

EXPRESSCLUSTER X 4.3 HA Cluster Configuration Guide for Amazon Web Services (Linux)

Release 2

NEC Corporation

Mar 24, 2023

TABLE OF CONTENTS:

1	Preface1.1Who Should Use This Guide1.2Scope of Application1.3How This Guide is Organized1.4EXPRESSCLUSTER X Documentation Set1.5Conventions1.6Contacting NEC	1 2 3 4 5 6
2	Overview2.1Functional overview2.2HA cluster configuration2.3Multi-AZ2.4Network partition resolution2.5On-premises and AWS	7 9 16 18 19
3	Operating Environment	25
4	Notes 4.1 Notes on Using EXPRESSCLUSTER in the VPC	27 27
5	Constructing an HA cluster based on VIP control5.1Configuring the VPC Environment5.2Configuring the instance5.3Setting up EXPRESSCLUSTER	29 32 36 39
6	Constructing an HA cluster based on EIP control6.1Configuring the VPC Environment6.2Configuring the instance6.3Setting up EXPRESSCLUSTER	51 53 56 59
7	Constructing an HA cluster based on DNS name control7.1Configuring the VPC Environment7.2Configuring the instance7.3Setting up EXPRESSCLUSTER	69 72 75 78
8	Configuring the IAM 8.1 Creating an IAM policy 8.2 Configuring the instance	89 90 92
9	Troubleshooting	95

10	Legal Notice	109
	10.1 Disclaimer	109
	10.2 Trademark Information	110
11	Revision History	111

CHAPTER

ONE

PREFACE

1.1 Who Should Use This Guide

The "*EXPRESSCLUSTER X 4.2 HA Cluster Configuration Guide for Amazon Web Services (Linux)*" is intended for administrators who set up cluster systems, system engineers who provide user support for such systems, and cluster-system maintenance personnel. They must also have knowledge of Amazon EC2, Amazon VPC, and IAM provided by Amazon Web Services.

1.2 Scope of Application

This guide covers the following product versions.

- EXPRESSCLUSTER X 4.2 for Linux (Internal version: 4.2.0-1)
- EXPRESSCLUSTER X Replicator 4.2 for Linux
- VPC Management console, EC2 Management Console: Environment as of November 25, 2019

1.3 How This Guide is Organized

- 2. Overview: Describes the functional overview.
- 3. Operating Environment: Describes the tested operating environment of this function.
- 4. *Notes*: Describes the notes on constructing a cluster.
- 5. Constructing an HA cluster based on VIP control: Describes how to create an HA cluster based on VIP control.
- 6. *Constructing an HA cluster based on EIP control*: Describes how to create an HA cluster based on EIP control.
- 7. *Constructing an HA cluster based on DNS name control*: Describes how to create an HA cluster based on DNS name control.
- 8. Configuring the IAM: Describes how to configure the IAM.
- 9. Troubleshooting: Describes the problems and their solutions.

1.4 EXPRESSCLUSTER X Documentation Set

The EXPRESSCLUSTER X manuals consist of the following six guides. The title and purpose of each guide is described below:

EXPRESSCLUSTER X Getting Started Guide

This guide is intended for all users. The guide covers topics such as product overview, system requirements, and known problems.

EXPRESSCLUSTER X Installation and Configuration Guide

This guide is intended for system engineers and administrators who want to build, operate, and maintain a cluster system. Instructions for designing, installing, and configuring a cluster system with EXPRESSCLUSTER are covered in this guide.

EXPRESSCLUSTER X Reference Guide

This guide is intended for system administrators. The guide covers topics such as how to operate EXPRESSCLUSTER, function of each module and troubleshooting. The guide is supplement to the Installation and Configuration Guide.

EXPRESSCLUSTER X Maintenance Guide

This guide is intended for administrators and for system administrators who want to build, operate, and maintain EXPRESSCLUSTER-based cluster systems. The guide describes maintenance-related topics for EXPRESSCLUSTER.

EXPRESSCLUSTER X Hardware Feature Guide

This guide is intended for administrators and for system engineers who want to build EXPRESSCLUSTER-based cluster systems. The guide describes features to work with specific hardware, serving as a supplement to the Installation and Configuration Guide.

EXPRESSCLUSTER X Legacy Feature Guide

This guide is intended for administrators and for system engineers who want to build EXPRESSCLUSTER-based cluster systems. The guide describes *EXPRESSCLUSTER* X 4.0 WebManager and Builder.

1.5 Conventions

In this guide, Note, Important, 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	
	text boxes, list boxes, menu selec-	Click Start.
	tions, buttons, labels, icons, etc.	Properties dialog box
Angled bracket within the command	Indicates that the value specified in-	clpstat -s[-h host_name]
line	side of the angled bracket can be	
	omitted.	
#	Prompt to indicate that a Linux user	# clpstat
	has logged on as root user.	
Monospace	Indicates path names, commands,	/Linux
	system output (message, prompt,	
	etc.), directory, file names, functions	
	and parameters.	
bold	Indicates the value that a user actu-	
	ally enters from a command line.	Enter the following:
		# clpcl -s -a
italic	Indicates that users should replace	<pre># ping <ip address=""></ip></pre>
	italicized part with values that they	
	are actually working with.	



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

1.6 Contacting NEC

For the latest product information, visit our website below:

https://www.nec.com/en/global/prod/expresscluster/

CHAPTER

OVERVIEW

2.1 Functional overview

The settings described in this guide allow you to construct an HA cluster with EXPERSSCLUSTER in the Amazon Virtual Private Cloud (VPC) environment provided by Amazon Web Services (AWS).

Because more important applications can be performed by constructing an HA cluster, a wider range of system configuration options are available in the AWS environment. The AWS has a robust configuration made up of multiple availability zones (hereafter referred to as AZ) in each region. The user can select and use an AZ as needed. EX-PERSSCLUSTER realizes highly available applications by allowing the HA cluster to operate between multiple AZs in a region (hereafter referred to as Multi-AZ).



Fig. 2.1: Mirror Type HA Cluster in Multi-AZ Configuration

In the AWS environment, a virtual IP can be used to connect to the cluster server. The AWS Virtual IP resource and AWS Elastic IP resource and AWS DNS resource enable the client not to be aware of switching the destination server even if a "failover" or "group transition" occurred.

2.2 HA cluster configuration

This guide describes two HA cluster configurations: HA cluster based on virtual IP (VIP) control, HA cluster based on elastic IP (EIP) control and HA cluster based on DNS name control. This section describes a single AZ configuration. For a multi-AZ configuration, refer to "2.3. *Multi-AZ*"

Location of a client accessing an HA cluster	Resource to be selected	Reference in this chapter
In the same VPC	AWS Virtual IP resource	HA cluster based on VIP control
Internet	AWS Elastic IP resource	HA cluster based on EIP control
Voluntary location	AWS DNS resource	HA cluster based on DNS name control

2.2.1 HA cluster based on VIP control

This guide assumes the configuration in which a client in the same VPC accesses an HA cluster via a VIP address. For example, a DB server is clustered and accessed from a web server via a VIP address.



Fig. 2.2: HA Cluster Based on VIP Control

In the above figure, the server instances are clustered and placed on the private subnet. The AWS Virtual IP resource of EXPRESSCLUSTER sets a VIP address to the active server instance and rewrites the VPC route table. This enables the client instance placed on any subnet in the VPC to access the active server instance via the VIP address. The VIP address must be out of the VPC CIDR range.

NEC has verified that the AWS specifications do not allow clients outside the VPC to access the server instance via the VIP address assigned by the AWS Virtual IP resource. Therefore, to enable clients outside the VPC to access, specify the EIP address assigned by the AWS Elastic IP resource.

When executing the AWS CLI or referencing the DNS, each server instance accesses the regional endpoint or the

Internet via a NAT instance placed on the public subnet as needed.

* When executing the AWS CLI, each instance must be able to communicate with the regional endpoint by -. In this guide, instance for NAT is used for the HA cluster based on VIP control.

The following resources and monitor resources are required for an HA cluster based on VIP control configuration.

Resource type	Description	Setup
AWS Virtual IP resource	Assigns a VIP address to an active	Required
	sever instance, changes the route	
	table of the assigned VIP address,	
	and publishes operations within the	
	VPC.	
AWS Virtual IP monitor resource		Required
	Periodically monitors whether the	
	VIP address assigned by the AWS	
	Virtual IP resource exists in the	
	local server and whether the VPC	
	route table is changed illegally.	
	(This monitor resource is	
	automatically added when the AWS	
	Virtual IP resource is added.)	
AWS AZ monitor resource	Periodically monitors the health of	Recommended
	the AZ in which the local server ex-	
	ists by using Multi-AZ.	
IP monitor resource	Monitors the health of communica-	Required to check the health of
	tion between subnets by checking	communication between subnets.
	whether communication with a NAT	
	is available.	
Other resources and monitor re-	Depends on the configuration of the	Optional
sources	application, such as a mirror disk,	
	used in an HA cluster.	

2.2.2 HA cluster based on EIP control

This guide assumes the configuration in which a client accesses an HA cluster via a global IP address assigned to the EIP through the Internet.

Clustered instances are placed on a public subnet. Each instance can access the Internet via the Internet gateway.



Fig. 2.3: HA Cluster Based on EIP Control

In the above figure, the server instances are clustered and placed on the public subnet. The AWS Virtual IP resource of EXPRESSCLUSTER attaches the EIP to the active server instance. This enables a client on the Internet to access the active server instance via the EIP address.

* When executing the AWS CLI, each instance must be able to communicate with the regional endpoint by using a method such as a proxy server, NAT, public IP, and EIP. In this guide, a public IP assigned to the instance is used for the HA cluster based on EIP control.

The following resources and monitor resources are required for an HA cluster based on EIP control configuration.

Resource type	Description	Setup
AWS Elastic IP resource	Assigns an EIP address to an active	Required
	sever instance and publishes opera-	
	tions to the Internet.	
AWS elastic IP monitor resource		Required
	Periodically monitors whether the	
	EIP address assigned by the AWS	
	Elastic IP resource exists in the	
	local server.	
	(This monitor resource is	
	automatically added when the AWS	
	Elastic IP resource is added.)	
AWS AZ monitor resource	Periodically monitors the health of	Recommended
	the AZ in which the local server ex-	
	ists by using Multi-AZ.	
Custom monitor resource	Monitors a network partition (NP)	Required to perform NP resolution
	so that the same resource does not	
	start in multiple instances at the	
	same time.	

2.2.3 HA cluster based on DNS name control

This guide assumes the configuration in which a client accesses an HA cluster via the same DNS name. For example, a DB server is clustered and accessed from a web server via a DNS name.



Fig. 2.4: HA cluster based on DNS name control

In the above figure, the server instances are clustered and placed on the private subnet. The AWS DNS resource of EXPRESSCLUSTER registers resource record set including the DNS name and the IP address of the active server into the Private Hosted Zone of Amazon Route 53. This enables the client instance placed on any subnet in the VPC to access the active server instance via the DNS name.

In this guide, clustered server instances are placed on the private subnet. However, the instances can be also placed on a public subnet. In this case, this enables a client on the Internet to access the active server instance via the DNS name by registering the resource record set including the DNS name and the public IP address of the active server into the Public Hosted Zone of Amazon Route 53. Furthermore, in order that the query to the domain of the Public Hosted Zone can refer to the Amazon Route 53 name server, it is required to set the name server (NS) record of the registrar in advance.

Moreover, for a configuration in which the cluster and client exist in different VPCs, use a VPC peering connection. Preliminary create a peering connection between the VPCs and associate the VPCs with the private hosted zone of Amazon Route 53. And then register the resource record set including the DNS name and the IP address of the active server into the private hosted zone. This enables the client in the different VPC to access the active server instance via DNS name.

* When executing the AWS CLI, each instance must be able to communicate with the regional endpoint by using a method such as a proxy server, NAT, public IP and EIP. In this guide, NAT is used for the HA cluster based on DNS name control.

The table below shows the necessary resources and monitor resources for constructing a HA cluster based on DNS name control.

Resource Type	Description	Configuration
AWS DNS resource	Registers the resource record sets including the DNS name and the IP address of the active server in- stance into the hosted zone of Ama- zon Route 53, and publishes opera- tions within the VPC or to the Inter- net.	Required
AWS DNS monitor resource	AWS DNS resource periodically monitors whether the registered resource record set exists in the hosted zone of Amazon Route 53 and whether the resolution of the DNS name is available. (This monitor resource is automatically added when the AWS DNS resource is added.)	Required
AWS AZ monitor resource	Periodically monitors the health of the AZ in which the local server ex- ists by using Multi-AZ.	Recommended
IP monitor resource	Monitors the health of communica- tion between subnets by checking whether communication with a NAT is available.	Required to check the health of communication between subnets.
Other resources and monitor re- sources	Depends on the configuration of the application, such as a mirror disk, used in an HA cluster.	Optional

2.3 Multi-AZ

In the AWS environment, the instances configuring an HA cluster can be distributed to AZs. This provides the instance redundancy for a failure occurrence in an AZ, and increases the system availability. The AWS AZ monitor resource monitors the health of each AZ. If the monitor resource detects a failure, it makes EXPRESSCLUSTER to issue a warning or perform a recovery operation. For details, refer to the following:

Reference Guide

-> Understanding AWS AZ monitor resources



Fig. 2.5: HA Cluster Using Multi-AZ

2.4 Network partition resolution

The instances configuring an HA cluster perform alive monitoring on each other by using heartbeat. In the configuration in which instances are distributed to multiple subnets, an undesirable condition such as redundant startup of a service occurs if the heartbeat is lost. To prevent redundant startup of a service, it is required to determine whether the instance itself was isolated in a network (network partition: NP) or the other instance was down.

The NP resolution conducts a ping or LISTEN port test for an always running device that can return a response (hereafter referred to as an *acknowledgement device*). If the acknowledgement device does not return a response, it is determined that an NP has occurred and the predefined process is performed (for example, issuing a warning, performing a recovery operation, or shutting down the server).

The Amazon VPC uses the following as the ping device usually.

HA cluster type	ping device	Method	Remarks
HA cluster based on	Instance always running	Ping	In this guide, Instance for
VIP control	on another subnet		NAT is used.
HA cluster based on	Regional endpoint	LISTEN port acknowl-	
EIP control		edgement	For the regional
			endpoints, refer to the
			following URL:
			https://docs.aws.amazon. com/general/latest/gr/ rande.html
			Example:
			When the region name is Asia Pacific (Tokyo), the regional endpoint is ec2.ap-northeast- 1.amazonaws.com.

2.5 On-premises and AWS

The following table describes the EXPRESSCLUSTER functional differences between the on-premises and AWS environments.

- √: Available
- n/a: Not available

Function	On-premises	AWS
Creation of a shared disk type cluster	\checkmark	n/a
Creation of a mirror disk type cluster	\checkmark	\checkmark
Floating IP resource	\checkmark	n/a
Virtual IP resource	\checkmark	n/a
AWS Elastic IP resource	n/a	\checkmark
AWS Virtual IP resource	n/a	\checkmark
AWS DNS resource	n/a	\checkmark

The following table describes the creation flow of a 2-node cluster that uses a mirror disk and various resources in the on-premises and AWS environments.

• Before installing EXPRESSCLUSTER

	Step	On-premises	AWS
1	Configure the VPC envi- ronment.	Not required	 When using the AWS Virtual IP resource, refer to "5.1. Configuring the VPC Environment" in this guide. When using the AWS Elastic IP resource, refer to "6.1. Configuring the VPC Environment" in this guide. When AWS DNS resource is used, refer to "7.1. Configuring the VPC Environment" in this guide.
2	Configure the instance.	Not required	 When using the AWS Virtual IP resource, refer to "5.2. <i>Configuring the instance</i>" in this guide. When using the AWS Elastic IP resource, refer to "6.2. <i>Configuring the instance</i>" in this guide. When AWS DNS resource is used, refer to "7.2. <i>Configuring the instance</i>" in this guide.

	Step	On-premises	AWS
3	Configure a partition for		Same as the on-premises environ-
	a mirror disk resource.	Refer to the following:	ment
		- Installation and Configuration	
		Guide	
		-> Determining a system	
		configuration	
		-> Settings after	
		configuring hardware	
		- Reference Guide	
		Vinderstanding Mirror	
		disk resources	
		uisk resources	
4	Adjust the OS startup		Same as the on-premises environ-
	time.	Refer to the following:	ment
		- Installation and Configuration	
		Guide	
		-> Determining a system	
		configuration	
		-> Settings after	
		configuring hardware	
		· · · · · · · · · · · · · · · · · · ·	
5	Check the network.		Same as the on-premises environ-
		Refer to the following:	ment
		- Installation and Configuration	
		Guide	
		-> Determining a system	
		configuration	
		-> Settings after	
		configuring hardware	
6	Check the root file sys-		Same as the on-premises environ-
	tem	Refer to the following:	ment
		- Installation and Configuration	
		Guide	
		-> Determining a system	
		configuration	
		-> Settings after	
		configuring hardware	
	Check the firewall.	Defende the falls	Same as the on-premises environ-
		Keler to the following:	ment
		- Installation and Configuration	
		Guide	
		-> Determining a system	
		configuration	
		-> Settings after	
		configuring hardware	

Table 2.7 – continued from previous page

	Step	On-premises	AWS
8	Synchronize the server		Same as the on-premises environ-
	time.	Refer to the following:	ment
		- Installation and Configuration	
		Guide	
		-> Determining a system	
		configuration	
		-> Settings after	
		configuring hardware	
9	Install EXPRESSCLUS-		Same as the on-premises environ-
	TER.	Refer to the following:	ment
		- Installation and Configuration	
		Guide	
		-> Installing	
		EXPRESSCLUSTER	

Table 2.7 – continued from previous page

• After installing EXPRESSCLUSTER

	Step	On-premises	AWS
10	Register the EXPRESS- CLUSTER license.	Refer to the following: - Installation and Configuration Guide -> Registering the license	Same as the on-premises environment
11	Construct a cluster - Set up the heartbeat method.	Refer to the following: - Installation and Configuration Guide -> Creating the cluster configuration data -> Creating the configuration data of a 2-node cluster	COM heartbeat, BMC heartbeat and DISK heartbeat cannot be used.

	Step	On-premises	AWS
12	Step Construct a cluster: Set up the NP resolution.	On-premises Use an NP resolution resource. Refer to the following: - Installation and Configuration Guide -> Creating the cluster	AWS - When using the AWS Virtual IP resource, refer to "5.3. Setting up EXPRESSCLUSTER" -> "3) Add a monitor
		configuration data -> Creating the cluster configuration data - Reference Guide -> Network partition resolution resources details	resource." -> "IP monitor resource" in this guide. - When using the AWS Elastic IP resource, refer to "6.3. Setting up EXPRESSCLUSTER" ->"1) Construct a cluster" in this guide. - When AWS DNS resource is used, refer to "7.3. Setting up EXPRESSCLUSTER" - "1) Cluster configuration" in this guide.

Table 2.8 – continued from previous page

Step	On-premises	AWS
13 Construct a clus Create a failover Create a monito Create a monito resource.	ter: r group r r Refer to the following: - Installation and Configur Guide -> Creating the clust configuration data -> Creating the clust configuration data	AWSationIn addition to the reference for the on-premises environment, refer to the following: - When using the AWS Virtual IP resourceter- "5.3. Setting up EXPRESSCLUSTER" in this guide - Reference Guide -> Understanding AWS Virtual IP resources- When using the AWS Elastic IP resource, refer to the following: - "6.3. Setting up EXPRESSCLUSTER" in this guide -> Understanding AWS Elastic IP resource, refer to the following: - "6.3. Setting up EXPRESSCLUSTER" in this guide -> Understanding AWS Elastic IP resources- When AWS DNS resource is used, refer to below documents: - "7.3. Setting up EXPRESSCLUSTER" in this guide. -> Understanding AWS Elastic IP resources- When AWS DNS resource is used, refer to below documents: - "7.3. Setting up EXPRESSCLUSTER" in this guide. -> Understanding AWS DNS resources

Table 2.8 – continued from previous page

CHAPTER

THREE

OPERATING ENVIRONMENT

For details, refer to the following:

- Getting Started Guide
 - -> Installation requirements for EXPRESSCLUSTER

-> Operation environment for AWS elastic ip resource, AWS virtual ip resource, AWS Elastic IP monitor resource, AWS virtual IP monitor resource, AWS AZ monitor resource

- Getting Started Guide
 - -> Installation requirements for EXPRESSCLUSTER
 - -> Operation environment for AWS DNS resource, AWS DNS monitor resource

CHAPTER

NOTES

4.1 Notes on Using EXPRESSCLUSTER in the VPC

Note the following points when using EXPRESSCLUSTER in the VPC environment.

Access from the Internet or different VPC

NEC has verified that the AWS specifications do not allow clients on the internet or different VPC to access the server instance via the VIP address assigned by the AWS Virtual IP resource. In case of accessing from the client on Internet, specify the EIP address assigned by the AWS Elastic IP resource. In case of accessing from the client on different VPC, specify the DNS name registered to Amazon Route 53 with AWS DNS resource and then make an access via VPC Peering Connection.

Access from different VPC via VPC peering connection

AWS virtual IP resources cannot be used if access via a VPC peering connection is necessary. This is because it is assumed that an IP address to be used as a VIP is out of the VPC range and such an IP address is considered invalid in a VPC peering connection. If access via a VPC peering connection is necessary, use the AWS DNS resource that use Amazon Route 53.

Using VPC endpoint

By using VPC endpoint, it is able to control Amazon EC2 services of AWS CLI without preparing proxy server or NAT, even on the private network. Therefore, in the case of "5. *Constructing an HA cluster based on VIP control*", it is able to use VPC endpoint instead of NAT. When the VPC endpoint is created, the name which ends in ".ec2" must be selected.

However, if NAT does not exist, IP address monitoring cannot be executed by IP monitor resource for NP resolution. Therefore, ping device should be prepared separately.

Moreover, even when VCP endpoint is used, NAT gateway etc. will be required if internet access (for online update of instance, module download etc.) or access to AWS cloud service which is not supported by VPC endpoint are needed.

Restrictions on the group resource and monitor resource functions

Refer to the following:

- Getting Started Guide
 - -> Notes and Restrictions
 - -> Setting up AWS elastic ip resources
 - -> Setting up AWS virtual ip resources
 - -> Setting up AWS DNS resources
 - -> Setting up AWS DNS monitor resources

Mirror disk performance

For a mirror type HA cluster, a write request to a mirror disk takes the following routes:

• Write request I/O:

Guest OS on the active server -> Host OS on the active server -> Host OS on the standby server -> Guest OS on the standby server

• Writing completion notice:

Guest OS on the standby server -> Host OS on the standby server -> Host OS on the active server -> Guest OS on the active server

If an HA cluster is constructed in a Multi-AZ configuration, the instances are located at long distances from each other, causing a TCP/IP response delay. This might affect a mirroring operation. Also, the usage of other systems affects the mirroring performance due to multi-tenancy. Therefore, the difference in the mirror disk performance in a cloud environment tends to be larger than that in a physical or general virtualized environment (non-cloud environment) (that is, the degradation rate of the mirror disk performance tends to be larger).

Take this point into consideration at the design phase if priority is put on writing performance in your system.

Disk device name to be specified for EXPRESSCLUSTER

In the AWS environment, the device file name of an NVMe EBS volume (e.g. /dev/nvme0n1) may be changed by rebooting, stopping/starting an instance or detaching/attaching an EBS volume, etc. Therefore, if you set the device file name of an NVMe EBS volume to the device name controlled by Disk Resource (disk resource, mirrored disk resource, etc.), the startup of the Disk Resource may fail because the device file name may be changed when the instance reboots.

One of the following methods is recommended to address this issue.

- Set the LVM logical volume name to the device name of a Disk Resource.
- Set the by-id name (e.g. /dev/disk/by-id/nvme-Amazon_Elastic_Block_Store_vol***) to the device name of a Disk Resource.

If the data partition of a mirror disk is configured with LVM, the data partition can be extended without business suspension.

CONSTRUCTING AN HA CLUSTER BASED ON VIP CONTROL

This chapter describes how to construct an HA cluster based on VIP control.

In the figure below, "Server Instance (Active)" and "Server Instance (Standby)" respectively represent the instance of the active server and that of the standby server.



Fig. 5.1: System Configuration of the HA Cluster Based on VIP Control

CIDR (VPC)	10.0.0/16	
VIP	10.1.0.20	
Public subnet (Subnet-1A)	10.0.10.0/24	
Continued on next page		

Table 5.1 – continued from previous page		
Public subnet (Subnet-1B)	10.0.20.0/24	
Private subnet (Subnet-2A)	10.0.110.0/24	
Private subnet (Subnet-2B)	10.0.120.0/24	

Table	5.1	- continued	from	previous page
-------	-----	-------------	------	---------------

5.1 Configuring the VPC Environment

Configure the VPC on the VPC Management console and EC2 Management console.

The IP addresses used in the figures and description are an example. In the actual configuration, use the actual IP addresses assigned to the VPC. When installing EXPRESSCLUSTER in the existing VPC, specify the appropriate settings such as adding a subnet if the number of subnets is insufficient. This guide does not describe the case to perform operations by adding an ENI to an instance of an HA cluster node.

1. Configure the VPC and subnet.

Create a VPC and subnet first.

-> Add a VPC and subnet in VPC and Subnets on the VPC Management console.

[1] VPC Write down the VPC ID (vpc-xxxxxx), which is needed later for setting up the AWS virtual IP resource.

2. Configure the Internet gateway.

Add an Internet gateway to access the Internet from the VPC.

-> To create an Internet gateway, select **Internet Gateways** > **Create internet gateway** on the VPC Management console. Attach the created Internet gateway to the VPC.

3. Configure the network ACL and security group.

Specify the appropriate network ACL and security group settings to prevent unauthorized network access from in and out of the VPC.

Change the network ACL and security group path settings so that the instances of the HA cluster node can communicate with the Internet gateway via HTTPS, communicate with Cluster WebUI, and communicate with each other. The instances are to be placed on the private networks (Subnet-2A and Subnet-2B).

-> Change the settings in Network ACLs and Security Groups on the VPC Management console.

For the port numbers that are used by the EXPRESSCLUSTER components, refer to the following:

Getting Started Guide

-> Notes and Restrictions

-> Before installing EXPRESSCLUSTER

4. Add an HA cluster instance.

Create an HA cluster node instance on the private networks (Subnet-2A and Subnet-2B). To use an IAM role by assigning it to an instance, specify the IAM role.

-> To create an instance, select **Instances** > **Launch Instance** on the EC2 Management console.

-> For details about the IAM settings, refer to "8. Configuring the IAM"

Disable Source/Dest. Check of the elastic network interface (ENI) assigned to each created instance.
To perform the VIP control by using the AWS Virtual IP resource, communication with the VIP address (10.1.0.20 in the above figure) must be routed to the ENI of the instance. It is necessary to disable **Source/Dest. Check** of the ENI of each instance to communicate with the private IP address and VIP address.

-> To change the settings, right-click the added instance in **Instances** on the EC2 Management console, and select Networking > Change Source/Dest. Check.

[7] Server Instance (Active), [8] Server Instance (Standby) The ENIs assigned respectively to the instance of the active server and the instance of the standby server can be identified according to the ENI IDs. Write down the ENI ID (eni-xxxxxxx) of each instance, because the ID is needed later for setting up the AWS virtual IP resource.

Use the following procedure to check the ENI ID assigned to the instance.

- 1. Select the instance to display its detailed information.
- 2. Click the target device in Network Interfaces.
- 3. Check Interface ID displayed in the pop-up window.



5. Add a NAT instance.

To perform the VIP control by using the AWS CLI, communication from the instance of the HA cluster node to the regional endpoint via HTTPS must be enabled.

To do so, create a NAT instance on the public networks (Subnet-1A and Subnet-1B). In the AWS environment, amzn-ami-vpc-nat-pv-2014.09.1.x86_64-ebs is prepared as the AMI with the string, amzn-ami-vpc-nat included.

When creating a NAT instance, enable the public IP. In addition, disable **Source/Dest. Check** of the added NAT instance to enable the NAT function.

-> To change the settings, right-click the NAT instance in **Instances** on the EC2 Management console, and select **Networking** > **Change Source/Dest. Check**.

6. Configure the route table.

Add the routing to the Internet gateway so that the AWS CLI can communicate with the regional endpoint via

NAT and the routing so that a client in the VPC can access the VIP address. The number of CIDR blocks of the VIP address must always be 32.

The following routings must be set in the route table (Public-AB) of the public networks (Subnet-1A and Subnet-1B in the above figure).

• Route table (Public-AB)

Destination	Target	Remarks
VPC network (Example: 10.0.0.0/16)	local	Existing by default
0.0.0/0	Internet gateway	Add (required)
VIP address (Example: 10.1.0.20/32)	eni-xxxxxxx (ENI ID of the active server instance) (ENI ID of the active server instance represented as "[7] Server Instance (Active)")	Add (required)

The following routings must be set in the route tables (Private-A and Private-B) of the private networks (Subnet-2A and Subnet-2B in the above figure).

• Route table (Private-A)

Destination	Target	Remarks
VPC network (Example: 10.0.0.0/16)	local	Existing by default
0.0.0/0	NAT1	Add (required)
VIP address (Example: 10.1.0.20/32)	eni-xxxxxxx (ENI ID of the active server instance) (ENI ID of the active server instance represented as "[7] Server Instance (Active)")	Add (required)

• Route table (Private-B)

Destination	Target	Remarks
VPC network (Example: 10.0.0.0/16)	local	Existing by default
0.0.0/0	NAT2	Add (required)

Continued on next page

	•	
Destination	Target	Remarks
VIP address (Example: 10.1.0.20/32)	eni-xxxxxxx (ENI ID of the active server instance) (ENI ID of the active server instance represented as "[7] Server Instance (Active)")	Add (required)

Table 5.4 - continued from previous page

When a failover occurred, the AWS Virtual IP resource switches all routings to the VIP address set in these route tables to the ENI of the standby server instance by using the AWS CLI.

[6] VIP

The VIP address must be out of the VPC CIDR range of the VPC.

Write down the VIP address set to the route table, because the address is needed later for setting up the AWS virtual IP resource.

Configure other routings according to the environment.

7. Add a mirror disk (EBS).

Add an EBS to be used as the mirror disk (cluster partition or data partition) as needed.

-> To add an EBS, select **Volumes** > **Create Volume** on the EC2 Management console, and then attach the created volume to an instance.

5.2 Configuring the instance

Log in to each instance of the HA cluster and specify the following settings. For the Python and AWS CLI versions supported by EXPRESSCLUSTER, refer to the following:

Getting Started Guide

-> Installation requirements for EXPRESSCLUSTER

-> Operation environment for AWS elastic ip resource, AWS virtual ip resource, AWS Elastic IP monitor resource, AWS virtual IP monitor resource, AWS AZ monitor resource

1) Disable SELinux.

Set permissive or disabled to SELinux to perform communication required by EXPRESSCLUSTER. Run the following command to check the status of SELinux.

\$ getenforce Enforcing

(* Enforcing indicates that SELinux is enabled.)

Change the status of SELinux to "disabled" by using /etc/sysconfig/selinux and restart SELinux. Then run the getenforce command to confirm that Disabled is returned.

2) Configure a firewall.

Change the firewall setting as needed. For the port numbers that are used by the EXPRESSCLUSTER components, refer to the following:

Getting Started Guide -> Notes and Restrictions -> Before installing EXPRESSCLUSTER

3) Install Python.

Install Python required by EXPRESSCLUSTER. First, confirm that Python is installed. If Python has not been installed, install it by using a command such as yum. The installation path of the python commands must be any of the following: /sbin, /bin, /usr/sbin, /usr/bin

4) Install the AWS CLI.

Install the AWS CLI by running the pip command from a shell.

\$ pip install awscli

For details about the pip command, refer to the following:

https://pip.pypa.io/en/latest/

The installation path of the AWS CLI must be any of the following: /sbin, /bin, /usr/sbin, /usr/bin, /usr/local/bin

For details about how to set up the AWS CLI, refer to the following:

https://docs.aws.amazon.com/cli/latest/userguide/cli-chap-install.html

(If EXPRESSCLUSTER has been installed before installing Python or the AWS CLI, be sure to restart the OS before using EXPRESSCLUSTER.)

5) Register the AWS access key ID.

Run the following command from the shell.

\$ sudo aws configure

Enter information such as the AWS access key ID to the inquiries.

The settings to be specified vary depending on whether an IAM role is assigned to the instance or not.

• Instance to which an IAM role is assigned.

```
AWS Access Key ID [None]: (Press Enter without entering anything.)
AWS Secret Access Key [None]: (Press Enter without entering anything.)
Default region name [None]: <default region name>
Default output format [None]: text
```

• Instance to which an IAM role is not assigned.

AWS Access Key ID [None]: <AWS access key ID> AWS Secret Access Key [None]: <AWS secret access key> Default region name [None]: <default region name> Default output format [None]: text

For "Default output format", other format than "text" may be specified. If you specified incorrect settings, delete the directory /root/.aws entirely, and specify the above settings again.

6) **Prepare the mirror disk.**

If an EBS has been added to be used as the mirror disk, divide the EBS into partitions and use each partition as the cluster partition and data partition.

For details about the mirror disk partition, refer to the following:

- Installation and Configuration Guide
 - -> Determining a system configuration
 - -> Partition settings for Mirror disk resource (when using Replicator)

7) Install EXPRESSCLUSTER.

For the installation procedure, refer to "Installation and Configuration Guide". Store the EXPRESSCLUSTER installation media in the environment to which to install EXPRESSCLUSTER. (To transfer data, use any method such as Remote Desktop and Amazon S3.)

After the installation, restart the OS.

5.3 Setting up EXPRESSCLUSTER

For details about how to set up and connect to Cluster WebUI, refer to the following:

Installation and Configuration Guide

-> Creating the cluster configuration data

This section describes how to add the following resources:

- Mirror disk resource
- AWS Virtual IP resource
- AWS AZ monitor resource
- AWS Virtual IP monitor resource
- NP resolution (IP monitor resource)

For the settings other than the above, refer to "Installation and Configuration Guide".

1. Construct a cluster.

Start the Cluster generation wizard to construct a cluster.

• Construct a cluster.

Steps

1. Access Cluster WebUI, and click Cluster generation wizard.

Cluster WebUI Cluster1			🔎 Config mode 🗸	¥	© 2	₽ i	? 📑
Cluster generation wizard	Get the Configuration File	A pply the Configuration File	Update Server Data				
							-

2. The Cluster window on the Cluster Generation Wizard is displayed.

Enter a cluster name in **Cluster Name**.

Select an appropriate language from Language. Click Next.

Cluster generation wizard	×
Server Server Cluster → Basic Settings → Interconnect	Server → NP Resolution → Group → Monitor
Cluster Name*	Cluster1
Comment	
Language*	English 🗸
Management IP Address	
• Start generating the cluster. Enter the cluster name, and then select the languag If using the integrated WebManager to manage mu The management IP address is a floating IP address address, the management IP address can be omitte To continue, click [Next].	ge (locale) of the environment that runs WebManager. Itiple clusters, specify a unique cluster name to identify the cluster. s used for a WebManager connection. If establishing connections by specifying each server IP ed.
	Back Next Cancel

3. The **Basic Settings** window is displayed.

The instance connecting to Cluster WebUI is displayed as the registered master server. Click **Add** to add other instances (by specifying their private IP addresses). Click **Next**.

Cluster generation	wizard								×
Cluster ♥ → Basic Add Remove Server Definitions	Settings → In	rver terconnect →	Server NP Resolution	→ Group	→ №	1onitor			
Order	Name								
Master server	node1								
1	node2								
\uparrow \downarrow									
Server Group Definitio	n			Settings					
Click "Add" to add s Click ↑ or ↓ to Click "Settings" to con	ervers constructing to change the server figure the server gro	the cluster. priority. up when using th	e server group.						
							 Back 	Next 🕨	Cancel

4. The Interconnect window is displayed.

Specify the IP address (private IP address of each instance) to be used for interconnect. Select mdc1 from **MDC** for the communication path of the mirror disk resource to be created later. Click **Next**.

🌮 Cluster g	eneration v	wizard				×
Cluster 📀	Server	Settings 📀 🔸	Server	server ect → NP Resolu	ution → Group → Monitor	
Interconnect	Add	Remove				
Priority Ty	ype		MDC	node1	node2	
1 4	Kernel Mode	~	mdc1 🗸	10.0.110.10	✔ 10.0.120.10	~
\uparrow \downarrow						
Configure For "Kernel Communica Configuring For "Kernel For "Witness Click "Up" o For "Mirror O For the com communicat	e the interco mode", "Use tion Only" se more than o mode" ", "U s HB" setting r "Down" to Communication tion route in	er mode", "BM etting, configu one routes is n Jser mode, "DI g, click each se configure the tion Only" setti route which is MDC column.	the servers cons IC", "DISK", "Wit re the route whi ecommended. SK" and "COM" : erver column cel priority to prefe ings, click each s used for data m	tructing the cluster.Cl ness HB" and "COM" ch is used only for da settings, click each se I to set "Use" or "Do 1 rentially use the LAN renver column cell to o irroring communicati	ick "Add" to add interconnect and sel settings, configure the route which is ta mirroring communication. rver column cell and set an IP addres not use", and then click "Properties" to only for the communication among th configure IP addresses. on, select the mirror disk connect nan	ect the type. used for heartbeat. For "Mirror s or device. o set detailed settings. ie cluster servers. ne to be allocated to the

5. The NP Resolution window is displayed.

However, the NP resolution is not set on this window. The same operation as the NP resolution can be achieved by adding the IP monitor resource and monitoring a NAT instance set in each AZ. (The NP resolution will be set in "3. Add a monitor resource." described later.)

You need to examine the NP resolution destination and method depending on the location of clients accessing a cluster system and the condition for connecting to an on-premise environment (for example, using a dedicated line). Additionally, you can use network partition resolution resolution resolution. Click **Next**.

CHER ITER

2. Add a group resource.

· Group definition

Create a failover group.

Steps

- 1. The **Group List** window is displayed. Click **Add**.
- The Group Definition dialog box is displayed. Enter the failover group name (failover1) in the Name box. Click Next.

Group Definition	failover
Basic Settings → Startup Servers	→ Group Attributes → Group Resource
Туре*	failover 🗸
Use Server Group Settings	
Name*	failover1
Comment	
 Select group type. If using virtual machine resources to clust "Failover". If using server group, check the "Use Server gr	er virtual machines, select "Virtual machine" as the type. In other cases, select ver Group".

- 3. The **Startup Servers** window is displayed. Click **Next** without specifying anything.
- 4. The **Group Attributes** window is displayed. Click **Next** without specifying anything.
- 5. The **Group Resource** window is displayed. Add a group resource on this page following the procedure below.
- Mirror disk resource

Create a mirror disk resource according the mirror disk (EBS) as needed.

For details, refer to the following:

Reference Guide

-> Understanding Mirror disk resources

Steps

- 1. Click Add in Group Resource List.
- 2. The **Resource Definition of Group | failover1 window** is displayed.

Select the group resource type (Mirror disk resource) from the **Type** box and enter the group resource name (md) in the **Name** box. Click **Next**.

- 3. The **Dependency** window is displayed. Click **Next** without specifying anything.
- 4. The **Recovery Operation** windows is displayed. Click **Next**.
- 5. The Advanced Settings window is displayed. Enter the device name for the partition set up in "5.2. Configuring the instance" -> "6. Prepare the mirror disk." in Data Partition Device Name and Cluster Partition Device Name. Specify Mount Point and File System. Click Finish to finish setting.
- AWS Virtual IP resource

Add the AWS Virtual IP resource that controls the VIP by using the AWS CLI.

For details, refer to the following:

Reference Guide

-> Understanding AWS Virtual IP resources

Steps

- 1. Click Add in Group Resource List.
- 2. The Resource Definition of Group | failover1 window is displayed.

Select the group resource type (AWS Virtual IP resource) from the **Type** box and enter the group resource name (awsvip1) in the **Name** box. Click **Next**.

Resource Definition of Group failover1					
Info → Dependency → Recovery	Operation 🗲 Details				
Туре*	AWS Virtual IP resource \checkmark				
Name*	awsvip1				
Comment					
Get license information					
Select the type of group resource and	enter its name.				

- 3. The Dependency window is displayed. Click Next without specifying anything.
- 4. The **Recovery Operation** window is displayed. Click **Next**.
- 5. The **Details** window is displayed.

Set a VIP address to be assigned in the **IP Address** box on the **Common** tab (corresponds to [6] in Figure 5.1 System Configuration of the HA Cluster Based on VIP Control).

Set the ID of the VPC including instances in the VPC ID box (corresponds to [1] in Figure 5.1 System Configuration of the HA Cluster Based on VIP Control).

To set up the servers individually, enter the VPC ID of one server on the **Common** tab and specify the VPC ID of the other server separately.

Enter the ENI ID of the active server instance to which the VIP address is to be routed in the ENI ID box (corresponds to [7] in Figure 5.1 System Configuration of the HA Cluster Based on VIP Control).

The ENI IDs of the servers must be set up individually. Enter the ENI ID of one server on the **Common** tab and specify the ENI ID of the other server separately.

Resource Definition of Group failover1				
Info ⊘ → Dependency ⊘ → Reco Common node1 node2	very Operation 🤡 🔶 Details			
IP Address*	10.1.0.20			
VPC ID*	vpc-1234abcd			
ENI ID*	eni-xxxxxxxxx			
Tuning				
		Back Finish Cancel		

6. Specify the node settings on each node tab

Select the Set Up Individually check box.

Confirm that the VPC ID specified on the **Common** tab is entered in the **VPC ID** box (corresponds to [1] in Figure 5.1 System Configuration of the HA Cluster Based on VIP Control).

Enter the ENI ID of the instance corresponding to the node in the ENI ID box (corresponds to [7] and [8] in Figure 5.1 System Configuration of the HA Cluster Based on VIP Control).

Resource Definition of Group failover1 awsvip ×					
Info ♥ → Dependency ♥ → Rec Common node1 node2	overy Operation 🔗 🔶 Details				
Set Up Individually					
VPC ID*	vpc-1234abcd				
ENI ID*	eni-xxxxxxxx				
		Back Finish Cancel			
Resource Definition of Group failove	r1	awsvip 🗙			
Info ⊘ → Dependency ⊘ → Reco Common node1 node2	overy Operation 🤡 🔶 Details				
Set Up Individually	\checkmark				
VPC ID*	vpc-1234abcd				
ENI ID*	eni-yyyyyyyy				
		Back Finish Cancel			

- 7. Click **Finish** to complete setting.
- 3) Add a monitor resource.
- AWS AZ monitor resource

Create an AWZ AZ monitor resource to check whether the specified AZ is usable by using the monitor command.

For details, refer to the following:

Reference Guide

-> Understanding AWS AZ monitor resources

Steps

- 1. Click Add in Monitor Resource List.
- 2. Select the monitor resource type (AWS AZ monitor) from the **Type** box and enter the monitor resource name (awsazw1) in the **Name** box. Click **Next**.

Monitor Resource Definition		awsazw 🗙
Info → Monitor(common) → Mor	itor(special) 🔸 Recovery Action	
Туре*	AWS AZ monitor	
Name*	awsazw1	
Comment		
Get Licence Info		
• Select the type of monitor resource an	nd enter its name.	
		▲ Back Next ► Cancel

- 3. The **Monitor (common)** window is displayed. Click **Next** without specifying anything.
- 4. The Monitor (special) window is displayed.

Enter the AZ to be monitored in the **Availability Zone** box on the **Common** tab. (Specify the AZ of the active server instance.) (corresponds to [2] in Figure 5.1 System Configuration of the HA Cluster Based on VIP Control)

Monitor Resource Definition		awsazw 🗙
Info ⊘ → Monitor(common) ⊘ →	→ Monitor(special) → Recovery Action	
Availability Zone*	ap-northeast-1a	
Action when AWS CLI command failed to receive response*	Disable recovery action(Display warning) \checkmark	
		Back Next Cancel

5. Specify the node settings on each node tab. Select the **Set Up Individually** check box.

Enter the AZ of the instance corresponding to the node in the **Availability Zone** box. (corresponds to [2] and [3] in Figure 5.1 System Configuration of the HA Cluster Based on VIP Control) Click **Next**.

Monitor Resource Definition		awsazw 🗙
Info ♥ → Monitor(common) ♥ · Common node1 node2 Set Up Individually Availability Zone*	 → Monitor(special) → Recovery Action ✓ ap-northeast-1a 	Back Next Cancel
Monitor Resource Definition		awsazw 🗙
Info ⊘ → Monitor(common) ⊘ · Common node1 node2	→ Monitor(special) → Recovery Action	
Set Up Individually Availability Zone*	☑ ap-northeast-1b	Gancel Accel

6. The **Recovery Action** window is displayed. Set LocalServer in the **Recovery Target** box.

Monitor Resource Definition					awsazw 🗙		
Info 🛛 🔸 Monitor(common) 🖉	→ Mor	nitor(special) 🖉 🚽	Recovery Actio	n			
Recovery Action	Cu	stom settings			~		
Recovery Target *	Loc	calServer		Browse			
Recovery Script Execution Count*	0	time					
Execute Script before Reactivation							
Maximum Reactivation Count		time					
Execute Script before Failover							
Execute migration before Failover							
Maximum Failover Count		time					
Execute Script before Final Action							
Final Action	No	No operation					
	-				Script Settings		
				< Back	Finish Cancel		

- 7. Click **Finish** to complete setting.
- AWS Virtual IP monitor resource

This resource is automatically added when the AWS Virtual IP resource is added.

The existence of the VIP address and the health of the route table can be checked by using the OS API and the AWS CLI commands.

For details, refer to the following:

Reference Guide

-> Understanding AWS Virtual IP monitor resources

• IP monitor resource

Create the IP monitor resource to monitor the health of the subnet by sending a ping to a NAT instance placed in each AZ. Specify the following:

Steps

- 1. Click Add in Monitor Resource List.
- 2. Select the monitor resource type (IP monitor) from the **Type** box and enter the monitor resource name (ipw1) in the **Name** box. Click **Next**.

Monitor Resource Definition		ipw 🗙
Info → Monitor(common) → Mon	itor(special) → Recovery Action	
Туре*	IP monitor	
Name*	ipw1	
Comment		
Get Licence Info		
• Select the type of monitor resource an	d enter its name.	
		Back Next Cancel

- 3. The **Monitor (common)** window is displayed. Confirm that **Monitoring Timing** is **Always** and click **Next**.
- 4. The Monitor (special) window is displayed.

Enter the private IP address of the NAT instance used by each node in the **IP Address** box of the **Common** tab (corresponds to [4] and [5] in Figure 5.1 System Configuration of the HA Cluster Based on VIP Control). Click **Next**.

Monitor Resource Definition	ipw 🗙
Info ⊘ → Monitor(common) ⊘ → Monitor(special) → Recovery Action Common node1 node2	
Edit Add Remove	
IP Address List IP Address	
10.0.10.100	
10.0.20.100	
 ✓ Back Next ► 	Cancel

5. The **Recovery Action** window is displayed.

Set LocalServer in the **Recovery Target** box. Select **Stop the cluster service and shutdown OS** in **Final Action**.

Monitor Resource Definition		ipw 🗙
Info 🛛 🔶 Monitor(common) 🔮 -	Monitor(special) 📀 🔶 Recovery Actio	on
Recovery Action	Custom settings	~
Recovery Target *	LocalServer	Browse
Recovery Script Execution Count*	0 time	
Execute Script before Reactivation		
Maximum Reactivation Count	0 time	
Execute Script before Failover		
Execute migration before Failover		
Maximum Failover Count	0 time	
Execute Script before Final Action		
Final Action	Stop the cluster service and shutdown OS \checkmark	
		Script Settings
		, back Hillish Callee

- 6. Click **Finish** to complete setting.
- 4) Apply the settings and start the cluster.
- 1. Click **Apply the Configuration File** on the **File** in the config mode of Cluster WebUI. If the upload succeeds, the message saying "The application finished successfully."
- 2. Select the **Operation Mode** on the drop down menu of the toolbar in Cluster WebUI to switch to the operation mode.
- 3. The procedure depends on the resource used. For details, refer to the following: Installation and Configuration Guide -> How to create a cluster

CONSTRUCTING AN HA CLUSTER BASED ON EIP CONTROL

This chapter describes how to construct an HA cluster based on EIP control.

In the figure below, "Server Instance (Active)" and "Server Instance (Standby)" respectively represent the instance of the active server and that of the standby server.



Fig. 6.1: System Configuration of the HA cluster based on EIP control

CIDR (VPC)	10.0.0/16
Public subnet (Subnet-1A)	10.0.10.0/24
Public subnet (Subnet-1B)	10.0.20.0/24

6.1 Configuring the VPC Environment

Configure the VPC on the VPC Management console and EC2 Management console.

The IP address used in the figures and description is an example. In the actual configuration, use the actual IP address assigned to the VPC. When installing EXPRESSCLUSTER in the existing VPC, specify the appropriate settings such as adding a subnet if the number of subnets is insufficient. This guide does not describe the case to perform operations by adding an ENI to an instance of an HA cluster node.

1) Configure the VPC and subnet.

Create a VPC and subnet first.

-> Add a VPC and subnet in VPC and Subnets on the VPC Management console.

2) Configure the Internet gateway.

Add an Internet gateway to access the Internet from the VPC.

-> To create an Internet gateway, select **Internet Gateways** > **Create internet gateway** on the VPC Management console. Attach the created Internet gateway to the VPC.

3) Configure the network ACL and security group.

Specify the appropriate network ACL and security group settings to prevent unauthorized network access from in and out of the VPC.

Change the network ACL and security group path settings so that the instances of the HA cluster node can communicate with the Internet gateway via HTTPS, communicate with Cluster WebUI, and communicate with each other. The instances are to be placed on the public networks (Subnet-1A and Subnet-1B).

-> Change the settings in Network ACLs and Security Groups on the VPC Management console.

For the port numbers that are used by the EXPRESSCLUSTER components, refer to the following:

- Getting Started Guide
 - -> Notes and Restrictions
 - -> Before installing EXPRESSCLUSTER

4) Add an HA cluster instance.

Create an HA cluster node instance on the public networks (Subnet-1A and Subnet-1B). When creating an HA cluster node instance, be sure to specify the setting to enable a public IP. If an instance is created without using a public IP, it is necessary to add an EIP or NAT needs to be prepared. (This guide does not describe this case.)

-> To create an instance, select Instances > Launch Instance on the EC2 Management console.

-> For details about the IAM settings, refer to "8. *Configuring the IAM*".

Check the ID of the elastic network interface (ENI) assigned to each created instance.

[4] Server Instance (Active), [5] Server Instance (Standby)

The ENIs assigned respectively to the instance of the active server and the instance of the standby server can be identified according to the ENI IDs.

Write down the ENI ID (eni-xxxxxxx) of each instance, because the ID is needed later for setting up the AWS elastic IP resource.

Use the following procedure to check the ENI ID assigned to the instance.

- 1. Select the instance to display its detailed information.
- 2. Click the target device in Network Interfaces.
- 3. Check Interface ID displayed in the pop-up window.



5) Add an EIP.

Add an EIP to access an instance in the VPC from the Internet.

-> To add an EIP, select **Elastic IPs > Allocate new address** on the EC2 Management console.

[3] Elastic IP Address

The EIP can be identified according to the EIP Allocation ID.

Write down the Allocation ID (eipalloc-xxxxxxx) of the added EIP, because the ID is needed later for setting up the AWS elastic IP resource.

6) Configure the route table.

Add the routing to the Internet gateway so that the AWS CLI can communicate with the regional endpoint via NAT.

The following routings must be set in the route table (Public-AB) of the public networks (Subnet-1A and Subnet-1B in the above figure).

• Route table (Public-AB)

Destination	Target	Remarks
VPC network (Example: 10.0.0.0/16)	local	Existing by default
0.0.0/0	Internet Gateway	Add (required)

When a failover occurred, the AWS Elastic IP resource deassigns the EIP assigned to the active server instance by using the AWS CLI, and assign it to the standby server instance. Configure other routings according to the environment.

7) Add a mirror disk (EBS).

Add an EBS to be used as the mirror disk (cluster partition or data partition) as needed.

-> To add an EBS, select **Volumes > Create volume** on the EC2 Management console, and then attach the created volume to an instance.

6.2 Configuring the instance

Log in to each instance of the HA cluster and specify the following settings.

For the Python and AWS CLI versions supported by EXPRESSCLUSTER, refer to the following:

- Getting Started Guide

-> Installation requirements for EXPRESSCLUSTER

-> Operation environment for AWS elastic ip resource, AWS virtual ip resource, AWS Elastic IP monitor resource, AWS virtual IP monitor resource, AWS AZ monitor resource

1) Disable SELinux.

Set permissive or disabled to SELinux to perform communication required by EXPRESSCLUSTER. Run the following command to check the status of SELinux.

\$ getenforce Enforcing

(* Enforcing indicates that SELinux is enabled.)

Change the status of SELinux to "disabled" by using /etc/sysconfig/selinux and restart SELinux. Then run the getenforce command to confirm that Disabled is returned.

2) Configure a firewall.

Change the firewall setting as needed.

For the port numbers that are used by the EXPRESSCLUSTER components, refer to the following:

- Getting Started Guide

-> Notes and Restrictions

-> Before installing EXPRESSCLUSTER

3) Install Python.

Install Python required by EXPRESSCLUSTER.

First, confirm that Python is installed.

If Python has not been installed, install it by using a command such as yum. The installation path of the python commands must be any of the following:

/sbin, /bin, /usr/sbin, /usr/bin

4) Install the AWS CLI.

Install the AWS CLI by running the pip command from a shell.

\$ pip install awscli

For details about the pip command, refer to the following: https://pip.pypa.io/en/latest/

The installation path of the AWS CLI must be any of the following: /sbin, /bin, /usr/sbin, /usr/bin, /usr/local/bin

For details about how to set up the AWS CLI, refer to the following: https://docs.aws.amazon.com/cli/latest/userguide/cli-chap-install.html

(If EXPRESSCLUSTER has been installed before installing Python or the AWS CLI, be sure to restart the OS before using EXPRESSCLUSTER.)

5) Register the AWS access key ID.

Run the following command from the shell.

\$ sudo aws configure

Enter information such as the AWS access key ID to the inquiries. The settings to be specified vary depending on whether an IAM role is assigned to the instance or not.

• Instance to which an IAM role is assigned.

AWS Access Key ID [None]: (Press Enter without entering anything.) AWS Secret Access Key [None]: (Press Enter without entering anything.) Default region name [None]: <default region name> Default output format [None]: text

Instance to which an IAM role is not assigned.

AWS Access Key ID [None]: <AWS access key ID> AWS Secret Access Key [None]: <AWS secret access key> Default region name [None]: <default region name> Default output format [None]: text

For "Default output format", other format than "text" may be specified. If you specified incorrect settings, delete the directory /root/.aws entirely, and specify the above settings again.

6) Prepare the mirror disk.

If an EBS has been added to be used as the mirror disk, divide the EBS into partitions and use each partition as the cluster partition and data partition.

For details about the mirror disk partition, refer to the following:

Installation and Configuration Guide

-> Determining a system configuration

-> Partition settings for Mirror disk resource (when using Replicator)

7) Install EXPRESSCLUSTER.

For the installation procedure, refer to "Installation and Configuration Guide".

Store the EXPRESSCLUSTER installation media in the environment to which to install EXPRESSCLUSTER. (To transfer data, use any method such as Remote Desktop and Amazon S3.)

After the installation, restart the OS.

6.3 Setting up EXPRESSCLUSTER

For details about how to set up and connect to Cluster WebUI, refer to the following:

Installation and Configuration Guide

-> Creating the cluster configuration data

This section describes how to add the following resources:

- Mirror disk resource
- AWS Elastic IP resource
- AWS AZ monitor resource
- AWS Elastic monitor resource
- NP resolution (Custom monitor resource)

For the settings other than the above, refer to "Installation and Configuration Guide".

1) Construct a cluster.

Start the Cluster generation wizard to construct a cluster.

• Construct a cluster.

Steps

1. Access Cluster WebUI, and click Cluster generation wizard.

Cluster WebUI Cluster1			🗲 Config mode 🗸	7 () ; P	i ? 📑
Cluster generation wizard	Get the Configuration File	↑ Apply the Configuration File	Update Server Data			

2. The **Cluster** window on the **Cluster Generation Wizard** is displayed. Enter a cluster name in **Cluster Name**.

Select an appropriate language from Language. Click Next.

Cluster generation wizard	×
Server Server Cluster → Basic Settings → Interconnect Cluster Name*	Server → NP Resolution → Group → Monitor Cluster1
Comment Language*	English 🗸
Management IP Address Start generating the cluster.	
Enter the cluster name, and then select the langua. If using the integrated WebManager to manage mu The management IP address is a floating IP addres address, the management IP address can be omitte To continue, click [Next].	je (locale) of the environment that runs WebManager. Itiple clusters, specify a unique cluster name to identify the cluster. s used for a WebManager connection. If establishing connections by specifying each server IP ed.
	Back Next Cancel

3. The **Basic Settings** window is displayed.

The instance connecting to Cluster WebUI is displayed as the registered master server. Click **Add** to add other instances (by specifying their private IP addresses). Click **Next**.

Ser Cluster 📀 🔶 Ba	ver sic Settings →	Server Interconnect	s • • N	erver IP Resolution	→ Group	\rightarrow	Monitor		
Add Remove									
Server Definitions									
Order	Name								
Master server	node1								
1	node2								
\uparrow \downarrow									
Server Group Defin	ition				Settings				
Click "Add" to ad Click 「↑」 or 「↓」	d servers construct to change the se	ting the cluster.							
Click "Cottinge" to a	onfigure the serve	er aroun when us	ing the s	server aroup					

4. The **Interconnect** window is displayed.

Specify the IP address (private IP address of each instance) to be used for interconnect. Select mdc1 from **MDC** for the communication path of the mirror disk resource to be created later. Click **Next**.

Cluster generation wizard				×
Server Cluster ♥ → Basic Settings Properties Add Remove	server s ⊘ → Interconr	Server	tion → Group → Monitor	
nterconnect List				
Priority Type	MDC	node1	node2	
1 Kernel Mode	✓ mdc1 ✓	10.0.10.10	▶ 10.0.20.10	~
↑ ↓				
Configure the interconnect al For "kernel mode", "User mode Communication Only" setting, c Configuring more than one rout For "Kernel mode" ", "User moc For "Witnes HB" setting, click Click "Up" or "Down" to configu For "Mirror Communication Only For the communication route w communication route in MDC co	mong the servers cons ", "BMC", "DISK", "Wi onfigure the route whi ces is recommended. de, "DISK" and "COM" each server column ce re the priority to prefe y" settings, click each : hich is used for data n olumn.	structing the duster.Cli tress HB" and "COM" s ich is used only for data settings, click each ser II to set "Use" or "Do n rentially use the LAN o server column cell to co nirroring communicatio	ck "Add" to add interconnect and sel- ettings, configure the route which is a mirroring communication. ver column cell and set an IP addres ot use", and then cick "Properties" t nly for the communication among th onfigure IP addresses. n, select the mirror disk connect nan	ect the type. used for heartbeat. For "Mirror s or device. o set detailed settings. e cluster servers. ne to be allocated to the

5. The NP Resolution window is displayed.

However, the NP resolution is not set on this. The same operation as the NP resolution can be achieved by adding the custom monitor resource to confirm whether listening on port 443 of the regional endpoint is normally performed. (The NP resolution will be set in "3. Add a monitor resource." described later.)

You need to examine the NP resolution destination and method depending on the location of clients accessing a cluster system and the condition for connecting to an on-premise environment (for example, using a dedicated line). Additionally, you can use network partition resolution resolution resolution.

Click Next.

2) Add a group resource.

• Group definition

Create a failover group.

Steps

- 1. The **Group List** window is displayed. Click **Add**.
- The Group Definition dialog box is displayed. Enter the failover group name (failover1) in the Name box. Click Next.

Group Definition	failover			
Basic Settings → Startup Servers	→ Group Attributes → Group Resource			
Туре*	failover 🗸			
Use Server Group Settings				
Name*	failover1			
Comment				
 Select group type. If using virtual machine resources to cluster virtual machines, select "Virtual machine" as the type. In other cases, select "Failover". If using server group, check the "Use Server Group". 				

- 3. The **Startup Servers** window is displayed. Click **Next** without specifying anything.
- 4. The **Group Attributes** window is displayed. Click **Next** without specifying anything.
- 5. The **Group Resource** window is displayed. Add a group resource on this page following the procedure below.
- Mirror disk resource

Create the mirror disk resource according the mirror disk (EBS) as needed.

For details, refer to the following:

- Reference Guide
 - -> Understanding Mirror disk resources

Steps

- 1. Click Add in Group Resource List.
- 2. The **Resource Definition of Group | failover1** window is displayed.

Select the group resource type (Mirror disk resource) from the **Type** box and enter the group resource name (md) in the **Name** box. Click **Next**.

- 3. The **Dependency** window is displayed. Click **Next** without specifying anything.
- 4. The **Recovery Operation** window is displayed. Click **Next**.
- 5. Enter the device name for the partition set up in "Configuring the instance" -> "6. Prepare the mirror disk." in Data Partition Device Name and Cluster Partition Device Name. Specify Mount Point and File System. Click Finish to finish setting.
- AWS Elastic IP resource

Add an AWS Elastic IP resource that controls the EIP by using the AWS CLI.

For details, refer to the following:

- Reference Guide

-> Understanding AWS Elastic IP resources

Steps

- 1. Click Add in Group Resource List.
- 2. The Resource Definition of Group | failover1 window is displayed.

Select the group resource type (AWS Elastic IP resource) from the **Type** box and enter the group resource name (awseip1) in the **Name** box. Click **Next**.

Resource Definition of Group failover1			
Info → Dependency → Recovery	Operation 🗲 Details		
Туре*	AWS Elastic IP resource 🗸		
Name*	awseip1		
Comment			
Get license information			
Select the type of group resource and	enter its name.		
		Back Next Cancel	

- 3. The Dependency window is displayed. Click Next without specifying anything.
- 4. The **Recovery Operation** window is displayed. Click **Next**.
- 5. The **Details** window is displayed.

Enter the allocation ID of the EIP to be assigned in the **EIP ALLOCATION ID** box on the **Common** tab (corresponds to [3] and [4] in Figure 6.1 System Configuration of the HA cluster based on EIP control). Enter the ENI ID of the active server instance to which the EIP is assigned in the **ENI ID** box.

Resource Definition of Group failover1				
Info \bigcirc \rightarrow Dependency \oslash \rightarrow Reco Common node1 node2	overy Operation 🤡 🗦 Details			
EIP ALLOCATION ID*	eipalloc-01234567			
ENI ID*	eni-xxxxxxxxx			
Tuning				
		Back Finish Cancel		

6. Specify the node settings on each node tab

Select the Set Up Individually check box.

Enter the ENI ID of the instance corresponding to the node in the ENI ID box (corresponds to [4] and [5] in Figure 6.1 System Configuration of the HA cluster based on EIP control).

Resource Definition of Group failover1 awseip							
Info ♥ → Dependency ♥ → Ree Common node1 node2	covery Operation ⊘ → Details						
Set Up Individually ENI ID [*]	✓ eni-xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx	Back Finish Cancel					
Resource Definition of Group failov	er1	awseip					
Resource Definition of Group failov Info ⊘ → Dependency ⊘ → Red Common node1 node2	er1	awseip 🗙					
Resource Definition of Group failov Info	er1 covery Operation	awseip 🗙					

7. Click **Finish** to complete setting.

3) Add a monitor resource.

• AWS AZ monitor resource

Create the AWZ AZ monitor resource to check whether the specified AZ is usable by using the monitor command.

For details, refer to the following:

- Reference Guide

-> Understanding AWS AZ monitor resources

Steps

- 1. Click Add in Monitor Resource List.
- 2. Select the monitor resource type (AWS AZ monitor) from the **Type** box and enter the monitor resource name (awsazw1) in the **Name** box. Click **Next**.

Monitor Resource Definition				
Info → Monitor(common) → Mor	itor(special) 🗲 Recovery Action			
Туре*	AWS AZ monitor			
Name*	awsazw1			
Comment				
Get Licence Info				
Select the type of monitor resource an	nd enter its name.			

- 3. The **Monitor (common)** window is displayed. Click **Next** without specifying anything.
- 4. The Monitor (special) window is displayed.

Enter the AZ to be monitored in the **Availability Zone** box on the **Common** tab. (Specify the AZ of the active server instance.) (corresponds to [1] in Figure 6.1 System Configuration of the HA cluster based on EIP control)

Monitor Resource Definition		awsazw 🗙
Info ⊘ → Monitor(common) ⊘ → Common node1 node2	Monitor(special) → Recovery Action	
Availability Zone*	ap-northeast-1a	
Action when AWS CLI command failed to receive response*	Disable recovery action(Display warning) \checkmark	

5. Specify the node settings on each node tab

Select the Set Up Individually check box.

Enter the AZ of the instance corresponding to the node in the **Availability Zone** box (corresponds to [1] and [2] in Figure 6.1 System Configuration of the HA cluster based on EIP control). Click **Next**.

Monitor Resource Definition			awsazw	×
Info ⊘ → Monitor(common) ⊘ → Common node1 node2	Monitor(special) → Recovery Action			
Set Up Individually	✓			
Availability Zone*	ap-northeast-1a			
		Back Next	Cance	el

Monitor Resource Definition		awsazw 🗙
Info ♥ → Monitor(common Common node1 node2)	
Set Up Individually		
Availability Zone*	ap-northeast-1b	

6. The **Recovery Action** window is displayed. Set LocalServer in the **Recovery Target** box.

Monitor Resource Definition					awsazw 🗙
Info 🛛 🔸 Monitor(common) 🛇	→	Monitor(special) \oslash \rightarrow	Recovery Actio	'n	
Recovery Action		Custom settings			~
Recovery Target *		LocalServer		Browse	
Recovery Script Execution Count*		0 time			
Execute Script before Reactivation Maximum Reactivation Count		0 time			
Execute Script before Failover					
Execute migration before Failover Maximum Failover Count		0 time			
Execute Script before Final Action					
Final Action		No operation	~		
					Script Settings
				 Back 	Finish Cancel

- 7. Click **Finish** to complete setting.
- AWS Elastic IP monitor resource

This resource is automatically added when the AWS Elastic IP resource is added.

The health of the EIP address can be checked by monitoring the communication with the EIP address that is assigned to the active server instance.

For details, refer to the following:

Reference Guide

-> Understanding AWS Elastic IP monitor resources

• Custom monitor resource

This resource checks the status of the communication with the EIP address by monitoring the communication with port 443 of the endpoint of the region in which the environment has been constructed.

For the regional endpoints, refer to the following URL:

https://docs.aws.amazon.com/general/latest/gr/rande.html

For details, refer to the following:

Reference Guide

-> Understanding custom monitor resources

4) Apply the settings and start the cluster.

- 1. Click **Apply the Configuration File** on the **File** in the config mode of Cluster WebUI. If the upload succeeds, the message saying "The application finished successfully."
- 2. Select the **Operation Mode** on the drop down menu of the toolbar in Cluster WebUI to switch to the operation mode.
- 3. The procedure depends on the resource used. For details, refer to the following: Installation and Configuration Guide -> How to create a cluster
CHAPTER

SEVEN

CONSTRUCTING AN HA CLUSTER BASED ON DNS NAME CONTROL

This chapter describes how to construct an HA cluster based on DNS name control.

In the figure below, "Server Instance (Active)" and "Server Instance (Standby)" respectively represent the instance of the active server and that of the standby server.



Fig. 7.1: System Configuration HA Cluster Based on DNS Name Control

CIDR (VPC)	10.0.0/16
Domain Name	srv.hz1.local
Public subnet (Subnet-1A)	10.0.10.0/24
Continuor	on novt nago

Continued on next page

Table 7.1 – continued from	previous page
Public subnet (Subnet-1B)	10.0.20.0/24
Private subnet (Subnet-2A)	10.0.110.0/24
Private subnet (Subnet-2B)	10.0.120.0/24

raple 1.1 - continued non previous page

7.1 Configuring the VPC Environment

Configure the VPC on the VPC Management console and EC2 Management console.

The IP addresses used in the figures and description are an example. In the actual configuration, use the actual IP addresses assigned to the VPC. When installing EXPRESSCLUSTER in the existing VPC, specify the appropriate settings such as adding a subnet if the number of subnets is insufficient. This guide does not describe the case to perform operations by adding an ENI to an instance of an HA cluster node.

1) Configure the VPC and subnet.

Create a VPC and subnet first.

-> Add a VPC and subnet in VPC and Subnets on the VPC Management console.

[1] VPC Write down the VPC ID (vpc-xxxxxx), which is needed later for adding the Hosted Zone.

Laur	nch Instance	Connect Actions	,	•	Ð	•	0
Q	Filter by tags and	Network Interface eth0	VPC ID		50 of	58)	> >
		Interface ID	eni-				
	Name	VPC ID	vpc-	nce State 🔺	Sta	tus C	hecks
	server1	Attachment Owner		inning	•	212 0	hocké
	Serveri	Attachment Status	attached	inning		212 0	HECKS .
	manager	Attachment Time	Fri Jan 05 15:08:39 GMT+900 2018	inning	0	2/2 c	hecks .
	nat1	Delete on Terminate	true	inning	0	2/2 c	hecks .
	server2	Private IP Address	11.1. TO 11.1.	Inning	0	2/2 c	heck <i>s</i> r.
<		Private DNS Name	ap-northeast-				. •
			1.compute.internal				
	Sch	ec Elastic IP Address					
		Source/Dest. Check	false				
		Description	Primary network interface				
		Security Groups	default				
		Platform -	Network interfaces	eth0			
		IAM role -	Source/dest. check	False			
			T2 Unlimited	Disabled			+

2) Configure the Internet gateway.

Add an Internet gateway to access the Internet from the VPC.

-> To create an Internet gateway, select **Internet Gateways > Create internet gateway** on the VPC Management console. Attach the created Internet gateway to the VPC.

3) Configure the network ACL and security group.

Specify the appropriate network ACL and security group settings to prevent unauthorized network access from in and out of the VPC.

Change the network ACL and security group path settings so that the instances of the HA cluster node can communicate with the Internet gateway via HTTPS, communicate with Cluster WebUI, and communicate with each other. The instances are to be placed on the private networks (Subnet-2A and Subnet-2B).

-> Change the settings in Network ACLs and Security Groups on the VPC Management console.

For the port numbers that are used by the EXPRESSCLUSTER components, refer to the following:

- Getting Started Guide
 - -> Notes and Restrictions
 - -> Before installing EXPRESSCLUSTER

4) Add an HA cluster instance.

Create an HA cluster node instance on the private networks (Subnet-2A and Subnet-2B).

- -> To create an instance, select **Instances > Launch Instance** on the EC2 Management console.
- -> For details about the IAM settings, refer to "8. Configuring the IAM"

5) Add a NAT instance.

To perform the VIP control by using the AWS CLI, communication from the instance of the HA cluster node to the regional endpoint via HTTPS must be enabled.

To do so, create a NAT instance on the public networks (Subnet-1A and Subnet-1B). In the AWS environment, amzn-ami-vpc-nat-pv-2014.09.1.x86_64-ebs is prepared as the AMI with the string, amzn-ami-vpc-nat included.

When creating a NAT instance, enable the public IP. In addition, disable **Source/Dest. Check** of the added NAT instance to enable the NAT function.

-> To change the settings, right-click the NAT instance in **Instances** on the EC2 Management console, and select **Networking** > **Change Source/Dest. Check**.

6) Configure the route table.

Add the routing to the Internet gateway so that the AWS CLI can communicate with the regional endpoint via NAT.

The following routings must be set in the route table (Public-AB) of the public networks (Subnet-1A and Subnet-1B in the above figure).

• Route Table (Public-AB)

Destination	Target	Remarks
VPC network (Example: 10.0.0.0/16)	local	Existing by default
0.0.0/0	Internet gateway	Add (required)

The following routings must be set in the route tables (Private-A and Private-B) of the private networks (Subnet-2A and Subnet-2B in the above figure).

• Route Table (Private-A)

Destination	Target	Remarks
VPC network (Example: 10.0.0.0/16)	local	Existing by default
		Continued on next page

Table 7.3	 continued from 	previous pag	je
-----------	------------------------------------	--------------	----

Destination	Target	Remarks
0.0.0.0/0	NAT1	Add (required)

• Route Table (Private-B)

Destination	Target	Remarks
VPC network (Example: 10.0.0.0/16)	local	Existing by default
0.0.0/0	NAT2	Add (required)

Configure other routings according to the environment.

7) Add a Hosted Zone

Private Hosted Zone is added to Amazon Route 53.

-> To add a hosted zone, select **DNS management > Created Hosted Zone** on the **Route 53 Management Console**. Select **Private Hosted Zone for Amazon VPC** from the **Type** box and set the ID of VPC where the instance belongs, in the **VPC ID** box.

[7] Amazon Route 53 (Hosted Zone)

The Hosted Zone can be identified according to the Hosted Zone ID.

Note the Hosted Zone ID separately because it will be needed for the setup of AWS DNS resource later.

The reason that this guide includes the procedure to add Private Hosted Zone is to make it possible to access from the client within the VPC with the cluster located on the Private subnet. When access from internet is required, cluster must be located on Public subnet, therefore Public Hosted Zone will be added.

8) Add a mirror disk (EBS).

Add an EBS to be used as the mirror disk (cluster partition or data partition) as needed.

-> To add an EBS, select **Volumes > Create Volume** on the EC2 Management console, and then attach the created volume to an instance.

7.2 Configuring the instance

Log in to each instance of the HA cluster and specify the following settings. For the Python and AWS CLI versions supported by EXPRESSCLUSTER, refer to the following:

- Getting Started Guide

- -> Installation requirements for EXPRESSCLUSTER
- -> Operation environment for AWS DNS resource, AWS DNS monitor resource

1) Disable SELinux.

Set permissive or disabled to SELinux to perform communication required by EXPRESSCLUSTER. Run the following command to check the status of SELinux.

\$ getenforce
Enforcing

(* Enforcing indicates that SELinux is enabled.)

Change the status of SELinux to "disabled" by using /etc/sysconfig/selinux and restart SELinux. Then run the getenforce command to confirm that Disabled is returned.

2) Configure a firewall.

Change the firewall setting as needed. For the port numbers that are used by the EXPRESSCLUSTER components, refer to the following:

- Getting Started Guide
 - -> Notes and Restrictions
 - -> Before installing EXPRESSCLUSTER

3) Install Python.

Install Python required by EXPRESSCLUSTER.

First, confirm that Python is installed.

If Python has not been installed, install it by using a command such as yum. The installation path of the python commands must be any of the following:

/sbin, /bin, /usr/sbin, /usr/bin

4) Install the AWS CLI.

Install the AWS CLI by running the pip command from a shell.

\$ pip install awscli

For details about the pip command, refer to the following:

https://pip.pypa.io/en/latest/

The installation path of the AWS CLI must be any of the following: /sbin, /bin, /usr/sbin, /usr/bin, /usr/local/bin

For details about how to set up the AWS CLI, refer to the following: https://docs.aws.amazon.com/cli/latest/userguide/cli-chap-install.html

(If EXPRESSCLUSTER has been installed before installing Python or the AWS CLI, be sure to restart the OS before using EXPRESSCLUSTER.)

5) Register the AWS access key ID.

Run the following command from the shell.

\$ sudo aws configure

Enter information such as the AWS access key ID to the inquiries.

The settings to be specified vary depending on whether an IAM role is assigned to the instance or not.

• Instance to which an IAM role is assigned.

```
AWS Access Key ID [None]: (Press Enter without entering anything.)
AWS Secret Access Key [None]: (Press Enter without entering anything.)
Default region name [None]: <default region name>
Default output format [None]: text
```

• Instance to which an IAM role is not assigned.

AWS Access Key ID [None]: <AWS access key ID> AWS Secret Access Key [None]: <AWS secret access key> Default region name [None]: <default region name> Default output format [None]: text

For "Default output format", other format than "text" may be specified. If you specified incorrect settings, delete the directory /root/.aws entirely, and specify the above settings again.

6) Prepare the mirror disk.

If an EBS has been added to be used as the mirror disk, divide the EBS into partitions and use each partition as the cluster partition and data partition.

For details about the mirror disk partition, refer to the following:

Installation and Configuration Guide

- -> Determining a system configuration
- -> Partition settings for Mirror disk resource (when using Replicator)

7) Install EXPRESSCLUSTER.

For the installation procedure, refer to "Installation and Configuration Guide". Store the EXPRESSCLUSTER installation media in the environment to which to install EXPRESSCLUSTER. (To transfer data, use any method such as Remote Desktop and Amazon S3.) After the installation, restart the OS.

7.3 Setting up EXPRESSCLUSTER

For details about how to set up and connect to Cluster WebUI, refer to the following:

Installation and Configuration Guide

-> Creating the cluster configuration data

This section describes how to add the following resources:

- Mirror disk resource
- AWS DNS resource
- AWS AZ monitor resource
- AWS DNS monitor resource
- NP resolution (IP monitor resource)

For the settings other than the above, refer to "Installation and Configuration Guide".

1) Construct a cluster.

Start the Cluster generation wizard to construct a cluster.

• Construct a cluster.

Steps

1. Access Cluster WebUI, and click Cluster generation wizard.

Cluster WebUI Cluster1			🗲 Config mode 🗸	¥	C C	₽ i ?	
Cluster generation wizard	Export Get the Configuration File	Apply the Configuration File	Update Server Data				

2. The **Cluster** window on the **Cluster Generation Wizard** is displayed. Enter a cluster name in **Cluster Name**.

Select an appropriate language from Language. Click Next.

Cluster generation wizard		×
Server Server Cluster → Basic Settings → Interconnect Cluster Name	Server → NP Resolution → Group → Monitor Cluster1	
Comment Language*	English 🗸	
Management IP Address		
Start generating the cluster. Enter the cluster name, and then select the languag If using the integrated WebManager to manage mult The management IP address is a floating IP address address, the management IP address can be omittee To continue, click [Next].	ge (locale) of the environment that runs WebManager. Itiple clusters, specify a unique cluster name to identify the cluster. s used for a WebManager connection. If establishing connections by specifying each server IP ed.	
	4 Back Next > Cance	Ι

3. The **Basic Settings** window is displayed.

The instance connecting to WebManager is displayed as the registered master server. Click **Add** to add other instances (by specifying their private IP addresses). Click **Next**.

Ser Cluster 📀 🔶 Ba	ver sic Settings →	Server Interconnect	s • • N	erver IP Resolution	→ Group	\rightarrow	Monitor		
Add Remove									
Server Definitions									
Order	Name								
Master server	node1								
1	node2								
\uparrow \downarrow									
Server Group Defin	ition				Settings				
Click "Add" to ad Click 「↑」 or 「↓」	d servers construct to change the se	ting the cluster.							
Click "Cottinge" to a	onfigure the serve	er aroun when us	ing the s	server aroup					

4. The Interconnect window is displayed.

Specify the IP address (private IP address of each instance) to be used for interconnect. Select mdc1 from **MDC** for the communication path of the mirror disk resource to be created later. Click **Next**.

Cluster generation wizard				
uster ♥ → Basic Settings ♥	Server Э → Interconr	Server ect → NP Resolu	tion → Group → Monitor	
erconnect List riority Type	MDC	node1	node2	
1 Kernel Mode	✓ mdc1 ✓	10.0.110.10	✔ 10.0.120.10	~
4				
Configure the interconnect and or "Kernel mode", "User mode", communication Only" setting, cor configuring more than one routes for "Kernel mode" ", "User mode, for "Witness HB" setting, click ea- click "Up" or "Down" to configure tilck "Up" or "Down" to configure for "Mirror Communication Only" for the communication route while communication route in MDC colu-	ng the servers cons "BMC", "DISK", "Wi figure the route whi is recommended, "DISK" and "COM" ch server column ce the priority to prefe settings, click each : ch is used for data n mm.	tructing the cluster. Cli ness HB" and "COM" s ch is used only for dat settings, click each ser I to set "Use" or "Do n rentially use the LAN o ervere column cell to c irroring communicatio	ck "Add" to add interconnect and s settings, configure the route which a mirroring communication. ver column cell and set an IP addr tot use", and then click "Properties" only for the communication among onfigure IP addresses. an, select the mirror disk connect n	select the type. is used for heartbeat. For "Mirror ess or device. " to set detailed settings. the cluster servers. ame to be allocated to the

5. The NP Resolution window is displayed.

However, the NP resolution is not set on this page. The same operation as the NP resolution can be achieved by adding the IP monitor resource and monitoring a NAT instance set in each AZ. (The NP resolution will be set in "3. Add a monitor resource." described later.)

You need to examine the NP resolution destination and method depending on the location of clients accessing a cluster system and the condition for connecting to an on-premise environment (for example, using a dedicated line). Additionally, you can use network partition resolution resources for NP resolution.

Click Next.

2) Add a group resource.

· Group definition

Create a failover group.

Steps

- 1. The **Group List** window is displayed. Click **Add**.
- The Group Definition dialog box is displayed.
 Enter the failover group name (failover1) in the Name box. Click Next.

Group Definition	failover 🗙
Basic Settings → Startup Servers	→ Group Attributes → Group Resource
Туре*	failover 🗸
Use Server Group Settings	
Name*	failover1
Comment	
 Select group type. If using virtual machine resources to clust "Failover". If using server group, check the "Use Server gr	er virtual machines, select "Virtual machine" as the type. In other cases, select ver Group".

- 3. The **Startup Servers** window is displayed. Click **Next** without specifying anything.
- 4. The **Group Attributes** window is displayed. Click **Next** without specifying anything.
- 5. The **Group Resource** window is displayed. Add a group resource on this page following the procedure below.
- Mirror disk resource

Create a mirror disk resource according the mirror disk (EBS) as needed.

For details, refer to the following:

- Reference Guide
 - -> Understanding Mirror disk resources

Steps

- 1. Click Add in Group Resource List.
- The Resource Definition of Group | failover1window is displayed.
 Select the group resource type (Mirror disk resource) from the Type box and enter the group resource
 - name (md) in the Name box. Click Next.
- The Dependency window is displayed. Click Next without specifying anything.
- 4. The **Recovery Operation** window is displayed. Click **Next**.
- 5. Enter the drive letter for the partition set up in "Configuring the instance" -> "6. Prepare the mirror disk." in Data partition device name and Cluster partition device name. Specify Mount Point and File System. Click Finish to finish setting.
- AWS DNS resource

Add the AWS DNS resource that controls the DNS name by using the AWS CLI.

For details, refer to the following:

- Reference Guide
 - -> Understanding AWS DNS resources

Steps

- 1. Click Add in Group Resource List.
- 2. The **Resource Definition of Group** | failover1 window is displayed. Select the group resource type (AWS DNS resource) from the **Type** box and enter the group resource name (awsdns1) in the **Name** box.

Resource Definition of Group failover1		
Info → Dependency → Recovery	Operation 🗲 Details	
Туре*	AWS DNS resource	
Name*	awsdns1	
Comment		
Get license information		
• Select the type of group resource and	enter its name.	

- 3. The Dependency window is displayed. Click Next without specifying anything.
- 4. The **Recovery Operation** window is displayed. Click **Next**.
- 5. The **Details** window is displayed.

Set the hosted zone ID in the **Hosted Zone ID** box on the **Common** tab (corresponds to [7] in Figure 7.1 System Configuration HA Cluster Based on DNS Name Control).

Set a DNS name to be assigned in the **Resource Record Set Name** box (corresponds to [6] in Figure 7.1 System Configuration HA Cluster Based on DNS Name Control).

Set the DNS name as FQDN, adding dot (.) at the end of the name.

Set the IP address corresponding to the DNS name in the **IP Address** box (corresponds to [4] in Figure 7.1 System Configuration HA Cluster Based on DNS Name Control).

Enter the IP address of one server on the **Common** tab and specify the IP address of the other server separately.

Since this guide uses the configuration in which the IP address of each server is included in the resource record set, the procedure is as described above. However, if VIP and EIP are included in the resource record set, enter the IP address on the **Common** tab. No individual setting is required. Set the time to live (TTL) of the cache in the **TTL** box.

The time is specified in seconds.

Set the Delete a resource record set at deactivation checkbox to on.

If the resource record set is not deleted from the hosted zone when AWS DNS resource is deactivated, uncheck the checkbox.

If it is not deleted, a client may access the remaining DNS name.

Resource Definition of Group failover1 awsdns					
Info ♥ → Dependency ♥ → Reco Common node1 node2	overy Operation 🤡 🔿 Det	ails			
Hosted Zone ID*	ABCDEFGHIJK123]			
Resource Record Set Name*	srv.hz1.local				
IP Address*	10.0.110.10				
TTL*	300	sec			
Delete a record set at deactivation					
Tuning					
			Back Finish Cancel		

6. Specify the node settings on each node tab.

Select the **Set Up Individually** check box.

Enter the IP address of the instance corresponding to the node in the IP Address box (corresponds to [4] and [6] in Figure 7.1 System Configuration HA Cluster Based on DNS Name Control).

Since this guide uses the configuration in which the IP address of each server is included in the resource record set, the procedure is as described above. However, if VIP and EIP are included in the resource record set, this procedure is not needed.

Resource Definition of Group failow	ver1	awsdns 🗙			
Info ♥ → Dependency ♥ → Re Common node1 node2	ecovery Operation 🤡 🔶 Details				
Set Up Individually					
IP Address	10.0.110.10				
		Image: Back Finish Cancel			
Resource Definition of Group failover1 awsdns X					
Resource Definition of Group failow	ver1	awsdns 🗙			
Resource Definition of Group failow Info \bigcirc \rightarrow Dependency \bigcirc \rightarrow Re	ver1 ecovery Operation 🤡 🔿 Details	awsdns 🗙			
Resource Definition of Group failow Info ⊘ → Dependency ⊘ → Re Common node1 node2	ver1 ecovery Operation 🤡 🔿 Details	awsdns 🗙			
Resource Definition of Group failow Info ♥ → Dependency ♥ → Re Common node1 node2 Set Up Individually	ver1 ecovery Operation ⊘ → Details	awsdns 🗙			
Resource Definition of Group failow Info ♥ → Dependency ♥ → Re Common node1 node2 Set Up Individually IP Address	ver1 ecovery Operation ⊘ → Details ✓ 10.0.120.10	awsdns 🗙			

7. Click Finish to complete setting.

3) Add a monitor resource.

• AWS AZ monitor resource

Create an AWZ AZ monitor resource to check whether the specified AZ is usable by using the monitor command.

For details, refer to the following:

Reference Guide

-> Understanding AWS AZ monitor resources

Steps

- 1. Click Add in Monitor Resource List.
- 2. Select the monitor resource type (AWS AZ monitor) from the **Type** box and enter the monitor resource name (awsazw1) in the **Name** box. Click **Next**.

Monitor Resource Definition		awsazw 🗙
Info → Monitor(common) → Mor	nitor(special) → Recovery Action	
Туре*	AWS AZ monitor	
Name*	awsazw1	
Comment		
Get Licence Info		
③ Select the type of monitor resource a	nd enter its name.	
		Back Next Cancel

- 3. The **Monitor (common)** window is displayed. Click **Next** without specifying anything.
- 4. The Monitor (special) window is displayed.

Enter the AZ to be monitored in the **Availability Zone** box on the **Common** tab. (Specify the AZ of the active server instance.) (corresponds to [2] in Figure 7.1 System Configuration HA Cluster Based on DNS Name Control)

Monitor Resource Definition		awsazw 🗙
Info ♥ → Monitor(common) ♥ → Common node1 node2	Monitor(special) → Recovery Act	ion
Availability Zone*	ap-northeast-1a	
Action when AWS CLI command failed to receive response*	Disable recovery action(Display warning)) 🗸
		Back Next Cancel

5. Specify the node settings on each node tab.

Select the Set Up Individually check box.

Enter the AZ of the instance corresponding to the node in the **Availability Zone** box (corresponds to [2] and [3] in Figure 7.1 System Configuration HA Cluster Based on DNS Name Control). Click **Next**.

Monitor Resource Definition		awsazw 🗙
Info ⊘ → Monitor(common) ⊘ - Common node1 node2	➤ Monitor(special) → Recovery Action	
Set Up Individually Availability Zone*	☑ ap-northeast-1a	Back Next Cancel
Marilan Daaraan Dafailian		
		awsazw 🗙
Info ⊘ → Monitor(common) ⊘ - Common node1 node2	Monitor(special) Recovery Action	awsazw 🗙
Monitor Resource Definition Info ♥ → Monitor(common) ♥ - Common node1 node2 Set Up Individually Availability Zone*	 Monitor(special) → Recovery Action ✓ ap-northeast-1b 	awsazw 🗙

6. The **Recovery Action** window is displayed. Set LocalServer in the **Recovery Target** box.

Monitor Resource Definition					awsazw 🗙
Info 🛛 🔸 Monitor(common) 🛇	÷	Monitor(special) 🔗 🔸	Recovery Actio	n	
Recovery Action		Custom settings			~
Recovery Target *		LocalServer		Browse	
Recovery Script Execution Count*		0 time			
Execute Script before Reactivation					
Maximum Reactivation Count		0 time			
Execute Script before Failover					
Execute migration before Failover					
Maximum Failover Count		0 time			
Execute Script before Final Action					
Final Action		No operation	~		
					Script Settings
				 ▲ Back 	Finish Cancel

- 7. Click **Finish** to complete setting.
- AWS DNS monitor resource

This resource is automatically added when the AWS DNS resource is added.

Using the OS API and the AWS CLI commands, check the existence of the resource record set and whether the registered IP address can be obtained by resolving the DNS name.

For details, refer to the following:

Reference Guide

- -> Understanding AWS DNS monitor resources
- IP monitor resource

Create the IP monitor resource to monitor the health of the subnet by sending a ping to a NAT instance placed in each AZ. Specify the following:

Steps

- 1. Click Add in Monitor Resource List.
- 2. Select the monitor resource type (IP monitor) from the **Type** box and enter the monitor resource name (ipw1) in the **Name** box. Click **Next**.

Monitor Resource Definition				ipw 🗙
Info → Monitor(common) → M	onitor(special) 🔶 R	ecovery Action		
Туре*	IP monitor	~		
Name*	ipw1			
Comment				
Get Licence Info				
• Select the type of monitor resource	and enter its name.			
			• Back N	ext • Cancel

- The Monitor (common) window is displayed.
 Confirm that Monitoring Timing is Always and click Next.
- 4. The Monitor (special) window is displayed.

Enter the private IP address of the NAT instance used by each node in the **IP Address** box of the **Common** tab (corresponds to [4] and [5] in Figure 7.1 System Configuration HA Cluster Based on DNS Name Control). Click **Next**.

Monitor Resource Definition	ipw 🗙
Info ⊘ → Monitor(common) ⊘ → Monitor(special) → Recovery Action	
Common node1 node2	
Edit Add Remove	
IP Address List	
IP Address	
10.0.10.100	
10.0.20.100	
	Back Next Cancel

5. The Recovery Action window is displayed.

Set LocalServer in the **Recovery Target** box.

Select Stop the cluster service and shutdown OS in Final Action.

Monitor Resource Definition				ipw 🗙
Info 🤡 🔶 Monitor(common) 🔗	→ Monitor(special) 🤡 🔶 Recovery A	Action	
Recovery Action	Custom s	settings		~
Recovery Target *	LocalServ	ver	Browse	
Recovery Script Execution Count*	0	time		
Execute Script before Reactivation				
Maximum Reactivation Count		time		
Execute Script before Failover				
Execute migration before Failover				
Maximum Failover Count		time		
Execute Script before Final Action				
Final Action	Stop the	cluster service and shutdown C	os 🗸	
	6		S	cript Settings
			Back Fit	nish Cancel

6. Click **Finish** to complete setting.

- 4) Apply the settings and start the cluster.
- 1. Click **Apply the Configuration File** on the **File** in the config mode of Cluster WebUI. If the upload succeeds, the message saying "The application finished successfully."
- 2. Select the **Operation Mode** on the drop down menu of the toolbar in Cluster WebUI to switch to the operation mode.
- 3. The procedure depends on the resource used. For details, refer to the following: Installation and Configuration Guide -> How to create a cluster

CHAPTER

CONFIGURING THE IAM

This chapter describes the Identity & Access Management (IAM) settings in the AWS environment. For the resource and monitor resources such as the AWS Virtual IP resource, the AWS CLI is run in a resource to process the resource itself. To run the AWS CLI correctly, it is required to configure the IAM in advance.

There are two methods to grant access permissions to the AWS CLI: the policy to use an IAM role and the policy to use an IAM user. NEC recommends the policy to use an IAM role because it is unnecessary to store the AWS access key ID and AWS secret access key in each instance in principle, enhancing the security.

The following table describes the advantages and disadvantages of both policies.

	Advantages	Disadvantages
Policy to use an IAM role		None.
	High security	
	Easy to manage key information.	
Policy to use an IAM user	Available to set access permissions	
	to an individual instance later	High risk of key information
		disclosure
		Complicated to manage key
		information

The procedure to configure the IAM is as follows:

- 1. First, create an IAM policy by referring to "Creating an IAM policy" below.
- 2. Next, configure the instance settings.

To use an IAM role, refer to "Configuring the instance - Using an IAM role" described later. To use an IAM user, refer to "Configuring the instance - Using an IAM user" described later.

8.1 Creating an IAM policy

Create a policy in which access permissions granted to the actions for the services such as EC2 and S3 of AWS are described. Access permissions need to be granted to the following actions so that the AWS related resources and monitor resources of EXPRESSCLUSTER run the AWS CLI.

The required policies may be changed in future.

• AWS Virtual IP resource and AWS Virtual IP monitor resource

Action	Description
ec2:DescribeNetworkInterfaces ec2:DescribeVpcs ec2:DescribeRouteTables	Required to obtain information of a VPC, route table, and network interface.
ec2:ReplaceRoute	Required to update a route table.

• AWS Elastic IP resource and AWS Elastic IP monitor resource

Action	Description
ec2:DescribeNetworkInterfaces ec2:DescribeAddresses	Required to obtain information of an EIP and net- work interface.
ec2:AssociateAddress	Required to assign an EIP to an ENI.
ec2:DisassociateAddress	Required to deassign an EIP from an ENI.

• AWS DNS resource/AWS DNS monitor resource

Action	Description
Route 53:ChangeResourceRecordSets	Required to add/delete a resource record set and update the setting details.
Route 53:ListResourceRecordSets	Required to obtain the information of a resource record set.

• AWS AZ monitor resource

Action	Description
ec2:DescribeAvailabilityZones	Required to obtain information of an AZ.

In the following custom policy example, access permissions are granted to all actions to be used by the AWS-related resources and monitor resources.

```
{
    "Version": "2012-10-17",
    "Statement": [
    {
        "Action": [
            "ec2:Describe*",
            "ec2:ReplaceRoute",
            "ec2:AssociateAddress",
            "ec2:DisassociateAddress",
            "route53:ChangeResourceRecordSets",
```

(continues on next page)

(continued from previous page)

```
"route53:ListResourceRecordSets"
],
"Effect": "Allow",
"Resource": "*"
}
```

-> To create a custom policy, select **Policies > Create Policy** on the IAM Management console.

8.2 Configuring the instance

Using an IAM role

Create an IAM role and assign the created IAM role to an instance to run the AWS CLI.



Fig. 8.1: Configuring the instance by using an IAM role

1) Create an IAM role. Attach the IAM policy to the created role.

-> To create an IAM role, select Roles > Create New Role on the IAM Management console.

- 2) When creating an instance, specify the created IAM role for IAM Role.
- 3) Log on to the instance.
- 4) Install Python.

Install Python required by EXPRESSCLUSTER. First, confirm that Python is installed. If Python has not been installed, install it by using a command such as yum. The installation path of the python commands must be any of the following: /sbin, /bin, /usr/sbin, /usr/bin

5) Install the AWS CLI.

Install the AWS CLI by running the pip command from a shell.

\$ pip install awscli

For details about the pip command, refer to the following: https://pip.pypa.io/en/latest/

The installation path of the AWS CLI must be any of the following: /sbin, /bin, /usr/sbin, /usr/bin, /usr/local/bin

For details about how to set up the AWS CLI, refer to the following:

https://docs.aws.amazon.com/cli/latest/userguide/cli-chap-install.html

(If EXPRESSCLUSTER has been installed before installing Python or the AWS CLI, be sure to restart the OS before using EXPRESSCLUSTER.)

6) Run the following command from the shell.

```
$ sudo aws configure
```

Enter information such as the AWS access key to the inquiries.

The settings to be specified vary depending on whether an IAM role is assigned to the instance or not.

AWS Access Key ID [None]: (Press Enter without entering anything.) AWS Secret Access Key [None]: (Press Enter without entering anything.) Default region name [None]: <default region name> Default output format [None]: text

If you specified incorrect settings, delete the directory /root/.aws entirely, and specify the above settings again.

Using an IAM user

Create an IAM user and store the access key ID and secret access key of the created user in an instance to run the AWS CLI. It is not required to assign the created IAM role to an instance to be created.



Fig. 8.2: Configuring the instance by using an IAM user

1) Create an IAM user. Attach the IAM policy to the created user.

-> To create an IAM user, select Users > Create New Users on the IAM Management console.

- 2) Log on to the instance.
- 3) Install Python.

Install Python required by EXPRESSCLUSTER. First, confirm that Python is installed. If Python has not been installed, install it by using a command such as yum. The installation path of the python commands must be any of the following: /sbin, /bin, /usr/sbin, /usr/bin

4) Install the AWS CLI.

Install the AWS CLI by running the pip command from a shell.

\$ pip install awscli

For details about the pip command, refer to the following:

https://pip.pypa.io/en/latest/

The installation path of the AWS CLI must be any of the following: /sbin, /bin, /usr/sbin, /usr/bin, /usr/local/bin

For details about how to set up the AWS CLI, refer to the following: http://docs.aws.amazon.com/cli/latest/userguide/installing.html

(If EXPRESSCLUSTER has been installed before installing Python or the AWS CLI, be sure to restart the OS before using EXPRESSCLUSTER.)

5) Run the following command from the shell.

\$ sudo aws configure

Enter the information required to run the AWS CLI to the inquiries. For the AWS access key ID and AWS secrete access key, enter those obtained from the IAM use detailed information window.

AWS Access Key ID [None]: <AWS access key ID> AWS Secret Access Key [None]: <AWS secret access key> Default region name [None]: <default region name> Default output format [None]: text

If you specified incorrect settings, delete the directory /root/.aws entirely, and specify the above settings again.

CHAPTER

TROUBLESHOOTING

This chapter describes the points to be checked and solutions if EXPRESSCLUSTER cannot be set up in the AWS environment.

• Failed to start a resource or monitor resource related to AWS.

Confirm that the OS has restarted, Python and the AWS CLI are installed, and the AWS CLI has been set up correctly.

If the OS has been restarted when installing EXPRESSCLUSTER, the environment variable settings might be changed by installing Python and the AWS CLI. In this case, restart the OS again.

• Failed to start the AWS Virtual IP resource.

Cluster WebUI message

Activating awsvipl resource has failed. (99 : Internal error. (status=nn))

Possible cause Any of the following might be the cause.

- Python has not been installed, or the path does not reach python.
- The AWS CLI has not been installed, or the path does not reach AWS CLI.

Solution

- Confirm that Python or the AWS CLI is installed.
- The installation path of the python commands must be any of the following: /sbin, /bin, /usr/sbin, /usr/bin
- The installation path of the AWS CLI must be any of the following: /sbin, /bin, /usr/sbin, /usr/bin, /usr/local/bin

Cluster WebUI message

```
Activating awsvipl resource has failed.(5 : Failed in the AWS CLI_ \rightarrow command.)
```

Possible cause Any of the following might be the cause.

- The AWS CLI has not been set up. (aws configure has not been run.)
- The AWS CLI configuration file could not be found. (A user other than root ran aws configure, or A user without sudo ran aws configure.)

Search for a credentials file and a config file by the following order (in case of policy for which the IAM user is used).

1) \$HOME/.aws follower

2) /root/.aws follower

- The specified AWS CLI settings (such as a region, access key ID, and secret key) are not correct.
- (For an operation using an IAM role) An IAM role has not been set to the instance. Access the URL below from the corresponding instance and then check whether the given IAM role name is displayed. If the message "404 Not Found" appears, no IAM role has been set.

http://169.254.169.254/latest/meta-data/iam/security-credentials/

- The specified VPC ID or ENI ID is invalid.
- The regional endpoint has been stopped due to maintenance or failure.
- An issue of the communication path to the regional endpoint.
- Delay caused by the heavily loaded node.

Solution Check the following:

- Correct the AWS CLI settings. Then confirm that the AWS CLI works successfully.
- When the node is heavily loaded, remove the causes.
- For an operation using an IAM role, check the settings on the AWS Management Console.

Cluster WebUI message

```
Activating awsvip1 resource has failed.(5 : The vpc ID 'vpc-xxxxxxx'.

→does not exist)
```

Possible cause The specified VPC ID might not be correct or might not exist.

Solution Specify a correct VPC ID.

Cluster WebUI message

Possible cause The specified ENI ID might not be correct or might not exist.

Solution Specify a correct ENI ID.

Cluster WebUI message

```
Activating awsvip1 resource has failed.(5 : You are not authorized to \rightarrow perform this operation.)
```

Possible cause If the ReplaceRoute right of an IAM role can be exercised only on a route table specified in a resource in the IAM policy, the route table might have an error or lack of its settings.

Solution

Of all route tables under a specified VPC, an AWS virtual IP resource updates only ones that include specified virtual IP address entries.

For all such route tables to be updated, give permission to the resource in the IAM policy.

Cluster WebUI message

Activating awsvip1 resource has failed.(6 : Timeout occurred.)

Possible cause Any of the following might be the cause:

- The AWS CLI command might not be able to communicate with the regional endpoint, due to a misconfiguration of the route table, NAT, or proxy server.
- Delay caused by the heavily loaded node.

Solution Check the following:

- The instance for NAT is running.
- The routing for the NAT instance has been set up.
- The packet is not excluded by filtering.
- Check the settings of the route table, NAT, or proxy server.
- When the node is heavily loaded, remove the causes.

Cluster WebUI message

```
Activating awsvip1 resource has failed.(7 : The VIP address vvv.www.xxx. \rightarrow yyy belongs to a VPC subnet.)
```

Possible cause The specified VIP address is not appropriate because it is within of the VPC CIDR range.

Solution Specify an IP address out of the VPC CIDR range as the VIP address.

• The AWS Virtual IP resource is running normally, but ping cannot reach the VIP address.

Cluster WebUI message

Possible cause Source/Dest. Check of the ENI set to the AWS Virtual IP resource is enabled.

Solution Disable Source/Dest. Check of the ENI set to the AWS Virtual IP resource.

• The AWS Virtual IP monitor resource enters the error state.

Cluster WebUI message

Detected an error **in** monitoring awsvipw1. (8 : The routing **for** VIP vvv.www. →xxx.yyy was changed.)

Possible cause In the route table, the target of the VIP address corresponding to the AWS Virtual IP resource has been changed to another ENI ID for some reason.

Solution

When an error is detected, the AWS Virtual IP resource is restarted automatically and the target is updated to a correct ENI ID.

Check whether another HA cluster uses the same VIP address mistakenly and so on.

• Failed to start the AWS Elastic IP resource.

Cluster WebUI message

Activating awseipl resource has failed. (99 : Internal error. (status=nn))

Possible cause Any of the following might be the cause.

- Python has not been installed, or the path does not reach python.
- The AWS CLI has not been installed, or the path does not reach AWS CLI.

Solution Check the following:

- Confirm that Python or the AWS CLI is installed.
- The installation path of the python commands must be any of the following: /sbin, /bin, /usr/sbin, /usr/bin
- The installation path of the AWS CLI must be any of the following: /sbin, /bin, /usr/sbin, /usr/bin, /usr/local/bin

Cluster WebUI message

```
Activating awseip1 resource has failed.(5 : Failed in the AWS CLI_ 

command.)
```

Possible cause Any of the following might be the cause:

- The AWS CLI has not been set up. (aws configure has not been run.)
- The AWS CLI configuration file could not be found. (A user other than root ran aws configure, or A user without sudo ran aws configure.) Search for a credentials file and a config file by the following order (in case of policy for

which the IAM user is used):

1) \$HOME/.aws follower

2) /root/.aws follower

- The specified AWS CLI settings (such as a region, access key ID, and secret key) are not correct.
- (For an operation using an IAM role) An IAM role has not been set to the instance. Access the URL below from the corresponding instance and then check whether the given IAM role name is displayed. If the message "404 Not Found" appears, no IAM role has been set.

http://169.254.169.254/latest/meta-data/iam/security-credentials/

• The specified EIP Allocation ID or ENI ID is invalid.

- The regional endpoint has been stopped due to maintenance or failure.
- An issue of the communication path to the regional endpoint.
- Delay caused by the heavily loaded node.

Solution Check the following:

- Correct the AWS CLI settings. Then confirm that the AWS CLI works successfully.
- When the node is heavily loaded, remove the causes.
- For an operation using an IAM role, check the settings on the AWS Management Console.

Cluster WebUI message

```
Activating awseip1 resource has failed.(5 : The allocation ID 'eipalloc-

\rightarrowxxxxxxxx' does not exist)
```

Possible cause The specified EIP Allocation ID might not be correct or might not exist.

Solution Specify a correct EIP Allocation ID.

Cluster WebUI message

```
Activating awseipl resource has failed.(5 : The networkInterface ID 'eni-

\rightarrowxxxxxxxx' does not exist)
```

Possible cause The specified ENI ID might not be correct or might not exist.

Solution Specify a correct ENI ID.

Cluster WebUI message

Activating awseip1 resource has failed.(6 : Timeout occurred.)

Possible cause Any of the following might be the cause:

- The AWS CLI command might not be able to communicate with the regional endpoint, due to a misconfiguration of the route table, NAT, or proxy server.
- Delay caused by the heavily loaded node.

Solution Check the following:

- Confirm that a public IP is assigned to each instance.
- Confirm that the AWS CLI works normally in each instance.
- Check the settings of the route table, NAT, or proxy server.
- When the node is heavily loaded, remove the causes.

• The AWS Elastic IP monitor resource enters the error state.

Cluster WebUI message

Detected an error **in** monitoring awseipw1. (7 : The EIP address does **not** exist. (EIP ALLOCATION ID=eipalloc-xxxxxxx))

Possible cause The specified ENI ID and elastic IP have been deassociated for some reason.

Solution

When an error is detected, the AWS Elastic IP resource is restarted automatically and the specified ENI ID and elastic IP are associated.

Check whether another HA cluster uses the same EIP allocation ID mistakenly and so on.

• Fails to start the AWS DNS resource.

Cluster WebUI message

Activating awsdns1 resource has failed.(99 : Internal error. (status=nn))

Possible cause Any of the following might be the cause:

- Python has not been installed, or the path does not reach python.
- The AWS CLI has not been installed, or the path does not reach AWS CLI.

Solution Check the following:

- Confirm that Python or the AWS CLI is installed.
- The installation path of the python commands must be any of the following: /sbin, /bin, /usr/sbin, /usr/bin
- The installation path of the AWS CLI must be any of the following: /sbin, /bin, /usr/sbin, /usr/bin, /usr/local/bin

Cluster WebUI message

```
Activating awsdns1 resource has failed. (5 : Failed in the AWS CLI \_ \rightarrow \texttt{command.})
```

Possible cause Any of the following might be the cause:

- The AWS CLI has not been set up (aws configure has not been started).
- The AWS CLI configuration could not be found (e.g. aws configuration was done by a user other than root, executed without sudo etc.)

When an IAM user is to be used, search for a credentials or config file by the following step:

1) Under <\$HOME/.aws>

2) Under </root/.aws>

- Incorrect values are set in AWS CLI configuration (e.g. region, accesskey, secret key etc.).
- An IAM role has not been set to the instance (for an operation using an IAM role) Access the URL below from the corresponding instance and then check whether the given IAM role name is displayed. If the message "404 Not Found" appears, no IAM role has been set.

http://169.254.169.254/latest/meta-data/iam/security-credentials/

• The specified resource record set is invalid.

- The regional endpoint has been stopped due to maintenance or failure.
- An issue of the communication path to the regional endpoint.
- Delay caused by the heavily loaded node.
- Route 53 cannot be accessed or does not respond.
- No VPC to which the HA instance belongs is added to a VPC targeted in the hosted zone of Route 53.
- DNS name resolution is not enabled in the VPC to which the HA instance belongs.
- The value of Resource Record Set Name is specified in capital letters.
- On the terminal of the node (instance), manually execute the following command:

If the error message "Could not connect to the endpoint URL" appears, the possible cause is either of the following:

- If you are using a VPC endpoint, which does not support the Route 53 service, AWS DNS resources/monitor resources are unavailable.

- If you are not using a VPC endpoint, there may be some issue of the AWS configuration.

Solution Check the following:

- · Correct the AWS CLI settings. Then confirm that the AWS CLI works successfully.
- When the node is heavily loaded, remove the causes.
- In applicable Hosted Zone of the Route 53 Management Console, check that the necessary VPC is added to **Associated VPC**.
- On the VPC Management Console, check that enableDnsSupport is enabled in the properties of the current VPC. If enableDnsSupport is intentionally disabled, set an appropriate DNS resolver for the record set added in the AWS DNS resource by the instance.
- Specify the value of Resource Record Set Name in lowercase letters.
- If you are using a VPC endpoint, consider changing to any of the following methods: a NAT gateway, NAT instance, or proxy server. If you are not using a VPC endpoint, consult AWS.
- For an operation using an IAM role, check the settings on the AWS Management Console.

Cluster WebUI message

```
Activating awsdns1 resource has failed. (5 : No hosted zone found with \rightarrow ID: %1)
```

Possible cause Specified Host Zone ID may not be correct or exist.

Solution Specify the correct Host Zone ID.

Cluster WebUI message

Activating awsdns1 resource has failed. (6: Timeout occurred.)

Possible cause Any of the following might be the cause:

- The AWS CLI command might not be able to communicate with the regional endpoint, due to a misconfiguration of the route table, NAT, or proxy server.
- Delay caused by the heavily loaded node.
- Delayed processing on the Route 53 endpoint side.
- Delayed access to the instance metadata by the AWS CLI.

Solution Check the following:

- If the NAT instance is running.
- If the routing for the NAT instance has been configured properly.
- If the packets are not blocked by filtering.
- Check the settings of the route table, NAT, or proxy server.
- When the node is heavily loaded, remove the causes.
- The value of **Timeout** for **Monitor** (**common**) in the AWS environment is set at or larger than that of the time required for running the AWS CLI. Measure the required time by manually executing the AWS CLI. The AWS DNS monitor resource runs the following AWS CLI:
 - # aws route53 list-resource-record-sets
- For an operation using an IAM role: When running the AWS CLI, the AWS DNS resource and monitor resource of EXPRESSCLUSTER acquires credentials (such as an access key ID) from the instance metadata.

Check if access to the instance metadata is not delayed, by manually determining the time required for executing the commands below.

If running either of the commands is delayed, the access to the instance metadata is delayed.

If the delay is confirmed, allow an IAM user to access the instance metadata--by running the aws configure command to add the settings of the access key ID and secret access key to each of the cluster nodes. This may reduce the occurrence of timeouts.

- On each of the cluster nodes, run the curl command or use a browser to access the URL: http://169.254.169.254/latest/meta-data/

- On any of the cluster nodes, run the command: aws configure list
- Despite the normal operation of the AWS DNS resource, it takes time to resolve names on clients.

Cluster WebUI message

Possible cause Any of the following might be the cause:

 Due to the specification of Route 53, it takes up to 60 seconds to propagate its settings to all the authoritative servers. Refer to the following:

https://aws.amazon.com/route53/faqs/?nc1=h_ls

- Amazon Route 53 FAQs
- Q. How quickly will changes I make to my DNS settings on Amazon Route 53 propagate globally?

- The OS-side resolver takes time.
- During a failover, the AWS DNS resource takes time to delete and create resource record sets. If the Delete a resource record set at deactivation checkbox is checked: A resource record set deleted on a failover source with the AWS DNS resource deactivated is created on a failover destination with the AWS DNS resource activated. This may delay name resolution. If the checkbox is not checked: No resource record set is deleted even with the AWS DNS resource deactivated or with the cluster stopped, and only the IP address of the corresponding resource record set is updated. This may shorten the time before names can be resolved. Even after the AWS DNS resource is deactivated or the cluster is stopped, names are resolved.
- A large value of TTL for the AWS DNS resource.
- A small value of Start Monitor Wait Time for the AWS DNS monitor resource.
 If a name resolution is tried prior to the completion of Route 53 change propagation, the DNS returns NXDOMAIN (non-existing domain). In this case, the name resolution fails until the valid period of the negative cache expires.

Therefore, with **Start Monitor Wait Time** set at a small value, a name resolution may take a long time.

Solution Check the following:

- Review the settings of the OS-side resolver.
- Uncheck the **Delete a resource record set at deactivation** checkbox of the AWS DNS resource.
- Set TTL at a smaller value for the AWS DNS resource.
- Set Start Monitor Wait Time at an allowable large value for the AWS DNS monitor resource.
- The AWS DNS monitor resource enters the error state.

Cluster WebUI message

```
Detected an error in monitoring awsdnsw1. (7 : The resource record set in_ →Amazon Route 53 does not exist.)
```

Possible cause Any of the following might be the cause:

- In the Host Zone, the resource record set corresponding to the AWS DNS resource has been deleted for some reason.
- Immediately after the AWS DNS resource is activated, if the AWS DNS monitor resource starts monitoring prior to the propagation of changed DNS settings in Route 53, the monitoring fails due to inability in resolving names. Refer to the following:
 - Getting Started Guide
 - -> Notes and Restrictions
 - -> Setting up AWS DNS monitor resources
- Of the IAM policy, the following is not set: route53:ChangeResourceRecordSets and route53:ListResourceRecordSets. Refer to "8.1. *Creating an IAM policy*".
- No VPC to which the HA instance belongs is added to a VPC targeted in the hosted zone of Route 53.

Solution Check the following:

- No other HA clusters use the same resource record set by mistake. (If used, that is a cause of the deleted resource record set.)
- The value of Start Monitor Wait Time of the AWS DNS monitor resource is set larger than that
 of the time to propagate changed DNS settings in Route 53.
- The following is set in the IAM policy: route53:ChangeResourceRecordSets and route53:ListResourceRecordSets.
- In applicable Hosted Zone of the Route 53 Management Console, the necessary VPC is added to Associated VPC.

Cluster WebUI message

```
Detected an error in monitoring awsdnsw1. (8: IP address different from.

\rightarrowthe setting is registered in the resource record set of Amazon Route.

\rightarrow53.)
```

- **Possible cause** In the Host Zone, the IP address of resource record set corresponding to the AWS DNS resource has been changed for some reason.
- **Solution** Resource record set may have been deleted when another HA cluster uses the same resource record set by mistake.

Cluster WebUI message

```
Detected an error in monitoring awsdnsw1. (9 : Failed to resolve domain \rightarrow name.)
```

Possible cause The name resolution using the DNS name registered in the hosted zone as resource record set failed.

Solution Check the following:

- If the resolver settings are correct.
- If the network settings are correct.
- If the domain query is set to refer to Amazon Route 53 name server (NS) based on the NS record setting of registrar when Public Host Zone is used.

Cluster WebUI message

```
Detected an error in monitoring awsdnsw1. (10 : IP address which is_

→resolved domain name from the DNS resolver does not match setting.)
```

Possible cause The IP address obtained by name resolution check with the DNS name registered in the Hosted Zone as the resource record set is not correct.

Solution Check the following:

- If the resolver setting is correct.
- If there are no entries related to the DNS name in the hosts file.
- The AWS DNS monitor resource enters the warning or error state.
Cluster WebUI message

[Warning]

```
Warn monitoring awsdnsw1. (106 : Timeout occurred.)
```

[Error]

```
Detected an error in monitoring awsdnswl. (6 : Timeout occurred.)
```

Possible cause Any of the following might be the cause:

- The AWS CLI command might not be able to communicate with the regional endpoint, due to a misconfiguration of the route table, NAT, or proxy server.
- Delay caused by the heavily loaded node.
- Delayed processing on the Route 53 endpoint side.
- Delayed access to the instance metadata by the AWS CLI.

Solution Check the following:

- If the NAT instance is running.
- If the routing for the NAT instance has been configured properly.
- If the packets are not blocked by filtering.
- Check the settings of the route table, NAT, or proxy server.
- The value of **Timeout** for **Monitor** (common) in the AWS environment is set at or larger than that of the time required for running the AWS CLI. Measure the required time by manually executing the AWS CLI. The AWS DNS monitor resource runs the following AWS CLI:
 - # aws route53 list-resource-record-sets
- For an operation using an IAM role: When running the AWS CLI, the AWS DNS resource and monitor resource of EXPRESSCLUSTER acquires credentials (such as an access key ID) from the instance metadata.

Check if access to the instance metadata is not delayed, by manually determining the time required for executing the commands below.

If running either of the commands is delayed, the access to the instance metadata is delayed. If the delay is confirmed, allow an IAM user to access the instance metadata--by running the aws configure command to add the settings of the access key ID and secret access key to each of the cluster nodes. This may reduce the occurrence of timeouts.

- On each of the cluster nodes, run the curl command or use a browser to access the URL: http://169.254.169.254/latest/meta-data/

- On any of the cluster nodes, run the command: aws configure list
- The AWS AZ monitor resource enters the warning or error state.

Cluster WebUI message

[Warning]

```
Warn monitoring awsazw1. (105 : Failed {\bf in} the AWS CLI command.)
```

[Error]

```
Detected an error in monitoring awsazwl. (5 : Failed in the AWS CLI \_ \rightarrow \texttt{command.})
```

Possible cause Any of the following might be the cause:

- The AWS CLI has not been set up. (aws configure has not been run.)
- The AWS CLI configuration file could not be found. (A user other than root ran aws configure, or A user without sudo ran aws configure.)

Search for a credentials file and a config file by the following order (in case of policy for which the IAM user is used).

1) \$HOME/.aws follower

- 2) /root/.aws follower
- The specified AWS CLI settings (such as a region, access key ID, and secret key) are not correct.
- (For an operation using an IAM role) An IAM role has not been set to the instance. Access the URL below from the corresponding instance and then check whether the given IAM role name is displayed. If the message "404 Not Found" appears, no IAM role has been set. http://169.254.169.254/latest/meta-data/iam/security-credentials/
- The specified AZ is invalid.
- The regional endpoint has been stopped due to maintenance or failure.
- An issue of the communication path to the regional endpoint.
- Delay caused by the heavily loaded node.
- Solution Check the following:
 - Correct the AWS CLI settings. Then confirm that the AWS CLI works successfully.
 - When the node is heavily loaded, remove the causes.
 - If the warning frequently appears, it is recommended to change to Disable recovery action (Display warning). Even if you do it, it is possible to detect errors except those caused by delayed response and by failure in running the AWS CLI on the monitor resource.
 - For an operation using an IAM role, check the settings on the AWS Management Console.

Cluster WebUI message

[Warning]

```
Warn monitoring awsazw1. (105 : Invalid availability zone: [ap-

→northeast-1x])
```

[Error]

```
Detected an error in monitoring awsazw1. (5 : Invalid availability_

→zone: [ap-northeast-1x])
```

Possible cause The specified AZ might not be correct or might not exist.

Solution Specify a correct AZ.

Cluster WebUI message

[Warning]

Warn monitoring awsazw1. (106 : Timeout occurred.)

[Error]

```
Detected an error in monitoring awsazw1. (6 : Timeout occurred.)
```

Possible cause Any of the following might be the cause:

- The AWS CLI command might not be able to communicate with the regional endpoint, due to a misconfiguration of the route table, NAT, or proxy server.
- Delay caused by the heavily loaded node.

Solution Check the following:

- The NAT instance is running.
- The routing for the NAT instance has been set up.
- The packet is not excluded by filtering.
- Check the settings of the route table, NAT, or proxy server.
- The value of **Timeout** for **Monitor** (**common**) in the AWS environment is set at or larger than that of the time required for running the AWS CLI. Measure the required time by manually executing the AWS CLI. The AWS AZ monitor resource runs the following AWS CLI:

```
# aws ec2 describe-availability-zones
```

• If When the node is heavily loaded, remove the causes.

CHAPTER

LEGAL NOTICE

10.1 Disclaimer

- Information in this document is subject to change without notice.
- NEC Corporation is not liable for technical or editorial mistakes in or omissions from this document. In addition, whether the customer achieves the desired effectiveness by following the introduction and usage instructions in this document is the responsibility of the customer.
- No part of this document may be reproduced or transmitted in any form by any means, electronic or mechanical, for any purpose, without the express written permission of NEC Corporation.

10.2 Trademark Information

- EXPRESSCLUSTER X is a registered trademark of NEC Corporation.
- Linux is a registered trademark of Linus Torvalds in the United States and other countries.
- Python is a registered trademark of the Python Software Foundation.
- Amazon Web Services and all AWS-related trademarks, as well as other AWS graphics, logos, page headers, button icons, scripts, and service names are trademarks, registered trademarks or trade dress of AWS in the United States and/or other countries.
- Other product names and slogans written in this manual are trademarks or registered trademarks of their respective companies.

CHAPTER

ELEVEN

REVISION HISTORY

Edition	Revised Date	Description
1st	Apr 09, 2021	New Guide
2nd	Mar 24, 2023	Updated "Notes on Using EXPRESSCLUSTER in the VPC".

© Copyright NEC Corporation 2021. All rights reserved.