ExpressCluster® X 3.1

HA Cluster Configuration Guide
for Amazon Web Services

10/12/2012
2nd Edition

Revision History

Edition	Revised Date	Description
1	05/08/2012	New Manual
2	10/12/2012	The description of the procedure to configure an HA cluster by using the EIP control.

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Preface

Who Should Use This Guide

The *HA Cluster Configuration Guide for Amazon Web Services* is intended for system engineers and administrators who want to build, operate, and maintain a cluster system.
This guide introduces configuration samples and setup examples. However, the configuration samples and setup examples introduced in this guide are for reference only, and the software is not guaranteed to run.

Scope of Application

This guide covers the following ExpressCluster versions.

- ExpressCluster X 3.1 for Windows
- ExpressCluster X 3.1 for Linux

How This Guide is Organized

Chapter 1	Functional Overview:	Provides the overview of the function to configure an HA cluster.
Chapter 2	Operating Environment:	Describes the environments in which configuring an HA cluster has been verified.
Chapter 3	Notes:	Describes the notes when configurating an HA cluster.
Chapter 4	Setup Procedures:	Describes how to configure an HA cluster.
Chapter 5	Configuration Files:	Describes the configuration files for the linkage commands.
Chapter 6	Command Reference:	Describes the command line and execution examples of the linkage commands provided by this function.
Appendix	Sample Script:	Describes sample scripts.

ExpressCluster Documentation Set

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

Getting Started Guide

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

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. This guide follows the actual sequence of actions performed when introducing a cluster system using ExpressCluster to describe how to design the system, install and set up ExpressCluster X, check the operation after the setup, and perform evaluation before starting operation.

Reference Guide

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

Integrated WebManager Administrator's Guide

This guide is intended for system administrators who manage cluster system using ExpressCluster with ExpressCluster Integrated WebManager and for system engineers who introduce the Integrated WebManager. In this guide, details on required items for introducing the cluster system using the Integrated WebManager are explained in accordance with the actual procedures.

WebManager Mobile Administrator's Guide

This guide is intended for system administrators who manage cluster system using ExpressCluster with ExpressCluster WebManager Mobile and for system engineers who introduce the WebManager Mobile. In this guide, details on those items required for introducing the cluster system using the WebManager Mobile are explained in accordance with the actual procedures.

Conventions

In this guide, **Note**, **Important**, **Related Information** 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.

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

The following conventions are used in this guide.

Convention	Usage	Example
Bold	Indicates graphical objects, such as fields, list boxes, menu selections, buttons, labels, icons, etc.	In **User Name**, type your name. On the **File** menu, click **Open Database**.
Angled bracket within the command line	Indicates that the value specified inside of the angled bracket can be omitted.	`clpstat -s[-h host_name]`
#	Prompt to indicate that a Linux user has logged on as root user.	`# clpcl  -s -a`
Monospace (courier)	Indicates path names, commands, system output (message, prompt, etc), directory, file names, functions and parameters.	`/Linux/3.0/eng/server/`
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.	`rpm -i expressclsbuilder`
		`-<version_number>-`
		`<release_number>.i686.rpm`

Contacting NEC

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Chapter 1 Functional Overview

Functional Overview

The settings described in this guide allow you to configure an HA cluster with ExpressCluster that uses the Amazon Virtual Private Cloud (hereafter referred to as VPC) in the Amazon Web Services (hereafter referred to as AWS) environment.

Because more important applications can be performed in the same environment, 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. ExpressCluster realizes highly available applications by allowing the HA cluster to operate between multiple AZs in a region (hereafter referred to as Multi-AZ).
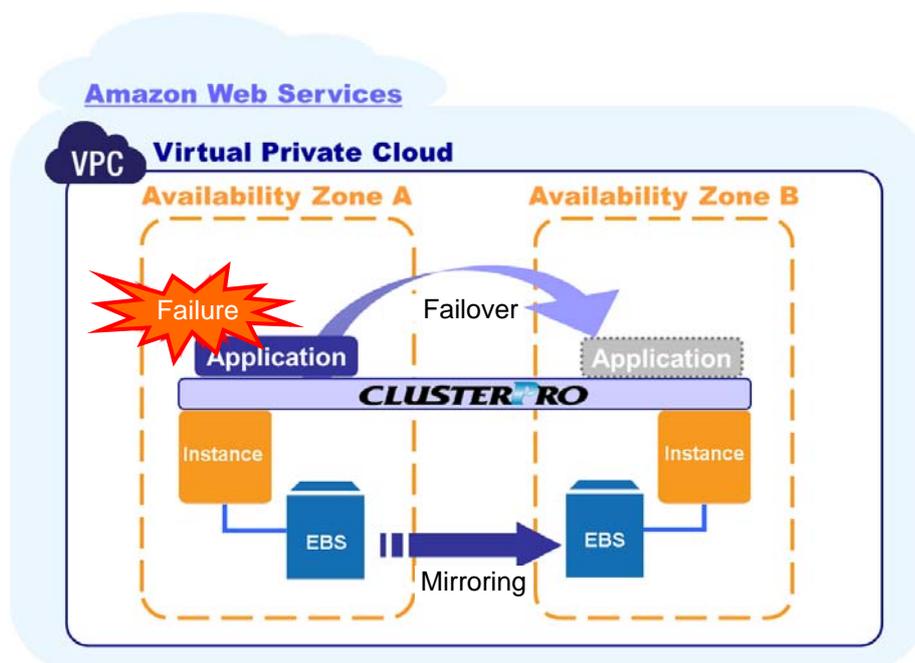
Figure 1 Mirror Type HA Cluster in Multi-AZ Configuration

Basic Configuration

This configuration guide assumes "HA cluster based on VIP control" and "HA cluster based on EIP control."

This guide describes how to configure an HA cluster with the data mirror method. The shared disk and hybrid methods are not covered.

1-1 HA Cluster Based on VIP Control

Use this type of HA cluster to locate instances on a private subnet (publish applications inside the VPC).

In the configuration assumed here, a clustered instance and a group of instances that access the clustered instance are located on a private subnet in each AZ and each instance can access the Internet via the NAT instance located on the public subnet.

Figure 2-1 HA Cluster Based on VIP Control

1-2 HA Cluster Based on EIP Control

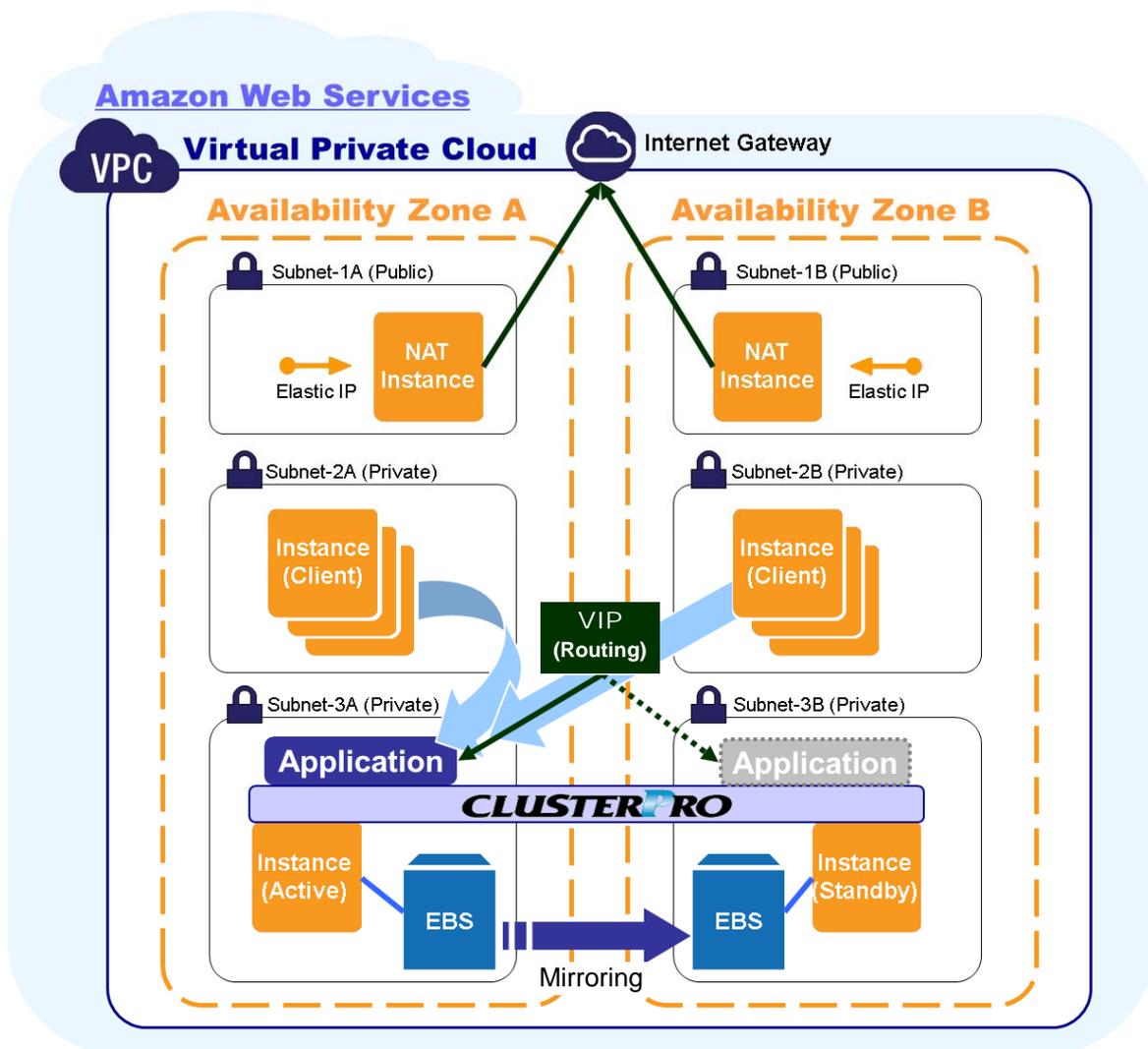Use this type of HA cluster to locate instances on a public subnet (publish applications outside the VPC).
In the configuration assumed here, a clustered instance is located on a public subnet in each AZ and each instance can access the Internet via the Internet gateway.
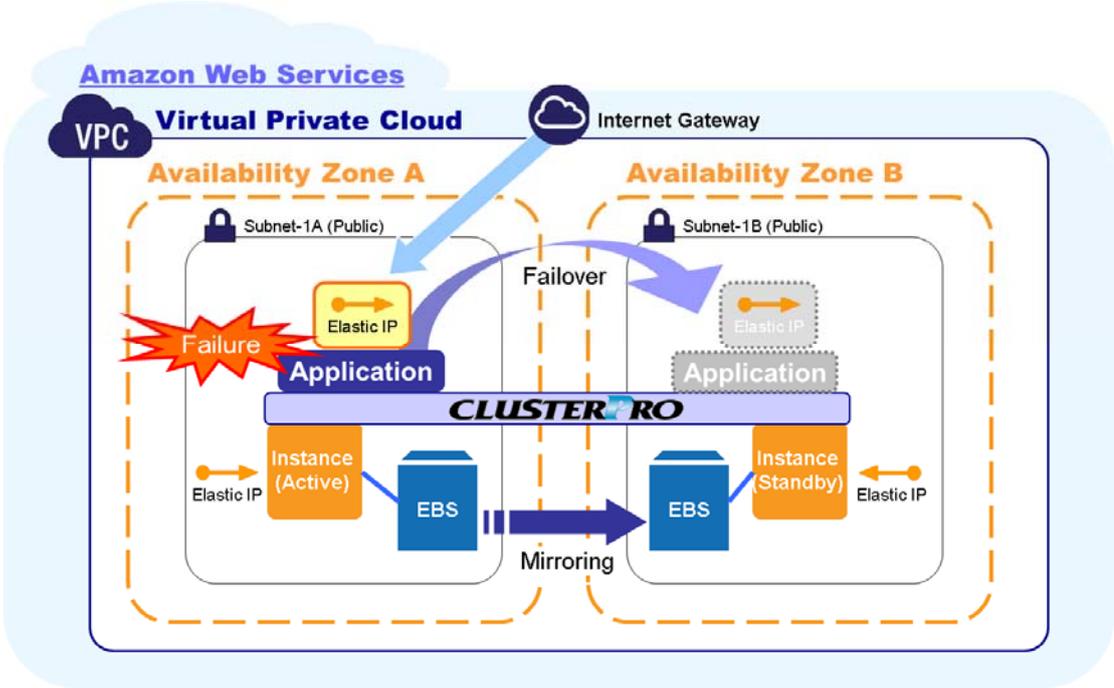
Figure 2-2 HA Cluster Based on EIP Control

Chapter 2   Operating Environment

The description in this configuration guide has been verified in the following environments.

Windows

OS	Microsoft Windows Server 2008 R2 Datacenter Edition SP1
ExpressCluster	ExpressCluster X 3.1
Amazon Web Services	Amazon Elastic Compute Cloud (Amazon EC2) Amazon Virtual Private Cloud (Amazon VPC)
ec2-api-tools	ec2-api-tools-1.6.3.0

Linux

OS	Red Hat Enterprise Linux 6.1 Red Hat Enterprise Linux 6.2 Red Hat Enterprise Linux 6.3
ExpressCluster	ExpressCluster X 3.1
Amazon Web Services	Amazon Elastic Compute Cloud (Amazon EC2) Amazon Virtual Private Cloud (Amazon VPC)
ec2-api-tools	ec2-api-tools-1.6.3.0

Install the following or later version of ExpressCluster.
- ExpressCluster X 3.1 for Windows: Internal version 11.13 or later
- ExpressCluster X 3.1 for Linux: rpm version 3.1.3 or later

Chapter 3   Notes

Notes on Using ExpressCluster in the VPC

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

Restrictions on group resource functions
- The following group resource functions cannot be used in the VPC environment.
    - Floating IP resources
    - Virtual IP resources

- The function equivalent to the virtual IP resources can be realized by using the VIP control command (refer to Chapter 6 for details).

- The following group resource functions cannot be partly used in the VPC environment.
    - Virtual computer name resources

- Note the following points when using the virtual computer name resources.
    - Virtual computer name resources cannot be linked with floating IPs
    - The WINS server must be configured in the server and clients.
      For how to configure the WINS server, refer to "Configuring WINS server" in "Understanding virtual computer name resources" in Chapter 5, "Group resource details" (Windows version) in the *Reference Guide*.

Performance of mirror disk
- In the HA cluster configured with the mirror method, the request to write into the mirror disk goes through the following path.
  Writing 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

  Because the HA cluster is configured in Multi-AZ configuration, mirroring is performed from some distance.
  The performance of mirror disk varies depending on the usage on other systems due to that mirroring distance as well as multitenancy.
  Therefore, the performance of mirror disk tends to differ more largely in the cloud environment than in the physical or other general virtualized environment (non-cloud environment) (That is, the degradation ratio of mirror disk performance is larger).
  Take this point into consideration at the design phase if priority is put on writing performance in your system.

Chapter 4   Setup Procedures

This chapter describes how to configure a cluster.
The system configurations of "HA cluster based on VIP control" and "HA cluster based on EIP control" are shown below.
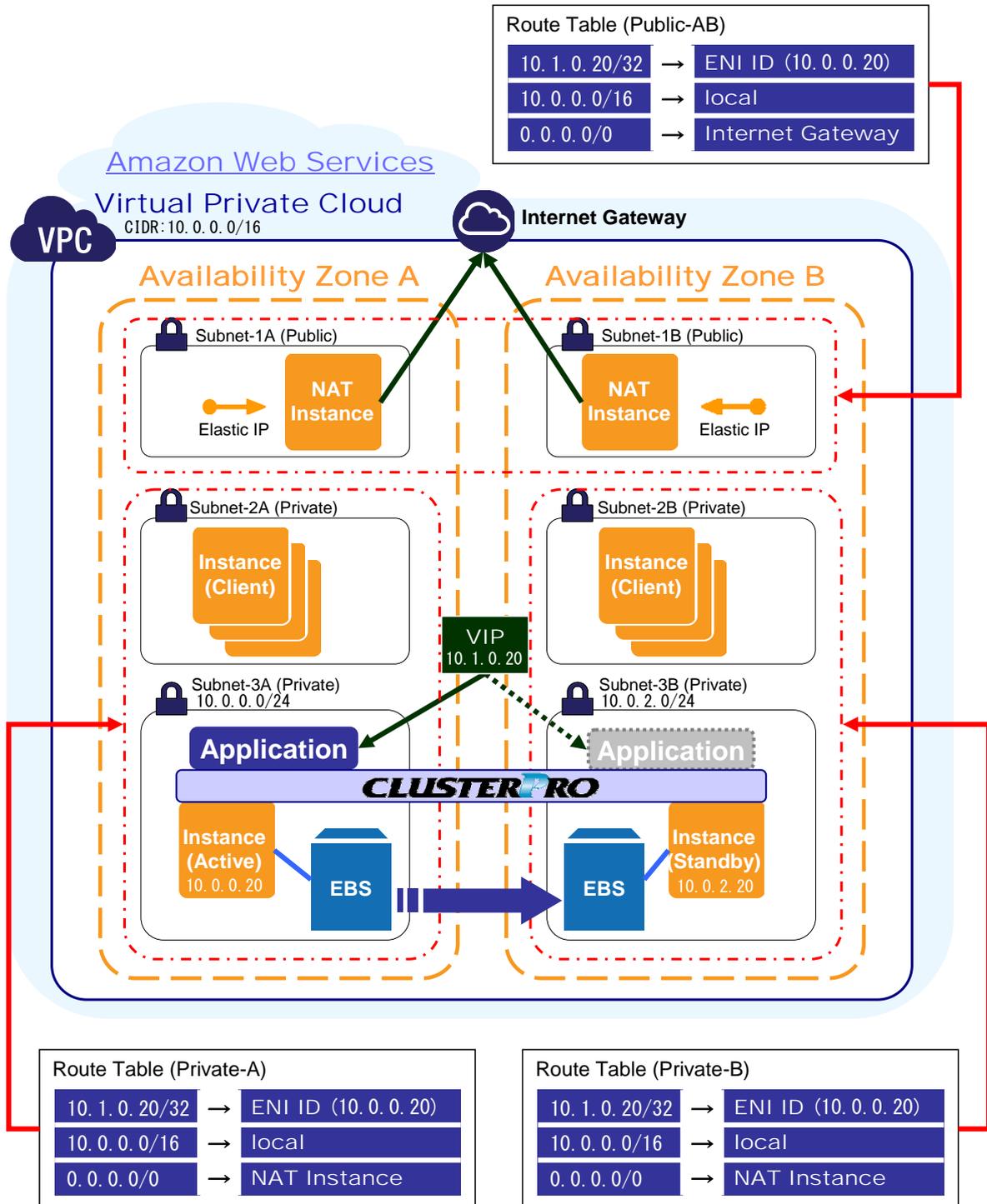

Figure 3-1 System Configuration: HA Cluster Based on VIP Control
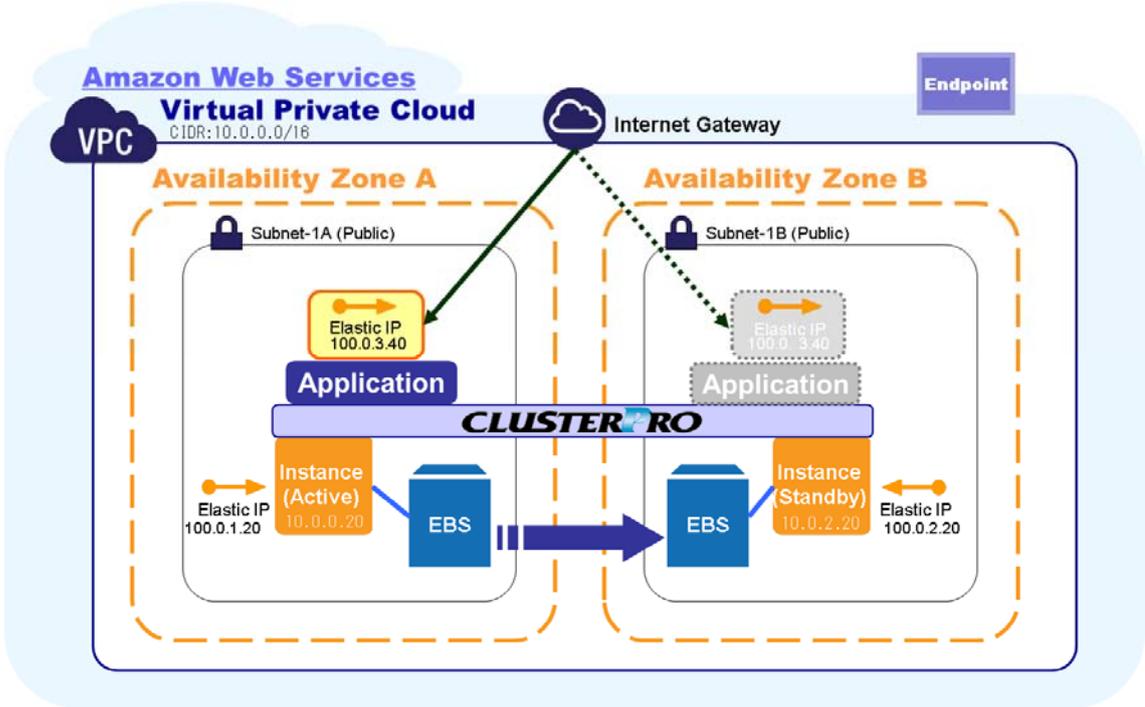
Figure 3-2 System Configuration: HA Cluster Based on EIP Control

4-1. Setup of VPC Environment

Perform the following settings on the AWS management console.
Settings differ depending on system configuration. Settings for each system configuration are described below.

- Common settings
- Settings for HA cluster based on VIP control
- Settings for HA cluster based on EIP control

• Common settings

Perform the following settings on the HA clusters based on VIP and EIP control.

• Specifying the network ACL and security group

Change the settings for the network ACL and security group for each path so that each instance (10.0.0.20 and 10.0.2.20 in the figure) can communicate to the Internet gateway via HTTPS and communicate with each other.

Because the server uses EC2 API Tools, the server must be able to communicate to the Internet gateway via HTTPS.
ExpressCluster uses several port numbers for communication between modules.
Specify the port numbers to be used, referring to "Before installing ExpressCluster" in Chapter 5, "Notes and Restrictions" in the *Getting Started Guide* (Windows version) or "Settings after configuring hardware" in Chapter 1, "Determining a system configuration" in the *Installation and Configuration Guide* (Linux version).

• Adding the EBS

Add the EBS to be used as mirror disk (cluster and data partitions).
Divide the EBS into partitions and use one of them as cluster partition and the other as data partition.
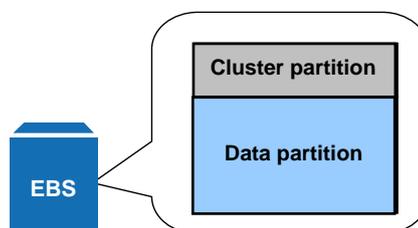
Figure Example of EBS Partitioning

For details on the partition for mirror disk, refer to "Mirror partition settings" (Windows version) or "Mirror disk resource partition settings" (Linux version) in Chapter 1, "Determining a system configuration" in the *ExpressCluster X Installation and Configuration Guide*.

- ## <u>Settings for HA cluster based on VIP control</u>
  Perform the following settings on the HA cluster based on VIP control.

  - **Setting up the elastic network interface**
    Disable **Source/Dest. Check** for the elastic network interface (hereafter referred to as ENI) for the instance to be clustered (10.0.0.20 and 10.0.2.20 in the figure).

    The virtual IP address (10.1.0.20 in the figure) must be routed to the ENI for the instance to use the VIP control command. Because the ENI for each instance can receive communication from the private and virtual IP addresses, disable **Source/Dest. Check**.

  - **Setting up the route table**
    Add the VIP (10.1.0.20/32) to each route table and the routing to the ENI ID of active instance (10.0.0.20 in the figure) as shown in the figure.

    The VIP control command switches the routing to the VIP to the standby instance (10.0.2.20 in the figure) during failover.
    Set up other routings according to your environment.

- ## <u>Settings for HA cluster based on EIP control</u>
  Perform the following settings on the HA cluster based on EIP control.

  - **Setting up the elastic network interface**
    Add an ENI to each instance. Assign an EIP to the ENI added to the active instance.

    The EIP control command detaches the EIP assigned to the active instance and assigns the EIP to the ENI added to the standby instance during failover.

4-2. Setup of Instances

Log into each instance (10.0.0.20 and 10.0.2.20 in the figure) and perform the following settings.

- **Installing Amazon EC2 API Tools**
  Download and install Amazon EC2 API Tools.

  In this configuration guide, the installation location is `C:\aws\` (Windows) or `/opt/aws` (Linux).
  In Windows, the JRE (Java Runtime Environment) must be separately installed.
  For details on the setting procedure, refer to the following Web site:

  http://aws.amazon.com/jp/documentation/ec2/
  └ Amazon EC2 Command Line Reference
     └ Getting Started with the CLI

- **Installing ExpressCluster in each instance**
  For details on the installation procedure, refer to the *ExpressCluster Installation and Configuration Guide*.
  Store the ExpressCluster installation media into the target environment.
  (Any data transfer method including FTP, SCP, or Amazon S3 can be used.)

- **Placing the monitor command and configuration file on each node**
  In this configuration guide, the destination location is `C:\aws\` (Windows) or `/opt/aws` (Linux).
  (For samples of the monitor commands and configuration files shown below, refer to the appendix.)

  (The monitor command type and the contents of the configuration file differ depending on the system configuration.)
  - Configuration file for HA cluster based on VIP control
  - Configuration file for HA cluster based on EIP control

  [Configuration file for HA cluster based on VIP control]
  (Windows)
```
aws_conf_sys.bat
aws_conf_user.bat
clpaws_mon.bat
clpaws_vipctl.bat
```
  (Linux)
```
aws_sys.conf
aws_user.conf
clpaws_mon.sh
clpaws_vipctl.sh
```

  [Configuration file for HA cluster based on EIP control]
  (Windows)
```
aws_conf_sys.bat
aws_conf_user.bat
clpaws_mon.bat
clpaws_eipctl.bat
```

  (Linux)
```
aws_sys.conf
aws_user.conf
clpaws_mon.sh
clpaws_eipctl.sh
```

- **Modifying the monitor command and configuration file on each node**
  Update the following configuration files according to each environment. For details, refer to Chapter 5, "Configuration Files."
  (1) User configuration files (`aws_conf_user.cmd`, `aws_user.conf`)
  (2) System configuration files (`aws_conf_sys.cmd`, `aws_sys.conf`)

- **Creating the VIP network adapter (loopback adapter)**
  The network adapter (loopback adapter) to add VIPs is required to configure the HA cluster based on VIP control in Windows.
  In Linux, you do not have to add this adapter because a loopback device (`/dev/lo`) already exists.

  The setting procedure is as shown below.

  - Adding the loopback adapter
    1. Select **Computer** - **Property** - **Device Manager**.
       Select **Network Adapter** in **Device Manager**.
       Select **Add legacy hardware** in **Operations**.
       Click **Next**.
       Select **Install the hardware selected from list** and click **Next**.
       Select **Network Adapter** in **Common hardware types** and click **Next**.
       Select **Microsoft** for **Manufacturer** and **Microsoft Loopback Adapter** for **Model** and click **Next**.
       Click **Next** to start installation.

  - Enabling IP routing
    1. Start the server manager.
       Select **Role** and click **Add role**.
       Click **Next**.
       Check **Network policy and access service** in **Role** and click **Next**.
       Click **Next**.
       Select **Routing and Remote Access service** for **Role service** and click **Next**.
       Click **Next**.
       Click **Install** on the confirmation screen.
    2. Open **Routing and remote access** from **Administrative Tool**.
       Select the local server and execute **Configure and enable routing and remote access** in **Operations**.
       On the **Routing and Remote Access Server Setup Wizard Welcome** page, click **Next**.
       On the **Configuration** page, select **Custom configuration** and click **Next**.
       On the **Custom Configuration** page, select **LAN routing** and click **Next**.
       Click **Finish**. Click **Start Service** to enable the IP routing.

4-3. Setup of ExpressCluster

Perform the following settings on Builder or WebManager.
Settings differ depending on system configuration. Setting procedures for each configuration are described below.
- Common setting procedures
- Setting procedures for HA cluster based on VIP control
- Setting procedures for HA cluster based on EIP control

- **Group resources**
  [Common setting]
  Mirror disk resources
    Add the mirror disk resources using the EBS.

  [Setting for HA cluster based on VIP control]
  EXEC resources/Script resources
    Define the VIP by using the VIP control command.

  [Setting for HA cluster based on EIP control]
  EXEC resources/Script resources
    Define the EIP address by using the EIP control command.

- **Monitor resources**
  [Common setting]
  Custom monitor resources
    Monitor the health of AZ by using the monitor command.

  [Settings for HA cluster based on VIP control]
  IP monitor resources
    Check the health of communication between subnets by monitoring communication to the NAT using the IP monitor resources.

  [Settings for HA cluster based on EIP control]
  IP monitor resources
    Check the health of EIP by monitoring communication to the EIP assigned to the active instance using the IP monitor resources.

- **NP resolution resources**
  [Settings for HA cluster based on EIP control]
  NP resolution resources
    Determine the state of the network partition by sending ping to the end point of the region configured in the environment.

Add the following group and monitor resources.
In the procedures below, resources are added to the failover group named failover1.
For details on other settings, refer to the *ExpressCluster Installation and Configuration Guide.*

- **Group resources**
  [Common setting]
    - Mirror disk resources (Windows /Linux)
      Create the mirror disk resources according to the EBS set up in 4-1.
      For details, refer to "Understanding mirror disk resources" in Chapter 5, "Group resource details" (Windows version) or "Understanding mirror disk resources" in Chapter 4, "Group resource details" (Linux version) in the *Reference Guide.*

      [Procedure: mirror disk resources (Windows)]

      1. Click **Add** in **Group Resource List**.
      2. The **Resource Definition of Group(failover1)** screen opens.
         Select the type of group resources (mirror disk resources) in the **Type** box and enter the group resource name (md) in the **Name** box.
         Click **Next**.
      3. The dependency setting page is displayed.
         Click **Next** without specifying anything.
      4. The **Recovery Operation at Activation Failure Detection** and **Recovery Operation at Deactivation Failure Detection** pages are displayed.
         Click **Next**.
      5. Enter the drive letter for the EBS set up in 4-1 in **Data Partition Drive Letter** and **Cluster Partition Drive Letter**.
      6. Click **Add** for the server that can be started.
      7. The **Selection of Partition** screen opens.
         Click **Connect** to obtain partition information.
         Select the data and cluster partitions and click **OK**.
      8. Perform steps 6 and 7 on the other node.
      9. Return to the detailed settings page and click **Finish** to complete the setting.

      [Procedure: mirror disk resources (Linux)]
      1. Click **Add** in **Group Resource List**.
      2. The **Resource Definition of Group(failover1)** screen opens.
         Select the type of group resources (mirror disk resource) in the **Type** box and enter the group resource name (md) in the **Name** box. Click **Next**.
      3. The dependency setting page is displayed.
         Click **Next** without specifying anything.
      4. The **Recovery Operation at Activation Failure Detection** and **Recovery Operation at Deactivation Failure Detection** pages are displayed.
         Click **Next**.
      5. The detailed settings page is displayed.
         Enter /dev/mnt in **Mount point** and the partition names of EBS specified in 4-1 in **Data partition device name** and **Cluster partition device name**. Click **Finish** to complete the setting.

[Settings for HA cluster based on VIP control]

- Script resources (Windows)/ EXEC resources (Linux)
  Create the script and EXEC resources for VIP control by using the VIP control command.
  - Start the VIP and update routing by using the start script.
  - Stop the VIP by using the stop script.

  For details, refer to "Understanding script resources" in Chapter 5, "Group resource details" (Windows version) or "Understanding EXEC resources" in Chapter 4, "Group resource details" (Linux version) in the *Reference Guide*.

  [Procedure: Script resources (Windows)]
  1. Click **Add** in **Group Resource List**.
  2. The **Resource Definition of Group(failover1)** screen opens.
     Select the type of group resources (script resources) in the **Type** box and enter the group resource name (`aws_vip`) in the **Name** box. Click **Next**.
  3. The dependency setting page is displayed. Click **Next** without specifying anything.
  4. The **Recovery Operation at Activation Failure Detection** and **Recovery Operation at Deactivation Failure Detection** pages are displayed.
     Click **Next**.
  5. The detailed settings page is displayed.
     Check **Script created with this product** and create the start script (`start.bat`) and stop script (`stop.bat`).
     (For created sample scripts, refer to the appendix.)
     Click **Tuning**.
  6. The **Script Resource Tuning Properties** screen opens.
     Set `0` to the normal return value for start and stop and click **OK**.
  7. Return to the detailed settings page and click **Finish** to complete the setting.

  [Procedure: EXEC resources (Linux)]
  1. Click **Add** in **Group Resource List**.
  2. The **Resource Definition of Group(failover1)** screen opens.
     Select the type of group resources (exec resources) in the **Type** box and enter the group resource name (`aws_vip`) in the **Name** box. Click **Next**.
  3. The dependency setting page is displayed. Click **Next** without specifying anything.
  4. The **Recovery Operation at Activation Failure Detection** and **Recovery Operation at Deactivation Failure Detection** pages are displayed.
     Click **Next**.
  5. The detailed settings page is displayed.
     Check **Script created with this product** and create the start script (`start.sh`) and stop script (`stop.sh`).
     (For created sample scripts, refer to the appendix.)
     Click **Tuning**.
  6. The **exec Resource Tuning Properties** screen opens.
     Specify the log file name (`/opt/aws/script_aws/log`) in **Log output destination** under **Maintenance** and click **OK**.
  7. Return to the detailed settings page and click **Finish** to complete the setting.

[Settings for HA cluster based on EIP control]
- Script resources (Windows)/ EXEC resources (Linux)
  Create the script and EXEC resources for EIP address control by using the elastic IP address control command.
  - Assign the EIP address by using the start script.
  - Detach the EIP address by using the stop script.

  For details, refer to "Understanding script resources" in Chapter 5, "Group resource details" (Windows version) or "Understanding EXEC resources" in Chapter 4, "Group resource details" (Linux version) in the *Reference Guide*.

  [Procedure: Script resources (Windows)]
  1. Click **Add** in **Group Resource List**.
  2. The **Resource Definition of Group(failover1)** screen opens.
     Select the type of group resources (script resources) in the **Type** box and enter the group resource name (`aws_eip`) in the **Name** box. Click **Next**.
  3. The dependency setting page is displayed. Click **Next** without specifying anything.
  4. The **Recovery Operation at Activation Failure Detection** and **Recovery Operation at Deactivation Failure Detection** pages are displayed.
     Click **Next**.
  5. The detailed settings page is displayed.
     Check **Script created with this product** and create the start script (`start.bat`) and stop script (`stop.bat`).
     (For created sample scripts, refer to the appendix.)
     Click **Tuning**.
  6. The **Script Resource Tuning Properties** screen opens.
     Set `0` to the normal return value for start and stop and click **OK**.
  7. Return to the detailed settings page and click **Finish** to complete the setting.

  [Procedure: EXEC resources (Linux)]
  1. Click **Add** in **Group Resource List**.
  2. The **Resource Definition of Group(failover1)** screen opens.
     Select the type of group resources (exec resources) in the **Type** box and enter the group resource name (`aws_eip`) in the **Name** box. Click **Next**.
  3. The dependency setting page is displayed. Click **Next** without specifying anything.
  4. The **Recovery Operation at Activation Failure Detection** and **Recovery Operation at Deactivation Failure Detection** pages are displayed.
     Click **Next**.
  5. The detailed settings page is displayed.
     Check **Script created with this product** and create the start script (`start.sh`) and stop script (`stop.sh`).
     (For created sample scripts, refer to the appendix.)
     Click **Tuning**.
  6. The **exec Resource Tuning Properties** screen opens.
     Specify the log file name (`/opt/aws/script_aws/log`) in **Log output destination** under **Maintenance** and click **OK**.
  7. Return to the detailed settings page and click **Finish** to complete the setting.

- **Monitor resources**
  [Common setting]
  <u>**Custom monitor resources**</u>
  - Custom monitor resources (Windows /Linux)
    Create the custom monitor resources to check whether the specified AZ is usable by using the monitor command.
    For details, refer to "Understanding custom monitor resources" in Chapter 6, "Monitor resource details" (Windows version) or "Understanding custom monitor resources" in Chapter 5, "Monitor resource details" (Linux version) in the *Reference Guide*.

    [Procedure: custom monitor resources]
    1. Click **Add** in **Group**.
    2. The **Monitor Resource List** page is displayed. Click **Add**. Select the type of monitor resources (custom monitoring in Windows and custom monitor in Linux) in the **Type** box and enter the monitor resource name (aws_azw) in the **Name** box.
       Click **Next**.
    3. Enter the monitoring settings. Set **Always** as the monitor timing and click **Next**.
    4. Select the script created with this product.
       Edit the file to create the script to monitor the status of AZ.
       (For created sample scripts, refer to the appendix.)
    5. Select **Custom setting** in the **Recovery Action** box.
       Also, set **LocalServer** to **Recovery Target**.
       Click **Finish** to complete the setting.

  [Settings for HA cluster based on VIP control]
  - IP monitor resources (Windows /Linux)
    Create the IP monitor resource that sends ping to the NAT instance on each AZ to determine the state of the network partition.

    For details, refer to "Understanding IP monitor resources" in Chapter 6, "Monitor resource details" (Windows version) or "Understanding IP monitor resources" in Chapter 5, "Monitor resource details" (Linux version) in the *Reference Guide*.

    [Procedure: IP monitor resources]
    1. Click **Next** in **Group**.
    2. The **Monitor Resource List** page is displayed. Click **Add**.
       Select the type of monitor resources (IP monitoring in Windows and ip monitor in Linux) in the **Type** box and enter the monitor resource name (ipw) in the **Name** box. Click **Next**.
    3. Set **Always** as the monitor timing and click **Next**.
    4. Select **Add** in the IP address list and enter the IP address to be monitored.
       Specify the private IP addresses assigned to the NAT (10.0.5.10 and 10.0.12.5).
    5. Select **Custom setting** in the **Recovery Action** box.
       Also, set **LocalServer** to **Recovery Target**.
       Select **Stop the cluster service and shutdown OS** for **Final Action**.
       Click **Finish** to complete the setting.

[Settings for HA cluster based on EIP control]
- IP monitor resources (Windows /Linux)
Create the IP monitor resource that sends ping to the EIP assigned to the active instance to determine the health of EIP.

  For details, refer to "Understanding IP monitor resources" in Chapter 6, "Monitor resource details" (Windows version) or "Understanding IP monitor resources" in Chapter 5, "Monitor resource details" (Linux version) in the *Reference Guide*.

  [Procedure: IP monitor resources]
  1. Click **Next** in **Group**.
  2. The **Monitor Resource List** page is displayed. Click **Add**.
     Select the type of monitor resources (IP monitoring in Windows and ip resource in Linux) in the **Type** box and enter the monitor resource name (`ipw_eip`) in the **Name** box. Click **Next**.
  3. Set **Active** as the monitor timing and select the script resource/EXEC resource (`aws_eip`) in the **Target Resource** box. Click **Next**.
  4. Select **Add** in the IP address list and enter the IP address to be monitored.
     Specify the EIP address used for redirecting (100.0.3.40).
  5. Select **Custom setting** in the **Recovery Action** box.
     Also, set **All Groups** to **Recovery Target**.
     Click **Finish** to complete the setting.

- **NP resolution resources**
  [Settings for HA cluster based on EIP control]
  NP resolution resources
     Determine the state of the network partition by sending ping to the end point of the region configured in the environment.
     Set an end point in **Ping target** as an NP resolution resource.

Chapter 5   Configuration Files

This chapter describes the following configuration files for the AWS and ExpressCluster linkage commands.

(1) User configuration files (`aws_conf_user.cmd`, `aws_user.conf`)

The user configuration files are used to define the parameters of AWS and ExpressCluster linkage commands.
To use the parameters, include them in the script set up by using the exec, script, or custom monitor resources.
Parameters specified in user configuration files differ depending on the system configuration.

- Settings for HA cluster based on VIP control
- Settings for HA cluster based on EIP control

Settings for HA cluster based on VIP control

Parameter	Description
CLP_NET_DEV	Specifies the name of the network device (loopback) which the VIP is added to.
CLP_VIP	Specifies the VIP.
EC2_ROUTE_TABLE_ID	Specifies the route tables IDs routed to the VIP separating them with one-byte spaces. Specified route tables IDs must have VIP routing.
EC2_NETWORK_IF_ID	Specifies the ENI ID for the VIP routing destination. Disable **Source/Dest. Check** for the specified ENI ID.
VPC_ID	Specifies the VPC ID which the server belongs to. All the route tables in the specified VPC ID must have VIP routing.
AVAILABILITY_ZONE	Specifies the availability zone to be monitored, which the server belongs to.

Settings for HA cluster based on EIP control

Parameter	Description
EC2_NETWORK_IF_ID	Specifies the ENI ID which the EIP is assigned to.
EC2_ALLOCATION_ID	Specifies the ID of EIP to be redirected.
AVAILABILITY_ZONE	Specifies the availability zone to be monitored, which the server belongs to.

(2) System configuration files (`aws_conf_sys.cmd`, `aws_sys.conf`)

The system configuration files are used to define the environment settings to use the AWS and ExpressCluster linkage commands. Include the system configuration files in the AWS and ExpressCluster linkage commands.

Parameter	Description
EC2_DIR	Specifies the directory that contains this configuration file and other data.
EC2_CERT	Specifies the certificate file for Amazon EC2.
EC2_PRIVATE_KEY	Specifies the private key for Amazon EC2.
EC2_URL	Specifies the entry point of the Amazon EC2 web service.
EC2_HOME	Specifies the installation path for EC2 API Tools.
JAVA_HOME	Specifies the installation path for Java.
PATH	Adds EC2_HOME and JAVA_HOME to the PATH environment variable.

Chapter 6   Command Reference

This chapter describes the following AWS and ExpressCluster linkage commands.

(1) VIP control commands (`clpaws_vipctl.bat`, `clpaws_vipctl.sh`)

```
clpaws_vipctl.bat
clpaws_vipctl.sh
```
   These commands control VIPs.

Command line
```
clpaws_vipctl.bat --bringup -d DEV -i IP
clpaws_vipctl.bat --bringdown -d DEV -i IP     (Windows)
clpaws_vipctl.sh --bringdown -d DEV            (Linux)
clpaws_vipctl.bat --replace-route -r ROUTE_TABLE( ROUTE_TABLE ...) -i
                  IP -n EC2_NETWORK_IF_ID
clpaws_vipctl.bat --replace-route -v VPC_ID -i IP -n EC2_NETWORK_IF_ID
```

Description
   These commands start and stop the network device with the VIP and update the VIP route table.
   The VIP can be used to access the starting server by starting the network device and updating the route tables to route to the ENI of the starting server when the server starts.

Parameters
   `--bringup`
      Starts the network device which the VIP is added to.
      The VIP specified in IP is added to the network device specified in DEV.

   `--bringdown`
      Stops the network device which the VIP is added to.
      The network device specified in DEV (the device and the VIP specified for IP address in Windows) is stopped.

   `--replace-route`
      Updates routing to the VIP.
      The route tables specified in *ROUTE_TABLE* or all the route tables in the VPC specified in VPC_ID are updated so that the VIP specified in IP is routed to the ENI specified in *EC2_NETWORK_IF_ID*.

   `-d DEV`
      Specifies the network device name.

   `-i IP`
      Specifies the VIP.

   `-r ROUTE_TABLE`
      Specifies the route tables to be updated.
      Specify the route tables which the client belongs to.

   `-n EC2_NETWORK_IF_ID`
      Specify the ENI for the routing destination.
      Specify the ENI added to the server itself.

   `-v VPC_ID`

Specifies the VPC which the client to be updated belongs to.
Specify the VPC which the server or client belongs to.

Returned values
0: Normal
Other than 0: Abnormal

Execution examples
1. Add VIP 10.1.0.20/32 to the network device *local_area_connection_2* and start it.

```
clpaws_vipctl.bat --bringup -d local_area_connection_2 -i
10.1.0.20/32
```

2. Stop the network device *local_area_connection_2* / VIP 10.1.0.20/32.

```
clpaws_vipctl.bat – bringdown -d local_area_connection_2 -i
10.1.0.20/32
```

3. Route VIP 10.1.0.20/32 to ENI eni-00000000 for route tables rtb-00000000 and rtb-00000001.

```
clpaws_vipctl.bat --replace-route -r rtb-00000000 rtb-00000001
                                       -i 10.1.0.20/32 -n
eni-00000000
```

4. Route VIP 10.1.0.20/32 to ENI eni-00000000 for all the route tables in VPC vpc-00000000.

```
clpaws_vipctl.bat --replace-route -v vpc-00000000
 -i 10.1.0.20/32 -n eni-00000000
```

Remarks
In Windows, specify the VIPs specified for the device and IP address for the network interface.

(2) EIP control commands (`clpaws_eipctl.bat`, `clpaws_eipctl.sh`)

```
clpaws_eipctl.bat
clpaws_eipctl.sh
```
These commands control EIPs.

Command line
```
clpaws_eipctl.bat --associate -n EC2_NETWORK_IF_ID -a
EC2_ALLOCATION_ID
clpaws_eipctl.bat --disassociate -a EC2_ALLOCATION_ID
```

Description
These commands redirect the EIP to the ENI.
The EIP starting server can be accessed by assigning the EIP to its own ENI when the server starts.

Parameters
```
--associate
```
Assigns the EIP to the ENI specified in *EC2_ALLOCATION_ID*.

```
--disassociate
```
Removes the specified EIP from the ENI.

```
--n EC2_NETWORK_IF_ID
```
Specifies the ENI which the EIP is assigned to.

```
--a EC2_ALLOCATION_ID
```
Specifies the EIP ID.

Returned values
0: Normal
Other than 0: Abnormal

Execution examples
1. Assign EIP eipalloc-00000000 to ENI eni-00000000.

```
clpaws_eipctl.bat --associate -n eni-00000000 -a eipalloc-00000000
```

2. Detach EIP eipalloc-00000000.

```
clpaws_eipctl.bat --disassociate -a eipalloc-00000000
```

Remarks
None

(3) AZ monitor commands (`clpaws_mon.bat, clpaws_mon.sh`)

```
clpaws_mon.bat
clpaws_mon.sh
```
    These commands monitor the AWS.

Command line
```
-clpaws_mon.bat --chkavz -a AVAILABILITY_ZONE
```

Description
    These commands monitor the AWS.

Options
```
--chkavz
```
    Monitors availability zones.
    The health of the availability zone specified in *AVAILABILITY_ZONE* is monitored.

```
-a AVAILABILITY_ZONE
```
    Specifies the availability zone to be monitored.

Returned values
    0: Normal
    Other than 0: Abnormal

Execution examples
    1. Monitor the health the ap-northeast-1a availability zone.

```
clpaws_mon.bat --chkavz -a ap-northeast-1a
```

Remarks
    None

Appendix Sample Scripts

The following scripts are used in this appendix.

(Windows)
The following sample batches are used in this document.

`aws_conf_user.cmd`	Configuration file for the IP address and ID of VIP and other details
`aws_conf_sys.cmd`	Configuration file for environment variables
`clpaws_mon.bat`	genw alive monitoring script to monitor whether the AZ is active
`clpaws_vipctl.bat`	Script to perform VIP routing during failover
`clpaws_eipctl.bat`	Script to redirect the EIP during failover

Customize the following batches according to your environment.

`start_sample_vip.bat`	Script to start the VIP and update routing
`stop_sample_vip.bat`	Script to stop the VIP
`start_sample_eip.bat`	Script to assign the EIP
`stop_sample_eip.bat`	Script to detach the EIP
`genw_sample.bat`	genw script to monitor whether the AZ is active

(Linux)
The following sample scripts are used in this document.

`aws_user.conf`	Configuration file for the IP address and ID of VIP and other details
`aws_sys.conf`	Configuration file for environment variables
`clpaws_mon.sh`	genw script to monitor whether the AZ is active
`clpaws_vipctl.sh`	Script to perform VIP routing during failover
`clpaws_eipctl.sh`	Script to redirect the EIP during failover

Customize the following script according to your environment.

`start_sample_vip.sh`	Script to start the VIP and update routing
`stop_sample_vip.sh`	Script to stop the VIP
`start_sample_eip.sh`	Script to assign the EIP
`start_sample_eip.sh`	Script to detach the EIP
`genw_sample.sh`	genw script to monitor the status of AZ

Sample batches and scripts are separately available.
For details, contact the following email address.

      Contact: info@expresscluster.jp.nec.com

(Windows)

(1) Batch related to VIP control
- start_sample_vip.bat
- stop_sample_vip.bat

- start_sample_vip.bat

```
@ECHO OFF
REM *************************************
REM *            start.bat             *
REM *                                  *
REM * title  : start script file sample *
REM * date   : 2012/04/09              *
REM * version : 11.1.3-1               *
REM *************************************


REM *********************************************
REM * Check CLP_EVENT                           *
REM *********************************************

IF "%CLP_EVENT%" == "RECOVER" GOTO :NORMAL_EXIT


REM *********************************************
REM * User definition                           *
REM *********************************************

SET CONF_USER_CMD=C:\aws\aws_conf_user.bat
SET CLP_VIP_CMD=C:\aws\clpaws_vipctl.bat
SET CLP_MON_CMD=C:\aws\clpaws_mon.bat


REM *********************************************
REM * Read config file                          *
REM *********************************************

IF NOT EXIST %CONF_USER_CMD% (
    GOTO :ABNORMAL_EXIT
)

CALL %CONF_USER_CMD%
IF NOT "%ERRORLEVEL%" == "0" (
    GOTO :ABNORMAL_EXIT
)

REM *********************************************
REM * VIP                                       *
REM *********************************************

cmd /c %CLP_VIP_CMD% --bringup -d %CLP_NET_DEV% -i %CLP_VIP%
IF NOT "%ERRORLEVEL%" == "0" (
    GOTO :ABNORMAL_EXIT
)

cmd /c %CLP_VIP_CMD% --replace-route -v %VPC_ID% -i %CLP_VIP%
-n %EC2_NETWORK_IF_ID%
IF NOT "%ERRORLEVEL%" == "0" (
    GOTO :ABNORMAL_EXIT
)

GOTO :NORMAL_EXIT
```

```
REM *******************************************
REM * NORMAL EXIT                             *
REM *******************************************
:NORMAL_EXIT
EXIT 0


REM *******************************************
REM * ABNORMAL EXIT                           *
REM *******************************************
:ABNORMAL_EXIT
EXIT 1
```

- stop_sample_vip.bat

```
@ECHO OFF
REM **************************************
REM *                stop.bat            *
REM *                                    *
REM * title   : stop script file sample  *
REM * date    : 2012/04/09               *
REM * version : 11.1.3-1                 *
REM **************************************


REM ********************************************
REM * User definition                          *
REM ********************************************

SET CONF_USER_CMD=C:\aws\aws_conf_user.bat
SET CLP_VIP_CMD=C:\aws\clpaws_vipctl.bat
SET CLP_MON_CMD=C:\aws\clpaws_mon.bat


REM ********************************************
REM * Read config file                         *
REM ********************************************

IF NOT EXIST %CONF_USER_CMD% (
    GOTO :ABNORMAL_EXIT
)

CALL %CONF_USER_CMD%
IF NOT "%ERRORLEVEL%" == "0" (
    GOTO :ABNORMAL_EXIT
)

REM ********************************************
REM * VIP                                      *
REM ********************************************

cmd /c %CLP_VIP_CMD% --bringdown -d %CLP_NET_DEV% -i %CLP_VIP%
IF NOT "%ERRORLEVEL%" == "0" (
    GOTO :ABNORMAL_EXIT
)

GOTO :NORMAL_EXIT


REM ********************************************
REM * NORMAL EXIT                              *
REM ********************************************
:NORMAL_EXIT
EXIT 0


REM ********************************************
REM * ABNORMAL EXIT                            *
REM ********************************************
:ABNORMAL_EXIT
EXIT 1
```

(2) Batch related to EIP control
- start_sample_eip.bat
- stop_sample_eip.bat

- start_sample_eip.bat

```
@ECHO OFF
REM *************************************
REM *                start.bat              *
REM *                                       *
REM * title  : start script file sample  *
REM * date   : 2012/04/09                 *
REM * version : 11.1.3-1                  *
REM *************************************


REM **********************************************
REM * Check CLP_EVENT                             *
REM **********************************************

IF "%CLP_EVENT%" == "RECOVER" GOTO :NORMAL_EXIT


REM **********************************************
REM * User definition                            *
REM **********************************************

SET CONF_USER_CMD=C:\aws\aws_conf_user.bat
SET CLP_EIP_CMD=C:\aws\clpaws_eipctl.bat
SET CLP_MON_CMD=C:\aws\clpaws_mon.bat


REM **********************************************
REM * Read config file                           *
REM **********************************************

IF NOT EXIST %CONF_USER_CMD% (
    GOTO :ABNORMAL_EXIT
)

CALL %CONF_USER_CMD%
IF NOT "%ERRORLEVEL%" == "0" (
    GOTO :ABNORMAL_EXIT
)

REM **********************************************
REM * EIP                                         *
REM **********************************************


cmd /c %CLP_EIP_CMD% --associate -n %EC2_NETWORK_IF_ID%
-a %EC2_ALLOCATION_ID%
IF NOT "%ERRORLEVEL%" == "0" (
GOTO :ABNORMAL_EXIT
)

GOTO :NORMAL_EXIT


REM **********************************************
REM * NORMAL EXIT                                 *
```

```
REM *********************************************
:NORMAL_EXIT
EXIT 0


REM *********************************************
REM * ABNORMAL EXIT                             *
REM *********************************************
:ABNORMAL_EXIT
EXIT 1
```

- stop_sample_eip.bat

```
@ECHO OFF
REM **************************************
REM *              stop.bat              *
REM *                                    *
REM * title   : stop script file sample  *
REM * date    : 2012/04/09               *
REM * version : 11.1.3-1                  *
REM **************************************


REM ********************************************
REM * User definition                          *
REM ********************************************

SET CONF_USER_CMD=C:\aws\aws_conf_user.bat
SET CLP_EIP_CMD=C:\aws\clpaws_eipctl.bat
SET CLP_MON_CMD=C:\aws\clpaws_mon.bat


REM ********************************************
REM * Read config file                         *
REM ********************************************

IF NOT EXIST %CONF_USER_CMD% (
    GOTO :ABNORMAL_EXIT
)

CALL %CONF_USER_CMD%
IF NOT "%ERRORLEVEL%" == "0" (
    GOTO :ABNORMAL_EXIT
)

REM ********************************************
REM * EIP                                      *
REM ********************************************

cmd /c %CLP_EIP_CMD% --disassociate -a %EC2_ALLOCATION_ID%

IF NOT "%ERRORLEVEL%" == "0" (
GOTO :ABNORMAL_EXIT
)

REM ********************************************
REM * NORMAL EXIT                              *
REM ********************************************
:NORMAL_EXIT
EXIT 0


REM ********************************************
REM * ABNORMAL EXIT                            *
REM ********************************************
:ABNORMAL_EXIT
EXIT 1
```

(3) Batch related to AZ monitoring
- `genw_sample.bat`

- `genw_sample.bat`

```
@ECHO OFF
REM **************************************
REM *               genw.bat             *
REM *                                     *
REM * title   : genw script file sample   *
REM * date    : 2012/04/09                 *
REM * version : 11.1.3-1                    *
REM **************************************


REM ********************************************
REM * User definition                          *
REM ********************************************

SET CONF_USER_CMD=C:\aws\aws_conf_user.bat
SET CLP_VIP_CMD=C:\aws\clpaws_vipctl.bat
SET CLP_MON_CMD=C:\aws\clpaws_mon.bat


REM ********************************************
REM * Read config file                         *
REM ********************************************

IF NOT EXIST %CONF_USER_CMD% (
    GOTO :ABNORMAL_EXIT
)

CALL %CONF_USER_CMD%
IF NOT "%ERRORLEVEL%" == "0" (
    GOTO :ABNORMAL_EXIT
)

REM ********************************************
REM * CHECK AVAILABILITY ZONE                   *
REM ********************************************

cmd /c %CLP_MON_CMD% --chkavz -a %AVAILABILITY_ZONE%
IF NOT "%ERRORLEVEL%" == "0" (
    GOTO :ABNORMAL_EXIT
)

GOTO :NORMAL_EXIT


REM ********************************************
REM * NORMAL EXIT                               *
REM ********************************************
:NORMAL_EXIT
EXIT 0


REM ********************************************
REM * ABNORMAL EXIT                             *
REM ********************************************
:ABNORMAL_EXIT
EXIT 1
```

(Linux)
(1) Script related to VIP control

- start_sample_vip.sh
- stop_sample_vip.sh

- start_sample_vip.sh

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

###
# User definition
###
CONF_USER_FILE=/opt/aws/aws_user.conf
CLP_VIP_CMD=/opt/aws/clpaws_vipctl.sh
CLP_MON_CMD=/opt/aws/clpaws_mon.sh

####
# Read config file
####
if [ ! -f "$CONF_USER_FILE" ]
then
     exit 1
fi

. "$CONF_USER_FILE"
if [ "$?" != "0" ]
then
     exit 1
fi

###
# main
###

"$CLP_VIP_CMD" --bringup -d "$CLP_NET_DEV" -i "$CLP_VIP"
if [ "$?" != "0" ]
then
     exit 1
fi

"$CLP_VIP_CMD" --replace-route -v "$VPC_ID" -i "$CLP_VIP" -n
"$EC2_NETWORK_IF_ID"
if [ "$?" != "0" ]
then
     exit 1
fi

echo "EXIT"
exit 0
```

- stop_sample_vip.sh

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

###
# User definition
###
CONF_USER_FILE=/opt/aws/aws_user.conf
CLP_VIP_CMD=/opt/aws/clpaws_vipctl.sh
CLP_MON_CMD=/opt/aws/clpaws_mon.sh

####
# Read config file
####
if [ ! -f "$CONF_USER_FILE" ]
then
     exit 1
fi

. "$CONF_USER_FILE"
if [ "$?" != "0" ]
then
     exit 1
fi

###
# main
###

"$CLP_VIP_CMD" --bringdown -d "$CLP_NET_DEV"
if [ "$?" != "0" ]
then
     exit 1
fi

echo "EXIT"
exit 0
```

(2) Script related to EIP control
- start_sample_eip.sh
- stop_sample_eip.sh

- start_sample_eip.sh

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

###
# User definition
###
CONF_USER_FILE=/opt/aws/aws_user.conf
CLP_EIP_CMD=/opt/aws/clpaws_eipctl.sh


####
# Read config file
####
if [ ! -f "$CONF_USER_FILE" ]
then
     exit 1
fi

. "$CONF_USER_FILE"
if [ "$?" != "0" ]
then
     exit 1
fi

###
# main
###

"$CLP_EIP_CMD" --associate -n "$EC2_NETWORK_IF_ID" -a "$EC2_ALLOCATION_ID"

if [ "$?" != "0" ]
then
     exit 1
fi

echo "EXIT"
exit 0
```

- stop_sample_eip.sh

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

###
# User definition
###
CONF_USER_FILE=/opt/aws/aws_user.conf
CLP_EIP_CMD=/opt/aws/clpaws_eipctl.sh

####
# Read config file
####
if [ ! -f "$CONF_USER_FILE" ]
then
     exit 1
fi

. "$CONF_USER_FILE"
if [ "$?" != "0" ]
then
     exit 1
fi

###
# main
###

"$CLP_EIP_CMD" --disassociate -a "$EC2_ALLOCATION_ID"

if [ "$?" != "0" ]
then
     exit 1
fi

echo "EXIT"
exit 0
```

(3) Script related to AZ monitoring
- genw_sample.sh

- genw_sample.sh

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

###
# User definition
###
CONF_USER_FILE=/opt/aws/aws_user.conf
CLP_VIP_CMD=/opt/aws/clpaws_vipctl.sh
CLP_MON_CMD=/opt/aws/clpaws_mon.sh

####
# Read config file
####
if [ ! -f "$CONF_USER_FILE" ]
then
     exit 1
fi

. "$CONF_USER_FILE"
if [ "$?" != "0" ]
then
     exit 1
fi

###
# main
###

"$CLP_MON_CMD" --chkavz -a "$AVAILABILITY_ZONE"
if [ "$?" != "0" ]
then
     exit 1
fi

echo "EXIT"
exit 0
```