EXPRESSCLUSTER X 4.2
HA Cluster Configuration Guide for Amazon Web Services (Windows)

Release 1

NEC Corporation

Apr 10, 2020

TABLE OF CONTENTS:

CHAPTER

ONE

PREFACE

1.1 Who Should Use This Guide

The "*EXPRESSCLUSTER® X 4.2 HA Cluster Configuration Guide for Amazon Web Services (Windows)*" 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 Windows (Internal version: 12.20)
- EXPRESSCLUSTER X Replicator 4.2 for Windows
- 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, Builder, and EXPRESSCLUSTER Ver 8.0 compatible commands.

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 selections, buttons, labels, icons, etc.	Click Start. Properties dialog box
Angled bracket within the command line	Indicates that the value specified inside of the angled bracket can be omitted.	`clpstat -s [-h host_name]`
>	Prompt to indicate that a Windows user has logged on as root user.	`> clpstat`
Monospace (Courier)	Indicates path names, commands, system output (message, prompt, etc.), directory, file names, functions and parameters.	`C:\Program Files`
Monospace **bold** (Courier)	Indicates the value that a user actually enters from a command line.	Enter the following: `> clpcl -s -a`
Monospace *italic* (Courier)	Indicates that users should replace italicized part with values that they are actually working with.	`> ping <IP address>`

1.6 Contacting NEC

For the latest product information, visit our website below:

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

CHAPTER

TWO

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. EXPERSSCLUSTER realizes highly available applications by allowing the HA cluster to operate between multiple AZs in a region (hereafter referred to as Multi-AZ).

In the AWS environment, a virtual IP can be used to connect to the cluster server. The AWS Virtual IP resource, 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.

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.

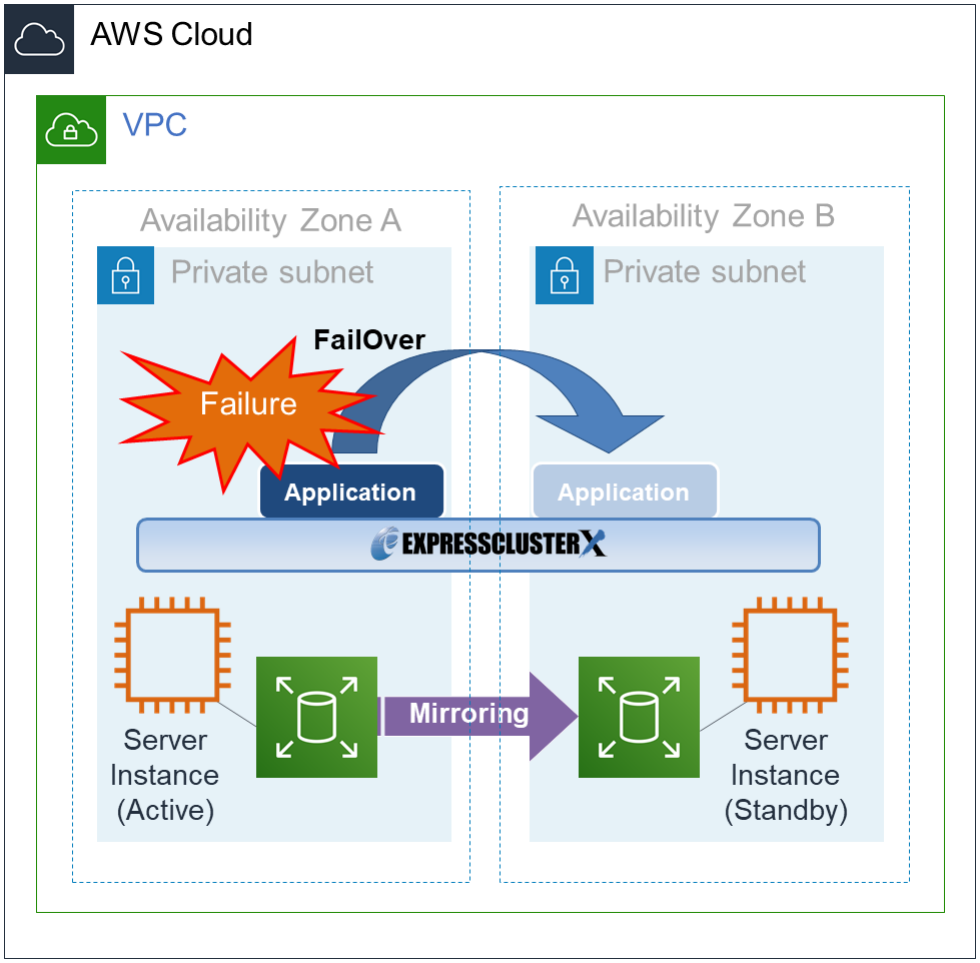

Fig. 2.1: Mirror Type HA Cluster in Multi-AZ Configuration

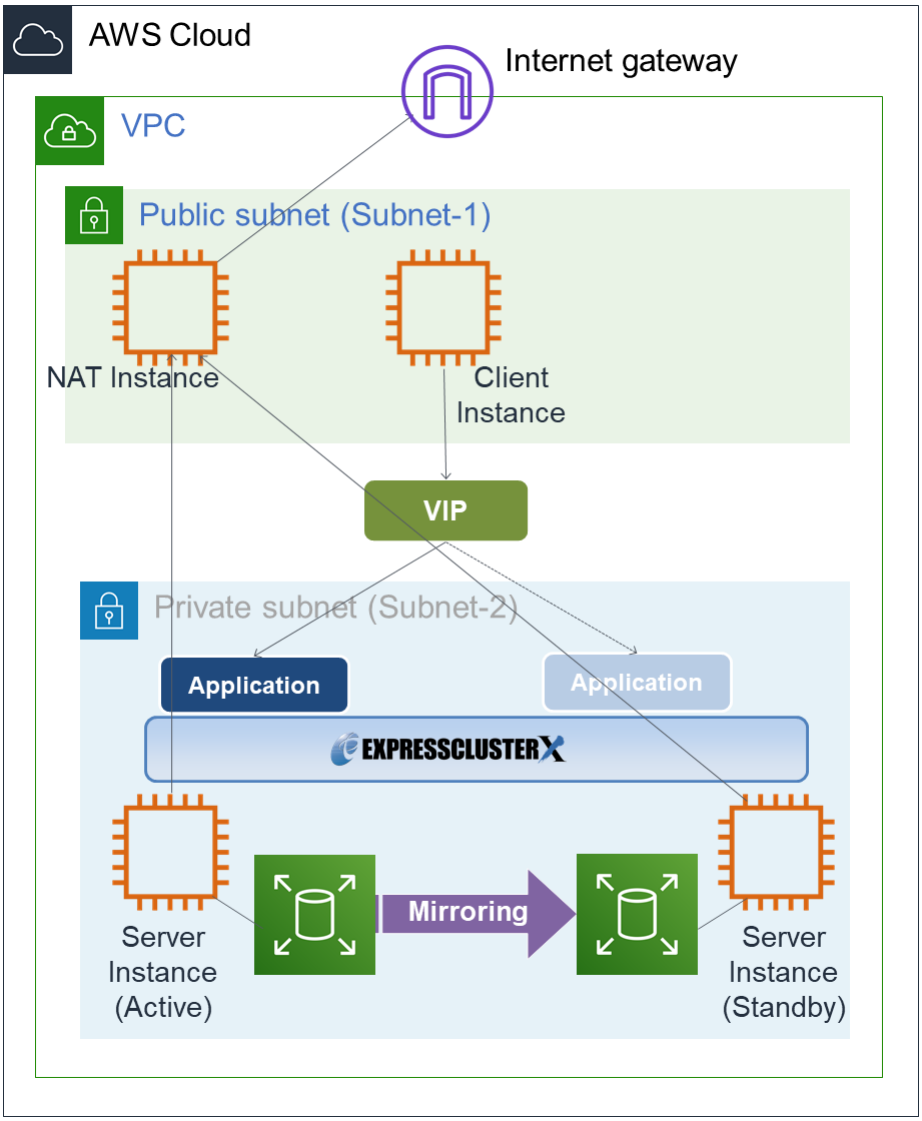

Fig. 2.2: HA Cluster Based on VIP Control

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 sever instance, changes the route table of the assigned VIP address, and publishes operations within the VPC.	Required
AWS Virtual IP monitor resource	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.)	Required
AWS AZ monitor resource	Periodically monitors the health of the AZ in which the local server exists by using Multi-AZ.	Recommended
IP monitor resource	Monitors the health of communication between subnets by checking whether communication with a NAT is available.	Required to check the health of communication between subnets.
Other resources and monitor resources	Depends on the configuration of the application, such as a mirror disk, used in an HA cluster.	Optional

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.

In the above figure, the server instances are clustered and placed on the public subnet. The AWS Elastic 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.

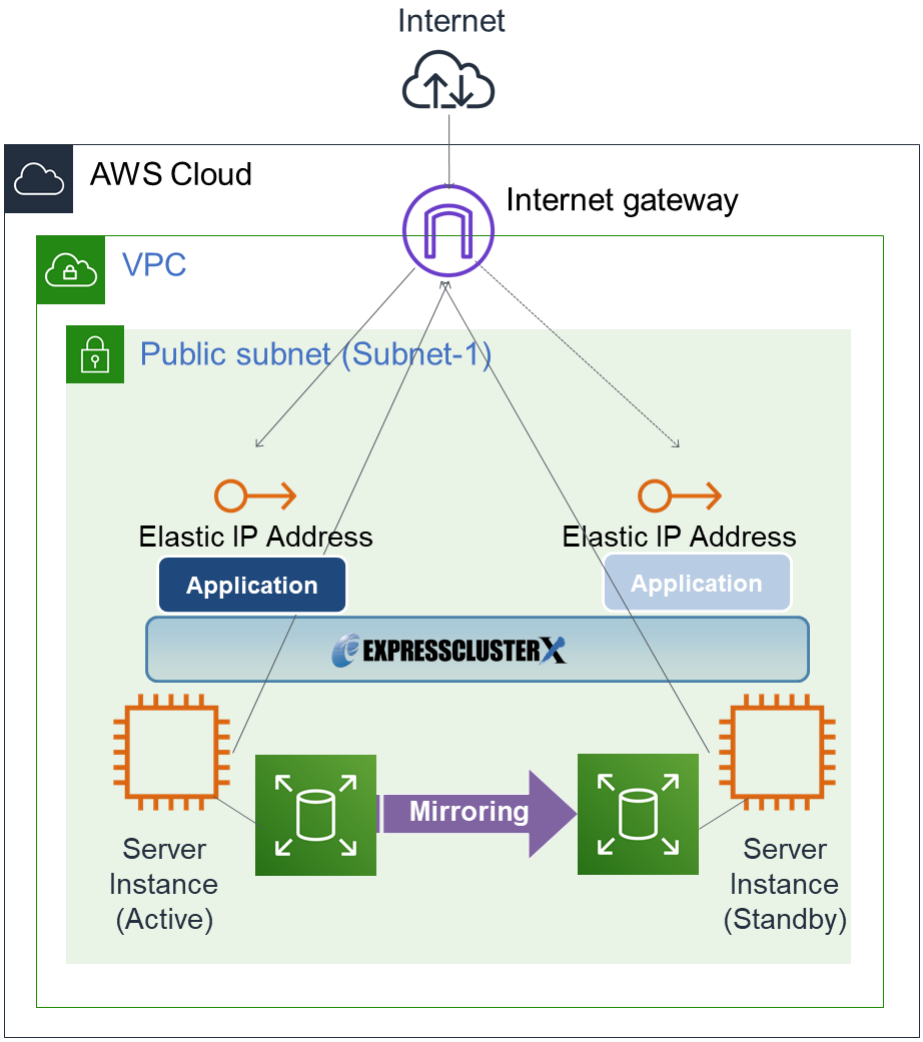

Fig. 2.3: HA Cluster Based on EIP Control

Resource type	Description	Setup
AWS Elastic IP resource	Assigns an EIP address to an active sever instance and publishes operations to the Internet.	Required
AWS Elastic IP monitor resource	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.)	Required
AWS AZ monitor resource	Periodically monitors the health of the AZ in which the local server exists by using Multi-AZ.	Recommended
Custom monitor resource	Monitors a network partition (NP) so that the same resource does not start in multiple instances at the same time.	Required to perform NP resolution
Other resources and monitor resources	Depends on the configuration of the application, such as a mirror disk, used in an HA cluster.	Optional

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.

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.

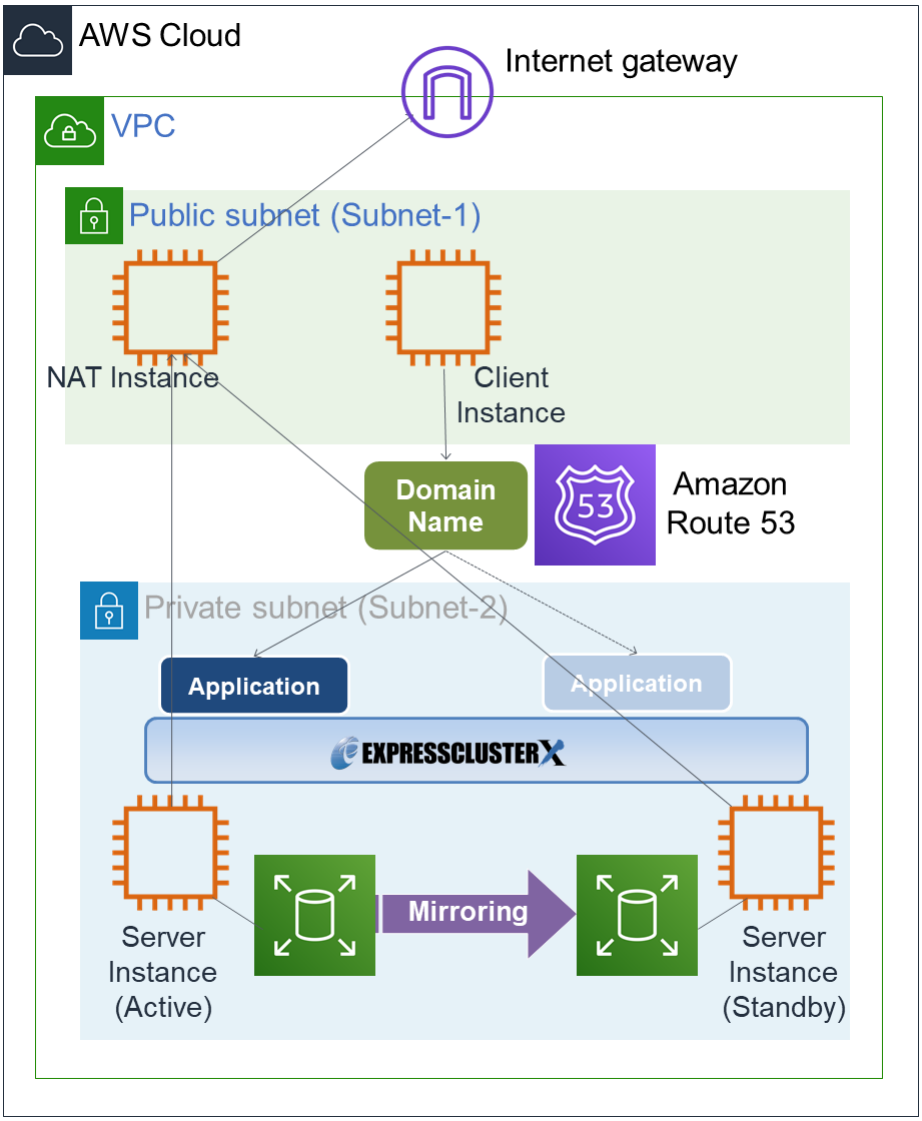

Fig. 2.4: HA cluster based on DNS name control

Resource Type	Description	Configuration
AWS DNS resource	Registers the resource record sets including the DNS name and the IP address of the active server instance into the hosted zone of Amazon Route 53, and publishes operations within the VPC or to the Internet.	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 exists by using Multi-AZ.	Recommended
IP monitor resource	Monitors the health of communication between subnets by checking whether communication with a NAT is available.	Required to check the health of communication between subnets.
Other resources and monitor resources	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

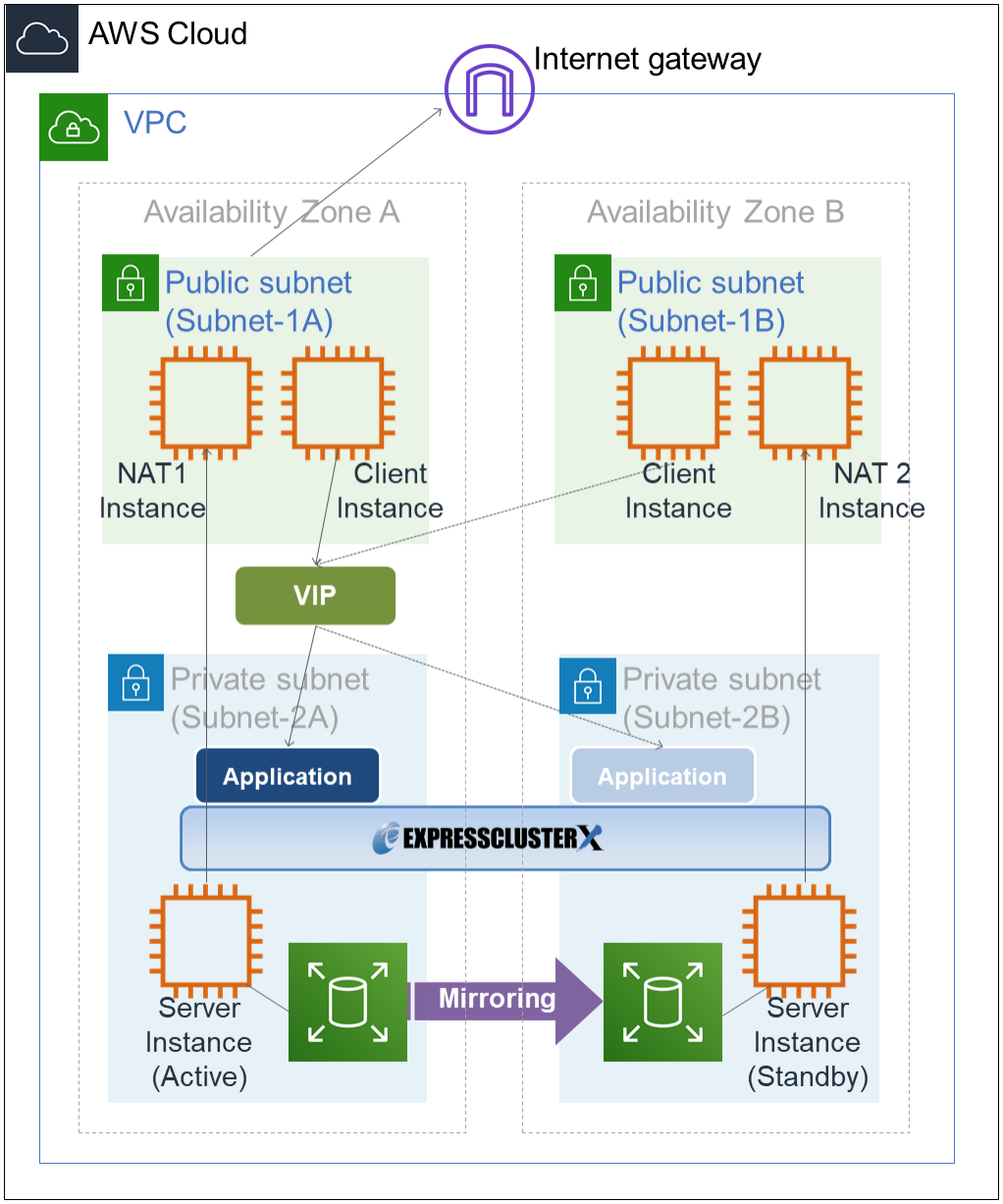

Fig. 2.5: HA Cluster Using Multi-AZ

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.

In the configuration example described in this guide, the IP monitor resource, instead of the network partition resolution resource, is used for resolving a network partition due to the following reasons. In other cases, the network partition resolution resource also can be used.

- In a Multi-AZ configuration, a NAT instance on each AZ needs to be set as a ping destination. A NAT instance can be set more easily for the IP monitor resource than for the network partition resolution resource.
- The IP monitor resource can link with the multi target monitor resource or the custom monitor resource when necessary.
- The IP monitor resource is necessary to check the soundness of the communication among subnets and is equivalent to the Ping method of the network partition resolution resource except that it does not consider the status of heartbeat communication with other nodes.

For details on network partition resolution resources, refer to the following:
- Reference Guide
    -> Details on network partition resolution resources

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 VIP control	Instance always running on another subnet	Ping	In this guide, NAT instance is used. Configure the ping device according to your environment.
	Web server on another subnet	HTTP	HTTP network partition resolution resource

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Table 2.5 – continued from previous page

HA cluster type	ping device	Method	Remarks
HA cluster based on EIP control	Regional endpoint	LISTEN port acknowledgement	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.
HA cluster based on DNS name control	Instance always running on another subnet	Ping	In this guide, NAT instance is used. Configure the ping device according to your environment.
	Web server on another subnet	HTTP	HTTP network partition resolution resource
	Regional endpoint	LISTEN port acknowledgement	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.
HA cluster based on DNS name control	Instance always running on another subnet or regional endpoint	Check Ping or LISTEN port acknowledgement.	This guide specifies, using an example, NAT instance.

Setting the destination and method of NP resolution

This guide describes an example of a complete cluster system within a VPC*. The destination and method of NP resolution need be individually considered in accordance with the locations of clients accessing a cluster system and with the conditions for connecting to an on-premise environment (e.g. using a leased line). * The health of subnet-to-subnet communication is monitored by checking whether an IP monitor resource can communicate to a NAT instance. With no response, an NP is considered to have occurred, and the corresponding node is shut down to avoid a split brain syndrome.

2.5 On-premises and AWS

The following table describes the EXPRESSCLUSTER functional differences between the on-premises and AWS environments.
A: Available, N: Not available

Function	On-premises	AWS
Creation of a shared disk type cluster	A	NA
Creation of a mirror disk type cluster	A	A
Floating IP resource	A	NA
Virtual IP resource	A	NA
AWS elastic ip resource	NA	A
AWS virtual ip resource	NA	A
Possibility of using AWS DNS resource	NA	A

The following table describes the creation flow of a 2-node cluster that uses a mirror disk and IP alias (on-premises: floating IP resource, AWS: AWS virtual ip resource) in the on-premises and AWS environments.

- Before installing EXPRESSCLUSTER

	Step	On-premises	AWS
1	Configure the VPC environment.	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.

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Table 2.7 – continued from previous page

	Step	On-premises	AWS
2	Configure the instance.	Not required	- When using the AWS Virtual IP resource, refer to "5.2. *Configuring the instance*" in this guide. - When using the AWS Elastic IP resource, refer to "6.2. *Configuring the instance*" in this guide. - When AWS DNS resource is used, refer to "7.2. *Configuring the instance*" in this guide.
3	Configure a partition for a mirror disk resource.	Refer to the following: - Installation and Configuration Guide -> Determining a system configuration -> Settings after configuring hardware - Reference Guide -> Understanding mirror disk resources	Same as the on-premises environment
4	Adjust the OS startup time.	Refer to the following: Installation and Configuration Guide -> Determining a system configuration -> Settings after configuring hardware	Same as the on-premises environment
5	Check the network.	Refer to the following: Installation and Configuration Guide -> Determining a system configuration -> Settings after configuring hardware	Same as the on-premises environment

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Table 2.7 – continued from previous page

	Step	On-premises	AWS
6	Check the firewall.	Refer to the following: Installation and Configuration Guide -> Determining a system configuration -> Settings after configuring hardware	Same as the on-premises environment
7	Synchronize the server time.	Refer to the following: Installation and Configuration Guide -> Determining a system configuration -> Settings after configuring hardware	Same as the on-premises environment
8	Install EXPRESSCLUSTER.	Refer to the following: - Installation and Configuration Guide -> Installing EXPRESSCLUSTER	Same as the on-premises environment

- After installing EXPRESSCLUSTER

	Step	On-premises	AWS
9	Register the EXPRESSCLUSTER license.	Refer to the following: - Installation and Configuration Guide -> Registering the license	Same as the on-premises environment
10	Construct a cluster - Set up the heartbeat method.	Refer to the following: - Installation and Configuration Guide -> Creating the cluster configuration data	BMC heartbeat and DISK heartbeat cannot be used.

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Table 2.8 – continued from previous page

	Step	On-premises	AWS
11	Construct a cluster: Set up the NP resolution.	Use an NP resolution resource. Refer to the following: - Installation and Configuration Guide -> Creating the cluster configuration data -> Creating the cluster configuration data - Reference Guide -> Details on network partition resolution resources	- When using the AWS Virtual IP resource, refer to "5.3. *Setting up EXPRESSCLUSTER*" in this guide. - When using the AWS Elastic IP resource, refer to "6.3. *Setting up EXPRESSCLUSTER*" in this guide. - When AWS DNS resource is used, refer to "7.3. *Setting up EXPRESSCLUSTER*" in this guide.

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Table 2.8 – continued from previous page

	Step	On-premises	AWS
12	Construct a cluster: Create a failover group Create a monitor resource.	Refer to the following: - Installation and Configuration Guide -> Creating the cluster configuration data -> Creating the cluster configuration data	In addition to the reference for the on-premises environment, refer to the following: - When using the AWS virtual ip resource - "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 - Reference Guide -> Understanding AWS elastic ip resources - When using the AWS DNS resource, refer to the following: - "7.3. *Setting up EXPRESSCLUSTER*" in this guide - Reference Guide -> Understanding AWS DNS resources

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

CHAPTER

FOUR

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 the 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.

Shutting down OS from the outside of cluster

In the AWS environment, it is technically possible to shutdown OS (stop the instance) from the outside of cluster by using EC2 Management Console, CLI etc.
However, if it is done, the process of stopping the cluster may not be completed properly.

In order to avoid this problem, please use clpstdncnf command. For details of the clpstdncnf command, refer to the following:

Reference Guide
-> "Setting an action for OS shutdown initiated by other than cluster service (clpstdncnf command)"

However, in the AWS environment, if it takes a long time to shutdown OS from EC2 Management Console, AWS CLI etc., AWS may stop the instance forcibly.
AWS does not publish the time which elapses before stopping the instance forcibly, and the time cannot be changed.

The influence of the stoppage of AWS endpoint

The AWS DNS monitor resource uses AWS CLI in order to check the existence of the resource record set.
To prevent a failover caused by an AWS endpoint under maintenance or failure or by a network path under delay constraint or failure, go to **Action when AWS CLI command failed to receive response** of the AWS DNS monitor resource and select either **Disable recovery action(Display warning)** or **Disable recovery action(Do nothing)**.
If the warning frequently appears, it is recommended to select **Disable recovery action(Do nothing)**.

CHAPTER

FIVE

CONSTRUCTING AN HA CLUSTER BASED ON VIP CONTROL

This chapter describes how to construct an HA cluster based on VIP control.
The numbers in the figure correspond to the descriptions and setting values in the following sections.

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 ID

   Write down the VPC ID (vpc-xxxxxxxx) because it is necessary to set up the AWS virtual ip resource later.

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).

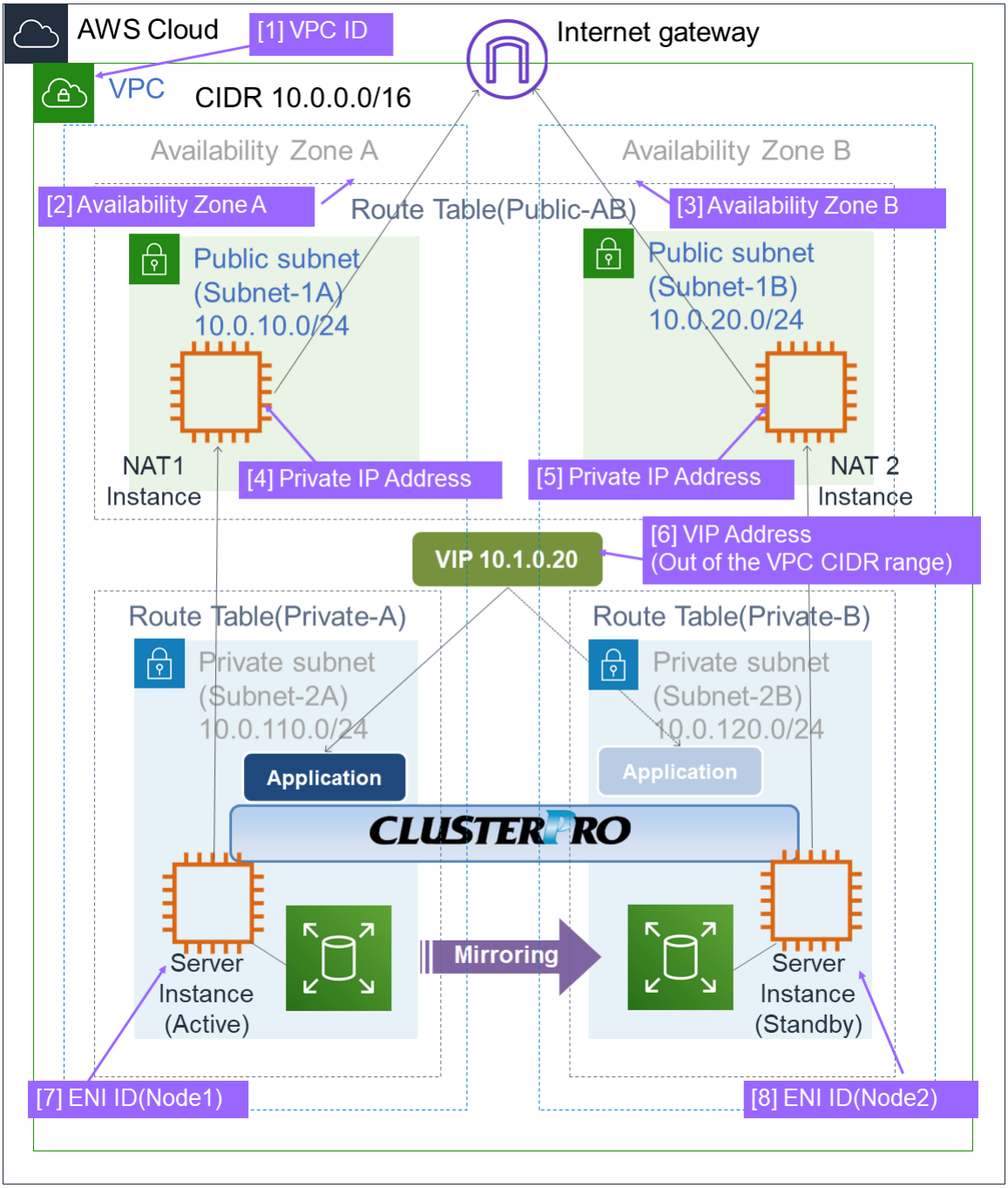


Fig. 5.1: System Configuration of the HA Cluster Based on VIP Control

-> 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.

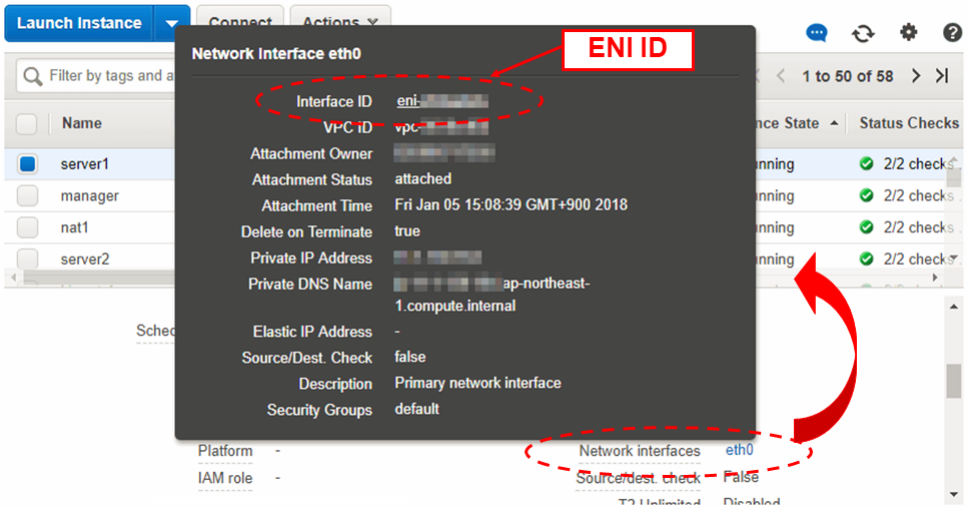
-> To change the settings, right-click the added instance in **Instances** on the EC2 Management console, and select **Networking > Change Source/Dest. Check**.

[7] ENI ID (Node1)	[8] ENI ID (Node2)

Write down the ENI ID (eni-xxxxxxxx) of each instance because it is necessary to set up the AWS virtual ip resource later.

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
0.0.0.0/0	Internet gateway	Add (required)

Continued on next page

Table 5.1 – continued from previous page

Destination	Target	Remarks
VIP address (Example: 10.1.0.20/32)	eni-xxxxxxxx (ENI ID of the active server instance) [7] ENI ID (Node1)	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
0.0.0.0/0	NAT1	Add (required)
VIP address (Example: 10.1.0.20/32)	eni-xxxxxxxx (ENI ID of the active server instance) [7] ENI ID (Node1)	Add (required)

- Route table (Private-B)

Destination	Target	Remarks
VPC network (Example: 10.0.0.0/16)	local	Existing by default
0.0.0.0/0	NAT2	Add (required)
VIP address (Example: 10.1.0.20/32)	eni-xxxxxxxx (ENI ID of the active server instance) [7] ENI ID (Node1)	Add (required)

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 Address

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 it is necessary to set up the AWS Virtual IP resource later.

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 and AWS AZ monitor resource

1) **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

2) **Install Python.**

   Install Python required by EXPRESSCLUSTER.
   First, confirm that Python is installed.
   If not installed, download Python from the following URL and install it.
   https://www.python.org/downloads/
   After the installation, go to **Control Panel** and add the path to python.exe to the environment variable **PATH**. Since the Python command is executed by the SYSTEM user, make sure that the path to the Python command is set in the system environment variable **PATH**.

3) **Install the AWS CLI.**

   From the web page below, download and install the AWS CLI version 1.
   Do not install the AWS CLI version 2, which has not yet been supported.
   The installer automatically adds the path information on the AWS CLI to the system environment variable PATH. If this addition does not occur, open the following web page and refer to "Add the AWS CLI version 1 Executable to Your Command Line Path":
   https://docs.aws.amazon.com/cli/latest/userguide/install-windows.html

If Python or the AWS CLI is installed in an environment with EXPRESSCLUSTER already installed, restart the OS before operating EXPRESSCLUSTER.

After the installation, do the following depending on the installer:

- If the MSI file is used

  If the installer is old, it may not install aws.exe. In this case, aws.cmd is the only AWS CLI executable file.

  Obtain the latest MSI installer for the AWS CLI version 1.

- If pip is used

  Confirm that the following is set in the environment variable configuration file `clpaws_setting.conf`: CLP_AWS_CMD=aws.cmd

  Confirm that the directory (e.g. `"C:\Program Files\Python38"`) where aws.cmd exists is set in the system environment variable PATH.

  With the environment variable configuration file `clpaws_setting.conf` configured with the setting of CLP_AWS_CMD, search for the system environment variable PATH. Then execute the file specified for CLP_AWS_CMD as the AWS CLI.

  For more information on the environment variable configuration file `clpaws_setting.conf`, refer to "Reference Guide" -> "Applying environment variables to AWS CLI run from the AWS virtual ip resource".

4) **Register the AWS access key ID.**

Start the command prompt as the Administrator user and run the following command:

```
> 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 folder `%SystemDrive%\Users\Administrator\.aws` entirely, and specify the above settings again.

5) **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
  -> Mirror partition settings (Required for mirror disks)

6) **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 ".

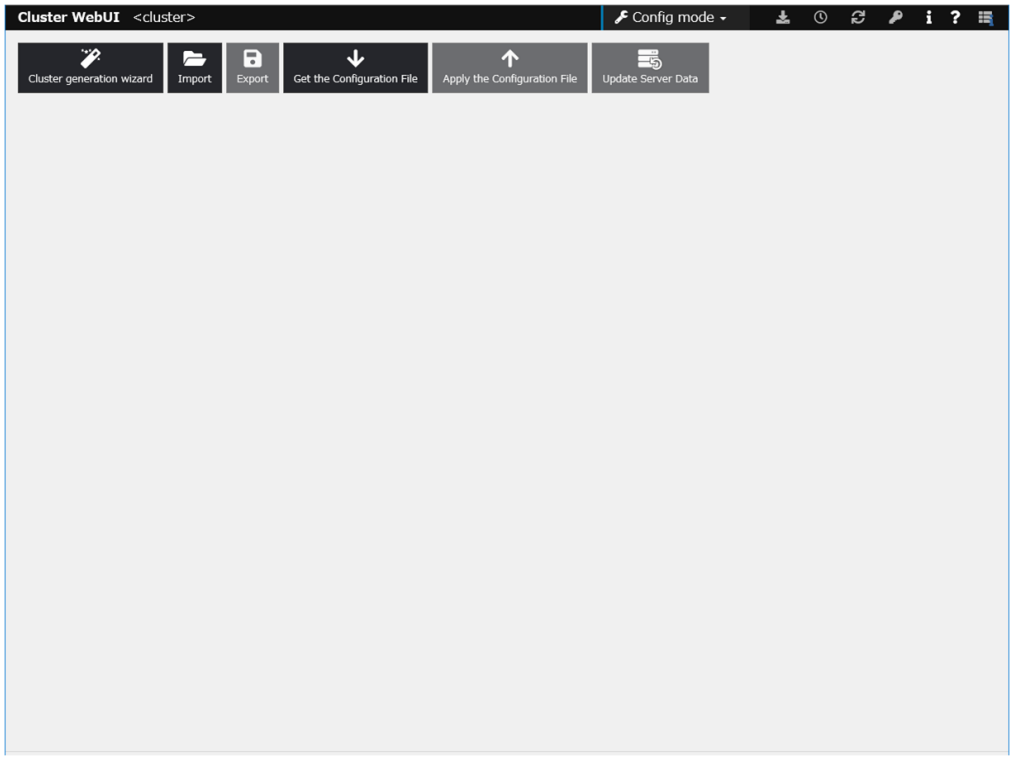
1) **Construct a cluster.**

   Start the cluster generation wizard to construct a cluster.

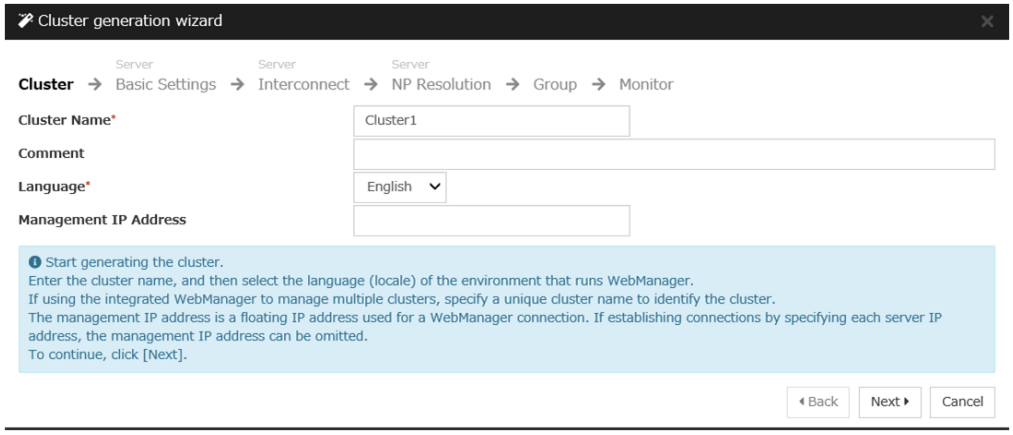
   - Construct a cluster.

     Steps

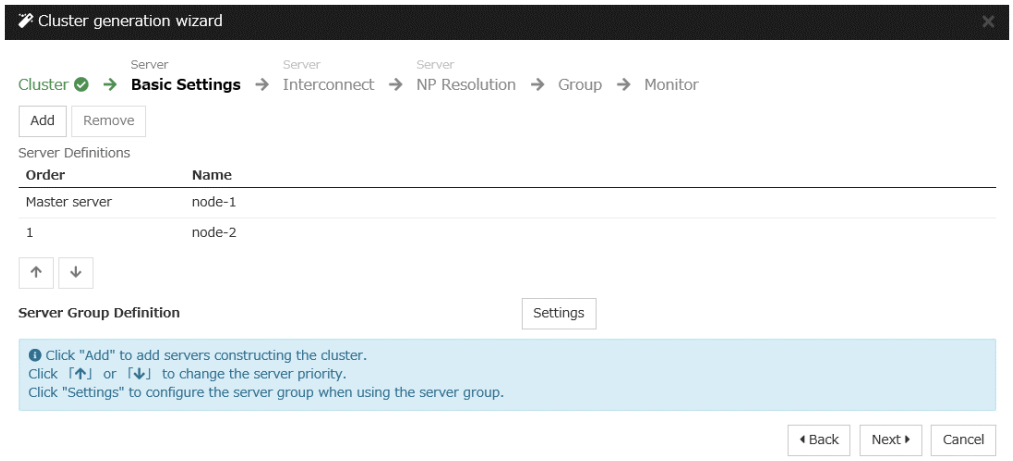
     1. Access Cluster WebUI, and click **Cluster generation wizard**.



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**.

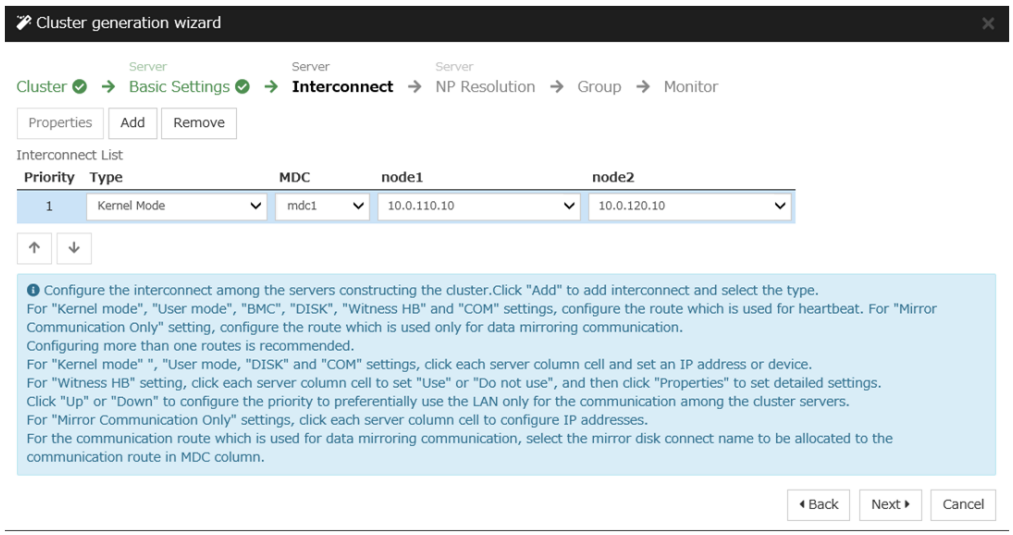


3. The **Basic Settings** window is displayed.
   The instance connecting to Cluster WebUI is displayed as the registered master server.
   Click **Add** to add other instances (by specifying their private IP addresses). Click **Next**.



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**.



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.)

   The destination and method of NP resolution need be individually considered in accordance with the locations of clients accessing a cluster system and with the conditions for connecting to an on-premise environment (e.g. using a leased line). There is no recommended destination or method of NP resolution. A possible option for NP resolution is to use a network partition resolution resource.

   Click **Next**.

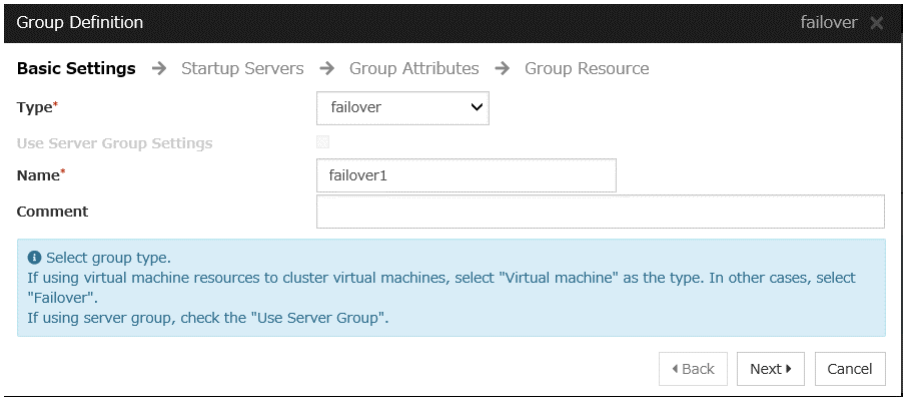
2) **Add a group resource.**

- Group definition

  Create a failover group.

  Steps

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



  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** 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.
  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 drive letter for the partition set up in "Configuring the instance" -> "5. Prepare the mirror disk." in **Data Partition Drive Letter** and **Cluster Partition Drive Letter**.

6. From **Servers that can run the group**, select the server name in the **Name** column, and click **Add**.
7. The **Selection of Partition** dialog box is displayed. Click **Connect**, select the data and cluster partitions, and click **OK**.
8. Perform steps 6 and 7 on the other node.
9. Return to the **Details** window and click **Finish** to complete setting.

- AWS Virtual IP resource

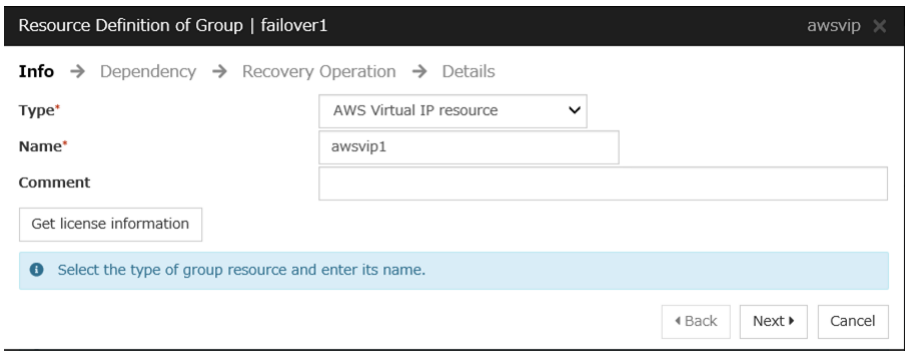
  Add the AWS Virtual IP resource that controls the VIP by using the AWS CLI.

  For details, refer to the following:

  - Reference Guide
    -> Understanding AWS Virtual IP resources

  Steps

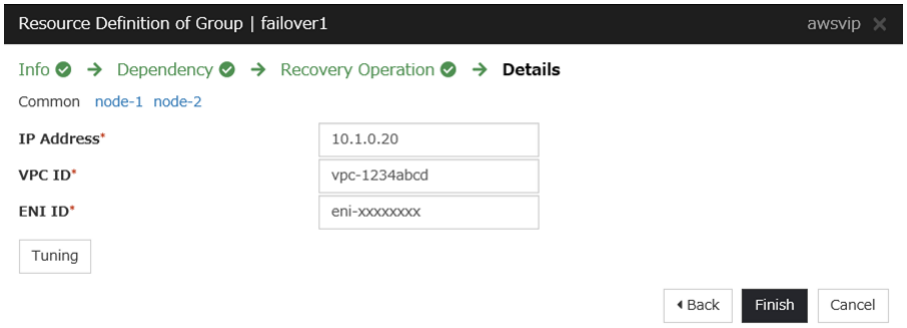
  1. Click **Add** in **Group Resource List**.
  2. The **Resource Definition of Group | failover1** is displayed.
     Select the group resource type (AWS Virtual IP resource) from the **Type** box and enter the group resource name (awsvip1) in the **Name** box. Click **Next**.



  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.

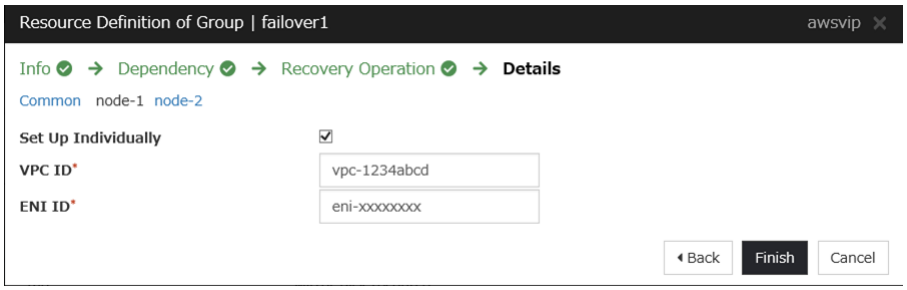


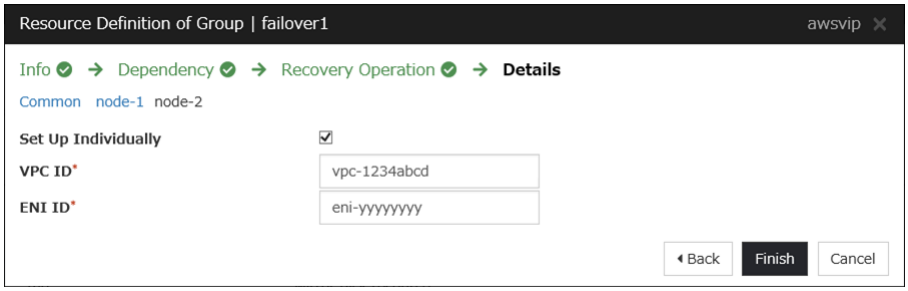
6. Specify the node settings on each node tab

   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).





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

3) **Add a monitor resource.**

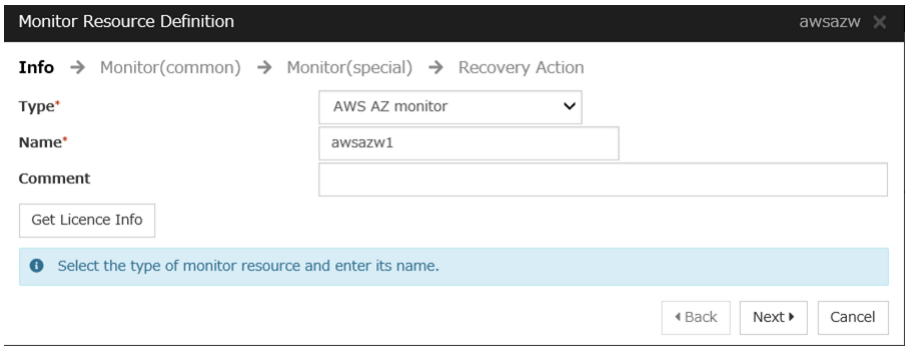
- AWS AZ monitor resource

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:

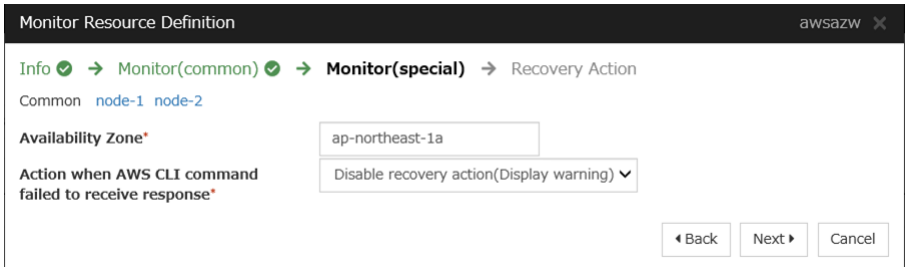
- Reference Guide
  -> Understanding AWS AZ monitor resources

Steps

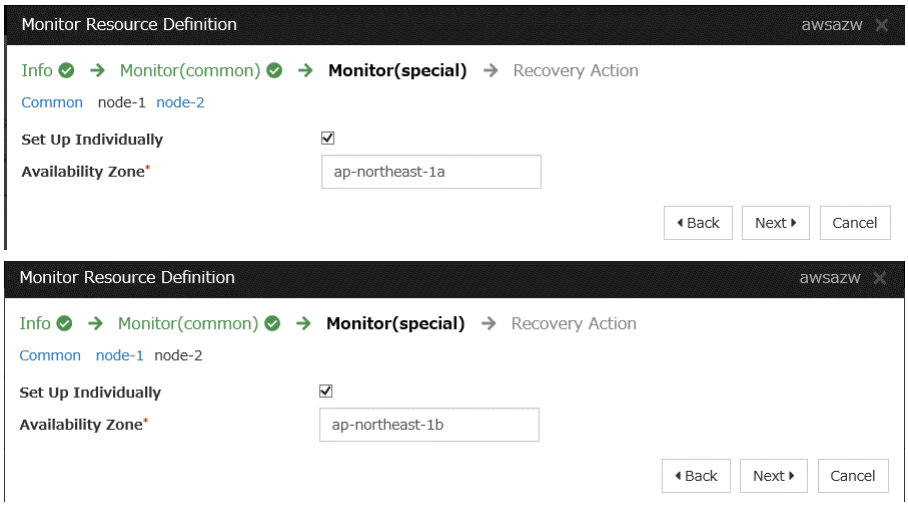
1. Click **Add** in **Monitor Resource List**.
2. Select the monitor resource type (AWS AZ monitor) from the **Type** box and enter the monitor resource name (awsazw1) in the **Name** box. Click **Next**.



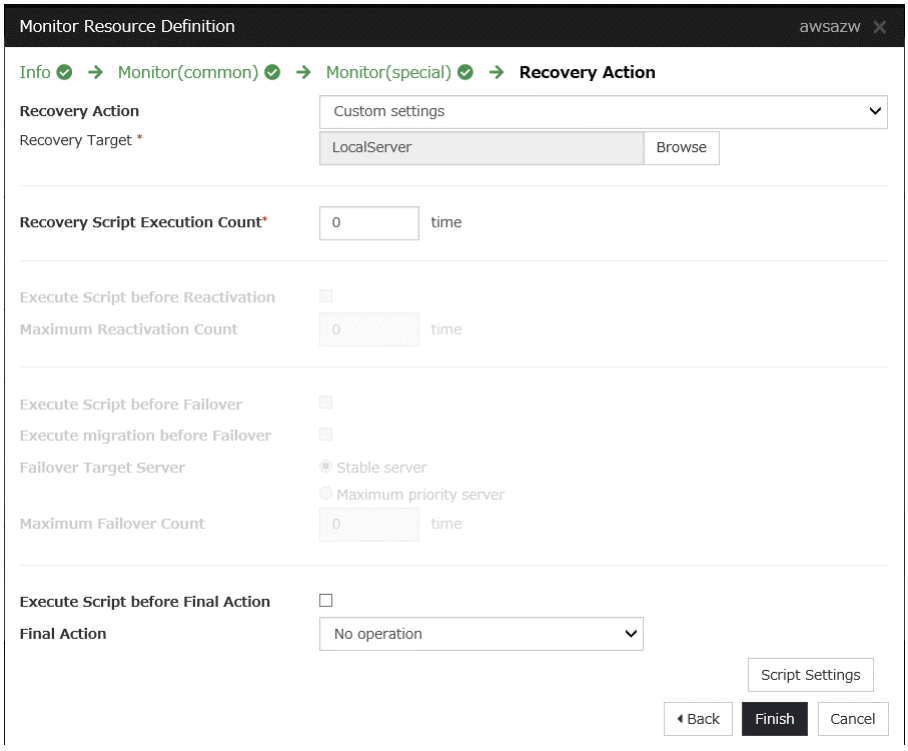
3. The **Monitor (common)** window is displayed.
   Click **Next** without specifying anything.
4. The **Monitor (special)** window is displayed.
   Enter the AZ to be monitored in the **Availability Zone** box on the **Common** tab. (Specify the AZ of the active server instance.) (corresponds to [2] in Figure 5.1 System Configuration of the HA Cluster Based on VIP Control)



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**.



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



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

- AWS Virtual IP monitor resource

  This resource is automatically added when the AWS Virtual IP monitor 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:

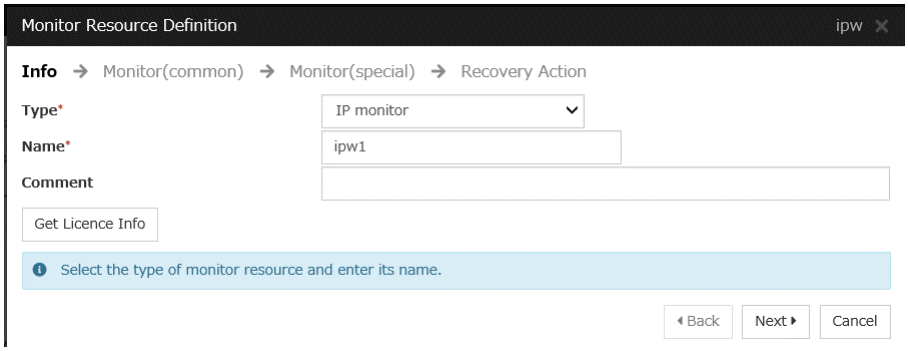
- Reference Guide
  -> Understanding AWS virtual ip monitor resources

- IP monitor resource

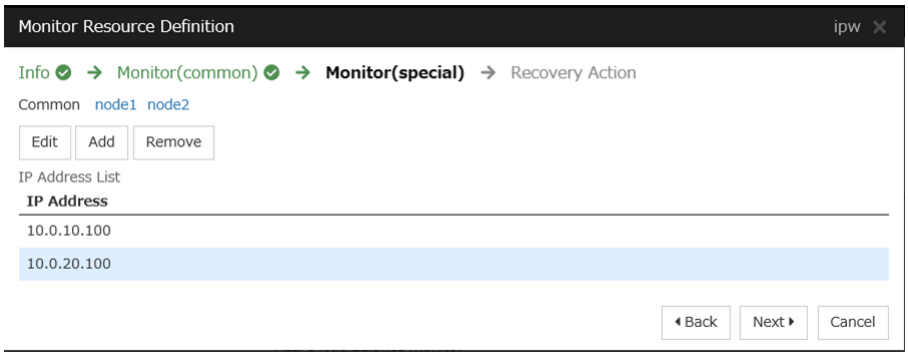
  Create the IP monitor resource to monitor the health of the subnet by sending a ping to a NAT instance placed in each AZ. Specify the following:

  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**.

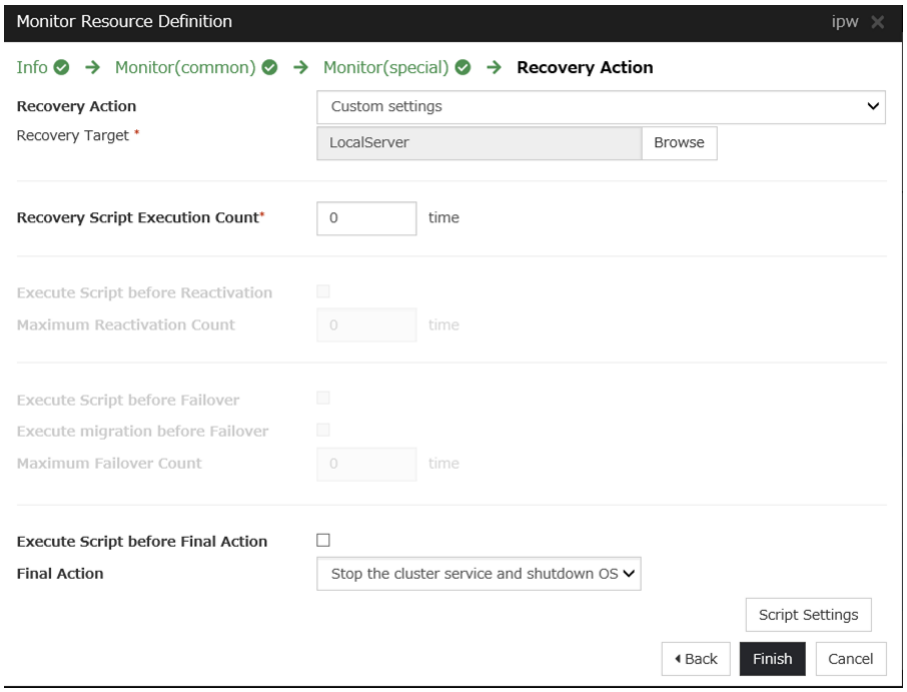


  3. The **Monitor (common)** window is displayed.
     Confirm that **Monitoring Timing** is **Always** and click **Next**.
  4. The **Monitor (special)** window is displayed.
     Enter the private IP address of the NAT instance used by each node in the **IP Address** box of the **Common** tab (corresponds to [4] and [5] in Figure 5.1 System Configuration of the HA Cluster Based on VIP Control). Click **Next**.



  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**.



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

4) **Apply the settings and start the cluster.**

1. Click **Apply the Configuration File** in the config mode of Cluster WebUI.
   A popup message asking "Do you want to perform the operations?" is displayed. Click **OK**.
   When the upload ends successfully, a popup message saying "The application finished successfully." is displayed. Click **OK**.
   If the upload fails, perform the operations by following the displayed message.
2. Select the **Operation Mode** on the drop down menu of the toolbar in Cluster WebUI to switch to the operation mode.
3. Select **Start Cluster** in the **Status** tab of Cluster WebUI and click.

Confirm that a cluster system starts and the status of the cluster is displayed to the Cluster WebUI. If the cluster system does not start normally, take action according to an error message.

For details, refer to the following:

- Installation and Configuration Guide
  -> How to create a cluster

CHAPTER

SIX

CONSTRUCTING AN HA CLUSTER BASED ON EIP CONTROL

This chapter describes how to construct an HA cluster based on EIP control.
The numbers in the figure correspond to the descriptions and setting values in the following sections.

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

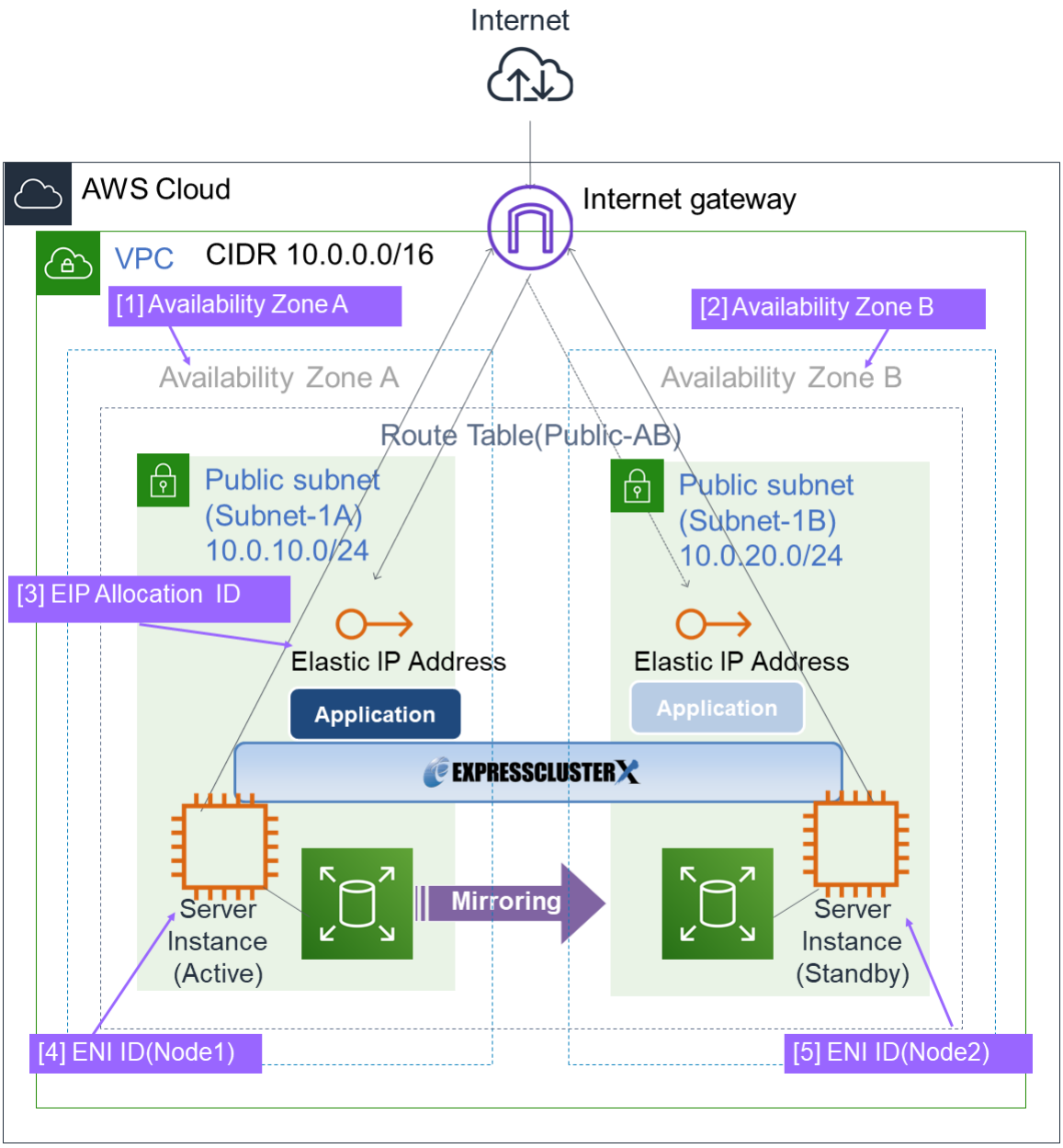


Fig. 6.1: System Configuration of the HA cluster based on EIP control

-> 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 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*."

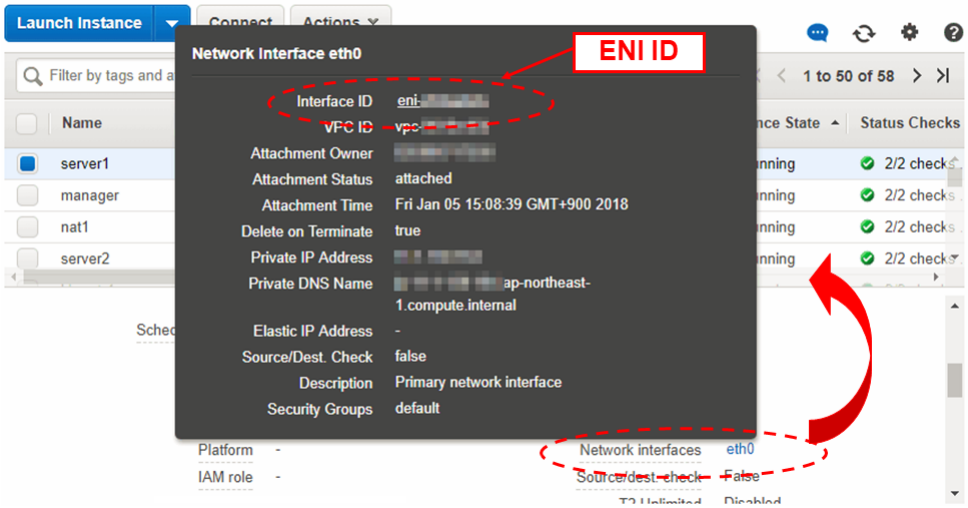
Check the ID of the elastic network interface (ENI) assigned to each created instance.

[4] ENI ID (Node1)	[5] ENI ID (Node2)

Write down the ENI ID (eni-xxxxxxxx) of each instance because it is necessary to set up the AWS elastic ip resource later.

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] EIP Allocation ID

Write down the Allocation ID (eipalloc-xxxxxxxx) of the added EIP because it is necessary to set up the AWS elastic ip resource later.

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
0.0.0.0/0	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 and AWS AZ monitor resource

1) **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

2) **Install Python.**

Install Python required by EXPRESSCLUSTER.
First, confirm that Python is installed.
If not installed, download Python from the following URL and install it.

https://www.python.org/downloads/

After the installation, add the path to python.exe to the environment variable **PATH** from **Control Panel**. Since the Python command is executed as the SYSTEM user,

3) **Install the AWS CLI.**

From the web page below, download and install the AWS CLI version 1.
Do not install the AWS CLI version 2, which has not yet been supported.
The installer automatically adds the path information on the AWS CLI to the system environment variable PATH. If this addition does not occur, open the following web page and refer to "Add the AWS CLI version 1 Executable to Your Command Line Path":

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

If Python or the AWS CLI is installed in an environment with EXPRESSCLUSTER already installed, restart the OS before operating EXPRESSCLUSTER.

After the installation, do the following depending on the installer:

- If the MSI file is used
  If the installer is old, it may not install aws.exe. In this case, aws.cmd is the only AWS CLI executable file.
  Obtain the latest MSI installer for the AWS CLI version 1.
- If pip is used
  Confirm that the following is set in the environment variable configuration file `clpaws_setting.conf`: CLP_AWS_CMD=aws.cmd
  Confirm that the directory (e.g. `"C:\Program Files\Python38"`) where aws.cmd exists is set in the system environment variable PATH.
  With the environment variable configuration file `clpaws_setting.conf` configured with the setting of CLP_AWS_CMD, search for the system environment variable PATH. Then execute the file specified for CLP_AWS_CMD as the AWS CLI.
  For more information on the environment variable configuration file `clpaws_setting.conf`, refer to "Reference Guide" -> "Applying environment variables to AWS CLI run from the AWS elastic ip resource".

4) **Register the AWS access key ID.**

Start the command prompt as the Administrator user and run the following command:

```
> 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 folder `%SystemDrive%\Users\Administrator\.aws` entirely, and specify the above settings again.

5) **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
  -> Mirror partition settings (Required for mirror disks)

6) **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 IP monitor resource
- NP resolution (Custom monitor resource)

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

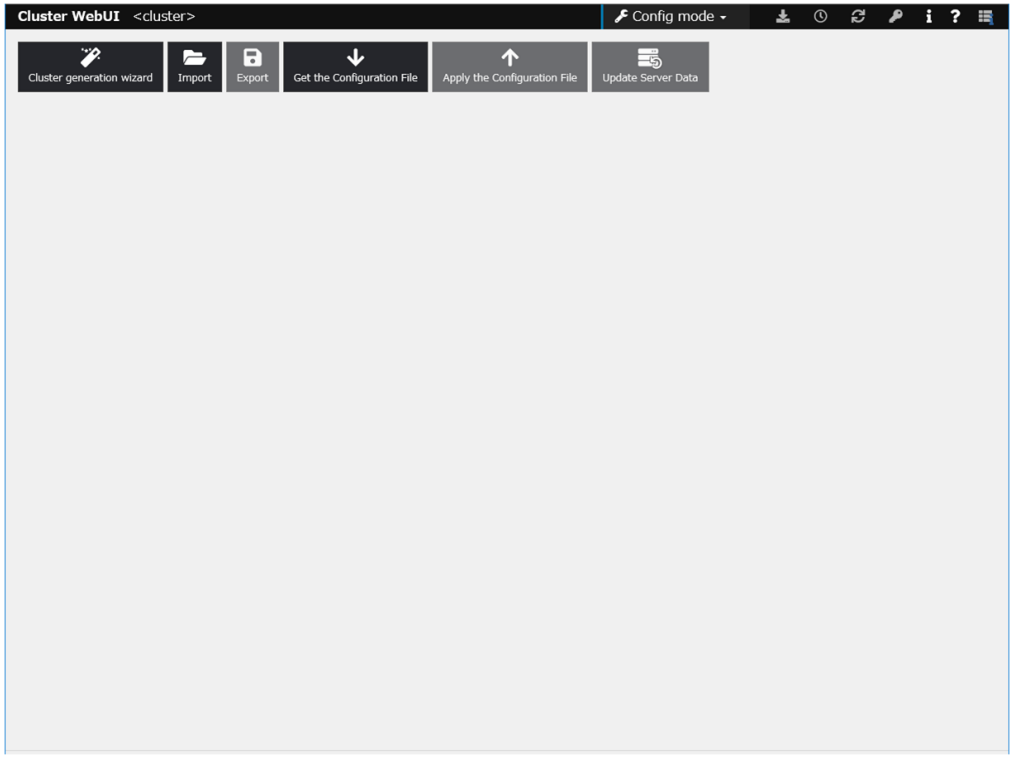
1) **Construct a cluster.**

   Start the cluster generation wizard to construct a cluster.

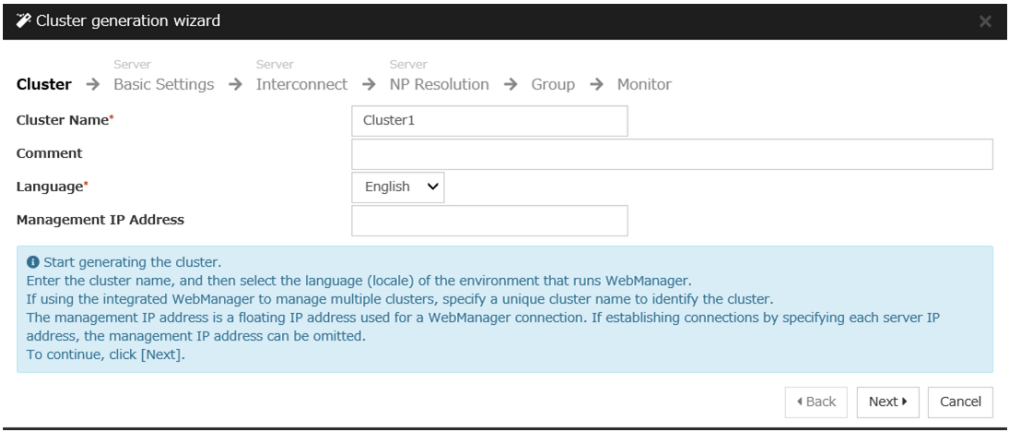
   - Construct a cluster.

     Steps

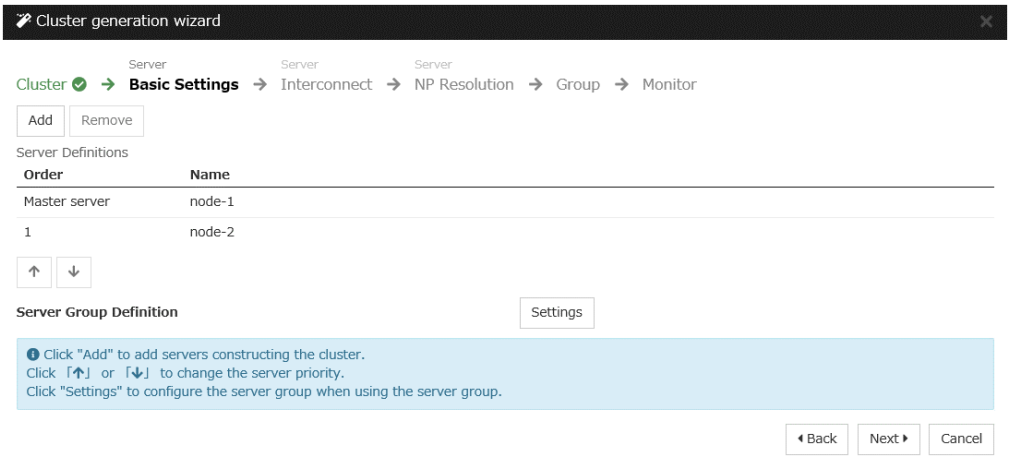
     1. Access Cluster WebUI, and click **Cluster generation wizard**.



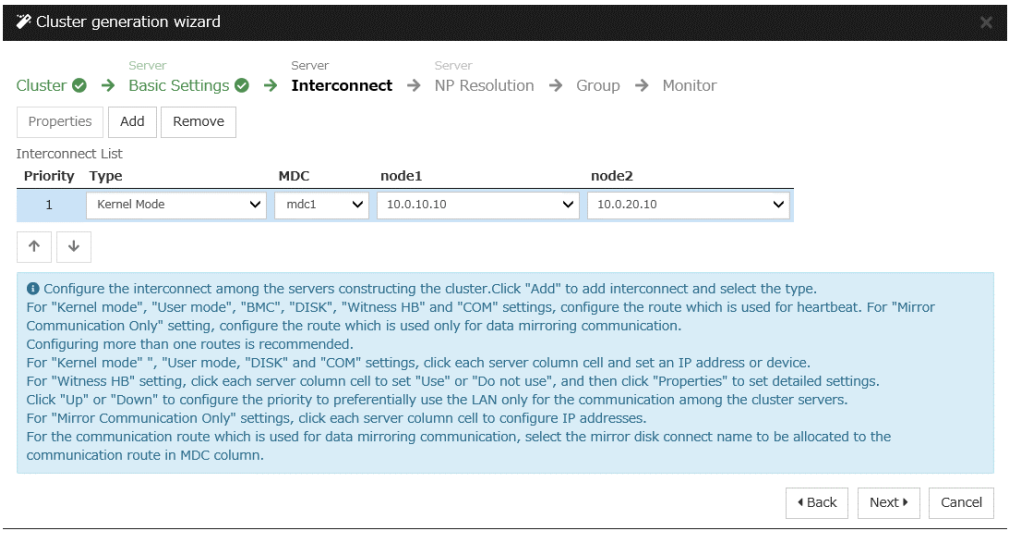
2. The **Cluster** window on the **Cluster Generation Wizard** is displayed.
   Enter a cluster name in **Cluster Name**.
   Select an appropriate language from **Language**. Click **Next**.



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**.



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**.



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 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.)

   The destination and method of NP resolution need be individually considered in accordance with the locations of clients accessing a cluster system and with the conditions for connecting to an on-premise environment (e.g. using a leased line). There is no recommended destination or method of NP resolution. A possible option for NP resolution is to use a network partition resolution resource.

   Click **Next**.

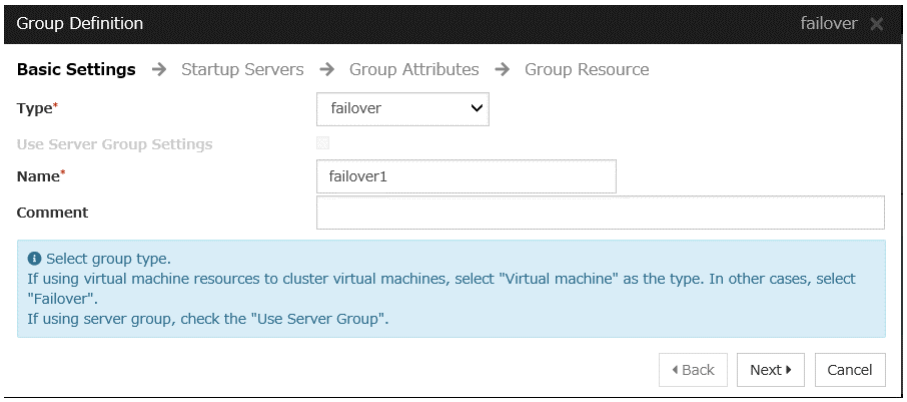
2) **Add a group resource.**

- Group definition

  Create a failover group.

  Steps

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



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** 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. The **Details** window is displayed.
     Enter the drive letter for the partition set up in "Configuring the instance" -> "5. Prepare the mirror disk." in **Data Partition Drive Letter** and **Cluster Partition Drive Letter**.
  6. From **Servers that can run the group**, select the server name in the **Name** column, and click **Add**.
  7. The **Selection of Partition** dialog box is displayed. Click **Connect**, select the data and cluster partitions, and click **OK**.
  8. Perform steps 6 and 7 on the other node.

9. Return to the **Details** window and click **Finish** to complete setting.

- AWS Elastic IP resource

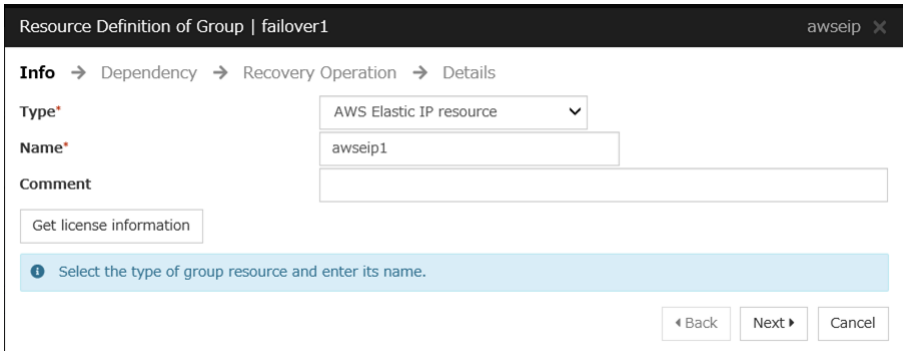
  Add an AWS Elastic IP resource that controls the EIP by using the AWS CLI.

  For details, refer to the following:

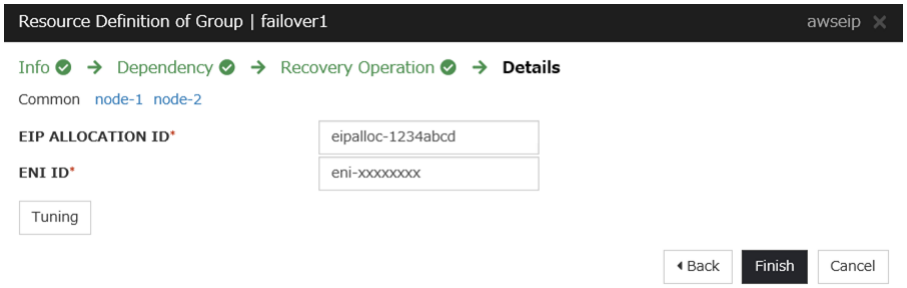
  - Reference Guide
    -> Understanding AWS elastic ip resources

  Steps

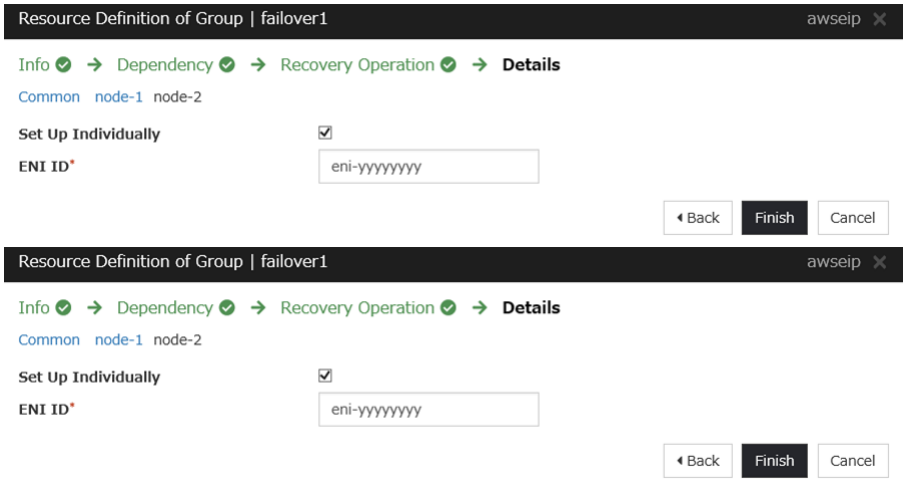
  1. Click **Add** in **Group Resource List**.
  2. The **Resource Definition of Group | failover1** is displayed.
     Select the group resource type (AWS Elastic IP resource) from the **Type** box and enter the group resource name (awseip1) in the **Name** box. Click **Next**.



  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.



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).



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

3) **Add a monitor resource.**

- AWS AZ monitor resource

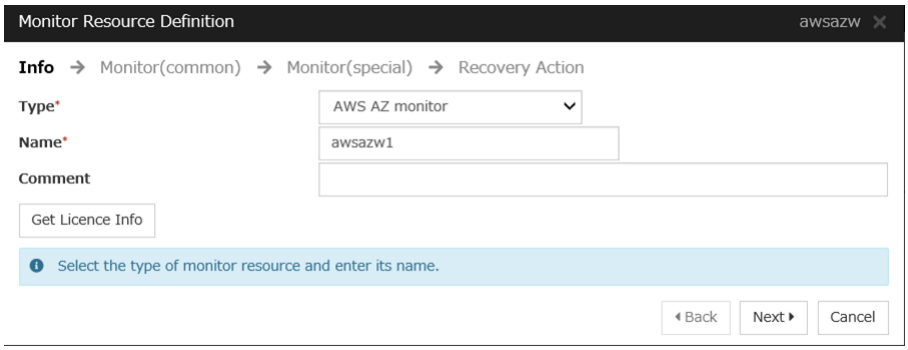
  Create the AWZ AZ monitor resource to check whether the specified AZ is usable by using the monitor command.

  For details, refer to the following:

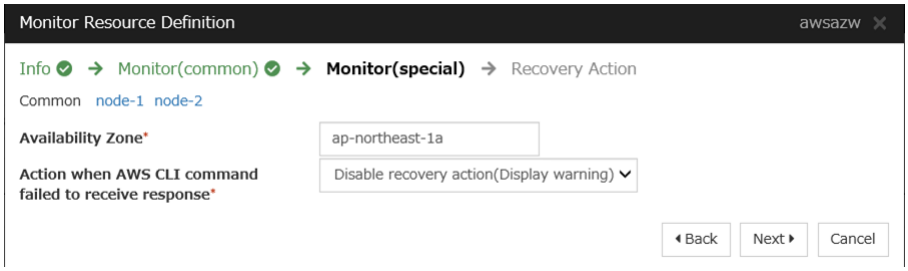
  - Reference Guide
    -> Understanding AWS AZ monitor resources

  Steps

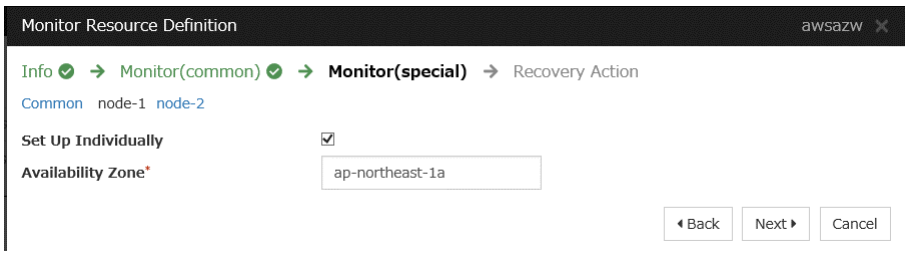
  1. Click **Add** in **Monitor Resource List**.
  2. Select the monitor resource type (AWS AZ monitor) from the **Type** box and enter the monitor resource name (awsazw1) in the **Name** box. Click **Next**.

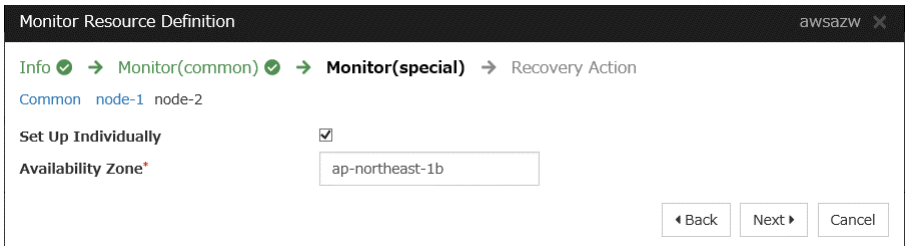


3. The **Monitor (common)** window is displayed.
   Click **Next** without specifying anything.
4. The **Monitor (special)** window is displayed.
   Enter the AZ to be monitored in the **Availability Zone** box on the **Common** tab. (Specify the AZ of the active server instance.) (corresponds to [1] in Figure 6.1 System Configuration of the HA cluster based on EIP control)

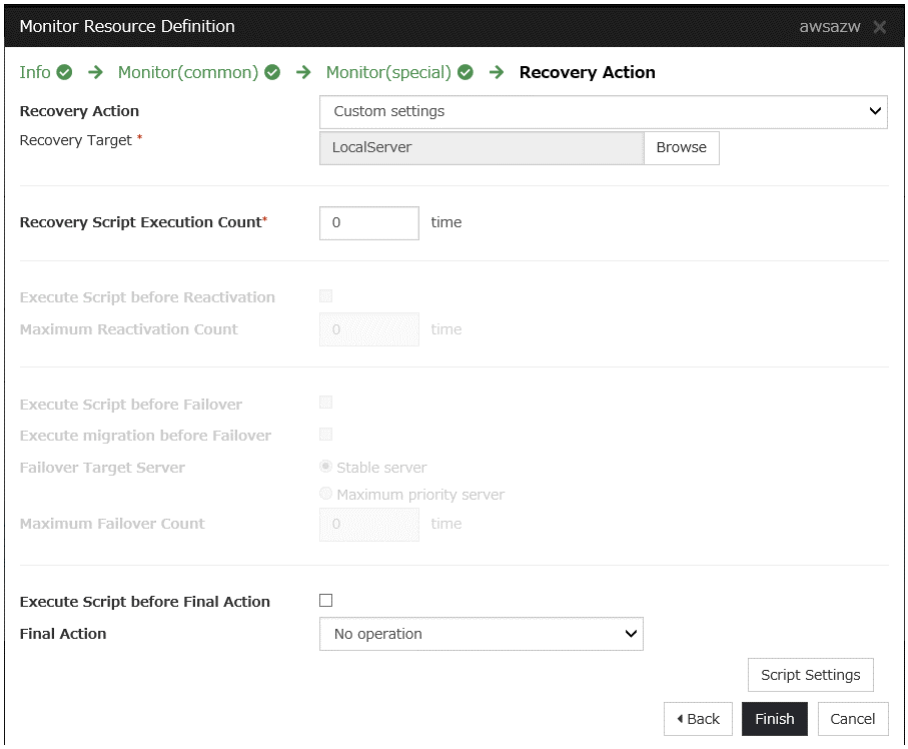


5. Specify the node settings on each node tab
   Select the **Set Up Individually** check box.
   Enter the AZ of the instance corresponding to the node in the **Availability Zone** box (corresponds to [1] and [2] in Figure 6.1 System Configuration of the HA cluster based on EIP control).
   Click **Next**.





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



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 in the config mode of Cluster WebUI.
      A popup message asking "Do you want to perform the operations?" is displayed. Click **OK**.
      When the upload ends successfully, a popup message saying "The application finished successfully." is displayed. Click **OK**.
      If the upload fails, perform the operations by following the displayed message.
   2. Select the **Operation Mode** on the drop down menu of the toolbar in Cluster WebUI to switch to the operation mode.
   3. Select **Start Cluster** in the **Status** tab of Cluster WebUI and click.

   Confirm that a cluster system starts and the status of the cluster is displayed to the Cluster WebUI. If the cluster system does not start normally, take action according to an error message.

   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.

The numbers in the figure correspond to the descriptions and setting values in the following sections.

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 ID

   Write down the VPC ID (vpc-xxxxxxxx) because it is necessary to add the Hosted Zone later.

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:

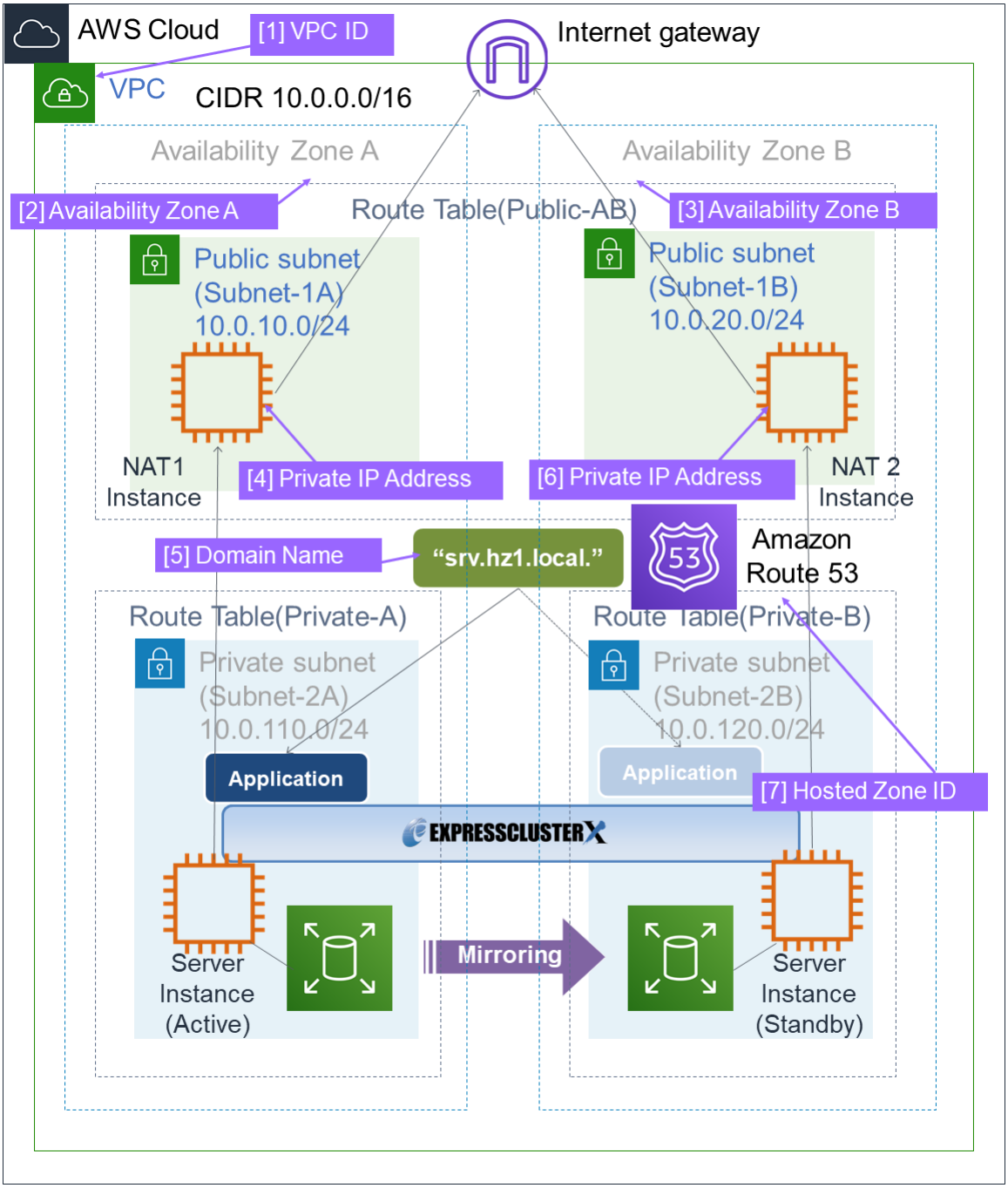


Fig. 7.1: System Configuration HA Cluster Based on DNS Name Control

- 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*"

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
0.0.0.0/0	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
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

Configure other routings according to the environment.

7) **Add a Hosted Zone**

Add a hosted zone 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 [1] VPC ID where the instance belongs, in the **VPC ID** box.

[7] Hosted Zone ID

Write down the Hosted Zone ID because it is necessary to set up the 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 and AWS DNS monitor resource

1) **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

2) **Install Python.**

Install Python required by EXPRESSCLUSTER.
First, confirm that Python is installed.
If not installed, download Python from the following URL and install it.

https://www.python.org/downloads/

After the installation, add the path to python.exe to the environment variable **PATH** from **Control Panel**. Since the Python command is executed as the SYSTEM user,

3) **Install the AWS CLI.**

From the web page below, download and install the AWS CLI version 1.
Do not install the AWS CLI version 2, which has not yet been supported.
The installer automatically adds the path information on the AWS CLI to the system environment variable PATH. If this addition does not occur, open the following web page and refer to "Add the AWS CLI version 1 Executable to Your Command Line Path":

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

If Python or the AWS CLI is installed in an environment with EXPRESSCLUSTER already installed, restart the OS before operating EXPRESSCLUSTER.

After the installation, do the following depending on the installer:

- If the MSI file is used
  If the installer is old, it may not install aws.exe. In this case, aws.cmd is the only AWS CLI executable file.
  Obtain the latest MSI installer for the AWS CLI version 1.
- If pip is used
  Confirm that the following is set in the environment variable configuration file `clpaws_setting.conf`: CLP_AWS_CMD=aws.cmd
  Confirm that the directory (e.g. `"C:\Program Files\Python38"`) where aws.cmd exists is set in the system environment variable PATH.
  With the environment variable configuration file `clpaws_setting.conf` configured with the setting of CLP_AWS_CMD, search for the system environment variable PATH. Then execute the file specified for CLP_AWS_CMD as the AWS CLI.
  For more information on the environment variable configuration file `clpaws_setting.conf`, refer to "Reference Guide" -> "Applying environment variables to AWS CLI run from the AWS DNS resource".

4) **Register the AWS access key ID.**

Start the command prompt as the Administrator user and run the following command:

```
> 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 folder `%SystemDrive%\Users\Administrator\.aws` entirely, and specify the above settings again.

5) **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
  -> Mirror partition settings (Required for mirror disks)

6) **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".

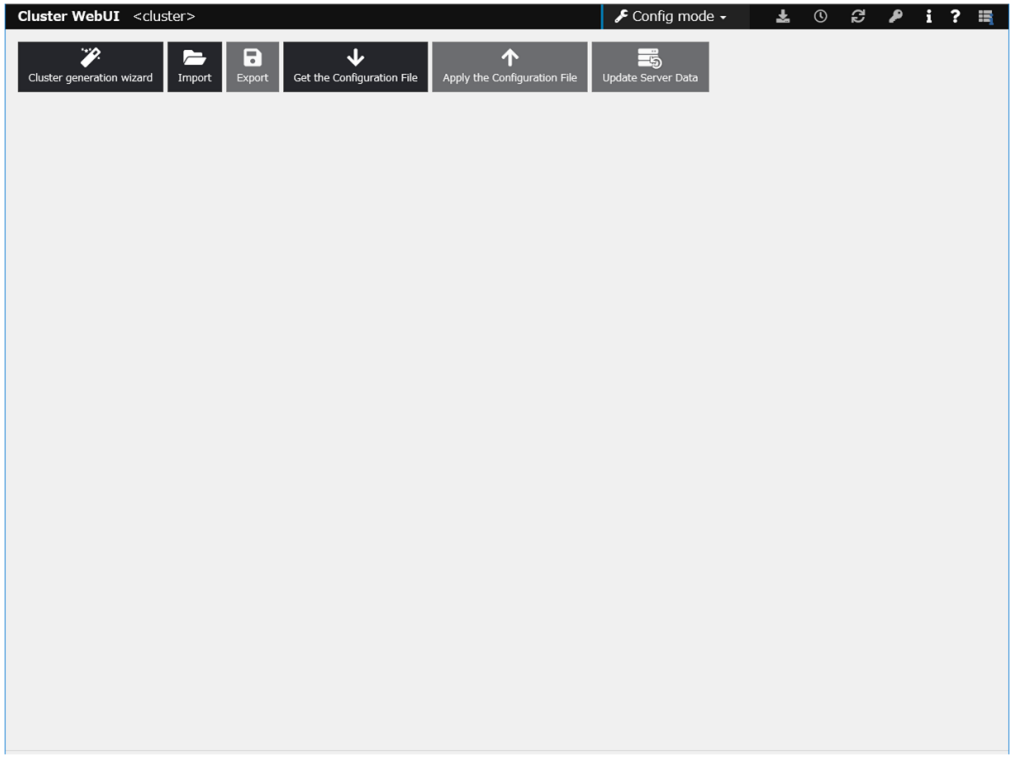
1) **Construct a cluster.**

Start the cluster generation wizard to construct a cluster.

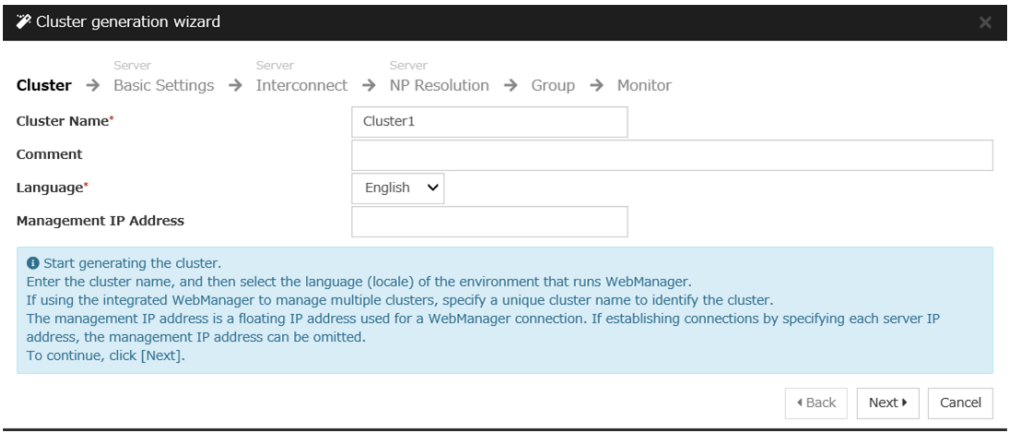
- Construct a cluster.

  Steps

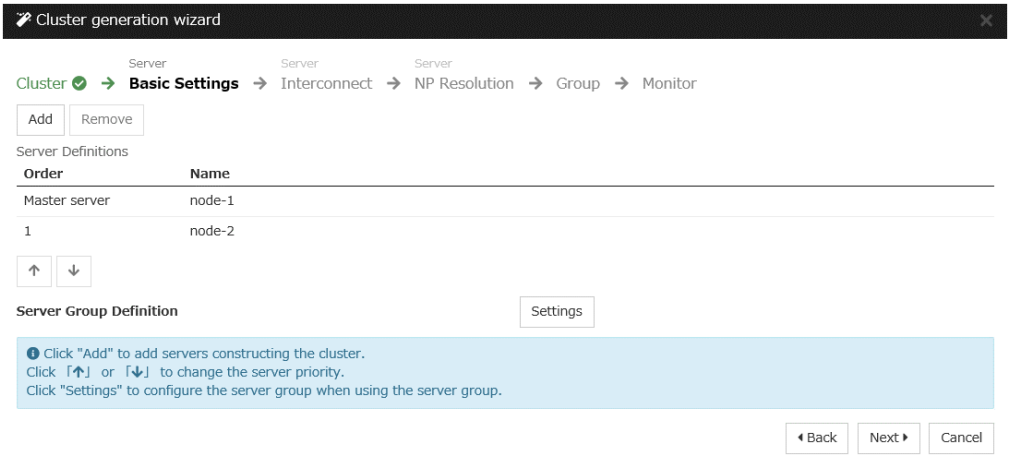
  1. Access Cluster WebUI, and click **Cluster generation wizard**.



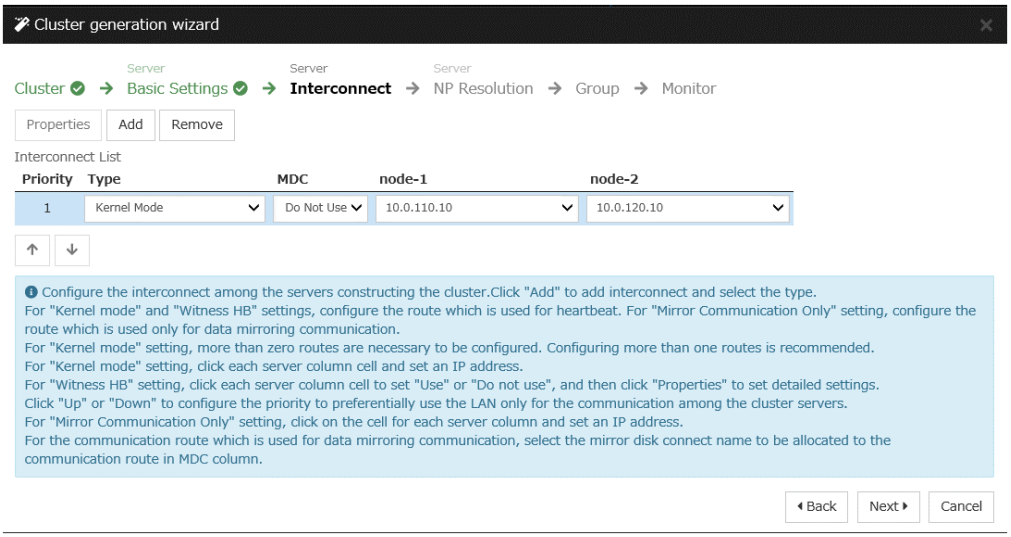
  2. The **Cluster** window on the **Cluster Generation Wizard** is displayed.
     Enter a cluster name in **Cluster Name**.
     Select an appropriate language from **Language**. Click **Next**.



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**.



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**.



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.)

   The destination and method of NP resolution need be individually considered in accordance with the locations of clients accessing a cluster system and with the conditions for connecting to an on-premise environment (e.g. using a leased line). There is no recommended destination or method of NP resolution. A possible option for NP resolution is to use a network partition resolution resource.

   Click **Next**.

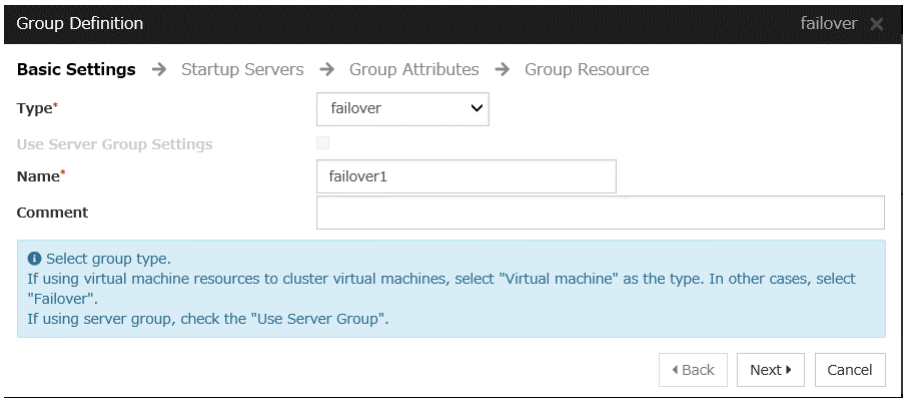
2) **Add a group resource.**

- Group definition

  Create a failover group.

  Steps

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



3. Click **Next**.
4. The **Startup Servers** window is displayed.
   Click **Next** without specifying anything.
5. The **Group Attributes** window is displayed.
   Click **Next** without specifying anything.
6. 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** 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.
  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 drive letter for the partition set up in "Configuring the instance" -> "5. **Prepare the mirror disk.**" in **Data Partition Drive Letter** and **Cluster Partition Drive Letter**.
  6. From **Servers that can run the group**, select the server name in the **Name** column, and click **Add**.
  7. The **Selection of Partition** dialog box is displayed. Click **Connect**, select the data and cluster partitions, and click **OK**.
  8. Perform steps 6 and 7 on the other node.
  9. Return to the **Details** window and click **Finish** to complete setting.

- AWS DNS resource

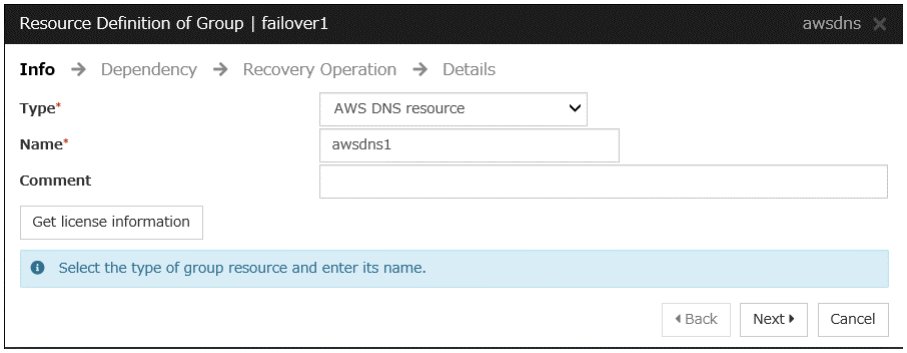
  Add the AWS DNS resource that controls the DNS name by using the AWS CLI.

  For details, refer to the following:

  Reference Guide
  -> Understanding AWS DNS resources

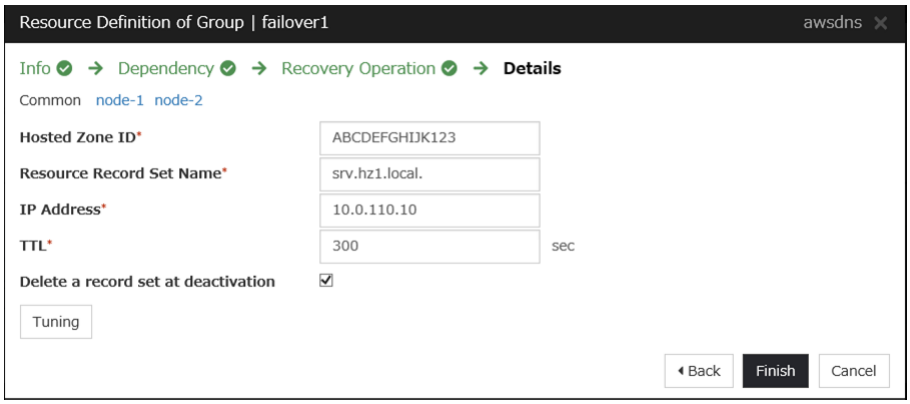
  Steps

1. Click **Add** in **Group Resource List**.
2. The **Resource Definition of Group | failover1** 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. Click **Next**.

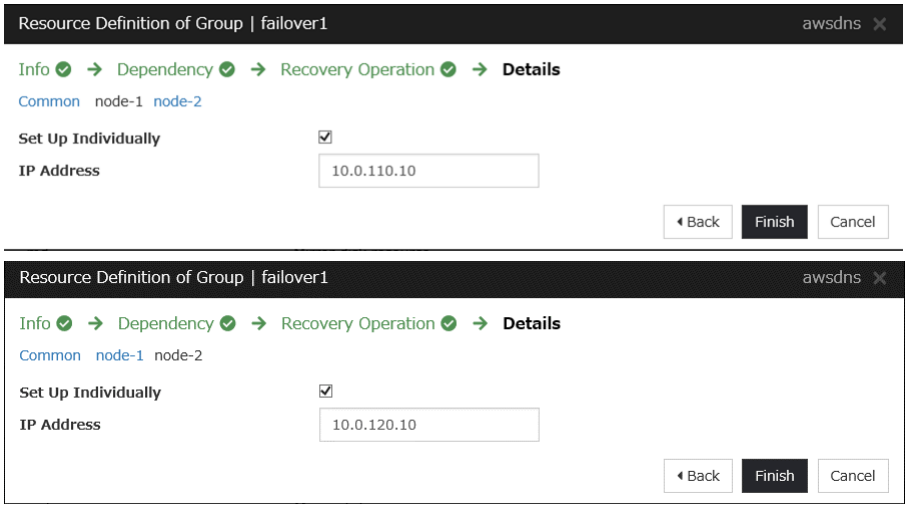


3. The **Dependency** window is displayed. Click **Next** without specifying anything.
4. The **Recovery Operation** window is displayed. Click **Next**.
5. The **Advanced Settings** window is displayed.
   Set the hosted zone ID in the **Hosted Zone ID** box on the **Common** tab (corresponds to [7] 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.



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.



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

3) **Add a monitor resource.**

- AWS AZ monitor resource

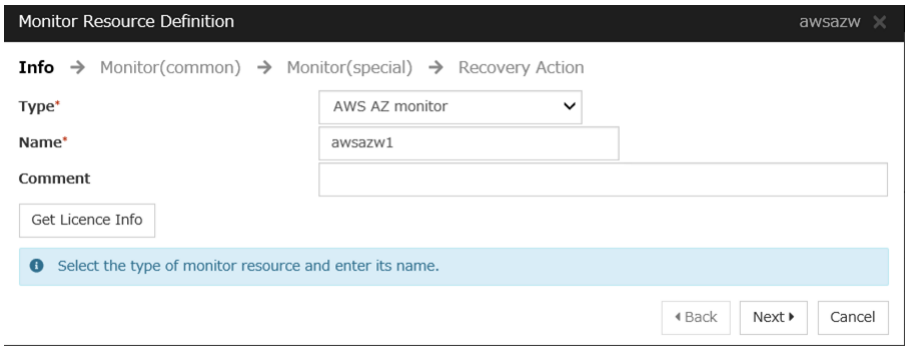
  Create an AWZ AZ monitor resource to check whether the specified AZ is usable by using the monitor command.

  For details, refer to the following:

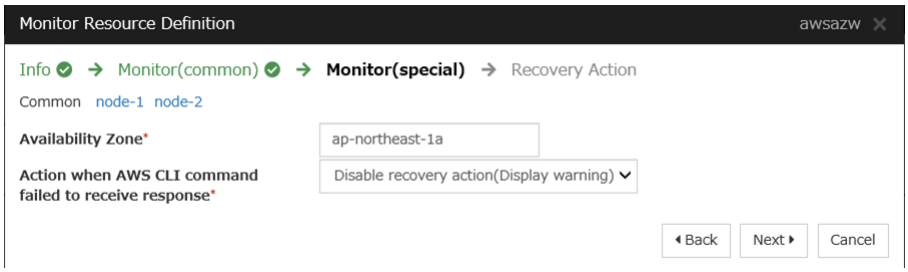
  - Reference Guide
    -> Understanding AWS AZ monitor resources

Steps

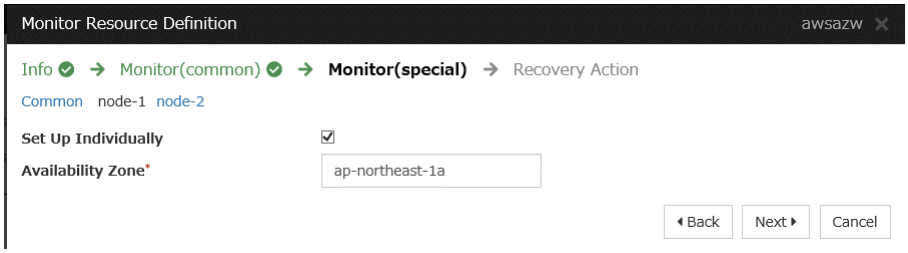
1. Click **Add** in **Monitor Resource List**.
2. Select the monitor resource type (AWS AZ monitor) from the **Type** box and enter the monitor resource name (awsazw1) in the **Name** box. Click **Next**.

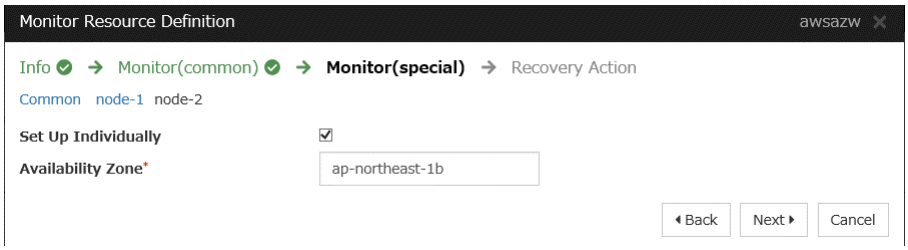


3. The **Monitor (common)** window is displayed.
   Click **Next** without specifying anything.
4. The **Monitor (special)** window is displayed.
   Enter the AZ to be monitored in the **Availability Zone** box on the **Common** tab. (Specify the AZ of the active server instance.) (corresponds to [2] in Figure 7.1 System Configuration HA Cluster Based on DNS Name Control)

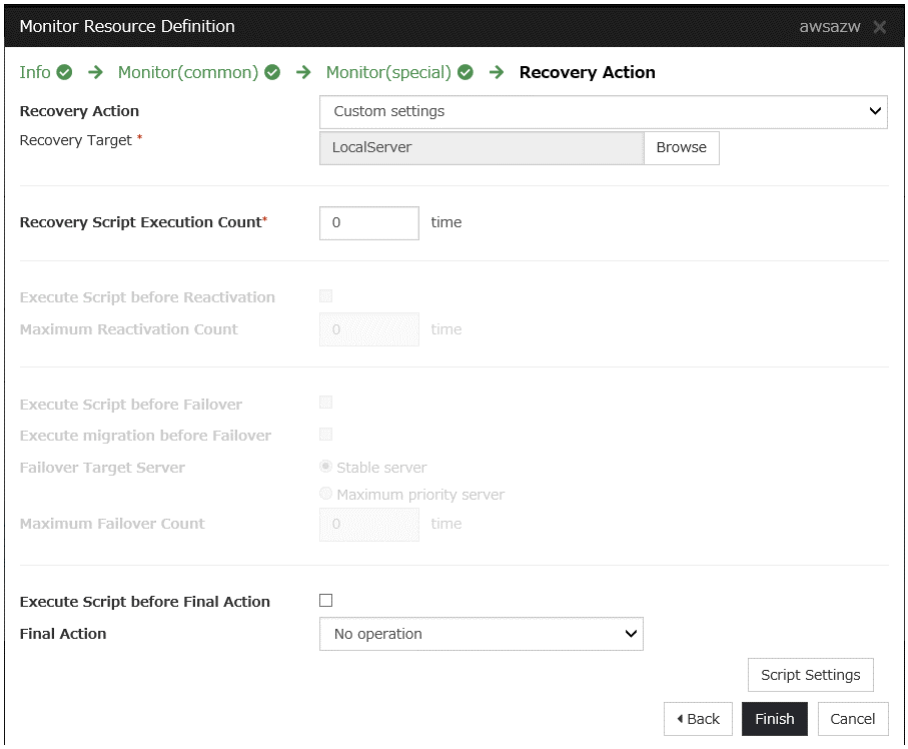


5. Specify the node settings on each node tab.
   Select the **Set Up Individually** check box.
   Enter the AZ of the instance corresponding to the node in the **Availability Zone** box.
   corresponds to [2] and [3] in Figure 7.1 System Configuration HA Cluster Based on DNS Name Control).
   Click **Next**.





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



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:

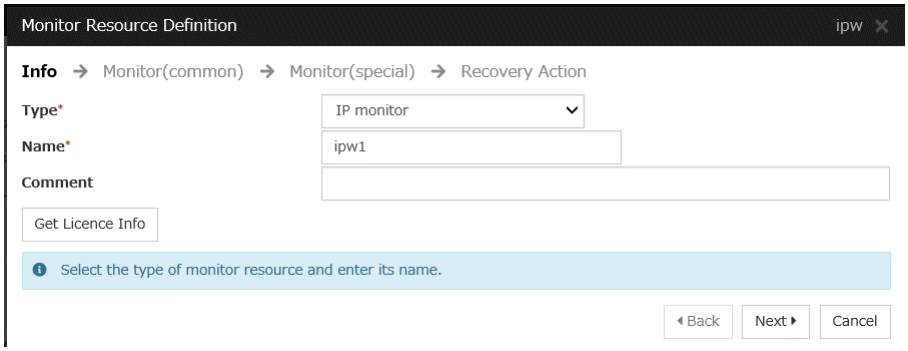
Reference Guide
-> Understanding AWS DNS monitor resources

- IP monitor resource

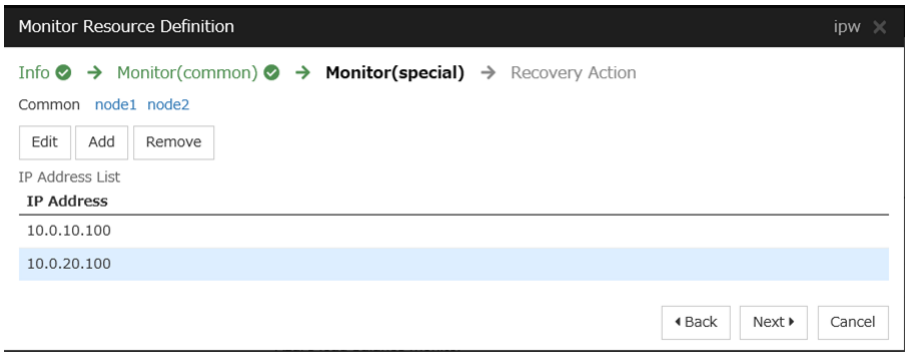
  Create the IP monitor resource to monitor the health of the subnet by sending a ping to a NAT instance placed in each AZ. Specify the following:

  Steps

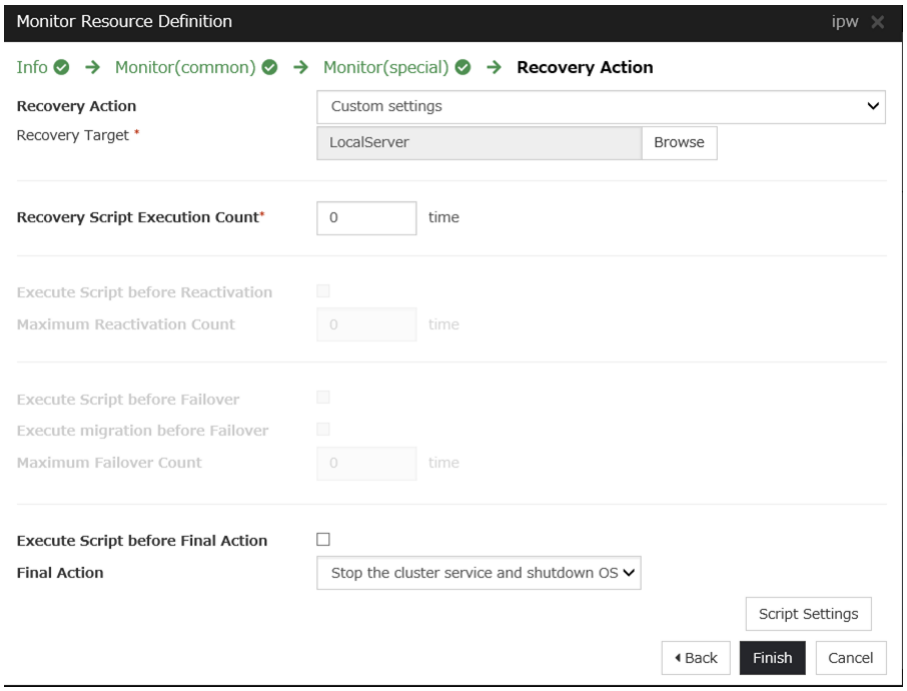
  1. Click **Add** in **Monitor Resource List**.
  2. Select the monitor resource type (IP monitor) from the **Type** box and enter the monitor resource name (ipw1) in the **Name** box. Click **Next**.



  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 7.1 System Configuration HA Cluster Based on DNS Name Control). Click **Next**.



  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**.



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

4) **Apply the settings and start the cluster.**

1. Click Apply the Configuration File in the config mode of Cluster WebUI.
   A popup message asking "Do you want to perform the operations?" is displayed. Click **OK**.
   When the upload ends successfully, a popup message saying "The application finished successfully." is displayed. Click **OK**.
   If the upload fails, perform the operations by following the displayed message.
2. Select the **Operation Mode** on the drop down menu of the toolbar in Cluster WebUI to switch to the operation mode.
3. Select **Start Cluster** in the **Status** tab of Cluster WebUI and click.

Confirm that a cluster system starts and the status of the cluster is displayed to the Cluster WebUI. If the cluster system does not start normally, take action according to an error message.

For details, refer to the following:

- Installation and Configuration Guide
  -> How to create a cluster

CHAPTER

EIGHT

CONFIGURING THE IAM

This chapter describes the Identity & Access Management (IAM) settings in the AWS environment.

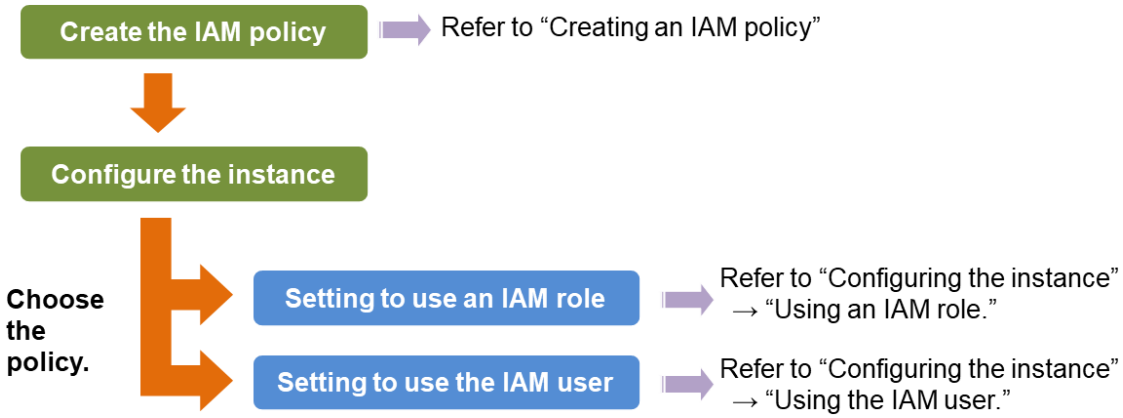
For the resource and monitor resources such as the AWS virtual ip resource, the AWS CLI is run in a resource to process the resource itself. To run the AWS CLI correctly, it is required to configure the IAM in advance.

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 secrete 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	High security Easy to manage key information.	None
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:



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 network 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",
```

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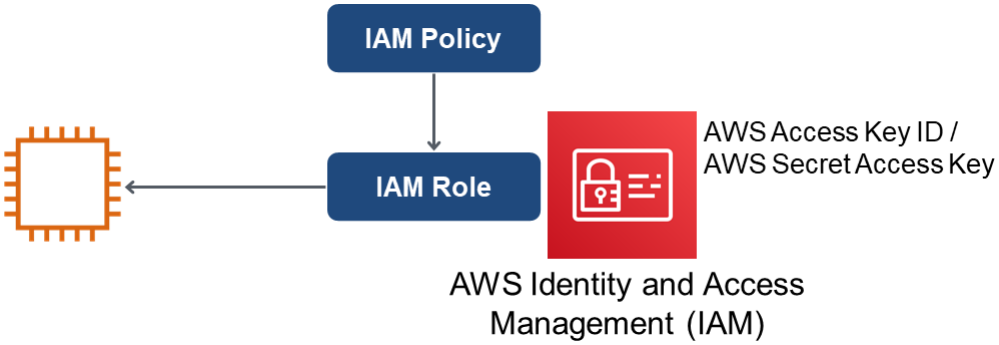
```
            "route53:ListResourceRecordSets"
        ],
        "Effect": "Allow",
        "Resource": "*"
    }
    ]
}
```

-> 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.



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 not installed, download Python from the following URL and install it.
   https://www.python.org/downloads/
   After the installation, add the path to python.exe to the environment variable **PATH** from **Control Panel**.

5) Install the AWS CLI.

   From the web page below, download and install the AWS CLI version 1.
   Do not install the AWS CLI version 2, which has not yet been supported.

The installer automatically adds the path information on the AWS CLI to the system environment variable PATH. If this addition does not occur, open the following web page and refer to "Add the AWS CLI version 1 Executable to Your Command Line Path":

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

If Python or the AWS CLI is installed in an environment with EXPRESSCLUSTER already installed, restart the OS before operating EXPRESSCLUSTER.

After the installation, do the following depending on the installer:

- If the MSI file is used

  If the installer is old, it may not install aws.exe. In this case, aws.cmd is the only AWS CLI executable file.

  Obtain the latest MSI installer for the AWS CLI version 1.

- If pip is used

  Confirm that the following is set in the environment variable configuration file `clpaws_setting.conf`: CLP_AWS_CMD=aws.cmd

  Confirm that the directory (e.g. `"C:\Program Files\Python38"`) where aws.cmd exists is set in the system environment variable PATH.

  For more information on the environment variable configuration file clpaws_setting.conf, refer to "Reference Guide" -> "Group resource details" -> the following:

  "Applying environment variables to AWS CLI run from the AWS virtual ip resource"

  "Applying environment variables to AWS CLI run from the AWS elastic ip resource"

  "Applying environment variables to AWS CLI run from the AWS DNS resource"

6) Start the command prompt as the Administrator user and run the following command:

```
> aws configure
```

Enter the information required to run the AWS CLI to the inquiries. Be careful not to enter the AWS access key ID and AWS secret access key.

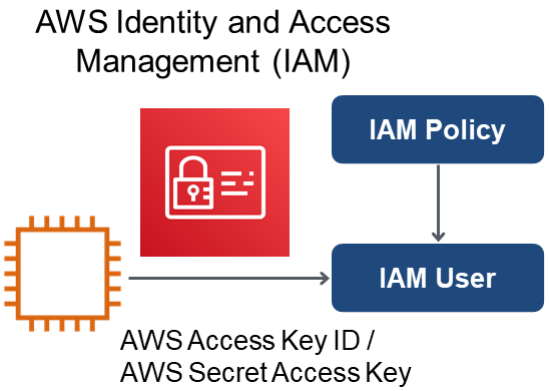
```
AWS Access Key ID [None]: (Press Enter without entering anything.)
AWS Secret Access Key [None]: (Press Enter without entering anything.)
Default region name [None]: <default region name>
Default output format [None]: text
```

For "Default output format", other format than "text" may be specified.

If you specified incorrect settings, delete the folder `%SystemDrive%\Users\Administrator\.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.



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.
   https://www.python.org/downloads/
   If not installed, download Python from the following URL and install it. After the installation, add the path to python.exe to the environment variable **PATH** from **Control Panel**.

4) Install the AWS CLI.

   From the web page below, download and install the AWS CLI version 1.
   Do not install the AWS CLI version 2, which has not yet been supported.
   The installer automatically adds the path information on the AWS CLI to the system environment variable PATH. If this addition does not occur, open the following web page and refer to "Add the AWS CLI version 1 Executable to Your Command Line Path":
   https://docs.aws.amazon.com/cli/latest/userguide/install-windows.html

   If Python or the AWS CLI is installed in an environment with EXPRESSCLUSTER already installed, restart the OS before operating EXPRESSCLUSTER.

   After the installation, do the following depending on the installer:

   - If the MSI file is used
     If the installer is old, it may not install aws.exe. In this case, aws.cmd is the only AWS CLI executable file.
     Obtain the latest MSI installer for the AWS CLI version 1.
   - If pip is used
     Confirm that the following is set in the environment variable configuration file `clpaws_setting.conf`: CLP_AWS_CMD=aws.cmd
     Confirm that the directory (e.g. `"C:\Program Files\Python38"`) where aws.cmd exists is set in the system environment variable PATH.

For more information on the environment variable configuration file clpaws_setting.conf, refer to "Reference Guide" -> "Group resource details" -> the following:

"Applying environment variables to AWS CLI run from the AWS virtual ip resource"

"Applying environment variables to AWS CLI run from the AWS elastic ip resource"

"Applying environment variables to AWS CLI run from the AWS DNS resource"

5) Start the command prompt as the Administrator user and run the following command:

```
> aws configure
```

Enter the information required to run the AWS CLI to the inquiries. For the AWS access key ID and AWS secret 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 folder `%SystemDrive%\Users\Administrator\.aws` entirely, and specify the above settings again.

CHAPTER

NINE

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

  ```
  Failed to start the resource awsvip1. (99 : Internal error occurred.)
  ```

  Possible cause Any of the following might be the cause.

  – Python has not been installed, or the path does not reach python.exe.

  – The AWS CLI has not been installed, or the path does not reach aws.exe.

  Solution

  Check the following:

  – Confirm that Python and the AWS CLI are installed.

  – Confirm that the paths to python.exe and aws.exe are set to the environment variable PATH.

Cluster WebUI message

```
Failed to start the resource awsvip1. (5 : the AWS CLI command failed.)
```

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 (file under `%SystemDrive%\Users\Administrator\.aws`) could not be found. (A user other than Administrator ran aws configure.)
- 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

```
Failed to start the resource awsvip1. (5 : The vpc ID 'vpc-xxxxxxxx'␣
↪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

```
Failed to start the resource awsvip1. (5 : The networkInterface ID 'eni-
↪xxxxxxxx' 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 awsvip1 resource has failed.(5 : You are not authorized to␣
↪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

```
Failed to start the resource awsvip1. (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 or NAT on the OS or due to a misconfiguration of the proxy server on EXPRESSCLUSTER.
- 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 or NAT on the OS or those of the proxy server on EXPRESSCLUSTER.
- When the node is heavily loaded, remove the causes.

Cluster WebUI message

```
Failed to start the resource awsvip1. (7 : The VIP address 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

```
Monitor awsvipw1 detected an error. (8 : The routing for VIP 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

  ```
  Failed to start the resource awseip1. (99 : Internal error occurred.)
  ```

  Possible cause Any of the following might be the cause.

  – Python has not been installed, or the path does not reach python.exe.

  – The AWS CLI has not been installed, or the path does not reach aws.exe.

  Solution Check the following:

  – Confirm that Python and the AWS CLI are installed.

  – Confirm that the paths to python.exe and aws.exe are set to the environment variable PATH.

Cluster WebUI message

```
Failed to start the resource awseip1. (5 : the AWS CLI command failed.)
```

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 (file under `%SystemDrive%\Users\Administrator\.aws`) could not be found. (A user other than Administrator ran aws configure.)
- 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

```
Failed to start the resource awseip1. (5 : The allocation ID 'eipalloc-
↪xxxxxxxx' 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

```
Failed to start the resource awseip1. (5 : The networkInterface ID 'eni-
↪xxxxxxxx' 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

```
Failed to start the resource awseip1. (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 or NAT on the OS or due to a misconfiguration of the proxy server on EXPRESSCLUSTER.
- 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 or NAT on the OS or those of the proxy server on EXPRESSCLUSTER.
- When the node is heavily loaded, remove the causes.

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

Cluster WebUI message

```
Monitor awseipw1 detected an error. (7 : The EIP address does not exist.)
```

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.

- Failed to start the AWS DNS resource

Cluster WebUI message

```
Failed to start the resource awsdns1. (99: Internal error occurred.)
```

Possible cause Any of the following might be the cause.

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

Solution Check the following:

- Confirm that Python and the AWS CLI are installed.
- Confirm that the paths to python.exe and aws.exe are set to the environment variable Path.

Cluster WebUI message

```
Failed to start the resource awsdns1. (5: AWS CLI command failed.)
```

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 (file under `%SystemDrive%\Users\Administrator\.aws`) could not be found. (A user other than Administrator ran aws configure.)
- The specified AWS CLI settings (such as a region, access key, and secrete key ID) 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 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.
- The preferred DNS server is incorrectly set in the TCP/IPv4 properties of the corresponding network.
- On the terminal of the node (instance), manually execute the following command:
  `> aws route53 list-resource-record-sets --hostted-zone-id <hosted-zone ID>`
  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.
- Correct the settings of the preferred DNS server.
- 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

```
Failed to start the resource awsdns1. (5: No hosted zone found with ID:
↪%1)
```

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

Solution Specify a correct hosted zone ID.

Cluster WebUI message

```
Failed to start the resource awsdns1. (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 or NAT on the OS or due to a misconfiguration of the proxy server on EXPRESSCLUSTER.
- 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:

- 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 or NAT on the OS or those of the proxy server on EXPRESSCLUSTER.
- 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/jp/route53/faqs/

    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 (e.g. 900 seconds by default in Windows) 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

```
Monitor awsdnsw1 detected an error. (7: The resource record set does not␣
↪exist in Amazon Route 53.)
```

Possible cause Any of the following might be the cause. - In the hosted 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 "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

```
Monitor awsdnsw1 detected an error. (8: The different IP address from␣
↪the setting value is registered in the resource record set.)
```

Possible cause In the hosted zone, the IP address of the resource record set corresponding to the AWS DNS resource has been deleted for some reason.

Solution Check whether another HA cluster uses the same resource record set mistakenly and so on.

Cluster WebUI message

```
Monitor awsdnsw1 detected an error. (9: Failed to check name resolution.)
```

Possible cause The DNS query using the DNS name registered in the hosted zone as resource record set failed to check the name resolution for some reason.

Solution Check the following:

- If there are no errors in the resolver settings.
- If there are no errors in the network settings.
- 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

```
Monitor awsdnsw1 detected an error. (10: The IP address obtained by the␣
↪DNS name resolution is different from the setting value.)
```

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]

```
Monitor awsdnsw1 is in the warning status. (106 : Timeout occurred)
```

[Error]

```
Monitor awsdnsw1 detected an error. (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 or NAT on the OS or due to a misconfiguration of the proxy server on EXPRESSCLUSTER.

– 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:

– 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 or NAT on the OS or those of the proxy server on EXPRESSCLUSTER.

– 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]

  ```
  Monitor awsazw1 is in the warning status. (105 : the AWS CLI command␣
  ↪failed.)
  ```

  [Error]

  ```
  Monitor awsazw1 detected an error. (5 : the AWS CLI command failed.)
  ```

  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 (file under `%SystemDrive%\Users\Administrator\.aws`) could not be found. (A user other than Administrator ran aws configure.)

  – 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]

```
Monitor awsazw1 is in the warning status. (105 : Invalid availability␣
↪zone: [ap-northeast-1x]  )
```

[Error]

```
Monitor awsazw1 detected an error. (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]

```
Monitor awsazw1 is in the warning status. (106 : Timeout occurred.)
```

[Error]

```
Monitor awsazw1 detected an error. (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 or NAT on the OS or due to a misconfiguration of the proxy server on EXPRESSCLUSTER.
- 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 or NAT on the OS or those of the proxy server on EXPRESSCLUSTER.
- 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
  ```

- When the node is heavily loaded, remove the causes.

CHAPTER

TEN

LEGAL NOTICE

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CHAPTER

ELEVEN

REVISION HISTORY

Edition	Revised Date	Description
1st	Apr 10, 2020	New Guide