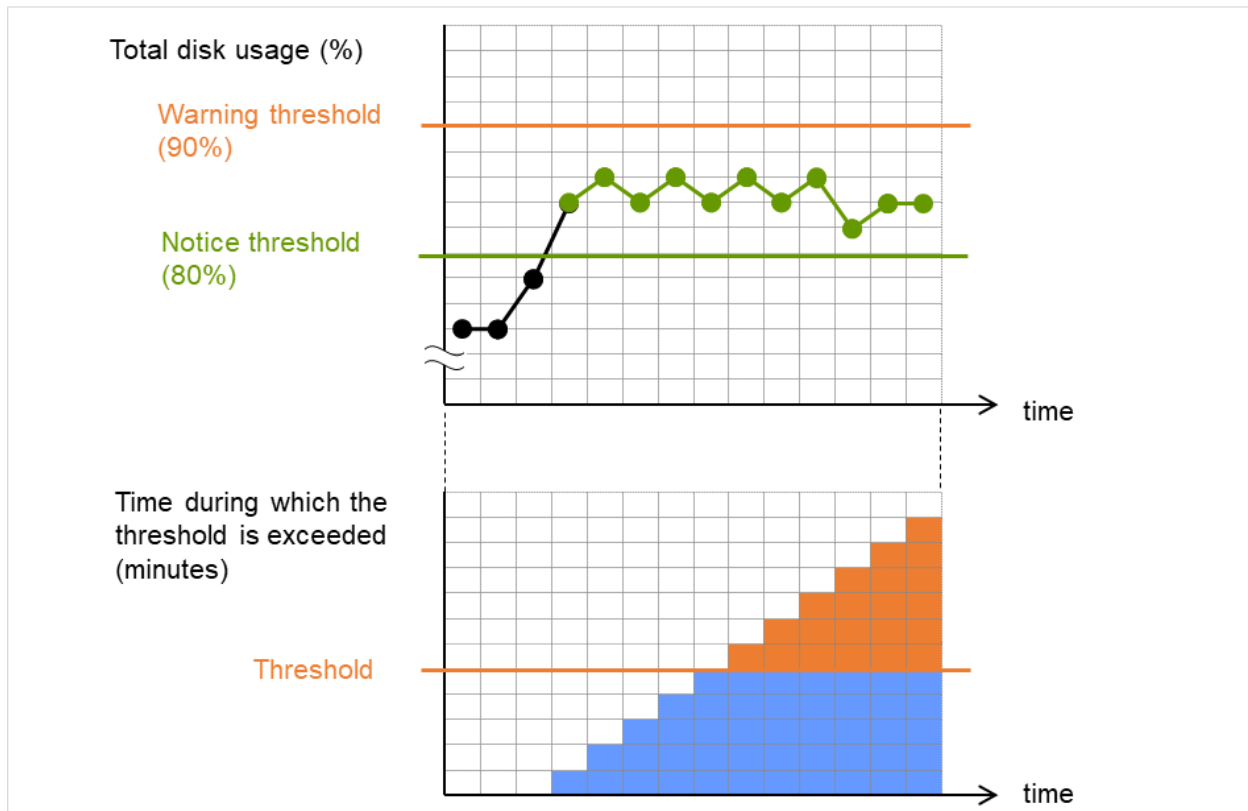


Fig. 6.26: Disk usage exceeds the notification level upper limit for a certain duration of time (an error detected)

- In the following example, disk usage increases and decreases within a certain range, and does not exceed the threshold specified as the notification level upper limit.

Disk usage rises and falls in the vicinity of the notification level upper limit, which is not determined as an error in monitoring the disk usage.

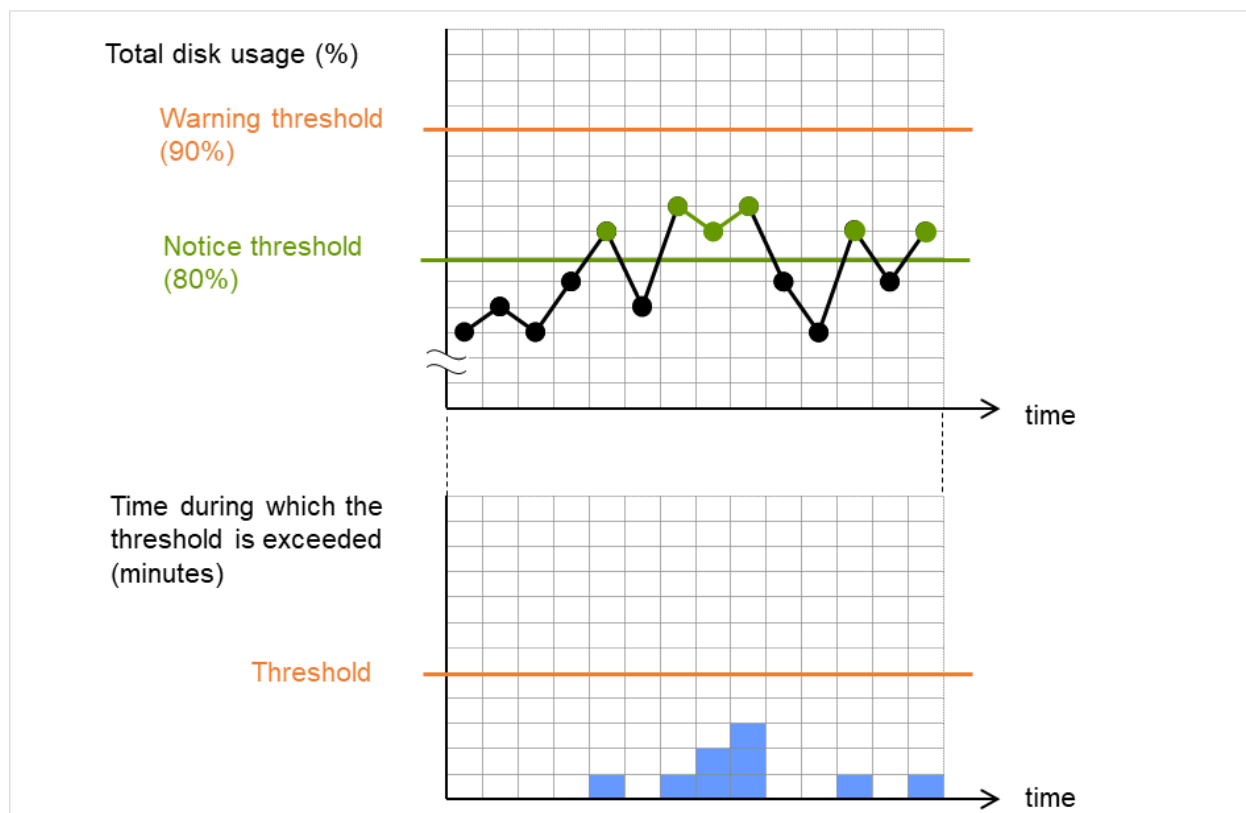


Fig. 6.27: The state of exceeding the notification level threshold in disk usage does not persist for a certain duration of time (no error detected)

6.37 Setting up Process resource monitor resources

Process resource monitor resources periodically collect statistical information about resources used by processes and analyze the information according to given knowledge data. Process resource monitor resources serve to detect the exhaustion of resources early according to the results of analysis.

6.37.1 Monitor(special) tab

Monitor Resource Properties | psrw1 psrw X

Info Monitor(common) **Monitor(special)** Recovery Action

Specify the process monitoring conditions for identifying failure

Process Name	<input type="text"/>	
Monitoring CPU usage	<input checked="" type="checkbox"/>	
CPU usage*	<input type="text" value="90"/>	%
Duration Time*	<input type="text" value="1440"/>	min
Monitoring usage of memory	<input checked="" type="checkbox"/>	
Rate of Increase from the First Monitoring Point*	<input type="text" value="10"/>	%
Duration Time*	<input type="text" value="1440"/>	min
Monitoring number of opening files(maximum number)	<input checked="" type="checkbox"/>	
Refresh Count*	<input type="text" value="1000"/>	time
Monitoring number of opening files(kernel limit)	<input checked="" type="checkbox"/>	
Ratio*	<input type="text" value="90"/>	%
Monitoring number of running threads	<input checked="" type="checkbox"/>	
Duration Time*	<input type="text" value="1440"/>	min
Monitoring Zombie Processes	<input checked="" type="checkbox"/>	
Duration Time*	<input type="text" value="1440"/>	min
Monitoring Processes of the Same Name	<input type="checkbox"/>	
Count	<input type="text" value="100"/>	

Process Name (within 1023 bytes)

Set the name of the target process. Without setting it, all started processes are monitored.

Wild cards can be used to specify a process name by using one of the following three patterns. No other wild card pattern is permitted.

[prefix search] <string included in the process name>*

[suffix search] *<string included in the process name>

[partial search] *<string included in the process name>*

Up to 1023 bytes can be specified for the monitor target process name. To specify a monitor target process with a name that exceeds 1023 bytes, use a wildcard (such as *).

If the name of the target process is 1024 bytes or longer, only the first 1023 bytes can be recognized as the process name. If you use a wild card (such as *) to specify a process name, specify a string containing the first 1024 or fewer bytes.

Check the monitor target process name which is actually running by ps(1) command, etc, and specify the monitor target process name.

- Execution result

UID	PID	PPID	C	STIME	TTY	TIME	CMD
root	1	0	0	Sep12	?	00:00:00	init [5]
:							
root	5314	1	0	Sep12	?	00:00:00	/usr/sbin/acpid
root	5325	1	0	Sep12	?	00:00:00	/usr/sbin/sshd
htt	5481	1	0	Sep12	?	00:00:00	/usr/sbin/htt -retryonerror 0

From the above command result, /usr/sbin/htt -retryonerror 0 is specified as monitor target process name in the case of monitoring /usr/sbin/htt.

The process name specified for the name of the target process specifies the target process, using the process arguments as part of the process name. To specify the name of the target process, specify the process name containing the arguments. To monitor only the process name with the arguments excluded, specify it with the wildcard (*) using right truncation or partial match excluding the arguments.

Monitoring CPU usage

Enables CPU usage monitoring.

- When the check box is selected:
Monitoring is enabled for the CPU usage.
- When the check box is not selected:
Monitoring is disabled for the CPU usage.

CPU usage (1 to 100)

Specify the threshold for the detection of the CPU usage.

Duration Time (1 to 129600)

Specify the duration for detecting the CPU usage.

If the threshold is continuously exceeded over the specified duration, the detection of an error is recognized.

Monitoring usage of memory

Enables the monitoring of the usage of memory.

- When the check box is selected:
Monitoring is enabled for the usage of memory.
- When the check box is not selected:
Monitoring is disabled for the usage of memory.

Rate of Increase from the First Monitoring Point (1 to 1000)

Specify the threshold for the detection of a memory use amount error.

Duration Time (1 to 129600)

Specify the duration for detecting a memory usage error.

If the threshold is continuously exceeded over the specified duration, the detection of an error is recognized.

Monitoring number of opening files(maximum number)

Enables the monitoring of the number of opening files(maximum number).

- When the check box is selected:
Monitoring is enabled for the number of opening files.
- When the check box is not selected:
Monitoring is disabled for the number of opening files.

Refresh Count (1 to 1024)

Specify the refresh count for the detection of the number of opening files error.

If the number of opening files maximum value is updated more count than specified, the detection of an error is recognized.

Monitoring number of opening files(kernel limit)

Enables the monitoring of the number of opening files(kernel limit).

- When the check box is selected:
Monitoring is enabled for the number of opening files.
- When the check box is not selected:
Monitoring is disabled for the number of opening files.

Ratio (1 to 100)

Specify the ratio for detection of the opening files(the percentage to the kernel limit).

Monitoring number of running threads

Enables the monitoring of the number of running threads.

- When the check box is selected:
Monitoring is enabled for the number of running threads.
- When the check box is not selected:
Monitoring is disabled for the number of running threads.

Duration Time (1 to 129600)

Specify the duration for detecting an error with the number of running threads.

If the threshold is continuously exceeded over the specified duration, the detection of an error is recognized.

Monitoring Zombie Process

Enables the monitoring of Zombie Processes.

- When the check box is selected:
Monitoring is enabled for the Zombie Processes.
- When the check box is not selected:
Monitoring is disabled for the Zombie Processes.

Duration Time (1 to 129600)

Specify the duration for detecting Zombie Processes.

If process is a Zombie Process over the specified duration, the detection of an error is recognized.

Monitoring Processes of the Same Name

Enables the monitoring of Processes of the Same Name.

- When the check box is selected:
Monitoring is enabled for the Processes of the Same Name.
- When the check box is not selected:
Monitoring is disabled for the Processes of the Same Name.

Count (1 to 10000)

Specify the count for detecting an error with the processes of the same name.

If the processes of the same name has been exists more than specified numbers, the detection of an error is recognized.

6.37.2 Notes on Process resource monitor resource

To use a Process resource monitor resource, zip and unzip packages must have been installed on the servers.

The use of the default Process resource monitor resource settings is recommended.

Swapped out processes are not subject to the detection of resource errors.

If the date or time of the OS has been changed while System Resource Agent is running, resource monitoring may operate incorrectly as described below since the timing of analysis which is normally done at 10 minute intervals may differ the first time after the date or time is changed.

- No error is detected even after the specified duration for detecting errors has passed.
- An error is detected before the specified duration for detecting errors has elapsed.

Once the cluster has been suspended and resumed, the collection of information is started from that point of time.

For the SELinux setting, set permissive or disabled.

The enforcing setting may disable the communication needed by EXPRESSCLUSTER.

Process resource monitor resource collected statistics information and analysis information, it outputs. When the number of these files reached following biggest number, it's eliminated from an old file.

(<data path> in following text is "<EXPRESSCLUSTER_install_path>/ha/sra/data/".)

- Statistical information data of process resources.
Path: <data path>/hasrm_monitor_list.xml.YYYMMDDhhmmss.zip
Maximum number of a file: 1500
- Analyzed information data of process resources.
Path: <data path>/hasrm_analyze_list.xml.YYYMMDDhhmmss.zip
Maximum number of a file: 3

To return the status of the process resource monitor resource from error to normal, perform either of the following:

- Suspending and resuming the cluster
- Stopping and starting the cluster

6.37.3 How Process resource monitor resources perform monitoring

Process resource monitor resources monitor the following:

Periodically collect the amounts of process resources used and then analyze the amounts

An error is recognized if the amount of a resource used exceeds a pre-set threshold.

When an error detected state persists for the monitoring duration, it is posted as an error detected during resource monitoring.

If process resource monitoring (of the CPU, memory, number of opening files, or number of zombie processes) operated by using the default values, a resource error is reported after 24 hours.

The following chart describes how process resource monitoring detects memory usage errors.

- In the following example, as time progresses, memory usage increases and decreases, the maximum value is updated more times than specified, and increases by more than 10% from its initial value.

The maximum value is kept updated for more than 24 hours (default) and the memory usage increases by more than 10% from its initial value, which is determined as a memory leak.

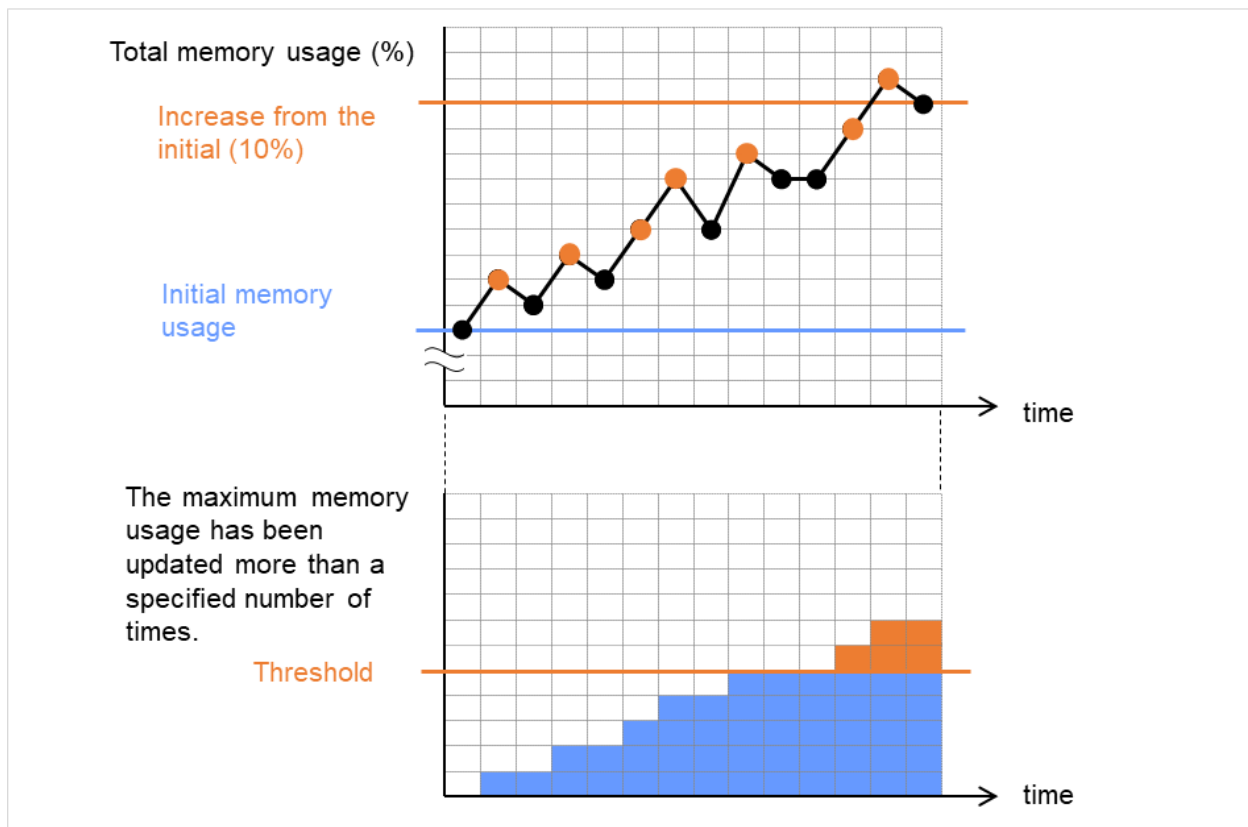


Fig. 6.28: The maximum value of the memory usage is updated more than the specified number of times, and the memory usage increases by more than 10% from its initial value (an error detected)

- In the following example, memory usage increases and decreases, but remains within a set range.

The memory usage increases and decreases within a set range, which is not determined as a memory leak.

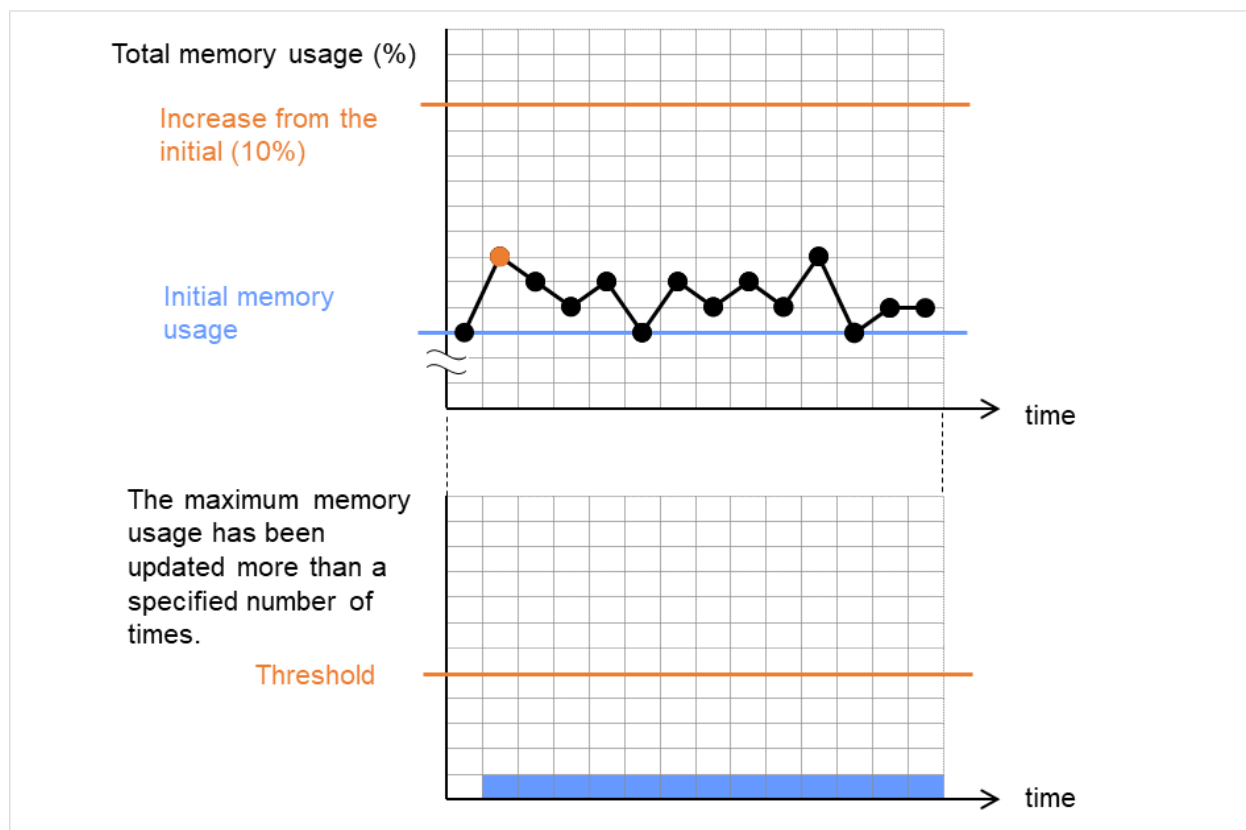


Fig. 6.29: The memory usage increases and decreases within a set range (no error detected)

HEARTBEAT RESOURCES

This chapter provides detailed information on heartbeat resources.

EXPRESSCLUSTER X SingleServerSafe uses windows common to those of the clustering software EXPRESSCLUSTER X to ensure high compatibility with EXPRESSCLUSTER X in terms of operation and other aspects.

This chapter covers:

- *7.1. Heartbeat resources list*
- *7.2. Setting up LAN heartbeat resources*

7.1 Heartbeat resources list

The heartbeat resource is used to monitor whether servers are activated. Heartbeat device types are:

Heartbeat Resource Name	Abbreviation	Functional Overview
LAN heart beat resource	lanhb	Uses a LAN to monitor if servers are activated.

- You need to set one LAN heartbeat resource.

7.2 Setting up LAN heartbeat resources

7.2.1 Notes on LAN heartbeat resources

- You need to set one LAN heartbeat resource.

DETAILS OF OTHER SETTINGS

This chapter provides details about the other items to be specified for EXPRESSCLUSTER X SingleServerSafe.

EXPRESSCLUSTER X SingleServerSafe uses windows common to those of the clustering software EXPRESSCLUSTER X to ensure high compatibility with EXPRESSCLUSTER X in terms of operation and other aspects.

This chapter covers:

- 8.1. *Cluster properties*
- 8.2. *Server properties*
- 8.3. *Number of components of each type that can be registered*

8.1 Cluster properties

In the **Cluster Properties** window, you can view and change the detailed data of EXPRESSCLUSTER X Single-ServerSafe.

8.1.1 Info tab

You can display the server name, and register and make a change to a comment on this tab.

The screenshot shows the 'Cluster Properties' window for 'server1'. The 'Info' tab is selected. The window has a dark title bar with a close button. Below the title bar is a tabbed interface with the following tabs: Info, Interconnect, NP Resolution, Timeout, Port No., Port No.(Mirror), Port No.(Log), Monitor, Recovery, Alert Service, WebManager, Alert Log, Delay Warning, Mirror Agent, Mirror Driver, JVM Monitor, and Extension. The 'Info' tab is active, showing three fields: 'Cluster Name' with the value 'server1', 'Comment' with an empty text box, and 'Language' with a dropdown menu showing 'English'. At the bottom right are three buttons: 'OK', 'Cancel', and 'Apply'.

Cluster Name:

Displays the server name. You cannot change the name here.

Comment (within 127 bytes)

Enter a new comment. You can only enter one byte English characters.

Language

Choose one of the display languages below. Specify the language (locale) of OS on which the Cluster WebUI runs.

- English
- Japanese
- Chinese

8.1.2 Interconnect tab

Not used.

8.1.3 NP Resolution tab

Not used.

8.1.4 Timeout tab

Specify values such as time-out on this tab.

Cluster Properties | server1

Info Interconnect NP Resolution **Timeout** Port No. Port No.(Mirror) Port No.(Log) Monitor Recovery
Alert Service WebManager Alert Log Delay Warning Mirror Agent Mirror Driver JVM Monitor Extension

Server Sync Wait Time 5 min

Heartbeat

Interval* 30 sec

Timeout* 300 sec

Server Internal Timeout* 180 sec

Initialize

OK Cancel Apply

Server Sync Wait Time (0 to 99)

Not used.

Heartbeat

Heartbeat interval and heartbeat time-out.

- **Interval** (1 to 99)
Interval of heartbeats.
- **Timeout** (2 to 9999)

A failed server is determined if there is no response for the time specified here.

- This time-out should be longer than the interval.
- To perform the shutdown monitoring this time-out should be longer than the time it takes to shut down applications and the operating system.

Server Internal Timeout (1 to 9999)

The timeout to be used in the EXPRESSCLUSTER Server internal communications that are performed while an EXPRESSCLUSTER command is executed, or an operation is performed or a screen is displayed by Cluster WebUI.

Initialize

Used for initializing the value to the default value. Click **Initialize** to initialize all the items to their default values.

8.1.5 Port No. tab

Specify TCP port numbers and UDP port numbers.

Cluster Properties | server1

Info Interconnect NP Resolution Timeout **Port No.** Port No.(Mirror) Port No.(Log) Monitor Recovery
Alert Service WebManager Alert Log Delay Warning Mirror Agent Mirror Driver JVM Monitor Extension

TCP

Server Internal Port Number* 29001

Data Transfer Port Number* 29002

WebManager HTTP Port Number* 29003

UDP

Heartbeat Port Number* 29002

Kernel Mode Heartbeat Port Number* 29006

Alert Sync Port Number* 29003

Initialize

OK Cancel Apply

TCP

No TCP port numbers can be overlapped.

- Server Internal Port Number (1 to 65535³)
This port number is used for internal communication.
- Information Base Port Number (1 to 65535³)
This port number is used for cluster information management.
- Data Transfer Port Number (1 to 65535³)
This port number is used for transactions such as applying and backing up the configuration data, sending and receiving the license data, and running commands.
- WebManager HTTP Port Number (1 to 65535³)
This port number is used for a browser to communicate with the EXPRESSCLUSTER Server.
- API HTTP Port Number (1 to 65535³)
This port number is used for a RESTful API client to communicate with the EXPRESSCLUSTER server.
- API Server Internal Port Number (1 to 65535³)
This port number is used for internal RESTful-API communication.

UDP

No UDP port numbers can be overlapped.

- Heartbeat Port Number (1 to 65535³)
This port number is used for the heartbeat.

³ It is strongly recommended not to use well-known ports, especially reserved ports from 1 to 1,023.

- Kernel Mode Heartbeat Port Number (1 to 65535³)
This port number is used for the kernel mode heartbeat.
- Alert Sync Port Number (1 to 65535³)
This port number is used to synchronize alert messages between servers.

Initialize

Used for initializing the value to the default value. Click **Initialize** to initialize all the items to their default values.

8.1.6 Port No. (Mirror) tab

Not used.

8.1.7 Port No. (Log) tab

Specify the communication method for internal logs.

Cluster Properties | server1

Info Interconnect NP Resolution Timeout Port No. Port No.(Mirror) Port No.(Log) Monitor Recovery
Alert Service WebManager Alert Log Delay Warning Mirror Agent Mirror Driver JVM Monitor Extension

Communication Method for Internal Logs

☐ UDP
☒ UNIX Domain
☐ Message Queue

Port Number 0

Initialize

OK Cancel Apply

Communication Method for Internal Logs

- UDP
Use UDP for the communication method for internal logs.
- UNIX Domain
Use UNIX Domain for the communication method for internal logs.
- Message Queue
Use Message Queue for the communication method for internal logs.

Port Number (1 to 65535)

This is the port number used when UDP is selected for the communication method for internal logs.

Initialize

Used for initializing the value to the default value. Click **Initialize** to initialize all the items to their default values.

8.1.8 Monitor tab

Configure the settings for monitoring.

Cluster Properties | server1

Info Interconnect NP Resolution Timeout Port No. Port No.(Mirror) Port No.(Log) **Monitor** Recovery
Alert Service WebManager Alert Log Delay Warning Mirror Agent Mirror Driver JVM Monitor Extension

Shutdown Monitor

☐ Always execute
☒ Execute when the group deactivation has been failed
☐ Not execute

Method*

Operation at Timeout Detection*

Enable SIGTERM handler ☐

Timeout ☐ Use Heartbeat Timeout
☒ Set Timeout sec

System Resource

Collect the System Resource Information ☐

Shutdown Monitor

Monitors whether or not the operating system is stalling when an EXPRESSCLUSTER command to shut down the server is run. The cluster service forcibly resets the operating system or performs a panic of the operating system if it determines the OS stall. Server panic can be set when the monitoring method is keepalive.

- **Always execute:**

If selected, the shutdown monitor is performed. For the heartbeat time-out, specify a longer time than the time required to shut down every application and the operating system (see "8.1.4. *Timeout tab*").

- **Execute when the group deactivation has been failed:**

The shutdown monitor is applied only when a group cannot be deactivated. For the heartbeat time-out, specify a longer time than the time required to shut down every application and the operating system (see "8.1.4. *Timeout tab*").

- **Not execute:**

If selected, the shutdown monitor is not performed.

Method

Select the shutdown monitor method from:

- softdog
- ipmi

- keepalive

Operation at Timeout Detection

Selects the operation performed when the operating system is determined to be stalled. This can be set only when the monitoring method is keepalive.

- RESET
Resets the server.
- PANIC
Performs a panic of the server.

Enable SIGTERM handler

Select this to enable SIGTERM handler when performing the shutdown monitor.

Note: If you select ipmi in **Method** and set **Enable SIGTERM handler** to **Off**, this may be reset even if the operating system is successfully shut down.

Use Heartbeat Timeout

Select this for heartbeat time-out to work in conjunction with shutdown monitoring time-out.

Set Timeout (2 to 9999)

Specify a time-out when the heartbeat time-out value is not used as shutdown monitoring time-out.

System Resource

Select whether to **Collect the System Resource Information**.

System resource information is collected regularly so as to improve system operability.

- When the check box is selected
System resource information related to the CPU, memory, processes, and others is collected regularly while the server is running.
The collected system resource information is collected when the clplogcc command or Cluster WebUI collects logs. When collecting logs, specify Pattern 2 or type2. A disk area of 450 MB or more is required to store the resource information, depending on the system operating conditions such as the number of processes that are running.
Using this function requires a zipping and unzipping package tool on each server.
- When the check box is cleared
No system resource information is collected.

8.1.9 Recovery tab

Specify the settings for recovery.

Cluster Properties | server1

Info

Interconnect

NP Resolution

Timeout

Port No.

Port No.(Mirror)

Port No.(Log)

Monitor

Recovery

Alert Service

WebManager

API

Encryption

Alert Log

Delay Warning

Mirror Agent

Mirror Driver

JVM Monitor

Cloud

Extension

Action When the Cluster Service Process Is Failure*

Shut down the OS

Recovery Action for HA Agents

Max Restart Count*

3

time

Recovery Action over Max Restart Count*

No operation

Action at Group Resource Activation or Deactivation Stall*

Stop the cluster service and shutdown OS

Disable the Final Action when OS Stops Due to Failure Detection

Detailed Settings

Disable Shutdown When Multi-Failover-Service Detected

Detailed Settings

Initialize

OK

Cancel

Apply

Action When the Cluster Service Process is Failure

Specify the action against process error in daemon.

- Shut down OS
Shuts down the OS.
- Reboot OS
Reboots the OS.

Recovery Action for HA Agents

- Max Restart Count (0 to 99)
Specify the max restart count when an HA Agent error has occurred.
- Recovery Action over Max Restart Count
Specify the action when an HA Agent error has occurred.
- No operation
- Stop the cluster service
Stops the cluster service of the server that detected an error.
- Stop the cluster service and shutdown OS
Stops the cluster service of the server that detected an error, and then shuts down the OS.
- Stop the cluster service and reboot OS
Stops the cluster service of the server that detected an error, and then reboots the OS.

Note: The HA process is used with the system monitor resources, the process resource monitor resources, JVM monitor resources, and the system resource information collection function.

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Chapter 8. Details of other settings

Action at Group Resource Activation or Deactivation Stall

Specify the action to apply in the event of an activation/deactivation stall of a group resource.

- Stop cluster service and shutdown OS
Stops the cluster service of the server that stalled, and then shuts down the OS.
- Stop cluster service and reboot OS
Stops the cluster service of the server that stalled, and then restarts the OS.
- Sysrq Panic
Performs a sysrq panic on the server that stalled.
- Keepalive Reset
Use this on the server that stalled to perform an OS reset by using the clpkhb and clpka drivers.
- Keepalive Panic
Use this on the server that stalled to perform an OS panic by using the clpkhb and clpka drivers.
- BMC Reset
Use this on the server that stalled to perform a hardware reset of the server by using the ipmi command.
- BMC Power Off
Use this on the server that stalled to power off the server by using the ipmi command. The OS may be shut down depending on how the ACPI of OS is configured.
- BMC Power Cycle
Use this on the server that stalled to perform the Power Cycle (powering on/off) by using the ipmi command. The OS may be shut down depending on how the ACPI of OS is configured.
- BMC NMI
Use this on the server that stalled to generate NMI in the server by using the ipmi command. The behavior after the generation of NMI depends on the OS setting.
- No Operation (Operates as an activity or deactivity failure)
Use this to perform recovery upon the detection of an activation/deactivation failure of a group resource. For details on the recovery operation, see "Displaying and changing the operation settings when a group resource error is detected (Common to group resources)" in "Displaying and changing the settings of group resources" in "[5. Group resource details](#)" in this guide.

Note: If a stall occurs with "Nothing (handle a stall as an activation/deactivation failure)" specified, the effect on the group resources is undefined, so we do not recommend changing the setting to "Nothing (handle a stall as an activation/deactivation failure)".

If you do specify "Nothing (handle a stall as an activation/deactivation failure)", set the recovery operation upon the detection of an activation/deactivation failure of a group resource as described below.

- Activation/Deactivation Retry Threshold: 0
 - Failover Threshold: 0
 - Final Action: Action that accompanies the OS stop
-

Disable the Final Action when OS Stops Due to Failure Detection

Click **Detailed Settings** to set suppression of the final action which accompanies the OS stop caused by error detection.

Detailed Settings

Final Action When OS Stops Due to All Server Shutdown

Group Resource When Activation Failure Detected ☐

Group Resource When Deactivation Failure Detected ☐

Monitor Resource When Failure Detected ☐

- **Group Resource When Activation Failure Detected**

If the final action caused by an activation error detection in a group resource accompanies the OS stop, the final action is suppressed.

- **Group Resource When Deactivation Failure Detected**

If the final action caused by a deactivation error detection in a group resource accompanies the OS stop, the final action is suppressed.

- **Monitor Resource When Failure Detected**

If the final action caused by an error detection in a monitor resource accompanies the OS stop, the final action is suppressed.

Note:

- The message receive monitor resource does not become the target for which the final action caused by error detection is suppressed.
- The following situations lead to an OS stop during the final action when an activation/deactivation error is detected in a group resource and during the final action when a monitor resource error is detected.
 - Cluster service stop and OS shutdown
 - Cluster service stop and OS restart
 - sysrq panic
 - keepalive reset
 - keepalive panic
 - BMC reset
 - BMC power off
 - BMC power cycle
 - BMC NMI

Disable Shutdown When Multi-Failover-Service Detected

Not used.

8.1.10 Alert Service tab

Configure alert notification settings.

To use the mail report function, register the Alert Service license.

Note: To use the mail report function, purchase EXPRESSCLUSTER X Alert Service 4.3 for Linux and register your license.

Cluster Properties | server1

[Info](#)
[Interconnect](#)
[NP Resolution](#)
[Timeout](#)
[Port No.](#)
[Port No.\(Mirror\)](#)
[Port No.\(Log\)](#)
[Monitor](#)
[Recovery](#)

[Alert Service](#)
[WebManager](#)
[API](#)
[Encryption](#)
[Alert Log](#)
[Delay Warning](#)
[Mirror Agent](#)
[Mirror Driver](#)

[JVM Monitor](#)
[Cloud](#)
[Extension](#)

Enable Alert Setting

☐

Edit

Mail Report

E-mail Address

Subject

EXPRESSCLUSTER

Mail Method

MAIL ▼

SMTP Settings

SNMP Trap

Destination Settings

Settings

Output the log level to syslog

☒

Use Chassis Identify

☐

☒ Execute Repeatedly

Interval 120 sec

☐ Do not Execute Repeatedly

Use Network Warning Light

☐

OK

Cancel

Apply

Enable Alert Setting

Configures whether or not to modify the default value of the alert settings. To modify the settings, click **Edit** to configure the destination address.

If you clear the checkbox, the destination address you have modified returns to the default settings temporarily.

For the predefined alert destinations, refer to "Messages reported by syslog, alert, mail, SNMP trap, and Message Topic" in "Error messages" in the "EXPRESSCLUSTER X SingleServerSafe Operation Guide".

E-mail Address (within 255 bytes)

Enter the mail address of alert destination. To specify multiple mail addresses, separate each of them by semi-colon ";".

Subject (within 127 bytes)

Enter the mail subject.

Mail Method

Configure the mail method.

- **MAIL**
This method uses the mail command. Check that a mail is sent to the mail address by using the mail command in advance.
- **SMTP**
This method allows mailing through direct communication with the SMTP server.

Output the log level to syslog

Output syslog messages produced by EXPRESSCLUSTER X SingleServerSafe during operation with their levels.

Use Chassis Identify

Not used.

Execute Repeatedly

Not used.

Do not Excute Repeatedly

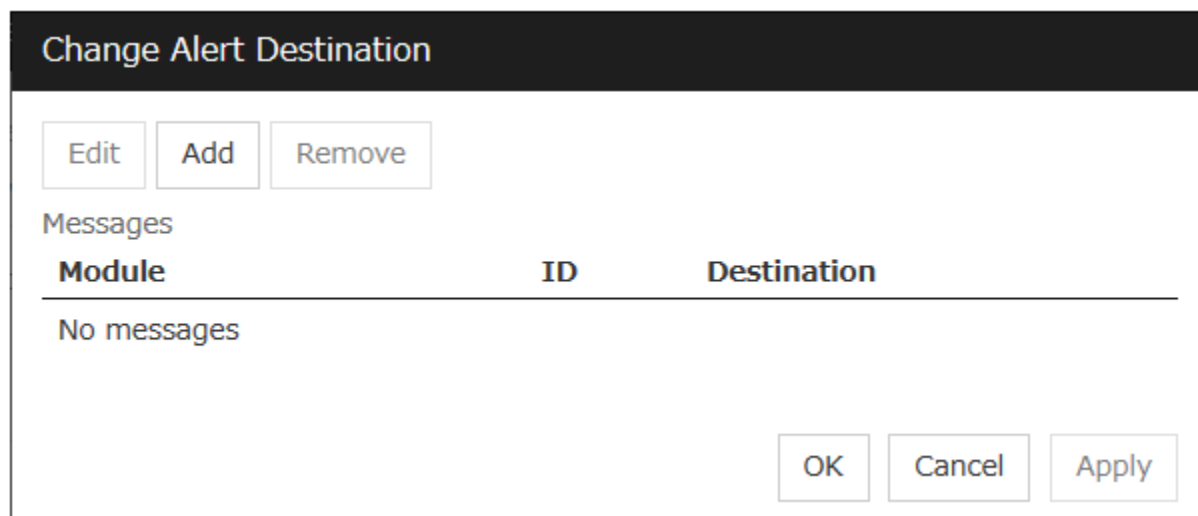
Not used.

Use Network Warning Light

Not used.

Change Alert Destination

Click **Edit** to display the **Change Alert Destination** dialog box.



The dialog box titled "Change Alert Destination" features a dark header bar. Below the header, there are three buttons: "Edit", "Add", and "Remove". Underneath these buttons, the word "Messages" is displayed. A table with three columns, "Module", "ID", and "Destination", is shown. The table is currently empty, with the text "No messages" centered below the column headers. At the bottom right of the dialog, there are three buttons: "OK", "Cancel", and "Apply".

Add

Add module types or event IDs for which the destinations are to be customized. Click **Add** to open the dialog box for entering the message.

Enter the message

Category

Core Modules

Module Type*

apisv

Event ID*

1

Destination

☒ System Log

☒ Alert Logs

☐ Mail Report

☐ SNMP Trap

☐ Message Topic

☐ Alert Extension

Command

Edit

Add

Remove

No commands

OK

Cancel

Category

Select a main category of module types.

Module Type (within 31 bytes)

Select the name of the module type for which you want to change the destination address.

Event ID

Enter the event type of the module type for which you want to change the destination address. For the event ID, refer to "Messages reported by syslog, alert, mail, SNMP trap, and Message Topic" in "Error messages" in the "EXPRESSCLUSTER X SingleServerSafe Operation Guide".

Destination

Select a message destination from the following options.

- System Log
This sends message to syslog of the OS.

- **Alert Logs**
This sends messages to the Alert logs.
- **Mail Report**
Uses the mail report function.
- **SNMP Trap**
Uses the SNMP trap transmission function to send messages.
- **Message Topic**
This sends message to Amazon SNS.
- **Alert Extension**
This executes the specified function by using the alert extension function. Modify the extension settings by using the **Add** button and/or the **Edit** button. (The command must be specified within four lines.)

Add

Add a command of the alert extension function. Click **Add** button to display the dialog box for entering a command. Up to 4 commands can be registered with one event ID.

Remove

Click this to remove a command of the alert extension function. Select the command, and then, click **Remove**.

Edit

Click this to modify a command of the alert extension function. Select the command, and then, click **Edit**.



Command (within 511 bytes)

Enter a command such as **SNMP trap** to execute reporting with the absolute path. The execution results of the specified command cannot be shown.

- **Keyword**
If you specify `% %MSG%`, the body message of the target event ID is inserted.
You cannot specify multiple `%%MSG%%` for one command.
Configure the command within 511 bytes including the description of `%%MSG%%`. As blank characters can be included in `%%MSG%%`, specify as `"%%MSG%%"` when specifying it for a command argument.

Setting example

```
/usr/local/bin/snmptrap -v1 -c HOME 10.0.0.2 0 10.0.0.1 1 0 ' ' 1 s "%%MSG%%"
```

SMTP Settings

Click **SMTP Settings** to display the **SMTP Settings** dialog box.

SMTP Settings

Mail Charset*

Send Mail Timeout*

30

sec

Subject Encode

☐

Edit

Add

Remove

SMTP Server List

Priority	SMTP Server
No SMTP Server	

↑

↓

Initialize

OK

Cancel

Apply

Mail Charset (within 127 bytes)

Configure the character set of the e-mails sent for mail report.

Send Mail Timeout (1 to 999)

Configure the timeout value for the communication with SMTP server.

Subject Encode

Configure whether or not to encode the subject of e-mails.

SMTP Server List

Use this button to display a SMTP server that has been configured. Only one SMTP server can be configured in this version.

Add

Use this button to add a SMTP server. Click **Add** to open the **Enter the SMTP Server** dialog box.


Remove

Select this to remove the SMTP server.

Edit

Use this button to modify the settings of SMTP server.

Enter the SMTP Server

SMTP Server*	<input type="text"/>
SMTP Port*	<input type="text" value="25"/>
Sender Address	<input type="text"/>
Enable SMTP Authentication	<input type="checkbox"/>
Authentication Method	<div>LOGIN </div>
User Name	<input type="text"/>
Password	<input type="password"/>

Change

OK

Cancel

SMTP Server (within 255 bytes)

Configure the IP address or host name of the SMTP server.

SMTP Port (1 to 65,535)

Configure the port number of the SMTP server.

Sender Address (within 255 bytes)

Configure the address from which mail report is sent.

Enable SMTP Authentication

Configure whether or not to enable SMTP authentication.

Method

Select a method of SMTP authentication.

User Name (within 255 bytes)

Configure the user name used for SMTP authentication.

Password (within 255 bytes)

Configure the password used for SMTP authentication.

Destination Settings

Edit

Add

Remove

Destination

Destination Server	SNMP Port	SNMP Version	SNMP Community Name
No Destination			

OK

Cancel

Apply

Destination

Displays the set SNMP trap transmission destinations. With this version, up to 255 SNMP trap transmission destinations can be set.

Add

Adds an SNMP trap transmission destination. Click **Add** to display the Change SNMP Destination dialog box.

Remove

Use **Remove** to remove the SNMP trap transmission destination settings.

Edit

Use **Edit** to modify the SNMP trap transmission destination settings.

Enter Destination

Destination Server*

SNMP Port*

SNMP Version

SNMP Community Name*

162

v2c

public

OK

Cancel

Destination Server (up to 255 bytes)

Configure the name of the SNMP trap transmission destination server.

SNMP Port No. (1 to 65535)

Configure the port number of the SNMP trap transmission destination.

SNMP Version

Configure the SNMP version of the SNMP trap transmission destination.

SNMP Community Name (up to 255 bytes)

Configure the SNMP community name of the SNMP trap transmission destination.

8.1.11 WebManager tab

Use this tab to configure the settings for the WebManager Server.

Cluster Properties | server1

Info

Interconnect

NP Resolution

Timeout

Port No.

Port No.(Mirror)

Port No.(Log)

Monitor

Recovery

Alert Service

WebManager

API

Encryption

Alert Log

Delay Warning

Mirror Agent

Mirror Driver

JVM Monitor

Cloud

Extension

Enable WebManager Service

☒

Communication Method

☒ HTTP

☐ HTTPS

Accessible number of clients*

64

Control connection by using password

Settings

Control connection by using client IP address

☐

Cluster WebUI Operation Log

Output Cluster WebUI Operation Log

☐

Log output path

File Size

0

MB

Integrated WebManager

Connection IP address

Settings

Tuning

If OS Authentication Method is configured, it is recommended to configure HTTPS for Communication Method.

OK

Cancel

Apply

Enable WebManager Service

The WebManager service is enabled.

- When selected:
The WebManager service is enabled.
- When cleared:
The WebManager service is disabled.

Communication Method

- HTTP
No encryption is used for communicating with a client.
- HTTPS
Encryption is used for communicating with a client.

Accessible number of clients (1 to 999)

Specify the number of client machines that can be connected.

Control connection by using password

Click **Settings** to display the **Password** dialog box.

Password Settings

☒ Cluster Password Method

Password for Operation

Change

Password for Reference

Change

☐ OS Authentication Method

Add

Remove

Edit

Authorized Group List

Group	Operation
No authorized groups	
Login Session Lifetime Period	<input type="text" value="1440"/> min
Automatic Logout Time Period	<input type="text" value="60"/> min
Lockout Threshold	<input type="text" value="0"/> time
Lockout Time	<input type="text" value="10"/> min

Initialize

ⓘ If OS Authentication Method is configured, it is recommended to configure HTTPS for Communication Method.

OK

Cancel

Apply

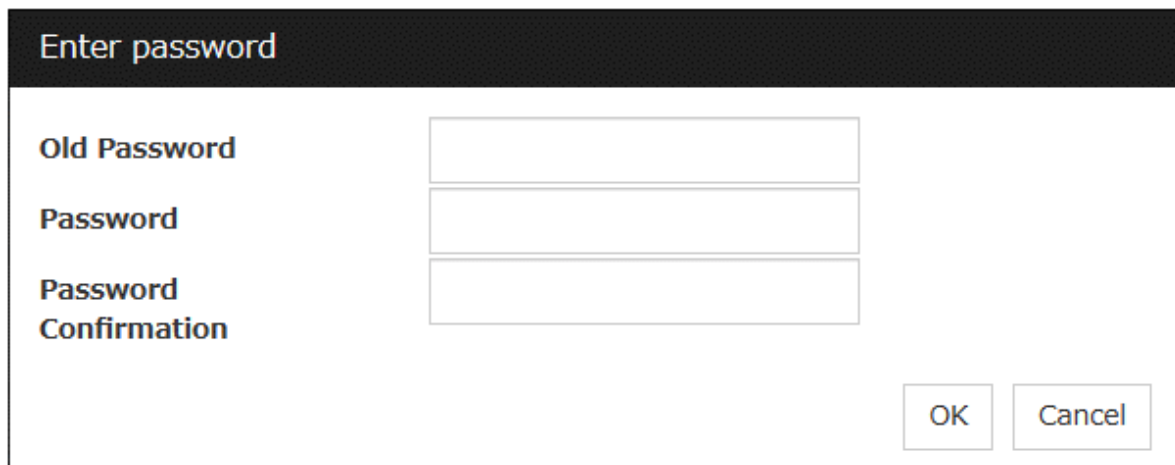
Cluster Password Method / OS Authentication Method

Choose a login method for Cluster WebUI from below.

- **Cluster Password Method**
Performs authentication with an operation/reference password you set.
- **OS Authentication Method**
Performs authentication with user and password of OS .

Cluster Password Method

- **Password for Operation**
Set a password that must be entered to enable connection to the Cluster WebUI in operation mode, config mode, or verification mode.
Click **Change** to display the **Enter Password** dialog box.
- **Password for Reference**
Set a password that must be entered to enable connection to the Cluster WebUI in reference mode. Click **Change** to display the **Enter Password** dialog box.



The screenshot shows a dialog box titled "Enter password". It contains three text input fields stacked vertically, labeled "Old Password", "Password", and "Password Confirmation". At the bottom right of the dialog, there are two buttons: "OK" and "Cancel".

- **Old Password: (Within 255 bytes)**
Enter the current password. If the password is not set, leave it blank.
- **New Password: (Within 255 bytes)**
Enter a new password. When deleting the old password, leave it blank.
- **Password Confirmation: (Within 255 bytes)**
Enter the password again which you entered in **New Password**.

OS Authentication Method

Users must be registered to the server in advance to login to Cluster WebUI. More specifically, a group must be registered to the server and the users must belong to it as the control permission of a cluster is assigned per group,

Add

Used to add a group to **Authorized Group List**. The **Group Name** dialog box appears when **Add** is clicked. To add a group, the **Operation** checkbox must be selected.



The dialog box has a dark header bar with the text "Group Name". Below the header, the text "Group Name*" is displayed in red. To the right of this text is a rectangular input field. At the bottom right of the dialog box are two buttons: "OK" and "Cancel".

- Group name (Within 255 bytes)
Enter a group name to which you want to give permission. The permission will be applied to the users belong to the group you entered. Groups must be registered to a server in advance.

Remove

Used to delete a group from **Authorized Group List**. Select a group you want to delete from **Authorized Group List**, and click **Remove**.

Edit

Used to edit a group. Select a group you want to edit from **Authorized Group List**, and click **Edit**. The **Group Name** dialog box with the selected group entered appears. The control permission does not change in this procedure.

Operation

Set control permission to a group registered in **Authorized Group List**.

- When the checkbox is selected:
Users belong to the group can control the cluster and view the status.
- When the checkbox is not selected:
Users belongs to the group can view the status only.

Login Session Lifetime Period (0 to 52560)

Time frame of login session. If this value is set to zero (0), the period becomes limitless.

Automatic Logout Time Period (0 to 99999)

Sets wait time for automatic logout if there is no communication between Cluster WebUI and the Web-Manager server. If this value is set to zero (0), no automatic logout occurs.

Lockout Threshold (0 to 999)

Locks out a client IP address which fails to login continuously. The client cannot login until **Lockout Time** passes once a client is locked out. If this value is set to zero (0), no client IP address is not be locked out.

Lockout Time (1 to 99999)

Sets lockout time for a client IP address. Once the time passes, the lockout is automatically released.

Initialize

Restores the default value. If **Initialize** is clicked, the values of **Login Session Lifetime Period**, **Automatic Logout Time Period**, **Lockout Threshold** and **Lockout Time** are restored to the default values.

Control connection by using client IP address

If selected, accesses are controlled by client IP addresses.

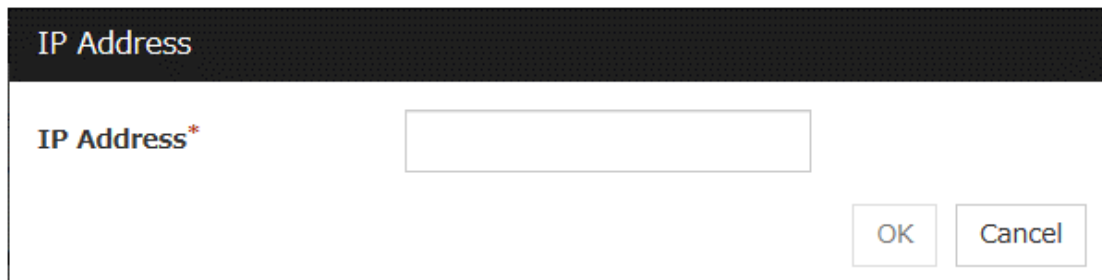
- When selected:

Add, **Remove** and **Edit** are displayed.

- When cleared:
Add, **Remove** and **Edit** are not displayed.

Add

Use **Add** to add an IP address to **Connection Permit Client IP Address List**. Click **Add** to display the **IP Address Settings** dialog box. Newly added IP addresses have the rights for the operation.

A screenshot of the 'IP Address' dialog box. It has a dark header bar with the text 'IP Address' in white. Below the header, there is a label 'IP Address*' in red text next to a white text input field. At the bottom right of the dialog, there are two buttons: 'OK' and 'Cancel'.

- **IP Address** (within 80 bytes)
Specify a client IP address that can be connected.
 - IP address: 10.0.0.21
 - Network address: 10.0.1.0/24

Remove

Use **Remove** to remove an IP address from **Connection Permit Client IP Address List**. Select the IP address to be removed from **Connection Permit Client IP Address List** and then click **Remove**.

Edit

Use **Edit** to edit an IP address. Select an IP address you want to edit from **Connection Permit Client IP Address List** and then click **Edit**. A dialog box where the specified IP address is preset is displayed. The rights for operating the edited IP addresses remain the same.

Note: The client IP address used to allow this connection is also used to restrict connections for external operations using clprexec.

Operation

Sets the operation rights for IP addresses that are registered in **Connection Permit Client IP Address List**.

- When selected:
A client can operate EXPRESSCLUSTER X SingleServerSafe and display its status.
- When cleared:
The client can only display the status of EXPRESSCLUSTER X SingleServerSafe.

Output Cluster WebUI Operation Log

Allows you to output the operation log of Cluster WebUI.

- If the check box is checked:
The operation log of Cluster WebUI is outputted.
- If the check box is not checked:
The operation log of Cluster WebUI is not outputted.

Log output path (Within 255 bytes)

Specify the output destination directory of the Cluster WebUI operation log with an absolute path consisting of ASCII characters.

File Size (1 to 10)

Specify the size of Cluster WebUI operation log.

When the log data reaches the specified size, a rotation occurs. Up to five generations of the data are saved.

IP address for Integrated WebManager

Click **Settings** to display the **IP address for the Integrated WebManager** dialog box.

IP address for Integrated WebManager

Add Remove

IP Address List

Priority	server1
No IP addresses	

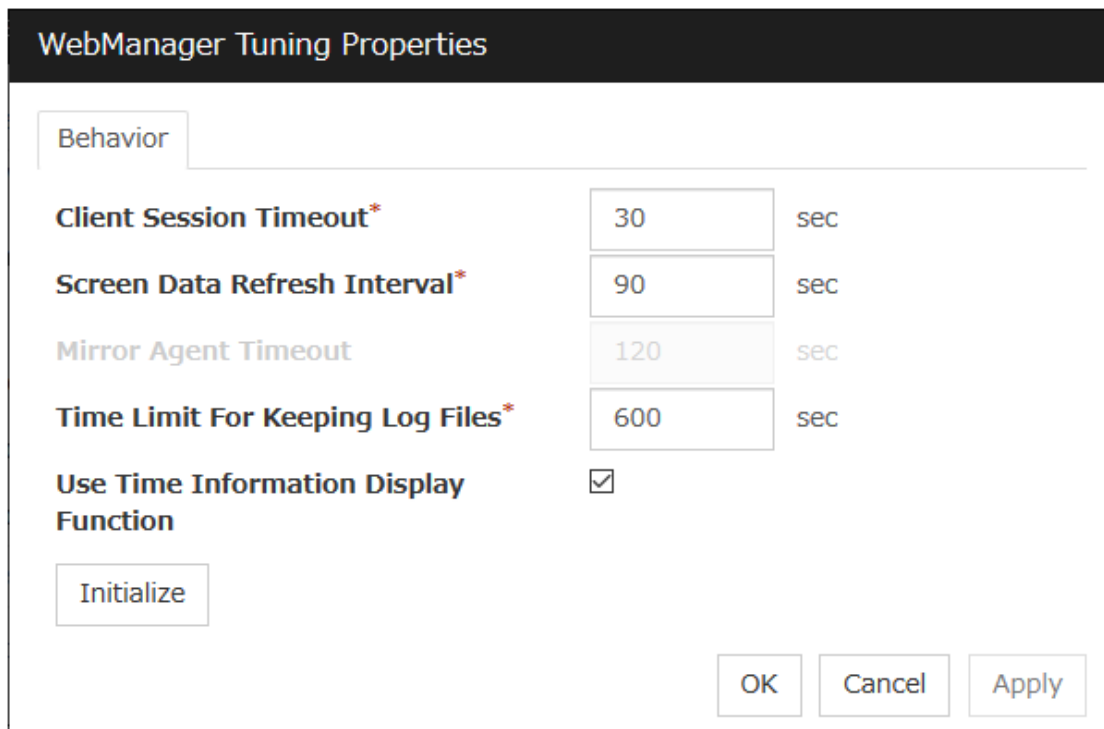
↑ ↓

OK Cancel Apply

- **Add**
Add IP addresses for the Integrated WebManager. Click the column cell of each server and select or enter IP address for the IP address of each server. For the communication path not connected to some server, set blank to the server cell of which the server is not connected.
- **Remove**
Remove the communication path. Select the communication path to be removed and click **Remove**, then the selected path is removed.
- **Priority**
When multiple IP addresses for Integrated WebManager are configured, the communication path with the smallest number in the **Priority** column is used preferentially for the internal communication among cluster servers. When changing the priority, click the arrows to change the order of the selected row.

Tuning

Use Tuning to tune the WebManager Server. Click Tuning displays the WebManager Tuning Properties dialog box.



The image shows a dialog box titled "WebManager Tuning Properties". It has a tab labeled "Behavior". Inside the dialog, there are five settings:

- Client Session Timeout***: A text box containing "30" followed by "sec".
- Screen Data Refresh Interval***: A text box containing "90" followed by "sec".
- Mirror Agent Timeout**: A text box containing "120" followed by "sec".
- Time Limit For Keeping Log Files***: A text box containing "600" followed by "sec".
- Use Time Information Display Function**: A checkbox that is checked.

At the bottom left is an "Initialize" button. At the bottom right are "OK", "Cancel", and "Apply" buttons.

- **Client Session Timeout (1 to 999)**
Specify the client session time-out. A timeout is determined if the time specified here elapses after the last communication between the WebManager server and the Cluster WebUI.
- **Reload Interval (0 to 999)**
At this time interval, the Cluster WebUI screen is refreshed.
- **Mirror Agent Timeout (1 to 999)**
Not used.
- **Time Limit For Keeping Log Files (60 to 43,200)**
Time limit determines when the log collection information temporarily saved on the server will be deleted. When the time specified here has elapsed, the log collection information will be deleted unless you save the file when the dialog box asking you if you save the log collection information is displayed.
- **Use Time Info**
Specify whether the time information display function is enabled or disabled.
 - When selected:
The time information display function is enabled.
 - When cleared:
The time information display function is disabled.
- **Initialize**
Used for initializing the value to the default value. Click **Initialize** to initialize all the items to their default values.

8.1.12 API tab

This tab allows you to set API services.

Enable API Service

Enables API services.

- When the checkbox is selected:
API services are enabled.
- When the checkbox is not selected:
API services are disabled.

Communication Method

- HTTP:
Does not use encryption for client communication.
- HTTPS:
Use encryption for client communication.

Control a privilege of operating clusters per group

Allows you to set and control a privilege of operating clusters per group.

- If the check box is checked:
Add, **Remove**, and **Edit** are displayed.
- If the check box is not checked:
Add, **Remove**, or **Edit** is not displayed.

Login users must be registered beforehand in the server which issues the request. More specifically, a group must be registered to the server and the users must belong to it as the control permission of a cluster is assigned per group.

- If the server belongs to a work group:
Register the same user name and group name in each of the servers which issues the request.

- If the server belongs to a domain:
Register users and groups in the domain.

Add

Allows you to add a group to **Authorized Group List**. Clicking **Add** displays the **Group Name** dialog box. Any group added here has the **Operation** box checked.

A dialog box titled "Group Name" with a dark header bar. The main area is white and contains a label "Group Name*" followed by a text input field. At the bottom right, there are two buttons: "OK" and "Cancel".

- Group name (up to 255 bytes)
Enter the name of a group. Users belonging to the group are to be given the permission.
The group must be registered to a server in advance.

Remove

Use this option to delete a group from **Authorized Group List**.

From **Authorized Group List**, select a group to be deleted. Then, click **Remove**.

Edit

Use this option to edit a group. From **Authorized Group List**, select a group to be edited. Then click **Edit**. The **Group Name** dialog box appears with the selected group entered. Editing the group here does not change its operation right.

Operation

Set operation rights for any of the groups registered in **Authorized Group List**.

- If the check box is checked:
The users of the group can operate the cluster and obtain its status.
- If the check box is not checked:
The users of the group can only obtain the status of the cluster.

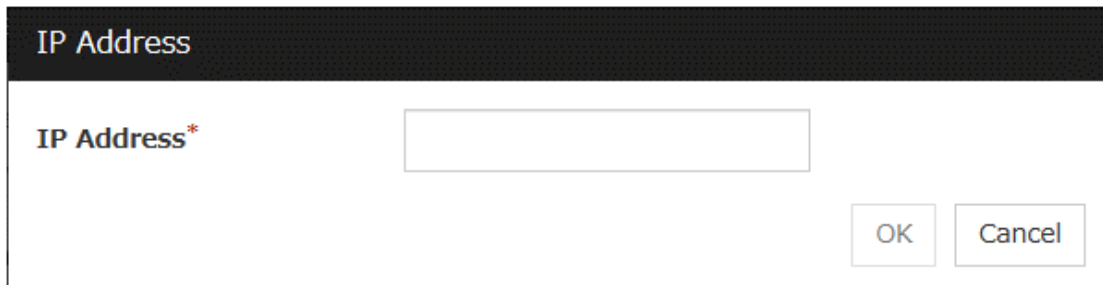
Control connection by using client IP address

Controls connections using client IP addresses.

- When the checkbox is selected:
Add, **Remove** and **Edit** are displayed.
- When the checkbox is not selected:
Add, **Remove** and **Edit** are not displayed.

Add

Use **Add** to add an IP address in **Connection Permit Client IP Address List**. Click **Add** to display the **IP Address** dialog box. Newly added IP addresses have the rights for the operation.



The dialog box has a dark header bar with the text "IP Address". Below the header, the label "IP Address*" is followed by a text input field. At the bottom right, there are two buttons: "OK" and "Cancel".

- **IP Address (Within 80 bytes)**

Specify a client IP address allowed for the connection.

- IP address: 10.0.0.21
- Network address: 10.0.1.0/24

Remove

Use **Remove** to remove an IP address from **Connection Permit Client IP Address List**. Select the IP address to be removed from **Connection Permit Client IP Address List** and then click **Remove**.

Edit

Use **Edit** to edit an IP address. Select the IP address you want to edit from **Connection Permit Client IP Address List** and then click **Edit**. A dialog box where the specified IP address is preset is displayed.

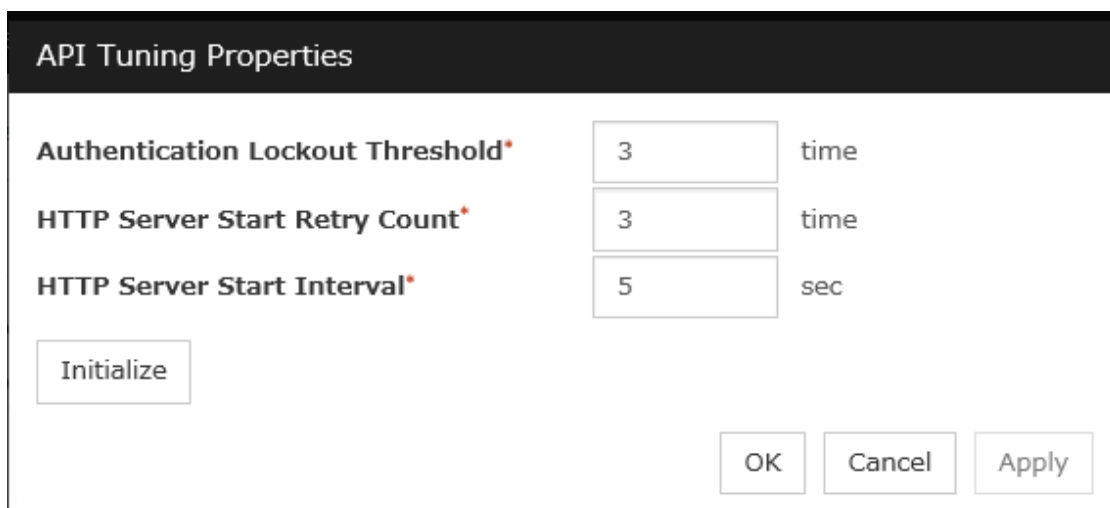
Operation

Set operation rights for any of the IP addresses registered in **Connection Permit Client IP Address List**.

- When the check box is selected:
A client can operate a cluster and display its status.
- When the check box is not selected:
A client can only view the status of a cluster.

Tuning.

Adjusts API services. Click **Tuning** to display **API Tuning Properties** dialog box.



The dialog box has a dark header bar with the text "API Tuning Properties". Below the header, there are three rows of settings:

Authentication Lockout Threshold*	<input type="text" value="3"/>	time
HTTP Server Start Retry Count*	<input type="text" value="3"/>	time
HTTP Server Start Interval*	<input type="text" value="5"/>	sec

Below these settings is an "Initialize" button. At the bottom right, there are three buttons: "OK", "Cancel", and "Apply".

- Authentication Lockout Threshold

Specify the number that counts continuous HTTP server authentication failures. If the counts reach this threshold, lockout is performed.

- HTTP Server Start Retry Count

Specify the retry number that counts API services failed to start a HTTP server.

- HTTP Server Start Interval

Specify the period of time between the time HTTP server start failure occurs and the time retry starts.

- Initialize

Use **Initialize** to restore the default value. All the items restore the default values when **Initialize** is clicked.

8.1.13 Encryption tab

Sets files and libraries used for encryption of the cluster related services.

Cluster Properties | cluster

Info Interconnect NP Resolution Timeout Port No. Port No.(Mirror) Port No.(Log) Monitor Recovery
Alert Service WebManager API Encryption Alert Log Delay Warning Mirror Agent Mirror Driver

Extension

Certificate File

Private Key File

SSL Library

Crypto Library

i The name and path of the OpenSSL library may be different.
Please confirm before setting.

OK Cancel Apply

Certificate File

Sets the server certificate file used for connecting to a client. Users need to prepare the server certificate file.

Private Key File

Sets the private key file used for connecting to a client. Users need to prepare the private key file.

SSL Library

Sets the SSL library file used for encryption and selects the SSL library file included in OpenSSL. Users need to change it based on the environment, such as an installation folder.

Crypto Library

Sets the Crypto library file used for encryption and selects the Crypto library file included in OpenSSL. Users need to change it based on the environment, such as an installation folder.

8.1.14 Alert Log tab

Configure the settings for the alert log.

Enable Alert Service

Select this to start alert service for the server.

- When selected:
Alert service is enabled.
- When cleared:
Alert service is disabled.

Max. Number to Save Alert Records (1 to 99,999)

Alert service for server can retain alert messages up to this number.

Alert Sync: Method

Not used.

Alert Sync: Communication Timeout (1 to 300)

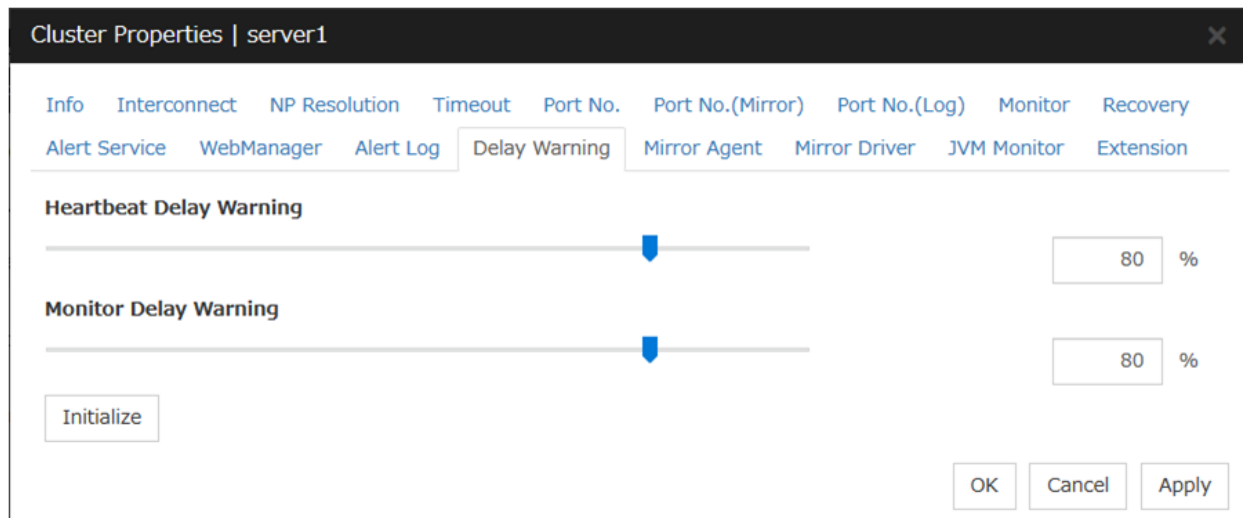
Not used.

Initialize

Used for initializing the value to the default value. Click **Initialize** to initialize all the items to their default values.

8.1.15 Delay Warning tab

Specify the settings for **Delay Warning** on this tab. For details about **Delay Warning**, see "9.7. Delay warning of a monitor resource" in "9. Monitoring details".



The screenshot shows a window titled "Cluster Properties | server1" with a close button (X) in the top right corner. Below the title bar is a tabbed interface with the following tabs: Info, Interconnect, NP Resolution, Timeout, Port No., Port No.(Mirror), Port No.(Log), Monitor, Recovery, Alert Service, WebManager, Alert Log, Delay Warning (selected), Mirror Agent, Mirror Driver, JVM Monitor, and Extension. The "Delay Warning" tab is active and displays two settings:

- Heartbeat Delay Warning:** A horizontal slider with a blue arrow pointing to the 80% mark. To the right of the slider is a text box containing "80" followed by a "%" symbol.
- Monitor Delay Warning:** A horizontal slider with a blue arrow pointing to the 80% mark. To the right of the slider is a text box containing "80" followed by a "%" symbol.

At the bottom left of the tab is an "Initialize" button. At the bottom right are three buttons: "OK", "Cancel", and "Apply".

Heartbeat Delay Warning (0 to 100)

Set a percentage of heartbeat timeout at which the heartbeat delay warning is issued. If the time for the percentage passes without any heartbeat response, the warning will be produced in an alert log. If you set 100, the warning will not be issued.

Monitor Delay Warning (0 to 100)

Set a percentage of monitor timeout at which the monitor delay warning is issued. If the time for the percentage passes without any monitor response, the warning will be produced in an alert log. If you set 100, the warning will not be issued.

Note:

If you specify 0% for the delay warning, an alert log is shown in every heartbeat interval and monitor interval. Setting 0% allows you to see the time spent for monitoring. This will be helpful particularly in a test operation. Make sure not to set low values such as 0% in the production environment.

8.1.16 Mirror Agent tab ~ For the Replicator/Replicator DR~

Not used.

8.1.17 Mirror driver tab ~ For Replicator/Replicator DR ~

Not used.

8.1.18 JVM monitor tab

Configure detailed parameters for the JVM monitor.

Note: To display the **JVM monitor** tab on the config mode of Cluster WebUI, you need to execute **Update Server Info** after the license for Java Resource Agent is registered.

Cluster Properties | server1

Info Interconnect NP Resolution Timeout Port No. Port No.(Mirror) Port No.(Log) Monitor Recovery
Alert Service WebManager API Encryption Alert Log Delay Warning Mirror Agent Mirror Driver

JVM Monitor Cloud Extension

Java Installation Path

Maximum Java Heap Size* MB

Java VM Additional Option

Log Output Setting

Resource Measurement Setting

Connection Setting

Load Balancer Linkage Settings*

Action Timeout* sec

Java Installation Path (up to 255 bytes)

Set the Java VM install path used by the JVM monitor. Specify an absolute path using ASCII characters. Do not add "/" to the end of the path. Specification example: /usr/java/jdk-9

Maximum Java Heap Size (7 to 4096)

Set, in megabytes, the maximum Java VM heap size used by the JVM monitor (equivalent to -Xmx of the Java VM startup option).

Java VM Additional Option (up to 1024 bytes)

Set the Java VM startup option used by the JVM monitor. However, specify -Xmx in the [Maximum Java Heap Size]. Specification example: -XX:+UseSerialGC

Log Output Setting

Click the **Settings** button to open the Log Output Setting dialog box.

Log Output Setting

Log Level* INFO

Generation* 10

Rotation Type

☒ File size Max Size* 3072 KB

☐ Time Start Time 00:00

Interval 24 hours

Initialize

OK Cancel Apply

Resource Measurement Setting

Click the **Settings** button to open the Resource Measurement Setting dialog box.

Connection Setting

Click the **Settings** button to open the Connection Setting dialog box.

Load Balancer Linkage Settings

Select the load balancer type and then click the **Settings** button. The **Load Balancer Linkage Settings** dialog box appears.

Select the load balancer type from the list. To perform load balancer linkage, select the load balancer you are using. To cancel the load balancer linkage, select **No linkage**.

Action Timeout (30 to 300)

Set the timeout value of [Command] specified in each window of the JVM monitor. This setting becomes common for all the [Command] items.

Log Output Setting

Clicking **Settings** displays the **Log Output Setting** dialog box.

Log Level

Select the log level of the log output by the JVM monitor.

Generation (2 to 100)

Set the number of generations to be retained for log output by the JVM monitor.

When **Period** is selected for **Rotation Type**, the rotation count is reset when cluster is suspended. Therefore, note that log files under the <EXPRESSCLUSTER_install_path>log/ha/jra increase per cluster suspend.

Rotation Type

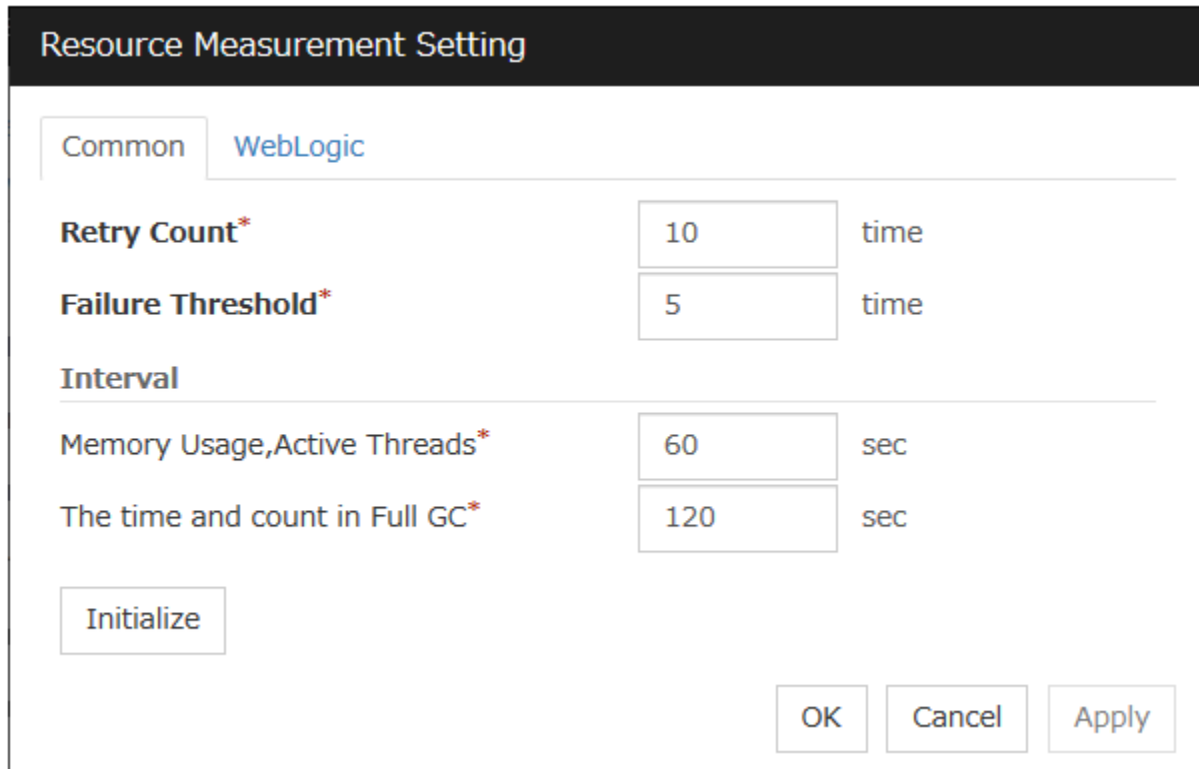
Select a rotation type for the log output by the JVM monitor. If you select **File Capacity** as the rotation type, set the maximum size (200 to 2097151), in kilobytes, for each log file such as the JVM operation log. If you select **Period** as the rotation type, set the log rotation start time in "hh:mm" format (hh: 0 to 23, mm: 0 to 59) and the rotation interval (1 to 8784) in hours.

Initialize

Clicking **Initialize** returns the log level, generation, and rotation type items to their default values.

Resource Measurement Setting [Common]

Clicking **Settings** displays the **Resource Measurement Setting** dialog box. For details on the scheme for error judgment by the JVM monitor, see "6. [Monitor resource details](#)".



The dialog box titled "Resource Measurement Setting" has two tabs: "Common" (selected) and "WebLogic". It contains several settings with input fields and units:

Setting	Value	Unit
Retry Count*	10	time
Failure Threshold*	5	time
Interval		
Memory Usage, Active Threads*	60	sec
The time and count in Full GC*	120	sec

At the bottom left is an "Initialize" button. At the bottom right are "OK", "Cancel", and "Apply" buttons.

Retry Count (1 to 1440)

Set a resource measurement retry count to be applied if the JVM monitor fails in resource measurement.

Error Threshold (1 to 10)

Set the number of times abnormal judgment is performed when the usage of the Java VM or the application server resources collected by the JVM monitor via resource measurement continuously exceed the customer-defined threshold.

Memory Usage, Active Threads (15 to 600)

Set the interval at which the JVM monitor measures the memory usage and active thread count.

The time and count in Full GC (15 to 600)

Set the **interval** at which the JVM monitor measures the time and count in Full GC execution.

Initialize

Clicking **Initialize** returns the retry count, error threshold, and interval items to their default values.

Resource Measurement Setting [WebLogic]

Clicking **Settings** displays the **Resource Measurement Setting** dialog box. For details on the scheme for error judgment by the JVM monitor, see "6. [Monitor resource details](#)".

Resource Measurement Setting

Common

WebLogic

Retry Count*

3

time

Failure Threshold*

5

time

Interval

The number of request*

60

sec

The average number of the request*

300

sec

Initialize

OK

Cancel

Apply

Retry Count (1 to 5)

Set the resource measurement retry count to be applied if the JVM monitor fails in resource measurement.

Error Threshold (1 to 10)

Set the number of times abnormal judgment is to be performed when the usage of the Java VM or the application server resources collected by the JVM monitor via resource measurement continuously exceed the customer-defined threshold.

The number of request (15 to 600)

Set the interval at which the JVM monitor measures the number of work manager or thread pool requests during WebLogic monitor.

The average number of the request (15 to 600)

Set the interval at which the JVM monitor measures the average number of work manager or thread pool requests during WebLogic monitor. Set a value that is an integer multiple of the value set in **The number of request**.

Initialize

Clicking **Initialize** returns the retry count, error threshold, and interval items to their default values.

Connection Setting

Clicking **Settings** displays the **Connection Setting** dialog box.

Connection Setting		
Management Port*	25500	
Retry Count*	3	time
Waiting time for reconnection*	60	sec
<div>Initialize</div>		
<div>OK Cancel Apply</div>		

Management Port (1 to 65535)

Sets the port number internally used by the JVM monitor resource. Make sure not to set the port number that has been used by other functions or programs. Set the number of the port connected to the monitor target Java VM. Do not set 32768 to 61000.

Retry Count (1 to 5)

Set the retry count to be applied if connection to the monitor target Java VM fails.

Waiting time for reconnection (15 to 60)

Set the interval at which the JVM monitor retries connection if it fails in Java VM connection.

Initialize

Clicking **Initialize** sets the management port, retry count, and wait time for reconnection items to their default values.

Load Balancer Linkage Settings

If you select other than BIG-IP LTM as the load balancer type and then click the **Settings** button, the **Load Balancer Linkage Settings** dialog box appears.

Load Balancer Linkage Settings		
Management Port for Load Balancer Linkage*	25550	
Health Check		
Health Check Linkage Function	<input type="checkbox"/>	
Directory containing HTML files		
HTML File Name		
HTML Renamed File Name		
Retry Count for renaming	3	time
Wait time for retry	3	sec
<div>Initialize</div>		
<div>OK Cancel Apply</div>		

Management Port for Load Balancer Linkage (1 to 65535)

Set the port number used by the load balancer linkage function. Do not set 32768 to 61000.

Health Check Linkage Function

Set whether to use the load balancer health check function if the monitor target Java VM detects a failure.

Directory containing HTML files (up to 1023 bytes)

Set the directory in which the HTML file used by the load balancer health check function is stored. Specify an absolute path using ASCII characters. Do not add "/" to the end of the path.

HTML File Name (up to 255 bytes)

Set the HTML file name used by the load balancer health check function. Specify this filename using ASCII characters.

HTML Renamed File Name (up to 255 bytes)

Set the HTML renamed file name used by the load balancer health check function. Specify this file name using ASCII characters. Specify an HTML renamed file name that is different from the HTML file name.

Retry count for renaming (0 to 5)

Set the number of times HTML file renaming is retried if it fails.

Wait time for retry (1 to 60)

Set the interval at which HTML file renaming is retried if it fails.

Initialize

Clicking **Initialize** returns the management port for load balancer linkage, health check linkage function, directory containing HTML files, HTML file name, HTML renamed file name, retry count for renaming and wait time for retry items to their default values.

Load Balancer Linkage Settings

Select BIG-IP LTM as the load balancer type and then click the **Settings** button. The **Load Balancer Linkage Settings** dialog box appears.

Load Balancer Linkage Settings

Management Port for Load Balancer Linkage*

Connect Info

mgmt IP address*

User Name*

Password*

Communications Port*

List of address of distributed nodes

Server	IP Address
<input type="text"/>	<input type="text"/>

Management Port for Load Balancer Linkage (1 to 65535)

Set the port number used by the load balancer linkage function. Do not set 42424 to 61000.

mgmt IP address

Set the BIG-IP LTM IP address.

User Name (up to 255 bytes)

Set the BIG-IP LTM management user name.

Password (up to 255 bytes)

Set the BIG-IP LTM management user password.

Communications Port (1 to 65535)

Set the communication port number for BIG-IP LTM.

Add

Add the server name and IP address for the distributed node. For the server name, specify the EXPRESSCLUSTER server name. For the IP address, specify the value set to **Members** in **LocalTraffic** -

Pools:PoolList - Relevant pool - Members of BIG-IP Configuration Utility. To change the value, select the line and directly edit the description.

Remove

Remove the server name and IP address for the distributed node. Select the line to be removed and then click **Remove**. The selected server is removed.

Initialize

Clicking **Initialize** returns the management port for load balancer linkage, management user name, and communication port number to the default settings.

8.1.19 Cloud tab

Configure functions for cloud environments.

Cluster Properties | cluster

Info Interconnect NP Resolution Timeout Port No. Port No.(Mirror) Port No.(Log) Monitor Recovery
Alert Service WebManager API Encryption Alert Log Delay Warning Mirror Agent Mirror Driver
JVM Monitor **Cloud** Extension

Amazon SNS

Enable Amazon SNS Linkage Function ☐

TopicArn

Amazon CloudWatch

Enable Amazon CloudWatch Linkage Function ☐

Namespace

Interval for Sending Metrics sec

OK Cancel Apply

Enable Amazon SNS linkage function

Enable or disable the Amazon SNS linkage function.

- If the check box is checked:
The Amazon SNS linkage function is enabled.
Amazon SNS is used as a destination of EXPRESSCLUSTER messages.
By default, the messages are sent as shown in "Error messages" in the "EXPRESSCLUSTER X SingleServerSafe Operation Guide": the "o"-marked lines of the [5] column in the table of "Messages reported by syslog, alert, mail, SNMP trap, and Message Topic".
To send other messages:
Go to **Cluster Properties** -> the **Alert Service** tab -> **Change Alert Destination** -> **Destination**, and then select **Message Topic**.
- If the check box is not checked:
The Amazon SNS linkage function is disabled.

TopicArn

Set TopicArn for the Amazon SNS linkage function.

Enable Amazon CloudWatch linkage function

Enable or disable the Amazon CloudWatch linkage function.

- If the check box is checked:
The Amazon CloudWatch linkage function is enabled.
Amazon CloudWatch is informed of the monitoring process time taken by the monitor resource.
- If the check box is not checked:
The Amazon CloudWatch linkage function is disabled.

Note: Using the Amazon CloudWatch linkage function requires turning on **Enable Amazon CloudWatch linkage function**, and enabling **Send polling time metrics** of the **Monitor (common)** tab for the target monitor resource.

Namespace

Set Namespace for the Amazon CloudWatch linkage function.

Interval for Sending Metrics

Set the frequency of informing Amazon CloudWatch of the monitoring process time taken by the monitor resource.

8.1.20 Extension tab

Configure other cluster settings.

Cluster Properties | server1

Info
Interconnect
NP Resolution
Timeout
Port No.
Port No.(Mirror)
Port No.(Log)
Monitor
Recovery
Alert Service
WebManager
API
Encryption
Alert Log
Delay Warning
Mirror Agent
Mirror Driver

Extension

Reboot Limitation

Max Reboot Count*
3
time

Max Reboot Count Reset Time*
60
min

Use Forced Stop
☐

Forced Stop Action
BMC Reset

Forced Stop Timeout
3
sec

Virtual Machine Forced Stop Setting
Settings

Execute Script for Forced Stop
☐
Script Settings

Use CPU Frequency Control
☐

Start Automatically After System Down
☒

Exclude Mount/Unmount Commands
☒

Grace period of server group failover policy
0
sec

Disable Cluster Operation (Recommended for maintenance purposes)

Group Automatic Startup
☐

Recovery Operation when Group Resource Activation Failure Detected
☐

Recovery Operation when Group Resource Deactivation Failure Detected
☐

Recovery Action when Monitor Resource Failure Detected
☐

Cluster Statistics

Group
☒
File Size
1
MB

Group Resource
☒
File Size
1
MB

Monitor Resource
☒
File Size
10
MB

Initialize

OK
Cancel
Apply

Reboot Limitation

In case that the final action of the group resource and the monitor resource when an error is detected is configured so that the OS reboot accompanies, reboot may be repeated infinitely. By setting the reboot limit, you can prevent repeated reboots.

- **Max Reboot Count** (0 to 99)

Specify how many times the operating system can reboot. The number specified here is separately counted for group resource and monitor resource.

- **Max Reboot Count Reset Time** (0 to 999)

When the max reboot count is specified, if the operation from the cluster startup keeps running normally for the time specified here, the reboot count is reset. The time specified here is separately counted for group resource and monitor resource.

Note: If **Max Reboot Count Reset Time** is set to 0, the reboot count is not reset. When you reset the reboot count, use the `clpregctrl` command.

Use Forced Stop

Not used.

Forced Stop Action

Not used.

Forced Stop Timeout (0 to 99)

Not used.

Virtual Machine Forced Stop Setting

Not used.

Execute Script for Forced Stop

Not used.

Script Settings

Not used.

Use CPU Frequency Control

Select the checkbox when you use CPU frequency control.

Select the checkbox to set the CPU frequency to high at group activation and set the CPU frequency of the server to low after group deactivation.

Clear the checkbox to disable the CPU frequency control.

When CPU frequency control is performed by using a command, the settings changed by the command are given higher priority regardless of whether the group is started or stopped. Note that the settings changed by the command is discarded after the server is stopped/started or suspended/resumed, so that CPU frequency is controlled by the server.

- When selected:
CPU frequency control is performed.
- When cleared:
CPU frequency control is not performed.

Note: To perform CPU frequency control, the frequency must be changeable with a BIOS setting, the CPU must support frequency control by the OS power management function, and the kernel must support such control.

Start Automatically After System Down

Set whether to prohibit automatic startup of the cluster service at the next OS startup when the server has been stopped by a means other than cluster shutdown or cluster stop, or when cluster shutdown or stop does not terminate normally.

Exclude Mount/Unmount Commands

Not used.

Grace period of server group failover policy (0 to 99999)

Not used.

Disable cluster operation

- Group Automatic Startup
 - If the check box is checked:
That disables automatic group startup.
 - If the check box is not checked:
That does not disable automatic group startup.
- Recovery operation when a group resource activation error is detected
 - If the check box is checked:
That disables recovery on detecting the activation failure of a group resource.
 - If the check box is not checked:
That does not disable recovery on detecting the activation failure of a group resource.
- Recovery operation when a group resource deactivation error is detected
 - If the check box is checked:
That disables recovery on detecting the deactivation failure of a group resource.
 - If the check box is not checked:
That does not disable recovery on detecting the deactivation failure of a group resource.
- Recovery action when a monitor resource error is detected
 - If the check box is checked:
That disables recovery on detecting the failure of a monitor resource.
 - If the check box is not checked:
That does not disable recovery on detecting the failure of a monitor resource.

Note:

Recovery on detecting the failure of a monitor resource cannot be disabled for user mode monitor resources.

Disabling recovery on detecting the failure of a monitor resource does not affect message receive monitor resources .

Cluster Statistics

You can collect and see data on the cluster operation such as the required time of a group failover and that of resource activation.

For more information, see "Cluster statistics information collection function" in "The system maintenance information" in the "Maintenance Guide" of EXPRESSCLUSTER X.

- When the check box is selected

The cluster statistical information is collected.

- **File size** (1 to 99)

Specify the size of the cluster statistical information file.

When the collected information reaches the specified size, rotation occurs to save up to two generations of the data.

- When the check box is cleared

The cluster statistical information is not collected.

Initialize

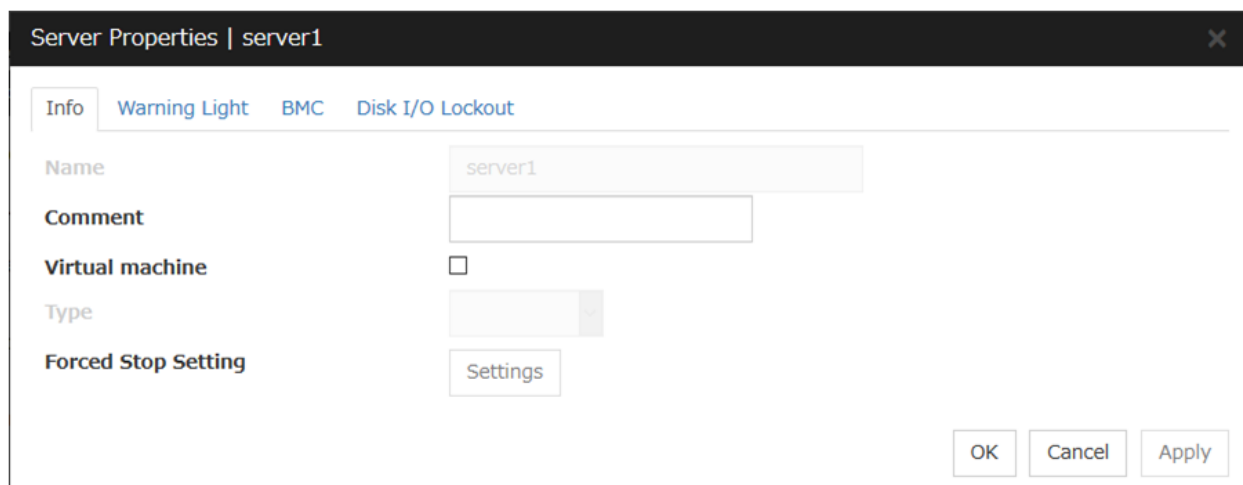
Used for initializing the value to the default value. Click Initialize to **initialize** all the items to their default values.

8.2 Server properties

In the **Server Properties** window, you can edit the special settings of the server.

8.2.1 Info tab

You can display the server name, and register and make a change to a comment on this tab.

The screenshot shows a window titled "Server Properties | server1". It has four tabs: "Info" (selected), "Warning Light", "BMC", and "Disk I/O Lockout". The "Info" tab contains the following fields: "Name" with a text box containing "server1", "Comment" with an empty text box, "Virtual machine" with an unchecked checkbox, "Type" with a dropdown menu, and "Forced Stop Setting" with a "Settings" button. At the bottom right are "OK", "Cancel", and "Apply" buttons.

Name:

The selected server name is displayed. You cannot change the name here.

Comment (within 127 bytes)

You can specify a comment for the server. You can only enter one byte English characters.

Virtual Machine

Specify whether this server is a virtual machine (guest OS).

- On
If selected, the server is a virtual machine (guest OS). You can configure this virtual machine.
- Off
If selected, the server is a physical machine. You cannot configure a virtual machine.

Type

Specify the type of virtual infrastructure.

- vSphere
Virtual infrastructure provided by VMware, Inc.
- KVM
Linux kernel virtual infrastructure.
- XenServer
Virtual infrastructure provided by Citrix Systems, Inc.
- Container
Virtual infrastructure provided by Oracle Systems, Inc.
Not used.

- Hyper-V
Virtual infrastructure provided by Microsoft Corporation.
- other
Specify this option to use any other virtual infrastructure.

Forced Stop Setting

Not used.

8.2.2 Warning Light tab

Not used.

8.2.3 BMC tab

Not used.

8.2.4 Disk I/O Lockout tab

Not used.

8.3 Number of components of each type that can be registered

	version	You can register up to
Server	4.0.0-1 or later	1
group	4.0.0-1 or later	128
Group resource (Per group)	4.0.0-1 later	256
Monitor resource	4.0.0-1 or later	512

MONITORING DETAILS

This chapter provides details about how several different types of errors are detected, in order to help you find out how to best set up the monitor interval, monitor timeout, and monitor retry count.

This chapter covers:

- *9.1. Always monitor and Monitors while activated*
- *9.2. Monitor resource monitor interval*
- *9.3. Action when an error is detected by a monitor resource*
- *9.4. Recovering from a monitor error (normal)*
- *9.5. Activation or deactivation error for the recovery target during recovery*
- *9.6. Recovery/pre-recovery action script*
- *9.7. Delay warning of a monitor resource*
- *9.8. Waiting for a monitor resource to start monitoring*
- *9.9. Limiting the reboot count for error detection*

9.1 Always monitor and Monitors while activated

When **Always monitor** is selected, monitoring begins when the server is up and running and EXPRESSCLUSTER X SingleServerSafe is ready to run.

When **Monitors while activated** is selected, monitoring is performed from when a specified group is activated (until that group is deactivated (stopped)).

Some monitor resources have a fixed monitor timing, while others allow you to choose between two monitor timing options.

- (1) Server startup: Server startup
- (2) Group activation: Group activation
- (3) Group deactivation: Group deactivation
- (4) Server stops: Server stop

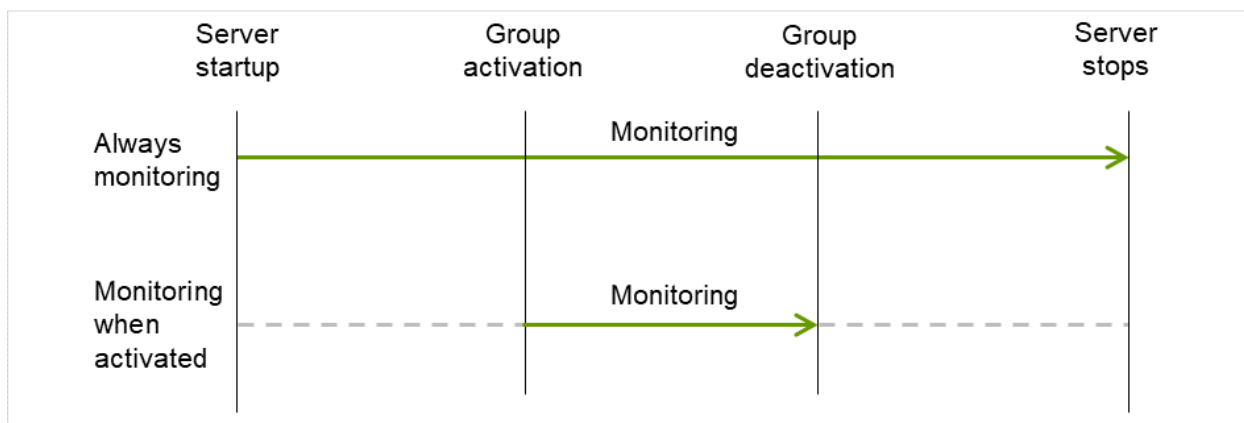


Fig. 9.1: Always monitor and Monitors while activated for a monitor resource

9.2 Monitor resource monitor interval

All monitor resources monitor their targets at every monitoring interval.

Following are different timelines illustrating how a monitor resource performs monitoring with or without an error based on the specified monitor interval.

When no error is detected

The following figure describes the operation when monitoring is started or restarted upon the activation of a server. When the main monitoring process receives a monitoring result, the monitoring is repeatedly started at the monitoring intervals.

Examples of behavior when the following values are set.

<Monitor>

Monitor Interval 30 sec

Monitor Timeout 60 sec

Monitor Retry Count 0 times

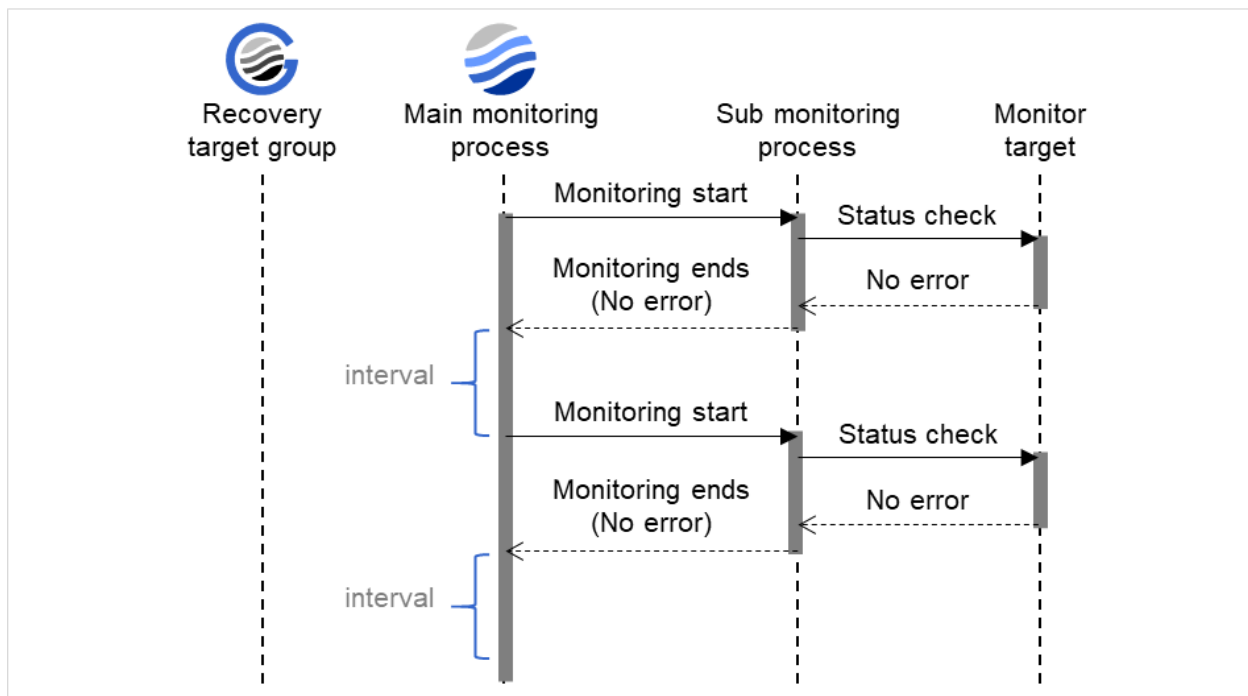


Fig. 9.2: Monitoring interval (no error detected)

When an error is detected (without monitor retry setting)

The figure below describes the flow where the occurrence of an error in the monitor target is detected. When the main monitoring process receives a monitoring result (an error), the failover of the recovery target group is executed.

After an error occurs, it is detected next time monitoring is performed, and then the recovery target is reactivated.

Examples of behavior when the following values are set.

<Monitor>

Monitor Interval 30 sec

Monitor Timeout 60 sec

Monitor Retry Count 0 times

<Error Detection>

Recovery Action Restart the recovery target

Recovery Target Group

Recovery Script Execution Count 0 time

Reactivation Threshold: One time

Final Action No Operation

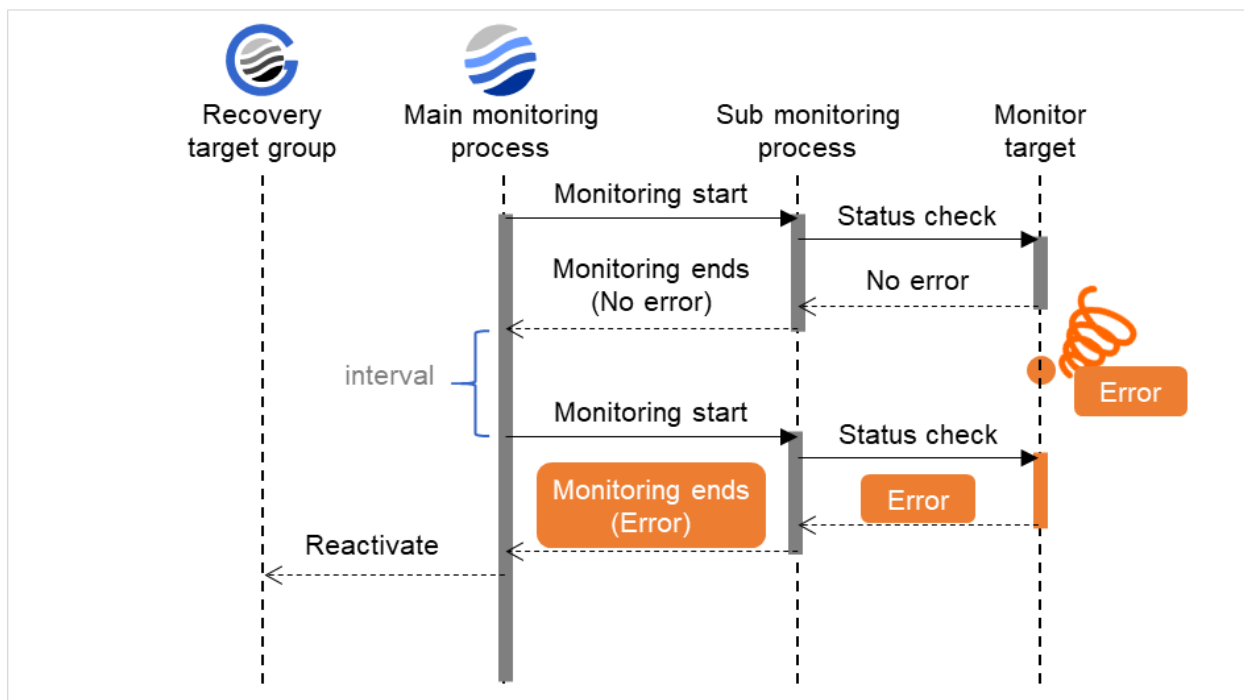


Fig. 9.3: Monitoring interval (an error detected, without monitor retry settings)

When an error is detected (with monitor retry settings)

The figure below describes the flow where the occurrence of an error in the monitor target is detected. When the main monitoring process receives a monitoring result (an error), the failover of the recovery target group is executed until the set monitoring retry count is reached. If the monitoring target still does not recover, perform the failover of the recovery target group.

After an error occurs, it is detected next time monitoring is performed, and then, if recovery cannot be achieved before the monitor retry count is reached, the recovery target is reactivated.

Examples of behavior when the following values are set.

<Monitor>

Monitor Interval 30 sec

Monitor Timeout 60 sec

Monitor Retry Count 2 times

<Error Detection>

Recovery Action Restart the recovery target

Recovery Target Group

Recovery Script Execution Count 0 time

Reactivation Threshold: One time

Final Action No Operation

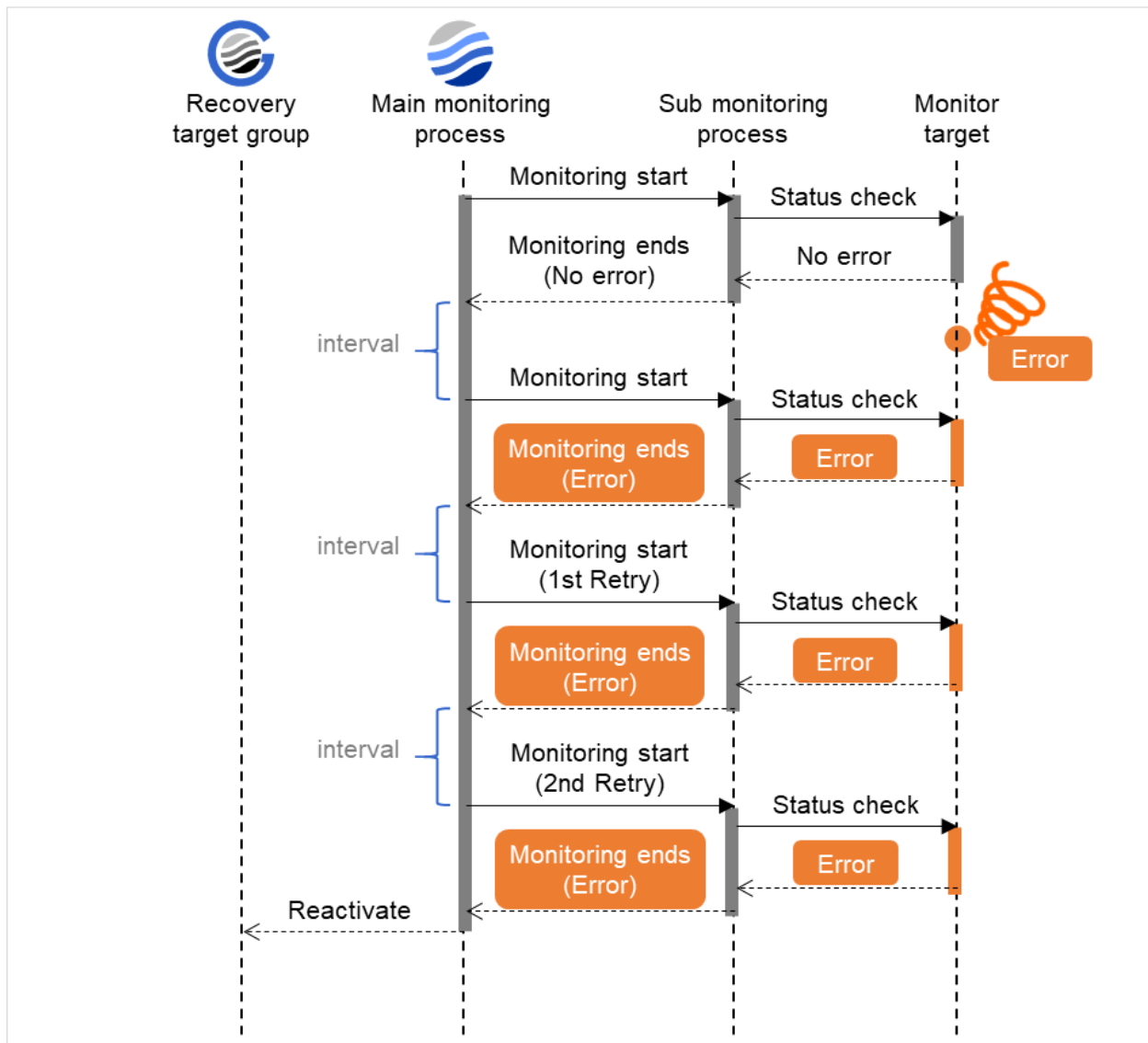


Fig. 9.4: Monitoring interval (an error detected, with monitor retry settings)

When an error is detected (without monitor retry settings)

In the figure below, the monitoring process has not been ended within the specified duration of time. After the main monitoring process has started the monitoring, if the monitoring result could not be obtained within the specified monitoring timeout, the failover of the recovery target group is executed.

After a monitor timeout occurs, the recovery target is immediately reactivated for the recovery action.

Examples of behavior when the following values are set.

<Monitor>

Monitor Interval 30 sec

Monitor Timeout 60 sec

Monitor Retry Count 0 times

<Error Detection>

Recovery Action Restart the recovery target

Recovery Target Group

Recovery Script Execution Count 0 time

Reactivation Threshold: One time

Final Action No Operation

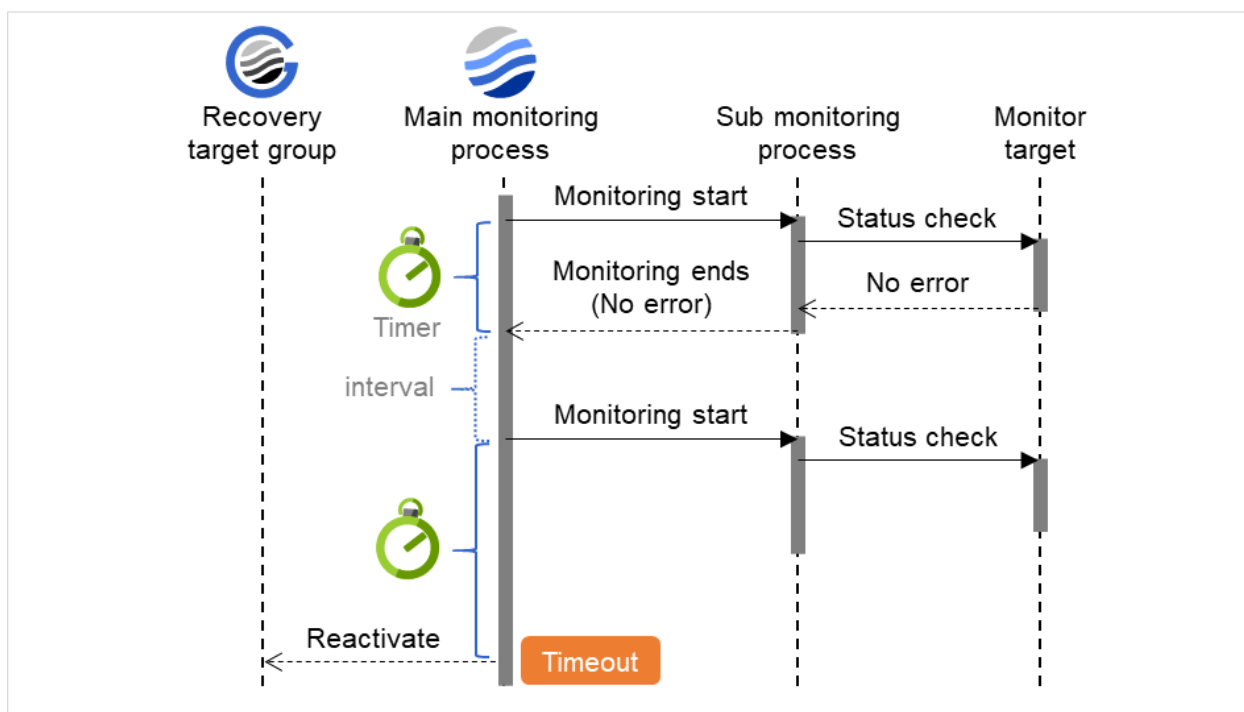


Fig. 9.5: Monitoring interval (a monitoring timeout detected, without monitor retry settings)

When a monitoring timeout is detected (with monitor retry setting)

In the figure below, the monitoring process has not been ended within the specified duration of time. After the main monitoring process has started the monitoring, if the monitoring result could not be obtained within the specified monitoring timeout, the monitoring is executed until the set monitoring retry count is reached. If the monitoring result could not be obtained, perform the failover of the recovery target group.

After a monitor timeout occurs, another monitor attempt is made and, if it fails, the recovery target is reactivated.

Examples of behavior when the following values are set.

<Monitor>

Monitor Interval 30 sec

Monitor Timeout 60 sec

Monitor Retry Count 1 time

<Error Detection>

Recovery Action Restart the recovery target

Recovery Target Group

Recovery Script Execution Count 0 time

Reactivation Threshold: One time

Final Action No Operation

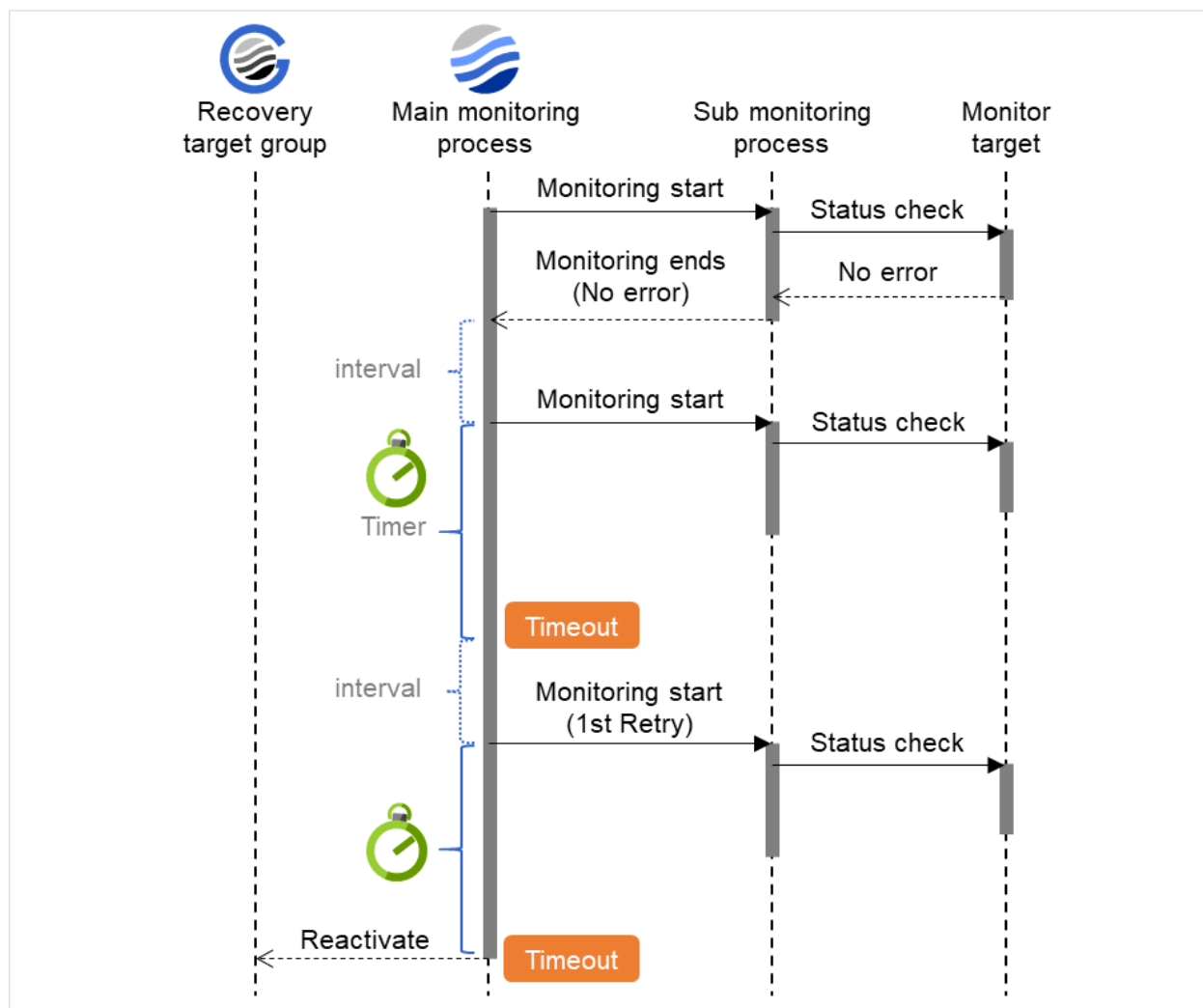


Fig. 9.6: Monitoring interval (a monitoring timeout detected, with monitor retry settings)

9.3 Action when an error is detected by a monitor resource

When an error is detected, the following recovery actions are taken against the recovery target in sequence:

- Execution of recovery script: this takes place when an error is detected in a monitor target.
- Reactivation of the recovery target: this takes place if the recovery script is executed up to the recovery script execution count. When the execution of a pre-reactivation script is specified, reactivation starts after that script has been executed.
- When an error is detected in the monitor target, the recovery target is reactivated. (This is not the case if **Execute Only Final Action** is selected for **Recovery Action** or if **Maximum Reactivation Count** is set to 0 in **Custom**).
- If reactivation fails or the error is detected again after reactivation, the final action is performed. (If **Maximum Reactivation Count** is set to 2 or greater in **Custom**, reactivation is retried the specified number of times.).

No recovery action is taken if the status of the recovery target is:

Recovery Target	Status	Reactivation ⁴	Final Action ⁵
Group/Group Resource	Already stopped	No	No
	Being activated/stopped	No	No
	Already activated	Yes	Yes
	Error	Yes	Yes
Local Server	-	-	Yes

Yes: Recovery action is taken No: Recovery action is not taken

Note: Do not perform the following operations by using the Cluster WebUI or command line while recovery processing is changing (reactivation -> final action), if a group resource (such as an EXEC resource or VM resource) is specified as a recovery target and when a monitor resource detects an error.

- Stopping/suspending the server
- Starting/stopping a group

If you perform the above-mentioned operations while recovery caused by detection of an error by a monitor resource is in progress, other group resources of the group with an error may not stop.

However, you can perform them when the final action is completed.

When the status of the monitor resource recovers from the error (becomes normal), the settings for the reactivation count and whether to execute the final action are reset. Note that, when a group or group resource is specified as the recovery target, these counters are reset only when the status of all the monitor resources for which the same recovery target is specified become normal.

An unsuccessful recovery action is also counted as part of the reactivation count.

⁴ Effective only when the value for the reactivation threshold is set to 1 (one) or greater.

⁵ Effective only when an option other than **No Operation** is selected.

9.4 Recovering from a monitor error (normal)

When return of the monitor resource is detected during or after recovery actions following the detection of a monitoring error, counts for the thresholds shown below are reset:

- Recovery Script Execution Count
- Reactivation Count

Whether or not to execute the final action is reset (execution required).

9.5 Activation or deactivation error for the recovery target during recovery

When the monitoring target of the monitor resource is the device used for the group resource of the recovery target, an activation/deactivation error of the group resource may be detected during recovery when a monitoring error is detected.

9.6 Recovery/pre-recovery action script

Upon the detection of a monitor resource error, a recovery script can be configured to run. Alternatively, before the reactivation, failover, or final action of a recovery target, a pre-recovery action script can be configured to run. The script is a common file.

Environment variables used in the recovery/pre-recovery action script

EXPRESSCLUSTER sets status information (the recovery action type) in the environment variables upon the execution of the script.

The script allows you to specify the following environment variables as branch conditions according to the operation of the system.

Environment variable	Value of the environment variable	Description
CLP_MONITORNAME (Monitor resource name)	Monitor resource name	Name of the monitor resource in which an error that causes the recovery/pre-recovery action script to run is detected.
CLP_VERSION_FULL (EXPRESSCLUSTER X SingleServerSafe full version number)	EXPRESSCLUSTER X SingleServerSafe full version number	EXPRESSCLUSTER X SingleServerSafe full version number. (Example) 4.1.0-1
CLP_VERSION_MAJOR (EXPRESSCLUSTER X SingleServerSafe major version)	EXPRESSCLUSTER X SingleServerSafe major version	EXPRESSCLUSTER X SingleServerSafe major version. (Example) 4
CLP_PATH (EXPRESSCLUSTER X SingleServerSafe installation path)	EXPRESSCLUSTER X SingleServerSafe installation path	Path of EXPRESSCLUSTER X SingleServerSafe installation. (Example) /opt/nec/clusterpro

Continued on next page

Table 9.2 – continued from previous page

Environment variable	Value of the environment variable	Description
CLP_OSNAME (Server OS name)	Server OS name	Name of the server OS on which the script is executed. (Example) (1) When the OS name could be acquired: Red Hat Enterprise Linux Server release 6.8 (Santiago) (2) When the OS name could not be acquired: Linux
CLP_OSVER (Server OS version)	Server OS version	Version of the server OS on which the script is executed. (Example) (1) When the OS version could be acquired:6.8 (2) When the OS version could not be acquired: *None
CLP_ACTION (Recovery action type)	RECOVERY	Execution as a recovery script.
	RESTART	Execution before reactivation.
	FAILOVER	Execution before failover. Not used.
	FINALACTION	Execution before final action.
CLP_RECOVERYCOUNT (Recovery script execution count)	Recovery Script Execution Count	Count for recovery script execution.
CLP_RESTARTCOUNT (Reactivation count)	Reactivation count	Count for reactivation.

Writing recovery/pre-recovery action scripts

This section explains the environment variables mentioned above, using a practical scripting example.

Example of a recovery/pre-recovery action script

```
#!/bin/sh

# *****
# *           preactaction.sh
# *****

# Allot a process by referencing environment variables for script starting_
↪factors.
if [ "$CLP_ACTION" = "RECOVERY" ]
then
    # Write the recovery process here.
    # This process is executed at the following timing:
    #
    # Recovery action: Recovery script

elif [ "$CLP_ACTION" = "RESTART" ]
then
    # Write the pre-reactivation process here.
    # This process is executed at the following timing:
    #
    # Recovery action: Reactivation

elif [ "$CLP_ACTION" = "FINALACTION" ]
then
    # Write the recovery process here.
    # This process is executed at the following timing:
    #
    # Recovery action: Final action

fi
exit 0
```

Tips for recovery/pre-recovery action script coding

Pay careful attention to the following points when coding the script.

- When the script contains a command that requires a long time to run, log the end of execution of that command. The logged information can be used to identify the nature of the error if a problem occurs. `clplogcmd` is used to log the information.
- How to use `clplogcmd` in the script
With `clplogcmd`, messages can be output to Cluster WebUI Alert logs or OS syslog. For `clplogcmd`, see "Outputting messages (`clplogcmd` command)" in "EXPRESSCLUSTER X SingleServerSafe command reference" in Operation guide.

(Ex. : Scripting image)

```
clplogcmd -m "recoverystart.."
recoverystart
clplogcmd -m "OK"
```

Note on the recovery/pre-recovery action script

- Stack size for commands and applications activated from the script
The recovery/pre-recovery action script runs with the stack size configured to 2 MB. If the script has a command or application that requires a stack size of 2 MB or more to run, a stack overflow occurs. If a stack overflow error occurs, adjust the stack size before the command or application is activated.

9.7 Delay warning of a monitor resource

When a server is heavily loaded, due to a reason such as applications running concurrently, a monitor resource may detect a monitoring timeout. It is possible to have settings to issue an alert at the time when the time for monitor processing (the actual elapsed time) reaches a certain percentages of the monitoring time before a timeout is detected. The following figure shows timeline until a delay warning of the monitor resource is used.

In this example, the monitoring timeout is set to 60 seconds and the delay warning rate is set to 80%, which is the default value.

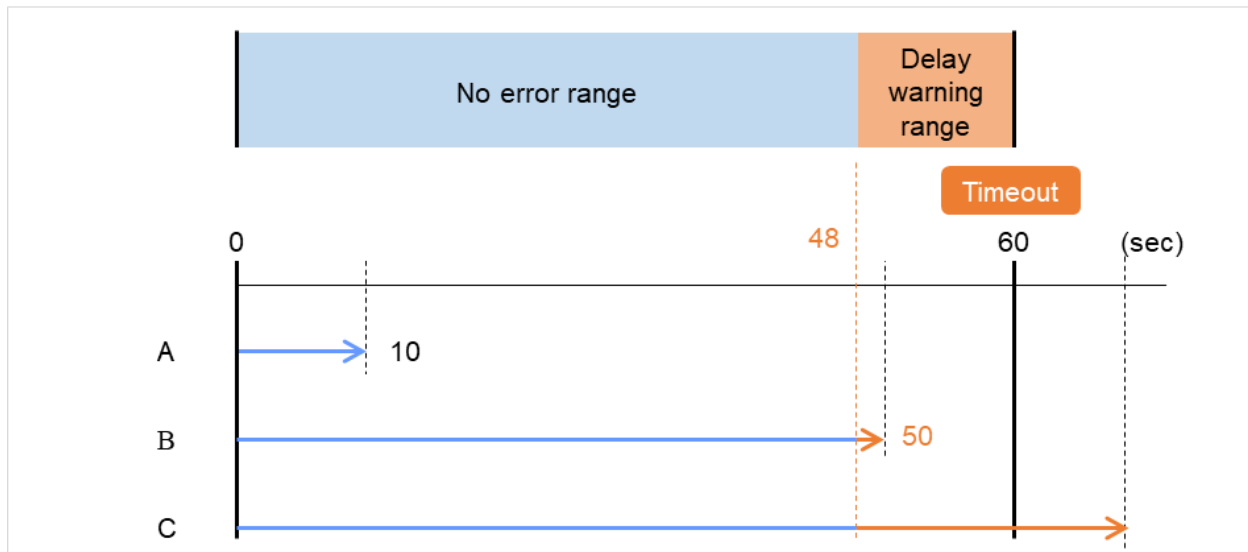


Fig. 9.7: Monitoring polling time and delay warning

- A. The polling time of monitoring is 10 seconds. The target of the monitor resource is in normal status. In this case, no alert is used.
- B. The polling time of monitoring is 50 seconds and the delay of monitoring is detected during this time. The target of the monitor resource is in the normal status. In this case, an alert is used because the delay warning rate has exceeded 80%.
- C. The polling time of monitoring has exceeded 60 seconds of the monitoring timeout and the delay of monitoring is detected. The target of the monitor resource has a problem. In this case, no alert is used.

If the delay warning rate is set to 0 or 100:

- When 0 is set to the delay monitoring rate
An alert for the delay warning is used at every monitoring.
By using this feature, the time for monitor processing for the monitor resource can be calculated at the time the server is heavily loaded, which will allow you to determine the time for monitoring timeout of a monitor resource.
- When 100 is set to the delay monitoring rate
The delay warning will not be is used.

Note: Be sure not to set a low value, such as 0%, except for a test operation.

See also:

To configure the delay warning of monitor resources, click **Cluster Properties** and select **Monitor Delay Warning** in the **Delay Warning** tab.

9.8 Waiting for a monitor resource to start monitoring

"Wait Time to Start Monitoring" refers to start monitoring after the time period specified as the waiting time elapses. The following describes how monitoring differs when the wait time to start monitoring is set to 0 second and 30 seconds.

If the wait time to start monitoring is set to 0 second, start the monitor resource polling after the server activation or monitoring restart.

Configuration of monitor resource

<Monitor>

Interval 30 sec

Timeout 60 sec

Retry Count 0 times

Wait Time to Start Monitoring 0 sec

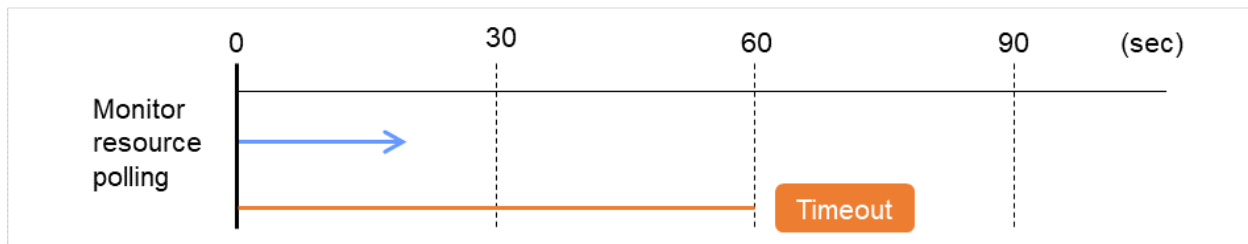


Fig. 9.8: Waiting for a monitor resource to start monitoring (the wait time to start monitoring set to 0 second)

If the wait time to start monitoring is set to 30 seconds, start the monitor resource polling 30 seconds after the server activation or monitoring restart.

<Monitor>

Interval 30 sec

Timeout 60 sec

Retry Count 0 times

Wait Time to Start Monitoring 30 sec

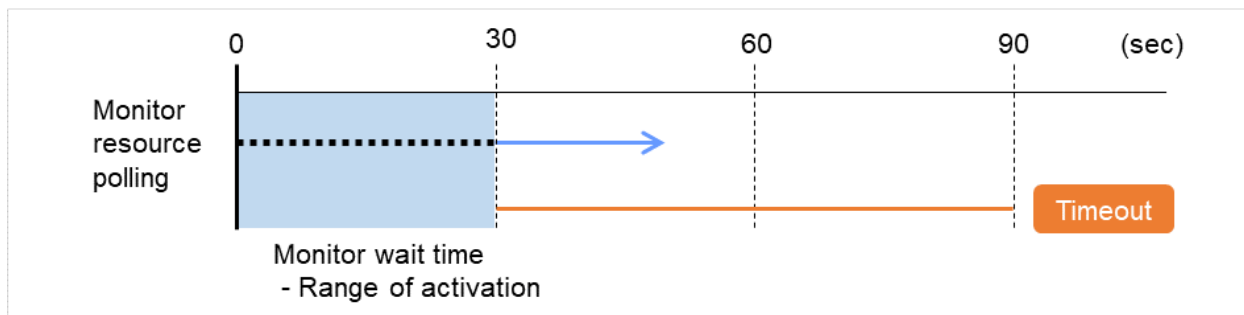


Fig. 9.9: Waiting for a monitor resource to start monitoring (the wait time to start monitoring set to 30 second)

Note: Monitoring will restart after the time specified to wait for start monitoring has elapsed even when the monitor resource is suspended and/or resumed by using the monitoring control commands.

The wait time to start monitoring is used when there is a possibility for monitoring to be terminated right after the start of monitoring due to incorrect application settings, such as an EXEC resource monitored by the PID monitor resource, and when they cannot be recovered by reactivation.

For example, when the monitor wait time is set to 0 (zero), recovery may be endlessly repeated. See the example below:

In this case, the application is started. And then, the monitoring by the PID monitor is started and the polling by the PID monitor is terminated normally. Afterwards, however, the application is terminated abnormally due to some reason.

Configuration of PID monitor resource

<Monitor>

Interval 5 sec

Timeout 60 sec

Retry Count 0 times

Wait Time to Start Monitoring 0 sec

<Error Detection>

Recovery Action Restart the recovery target

Recovery Target exec

Reactivation Threshold: One time

Final Action Stop Group

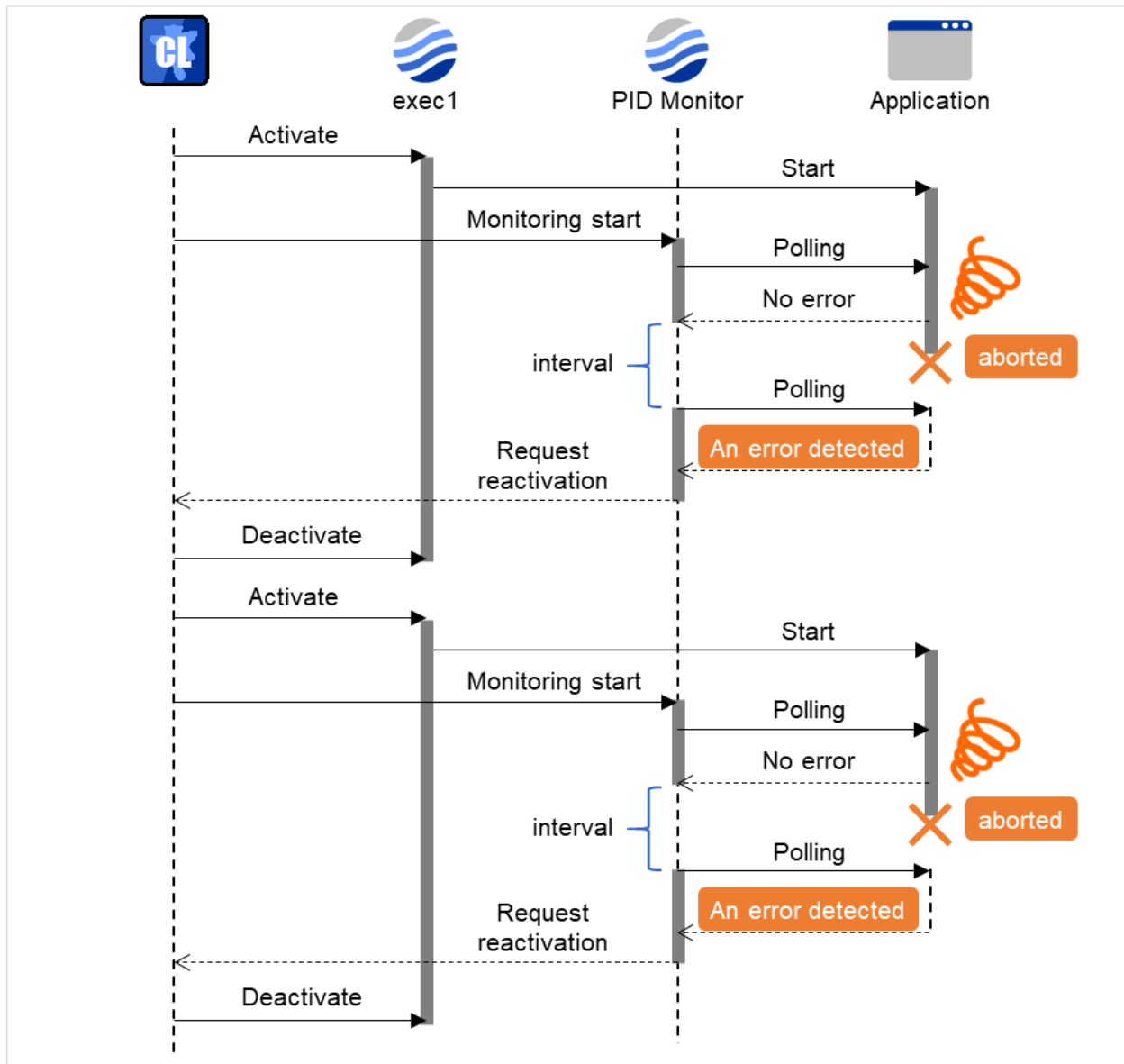


Fig. 9.10: Waiting for a monitor resource to start monitoring (the wait time to start monitoring set to 0 second)

The reason why recovery action is endlessly repeated is because the initial monitor resource processing has terminated successfully. The current count of recoveries the monitor resource has executed is reset when the status of the monitor resource becomes normal (finds no error in the monitor target). Because of this, the current count is always reset to 0 and reactivation for recovery is endlessly repeated.

You can prevent this problem by setting the wait time to start monitoring.

By default, 60 seconds is set as the wait time from the application startup to the end.

In this case, the application is started. Then, after waiting for the set wait time for start monitoring, the PID monitor start monitoring. After that, the application is terminated abnormally for some reason, which will be detected by the polling by the PID monitor.

Configuration of PID monitor resource

<Monitor>

Interval 5 sec

Timeout 60 sec

Retry Count 0 times

Wait Time to Start Monitoring: 60 sec

<Error Detection>

Recovery Action Restart the recovery target

Recovery Target exec

Reactivation Threshold: One time

Final Action Stop Group

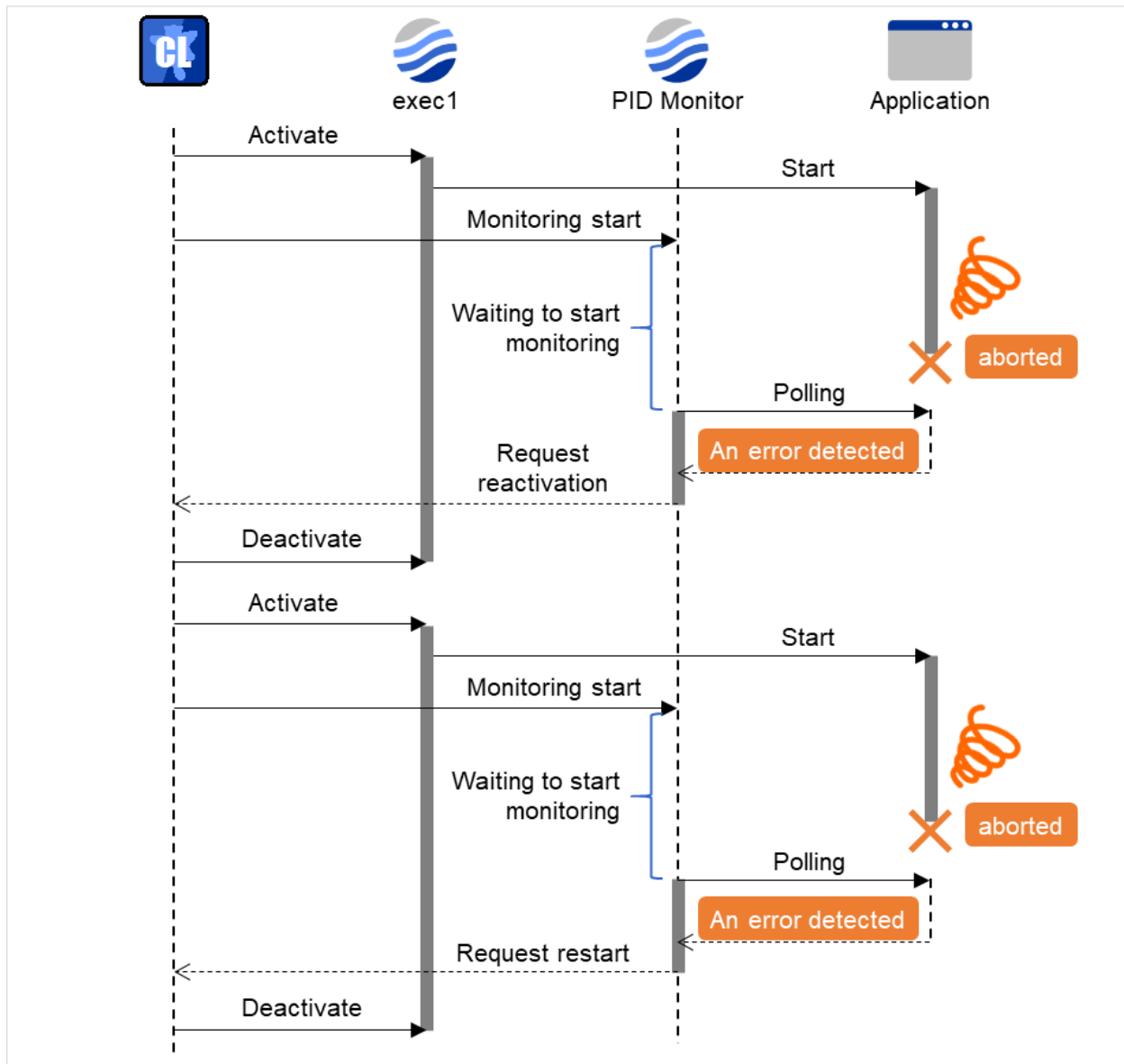


Fig. 9.11: Waiting for a monitor resource to start monitoring (the wait time to start monitoring set to 60 second)

9.9 Limiting the reboot count for error detection

In case that the final action when an error is detected at activation or deactivation, or the final action of the monitor resource when an error is detected is configured so that the OS reboot accompanies, the number of shutdowns or reboots can be limited.

Note: The maximum reboot count is on a server basis because the number of reboots is recorded on a server basis.

The number of reboots caused by a final action in detection of error in group activation/deactivation and the number of reboots caused by a final action in detection of error by a monitor resource are recorded separately.

If the time to reset the maximum reboot count is set to zero (0), the number of reboots will not be reset. When you reset the reboot count, use the `clpregctl` command.

NOTES AND RESTRICTIONS

This chapter provides information on known problems and how to troubleshoot the problems.

This chapter covers:

- 10.1. *Designing a system configuration*
- 10.2. *Notes when creating EXPRESSCLUSTER X SingleServerSafe configuration data*
- 10.3. *Notes when changing the EXPRESSCLUSTER X SingleServerSafe configuration*

10.1 Designing a system configuration

This section describes the matters to be careful of in configuring the system.

10.1.1 JVM monitor resources

- Up to 25 Java VMs can be monitored concurrently. The Java VMs that can be monitored concurrently are those which are uniquely identified by the Cluster WebUI (with **Identifier** in the **Monitor (special)** tab).
- Connections between Java VMs and JVM monitor resources do not support SSL.
- It may not be possible to detect thread deadlocks. This is a known problem in Java VM. For details, refer to "Bug ID: 6380127" in the Oracle Bug Database.
- The JVM monitor resources can monitor only the Java VMs on the server on which the JVM monitor resources are running.
- The JVM monitor resources can monitor only one JBoss server instance per server.
- Application monitoring is disabled when an application to be monitored on the IA32 version is running on an x86_64 version OS.
- If a large value such as 3,000 or more is specified as the maximum Java heap size by the Cluster WebUI (by using **Maximum Java Heap Size** on the **JVM monitor** tab in **Cluster Properties**), The JVM monitor resources will fail to start up. The maximum heap size differs depending on the environment, so be sure to specify a value based on the capacity of the mounted system memory.
- Using SingleServerSafe is recommended if you want to use the target Java VM load calculation function of the coordination load balancer. It's supported only by Red Hat Enterprise Linux.
- If "-XX:+UseG1GC" is added as a startup option of the target Java VM, the settings on the Memory tab on the Monitor(special) tab in Property of JVM monitor resources cannot be monitored before Java 7.
It's possible to watch by choosing [Oracle Java (usage monitoring)] in [JVM Type] on the Monitor(special) tab after Java 8.

10.1.2 Mail reporting

The mail reporting function is not supported by STARTTLS and SSL.

10.2 Notes when creating EXPRESSCLUSTER X SingleServerSafe configuration data

This section describes the items to note before designing and creating configuration data based on the system configuration.

10.2.1 Directories and files in the location pointed to by the EXPRESSCLUSTER X SingleServerSafe installation path

The directories and files in the location pointed to by the EXPRESSCLUSTER installation path must not be handled (edited, created, added, or deleted) by using any application or tool other than EXPRESSCLUSTER X SingleServerSafe.

Any effect on the operation of a directory or file caused by using an application or tool other than EXPRESSCLUSTER X SingleServerSafe will be outside the scope of NEC technical support.

10.2.2 Environment variable

The following scripts cannot be executed under the environment where more than 255 environmental variables are set. When using the following function of resource, set the number of environmental variables less than 256.

- Start/Stop script executed by EXEC resource when activating/deactivating
- Script executed by Custom monitor Resource when monitoring
- Script before final action after the group resource or the monitor resource error is detected.

10.2.3 Server reset, server panic, and power off

When EXPRESSCLUSTER performs "Server reset," "Server panic," or "Server power off," the servers are not shut down normally. Therefore, the following may occur.

- Damage to a mounted file system
- Loss of unsaved data

"Server reset" or "Server panic" occurs under the following settings:

- Action upon an error when activating or deactivating a group resource
 - sysrq Panic
 - keepalive Reset
 - keepalive Panic
 - BMC Reset
 - BMC Power Off
 - BMC Cycle
 - BMC NMI
- Final action when a monitor resource detects an error
 - sysrq Panic
 - keepalive Reset

- keepalive Panic
- BMC Reset
- BMC Power Off
- BMC Cycle
- BMC NMI
- Action when a user space monitoring timeout is detected
 - softdog monitoring method
 - ipmi monitoring method
 - keepalive monitoring method

Note: A server panic can be specified when the monitoring method is keepalive.

- Shutdown monitoring
 - softdog monitoring method
 - ipmi monitoring method
 - keepalive monitoring method

Note: Server panic can be set when the monitoring method is keepalive.

10.2.4 Final action for group resource deactivation error

If select **No Operation** as the final action when a deactivation error is detected, the group does not stop but remains in the deactivation error status.

Make sure not to set **No Operation** in the production environment.

10.2.5 Verifying raw device for VxVM

Check the raw device of the volume raw device in advance:

1. Import all disk groups which can be activated on one server and activate all volumes before installing EXPRESSCLUSTER.
2. Run the command below:

In the following output examples, `/dev/raw/raw2` and `/dev/raw/raw3` indicate RAW device names.
`major 199, minor 2` and `major 199, minor 3` indicate major/minor numbers.

```
# raw -qa
/dev/raw/raw2: bound to major 199, minor 2
/dev/raw/raw3: bound to major 199, minor 3
```

Example: Assuming the disk group name and volume name are:

- Disk group name: dg1

- Volume name under dg1: vol1, vol2

3. Run the command below:

In the following output examples, 199, 2 and 199, 3 indicate major/minor numbers.

```
# ls -l /dev/vx/dsk/dg1/  
brw----- 1 root    root    199, 2    May 15 22:13 vol1  
brw----- 1 root    root    199, 3    May 15 22:13 vol1
```

4. Confirm that major and minor numbers are identical between (B) and (C).

Never use these raw devices (A) as an EXPRESSCLUSTER disk monitor resource for which the monitor method is not READ(VxVM).

10.2.6 Delay warning rate

If the delay warning rate is set to 0 or 100, the following can be achieved:

- When 0 is set to the delay monitoring rate
An alert for the delay warning is issued at every monitoring.
By using this feature, you can calculate the polling time for the monitor resource at the time the server is heavily loaded, which will allow you to determine the time for monitoring timeout of a monitor resource.
- When 100 is set to the delay monitoring rate
The delay warning will not be issued.

Be sure not to set a low value, such as 0%, except for a test operation.

10.2.7 TUR monitoring method for disk monitor resources

- This method cannot be used for a disk or disk interface (HBA) that does not support the SCSI Test Unit Ready command or SG_IO command.
Even if your hardware supports these commands, consult the driver specifications because the driver may not support them.
- For an S-ATA interface disk, the OS identifies the device as an IDE interface disk (hd) or SCSI interface disk (sd) depending on the disk controller type or distribution.
When the device is identified as using the IDE interface, TUR cannot be used.
When the device is identified as using the SCSI interface, TUR (legacy) can be used. TUR (generic) cannot be used.
- TUR methods burdens OS and disk load less compared to Read methods.
- In some cases, Test Unit Ready may not be able to detect actual errors in I/O to media.

10.2.8 Double-byte character set that can be used in script comments

- Scripts edited in Linux environment are dealt as EUC code, and scripts edited in Windows environment are dealt as Shift-JIS code. In case that other character codes are used, character corruption may occur depending on environment.

10.2.9 System monitor resource settings

- Pattern of detection by resource monitoring

The System Resource Agent detects by using thresholds and monitoring duration time as parameters.

The System Resource Agent collects the data (number of opened files, number of user processes, number of threads, used size of memory, CPU usage rate, and used size of virtual memory) on individual system resources continuously, and detects errors when data keeps exceeding a threshold for a certain time (specified as the duration time).

10.2.10 Message receive monitor resource settings

- Error notification to message receive monitor resources can be done in following way:
 - using the clprexec command.
- To use the clprexec command, use the relevant file stored on the EXPRESSCLUSTER CD. Use this method according to the OS and architecture of the notification-source server. The notification-source server must be able to communicate with the notification-destination server.

10.2.11 JVM monitor resource settings

- When the monitoring target is the WebLogic Server, the maximum values of the following JVM monitor resource settings may be limited due to the system environment (including the amount of installed memory):
 - **The number under Monitor the requests in Work Manager**
 - **Average under Monitor the requests in Work Manager**
 - **The number of Waiting Requests under Monitor the requests in Thread Pool**
 - **Average of Waiting Requests under Monitor the requests in Thread Pool**
 - **The number of Executing Requests under Monitor the requests in Thread Pool**
 - **Average of Executing Requests under Monitor the requests in Thread Pool**
- When the monitoring-target is a 64-bit JRockit JVM, the following parameters cannot be monitored because the maximum amount of memory acquired from the JRockit JVM is a negative value that disables the calculation of the memory usage rate:
 - **Total Usage under Monitor Heap Memory Rate**
 - **Nursery Space under Monitor Heap Memory Rate**
 - **Old Space under Monitor Heap Memory Rate**
 - **Total Usage under Monitor Non-Heap Memory Rate**
 - **ClassMemory under Monitor Non-Heap Memory Rate**
- To use the Java Resource Agent, install the Java runtime environment (JRE) described in "Operation environment for JVM Monitor" in ""EXPRESSCLUSTER X SingleServerSafe Installation Guide"" You can use either the same JRE as that used by the monitoring target (WebLogic Server or WebOTX) or a different JRE.

- The monitor resource name must not include a blank.
- **Command**, which is intended to execute a command for a specific failure cause upon error detection, cannot be used together with the load balancer linkage function.

10.3 Notes when changing the EXPRESSCLUSTER X SingleServer-Safe configuration

The section describes what happens when the configuration is changed after starting to use EXPRESSCLUSTER in the cluster configuration.

10.3.1 Dependency between resource properties

When the dependency between resources has been changed, the change is applied by suspending and resuming the cluster.

If a change in the dependency between resources that requires the resources to be stopped during application is made, the startup status of the resources after the resume may not reflect the changed dependency.

Dependency control will be performed at the next group startup.

10.3.2 Adding and deleting group resources

When you move a group resource to another group, follow the procedure shown below.

If this procedure is not followed, the cluster may not work normally.

Example) Moving exec1 (exec resource) from failover1 group to failover2 group

1. Delete exec1 from failover1.
2. Reflect the setting to the system.
3. Add exec1 to failover2.
4. Reflect the setting to the system.

10.3.3 Setting cluster statistics information of message receive monitor resources

Once the settings of cluster statistics information of monitor resource has been changed, the settings of cluster statistics information are not applied to message receive monitor resources even if you execute the suspend and resume. Reboot the OS to apply the settings to the message receive monitor resources.

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