

EXPRESSCLUSTER X 4.2

HA Cluster Configuration Guide for Microsoft Azure (Linux) Release 2

NEC Corporation

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CHAPTER

PREFACE

1.1 Who Should Use This Guide

The HA Cluster Configuration Guide for Microsoft Azure (Linux) is intended for administrators who want to build a cluster system, and for system engineers and maintenance personnel who provide user support.

The software and setup examples introduced in this guide are for reference only, and the software is not guaranteed to run.

1.2 Scope of application

This guide covers the following product versions.

- EXPRESSCLUSTER X 4.2 for Linux (Internal version: 4.2.0-1)
- CentOS 7.6
- Microsoft Azure portal: Environment as of December 19, 2019
- Azure CLI 2.0

If the product versions that you use differ from the above, some display and configuration contents may differ from those described in this guide.

The display and configuration contents may also change in the future. Therefore, for the latest information, see the website or manual of each product and service.

1.3 How This Guide is Organized

- 2. Overview: Describes the functional overview.
- 3. Operating Environments: Describes the tested operating environment of this function.
- 4. *Cluster Creation Procedure (for an HA Cluster Using Azure DNS)*: Describes the procedure to create an HA cluster using Azure DNS.
- 5. *Cluster Creation Procedure (for an HA Cluster Using an Public Load Balancer)*: Describes the procedure to create an HA cluster using an public load balancer.
- 6. *Cluster Creation Procedure (for an HA Cluster Using an Internal Load Balancer)*: Describes the procedure to create an HA cluster using an internal load balancer.

- 7. Error Messages: Describes the error messages and solutions.
- 8. Notes and Restrictions: Describes the notes and restrictions on creating and operating a cluster.

1.4 EXPRESSCLUSTER X Documentation Set

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

EXPRESSCLUSTER X Getting Started Guide

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

EXPRESSCLUSTER X Installation and Configuration Guide

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

EXPRESSCLUSTER X Reference Guide

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

EXPRESSCLUSTER X Maintenance Guide

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

EXPRESSCLUSTER X Hardware Feature Guide

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

EXPRESSCLUSTER X Legacy Feature Guide

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

1.5 Conventions

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

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

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

See also:

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

The following conventions are used in this guide.

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

1.6 Contacting NEC

For the latest product information, visit our website below:

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

CHAPTER

OVERVIEW

2.1 Functional overview

This guide describes how to configure an HA cluster based on EXPRESSCLUSTER X (hereinafter referred to as "EXPRESSCLUSTER") using Azure Resource Manager on a Microsoft Azure cloud service.



Fig. 2.1: HA Cluster on a Cloud Service (Using Azure DNS)

Operational availability can be increased by clustering virtual machines (VMs in Figure 2.1 HA Cluster on a Cloud Service (Using Azure DNS)) using a Microsoft Azure region and availability set in a Microsoft Azure environment.

• Microsoft Azure region

Physical and logical units called a Microsoft Azure region are provided.

It is possible to build all nodes in a single region (such as Japan East or Japan West). However, if all nodes are built in a single region, there is a possibility for nodes to go down due to a network failure or natural disaster, causing interruption to the flow of business. Distributing nodes into multiple regions can improve the operational availability.

· Availability set

Microsoft Azure allows each node to be deployed in a logical group called an *availability set*. Locating each node in an availability set minimizes the impact of planned maintenance or unplanned maintenance due to a physical hardware failure of the Microsoft Azure platform. This guide describes the configuration using an availability set.

For details about an availability set, see the following website:

Manage the availability of Linux virtual machines: https://docs.microsoft.com/en-us/azure/virtual-machines/linux/manage-availability

2.2 Basic configuration

This guide assumes two types of HA clusters. One is an HA cluster using Azure DNS of the Resource Manager deployment model. The other is an HA cluster using a load balancer of the Resource Manager deployment model. (Both HA clusters are configured as a unidirectional standby cluster.) The following table describes the EXPRESSCLUSTER resources to be selected depending on the Microsoft Azure deployment model in use.

Purpose	EXPRESSCLUSTER resource to use
Accessing the cluster by using a	Azure DNS resource
DNS name (Azure DNS needs to be installed)	
Accessing the cluster by using a virtual IP address(global IP address) (Use public load balancer)	Azure probe port resource
	Azure probe port resource
Accessing the cluster by using a virtual IP address(private IP address)	
(Use internal load balancer)	

	Azure probe port resource
Accessing the cluster by using a	
virtual IP address(private IP	
address) and applications to be	
clustered is Always On	
configuretion	
(Use internal load balancer and	
configure Direct Server Return	
(DSR))	

Table 2.1 – continued from previous page

HA cluster using Azure DNS

In this configuration, two virtual machines are deployed the same resource group so that the cluster can be accessed by using the same DNS name. The EXPRESSCLUSER Azure DNS resource uses Azure DNS to enable access with a DNS name. For details about Azure DNS, see the following website:

Azure DNS: https://azure.microsoft.com/en-us/services/dns/



Fig. 2.2: HA Cluster Using Azure DNS

These two virtual machines use the same availability set to minimize the impact of planned maintenance or unplanned maintenance due to a physical hardware failure of the Microsoft Azure platform.

The cluster in Figure 2.2 HA Cluster Using Azure DNS is accessed by using the DNS name of the Azure DNS zone. EXPRESSCLUSTER manages record sets and DNS A records of the Azure DNS zone to find an IP address according to the DNS name. A client need not be conscious about the switching of virtual machines upon failover occurrence or group migration.

The following table describes the EXPRESSCLUSTER resources and monitor resources required for a HA cluster configuration using Azure DNS.

Resource	Description	Setting
or monitor		
resource		
type		
Azure	Manages the record sets (A records) of the	Required
DNS	Azure DNS zone to find an IP address ac-	
resource	cording to the DNS name.	
Azure	Monitors that the results of name resolu-	Required
DNS	tion are normal in relation to the Azure	
monitor	DNS record set.	
resource		
IP monitor	Monitors whether communication with	When an public load balancer is used,
resource	the Microsoft Azure Service Management	required to monitor communication be-
	API is possible, and also monitors health	tween clusters that are configured with
	of communication with an external net-	virtual machines, and also to monitor
	work.	health of communication with an internal
		network.
Custom	Monitors communication between clus-	When an public load balancer is used, re-
monitor	ters that are configured with virtual ma-	quired to monitor whether communication
resource	chines, and also monitors health of com-	with the Microsoft Azure Service Man-
	munication with an internal network.	agement API is possible, and also to mon-
		itor health of communication with an ex-
		ternal network.
Multi	Monitors the statuses of both the IP moni-	When an public load balancer is used, re-
target	tor resource and custom monitor resource.	quired to monitor health of communica-
monitor	If the statuses of both monitor resources	tion between an internal network and ex-
resource	are abnormal, a script in which a process	ternal network.
	for network partition resolution (NP reso-	
	lution) is described is executed.	
Otner	Depends on the configuration of applica-	Optional
resources	tion, such as a mirror disk, that is used in	
and mon-	an HA cluster.	
itor re-		
sources		

HA cluster using a load balancer

A client application can connect a virtual machine on an availability set in a Microsoft Azure environment to a cluster node by using frontend IP address. By using a VIP (Virtual IP), a client need not be conscious about the switching of virtual machines upon failover occurrence or group migration. A cluster built in a Microsoft Azure environment in Figure 2.3 HA Cluster Using an Public Load Balancer is accessed by specifying a global IP address of the Microsoft Azure Load Balancer (Load Balancer in Figure 2.3 HA Cluster Using an Public Load Balancer).

Active and standby nodes of a cluster are switched by using probes of Microsoft Azure Load Balancer. To use Microsoft Azure Load Balancer probes, use a probe port provided by the EXPRESSCLUSTER Azure probe port resource.



Fig. 2.3: HA Cluster Using an Public Load Balancer

Activating the Azure probe port resource starts a probe port control process in standby for alive monitoring (access to a probe port) from Microsoft Azure Load Balancer.

Deactivating the Azure probe port resource stops a probe port control process in standby for alive monitoring (access to a probe port) from Microsoft Azure Load Balancer.

The Azure probe port resource also supports the Microsoft Azure internal load balancer (Internal Load Balancing: ILB). For the internal load balancer, a Microsoft Azure private IP address is used as a VIP.



Fig. 2.4: HA Cluster Using the Internal Load Balancer

The following are examples of two HA cluster configurations using a load balancer. Select a load balancer to use depending on your purpose.

Purpose	Load balancer to use	Creating procedure
Disclosing operations outside	Public load balancer	See "5. Cluster Creation Proce-
the Microsoft Azure network		dure (for an HA Cluster Using
		an Public Load Balancer)" in
		this guide.

Purpose	Load balancer to use	Creating procedure
Publishing operations within the Microsoft Azure network	Internal load balancer (ILB)	See "6. Cluster Creation Proce- dure (for an HA Cluster Using
		an Internal Load Balancer)" in this guide.

Table 2.3 – continued from previous page

The following table describes the EXPRESSCLUSTER resources and monitor resources required for a HA cluster using a load balancer.

Azure probe port resource Provi for al balan a nod runni Azure probe port monitor resource Perfore a provi which the A for a a rod runni	ides a mechanism to wait live monitoring from a load ocer on a specific port of de in which operations are ing. The port control process, h starts upon activation of Azure probe port resource, node in which the Azure e port resource is running.	Required
Azure probe port monitor re- source Perfo which the A for a	orms alive monitoring of obe port control process, h starts upon activation of Azure probe port resource, node in which the Azure e port resource is running.	Required
probe	tana milastana sa sa 141	
Azure load balance monitorMoniresourcethe sais opeAzurerunni	ame number as a probe port en for a node in which the e probe port resource is not ing.	Required
IP monitor resource Monition v Service possible health an ex	itors whether communica- with the Microsoft Azure ice Management API is ble, and also monitors h of communication with tternal network.	When an public load balancer is used, required to monitor communication between clus- ters that are configured with vir- tual machines, and also to mon- itor health of communication with an external network.
Custom monitor resource Moni tweer ured also r nicati work.	itors communication be- n clusters that are config- with virtual machines, and monitors health of commu- ion with an internal net-	When an public load balancer is used, required to monitor whether communication with the Microsoft Azure Service Management API is possible, and also to monitor health of communication with an external network.
Multi target monitor resource Moni the I custor the st sourc in wh partit tion)	itors the statuses of both IP monitor resource and om monitor resource. If tatuses of both monitor re- ces are abnormal, a script hich a process for network tion resolution (NP resolu- is described is executed.	When anpublic load balancer is used, required to monitor health of communication between an internal network and external network.

Resource or monitor re-	Description	Setting	
source type			
PING network partition reso-	When an internal load balancer	When an internal load balancer	
lution resource	(ILB) is used, monitors health	(ILB) is used, required to moni-	
	of communication between sub-	tor health of communication be-	
	nets by checking whether to	tween subnets.	
	communicate with a device that	t l	
	is always on and can return a re-		
	sponse to ping (ping device).		
Other resources and monitor	Depends on the configuration	Optional	
resources	of application, such as a mirror		
	disk, that is used in an HA clus-		
	ter.		

Table 2.4 – continued from previous page

2.3 Network partition resolution

Virtual machines configuring an HA cluster mutually performs alive monitoring through a heartbeat communication. If the virtual machines exist in different subnets, an undesirable event, such as an application starting more than once, occurs if a heartbeat ceases. To prevent a service from starting more than once, it is necessary to identify whether other virtual machines went down or whether the applicable virtual machine was isolated from a network (network partitioning: NP).

The network partition resolution feature (NP resolution) sends ping to or checks a LISTEN port of a device that is always on and can return a response to ping etc. (access destination). If there is no reply, this feature judges that the device entered the NP status and executes the specified action (such as a warning, recovery action, and server shutdown).

The access destination in the following table are used as ping devices for Microsoft Azure. (*) A private IP address of an internal load balancer (ILB) cannot be used because it does not reply to ping.

Scope of disclosure	access destination	Procedure	EXPRESSCLUSTER resources, monitor resources, and com- mands to be used for NP resolution
Outside the Mi- crosoft Azure Virtual network	Microsoft Azure Service Manage- ment API (manage- ment.core.windows.net)	Checking a LISTEN port	Custom monitor resource clpazure_port_checker command
	each cluster server	Ping	IP monitor resource
Inside the Microsoft Azure Virtual net- work	Servers, excluding a cluster server, that ex- ist within the Microsoft Azure network(*)	Ping	PING network par- tition resolution resource

Scope of disclosure	access destination	Procedure	EXPRESSCLUSTER resources, monitor resources, and com- mands to be used
			for NP resolution
	Web servers that ex-	HTTP	HTTP network par-
	ist within the Microsoft		tition resolution
	Azure network		resource

Table 2.5 – continued from previous page

For details about NP resolution, see the following:

• "Network partition resolution resources details" in the Reference Guide.

Setting the NP resolution destination

You need to examine the NP resolution destination and method depending on the location of clients accessing a cluster system and the condition for connecting to an on-premise environment (for example, using a dedicated line). There is no NP resolution destination nor method to recommend.

How to judge the network partition status

EXPRESSCLUSTER provides the clpazure_port_checker command to check the TCP port listening status. Use this command as **Script created with this product** of the custom monitor resource or multi target monitor resource.

For details about the clpazure_port_checker command, see the following subsections.

Checking the TCP port listening status (clpazure_port_checker command)

clpazure_port_checker

Checks whether a LISTEN port exists among TCP ports of the specified server.

Command line clpazure_port_checker -h *hostname* -p *port*

Description

This command checks whether a LISTEN port exists among TCP ports of the server specified for an argument.

If there is no response five seconds (fixed) after the command execution, it is judged that an error (timeout) has occurred.

In case of an error, an error message is output to the standard output.

Executing this command from the custom monitor resource makes it possible to judge the network partition status.

For the configuration example of network partition resolution using this command, see "4.3. *Configuring the EXPRESSCLUSTER settings*" and "6.3. *Configuring the EXPRESSCLUSTER settings*"

Options

-h *hostname* Specify the determining server as *hostname* (by using an FQDN name or IP address). This option cannot be omitted.

-p *port* Specify the determining port number as port (by using a port number or service name). This option cannot be omitted.

Return values

- 0 Normal
- 1 Error (communication error)

- 2 Error (timeout)
- **3** Error (invalid argument or internal error)

2.4 Differences between on-premises and Microsoft Azure

The following table describes the functional differences of EXPRESSCLUSTER between on-premises and Microsoft Azure. "Y" indicates that the relevant function can be used and "N" indicates that the relevant function cannot be used.

Function	On-premise	Microsoft Azure
Creating a shared disk type cluster	Y	Y
Creating a mirror disk type cluster	Y	Y
Creating a hybrid disk type cluster	Y	Y
Using the floating IP resource	Y	N
Using the virtual IP resource	Y	N
Using the Azure probe port resource	N	Y
Using the Azure DNS resource	N	Y

For the procedure to create a 2-node cluster using a mirror disk on an on-premise or Microsoft Azure environment, see the following subsections.

The difference of the procedure to create a cluster between an on-premise environment and Microsoft Azure environment is whether or not configuring the Microsoft Azure settings in advance is required.

HA cluster using Azure DNS

For Microsoft Azure, execute steps 1 to 6 in the following table after logging in to the Microsoft Azure portal (https://portal.azure.com/).

For Microsoft Azure, execute steps 7 to 18 after logging in to each virtual machine.

• Before Installing EXPRESSCLUSTER

Step No.	Procedure	On-premise	Microsoft Azure	
1	Creating a resource	Not required	See "4.2. Configuring	
	group		Microsoft Azure" in	
			this guide.	
2	Creating a virtual net-	Not required	See "4.2. Configuring	
	work		Microsoft Azure" in	
			this guide.	
3	Creating a virtual ma-	Not required	See "4.2. Configuring	
	chine		Microsoft Azure" in	
			this guide.	
4	Setting a private IP	Not required	See "4.2. Configuring	
	address		Microsoft Azure" in	
			this guide.	
5	Adding a disk	Not required	See "4.2. Configuring	
			Microsoft Azure" in	
			this guide.	
Continued on next page				

Step No.	Procedure	On-premise	Microsoft Azure
6	Creating a DNS zone	Not required	See "4.2. Configuring Microsoft Azure" in this guide.
7	Setting up the DNS server	See the manual pro- vided with an OS or DNS server such as Red Hat Enter- prise Linux 7 Net- work Guide.	Not required
8	Setting a partition for the mirror disk re- source	See the following: "Settings after configuring hardware" in Determining a system configuration in the Installation and Configuration Guide "Understanding Mirror disk resources" in the Reference Guide.	See "4.2. <i>Configuring</i> <i>Microsoft Azure</i> " in this guide.
9	Adjusting the OS startup time	See "Settings after configuring hard- ware" in Determining a system configura- tion in the Installation and Configuration Guide.	Same as "On- premise"
10	Checking the net- work setting	See "Settings after configuring hard- ware" in Determining a system configura- tion in the Installation and Configuration Guide.	Same as "On- premise"
11	Checking the root file system	See "Settings after configuring hard- ware" in Determining a system configura- tion in the Installation and Configuration Guide.	Same as "On- premise"

Table 2.7 – continued from previous page

Step No.	Procedure	On-premise	Microsoft Azure
12	Checking the firewall	See "Settings after	Same as "On-
	setting	configuring hard-	premise"
		ware" in Determining	
		a system configura-	
		tion in the Installation	
		and Configuration	
		Guide.	
13	Synchronizing the	See "Settings after	Same as "On-
	server time	configuring hard-	premise"
		ware" in Determining	
		a system configura-	
		tion in the Installation	
		and Conliguration	
14	Chaolaina tha	Guide.	Sama as "On
14	SEL inux setting	see Settings after	premise"
	SELINUX Setting	ware" in Determining	prennse
		a system configura-	
		tion in the Installation	
		and Configuration	
		Guide.	
15	Installing the Azure	Not required	See "4.2. Configuring
	CLI		Microsoft Azure" in
			this guide.
16	Registering the ser-	Not required	See "4.2. Configuring
	vice principal		Microsoft Azure" in
			this guide.
17	Installing EXPRESS-	See "Installing EX-	Same as "On-
	CLUSTER	PRESSCLUSTER"	premise"
		in the Installation and	
		Configuration Guide.	

Table 2.7 – continued from previous page

• After Installing EXPRESSCLUSTER

Step No.	Procedure	On-premise	Microsoft Azure
18	Registering the EX-	See Registering the	Same as "On-
	PRESSCLUSER	license in the Instal-	premise"
	license	lation and Configura-	
		tion Guide.	
19	Creating a cluster:	See "Creating the	The COM heartbeat,
	Setting the heartbeat	configuration data of	BMC heartbeat, and
	method	a 2-node cluster" in	disk heartbeat cannot
		Creating the cluster	be used.
		configuration data in	
		the Installation and	
		Configuration Guide.	

Step No.	Procedure	On-premise	Microsoft Azure
20	Creating a cluster: Setting the NP resolution processing	The network partition resolution resource is used. See the following: "Creating the configuration data of a 2-node cluster" in Creating the cluster configuration data in the Installation and Configuration Guide. "Network partition resolution resources details" in the Reference Guide.	See "4.3. Configuring the EXPRESSCLUSTER settings" in this guide.
21	Creating a cluster: Creating a failover group and monitor resource	See "Creating the configuration data of a 2-node cluster" in Creating the cluster configuration data in the Installation and Configuration Guide.	In addition the references for on-premises, see the following: "Understanding Azure DNS resources" in the Reference Guide. "Understanding Azure DNS monitor resources" in the Reference Guide. "4.3. Configuring the EXPRESSCLUSTER settings" in this guide.

Table	2.8 -	continued	from	previous	page

HA cluster using a load balancer

For Microsoft Azure, execute steps 1 to 5, and 7 to 8 in the following table after logging in to the Microsoft Azure portal (https://portal.azure.com/).

For Microsoft Azure, execute steps 6, and 9 to 16 after logging in to each virtual machine.

• Before Installing EXPRESSCLUSTER

Step No.	Procedure	On-premise	Microsoft Azure
1	Creating a resource	Not required	
	group		See either of the following depending on the load balancer to use:
			Configuring Microsoft Azure" in this
			"6.2. Configuring
			<i>Microsoft</i> <i>Azure</i> " in this guide
2	Creating a virtual net- work	Not required	See either of the following depending on the load balancer to use: "5.2. <i>Configuring</i> <i>Microsoft</i> <i>Azure</i> " in this guide "6.2. <i>Configuring</i>
			<i>Microsoft</i> <i>Azure</i> " in this guide
3	Creating a virtual ma- chine	Not required	See either of the following depending on the load balancer
			to use: "5.2. Configuring Microsoft Azure" in this guide "6.2. Configuring Microsoft Azure" in this guide

Step No.	Procedure	On-premise	Microsoft Azure
4	Setting a private IP address	Not required	See either of the following depending on the load balancer to use: "5.2. <i>Configuring</i> <i>Microsoft</i> <i>Azure</i> " in this guide "6.2. <i>Configuring</i> <i>Microsoft</i> <i>Azure</i> " in this guide
5	Adding a disk	Not required	See either of the following depending on the load balancer to use: "5.2. <i>Configuring</i> <i>Microsoft</i> <i>Azure</i> " in this guide "6.2. <i>Configuring</i> <i>Microsoft</i> <i>Azure</i> " in this guide

Table 2.9 – continued from previous page

Step No.	Procedure	On-premise	Microsoft Azure
6	Setting a partition for the mirror disk resource	See the following: "Settings after configuring hardware" in Determining a system configuration in the Installation and Configuration Guide. "Understanding Mirror disk resources" in the Reference Guide.	See either of the following depending on the load balancer to use: "5.2. <i>Configuring</i> <i>Microsoft</i> <i>Azure</i> " in this guide "6.2. <i>Configuring</i> <i>Microsoft</i> <i>Azure</i> " in this guide
7	Creating and config- uring a load balancer	Not required	See either of the following depending on the load balancer to use: "5.2. <i>Configuring</i> <i>Microsoft</i> <i>Azure</i> " in this guide "6.2. <i>Configuring</i> <i>Microsoft</i> <i>Azure</i> " in this guide
8	Setting the inbound security rules	Not required	"5.2. Configuring Mi- crosoft Azure" in this guide
9	Adjusting the OS startup time	See "Settings after configuring hard- ware" in Determining a system configura- tion in the Installation and Configuration Guide.	Same as "On- premise"

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lable	2.9 – continued f	rom previous page

Step No.	Procedure	On-premise	Microsoft Azure
10	Checking the net- work setting	See "Settings after configuring hard- ware" in Determining a system configura- tion in the Installation and Configuration Guide.	Same as "On- premise"
11	Checking the root file system	See "Settings after configuring hard- ware" in Determining a system configura- tion in the Installation and Configuration Guide.	Same as "On- premise"
12	Checking the firewall setting	See "Settings after configuring hard- ware" in Determining a system configura- tion in the Installation and Configuration Guide.	Same as "On- premise"
13	Synchronizing the server time	See "Settings after configuring hard- ware" in Determining a system configura- tion in the Installation and Configuration Guide.	Same as "On- premise"
14	Checking the SELinux setting	See "Settings after configuring hard- ware" in Determining a system configura- tion in the Installation and Configuration Guide.	Same as "On- premise"
15	Installing EXPRESS- CLUSTER	See "Installing EX- PRESSCLUSTER" in the Installation and Configuration Guide.	Same as "On- premise"

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• After Installing EXPRESSCLUSTER

Step No.	Procedure	On-premise	Microsoft Azure
16	Registering the EX-	See Registering the	Same as "On-
	PRESSCLUSER	license in the Instal-	premise"
	license	lation and Configura-	
		tion Guide.	

Sten No	Procedure	On-premise	Microsoft Azure
17	Creating a cluster	Soo "Crooting the	The COM hearthast
	Softing the hearthast	see Cleaning the	PMC baarthaat and
	Setting the heartbeat	configuration data of	DIVIC licalitical, allu
	method	a 2-node cluster in	DISK neartbeat can-
		Creating the cluster	not be used.
		configuration data in	
		the Installation and	
		Configuration Guide.	
	~		~
18	Creating a cluster:	The network partition	See either of the
	Setting the NP	resolution resource is	following depending
	resolution processing	used.	on the load balancer
		See the following:	to use:
		"Creating the	See "5.3.
		configuration	Configuring
		data of a	the EXPRESS-
		2-node cluster"	CLUSTER
		in Creating the	settings" in this
		cluster	guide.
		configuration	See "6.3.
		data in the	Configuring
		Installation and	the EXPRESS-
		Configuration	CLUSTER
		Guide.	settings" in this
		"Network	guide.
		partition	
		resolution	
		resources	
		details" in the	
		Reference	
		Guide.	

Table 2.10 – continued from previous page

19 Creating a cluster: group and monitor resource See "Creating the configuration data of a 2-node cluster" in Creating the cluster in the Installation and Configuration Guide. See the following in addition to the description of "On-premise." on-premise." onderstanding Azure probe port resources" in the Reference Guide. 19 Understanding Azure probe port resources" in the Reference Guide. "Understanding Azure probe port resources" in the Reference Guide. 19 Image: state of the state	Step No.	Procedure	On-premise	Microsoft Azure
guide.	19	Creating a cluster: Creating a failover group and monitor resource	See "Creating the configuration data of a 2-node cluster" in Creating the cluster configuration data in the Installation and Configuration Guide.	See the following in addition to the description of "On-premise." "Understanding Azure probe port resources" in the Reference Guide. "Understanding Azure probe port monitor resources" in the Reference Guide. "Understanding Azure load balance monitor resources" in the Reference Guide. See either of the following depending on the load balancer to use: See "5.3. Configuring the EXPRESS- CLUSTER settings" in this guide. See "6.3. Configuring the EXPRESS- CLUSTER settings" in this
				8

Table 2	2.10 –	continued	from	previous	page
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CHAPTER

THREE

OPERATING ENVIRONMENTS

3.1 HA cluster using Azure DNS

Supports the OS versions listed in the following manuals:

• "Getting Started Guide" > "Installation requirements for EXPRESSCLUSTER" > "Operation environment for Azure DNS resource, Azure DNS monitor resource"

Its operation has been verified in the following environments.

If the OS version is supported by Azure in EXPRESSCLUSTER X 4.2, you can use it by the same procedure. If the procedure differs depending on the OS version, Microsoft Azure portal, and Azure CLI, please replace it as appropriate.

x86_64

OS	CentOS 7.6
EXPRESSCLUSTER	EXPRESSCLUSTER X 4.2 for Linux (Internal ver-
	sion: 4.2.0-1)
Microsoft Azure deployment model	Resource Manager
Region	(Asia Pacific) Japan East
Mirror disk size	Disk size: 20 GB (1 GB for a cluster partition and 19 GB for a data partition)
Azure CLI	Azure CLI 2.0
Python	2.7

The Azure CLI and Python must be installed because Azure DNS resource use them. Since Python 2.7 is required when using Azure CLI 2.0. For details about the Azure CLI, see the following website:

Get started with Azure CLI:

https://docs.microsoft.com/en-us/cli/azure/get-started-with-azure-cli?view=azure-cli-latest

Install the Azure classic CLI: https://docs.microsoft.com/en-us/cli/azure/install-classic-cli

Python is bundled with Linux OS.

Since Azure CLI 1.0 (Azure classic CLI) running on Python 2.6 has been unrecommended, install Python by using the package manager of each distribution (e.g. APT, yum, and zipper) if Python 2.7 is not bundled.

Azure DNS must be installed because the Azure DNS resource use it. For details about Azure DNS, see the following website:

Azure DNS: https://azure.microsoft.com/en-us/services/dns/

3.2 HA cluster using a load balancer

Supports the OS versions listed in the following manuals:

• "Operation environment for Azure probe port resource, Azure probe port monitor resource, Azure load balance monitor resource" in "Installation requirements for EXPRESSCLUSTER" in the Getting Started Guide.

Its operation has been verified in the following environments.

If the OS version is supported by Azure in EXPRESSCLUSTER X 4.2, you can use it by the same procedure. If the procedure differs depending on the OS version, Microsoft Azure portal, and Azure CLI, please replace it as appropriate.

OS	CentOS 7.6
EXPRESSCLUSTER	EXPRESSCLUSTER X 4.2 for Linux (Internal ver-
	sion: 4.2.0-1)
Microsoft Azure deployment model	Resource Manager
Region	(Asia Pacific) Japan East
Mirror disk size	Disk size: 20 GB (1 GB for a cluster partition and 19 GB for a data partition)

x86_64

CHAPTER

FOUR

CLUSTER CREATION PROCEDURE (FOR AN HA CLUSTER USING AZURE DNS)

4.1 Creation example

This guide introduces the procedure for creating a 2-node unidirectional standby cluster using EXPRESSCLUSTER. This procedure is intended to create a mirror disk type configuration in which node1 is used as an active server.

The following tables describe the parameters that do not have a default value and the parameters whose values are to be changed from the default values.

• Microsoft Azure settings (common to node1 and node2)

Setting item	Setting value	
Resource group setting		
– Resource group	TestGroup1	
– Region	(Asia Pacific) Japan East	
Virtual network setting		
– Name	Vnet1	
– Address space	10.5.0.0/24	
– Subnet Name	Vnet1-1	
– Subnet Address range	10.5.0.0/24	
– Resource group	TestGroup1	
– Location	(Asia Pacific) Japan East	
DNS zone setting		
– Name	cluster1.zone	
– Resource group	TestGroup1	
- Record set	test-record1	

• Microsoft Azure settings (specific to each of node1 and node2)

Setting item	Setting value		
	node1	node2	
Virtual machine setting			
– Disk type	Standard HDD		
– User name	testlogin		
– Password	PassWord_123		
– Resource group	TestGroup1		
– Region	(Asia Pacific) Japan East		
Network security group setting			
– Name	node1-nsg	node2-nsg	
Availability set setting			
– Name	AvailabilitySet1		
- Update domains	5		
– Fault domains	2		
Diagnostics storage account setting	ng		
– Name	Automatically generated		
– Performance	Standard		
– Replication	Locally-redundant storage (LRS)		
IP configuration setting			
– IP address	10.5.0.110	10.5.0.111	
Disk setting			
– Name	node1_DataDisk_0	node2_DataDisk_0	
– Source type	None (empty disk)	1	
– Account type	Standard HDD		
– Size	20		

• EXPRESSCLUSTER settings (cluster properties)

Setting item	Setting value	
	node1	node2
– Cluster Name	Cluster1	
– Server Name	nodel	node2
– Timeout Tab: Heartbeat timeout	120	

• EXPRESSCLUSTER settings (failover group)

Resource name	Setting item	Setting value
Mirror disk resource	Name	md
	Details Tab: Mount Point	/mnt/md
	Details Tab: Data Partition Device	/dev/sdc2
	Name	
	Details Tab: Cluster Partition De-	/dev/sdc1
	vice Name	
	Details Tab: File System	ext4
	Mirror Tab: Execute the initial	On
	mirror construction	
	Mirror Tab: Execute initial mkfs	On
Azure DNS resource	Name	azuredns1
	Record Set Name	test-record1
	Zone Name	cluster1.zone
	IP Address	
		(node1) 10.5.0.110
		(node2) 10.5.0.111
	Resource Group Name	TestGroup1
	User URI	http://azure-test
	Tenant ID	XXXXXXXX-XXXX-XXXX-
		XXXXXXXXXXX
	File Path of Service Principal	/home/testlogin/tmpbyJ1cK.pem
	Azure CLI File Path	/usr/bin/az

• EXPRESSCLUSTER settings (monitor resource)

Monitor resource name	Setting item	Setting value
Mirror disk monitor resource	Name	mdw1
Azure DNS monitor resource	Name	azurednsw1
Custom monitor resource	Name	genw1
	Script created with this product	On
	Monitor Type	Synchronous
	Normal Return Value	0
	Recovery Action	Execute only the final action
	·	Continued on port page

Monitor resource name	Setting item	Setting value		
Monitor resource name				
	Recovery larget	LocalServer		
IP monitor resource	Name	ipw1		
	Server to monitor	node1		
	IP Address	10.5.0.111		
	Recovery Action	Execute only the final action		
	Recovery Target	LocalServer		
IP monitor resource	Name	ipw2		
	Server to monitor	node2		
	IP Address	10.5.0.110		
	Recovery Action	Execute only the final action		
	Recovery Target	LocalServer		
Multi target monitor resource	Name	mtw1		
	Monitor resource list			
		genw1		
		ipw1		
		ipw2		
	Recovery Action	Execute only the final action		
	Recovery Target	LocalServer		

Table 4.2 – continued from previous page

4.2 Configuring Microsoft Azure

1) Creating a resource group

Log in to the Microsoft Azure portal (https://portal.azure.com/) and create a resource group following the steps below.

1. Select the **Resource groups** icon on the upper part of the window. If there are existing resource groups, they are displayed in a list.

+			•	e				SQL	\rightarrow
Create a resource	Resource groups	Network security groups	Virtual machines	Subscriptions	All resources	App Services	Storage accounts	SQL databases	More services
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Navigate	riptions	Resource	e groups	All r	resources	Dasht	oard		

2. Select +Add on the upper part of the window.

Microsoft Azure	Search resources, services, and docs (G+/)	>_ 17; ₽; @ ? ©				
Home > Resource groups						
Resource groups			\$			
+ Add ≡≡ Edit columns 🖒 Refresh 🞍 Export to CSV	🖗 Assign tags 🛛 🛇 Feedback					
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Showing 1 to 30 of 30 records.		No grouping	\sim			
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		South Central US				
		Central US				
		Japan East				
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3. Specify Subscription, Resource group, and Region, and click Review+Create.
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2) Creating a virtual network

Log in to the Microsoft Azure portal (https://portal.azure.com/) and create a virtual network following the steps below.

1. Select the +Create a resource icon on the upper part of the window.

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+				e				SQL	\rightarrow	
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8 Navigate								32 min ago		
📍 Subsc	criptions	Resource	e groups	All r	resources	Dasht	ooard			
Tools										

2. Select Networking and then Virtual network.



3. Specify Name, Address space, Subscription, Resource group, Location, Name of Subnet, and Address

Microsoft Azure > 💀 🖓 🍪 ? 😊 Home > New > Create virtual network Create virtual network $\Box \times$ Name ★ Vnet1 Address space * 10.5.0.0/24 10.5.0.0 - 10.5.0.255 (256 addresses) Add an IPv6 address space 🛈 Subscription * \sim Resource group * TestGroup1 \sim Create new Location * (Asia Pacific) Japan East \sim Subnet Name * Vnet1-1 Address range * 10.5.0.0/24 10.5.0.0 - 10.5.0.255 (256 addresses) DDoS protection ① Basic Standard Service endpoints () Disabled Enabled Firewall 🛈 Disabled Enabled Automation options

range of Subnet, and click Create.

3) Creating a virtual machine

Log in to the Microsoft Azure portal (https://portal.azure.com/) and create virtual machines and disks following the steps below.

Create as many virtual machines as required to create a cluster. Create node1 and then node2.

1. Select the Create a resource icon on the upper part of the window.

Azure servic	es	_							
+	[]		•	+		٢		SQL	\rightarrow
Create a resource	Resource groups	Network security groups	Virtual machines	Subscriptions	All resources	App Services	Storage accounts	SQL databases	More services
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2. Select **Compute** and then **See all**.



3. Select CentOS-based 7.6.

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Home > New > Create	Select an image		×
Create a virtual m			
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customization. Looking for classic VMs?	Compute	This distribution of Linux is based on CentOS and is provided by Rogue Wave Software.	
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Resource group	Identity	I his distribution of Linux is based on CentOS and is provided by Rogue Wave Software.	
	Integration	CentOS-based 7.4 HPC Roque Wave Software (formerly OpenLogic)	- 1
Instanco dotaile	Internet of Things	This distribution of Linux is based on CentOS and is provided by Rogue Wave Software.	
Virtual machine name *	IT & Management Tools	CentOS-based 7.7	
. **	Media	Rogue Wave Software This distribution of Linux is based on CentOS and is provided by Rogue Wave Software.	
Region *()	Mixed Reality	CentOS-based 7.5	
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Availability set 📩	Security	This distribution of Linux is based on CentOS and is provided by Rogue Wave Software.	
	Software as a Service (SaaS)	CentOS 7.6 Roque Wave Software (formerly OpenLonic)	
Image 🏝	Storage	This distribution of Linux is based on CentOS and is provided by Rogue Wave Software.	
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neview - create		CentOS-based 7.1 HPC	
<		Rogue Wave Software (formerly OpenLogic) This distribution of Linux is based on ContOS and is provided by Poque Mayo Software	~

- 4. Click Create.
- When the Basics tab appears, specify the settings of Subscription, Resource group, Virtual machine name, Region, Image, Size, Username, Password, and Confirm password.
 Select Availability set from Availability options, and click Create new under the Availability set field.

When **Create new** appears, specify the settings of **Name**, **Fault domains**, and **Update domains**. Then click **OK**.

EXPRESSCLUSTER X 4.2 HA Cluster Configuration Guide for Microsoft Azure (Linux), Release 2

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Home > New > Create a virt	ual machine		
Create a virtual machi	ne		×
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Complete the Basics tab then F customization.	eview + create to provision a virtual m	achine with default parameters or review each tab for full	
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Project details			
Select the subscription to man your resources.	age deployed resources and costs. Use	resource groups like folders to organize and manage all	
Subscription *		\sim	
Resource group *	TestGroup1	~	
	Create new		
Instance details			
Virtual machine name *	node1	×	
Region * ①	(Asia Pacific) Japan East	~	
Availability options 🕕	Availability set		
Availability set 📩	No existing availability sets in curren	nt resource aroup and location.	
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Image 📩	CentOS-based 7.6	~	
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6. Click Change size to display Select a VM size.

From the list, choose a size (**Standard** - **A1** in this guide) suitable for your virtual machine and click **Select**.

Regarding the **Virtual machine name**, node1 is for node1, and node2 is for node2. Click **Next: Disks >**

7. When the **Disks** tab appears, go through the following steps to add a disk to be used for a mirror disk (cluster partition or data partition).

From the DATA DISKS list, click Create and attach a new disk.

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Enable Ultra Disk compatibility	Yes 🖲 No									
0	Ultra Disk compatibility is not a	∕ailable for this VM si	ze and location.							
Data disks										
You can add and configure addi temporary disk.	itional data disks for your virtual n	nachine or attach exist	ing disks. This VM also comes w	ith a						
LUN Name	Size (GiB)	Disk type	Host caching							
Create and attach a new disk	Attach an existing disk									
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8. Create a new disk appears.

Specify the settings of**Name**, **Source type**, and **Size**. Then click **OK**. Click **Next: Networking >**

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		Browse available disk size	es and their features.							
Create a new disk to store a	applications and data on your VM. Disk pricir	Account type ①								
storage type, and number of	of transactions. Learn more about Azure Ma	Standard HDD			\vee					
Name *	node1_DataDisk_0	Size	Disk tier	Max IOPS	Max throughput					
Source type *	None (empty disk)	32 GiB	S4	500	60					
Size *	1024 GiB	64 GiB	S6	500	60					
	Standard SSD	128 GiB	S10	500	60					
	Change size	256 GiB	S15	500	60					
		512 GiB	S20	500	60					
		1024 GiB	\$30	500	60					
		2048 GiB	S40	500	60					
		4096 GiB	S50	500	60					
		8192 GiB	S60	1300	300					
		16384 GiB	S70	2000	500					
		32767 GiB	S80	2000	500					
		Create a custom size								
		Enter the size of the disk	you would like to create. You wil	Il be charged the same rate for your p	rovisioned disk, regardless of how much of					
		the disk space is being u	sed For example, a 200 GIB disk i	is provisioned on a 256 GiB disk, so yo	u would be billed for the 256 GiB					
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9. The **Networking** tab appears.

Specify the settings of Virtual network, Subnet, NIC Network security group, and Configure network security group.

Click **Create new** under the **Configure network security group** field to display **Create network security group**. Specify the setting of **Name** and then click **OK**.

Click Next: Management >.

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10. The **Management** tab appears.

Click **Create new** under the **Diagnostics storage account** field to display **Create storage account**. Specify the settings of **Name**, **Account kind**, and **Replication**. Then click **OK**.

In the **Diagnostics storage account** field, the default value is automatically generated and entered. Click **Next: Details >**.

EXPRESSCLUSTER X 4.2 HA Cluster Configuration Guide for Microsoft Azure (Linux), Release 2

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11. Click Next: Tags >.

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Add additional configuration, agents, scripts or applications via	virtual machine extensions or cloud-init.					
Extensions						
Extensions provide post-deployment configuration and automa	tion.					
Extensions ① Select an extension to install						
Cloud init						
Cloud init is a widely used approach to customize a Linux VM a packages and write files or to configure users and security. Lea	it boots for the first time. You can use cloud-init to install m more					
The selected image does not support cloud init.						
Host						
Azure Dedicated Hosts allow you to provision and manage a ph Azure subscription. A dedicated host gives you assurance that choose VMs from your subscription that will be provisioned on of the host. Learn more	ysical server within our data centers that are dedicated to your nly VMs from your subscription are on the host, flexibility to the host, and the control of platform maintenance at the level					
Host group ① No host group found	~					
Dedicated hosts cannot be used with availability sets.						
Proximity placement group						
Proximity placement groups allow you to group Azure resource	s physically closer together in the same region. Learn more					
Proximity placement group INO proximity placement group	ns found V					~
Review + create < Previous Next : 1	ags >					
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12. Click Next: Review + create >.

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Home > New > Create a	virtual machine					
Create a virtual ma	achine					
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Tags are name/value pairs multiple resources and res	that enable you to categorize resources ar ource groups. Learn more about tags of	d view consolidated billing by applying the same tag to				
Note that if you create tag	s and then change resource settings on ot	ner tabs, your tags will be automatically updated.				
Name 🕕	Value 🕕	Resource				
	✓ :	✓ 11 selected ✓				
Review + create	< Previous Next : Review	/ + create >				
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13. The Review + create tab appears. Check the contents. If there is no problem, click Create. The deploy-

ment starts and takes several minutes.

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Home > New > Create a virtual machine								
Create a virtual machine								\times
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PRODUCT DETAILS								
Standard A1 v2	Subscription credits apply ①							
by Microsoft	6.0500 JPY/hr							
Terms of use Privacy policy	Pricing for other VM sizes							
TERMS								
By clicking "Create", I (a) agree to the legal term authorize Microsoft to bill my current payment r my Azure subscription; and (c) agree that Micros the offering(s) for support, billing and other tran Azure Marketplace Terms for additional details.	: and privacy statement(s) associated with the Marketplace offering(s) listed above; (b) nethod for the fees associated with the offering(s), with the same billing frequency as and may share my contact, usage and transactional information with the provider(s) of sactional activities. Microsoft does not provide rights for third-party offerings. See the							
Basics								
Subscription	APROX TO A CONTRACTOR							
Resource group	TestGroup1							
Virtual machine name	node1							
Region	(Asia Pacific) Japan East							
Availability options	Availability set							
Availability set	(new) AvailabilitySet1							
Authentication type	Password							
Username	testlogin							
Azure Spot	No							
Disks								
OS disk type	Standard HDD							~
Create < Previ	ous Next > Download a template for automation							
\ \								

4) Setting a private IP address

Log in to the Microsoft Azure portal (https://portal.azure.com/) and change the private IP address setting following the steps below. Since an IP address is initially set to be assigned dynamically, change the setting so that an IP address is assigned statically. Change the settings of node1 and then node2.

1. Select the **Resource groups** icon on the upper part of the window.

osone Azure				,			_ <u>an</u> g iyi	<u></u>	
Azure serv	ices								
+				†				SQL	\rightarrow
Create a resource	Resource groups	Network security groups	Virtual machines	Subscriptions	All resources	App Services	Storage accounts	SQL databases	More services
Recent res	ources								
	NAME			TYPE				LAST VIEWED	
{··>								22 min ago	
								24 min ago	
[;]								24 min ago	
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ONS								28 min ago	
•								29 min ago	
•								30 min ago	
8								32 min ago	
Navigate	scriptions	() Resource	e groups	All I	esources	Dash	board		
Tools									

- 2. Select TestGroup1 from the resource group list.
- 3. The summary of TestGroup1 is displayed. Select virtual machine node1 or node2 from the item list.

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Home > Resource groups > TestGroup	1			
(i) TestGroup1 Resource group				\$ ×
	+ Add ≡≡ Edit columns 📋 Delete resource group 🖒 Refresh -	→ Move 🛓 Export to CSV 🛛 🖉 Assign t	ags 📋 Delete	··· More
😥 Overview	Essentials	*		
Activity log	Filter by name	(⁺ _▼ Add filter	No grouping	×
Access control (IAM)	Showing 1 to 13 of 13 records. Show hidden types ①		No grouping	•
Tags	Name ↑↓	Туре ↑↓	Location ↑↓	
🗲 Events		Availability set	Japan East	
Settings		Virtual machine	Japan East	•••
Ouickstart		Network security group	Japan East	•••
		Network interface	Japan East	
Bolicion		Disk	Japan East	
Transition		Disk	Japan East	
		Virtual machine	Japan East	
		Network security group	Japan East	•••
Export template		Network interface	Japan East	•••
Cost Management		Disk	Japan East	
🙊 Cost analysis		Disk	Japan East	
Cost alerts		Storage account	Japan East	
③ Budgets	•	Virtual network	Japan East	
Advisor recommendations				
Monitoring				
Insights (preview)				
💵 Alerts				
Metrics	Devices Press de 2 d of 1 North			
Diagnostic settings	< Previous Page 1 of 1 Next >			
<				>

4. Select Networking.

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Home > Resource groups > TestGrou	p1		_	
FestGroup1				\$ ×
	X + Add ≡≡ Edit columns 📋 Delete resource group 🖒 Refresh	→ Move 🛓 Export to CSV 🛛 🖉 Assign ta	gs 📋 Delete	··· More
Overview	Essentials	*		
Activity log	Filter by name Type == all () Location == all ()	+ Add filter		
Access control (IAM)	Showing 1 to 13 of 13 records. Show hidden types ①		No grouping	\checkmark
Tags	Name ↑↓	Туре ↑↓	Location ↑↓	
Events		Availability set	Japan East	
C-Winer		Virtual machine	Japan East	
Settings		Network security group	Japan East	
Quickstart		Network interface	Japan East	
Depioyments		Disk	Japan East	
Policies		Disk	Japan East	
Properties		Virtual machine	Japan East	•••
EUCKS		Network security group	Japan East	•••
Export template		Network interface	Japan East	
Cost Management		Disk	Japan East	
🗙 Cost analysis		Disk	Japan East	
Cost alerts		Storage account	Japan East	
Budgets	☐ <→	Virtual network	Japan East	
Advisor recommendations				
Monitoring				
Insights (preview)				
💵 Alerts				
Metrics	Device Pres () (of) Nexts			
Diagnostic settings	V Previous Page I V OI I Next 2			
1				>

- 5. Select a network interface displayed in the list. The network interface name is generated automatically.
- 6. Select IP configurations.

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Home > Resource groups > TestGroup1	> node1 - Networkin	ng > node1186 - I	P configurations	;							
node1186 - IP configuration	ons										×
	🕂 Add 🛛 🗟 Sav	ve 🗙 Discard									
 Overview Activity log Access control (IAM) Tags Settings 	IP forwarding set IP forwarding Virtual network IP configurations Subnet *	tings ;		(Disabled Enabled) Vnet1							~
IP configurations				Vict I (10.5.0.0/24)							
DNS servers		figurations									
💎 Network security group	Name	IP Version	Туре	Private IP address			Pu	blic IP a	address		
HI Properties	ipconfig1	IPv4	Primary	10.5.0.4 (Dynamic)			-				
🔒 Locks											
👰 Export template											
Support + troubleshooting											
Effective security rules											
New support request											
<											>

- 7. Only ipconfig1 is displayed in the list. Select it.
- 8. Select **Static** for **Assignment** under **Private IP address settings**. Enter the IP address to be assigned statically in the **IP address** text box and click **Save** at the top of the window. The IP address of node1 is 10.5.0.110. The IP address of node2 is 10.5.0.111.

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Home > Resource groups > TestGroup1 > node1 - Networking	> node1186 - IP configurations > ipconfig1							
ipconfig1								
🔚 Save 🗙 Discard								
The virtual machine associated with this network interface will be new private IP address. The network interface will be reprovision configuration settings, including secondary IP addresses, subnet gateway, will need to be manually reconfigured within the virtual	restarted to utilize the ed and network masks, and default machine. Learn more							
Public IP address settings Public IP address (Disabled Enabled)								
Private IP address settings Virtual network/subnet								
Assignment Dynamic Static								
IP address * 10.5.0.110								

9. The virtual machines restart automatically so that new private IP addresses can be used.

5) Creating a DNS zone

Log in to the Microsoft Azure portal (https://portal.azure.com/) and configure the DNS zone following the steps below.

1. Select the **Create a resource** icon on the upper part of the window.

Microsoft Azure		8	⊃ Search resour	ces, services, and doo	rs (G+/)	>.	_ 🖓 Q	¢\$? ©	-
Azure services									
+	[]			•		۲		SQL	\rightarrow
Create a resource	Resource groups	Network security groups	Virtual machines	Subscriptions	All resources	App Services	Storage accounts	SQL databases	More services
Recent resour	ces								
NA	ME			TYPE				LAST VIEWED	
~ >								22 min ago	
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P								29 min ago	
Q								30 min ago	
8								32 min ago	
Navigate								32 min ago	
📍 Subscript	ions	Resource	e groups	All r	esources	Dashi	ooard		
Tools									
10015		_			_				

2. Select Networking and then See all. Search for DNS zone.

Microsoft Azure			>_	Ū.	Ф 🕸	0	and the second	
ome > New								
New								
○ DNS zone		×						
DNS zone								
Private DNS zone								
Get started	6	Virtual network						
Recently created		Quickstart tutorial						
AI + Machine Learning		Check Point CloudGuard IaaS R80.10						
Analytics	PREVIEW	Cluster (preview)						
Blockchain	_	Learn more						
Compute		Load Balancer Learn more						
Containers								
Databases		Application Gateway						
Developer Tools	v	Learn more						
DevOns		Front Door						
Identity	db	Learn more						
Integration		Firewall						
Integration	Ē	Learn more						
Media		Vietual WAN						
Mixed Reality	1	Learn more						
IT & Management Tools								
Networking	1 😯	Network security group Quickstart tutorial						
Software as a Service (SaaS)								
Security	ھ	ExpressRoute						
Storage								
Web	(···>	Connection						
		Learn more						

3. Create DNS zone is displayed. Specify Subscription, Resource group, and Name, and click Re-

view+create. Then click Create.

=	Microsoft Azure		\wp Search resources, services, and	docs (G+/)	>_ 🛱	Q (<u>۶</u>	٢	-	
Hom	e > New > DNS zone >	Create DNS zone								
Cre	ate DNS zone									×
Bas	ics Tags Review +	create								
A DN numl allow from	IS zone is used to host the per of DNS records such as s you to host your DNS zo end users with the DNS re	DNS records for a particular domain s 'mail.contoso.com' (for a mail serve one and manage your DNS records, a ecords that you create. Learn more.	 h. For example, the domain 'contoso. r) and 'www.contoso.com' (for a web and provides name servers that will re 	om' may contain a site). Azure DNS spond to DNS queries						
Proje	ect details									
Subs	cription *			\sim						
	– Resource group *	TestGroup1		\sim						
		Create new								
Insta	ince details									
Nam	e *	cluster1.zone		 ✓ 						
Reso	urce group location 🛈	(Asia Pacific) Japan East		\sim						
R	eview + create	< Previous Next : Tags >	Download a template for automation							
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6) Configuring virtual machines

Log in to the created node1 and node2 and specify the settings following the procedure below.

Set a partition for the mirror disk resource. Create a file system in the added disk.

Secure an area in the added disk by using the fdisk command and then create a file system.

For details about the partition for the mirror disk resource, see "Partition settings for Mirror disk resource (when using Replicator)" in "Settings after configuring hardware" in "Determining a system configuration" in the Installation and Configuration Guide.

1. Check the partition list. In the following example, the last line shows the added disk.

\$ cat	/proc/p	artition	ıs	
major	minor	#blocks	nar	ne
2	0		4	fd0
8	0	31457	280	sda
8	1	512	2000	sda1
8	2	30944	256	sda2
8	16	73400	320	sdb
8	17	73398	3272	sdb1
8	32	20971	520	sdc

- 2. Create a cluster partition and data partition in the added disk by using the fdisk command. Allocate 1 GB (1*1024*1024*1024 bytes) or more to a cluster partition. (If the size is specified as just 1 GB, the actual size will be larger than 1 GB depending on the disk geometry difference. This is not a problem.) Also, do not create a file system in a cluster partition.
- 3. If you select Execute initial mkfs when creating the cluster configuration data by using Cluster WebUI,

EXPRESSCLUSTER creates a file system automatically. Note that existing data in the partition will be lost.

7) Adjusting the OS startup time, checking the network setting, checking the root file system, checking the firewall setting, synchronizing the server time, and checking the SELinux setting.

For each procedure, see "Settings after configuring hardware." in "Determining a system configuration" in the Installation and Configuration Guide.

8) Installing the Azure CLI

Install the Azure CLI.

The procedure to install the Azure CLI from an npm package is described. For details about this procedure and other procedures, see the following websites:

Install the Azure CLI:

https://docs.microsoft.com/en-us/cli/azure/install-azure-cli

Log in to the created node1 and node2 and install the Azure CLI following the procedure below. Be sure to use the following installation procedure. If the Azure CLI is installed in other ways, Azure DNS resource will not work properly.

```
$ sudo yum check-update; sudo yum install -y gcc libffi-devel python-devel_

openssl-devel
$ curl -L https://aka.ms/InstallAzureCli | bash -
$ exec -1 $SHELL
```

9) Creating a service principal

Create a service principal using the Azure CLI.

Azure DNS resource performs login to Microsoft Azure and DNS zone registration and monitoring. When logging in to Microsoft Azure, Azure login with a service principal is used.

Please note that certificates have an expiration date.

For more details, see the --years option of az ad sp create-for-rbac.

https://docs.microsoft.com/en-us/cli/azure/ad/sp?view=azure-cli-latest#az-ad-sp-create-for-rbac

For details about a service principal and procedure, see the following websites:

Sign in with Azure CLI:

https://docs.microsoft.com/en-us/cli/azure/authenticate-azure-cli

Create an Azure service principal with Azure CLI:

https://docs.microsoft.com/en-us/cli/azure/create-an-azure-service-principal-azure-cli

1. Log in with an organizational account.

```
$ az login -u <account_name> -p <password>
```

2. Create and register a service principal. Write down the displayed name and tenant because it is necessary to set them in the Azure DNS resource settings of Cluster WebUI. In the following example, a service principal is created in /home/testlogin/tmpbyJ1cK.pem. The valid period of certificates is set to 10 years.

```
$ az ad sp create-for-rbac --name azure-test --create-cert --years 10
{
    "appId": "xxxxxxx-xxxx-xxxx-xxxx-xxxxxxxx",
    "displayName": "azure-test",
    "fileWithCertAndPrivateKey": "/home/testlogin/tmpbyJlcK.pem",
    "name": "http://azure-test",
    "password": null,
    "tenant": "xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx""
}
```

3. Log out.

```
$ az logout --u <account_name>
```

4. Check whether login to Microsoft Azure using the created service principal is possible.

```
$ az login --service-principal -u <name_value_in_step_2> --tenant
<tenant_value_in_step_2> -p <fileWithCertAndPrivateKey_value_in_step_2>
```

The following is displayed upon successful sign-in.

```
[
{
    "cloudName": "AzureCloud",
    "id": "xxxxxxx-xxxx-xxxx-xxxx-xxxxxxxxx,
    "isDefault": true,
    "name": "xxxxxxxxx",
    "state": "Enabled",
    "tenantId": "xxxxxxx-xxxx-xxxx-xxxx-xxxxxxxxx,
    "user": {
        "name": "http://azure-test",
        "type": "servicePrincipal" }
]
```

5. Log out.

\$ az logout --username <name_value_in_step_4>

When changing the role of the created service principal from the default "Contributor" to another role, select a role that has access permissions to all of the following operations as the Actions properties. If the role is changed to a role that does not satisfy this condition, monitoring by the Azure DNS monitor resource, which are set up later, will fail due to an error.

```
Microsoft.Network/dnsZones/A/write
Microsoft.Network/dnsZones/A/delete
Microsoft.Network/dnsZones/NS/read
```

10) Installing EXPRESSCLUSTER

For the installation procedure, see the Installation and Configuration Guide. After installation is complete, restart the OS.

11) Registering the EXPRESSCLUSER license

For the license registration procedure, see the Installation and Configuration Guide.

4.3 Configuring the EXPRESSCLUSTER settings

For the Cluster WebUI setup and connection procedures, see "Creating the cluster configuration data" in the Installation and Configuration Guide.

This section describes the procedure to add the following resources and monitor resources:

- · Mirror disk resource
- Azure DNS resource
- Azure DNS monitor resource
- Custom monitor resource (for NP resolution)
- IP monitor resource (for NP resolution)
- Multi target monitor resource (for NP resolution)

For the settings of other resources and monitor resources, see the Installation and Configuration Guide and the Reference Guide.

1) Creating a cluster

Start the Cluster generation wizard to create a cluster.

- · Creating a cluster
 - 1. .Access Cluster WebUI, and click Cluster generation wizard.

Cluster WebUI <cluster></cluster>	F	Config mode 🗸 🛃	. 0 8 /	9 i ? ≝
Cluster generation wizard File	Configuration File Update Server D	tata Check the Configuration	File	

 Cluster of Cluster generation wizard is displayed. Enter a desired name in Cluster Name. Select an appropriate language in Language. Click Next.

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

3. Basic Settings is displayed.

The instance connected to Cluster WebUI is displayed as a registered master server. Click **Add** to add the remaining instances (by specifying the private IP address of each instance). Click **Next**.

Add server		6	
Server Name or IP Address*	10.5.0.111		
• Enter an IP address or a server name. When entering a server name, name reso Both IPv4 and IPv6 for IP address can be When entering an IP address, the server i	lution is necessary. used. name is automatically acquired.		
	OK Cancel		
Cluster generation wizard			
Add Remove Server Definitions Order			
Master server node1			
1 node2			
↑ ↓			
Server Group Definition	Settings		
Click "Add" to add servers constructing the clu Click 「↑」 or 「↓」 to change the server priority Click "Settings" to configure the server group who	ister. y. en using the server group.		

4. The Interconnect window is displayed.

Specify the IP addresses (IP address of each instance) to be used for interconnect. In addition, select mdc1 for **MDC** as a communication path of a mirror disk resource to be created later. Click **Next**.



5. The NP Resolution window is displayed.

Note that NP resolution is not configured on this window. The equivalent feature is achieved by adding the IP monitor resource, custom monitor resource, and multi target monitor resource. Configure NP resolution in "3 Adding a monitor resource."

You need to examine the NP resolution destination and method depending on the location of clients accessing a cluster system and the condition for connecting to an on-premise environment (for example, using a dedicated line). There is no NP resolution destination nor method to recommend. Additionally, you can use network partition resolution resources for NP resolution.





2) Adding a group resource

• Defining a group

Create a failover group.

1. The Group List window s displayed. Click Add.

Cluster generation wizard	×
Cluster O → Basic Settings O → Server Server Properties Add Remove → NP Resolution O	→ Group → Monitor Group Resource
Group List No groups	Туре
 Configure failover group to be a unit of fail over. Click "Add" to add a group. Click "Properties" to configure the properties of the selected group. Click "Group Resource" to add resource to the selected group. 	

2. The **Group Definition** window is displayed.

Specify a failover group name (failover1) for Name. Click Next.

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

- 3. The **Startup Servers** window is displayed. Click **Next** without specifying anything.
- 4. The **Group Attributes** window is displayed. Click **Next** without specifying anything.
- 5. Group Resource List is displayed.

On this page, add a group resource following the procedure below.

Group Defini	tion								ailover 🗙
Basic Setting	js 📀 🔸	➔ Startup	Servers 🛇	→ Group A	ttributes 📀	→	Group Resource		
Properties	Add	Remove							
Group Resour	ce List								
Name					Туре				
No resources									
Click "Ac Click "Proper	ld" to ac ties" to	ld resources configure th	a properties of	f the selected	resource.				
							 Back 	Finish	Cancel

• Mirror disk resource

Create a mirror disk resource.

For details, see "Understanding mirror disk resources" in the Reference Guide.

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

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

Resource Definition of Group failover	1	md 🗙			
Info → Dependency → Recovery Operation → Details					
Туре*	Mirror disk resource \checkmark				
Name*	md				
Comment					
Get License Info					
Select the type of group resource and	enter its name.				
		Back Next Cancel			

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

Enter the device name of the partition created in "6. Configuring virtual machines" in Data Partition Device Name and Cluster Partition Device Name. Specify Mount Point and File System. Click Finish to finish setting.

Resource Definition of Group failover	-1			md 🗙
Info ⊘ → Dependency ⊘ → Reco Common node1 node2	overy Operation 🥏	→ Details		
Mirror Partition Device Name*	/dev/NMP1 🗸			
Mount Point*	/mnt/md			
Data Partition Device Name*	/dev/sdc2	~		
Cluster Partition Device Name*	/dev/sdc1	~		
File System*	ext4	~		
Mirror Disk Connect				Select
Tuning				
			Back Finish	Cancel

• Azure DNS resource

Provides a mechanism to register or unregister a record to or from Azure DNS. For details about the Azure DNS resource, see "Understanding Azure DNS resources" in the Reference Guide.

- 1. Click Add on the Group Resource List page.
- 2. The **Resource Definition of Group | failover1** window is displayed. Select the group resource type (Azure DNS resource) from the **Type** box and enter the group name (azuredns1) in the **Name** box. Click **Next**.

Resource Definition of Group failover1				
Info → Dependency → Recovery	Operation 🗲 Details			
Type*	Azure DNS resource			
Name*	azuredns1			
Comment				
Get License Info				
3 Select the type of group resource and	l enter its name.			

- 3. The **Dependency** window is displayed. Click **Next** without specifying anything.
- 4. The **Recovery Operation** window is displayed. Click **Next**.
- 5. Enter the values for each of the following: Record Set Name, Zone Name, IP Address, Resource Group Name, User URI, Tenant ID, File Path of Service Principal, Thumbprint of Service Principal, Azure CLI File Path. When using the IP address of each server, enter the IP address in the tab for each server. When setting up the servers separately, enter any IP address of the servers in the Common tab and then make settings for other servers. Only when using Azure CLI 1.0 (Azure classic CLI), enter Thumbprint of Service Principal. For User URI and Tenant ID, specify respectively the name and the tenant you wrote down at "9. Creating a service principal".

Resource Definition of Group failover1			azuredns 🗙
Info ♥ → Dependency ♥ → Reco Common node1 node2	overy Operation 🔗 🔶 Deta	ails	
Record Set Name*	test-record1		
Zone Name*	cluster1.zone		
IP Address*	10.5.0.110		
TTL*	3600	sec	
Resource Group Name*	TestGroup1		
Account			
User URI*	http://azure-test		
Tenant ID*	XXXXXXXXXX-XXXX-XXXX-XXXX-XXX		
File Path of Service Principal*	/home/testlogin/tmpbyJ1cK.		
Thumbprint of Service Principal			
Azure CLI File Path*	/usr/bin/az		
Delete a record set at deactivation	\checkmark		
Tuning			
		 ▲ Back 	Finish Cancel

6. Click Finish.

3) Adding a monitor resource

• Azure DNS monitor resource

The mechanism to check the record sets registered to the Azure DNS and whether the name resolution is available is provided.

For details about Azure DNS monitor resources, see "Reference Guide" > "Understanding Azure DNS monitor resources"

Adding one Azure DNS resource creates one Azure DNS monitor resource automatically.

• Custom monitor resource

Sets a script to monitor whether communication with the Microsoft Azure Service Management API is possible, and also to monitor health of communication with an external network.

For details about the custom monitor resource, see "Understanding custom monitor resources" in the Reference Guide.

- 1. Click Add on the Monitor Resource List page.
- 2. Select the monitor resource type (Custom monitor) from the **Type** box and enter the monitor resource name (genw1) in the **Name** box. Click **Next**.

Monitor Resource Definition		genw 🗙
Info → Monitor(common) → Mon	itor(special) 🗲 Recovery Action	
Type*	Custom monitor	
Name*	genw1	
Comment		
Get Licence Info		
• Select the type of monitor resource an	nd enter its name.	
		Back Next Cancel

3. The **Monitor** (common) window is displayed.

Confirm that Monitor Timing is Always and click Next.

Monitor Resource Definition		genw 🗙
Info 🛇 🔶 Monitor(common) 🔶 Monitor(special)	→ Recovery	Action
Interval*	60	sec
Timeout*	120	sec
Do Not Retry at Timeout Occurrence		
Do Not Execute Recovery Action at Timeout Occurrence		
Retry Count*	0	time
Wait Time to Start Monitoring*	0	sec
Monitor Timing		
Always Alw		
○ Active		
Target Resource		Browse
Nice Value		0
Choose servers that execute monitoring	Server	

4. The **Monitor** (**special**) window is displayed. Select **Script created with this product**. The following shows the sample of a script to be created.

```
#! /bin/sh
<EXPRESSCLUSTER-installation-path>/bin/clpazure_port_checker -h_
_management.core.windows.net -p 443
exit $?
```

Select Synchronous for Monitor Type. Click Next.



5. The Recovery Action window is displayed.

Select Execute only the final action for Recovery Action, LocalServer for Recovery Target, and No operation for Final Action.

Monitor Resource Definition					genw 🗙
Info 📀 🔸 Monitor(common) 📀	→	Monitor(special) 🥥 🔸	Recovery Action	ı	
Recovery Action		Execute only the final action	n		~
Recovery Target *		LocalServer		Browse	
Recovery Script Execution Count					
Execute Script before Reactivation					
Maximum Reactivation Count					
Execute Script before Failover					
Execute migration before Failover					
Maximum Failover Count					
Execute Script before Final Action]			
Final Action		No operation	~		
					Script Settings
				A Back	Finish Cancel

- 6. Click **Finish** to finish setting.
- IP monitor resource

Creates an IP monitor resource to monitor communication between clusters that are configured with virtual machines, and also to monitor whether communication with an internal network is health. For details about the IP monitor resource, see Understanding IP monitor resources in the Reference Guide.

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

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

3. The **Monitor (common)** window is displayed. Confirm that **Monitor Timing** is **Always**.

EXPRESSCLUSTER X 4.2 HA Cluster Configuration Guide for Microsoft Azure (Linux), Release 2

Monitor Resource Definition			ipw 🗙
Info 🛇 🔶 Monitor(common) 🌛 Monitor(special)	→ Recovery	Action	
Interval*	30	sec	
Timeout*	30	sec	
Collect the dump file of the monitor process at timeout occurrence			
Do Not Retry at Timeout Occurrence			
Do Not Execute Recovery Action at Timeout Occurrence			
Retry Count*	0	time	
Wait Time to Start Monitoring*	0	sec	
Monitor Timing			
Always			
○ Active			
Target Resource			Browse
Nice Value			0
Choose servers that execute monitoring	Server		
		 Back 	Next Cancel

Select one available server for Choose servers that execute monitoring.

Failure Detection Server			
 ○ All servers ● Select Servers that can run the Group 		Available Servers	
Name	←	Name	
node1	Add	node2	
	→ Remove		
			OK Cancel Apply

Click Next.

4. The Monitor (special) window is displayed.



On the **Common** tab, select **Add** of **IP Address** and set an IP address of a server other than the server selected in step 3. Click **Next**.

IP Address Setting	S	
IP Address*	10.5.0.111	
		OK Cancel

Monitor Resource Definition	ipw 🗙
Info S → Monitor(common) S → Monitor(special) → Recovery Action Common node1 node2 Edit Add Remove IP Address List	
IP Address	
10.5.0.111	
	ext Cancel

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

Select Execute only the final action for Recovery Action, LocalServer for Recovery Target, and No operation for Final Action.

Monitor Resource Definition			ipw 🗙
Info 🛛 🔸 Monitor(common) 🛇	→ Monitor(special) → Recov	very Action	
Recovery Action	Execute only the final action		~
Recovery Target *	LocalServer	Browse	
Recovery Script Execution Count			
Execute Script before Reactivation			
Maximum Reactivation Count			
Execute Script before Failover			
Execute migration before Failover			
Maximum Failover Count			
Execute Script before Final Action			
Final Action	No operation	~	
		Script	Settings
		■ Back Finish	Cancel

- 6. Click **Finish** to finish setting.
- 7. Then, create a monitor resource on the other server. Click Add on the Monitor Resource List page.
- 8. Select the monitor resource type (IP monitor) from the **Type** box and enter the monitor resource name (ipw2) in the **Name** box. Click **Next**.
- The Monitor (common) window is displayed. Confirm that Monitor Timing is Always. Select one available server for Choose servers that execute monitoring. Click Next.
- The Monitor (special) window is displayed.
 On the Common tab, select Add of IP Address and set an IP address of a server other than the server selected in step 9. Click Next.
- The Recovery Action window is displayed.
 Select Execute only the final action for Recovery Action, LocalServer for Recovery Target, and No operation for Final Action.

- 12. Click Finish to finish setting.
- Multi target monitor resource

Creates a multi target monitor resource to check the statuses of both the custom monitor resource monitoring communication to Microsoft Azure Service Management API and the IP monitor resource between clusters that are configured with virtual machines.

If the statuses of both monitor resources are abnormal, execute the script in which the processing for NP resolution is described.

For details about the multi target monitor resource, see Understanding multi target monitor resources in the Reference Guide.

- 1. Click Add on the Monitor Resource List page.
- 2. Select the monitor resource type (Multi target monitor) from the **Type** box and enter the monitor resource name (mtw1) in the **Name** box. Click **Next**.

Monitor Resource Definition		mtw 🗙
Info → Monitor(common) → Mor	nitor(special) 🔶 Recovery Action	
Туре*	Multi target monitor	
Name*	mtw1	
Comment		
Get Licence Info		
• Select the type of monitor resource a	nd enter its name.	

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

Monitor Resource Definition		mtw 🗙
Info 📀 🔶 Monitor(common) 🌛 Monitor(special)	→ Recovery	Action
Interval*	30	sec
Timeout*	30	sec
Collect the dump file of the monitor process at timeout occurrence		
Do Not Retry at Timeout Occurrence		
Do Not Execute Recovery Action at Timeout Occurrence		
Retry Count*	0	time
Wait Time to Start Monitoring*	0	sec
Monitor Timing		
Always		
○ Active		
Target Resource		Browse
Nice Value		0
Choose servers that execute monitoring	Server	
		Back Next Cancel

4. The Monitor (special) window is displayed.

From **Available Monitor Resources**, select the custom monitor resource (genw1) for checking communication with Service Management API and two IP monitor resources (ipw1 and ipw2) that are set to both servers. Then, click **Add** to add them to **Monitor Resource List**. Click **Next**.

Monitor Resource Definition	n			mtw 🗙
Info 📀 🔸 Monitor(comr	mon) 🥑 🔶 Mon	itor(special) 🔶 R	ecovery Action	
Monitor Resources Monitor Resource	Туре	←	Available Monitor Resources Monitor Resource	Туре
genw1	genw	Add	No Available Monitor Resources	
ipw1	ipw	<i>></i>		
ipw2	ipw	Remove		
Tuning			4 Back Navt	Cancel
			Back Next	Cancel

5. The Recovery Action window is displayed.

Specify **Execute only the final action** for **Recovery Action**, **LocalServer** for **Recovery Target**, and **Stop the cluster service and shutdown OS** for **Final Action**.

Monitor Resource Definition				mtw 🗙
Info 🛛 🔸 Monitor(common) 🛇 🗧	Monitor(sp	ecial) 🤡 🔶 Recovery Actio	on	
Recovery Action	Execute on	ly the final action		~
Recovery Target *	LocalServer		Browse	
Recovery Script Execution Count				
Execute Script before Reactivation				
Maximum Reactivation Count				
Execute Script before Failover				
Execute migration before Failover				
Maximum Failover Count				
Execute Script before Final Action				
Final Action	Stop the cl	uster service and shutdown OS \smallsetminus		
				Script Settings
			 Back 	Finish Cancel

6. Click Finish.

4) Setting the cluster properties

For details about the cluster properties, see "Cluster properties" in the Reference Guide.

• Cluster properties

Configure the settings in Cluster Properties to link Microsoft Azure and EXPERSSCLUSTER.

1. Enter Config Mode from Cluster WebUI, click the property icon of a cluster name.

Cluster Properties Cluster1		×
Info Interconnect NP Resolution Alert Service WebManager API Extension	Timeout Port No. Port No. (Mirror) Encryption Alert Log Delay Warning	Port No.(Log) Monitor Recovery Mirror Agent Mirror Driver
Cluster Name Comment	Cluster1	
Language	English 🗸	OK Cancel Apply

- 2. Select the **Timeout** tab. For **Timeout** of **Heartbeat**, specify a value calculated by "A+B+C" as described below.
 - A: Interval of the monitor resource being monitored by the multi target monitor resource for NP resolution x (Retry Count+1)

* Among three monitor resources, select the monitor resource whose calculation result is the largest.

- B: Interval of the multi target monitor resource x (Retry Count+1)
- C: 30 seconds (Waiting time for heartbeat not to time out before the multi target monitor resource detects an error. The time can be changed accordingly.

Note: If **Timeout** of **Heartbeat** is shorter than the time that it took for the multi target monitor resource to detect an error, a heartbeat timeout will be detected before starting the NP resolution processing. In this case, the same service may start doubly in the cluster because the service also starts on the standby server.

Cluster Properties Cluster1						×
Info Interconnect NP Resolution Alert Service WebManager API Extension	Timeout Encryption	Port No. Alert Log	Port No.(Mirror) Delay Warning	Port No.(Log) Mirror Agent	Monitor Mirror Driv	Recovery ver
Server Sync Wait Time* Heartbeat	5	min				
Interval*	3	sec				
Timeout*	120	sec				
Server Internal Timeout*	180	sec				
Initialize						
				(OK Cano	Apply

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

4.4 Verifying the created environment

Verify whether the created environment works properly by generating a monitoring error to fail over a failover group. If the cluster is running normally, the verification procedure is as follows:

- 1. Start the failover group (failover1) on the active node (node1). In the **Status** tab on the Cluster WebUI, confirm that **Group Status** of failover1 of node1 is **Normal**.
- 2. Log in to the Microsoft Azure portal, select cluster1.zone on the DNS zone, and then select **Summary**. Check the DNS servers displayed on the upper right of the window (name server 1, name server 2, name server 3, and name server 4 in the window example).
- 3. Confirm that the relevant record set exists in the DNS servers checked in the above step by executing the nslookup command as follows:

\$ nslookup test-record1.cluster1.zone <DNS_servers_checked_in_the_above_step>

- 4. On the Microsoft Azure portal, delete an A record from the DNS zone. This causes azurednsw1 to detect a monitoring error. On the DNS zone, select cluster1.zone and then **Summary**.
- 5. Select the record you want to delete and click **Delete**. When the deletion confirmation dialog box is displayed, select **Yes**.
- 6. When the time specified for **Interval** of azurednsw1 elapses, the failover group (failover1) enters an error status and fails over to node2. In the **Status** tab on the Cluster WebUI, confirm that **Group Status** of failover1 of node2 is **Normal**.
- 7. Confirm that the relevant record set exists in the DNS servers checked in the above step by executing the nslookup command as follows:

\$ nslookup test-record1.cluster1.zone <DNS_servers_checked_in_the_above_step>

Verifying the failover operation when an A record is deleted from the DNS server is now complete. Verify the operations in case of other failures if necessary.
CLUSTER CREATION PROCEDURE (FOR AN HA CLUSTER USING AN PUBLIC LOAD BALANCER)

5.1 Creation example

This guide introduces the procedure for creating a 2-node unidirectional standby cluster using EXPRESSCLUSTER on Microsoft Azure. This procedure is intended to create a mirror disk type configuration in which node1 is used as an active server.

The following tables describe the parameters that do not have a default value and the parameters whose values are to be changed from the default values.

Setting item	Setting value
Resource group setting	
– Resource group	TestGroup1
– Region	(Asia Pacific) Japan East
Virtual network setting	
– Name	Vnet1
– Address space	10.5.0.0/24
– Subnet Name	Vnet1-1
– Subnet Address range	10.5.0.0/24
– Resource group	TestGroup1
– Location	(Asia Pacific) Japan East

• Microsoft Azure settings (common to node1 and node2)

Continued on next page

Setting item	Setting value
Load balancer setting	
– Name	TestLoadBalancer
– Туре	Public
– Public IP address	TestLoadBalancerPublicIP
– Public IP address: Assignment	Static
– Resource group	TestGroup1
– Region	(Asia Pacific) Japan East
- Backend pool: Name	TestBackendPool
- Associated to	Availability set
– Target virtual machine	node1 node2
– Network IP configuration	10.5.0.110 10.5.0.111
– Health probe: Name	TestHealthProbe
– Health probe: Port	26001
– Load balancing rule: Name	TestLoadBalancingRule
- Load balancing rule: Port	80 (Port number offering the operation)
 Load balancing rule: Backend port 	8080 (Port number offering the operation)
Inbound security rule setting	1
– Name	TestHTTP

Table 5.1 – continued from previous page

Continued on next page

Setting item	Setting value
– Protocol	ТСР
 Destination Port range 	8080 (Port number offering the operation)

Table 5.1 – continued from previous page

• Microsoft Azure settings (specific to each of node1 and node2)

Setting item	Setting value	
	node1	node2
Virtual machine setting		
– Disk type	Standard HDD	
– User name	testlogin	
– Password	PassWord_123	
- Resource group	TestGroup1	
– Region	(Asia Pacific) Japan East	
Network security group setting		
– Name	node1-nsg	node2-nsg
Availability set setting		
– Name	AvailabilitySet1	
– Update domains	5	
– Fault domains	2	
Diagnostics storage account setti	ng	
– Name	Automatically generated	
– Performance	Standard	
– Replication	Locally-redundant storage (LRS)	
IP configuration setting		
– IP address	10.5.0.110	10.5.0.111
Disk setting		
– Name	node1_DataDisk_0	node2_DataDisk_0
– Source type	None (empty disk)	1
– Account type	Standard HDD	
– Size	20	

• EXPRESSCLUSTER settings (cluster properties)

Setting item	Setting value	
	node1	node2
– Cluster Name	Cluster1	
– Server Name	nodel	node2
– Timeout Tab: Heartbeat timeout	120	

• EXPRESSCLUSTER settings (failover group)

Resource name	Setting item	Setting value
Mirror disk resource	Name	md
	Details Tab: Mount Point	/mnt/md
	Details Tab: Data Partition Device	/dev/sdc2
	Name	
	Details Tab: Cluster Partition De-	/dev/sdc1
	vice Name	
	Details Tab: File System	ext4
	Mirror Tab: Execute the initial	On
	mirror construction	
	Mirror Tab: Execute initial mkfs	On
Azure probe port resource	Name	azurepp1
	Probe port	26001 (Value specified for Port of
		Health probe)

• EXPRESSCLUSTER settings (monitor resource)

Monitor resource name	Setting item	Setting value
Mirror disk monitor resource	Name	mdw1
Azure probe port monitor re-	Name	azureppw1
source		
	Recovery Target	azurepp1
Azure load balance monitor re-	Monitor resource name	aurelbw1
source		
	Recovery Target	azurepp1
Custom monitor resource	Name	genw1
	Script created with this product	On
	Monitor Type	Synchronous
	Normal Return Value	0
	Recovery Action	Execute only the final action
	Recovery Target	LocalServer
IP monitor resource	Name	ipw1
	Server to monitor	node1
	IP Address	10.5.0.111
	Recovery Action	Execute only the final action

Continued on next page

1401		Jugo
Monitor resource name	Setting item	Setting value
	Recovery Target	LocalServer
IP monitor resource	Name	ipw2
	Server to monitor	node2
	IP Address	10.5.0.110
	Recovery Action	Execute only the final action
	Recovery Target	LocalServer
Multi target monitor resource	Name	mtw1
	Monitor resource list	
		genw1
		ipw1
		ipw2
		-
	Recovery Action	Execute only the final action
	Recovery Target	LocalServer
	Recovery Target Execute Script before Final Ac-	LocalServer On
	Recovery Target Execute Script before Final Ac- tion	LocalServer On

Table 5.3 – continued from previous page

5.2 Configuring Microsoft Azure

1. Creating a resource group

Log in to the Microsoft Azure portal (https://portal.azure.com/) and create a resource group following the steps below.

1. Select the **Resource groups** icon on the upper part of the window. If there are existing resource groups, they are displayed in a list.

crosoft Azure				ces, services, and doo	rs (G+/)	>_	. 🕼 Q	@? ©	1
Azure servi	ices								
+	[]		•	†		۲		SQL	\rightarrow
Create a resource	Resource groups	Network security groups	Virtual machines	Subscriptions	All resources	App Services	Storage accounts	SQL databases	More services
Recent rese	ources								
	NAME			TYPE				LAST VIEWED	
{·· >								22 min ago	
								24 min ago	
()								24 min ago	
=								26 min ago	
=								26 min ago	
								27 min ago	
								28 min ago	
-								28 min ago	
(DNS)								28 min ago	
								29 min ago	
•								30 min ago	
2								32 min ago	

2. Select +Add at the upper part of the window.

≡ Microsoft Az	ıre	\wp Search resources, services, and do	ıcs (G+/)	>_ 🖓	_ @ ? ©	And Descent	2
Home > Resource gro	ups						
Resource group	;						\$ ×
+ Add ≡≡ Edit col	mns 🜔 Refresh 🞍 Export to CSV	🖉 Assign tags 🛛 💙 Feedback					
	Subscription == all Locati	on == all 💿 (+🗢 Add filter					
Showing 1 to 30 of 30 re	cords.					No grouping	\sim
Name ↑↓			Subscription \uparrow_{\downarrow}		Location ↑↓		
					Japan East		,
					Southeast Asia		
					West US		
					South Central US		
					South Central US		
					Japan West		
					East Asia		
					South Central US		
					South Central US		
					North Europe		
					South Central US		
					South Central US		
					Central US		
					Japan East		
					West India		
					Japan East		
					Japan East		
					Japan East		
					· - ·		
< Previous Page	1 V of 1 Next >						

3. Specify Subscription, Resource group, and Region, and click Review+Create.

				>_ Q	Q 6		and strength of
Home > Resource groups > C	Create a resource group						
Create a resource grou	up						
Basics Tags Review + o	create						
Resource group - A container t resources for the solution, or or allocate resources to resource g	that holds related resources for an Az nly those resources that you want to groups based on what makes the mo	ure solution. The resource group can include all the manage as a group. You decide how you want to st sense for your organization. Learn more					
Project details							
Subscription *		``	/				
Resource group *	TestGroup1	,	~				
Region *	(Acia Dacific) Japan Fact		2				
	(Asia Pacific) Japan East						
Review + create	Previous Next : Tags >						
	Next . Tags >						
<							

2. Creating a virtual network

Log in to the Microsoft Azure portal (https://portal.azure.com/) and create a virtual network following the steps below.

1. Select the **Create a resource** icon on the upper part of the window.

crosoft Azure				ces, services, and doo	:s (G+/)	>.	_ 🖓 Q	@? ©	1.0
Azure serv	ices								
+	[]			+		۲		SQL	\rightarrow
Create a resource	Resource groups	Network security groups	Virtual machines	Subscriptions	All resources	App Services	Storage accounts	SQL databases	More services
Recent res	ources								
	NAME			TYPE				LAST VIEWED	
~~>								22 min ago	
								24 min ago	
()								24 min ago	
								26 min ago	
								26 min ago	
•••								27 min ago	
•••								28 min ago	
5								28 min ago	
								28 min ago	
								29 min ago	
								30 min ago	
8								32 min ago	

2. Select **Networking** and then **Virtual network**.

\equiv Microsoft Azure			ervices, and docs (G+/)	>_ 0	ð 🖓	\$? 😊	1000	
Home > New								
New								×
, ○ Search the Marketplace								^
Azure Marketplace See all	Featured See all							
Get started	Virtual network							
Recently created	Quickstairt tutoin							
AI + Machine Learning	Check Point Clo	udGuard laaS R80.10						
Analytics	PREVIEW Learn more)						
Blockchain	Lond Palancar							
Compute	Learn more							
Containers	_							
Databases	Application Gat	eway						
Developer Tools								
DevOps	Front Door							
Identity	Learn more							
Integration	Firewall							
Internet of Things	Learn more							
Modia	Vintual WAN							
Mixed Reality	Learn more							
IT & Management Tools								
n & Management roois	Network securit	y group						
Networking	Calcionaria and							
Software as a Service (SaaS)	ExpressRoute							
Security	Learn more							
Storage	Connection							
Web	Learn more							
								~

3. Specify Name, Address space, Subscription, Resource group, Location, Name of Subnet, and Address range of Subnet, and click Create.

Home > New > Create virtual network Create virtual network Name * Vveti Name * Vveti ID3.50.07-10.50.235 (256 addressep) I addres range *O ID3.60/2 Vveti-1 Create new Location * (data bachc) rapon tast Vveti-1 Vveti-1 Vveti-1 Vveti-1 Voeti-1 ID3.50/2 ID3.50/2 ID3.50/2 Subnet Name * Vveti-1 ID3.50/2 ID3.50/2 ID3.50/2 ID3.50/2 ID3.50/2 Vetel-1 ID3.50/2	Microsoft Azure	>_	Ŗ	L. 6			
Create virtual network × Name * × Yvet! × Address space *O 1053.027 1053.027 × Subcription * × I cation * × (Aia Back(s) pane fast × Subnet × Name * × Vivet! × Address range *O 1053.024 1053.024 × 1053.024 × 1053.024 × 1053.024 × 1053.024 × 1053.024 × 1053.024 × 1053.024 × 1053.024 × 1053.024 × 1053.024 × 1053.024 × 1053.024 × 1053.024 × 1053.024 ×	Home > New > Create virtual network						
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3. Creating a virtual machine

Log in to the Microsoft Azure portal (https://portal.azure.com/) and create virtual machines and disks following the steps below.

Create as many virtual machines as required to create a cluster. Create node1 and then node2.

1. Select the **Create a resource** icon on the upper part of the window.

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Create a resource	Resource groups	Network security groups	Virtual machines	Subscriptions	All resources	App Services	Storage accounts	SQL databases	More services
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2. Select **Compute** and then **See all**.

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3. Select CentOS-based 7.6



- 4. Click Create.
- 5. When the Basics tab appears, specify the settings of Subscription, Resource group, Virtual machine name, Region, Image, Size, Username, Password, and Confirm password. Select Availability set from Availability options, and click Create new under the Availability set field. When Create new appears, specify the settings of Name, Fault domains, and Update domains. Then click OK.

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6. Click **Change size** to display **Select a VM size**.

From the list, choose a size (**Standard - A1** in this guide) suitable for your virtual machine and click **Select**.

Regarding the **Virtual machine name**, node1 is for node1, and node2 is for node2. Click **Next: Disks >** 7. When the **Disks** tab appears, go through the following steps to add a disk to be used for a mirror disk (cluster partition or data partition).

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Azure VMs have one operating syste The size of the VM determines the t	em disk and a temporary d type of storage you can use	isk for short-term storage and the number of data	e. You can attach additional data di disks allowed. Learn more	sks.					
Disk options									
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Enable Ultra Disk compatibility	Yes 💿 No								
① Ult	ra Disk compatibility is no	t available for this VM si	ze and location.						
Data disks									
You can add and configure addition	nal data disks for your virtu	al machine or attach exis	ting disks. This VM also comes with	a					
temporary disk.	Size (GiB)	Disk type	Host caching						
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Create and attach a new disk Al	ttach an existing disk								
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From the DATA DISKS list, click Create and attach a new disk.

8. Create a new disk appears.

Specify the settings of **Name**, **Source type** and **Size**. Then click **OK**. Click **Next: Networking** >.

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		Browse available disk size	es and their features.							
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Name *	node1_DataDisk_0	Size	Disk tier	Max IOPS	Max throughput					
Source type 📩	None (empty disk)	32 GiB	S4	500	60					
Size *	1024 GiB	64 GiB	S6	500	60					
	Standard SSD	128 GiB	S10	500	60					
	Change size	256 GiB	S15	500	60					
		512 GiB	S20	500	60					
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		2048 GiB	S40	500	60					
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		8192 GiB	S60	1300	300					
		16384 GiB	S70	2000	500					
		32767 GiB	S80	2000	500					
		Create a custom size								
		Enter the size of the disk the disk space is being u provisioned.	you would like to create. You wil sed For example, a 200 GiB disk i	ll be charged the same rate for your pi s provisioned on a 256 GiB disk, so yo	rovisioned disk, regardless of how much of u would be billed for the 256 GiB					
		Custom disk size (GiB) 7	•							
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9. The **Networking** tab appears.

Specify the settings of Virtual network, Subnet, NIC Network security group, and Configure network security group.

Click **Create new** under the **Configure network security group** field to display **Create network security group**. Specify the setting of **Name** and then click **OK**.

Click Next: Management >.

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Define network connectivity to ports, inbound and outbound o Learn more	r your virtual machine by configuring connectivity with security group rule	, network interface card (NIC) settings. You can co ;, or place behind an existing load balancing solu	ontrol tion.					
Network interface								
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Load balancing								
You can place this virtual mach	ine in the backend pool of an existin	g Azure load balancing solution. Learn more						
Place this virtual machine behind an existing load balancing solution?	🔿 Yes 💿 No							
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10. The Management tab appears.

Click **Create new** under the **Diagnostics storage account** field to display **Create storage account**. Specify the settings of **Name**, **Account kind**, and **Replication**. Then click **OK**.

In the **Diagnostics storage account** field, the default value is automatically generated and entered. Click **Next: Details >**.

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11. Click Next: Tags >.

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Add additional configuration, agents, scripts or applications via virtu	ual machine extensions or cloud-init.			
Extensions				
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Cloud init				
Cloud init is a widely used approach to customize a Linux VM as it b	poots for the first time. You can use cloud-init to install			
packages and write files or to configure users and security. Learn n	nore			
 The selected image does not support cloud init. 				
Host				
Azure Dedicated Hosts allow you to provision and manage a physic Azure subscription. A dedicated host gives you assurance that only	al server within our data centers that are dedicated to your VMs from your subscription are on the host, flexibility to			
choose VMs from your subscription that will be provisioned on the of the host. Learn more	host, and the control of platform maintenance at the level			
Host group () No bost aroun found	~			
a nos group jound				
Dedicated hosts cannot be used with availability sets.				
Proximity placement group				
Proximity placement groups allow you to group Azure resources ph	ysically closer together in the same region. Learn more			
Proximity placement group () No proximity placement groups for	und v			ì
Review + create < Previous Next : Tags	>			
INCAL TAYS]			
<				>

12. Click **Next: Review + create >**.

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Home > New > Create a virtual machine				
Create a virtual machine				×
Basics Disks Networking Management Advanced	Tags Review + create			
Tags are name/value pairs that enable you to categorize resource:	s and view consolidated billing by applying the same tag to			
multiple resources and resource groups. Learn more about tags				
Note that if you create tags and then change resource settings on	other tabs, your tags will be automatically updated.			
Name 🕕 Value 🗇	Resource			
· · · · · · · · · · · · · · · · · · ·	✓ 11 selected ✓			
Review + create < Previous Next : Rev	iew + create >			
6				>

13. The **Review + create** tab appears. Check the contents. If there is no problem, click **Create**. The deployment starts and takes several minutes.

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Home > New > Create a virtual machine							
Create a virtual machine							\times
Validation passed							
Basics Disks Networking Manage	ment Advanced Tags Review + create						^
PRODUCT DETAILS							
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by Microsoft	6.0500 JPY/hr						
Terms of use Privacy policy	Pricing for other VM sizes						
TERMS							
By clicking "Create", 1(a) agree to the legal terms authorize Microsoft to bill my current payment m my Azure subscription; and (c) agree that Microso the offering(s) for support, billing and other trans Azure Marketplace Terms for additional details.	and privacy statement(s) associated with the Marketplace offering(s) listed above; (b) ethod for the fees associated with the offering(s), with the same billing frequency as ft may share my contact, usage and transactional information with the provider(s) of actional activities. Microsoft does not provide rights for third-party offerings. See the						
Basics							
Subscription	PLUE _ 1114 _ 1.1110						
Resource group T	estGroup1						
Virtual machine name	ode1						
Region (Asia Pacific) Japan East						
Availability options A	vailability set						
Availability set (new) AvailabilitySet1						
Authentication type	assword						
Username t	estlogin						
Azure Spot	lo						
Disks							
OS disk type	tandard HDD						~
Create < Previo	us Next > Download a template for automation						
<							>

4. Setting a private IP address

Log in to the Microsoft Azure portal (https://portal.azure.com/) and change the private IP address setting following the steps below. Since an IP address is initially set to be assigned dynamically, change the

setting so that an IP address is assigned statically. Change the settings of node1 and then node2.

1. Select the **Resource groups** icon on the upper part of the window.

+	[]		.	+		۲		SQL	\rightarrow
Create a resource	Resource groups	Network security groups	Virtual machines	Subscriptions	All resources	App Services	Storage accounts	SQL databases	More services
Recent re	sources								
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9								30 min ago	
8								32 min ago	
Navigate	bscriptions	() Resource	e groups	All r	esources	Dashi	poard		

- 2. Select TestGroup1 from the resource group list.
- 3. The summary of TestGroup1 is displayed. Select virtual machine node1 or node2 from the item list.

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Home > Resource groups > TestGroup1				
FestGroup1				\Rightarrow ×
	Add 🗮 Edit columns 📋 Delete resource group 💍 Refresh	→ Move 🛓 Export to CSV 🛛 🖉 Assign tags	Delete	More
Esse	entials	*		
Filte	er by name Type == all	ty Add filter		
Accord control (IAM) Show	wing 1 to 13 of 13 records. Show hidden types ①		No grouping	~
	Name 🔨	Туре ↑↓	Location ↑↓	
Tags	0	Availability set	Japan East	
7 Events	ф	Virtual machine	Japan East	
Settings	•	Network security group	Japan East	
4 Quickstart	9	Network interface	Japan East	
Deployments	2	Disk	Japan East	
Policies	-	Disk	Japan East	
2 Properties		Virtual machine	Janan Fast	
🔒 Locks	0	Network security aroun	Japan East	
🖳 Export template		Network interface	Japan East	
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So Cost analysis	-	Dick	Japan East	
S Cost alerts	-	Storage account	Japan Fast	
Budgets		Storage account	Japan East	
Advisor recommendations	<**2	Virtual network	Japan East	
Monitoring				
Insights (preview)				
💵 Alerts				
mi Metrics <	< Previous Page 1 V of 1 Next >			
Diagnostic settings	·····			
<				>

4. Select Networking.

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Home > Resource groups > TestGroup	1			
FestGroup1				\times &
, Search (Ctrl+/)	+ Add ≡≡ Edit columns 📋 Delete resource group 🌔 Refresh -	→ Move 🞍 Export to CSV 🛛 🖉 Assign tag	s 🗐 Delete	··· More
Overview	Essentials	*		
Activity log	Showing 1 to 13 of 13 records. Show hidden types O	() no me	No grouping	\sim
Access control (IAM)	□ Name ↑↓	Type ↑↓	Location ↑↓	
 Tags Events 		Availability set	Japan East	
/ Events		Virtual machine	Japan East	
Settings		Network security group	Japan East	
Quickstart		Network interface	Japan East	
Deployments		Disk	Japan East	
Policies		Disk	Japan East	•••
		Virtual machine	Japan East	
Export template		Network security group	Japan East	
		Network interface	Japan East	
Cost Management		Disk	Japan East	
So Cost analysis		Disk	Japan East	
Cost alerts		Storage account	Japan East	
S Budgets	↓ ↔	Virtual network	Japan East	
Advisor recommendations				
Monitoring				
Insights (preview)				
Alerts				
Metrics	< Previous Page 1 V of 1 Next >			
Diagnostic settings				

- 5. Select a network interface displayed in the list. The network interface name is generated automatically.
- 6. Select **IP configurations**.

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Home > Resource groups > TestGroup1	> node1 - Networkir	ng 👌 node1186 - IP	configurations	;						
node1186 - IP configuratio	ons									\times
	🕂 Add 🗄 Sav	ve 🗙 Discard								
Overview	IP forwarding set	ttings								
Activity log	IP forwarding			Disabled Enabled						
Access control (IAM)	Virtual network			Vnet1						
Tags	IP configurations									
Settings	Subnet *			Vnet1-1 (10.5.0.0/24)						\sim
IP configurations	0									
DNS servers	Name	IP Version	Type	Private IP address			Public IP a	dress		
💎 Network security group	inconfig1	IDv4	Primany	10.5.0.4 (Dunamic)			-	ancos		
Properties	ipconing i	12.14	Phillidiy	10.5.0.4 (Dynamic)						
🔒 Locks										
🕎 Export template										
Support + troubleshooting										
📩 Effective security rules										
Effective routes										
📯 New support request										
<										>

- 7. Only ipconfig1 is displayed in the list. Select it.
- 8. Select **Static** for **Assignment** under **Private IP address settings**. Enter the IP address to be assigned statically in the **IP address** text box and click **Save** at the top of the window. The IP address of node1 is 10.5.0.110. The IP address of node2 is 10.5.0.111.

■ Microsoft Azure		>_ 🕼 🗳	© ? ©	
Home > Resource groups > TestGroup1 > node1 - Networking	> node1186 - IP configurations > ipconfig1			
ipconfig1				
🔚 Save 🗙 Discard				
The virtual machine associated with this network interface will be new private IP address. The network interface will be reprovision configuration settings, including secondary IP addresses, subter gateway, will need to be manually reconfigured within the virtua	restarted to utilize the ed and network masks, and default machine. Learn more			
Public IP address settings Public IP address (Disabled) Enabled				
Private IP address settings Virtual network/subnet Vnet1/Vnet1-1				
Assignment Dynamic Static				
IP address * 10.5.0.110				
<				>

9. The virtual machines restart automatically so that new private IP addresses can be used.

5. Configuring virtual machines

Log in to the created node1 and node2 and specify the settings following the procedure below.

Set a partition for the mirror disk resource. Create a file system in the added disk.

Secure an area in the added disk by using the fdisk command and then create a file system.

For details about the partition for the mirror disk resource, see "Partition settings for Mirror disk resource (when using Replicator)." in "Settings after configuring hardware" in "Determining a system configuration".in the Installation and Configuration Guide.

1. Check the partition list. In the following example, the last line shows the added disk.

\$ cat	/proc/partitions							
major	minor #b	locks nar	ne					
2	0	4	fd0					
8	0	31457280	sda					
8	1	512000	sda1					
8	2	30944256	sda2					
8	16	73400320	sdb					
8	17	73398272	sdb1					
8	32	20971520	sdc					
1								

2. Create a cluster partition and data partition in the added disk by using the fdisk command. Allocate 1 GB (1*1024*1024*1024 bytes) or more to a cluster partition. (If the size is specified as just 1 GB,

the actual size will be larger than 1 GB depending on the disk geometry difference. This is not a problem.) Also, do not create a file system in a cluster partition.

3. If you select **Execute initial mkfs** when creating the cluster configuration data by using Cluster WebUI, EXPRESSCLUSTER creates a file system automatically. Note that existing data in the partition will be lost.

6. Configuring a load balancer

Log in to the Microsoft Azure portal (https://portal.azure.com/) and add a load balancer following the steps below.

For details, see the following websites:

• Load Balancer documentaion:

https://docs.microsoft.com/en-us/azure/load-balancer/

1. Select the Create a resource icon on the upper part of the window.

+	[]	-	<u>.</u>	*		۲		SQL	\rightarrow	
Create a resource	Resource groups	Network security groups	Virtual machines	Subscriptions	All resources	App Services	Storage accounts	SQL databases	More services	
Recent res	ources									
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<u> </u>		Paraura	arouns	All r	esources	Dashi	oard			

- 2. Select Networking and then Load Balancer.
- 3. The **Create load balancer** blade is displayed. Specify **Name**. Select **Public** for **Type** and **Basic** for **SKU**, respectively.
- 4. Specify Create new, Public IP address Name and Assignment for Public IP address.
- 5. Specify **Subscription**, **Resource group**, and **Region**, and click **Review+create**. Then click **Create**. Deploying the load balancer starts. This processing takes several minutes.

\equiv Microsoft Azure	Search resources, services, and docs (G+/)		Ģ							
Home > New > Create load balancer										
Create load balancer	Create load balancer ×									
Basics Tags Review + creaters Azure load balancer is a layer 4 loa	ate d balancer that distributes incoming traffic among healthy virtual machine instances. Load									
balancers uses a hash-based distrib destination port, protocol type) has accessible via public IP addresses, o support Network Address Translati	bution algorithm. By default, it uses a 5-tuple (source IP, source port, destination IP, sh to map traffic o available servers. Load balances can either be internet-facing where it is or internal where it is only accessible from a virtual network. Azure load balancers also on (NAT) to route traffic between public and private IP addresses. Learn more.									
Project details										
Subscription *	۰ ۷									
Resource group *	TestGroup1 V									
	Create new									
Instance details										
Name *	TestLoadBalancer 🗸									
Region *	(Asia Pacific) Japan East									
Туре * 🕕	🔿 Internal 💿 Public									
sku * ①	Basic Standard									
Public IP address										
Public IP address *	Create new Use existing									
Public IP address name *	TestLoadBalancerPublicIP 🗸									
Public IP address SKU	Basic									
Assignment *	O Dynamic 💿 Static									
Review + create < Pr	revious Next : Taos > Download a template for automation									
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- 7. Configuring a load balancer (configuring a backend pool)
- 1. Associate a virtual machine registered to the availability set to the load balancer. After the load balancer has been deployed, select the **Resource groups** icon on the upper part of the window.

+	[]			+		۲		SQL	\rightarrow
Create a resource	Resource groups	Network security groups	Virtual machines	Subscriptions	All resources	App Services	Storage accounts	SQL databases	More services
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Navigate		(a)				Dashi	nard		

- 2. Select the resource group to which the created load balancer belongs from the resource group list.
- 3. The summary of the selected resource group is displayed. Select the created load balancer from the item list.

\equiv Microsoft Azure		resources, services, and docs (G+/)	E 🖓 🖓	l	
Home > Resource groups > 1	TestGroup1				
FestGroup1					\$ ×
	«	+ Add ≡≡ Edit columns 📋 Delete resource group 🖒 Refres	$h \rightarrow$ Move \downarrow Export to CSV $ $ \otimes h	Assign tags 🏾 🖄 Delete 🚽 Export templat	te 🦳 ···
() Overview	^	Essentials	*		
Activity log		Filter by name Type == all () Location == a	all ♥ (+ ₇ Add filter		
Access control (IAM)		Showing 1 to 18 of 18 records. Show hidden types ①		No grouping	\sim
🔶 Tags		Name ↑↓	Type ↑↓	Location $\uparrow \downarrow$	
🗲 Events			Availability set	Japan East	^
Settings			DNS zone	global	
📣 Quickstart			Public IP address	Japan East	
Deployments			Public IP address	Japan East	
Policies			Virtual machine	Japan East	
🐲 Properties			Network security group	Japan East	
🔒 Locks			Network interface	Japan East	
🖳 Export template			Disk	Japan East	
Cost Management			Disk	Japan East	
🙇 Cost analysis			Virtual machine	Japan East	
💐 Cost alerts			Network security group	Japan East	
③ Budgets			Network interface	Japan East	
Advisor recommendations			Disk	Japan East	
Monitoring			Disk	Japan East	
Insights (preview)			Storage account	Japan East	
Alerts		C 🔷 TestLoadBalancer	Load balancer	Japan East	···· 🗸
Metrics		Tosti opdPoloncorDublictD	Dublic ID addrace	lanan Fact	
Diagnostic settings	~	< Previous Page 1 V of 1 Next >			
<					>

- 4. Select Backend pools.
- 5. Click Add.

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Home > TestLoadBalancer - Backend poo	ls				
TestLoadBalancer - Backe	end pools				×
	🕂 Add 💍 Refresh				
 Overview Activity log Access control (IAM) Tags Diagnose and solve problems Settings Frontend IP configuration 	Virtual machine No results	Virtual machine status	Network interface	Private IP address	
Backend pools					
Health probes					
📒 Load balancing rules					
Inbound NAT rules					
Properties					
🔒 Locks					
Export template					
Monitoring					
Diagnostic settings					
🯩 Logs					
Support + troubleshooting					
R New support request					

- 6. Add backend pool is displayed. Specify Name.
- 7. Select Virtual machine for Associated to.
- 8. Specify **Virtual machine** and **IP address** for the virtual machine you want to associate. Repeat this procedure for the rest of such virtual machines.
- 9. Then click Add.

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Home > TestGroup1 > TestLoadBalancer	- Backend pools	Add backend pool ×
TestLoadBalancer - Backe	nd pools	lestLoadBalancer
	+ Add 🖒 Refresh	Name *
Overview	Virtual machine Virtual machine status	Virtual network ①
Activity log	No results	Vnet1
Access control (IAM)	NO IESUIS	IP version
🔷 Tags		
Diagnose and solve problems		Virtual machine
Settings		
Frontend IP configuration		Virtual machines
Backend pools		Virtual Machines must be in same location as Load Balancer. Only IP configurations that have
Health probes		the same SKU (Basic/Standard) as the Load Balancer can be selected. All of the IP configurations have to be in the same Virtual Network.
📒 Load balancing rules		
Inbound NAT rules		Virtual machine IP address
Properties		node1 ipconfig1 (10.5.0.110)
🔒 Locks		node2 ipconfig1 (10.5.0.111)
🕺 Export template		
Support + troubleshooting		
Rew support request		
-		Add

- 8. Configuring a load balancer (configuring a health probe)
- 1. Select Health probes.



- 2. Click Add.
- 3. Add health probe is displayed. Specify Name.
- 4. Specify Protocol and Port, and click OK.

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Hor	me > TestGroup1 > Test	LoadBalancer - Health probes > Add health probe							
Ac Test	ld health probe								×
Nai	me *								
Te	estHealthProbe								
Pro	otocol 🛈								
Т	CP	×							
Por	t * ①								
26	5001								
Inte	erval * 🛈								
5									
		seconds							
Unl	healthy threshold *								
2		consecutive failures							
	ОК								
,									

- 9. Configuring a load balancer (setting the load balancing rules)
- 1. Select Load balancing rules.

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Home > TestGroup1 > TestLoadBalancer	- Load balancing rules									
E TestLoadBalancer - Load	balancing rules									×
	+ Add									
Overview	<u>کا</u>									
 Activity log 	Name	\uparrow_{\downarrow} Load balancing rule	\uparrow_{\downarrow} Backend poo	1		\uparrow_{\downarrow}	Health probe	2	\uparrow_{\downarrow}	
Access control (IAM)	No results.									
🔷 Tags										
Diagnose and solve problems										
Settings										
Frontend IP configuration										
Backend pools										
Health probes										
📒 Load balancing rules										
Inbound NAT rules										
Properties										
🔒 Locks										
😫 Export template										
Monitoring										
Diagnostic settings										
😥 Logs										
Support + troubleshooting										
Rew support request										
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- 2. Click Add.
- 3. The Add load balancing rule blade is displayed. Specify Name.
- 4. Specify Port and Backend port, and click OK.

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Home > TestGroup1 > Test	stLoadBalancer - Load balancing rules > Add load balancing rule							
Add load balancing	rule							×
Name *								
TestLoadBalancingRule		 						
IP Version *								
IPv4 IPv6								
Frontend IP address *								
52.185.154.20 (LoadBalanc	erFrontEnd)	\sim						
Protocol								
TCP UDP								
Port *								
80								
Backend port *								
8080		\checkmark						
Backend pool ①								
TestBackendPool		\sim						
Health probe ①								
TestHealthProbe (TCP:2600	01)	\checkmark						
Session persistence ①								
None		\checkmark						
Idle timeout (minutes) 🛈								
0		4						
Floating IP (direct server ref	turn) 🛈							
Disabled Enabled								
ОК								
()

10. Setting the inbound security rules

Log in to the Microsoft Azure portal (https://portal.azure.com/) and set the inbound security rules following the steps below.

- 1. Search for Network security group.
- 2. Select Network security groups.

Microsoft Azure	P Network secuity group		× D G 4	e 🗧	? 😳	-	
Azure servic	Services	See all	Marketplace				~
	Network security groups		Network security group				
+	🜍 Network security groups (classic)		Azure Network Security Group Analytics		SQL	\rightarrow	
Create a	<-> Virtual networks		Documentation		atabases	More services	
resource	Application security groups		Deploy Azure Multi-Factor Authentication - Azure Activ	/e			
	A Groups		Resource Groups				
Recent reso	Network interfaces		No results were found.				
Name	Network Watcher				Viewed		
🚯 Testi oadRais	Host groups				in ago		
	(A) Management groups				00		
	Resource groups				90		
	Resources				90		
Availabilityse	No results were found.				yo		
cluster1.zone	Searching all subscriptions. Change				go		
[iii] TestGroup1		Res	ource group	1 h a	ago		
TestLoadBala	ncerPublicIP	Pub	olic IP address	1 h a	ago		
😨 (Virt	ual machine	4 d a	ago		
📮 :		Virt	ual machine	4 d a	ago		
📮 :		Virt	ual machine	4 d a	ago		
(3)		Net	twork interface	4 d a	ago		
6		Net	work interface	4 d a	ago		
Navigate	ions () Resource groups		All resources	Dashboard	đ		
Tools							~

- 3. From the network security group list, select node1-nsg for node1 or node2-nsg for node2.
- 4. The summary is displayed.

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Home > Network security groups > noc	de1-nsg								
node1-nsg Network security group								\$ ×	
, P Search (Ctrl+/) ≪	→ Move 📋	Delete 💍 Refresh							
Overview	Essentials			*					
Activity log	Inbound security rules								
Access control (IAM)	Priority	Name	Port	Protocol	Source	Destination	Action		
Tags	1000	▲ default-allow-ssh	22	TCP	Any	Any	Allow		
Diagnose and solve problems	1010								
	65000	AllowVnetInBound	Any	Any	VirtualNetwork	VirtualNetwork	Allow		
Settings	65001	AllowAzureLoadBalancerInBound	Any	Any	AzureLoadBalancer	Any	Allow		
Inbound security rules	65500	DenyAllinBound	Any	Any	Any	Any	Oeny		
Outbound security rules	Outbound secu	ity rules							
Network interfaces	Priority	Name	Port	Protocol	Source	Destination	Action		
•> Subnets	65000	Allout(natOutRound	Any	10000	VirtualNetwork	VirtualNatwork	Allow		
Properties	65001	AllowinternatOutBound	Any	Any	Anu	Internet	 Allow 		
🔒 Locks	05001	AllowinternetOutBound	Any	Any	Any	Internet	Allow		
Export template	65500	DenyAllOutBound	Any	Any	Any	Any	o Deny		
Monitoring									
Diagnostic settings									
📫 Logs									
NSG flow logs									
Support + troubleshooting									
📩 Effective security rules									
📯 New support request									
<								>	

- 5. Select **Inbound security rules**.
- 6. Click Add.

- 7. The Add inbound security rule blade is displayed. Specify Name.
- 8. Specify **Destination port range** and **Protocol**, and click **Add**.

Microsoft Azure	,	ces, services, and docs	> 📭 ¢ 🔅 ? 😊 💶 🕒
Create a resource A Home	Home > Network security groups > NetSecGroup Network security grou 《 ぷ × 聞社のディレクトリ(WPEG)	1 - Inbound security rules	Add inbound security rule X NetesGroup1 × P Basic X X
 Dashboard All services FAVORITES 	Add EE Edit columns ···· More Filter by name_ NAME	Search (Ctrl+/) Overview Activity log	* Source @ Any Source port copers. @
All resources	Contraction of the second states	Access control (IAM) Tags Diagnose and solve problems	• • • • • • • • • • • • • • • • • •
App Services Function Apps SQL databases Aprice Cosmos DB	 In regional parts In regional parts 	Settings	Destination port ranges B000 Portcol com com
Virtual machines Load balancers Storage accounts	tel tertingi reg tel tertingi tertingi tertingi	Outbound security rules Network interfaces Subnets	Any ICP UDP • Action Allow Deny • Sociality
Virtual networks Azure Active Directory Monitor	Image: Web Sector output Image: Web Sector output Image: Web Sector output Image: Web Sector output	Properties Locks Automation script	Name TestHTP
Advisor Security Center Cost Management + Bill	 Interneting Interneting Interneting Interneting 	Monitoring Diagnostic settings NGG flow logs	Description
 Help + support Subscriptions App registrations 		Support + troubleshooting Effective security rules New support request	Add

Then, check <*Load_balancer_frontend_IP(public_IP_address)*> specified in the script before recovery action of the multi target monitor resource that is set in "3. Adding a monitor resource". Write down the confirmatory result.

1. Select the **Resource groups** icon on the upper part of the window.

rosont Azure		Ľ	o search resour	ces, services, and add	S (0+/)		_ 477 LJ	\$\$! \$	
Azure servi	ces								
+	[]		P	+		۲		SQL	\rightarrow
Create a resource	Resource groups	Network security groups	Virtual machines	Subscriptions	All resources	App Services	Storage accounts	SQL databases	More services
Recent rese	ources								
	NAME			TYPE				LAST VIEWED	
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								24 min ago	
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9								29 min ago	
.								30 min ago	
8								32 min ago	

2. Select the resource group to which the created load balancer belongs from the resource group list.

3. The summary of the selected resource group is displayed. Select the created load balancer from the item list.

\equiv Microsoft Azure	、P Search resources, services, and docs (G+/) D 取 🗘 🔅	≉ ? ☺	
Home > Resource groups >	TestGroup1		
(TestGroup1 Resource group			\$ ×
. Search (Ctrl+/)	$_{\ll}$ + Add $\equiv\equiv$ Edit columns 📋 Delete resource group 🕐 Refresh \rightarrow Move \downarrow Export to CSV \mid \otimes Assignment Add $\equiv\equiv$ Edit columns	ın tags 📋 Delete 🞍 Export templa	ite 🛛 …
Overview	Essentials ×		
Activity log	Filter by name Type == all () Location == all () († Add filter		
Access control (IAM)	Showing 1 to 18 of 18 records Show hidden types ①	No grouping	~
 Taris 		no grouping	
 Fugst 	Name ↑↓ Type ↑↓	Location ↑↓	
vents	Availability set	Japan East	^
Settings	DNS zone	global	
📣 Quickstart	Public IP address	Japan East	
Deployments	Dublic IP address	Japan East	
Policies	Virtual machine	Japan East	
📒 Properties	Network security group	Japan East	
🔒 Locks	Network interface	Japan East	
関 Export template	Disk	Japan East	
Cost Management	Disk	Japan East	
S Cost analysis	Virtual machine	Japan East	
S Cost alerts	Network security group	Japan East	
Budgets	Network interface	Japan East	
 Advisor recommendations 	Disk	Japan East	
	Disk	Japan East	
Monitoring	Storage account	Japan East	
Insights (preview)	A TestLoadBalancer Load balancer	Japan East	
Alerts	Tertt oodBalancerBublietD Dublic ID address	lanan Fact	···· `
Metrics	C Dravinus Daga 1 X of 1 Novt		
Diagnostic settings	V PICATORS Page I V UT MEAN		
(N

4. The summary of the load balancer is displayed. Select Public IP address from the item list.



11. Adjusting the OS startup time, checking the network setting, checking the root file system, checking the firewall setting, synchronizing the server time, and checking the SELinux setting.

For each procedure, see "Settings after configuring hardware" in "Determining a system configuration" in the Installation and Configuration Guide.

12. Installing EXPRESSCLUSTER

For the installation procedure, see the Installation and Configuration Guide. After installation is complete, restart the OS.

13. Registering the EXPRESSCLUSER license

For the license registration procedure, see the Installation and Configuration Guide.

5.3 Configuring the EXPRESSCLUSTER settings

For the Cluster WebUI setup and connection procedures, see "Creating the cluster configuration data" in the Installation and Configuration Guide.

This section describes the procedure to add the following resources and monitor resources:

- Mirror disk resource
- Azure probe port resource
- Azure probe port monitor resource
- · Azure load balance monitor resource
- Custom monitor resource (for NP resolution)
- IP monitor resource (for NP resolution)
- Multi target monitor resource (for NP resolution)

For the settings of other resources and monitor resources, see the Installation and Configuration Guide and the Reference Guide.

1) Creating a cluster

Start the Cluster generation wizard to create a cluster.

- · Creating a cluster
 - 1. Access Cluster WebUI, and click Cluster generation wizard.

Cluster WebUI <cluster></cluster>				🗲 Confi	g mode 🗸	Ł	٩	ß	۶	i	? 🗉	
Cluster generation wizard	Export Get the Configuration File	Apply the Configuration File	Update Ser	ver Data	¢. Check the Configu	ration File						

2. Cluster of Cluster generation wizard is displayed.

Enter a desired name in **Cluster Name**. Select an appropriate language in **Language**. Click **Next**.

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

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

The instance connected to Cluster WebUI is displayed as a registered master server. Click **Add** to add the remaining instances (by specifying the private IP address of each instance). Click **Next**.

Add server			
Server Name or IP Addre	ess*	10.5.0.111	
• Enter an IP address or When entering a server r Both IPv4 and IPv6 for IF When entering an IP add	a server name. name, name reso address can be ress, the server r	lution is necessary. used. name is automatically a	cquired.
			OK Cancel
Cluster generation wizar	d		
Cluster S Add Remove Server Definitions Order Nar	n gs → Intercon ne	nnect ᢣ NP Resolutio	n → Group →
Master server nod	e1		
1 nod T Server Group Definition	e2		Settings
Click "Add" to add servers Click 「↑」 or 「↓」 to chang Click "Settings" to configure to	constructing the clu the server priority the server group wh	ister. y. en using the server group.	

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

Specify the IP addresses (IP address of each instance) to be used for interconnect. In addition, select mdc1 for **MDC** as a communication path of a mirror disk resource to be created later. Click **Next**.

Cluster generation wizard				×
Cluster Server Properties Add Remove	Server	Server ◆ NP Resolution → 0	Group 🔶 Monitor	
Interconnect List Priority Type	MDC	node1	node2	
1 Kernel Mode 🗸	mdc1 🗸	10.5.0.110 🗸	10.5.0.111	\checkmark
↑ ↓				
● Configure the interconnect among For "Kernel mode", "User mode", "BM Only" setting, configure the route whit Configuring more than one routes is n For "Kernel mode" ", "User mode, "Di For "Witness HB" setting, click each s Click 1 [↑] ar " J" to configure the prior For "Mirror Communication Only" sett For the communication route which is MDC column.	the servers const IC", "DISK", "Witi ch is used only for ecommended. SK" and "COM" server column cell rity to preferentia ings, click each s used for data m	ructing the cluster.Click "Add" to ress HB" and "COM" settings, cor or data mirroring communication. ettings, click each server column to set "Use" or "Do not use", and ully use the LAN only for the com erver column cell to configure IP rroring communication, select th	add interconnect and select th figure the route which is used cell and set an IP address or of then click "Properties" to set nunication among the cluster addresses. e mirror disk connect name to	e type. for heartbeat. For "Mirror Communication device. detailed settings. servers. be allocated to the communication route in
				Back Next Cancel

5. The **NP Resolution** window is displayed.

Note that NP resolution is not configured on this window. The equivalent feature is achieved by adding the IP monitor resource, custom monitor resource, and multi target monitor resource. Configure NP resolution in "3. Adding a monitor resource".

You need to examine the NP resolution destination and method depending on the location of clients accessing a cluster system and the condition for connecting to an on-premise environment (for example, using a dedicated line). There is no NP resolution destination nor method to recommend. Additionally, you can use network partition resolution resources for NP resolution.

Click Next.

Cluster generation wizard				×
Cluster ♥ → Basic Settings ♥	Server Server → Interconnect ♥ → NP Resol	ution → Group	➔ Monitor	
Properties Add Remove				
NP Resolution List				
Type Target	node1 node2			
Tuning				
Configure network partition (NP) Click "Add" to add NP resolution res For "Ping" setting, dick Target colu For "HTTP" setting, dick Target colu The detailed settings can be verified Click "Tuning" to configure the action	resolution function. source and select the type. mn cell to configure IP address of Ping dee umn cell to configure HTTP packet destina d and changed by clicking "Properties". ons at NP occurrence.	tination, and then clic tion, and then click ea	ck each server column cell to c ach server column cell to config	configure "Use" or "Do not use". gure "Use" or "Do not use".
				Back Next ► Cancel

- 2) Adding a group resource
- Defining a group

Create a failover group.

1. The Group List window s displayed.

Click Add.	
Cluster generation wizard	×
Server Server Server Cluster ♥ → Basic Settings ♥ → Interconnect ♥ → NP Resolution ♥ → Group → Monitor Properties Add Remove	Group Resource
Group List Name Type	1
No groups	
 Configure failover group to be a unit of fail over. Click "Add" to add a group. Click "Properties" to configure the properties of the selected group. Click "Group Resource" to add resource to the selected group. 	
4	Back Next Cancel

2. The Group Definition window is displayed.

S	becify	a failover	group name	(failover1)	for Name.	Click Next.
· · ·			0	(

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

- 3. The **Startup Servers** window is displayed. Click **Next** without specifying anything.
- 4. The Group Attributes window is displayed.

Click Next without specifying anything.

5. The Group Resource window is displayed.

On this page, add a group resource following the procedure below.

Group Definition	failover 🗙			
Basic Settings ⊘ → Startup Servers ⊘ → Group Attributes ⊘ → Group Res	source			
Properties Add Remove				
Group Resource List				
Name Type				
No resources				
Click "Add" to add resources. Click "Properties" to configure the properties of the selected resource.				
	Back Finish Cancel			

• Mirror disk resource

Create a mirror disk resource. For details, see Understanding Mirror disk resources in "Group resource details" in the Reference Guide.

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

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

Resource Definition of Group failover1 md				
Info → Dependency → Recovery	Operation 🔶 Details			
Туре*	Mirror disk resource			
Name*	md			
Comment				
Get License Info				
Select the type of group resource and enter its name.				

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

Enter the device name of the partition created in "5. Configuring virtual machines" in Data Partition Device Name and Cluster Partition Device Name. Specify Mount Point and File System. Click Finish to finish setting.
Resource Definition of Group failover	r1	md 🗙
Info ⊘ → Dependency ⊘ → Reco Common node1 node2	overy Operation 🔗 🔶 Det	tails
Mirror Partition Device Name*	/dev/NMP1 🗸	
Mount Point*	/mnt/md	
Data Partition Device Name*	/dev/sdc2 🗸	·
Cluster Partition Device Name*	/dev/sdc1 🗸	·
File System*	ext4 🗸	·
Mirror Disk Connect		Select
Tuning		
		Back Finish Cancel

• Azure probe port resource

When EXPRESSCLUSTER is used on Microsoft Azure, EXPRESSCLUSTER provides a mechanism to wait for alive monitoring from a load balancer on a port specific to a node in which operations are running. For details about the Azure probe port resources", see "Understanding Azure probe port resources" in "Group resource details" in the Reference Guide.

- 1. Click Add on the Group Resource List page.
- 2. The **Resource Definition of Group | failover1** window is displayed. Select the group resource type (Azure probe port resource) from the **Type** box and enter the group name (azurepp1) in the **Name** box. Click **Next**.

Resource Definition of Group failover1						
Info → Dependency → Recovery Operation → Details						
Туре*	Azure probe port resource \checkmark					
Name*	azurepp1					
Comment						
Get license information						
• Select the type of group resource and	enter its name.					
			Next 🕨	Cancel		

- 3. The Dependency window is displayed. Click Next without specifying anything.
- 4. The Recovery Operation window is displayed. Click Next.
- 5. For **Probeport**, enter the value specified for **Port** when configuring a load balancer (configuring health probe).

Resource Definition of Group failover1 azurepp					
Info 🛇 🔸 Dependency 🛇 🔸	Recovery Operation 📀 🔶 Details				
Probeport*	26001				
Tuning					
		Back Finish Cancel			

- 6. Click Finish.
- 3) Adding a monitor resource
- Azure probe port monitor resource

The port monitoring mechanism for alive monitoring is provided for the node in which the Microsoft Azure probe port resource is running. For details about the Azure probe port monitor resource, see "Understanding Azure probe port monitor resources" in the Reference Guide. Adding one Azure probe port monitor resource creates one Azure probe port monitor resource automatically.

· Azure load balance monitor resource

The mechanism to monitor whether the port with the same port number as the probe port is open or not is provided for the node in which the Microsoft Azure probe port resource is not running. For details about the Azure load balance resource, see "Understanding Azure load balance monitor resources" in the Reference Guide. Adding one Azure probe port resource creates one Azure load balance monitor resource automatically.

• Custom monitor resource

Sets a script to monitor whether communication with Microsoft Azure Service Management API is possible, and also monitors health of communication with an external network. For details about the custom monitor resource, see "Understanding custom monitor resources" in the Reference Guide.

- 1. Click Add on the Monitor Resource List page.
- 2. Select the monitor resource type (Custom monitor) from the **Type** box and enter the monitor resource name (genw1) in the **Name** box. Click **Next**.

Monitor Resource Definition		genw 🗙
Info → Monitor(common) → Mon	itor(special) 🔶 Recovery Action	
Туре*	Custom monitor 🗸 🗸	
Name*	genw1	
Comment		
Get Licence Info		
• Select the type of monitor resource ar	nd enter its name.	

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

Monitor Resource Definition		genw 🗙
Info 🛛 🔸 Monitor(common) 🔸 Monitor(special)	→ Recovery	Action
Interval*	60	sec
Timeout*	120	sec
Do Not Retry at Timeout Occurrence		
Do Not Execute Recovery Action at Timeout Occurrence		
Retry Count*	0	time
Wait Time to Start Monitoring*	0	sec
Monitor Timing		
Always		
○ Active		
Target Resource		Browse
Nice Value		0
Choose servers that execute monitoring	Server	
		Back Next Cancel

4. The Monitor (special) window is displayed.

Select Script created with this product.

The following shows the sample of a script to be created.

Select Synchronous for Monitor Type. Click Next.



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

Select Execute only the final action for Recovery Action, LocalServer for Recovery Target, and No operation for Final Action.

Monitor Resource Definition									genw 🗙	ς
Info 🛛 🔸 Monitor(common) 🛇	→	Monitor(special) \bigcirc \rightarrow	R	Recovery Act	tion					
Recovery Action		Execute only the final acti	tion	1					~	
Recovery Target *		LocalServer			E	Browse				
Recovery Script Execution Count										
Execute Script before Reactivation										
Maximum Reactivation Count										
Execute Script before Failover										
Execute migration before Failover										
Maximum Failover Count										
Execute Script before Final Action										
Final Action		No operation		,	~					
								Script	Settings	
							Fi	nish	Cancel	

- 6. Click **Finish** to finish setting.
- IP monitor resource

Creates an IP monitor resource to monitor communication between clusters that are configured with virtual machines, and also to monitor whether communication with an internal network is health. For details about the IP monitor resource, see Understanding IP monitor resources in the Reference Guide.

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

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

3. The **Monitor (common)** window is displayed. Confirm that **Monitor Timing** is **Always**.

Monitor Resource Definition		ipw (
Info 🛇 🔶 Monitor(common) 🍝 Monitor(special)	→ Recovery	y Action	
Interval*	30	sec	
Timeout*	30	sec	
Collect the dump file of the monitor process at timeout occurrence			
Do Not Retry at Timeout Occurrence			
Do Not Execute Recovery Action at Timeout Occurrence			
Retry Count*	0	time	
Wait Time to Start Monitoring*	0	sec	
Monitor Timing			
Always			
○ Active			
Target Resource		Browse	
Nice Value		0	
Choose servers that execute monitoring	Server		

Select one available server for Choose servers that execute monitoring.

Failure Detection Server			i .
 All servers Select Servers that can run the Group 		Available Servers	
Name	←	Name	
node1	Add	node2	
	→ Remove		
			OK Cancel Apply

Click Next.

4. The Monitor (special) window is displayed.



On the **Common** tab, select **Add** of **IP Address** and set an IP address of a server other than the server selected in step 3. Click **Next**.

JS	
10.5.0.111	
	OK Cancel
	10.5.0.111

Monitor Resource Definition	ipw 🗙
Info ♥ → Monitor(common) ♥ → Monitor(special) → Recovery Action Common node1 node2 Edit Add Remove IP Address List	
10.5.0.111	
	Back Next Cancel

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

Select Execute only the final action for Recovery Action, LocalServer for Recovery Target, and No operation for Final Action.

Monitor Resource Definition			ipw 🗙
Info 📀 🔸 Monitor(common) 📀	→ Monitor(special) → Recov	very Action	
Recovery Action	Execute only the final action		~
Recovery Target *	LocalServer	Browse	
Recovery Script Execution Count			
Execute Script before Reactivation			
Maximum Reactivation Count			
Execute Script before Failover			
Execute migration before Failover			
Maximum Failover Count			
Execute Script before Final Action			
Final Action	No operation	~	
		Script S	Settings
		Back Finish	Cancel

- 6. Click **Finish** to finish setting.
- 7. Then, create a monitor resource on the other server. Click Add on the Monitor Resource List page.
- 8. Select the monitor resource type (ip monitor) from the **Type** box and enter the monitor resource name (ipw2) in the **Name** box. Click **Next**.
- The Monitor (common) window is displayed. Confirm that Monitor Timing is Always. Select one available server for Choose servers that execute monitoring. Click Next.
- The Monitor (special) window is displayed.
 On the Common tab, select Add of IP Address and set an IP address of a server other than the server selected in step 9. Click Next.
- The Recovery Action window is displayed.
 Select Execute only the final action for Recovery Action, LocalServer for Recovery Target, and No operation for Final action.

- 12. Click Finish to finish setting.
- Multi target monitor resource

Creates a multi target monitor resource to check the statuses of the custom monitor resource and IP monitor resource. The custom monitor resource monitors communication to Microsoft Azure Service Management API. The IP monitor resource monitors communication between clusters that are configured with virtual machines. If their statuses are abnormal, execute the script in which the processing for NP resolution is described. For details about the multi target monitor resource, see Understanding multi target monitor resources in the Reference Guide.

- 1. Click Add on the Monitor Resource List page.
- 2. Select the monitor resource type (Multi target monitor) from the **Type** box and enter the monitor resource name (mtw1) in the **Name** box. Click **Next**.

Monitor Resource Definition		mtw 🗙
Info → Monitor(common) → Mon	itor(special) \rightarrow Recovery Action	
Туре*	Multi target monitor	
Name*	mtw1	
Comment		
Get Licence Info		
• Select the type of monitor resource an	nd enter its name.	
		Back Next Cancel

3. The **Monitor** (common) window is displayed.

Confirm that Monitor Timing is Always and click Next.

Monitor Resource Definition					mtw 🗙
Info 📀 🔶 Monitor(common) 🍝 Monitor(special)	→ Recovery	Action			
Interval*	30	sec			
Timeout*	30	sec			
Collect the dump file of the monitor process at timeout occurrence					
Do Not Retry at Timeout Occurrence					
Do Not Execute Recovery Action at Timeout Occurrence					
Retry Count*	0	time			
Wait Time to Start Monitoring*	0	sec			
Monitor Timing					
 Always 					
○ Active					
Target Resource				Bro	wse
Nice Value			_		0
Choose servers that execute monitoring	Server				
			 Back 	Next 🕨	Cancel

4. The Monitor (special) window is displayed.

From **Available Monitor Resources**, select the custom monitor resource (genw1) for checking communication with Service Management API and two IP monitor resources (ipw1 and ipw2) that are set to both servers. Then, click **Add** to add them to **Monitor Resource List**. Click **Next**.

Monitor Resource Definition	'n			mtw 🗙
Info 🛇 🔸 Monitor(comr	non) 📀 🔶 Mon	itor(special) 🔶 R	Recovery Action	
Monitor Resources			Available Monitor Resources	
Monitor Resource	Туре	~	Monitor Resource	Туре
genw1	genw	Add	No Available Monitor Resources	
ipw1	ipw	<i>></i>		
ipw2	ipw	Remove		
Tuning				
			Gack Next Next	Cancel

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

Select Execute only the final action for Recovery action, LocalServer for Recovery Target, and No operation for Final action, and select the Execute Script before Final Action check box.

Click **Script Settings** and create a script to be executed when the multi target monitor resource detects an error.

	~		A ation		- III.W >
Recovery Action	7	Execute only the final action	covery Action		
Recovery Target *		LocalServer		Browse	
Recovery Script Execution Count					
Execute Script before Reactivation					
Maximum Reactivation Count					
Execute Script before Failover					
Execute migration before Failover					
Maximum Failover Count					
Execute Script before Final Action		v			
Final Action		No operation	~		
					Script Settings
				A Back	Finish Cancel

6. The script editing dialog box is displayed.

Select **Script created with this product** and click **Edit** to edit the script. The following shows the sample of a script to be created.

Specify the following by referring to "4.1. Creation example" The ports differ depending on operations.

- Load balancing rule > Backend port of the load balancer
- Load balancing rule > Port of the load balancer

Set the public IP address that you wrote down in "10) Setting the inbound security rules" to the following: - **Frontend IP** (public IP address) of the load balancer

For **Timeout**, specify a value larger than the timeout value of clpazure_port_checker (fixed to five seconds). In the case of the above sample script, it is recommended to set a value larger than 10 seconds in order to execute clpazure_port_checker twice. Click **OK**.

Edit Script					×
○ User Application ● Script created with this pro	oduct				
File	preactio	n.sh			
Timeout*	5	sec	Edit	View	Replace
			OK	Cancel	Apply

7. Click Finish to finish setting.

4) Setting the cluster properties

For details about the cluster properties, see "Cluster properties" in the Reference Guide.

• Cluster properties

Configure the settings in Cluster Properties to link Microsoft Azure and EXPERSSCLUSTER.

1. Enter Config Mode from Cluster WebUI, click the property icon of the cluster name.

Cluster Properties Cluster1		
Info Interconnect NP Resolution Alert Service WebManager API E Extension	Timeout Port No. Port No.(Mirror) Encryption Alert Log Delay Warnin) Port No.(Log) Monitor Recovery g Mirror Agent Mirror Driver
Cluster Name	Cluster1	
Comment		
Language	English 🗸	
		OK Cancel Apply

- 2. Select the **Timeout** tab. For **Timeout** of **Heartbeat**, specify a value calculated by "A+B+C" as described below.
 - A: Interval of the monitor resource being monitored by the multi target monitor resource for NP resolution x (Retry Count+1)

- * Among three monitor resources, select the monitor resource whose calculation result is the largest.
- B: Interval of the multi target monitor resource x (Retry Count+1)
- C: 30 seconds (Waiting time for heartbeat not to time out before the multi target monitor resource detects an error. The time can be changed accordingly.

Note: If **Timeout** of **Heartbeat** is shorter than the time that the multi target monitor resource requires to detect an error, a heartbeat timeout will be detected before starting the NP resolution processing. In this case, the same service may start doubly in the cluster because the service also starts on the standby server.

Cluster Properties Cluster1						×	
Info Interconnect NP Resolution Alert Service WebManager API E Extension	Timeout P	Port No. Alert Log	Port No.(Mirror) Delay Warning	Port No.(Log) Mirror Agent	Monitor Mirror Driv	Recovery ver	
Server Sync Wait Time*	5	min					
Heartbeat							
Interval*	3	sec					
Timeout*	120	sec					
Server Internal Timeout*	180	sec					
Initialize							
				C	OK Cano	el Apply	

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

5.4 Verifying the created environment

Verify whether the created environment works properly by generating a monitoring error to fail over a failover group. If the cluster is running normally, the verification procedure is as follows:

- 1. Start the failover group (failover1) on the active node (node1). In the **Status** tab on the Cluster WebUI, confirm that **Group Status** of failover1 of node1 is **Normal**.
- 2. Change Operation Mode to Verification Mode from the Cluster WebUI pull-down menu.
- 3. In the Status tab on the Cluster WebUI, click the Enable dummy failure icon of azureppw1 of Monitors.
- 4. After the Azure probe port resource (azurepp1) activated three times, the failover group (failover1) becomes abnormal and fails over to node2. In the **Status** tab on the Cluster WebUI, confirm that **Group Status** of failover1 of node2 is **Normal**.

Also, confirm that access to the frontend IP and port of the Azure load balancer is normal after the failover.

Verifying the failover operation in case of a dummy failure is now complete. Verify the operations in case of other failures if necessary.

CLUSTER CREATION PROCEDURE (FOR AN HA CLUSTER USING AN INTERNAL LOAD BALANCER)

6.1 Creation example

This guide introduces the procedure for creating a 2-node unidirectional standby cluster using EXPRESSCLUSTER. This procedure is intended to create a mirror disk type configuration in which node1 is used as an active server.

The following tables describe the parameters that do not have a default value and the parameters whose values are to be changed from the default values.

• Microsoft Azure settings (common to node1 and node2)

Setting item	Setting value
Resource group setting	
Resource group	TestGroup1
Region	(Asia Pacific) Japan East
Virtual network setting	
Name	Vnet1
Address space	10.5.0.0/24
Subnet Name	Vnet1-1
Subnet Address range	10.5.0.0/24
Resource group	TestGroup1
Location	(Asia Pacific) Japan East
Load balancer setting	
Name	TestLoadBalancer
Туре	Internal
Virtual network	Vnet1
Subnet	Vnet1-1
IP address assignment	Static
Private IP address	10.5.0.200
Resource group	TestGroup1
Region	(Asia Pacific) Japan East
Backend pool: Name	TestBackendPool
Associated to	Availability set
Target virtual machine	
	node1
	node2

Continued on next page

Setting item	Setting value
Network IP configuration	
	10.5.0.110
	10.5.0.111
Health probe: Name	TestHealthProbe
Health probe: Port	26001
Load balancing rule: Name	TestLoadBalancingRule
Load balancing rule: Port	80 (Port number offering the operation)
Load balancing rule: Backend port	8080 (Port number offering the operation)

Table 6.1 – continued from previous page

• Microsoft Azure settings (specific to each of node1 and node2)

Setting item	Setting value				
	node1	node2			
Virtual machine setting					
– Disk type	Standard HDD				
– User name	testlogin				
– Password	PassWord_123				
– Resource group	TestGroup1				
– Region	(Asia Pacific) Japan East				
Network security group setting					
– Name	node1-nsg	node2-nsg			
- Availability set setting					
– Name	AvailabilitySet1				
– Update domains	5				
– Fault domains	2				
Diagnostics storage account setti	ing				
– Name	Automatically generated				
– Performance	Standard				
– Replication	Locally-redundant storage (LRS)				
IP configuration setting					
– IP address	10.5.0.110 10.5.0.111				
Disk setting					
– Name	node1_DataDisk_0	node2_DataDisk_0			
– Source type	None (empty disk)				
– Account type	Standard HDD				
– Size	20				

• EXPRESSCLUSTER settings (cluster properties)

Setting item	Setting value	
	node1	node2
– Cluster Name	Cluster1	
– Server Name	node1	node2
– NP Resolution Tab: Type	Ping	
– NP Resolution Tab: Ping Target	10.5.0.5	
– NP Resolution Tab: <server> column</server>	Use	Use

• EXPRESSCLUSTER settings (failover group)

Resource name	Setting item	Setting value
Mirror disk resource	Name	md
	Details Tab: Mount Point	/mnt/md
	Details Tab: Data Partition Device	/dev/sdc2
	Name	
	Details Tab: Cluster Partition De-	/dev/sdc1
	vice Name	
	Details Tab: File System	ext4
	Mirror Tab: Execute the initial	On
	mirror construction	
	Mirror Tab: Execute initial mkfs	On
Azure probe port resource	Name	azurepp1
	Probe port	26001 (Value specified for Port of
		Health probe)
Exec resource (for DSR)	Name	exec1

• EXPRESSCLUSTER settings (monitor resource)

Monitor resource name	Setting item	Setting value
Mirror disk monitor resource	Name	mdw1
Azure probe port monitor resource	Name	azureppw1
	Recovery Target	azurepp1
Azure load balance monitor resource	Name	aurelbw1
	Recovery Target	azurepp1

6.2 Configuring Microsoft Azure

1) Creating a resource group

Log in to the Microsoft Azure portal (https://portal.azure.com/) and create a resource group following the steps below.

1. Select the **Resource groups** icon on the upper part of the window. If there are existing resource groups, they are displayed in a list.

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2. Select +Add at the upper part of the window.

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Home > Resource groups			
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3. Specify Subscription, Resource group, and Region, and click Review+Create.

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Home > Resource groups > C	Create a resource group							
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Resource details Region ★⊙	(Asia Pacific) Japan East		Y					
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2) Creating a virtual network

Log in to the Microsoft Azure portal (https://portal.azure.com/) and create a virtual network following the steps below.

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Create a resource	Resource groups	Network security groups	Virtual machines	Subscriptions	All resources	App Services	Storage accounts	SQL databases	More services	
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1. Select the Create a resource icon on the upper partof the window.

2. Select Networking and then Virtual network.



3. Specify Name, Address space, Subscription, Resource group, Location, Name of Subnet, and Address range of Subnet, and click Create.

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Home > New > Create virtual network								_
Create virtual network	×							
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3) Creating a virtual machine

Log in to the Microsoft Azure portal (https://portal.azure.com/) and create virtual machines and disks following the steps below.

Create as many virtual machines as required to create a cluster. Create node1 and then node2.

1. Select the **Create a resource** icon on the upper part of the window.

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2. Select Compute and then See all.



3. Select CentOS-based 7.6.

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customization. Looking for classic VMs?	Compute	This distribution of Linux is based on CentOS and is provided by Rogue Wave Software.	
	Containers	CentOS-based 7.6	
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	Integration	CentOS-based 7.4 HPC Roque Wave Software (formerly OpenLogic)	
Instance details	Internet of Things	This distribution of Linux is based on CentOS and is provided by Rogue Wave Software.	
Virtual machine name *	IT & Management Tools	CentOS-based 7.7	
Perion *	Media	This distribution of Linux is based on CentOS and is provided by Rogue Wave Software.	
Region	Mixed Reality	CentOS-based 7.5	
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	Software as a Service (SaaS)	Rogue Wave Software (formerly OpenLogic)	
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- 4. Click Create.
- 5. When the Basics tab appears, specify the settings of Subscription, Resource group, Virtual

machine name, Region, Image, Size, Username, Password, and Confirm password. Select Availability set from Availability options, and click Create new under the Availability set field. When Create new appears, specify the settings of Name, Fault domains, and Update domains. Then click OK.

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6. Click Change size to display Select a VM size.

From the list, choose a size (**Standard** - **A1** in this guide) suitable for your virtual machine and click **Select**.

Regarding the **Virtual machine name**, node1 is for node1, and node2 is for node2. Click **Next: Disks >**

7. When the **Disks** tab appears, go through the following steps to add a disk to be used for a mirror disk (cluster partition or data partition).

From the DATA DISKS list, click Create and attach a new disk.

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Azure VMs have one operating The size of the VM determines	g system disk and a temporary disk the type of storage you can use an	for short-term storage. You id the number of data disk	u can attach additional data di s allowed. Learn more	sks.					
Disk options									
OS disk type ⊁	Standard HDD			\sim					
Enable Ultra Disk compatibilit ①	Y 🔿 Yes 🔘 No								
	Ultra Disk compatibility is not av	vailable for this VM size ar	id location.						
Data disks You can add and configure ad temporary disk.	ditional data disks for your virtual n	nachine or attach existing o	lisks. This VM also comes with	a					
LUN Name	Size (GiB)	Disk type	Host caching						
Create and attach a new disk	Attach an existing disk								
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,									

8. Create a new disk appears.

Specify the settings of **Name**, **Source type** and **Size **. Then click **OK**. Click **Next: Networking >**

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Home > New > Create a v	rirtual machine > Create a new disk	Select a disk size			×
Create a new disk					
		Browse available disk size	s and their features.		
Create a new disk to store a	pplications and data on your VM. Disk pricin	Account type ①			
storage type, and number o	i transactions. Learn more about Azure Mar	Standard HDD			~
Name *	node1_DataDisk_0	Size	Disk tier	Max IOPS	Max throughput
Source type *	None (empty disk)	32 GiB	S4	500	60
Size *	1024 GiB	64 GiB	S6	500	60
	Standard SSD	128 GiB	S10	500	60
	Change size	256 GiB	S15	500	60
		512 GiB	S20	500	60
		1024 GiB	S30	500	60
		2048 GiB	S40	500	60
		4096 GiB	S50	500	60
		8192 GiB	S60	1300	300
		16384 GiB	S70	2000	500
		32767 GiB	S80	2000	500
		Create a custom size			
		Enter the size of the disk y the disk space is being us provisioned.	/ou would like to create. You wi ed For example, a 200 GiB disk	ill be charged the same rate for your pr is provisioned on a 256 GiB disk, so you	ovisioned disk, regardless of how much of I would be billed for the 256 GiB
		Custom disk size (GiB) *			
		20			✓
ок		ОК			
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9. The Networking tab appears.

Specify the settings of Virtual network, Subnet, NIC Network security group, and Configure network security group.

Click **Create new** under the **Configure network security group** field to display **Create network security group**. Specify the setting of **Name** and then click **OK**.

Click **Next: Management >**.

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Home > New > Create a virt	ual machine						
Create a virtual mach	ine						×
Basics Disks Networki	ing Management Advanced	Tags Review + create					
Define network connectivity fo ports, inbound and outbound Learn more	rr your virtual machine by configuring connectivity with security group rules	network interface card (NIC) settings. You can contr , or place behind an existing load balancing solution	ol				
Network interface							
When creating a virtual machir	ne, a network interface will be created	for you.					
Virtual network *	Vnet1		\sim				
	Create new						
Subnet *	Vnet1-1 (10.5.0.0/24)		\sim				
	Manage subnet configuration						
Public IP 🕕	None		\sim				
	Create new						
NIC network security group 🛈) 🔿 None 🔿 Basic 💿 Advan	ced					
Configure network security	(new) node1-nsg		\sim				
group *	Create new						
Accelerated networking $\ensuremath{\bigcirc}$	🔾 On 🖲 Off						
	The s	elected VM size does not support accelerated netv	vorking.				
Load balancing							
You can place this virtual mach	nine in the backend pool of an existin	g Azure load balancing solution. Learn more					
Place this virtual machine behind an existing load balancing solution?	🔿 Yes 💿 No						
Review + create	< Previous Next : Mana	gement >					
<							>

10. The Management tab appears.

Click **Create new** under the **Diagnostics storage account** field to display **Create storage account**. Specify the settings of **Name**, **Account kind**, and **Replication**. Then click **OK**.

In the **Diagnostics storage account** field, the default value is automatically generated and entered. Click **Next: Details >**

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Home > New > Create a virtu	al machine						
Create a virtual machi	ne						\times
Basics Disks Networking	ng Management Advanced	Tags Review + create					
Configure monitoring and man	agement options for your VM.						
Azure Security Center							
Azure Security Center provides Learn more	unified security management and a	ivanced threat protection across hybrid	cloud workloads.				
 Your subscription is protect 	ted by Azure Security Center basic	lan.					
Monitoring							
Boot diagnostics ①	● On ○ Off						
OS guest diagnostics ①	🔿 On 🖲 Off						
Diagnostics storage account * ①	(new) testgroup1diag600 Create new		~				
Identity							
System assigned managed identity	🔿 On 💿 Off						
Azure Active Directory							- 1
Login with AAD credentials (Preview) 🛈	🔾 On 🖲 Off						
A This image does not supp	ort Login with AAD.						~
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EXPRESSCLUSTER X 4.2 HA Cluster Configuration Guide for Microsoft Azure (Linux), Release 2

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Home > New > Create a virtual machine			Create storage account $ imes$
Create a virtual machine			
Basics Disks Networking Managem Configure monitoring and management options Azure Security Center Azure Security Center provides unified security n Learn more	ent Advanced Tags Review + create for your VM.		Name * ketgroup1diag600 .core.windows.net Account kind () Storage (general purpose v1) ~ Performance () (Standart Premium)
Your subscription is protected by Azure Sec	urity Center basic plan.		Replication ① Locally-redundant storage (LRS)
Monitoring			
Boot diagnostics ①	ff		
OS guest diagnostics ① On O On	ff		
Diagnostics storage account * (new) testgrou ① Create new	p1diag600 V		
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System assigned managed On 💿 O identity 🛈	ff		
Azure Active Directory			
Login with AAD credentials On On	ff		
A This image does not support Login with AAD			
Review + create < Previous	Next : Advanced >	-	OX

11. Click Next: Tags >.

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Home > New > Create a virtual machine					
Create a virtual machine					×
Basics Disks Networking Management Advanced	Tags Review + create				^
Add additional configuration, agents, scripts or applications via virt	ual machine extensions or cloud-init.				
Extensions					
Extensions provide post-deployment configuration and automation					
Extensions ① Select an extension to install					
Cloud init					
Cloud init is a widely used approach to customize a Linux VM as it t packages and write files or to configure users and security. Learn n	oots for the first time. You can use cloud-init to install hore				
1 The selected image does not support cloud init.					
Host Azure Dedicated Hosts allow you to provision and manage a physic Azure subscription. A dedicated host gives you assurance that only choose VMs from your subscription that will be provisioned on the of the host. Learn more	al server within our data centers that are dedicated to your VMs from your subscription are on the host, flexibility to host, and the control of platform maintenance at the level				
Host group () No host group found	\checkmark				
() Dedicated hosts cannot be used with availability sets.					
Proximity placement group					
Proximity placement groups allow you to group Azure resources ph	ysically closer together in the same region. Learn more				
Proximity placement group No proximity placement groups for	und V				~
Review + create < Previous Next : Tags	>				
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12. Click Next: Review + create >

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Home > New > Create a virtual machine			
Create a virtual machine			×
Basics Disks Networking Management	Advanced Tags Review + create		
Tags are name/value pairs that enable you to catego	arize resources and view consolidated billing by applying the same tag to		
multiple resources and resource groups. Learn more	about tags of		
Note that if you create tags and then change resource	e settings on other tabs, your tags will be automatically updated.		
Name 🕕 Value 🔅) Resource		
✓ :	✓ 11 selected ✓		
Review + create < Previous	Next : Review + create >		
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13. The **Review + create** tab appears. Check the contents. If there is no problem, click **Create**. The deployment starts and takes several minutes.

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Home > New > Create a virtual machine							
Create a virtual machine							\times
Validation passed							
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PRODUCT DETAILS							
Standard A1 v2	ubscription credits apply ${\mathbb O}$						
by Microsoft	6.0500 JPY/hr						
Terms of use Privacy policy	Pricing for other VM sizes						
TERMS							
By clicking "Create", 1(a) agree to the legal terms authorize Microsoft to bill my current payment m my Azure subscription; and (c) agree that Microso the offering(s) for support, billing and other trans Azure Marketplace Terms for additional details.	and privacy statement(s) associated with the Marketplace offering(s) listed above; (b) ethod for the fees associated with the offering(s), with the same billing frequency as ft may share my contact, usage and transactional information with the provider(s) of actional activities. Microsoft does not provide rights for third-party offerings. See the						
Basics							
Subscription	PLUE _ 1114 _ 1.1110						
Resource group T	estGroup1						
Virtual machine name	ode1						
Region (Asia Pacific) Japan East						
Availability options A	vailability set						
Availability set (new) AvailabilitySet1						
Authentication type	assword						
Username t	estlogin						
Azure Spot	lo						
Disks							
OS disk type	tandard HDD						~
Create < Previo	us Next > Download a template for automation						
<							>

4) Setting a private IP address

Log in to the Microsoft Azure portal (https://portal.azure.com/) and change the private IP address setting following the steps below. Since an IP address is initially set to be assigned dynamically, change the

setting so that an IP address is assigned statically. Change the settings of node1 and then node2.

1. Select the **Resource groups** icon on the upper part of the window.

+	[]		.	+		۲		SQL	\rightarrow	
Create a resource	Resource groups	Network security groups	Virtual machines	Subscriptions	All resources	App Services	Storage accounts	SQL databases	More services	
Recent re	sources									
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Navigate	bscriptions	() Resource	e groups	All r	esources	Dashi	poard			

- 2. Select TestGroup1 from the resource group list.
- 3. The summary of TestGroup1 is displayed. Select virtual machine node1 or node2 from the item list.

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Но	me > Resource groups > TestG	Group1		_
	TestGroup1		۶	? ×
,c	Search (Ctrl+/)	$^{\circ}$ + Add ≡ Edit columns 📋 Delete resource group \bigcirc Refresh → Move \downarrow Export to CSV $ $ \otimes Assign tags	🗊 Delete 🛛 😶 M	lore
()	Overview	Essentials ×		
	Activity log	Filter by name Type == all (Location == all (Add filter	No grouping	
ጵ	Access control (IAM)	Showing 1 to 13 of 13 records. Show hidden types ①	No grouping	<u> </u>
	Tags	Name ↑↓ Type ↑↓	⊾ocation ↑↓	
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Set	ting	Virtual machine	lapan East	
		Network security group	lapan East	
•••	Quickstart	Network interface	lapan East	
	Deployments	Disk J	lapan East	
	Policies	Disk J	lapan East	
0	Properties	Virtual machine	Japan East	
Β	Locks	Network security group	Japan East	
*	Export template	Retwork interface	Japan East	
Cos	st Management	Disk J	Japan East	
\$ 0,	Cost analysis	Disk J	Japan East	
ş	Cost alerts	Storage account	Japan East	
۲	Budgets	Virtual network	Japan East	
	Advisor recommendations			
Ma	nitoring			
Ŷ	Insights (preview)			
	Alerts			
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-	Diagnostic settings	<pre></pre>		
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4. Select Networking.

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Home > Resource groups > TestGroup1				
FestGroup1				× %
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() Overview	Essentials	*		
Activity log	Filter by name	⊋ Add filter	No grouping	
Access control (IAM)	Showing 1 to 13 of 13 records. Show hidden types ③		No grouping	
Tags	Name ↑↓	Туре ↑↓	Location ↑↓	
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C-Min		Virtual machine	Japan East	
Setungs		Network security group	Japan East	
 Quickstart 		Network interface	Japan East	
Deployments		Disk	Japan East	
Policies		Disk	Japan East	
🐲 Properties		Virtual machine	Japan East	
🔒 Locks		Network security group	Japan East	
🖳 Export template		Network interface	Japan East	
Cost Management		Disk	Japan East	
🍇 Cost analysis		Disk	Japan East	
Cost alerts		Storage account	Japan East	
③ Budgets		Virtual network	Japan East	
Advisor recommendations				
Monitoring				
Insights (preview)				
Alerts				
🖬 Metrics				
Diagnostic settings	< Previous Page 1 V of 1 Next >			

- 5. Select a network interface displayed in the list. The network interface name is generated automatically.
- 6. Select **IP configurations**.

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Home > Resource groups > TestGroup1	> node1 - Networkir	ng 👌 node1186 - IP	configurations	;						
node1186 - IP configuratio	ons									\times
	🕂 Add 🗄 Sav	ve 🗙 Discard								
Overview	IP forwarding set	ttings								
Activity log	IP forwarding			Disabled Enabled						
Access control (IAM)	Virtual network			Vnet1						
Tags	IP configurations									
Settings	Subnet *			Vnet1-1 (10.5.0.0/24)						\sim
IP configurations	0									
DNS servers	Name	IP Version	Type	Private IP address			Public IP a	dress		
💎 Network security group	inconfig1	IDv4	Primany	10.5.0.4 (Dunamic)			-	ancos		
Properties	ipconing i	1214	Phillidiy	10.5.0.4 (Dynamic)						
🔒 Locks										
🕎 Export template										
Support + troubleshooting										
📩 Effective security rules										
Effective routes										
📯 New support request										
<										>

- 7. Only ipconfig1 is displayed in the list. Select it.
- 8. Select **Static** for **Assignment** under **Private IP address settings**. Enter the IP address to be assigned statically in the **IP address** text box and click **Save** at the top of the window. The IP address of node1 is 10.5.0.110. The IP address of node2 is 10.5.0.111.

	\wp Search resources, services, and docs (G+/)	> 🗣 🖨 🎯 ? 😳	
Home > Resource groups > TestGroup1 > node1 - Networking	> node1186 - IP configurations > ipconfig1		
ipconfig1			
🔚 Save 🗙 Discard			
The virtual machine associated with this network interface will be new private IP address. The network interface will be reprovisions configuration settings, including secondary IP addresses, subret gateway, will need to be manually reconfigured within the virtual	restanted to utilize the d and network masks, and default machine. Learn more		
Public IP address settings Public IP address (Disabled) Enabled			
Private IP address settings Virtual network/subnet Vnet1/Vnet1-1			
Assignment Dynamic Static IP address *			
10.5.0.110	<u></u>		
<			>

9. The virtual machines restart automatically so that new private IP addresses can be used.

5) Configuring virtual machines

Log in to the created node1 and node2 and specify the settings following the procedure below.

Set a partition for the mirror disk resource. Create a file system in the added disk. Secure an area in the added disk by using the fdisk command and then create a file system.

For details about the partition for the mirror disk resource, see "Settings after configuring hardware" in "Partition settings for Mirror disk resource (when using Replicator)" in "Determining a system configuration" in the Installation and Configuration Guide

1. Check the partition list. In the following example, the last line shows the added disk.

\$ cat	/proc/pa	rtitions	
major	minor #	blocks nar	ne
2	0	4	fd0
8	0	31457280	sda
8	1	512000	sda1
8	2	30944256	sda2
8	16	73400320	sdb
8	17	73398272	sdb1
8	32	20971520	sdc
1			

2. Create a cluster partition and data partition in the added disk by using the fdisk command. Allocate 1 GB (1*1024*1024*1024 bytes) or more to a cluster partition. (If the size is specified as just 1 GB,

the actual size will be larger than 1 GB depending on the disk geometry difference. This is not a problem.) Also, do not create a file system in a cluster partition.

3. If you select **Execute initial mkfs** when creating the cluster configuration data by using Cluster WebUI, EXPRESSCLUSTER creates a file system automatically. Note that existing data in the partition will be lost.

For DSR, add a Loopback Adapter in each node configuring a cluster.

6) Configuring a load balancer

Log in to the Microsoft Azure portal (https://portal.azure.com/) and add an internal load balancer following the steps below. For details, see the following websites:

• Load Balancer documentaion:

https://docs.microsoft.com/en-us/azure/load-balancer/

1. Select the Create a resource icon on the upper part of the window.

Create a	Resource	Network	Virtual	Subscriptions	All resources	App Services	Storage	SOL databases	More services
resource	groups	security groups	machines				accounts		
Recent res	ources								
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- 2. Select Networking and then Load balancer.
- 3. The Create load balancer blade is displayed. Specify Name. Select Internal for Type and Basic for SKU, respectively.
- 4. For **Virtual network** and **Subnet**, select the virtual network and subnet created in "2) Creating a virtual network."
- 5. Specify **Subscription**, **Resource group**, and **Region**, and click **Review+create**. Then click **Create**. Deploying the load balancer starts. This processing takes several minutes.

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Home > Create load balancer												
Create load balancer												
Basics Tags Review + create Azure load balancer is a layer 4 load balan balancers uses a hash-based distribution of destination port, protocol type) hash to m accessible valubic IP address, or inter support Network Address Translation (NA	icer that distributes incoming traffic among healthy virtual machine instances. Load algorithm. By default, it uses a 5-tuple (source IP, source port, destination IP, ap traffic to available servers. Load balancers can either be internet-facing where it is an where it is only accessible from a virtual network. Azure load balancers also 1) to route traffic between public and private IP addresses. Learn more.										^	
Project details												
Subscription *	· · · · · · · · · · · · · · · · · · ·											
Resource group *	TestGroup1 V	1										
	Create new	_										
Instance details												
Name *	TestLoadBalancer 🗸											
Region *	(Asia Pacific) Japan East]										
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sku * ⊙	● Basic ◯ Standard											
Configure virtual network.												
Virtual network *	Vnet1 ~]										
Subnet *	Vnet1-1 (10.5.0.0/24)]										
	Manage subnet configuration	_										
IP address assignment *	Static O Dynamic											
Private IP address *	10.5.0.200										~	
Review + create < Previous	Next : Tags > Download a template for automation											

- 7) Configuring a load balancer (configuring a backend pool)
- 1. Associate a virtual machine registered to the availability set to the load balancer. After the load balancer has been deployed, select the **Resource groups** icon on the upper part of the window.

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Create a resource	Resource groups	Network security groups	Virtual machines	Subscriptions	All resources	App Services	Storage accounts	SQL databases	More services			
Recent res	ources											
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2. Select the resource group to which the created load balancer belongs from the resource group list.

3. The summary of the selected resource group is displayed. Select the created load balancer from the item list.

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Home > Resource groups >	TestGroup1		
(intersting TestGroup1			\$ X
	$_{\ll}$ + Add $\equiv\equiv$ Edit columns 📋 Delete resource group 🖒 Refresh \rightarrow Move \downarrow Export to CSV \oslash Assignment Add Assignment Add Assignment Add Assignment Add Add Add Add Add Add Add Add Add Ad	gn tags 🗊 Delete 🚽 Export templ	late
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Tags	□ Name ↑↓ Type ↑↓	Location ↑↓	
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Settings	DNS zone	global	
📣 Quickstart	Public IP address	Japan East	
Deployments	Dublic IP address	Japan East	
Policies	Virtual machine	Japan East	
🐲 Properties	Network security group	Japan East	
🔒 Locks	Network interface	Japan East	
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Cost Management	Disk	Japan East	
🗞 Cost analysis	Virtual machine	Japan East	
Cost alerts	Retwork security group	Japan East	
③ Budgets	Retwork interface	Japan East	
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Diagnostic settings	Previous Page 1 v of 1 Next >		
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4. Select Backend pools.

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	TestLoadBalance	er																\$ ×
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19 1	Diagnose and solve proble	ems																
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- I	Frontend IP configuration		Balance IPv4 and IPv6 addresses Native dual-stack endpoints help meet regulatory							l highly	reliabl	e appli	catio	ns				
8	Backend pools		requirements and address the fast-growing number of devices in mobile and IoT.															
•	Health probes																	
) (Load balancing rules				View fron	tend IP config	guration		View	load ba	lancing	nulos						
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। প	New support request						View i	inbound NAT ru	ules									

5. Click Add.



- 6. Add backend pool is displayed. Specify Name.
- 7. Select Virtual machine for Associated to.
- 8. Specify **Virtual machine** and **IP address** for the virtual machine you want to associate. Repeat this procedure for the rest of such virtual machines.
- 9. Then click Add.



- 8) Configuring a load balancer (configuring a health probe)
- 1. Select Health probes.
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|---|---------------------------------------|-------------|---------------------------------|-------|----------------------|
| Home > TestGroup1 > TestLoadBalance | r - Health probes | | | | |
| TestLoadBalancer - Healt | th probes | | | | × |
| | + Add | | | | |
| Overview | ✓ Search probes | | | | |
| Activity log | Name \uparrow_{\downarrow} Proto | col ↑↓ Port | \uparrow_{\downarrow} Used By | | $\uparrow\downarrow$ |
| Access control (IAM) | No results. | | | | |
| Tags | | | | | |
| Diagnose and solve problems | | | | | |
| Settings | | | | | |
| Frontend IP configuration | | | | | |
| Backend pools | | | | | |
| Health probes | | | | | |
| 📒 Load balancing rules | | | | | |
| Inbound NAT rules | | | | | |
| Properties | | | | | |
| 🔒 Locks | | | | | |
| Export template | | | | | |
| Monitoring | | | | | |
| Diagnostic settings | | | | | |
| 😭 Logs | | | | | |
| Support + troubleshooting | | | | | |
| R New support request | | | | | |
| < | | | | | > |

- 2. Click Add.
- 3. Add health probe is displayed. Specify Name.
- 4. Specify **Protocol** and **Port**, and click **OK**.

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Home > TestGroup1 > Test	stLoadBalancer - Health probes > Add health probe						
Add health probe							>
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TestHealthProbe	~ ~						
Protocol ①							
ТСР	~						
Port *							
26001	~ 						
Interval *							
5							
	seconds						
Unhealthy threshold *							
2	consocutivo failuros						
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- 9) Configuring a load balancer (setting the load balancing rules)
- 1. Select Load balancing rules.

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TestLoadBalancer - Load	balancing rules								×
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Settings									
Frontend IP configuration									
Backend pools									
Health probes									
E Load balancing rules									
Inbound NAT rules									
III Properties									
🔒 Locks									
🖳 Export template									
Monitoring									
Diagnostic settings									
🧐 Logs									
Support + troubleshooting									
New support request									

- 2. Click Add.
- 3. The Add load balancing rule blade is displayed. Specify Name.
- 4. Specify Port and Backend port, and click OK.

For DSR, specify **Port** and **Backend port** to same port number, enable to **Floating IP(Direct Server Return)**, and click **OK**.

(Specify the port number used to connect to the application (example.80).)

■ Microsoft Azure	E & @ ? © .
Home > TestLoadBalancer - Load balancing rules > Add load balancing rule	
Add load balancing rule	×
Name *	
TestLoadBalancingRule 🗸	
IP Version *	
● IPv4 ◯ IPv6	
Frontend IP address * ①	
10.5.0.200 (LoadBalancerFrontEnd)	
Protocol	
• TCP UDP	
Port *	
80	
Backend port * 🛈	
8080	
Backend pool 🛈	
TestBackendPool V	
Health probe ①	
TestHealthProbe (TCP:26001)	
Session persistence ①	
None	
Idle timeout (minutes)	
O 4_	
Floating IP (direct server return)	
Disabled Enabled	
ОК	
<	>

10) Adjusting the OS startup time, checking the network setting, checking the root file system, checking the firewall setting, synchronizing the server time, and checking the SELinux setting.

For each procedure, see "Settings after configuring hardware" in "Determining a system configuration" in the Installation and Configuration Guide.

11) Installing EXPRESSCLUSTER

For the installation procedure, see the Installation and Configuration Guide. After installation is complete, restart the OS.

12) Registering the EXPRESSCLUSER license

For the license registration procedure, see the Installation and Configuration Guide.

6.3 Configuring the EXPRESSCLUSTER settings

For the Cluster WebUI setup and connection procedures, see "Creating the cluster configuration data" in the Installation and Configuration Guide.

This section describes the procedure to add the following resources and monitor resources:

- · Mirror disk resource
- Azure probe port resource
- Azure probe port monitor resource
- Azure load balance monitor resource
- PING network partition resolution resource (for NP resolution)

For the settings of other resources and monitor resources, see the Installation and Configuration Guide and the Reference Guide.

1) Creating a cluster

Start the Cluster generation wizard to create a cluster.

- Creating a cluster
 - 1. Access Cluster WebUI, and click Cluster generation wizard.

Cluster WebUI <cluster></cluster>				۶ Config mode 🗸	Ł	0	ß	۶	i	? ≣	
Cluster generation wizard	Rport Get the Configuration File	↑ Apply the Configuration File	Update Serv	er Data Check the Conf	ciguration File						

 Cluster of Cluster generation wizard is displayed. Enter a desired name in Cluster Name. Select an appropriate language in Language. Click Next.

Cluster generation wizard	· · · · · · · · · · · · · · · · · · ·	<
Server Server Cluster → Basic Settings → Interconnect Cluster Name* Comment Language* Management IP Address	Server > NP Resolution > Group > Monitor Cluster1 English	
• Start generating the cluster. Enter the cluster name, and then select the language If using the integrated WebManager to manage multi The management IP address is a floating IP address in management IP address can be omitted. To continue, click [Next].	(locale) of the environment that runs WebManager. Jle clusters, specify a unique cluster name to identify the cluster. Jle for a WebManager connection. If establishing connections by specifying each server IP address, the	
	4Back Next ► Cancel	

3. Basic Settings is displayed.

The instance connected to Cluster WebUI is displayed as a registered master server. Click **Add** to add the remaining instances (by specifying the private IP address of each instance). Click **Next**.

Add server		×
Server Name or IP Address*	10.5.0.111	
• Enter an IP address or a server name. When entering a server name, name re Both IPv4 and IPv6 for IP address can When entering an IP address, the serve	e. solution is necessary. de used. rr name is automatically ac	quired.
	C	Cancel
Cluster generation wizard		
Cluster I I Server Server	Server	a → Group →
Add Remove		
Server Definitions		
Master server node1		
1 node2		
↑ ↓		
Server Group Definition		Settings
● Click "Add" to add servers constructing the Click 「↑」 or 「↓」 to change the server pric Click "Settings" to configure the server group	cluster. rity. when using the server group.	

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

Specify the IP addresses (IP address of each instance) to be used for interconnect. In addition, select mdc1 for **MDC** as a communication path of a mirror disk resource to be created later. Click **Next**.

Cluster generation wizard				×
Cluster Server Cluster Add Remove	Server → Interconne	server ect → NP Resolution → (Group 🗲 Monitor	
Interconnect List Priority Type	MDC	node1	node2	
1 Kernel Mode 🗸	mdc1 V	10.5.0.110 🗸	10.5.0.111	~
\uparrow \downarrow				
● Configure the interconnect among For "Kernel mode", "User mode", "Bt Only" setting, configure the route wh Configuring more than one routes is For "Kernel mode" ", "User mode, "D For "Witnes HB" setting, click each e Click "1" or " ↓" to configure the prin For "Mirror Communication Only" set For the communication route which in MDC column.	the servers const MC", "DISK", "Witr ich is used only for recommended. IISK" and "COM" s server column cell pority to preferentia tings, click each s s used for data mi	ructing the cluster.Click "Add" to less HB" and "COM" settings, cor or data mirroring communication. ettings, click each server column to set "Use" or "Do not use", and ully use the LAN only for the comm erver column cell to configure IP rroring communication, select the	add interconnect and select t figure the route which is used cell and set an IP address or I then click "Properties" to set nunication among the cluster addresses. e mirror disk connect name to	he type. d for heartbeat. For "Mirror Communication device. t detailed settings. • servers. o be allocated to the communication route in

5. The NP Resolution window is displayed.

To execute NP resolution by using a ping, click **Add** to add a line to the NP resolution list. Click a cell of the **Type** column and select **Ping**. Click the cell of the **Ping target** column and set the IP address of the device to which to send a ping. Be sure to specify the IP address of a server other than cluster servers within the Microsoft Azure network. Click a cell of each server column and select **Use** or **Not use**. Click **Next**.

uster 📀	generation wizard Server → Basic Settings ⊘ →	Server Interconnect 🤗	Server → NP Resolution → Group → Monitor	
roperties	Add Remove			
Resolution	n List			
ype 7	Target	node1 r	node2	
Ping 🗸	10.5.0.5	Use 🗸	Use 🗸	
Configur Configur Configur Click "Add" or "Ping" s	e network partition (NP) resolu to add NP resolution resource setting, click Target column cell setting, click Target column ce	ition function. and select the type I to configure IP ad ell to configure HTT	e. Idress of Ping destination, and then click each server column cell to configure "Use" or "Do not. IP packet destination, and then click each server column cell to configure "Use" or "Do not use"	use".

- 2) Adding a group resource
- Defining a group

Create a failover group.

1. The Group List window s displayed.

Click Add.	
Cluster generation wizard	>
Server Server Server Cluster ♥ → Basic Settings ♥ → Interconnect ♥ → NP Resolution ♥ → Group → Monitor	
Properties Add Remove	Group Resource
Name Type	
No groups	
 Configure failover group to be a unit of fail over. Click "Add" to add a group. Click "Properties" to configure the properties of the selected group. Click "Group Resource" to add resource to the selected group. 	
4 Bac	ck Next Cancel

2. The Group Definition window is displayed.

Specify a failover group name (failover1) for Name. Click Next.

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

- 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.

On this page, add a group resource following the procedure below.

Group Definition	failover 🗙
Basic Settings ⊘ → Startup Servers ⊘ → Group Attributes ⊘ → Grou	p Resource
Properties Add Remove	
Group Resource List	
Name Type	
No resources	
• Click "Add" to add resources. Click "Properties" to configure the properties of the selected resource.	
	Back Finish Cancel

· Mirror disk resource

Create a mirror disk resource.

For details, see Understanding Mirror disk resources in "Group resource details" in the Reference Guide.

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

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

Resource Definition of Group failover1		md 🗙
Info → Dependency → Recovery Operation → Details		
Туре*	Mirror disk resource \checkmark	
Name*	md	
Comment		
Get License Info		
• Select the type of group resource and	enter its name.	
		Gancel Accel Cancel

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

Enter the device name of the partition created in "5) **Configuring virtual machines**" in **Data Partition Device Name** and **Cluster Partition Device Name**. Specify **Mount Point** and **File System**. Click **Finish** to finish setting.

Resource Definition of Group failover1 md 🗙				
Info \bigcirc \rightarrow Dependency \oslash \rightarrow Reco	overy Operation \oslash \rightarrow	Details		
Common nodel node2				
Mirror Partition Device Name*	/dev/NMP1 🗸			
Mount Point*	/mnt/md			
Data Partition Device Name*	/dev/sdc2	~		
Cluster Partition Device Name*	/dev/sdc1	~		
File System*	ext4	~		
Mirror Disk Connect				Select
Tuning				
			Back Finish	Cancel

• Azure probe port resource

When EXPRESSCLUSTER is used on Microsoft Azure, EXPRESSCLUSTER provides a mechanism to wait for alive monitoring from a load balancer on a port specific to a node in which operations are running.

For details about the Azure probe port resources", see "Understanding Azure probe port resources" in the Reference Guide.

- 1. Click Add on the Group Resource List page.
- 2. The **Resource Definition of Group | failover1** window is displayed. Select the group resource type (Azure probe port resource) from the **Type** box and enter the group name (azurepp1) in the **Name** box. Click **Next**.

Resource Definition of Group failover1		azurepp 🗙
Info → Dependency → Recovery Operation → Details		
Type*	Azure probe port resource \checkmark	
Name*	azurepp1	
Comment		
Get license information		
• Select the type of group resource and	enter its name.	

- 3. The **Dependency** window is displayed. Click **Next** without specifying anything.
- 4. The Recovery Operation window displayed. Click Next.
- 5. For **Probeport**, enter the value specified for **Port** when configuring a load balancer (configuring health probe).

Resource Definition of Group failover1		
Info 🥑 🔶 Dependency 🤗	→ Recovery Operation ② → Details	
Probeport*	26001	
Tuning		
		Back Finish Cancel

- 6. Click Finish.
- EXEC resource(for DSR)

EXPRESSCLUSTER provides a mechanism to add / remove front-end ip address as the load balancer switches. For details about the EXEC resources", see "Understanding EXEC resources" in the Reference Guide.

- 1. Click Add on the Group Resource List page.
- 2. The **Resource Definition of Group | failover1** window is displayed. Select the group resource type (EXEC resource) from the **Type** box and enter the group name (exec1) in the **Name** box.
- 3. Click Next.
- 4. The Dependency window is displayed. Click Next without specifying anything.
- 5. The Recovery Operation window displayed. Click Next.
- The Details window displayed. Select the start.sh. Click Edit. The following script is a sample script. Customize it to change your environment.

(Example: sample script of start.sh)

```
# Server1
SERVER1_NAME="server1" # hostname
SERVER1_NIC="lo" # Interface name for local loopback
# Server2
SERVER2_NAME="server2" # hostname
SERVER2_NIC="lo" # Interface name for local loopback
# VIP Address
VIP=10.5.0.200 # Load balancer front-end IP address
NETMASK=255.255.255.255 # Front-end IP address netmask
# HostName
CURRENT_HOSTNAME=`hostname`
if [ $CURRENT_HOSTNAME = $SERVER1_NAME ]; then
    NIC=$SERVER1_NIC
elif [ $CURRENT_HOSTNAME = $SERVER2_NAME ]; then
    NIC=$SERVER2_NIC
else
    echo "SERVER is not found."
    exit 1
fi
# Add IP Address
ip addr add $VIP/$NETMASK brd + dev $NIC
RET=$?
if [ $RET = 0 ]; then
    exit O
else
    echo "Failure to add IP Address"
    exit 1
fi
```

 The Details window displayed. Select the stop.sh. Click Edit. The following script is a sample script. Customize it to change your environment.

(Example: sample script of stop.sh)

```
# Server1
SERVER1_NAME="server1" # hostname
SERVER1_NIC="lo" # Interface name for local loopback
# Server2
SERVER2_NAME="server2" # hostname
SERVER2_NIC="lo" # Interface name for local loopback
# VIP Address
VIP=10.5.0.200 # Load balancer front-end IP address
NETMASK=255.255.255.255 # Front-end IP address netmask
# HostName
CURRENT_HOSTNAME=`hostname`
if [ $CURRENT_HOSTNAME = $SERVER1_NAME ]; then
   NIC=$SERVER1_NIC
elif [ $CURRENT_HOSTNAME = $SERVER2_NAME ]; then
   NIC=$SERVER2_NIC
else
   echo "SERVER is not found."
   exit 1
fi
# Del IP Address
ip addr del $VIP/$NETMASK brd + dev $NIC
RET=$?
if [ $RET = 0 ]; then
   exit O
else
   echo "Failure to del IP Address"
   exit 1
fi
```

8. Click Finish.

3) Adding a monitor resource

• Azure probe port monitor resource

The port monitoring mechanism for alive monitoring is provided for the node in which the Microsoft Azure probe port resource is running.

For details about the Azure probe port resources", see "Understanding Azure probe port resources" in the Reference Guide.

Adding one Azure probe port monitor resource creates one Azure probe port monitor resource automatically.

• Azure load balance monitor resource

The mechanism to monitor whether the port with the same port number as the probe port is open or not is provided for the node in which the Microsoft Azure probe port resource is not running.

For details about the Azure load balance resource, see "Understanding Azure load balance monitor resources" in the Reference Guide.

Adding one Azure probe port resource creates one Azure load balance monitor resource automatically.

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

6.4 Verifying the created environment

Verify whether the created environment works properly by generating a monitoring error to fail over a failover group.

If the cluster is running normally, the verification procedure is as follows:

1. Start the failover group (failover1) on the active node (node1). In the **Status** tab on the Cluster WebUI, confirm that **Group Status** of failover1 of node1 is **Normal**.

When using DSR, perform packet capture and confirm that communication is being performed with the ip address of the client and the front-end IP address of the load balancer.

- 2. Change Operation Mode to Verification Mode from the WebManager pull-down menu.
- 3. In the Status tab on the Cluster WebUI, click the Enable dummy failure icon of azureppw1 of Monitors.
- 4. When the time specified for Interval elapses, the failover group (failover1) enters an error status and fails over to node2. In the Status tab on the Cluster WebUI, confirm that Group Status of failover1 of node2 is Normal. Also, confirm that access to the frontend IP and port of the Azure load balancer is normal after the failover. When using DSR, perform packet capture and confirm that communication is being performed with the ip address of the client and the front-end IP address of the load balancer.

Verifying the failover operation in case of a dummy failure is now complete. Verify the operations in case of other failures if necessary.

SEVEN

ERROR MESSAGES

For the error messages related to resources and monitor resources, see the following:

• "Error messages" in the Reference Guide.

NOTES AND RESTRICTIONS

8.1 HA cluster using Azure DNS

8.1.1 Notes on Microsoft Azure

- There is a tendency for the performance difference (performance deterioration rate) to increase in a multitenant cloud environment compared to a physical environment or general virtualization environment (non-cloud environment). Therefore, pay careful attention to this point when designing a performance-oriented system.
- Even if a virtual machine is just shut down, its status is **Stopped** and billing continues. Execute **Stop** on the virtual machine setting window of the Microsoft Azure portal to change the virtual machine state to **Stopped** (**Deallocated**).
- An availability set can be set only when creating a virtual machine. To move a virtual machine to and from the availability set, it is necessary to create an availability set again.
- To set up EXPRESSCLUSTER to work with Microsoft Azure, a Microsoft Azure organizational account is required. An account other than the organizational account cannot be used because an interactive login is required when executing the Azure CLI.

8.1.2 Notes on EXPRESSCLUSTER

Please refer the following for notes for EXPRESSCLUSTER on Azure:

EXPRESSCLUSTER X Getting Started Guide

- "Communication port number" in "Notes and Restrictions"
- "Azure DNS resources" in "Notes and Restrictions"
- "Setting up Azure DNS resources" in "8. Notes and Restrictions"

EXPRESSCLUSTER X Reference Guide

- "Notes on Azure DNS resources"
- "Notes on Azure DNS monitor resources"

Virtual machines are paused for up to 30 seconds for Azure memory preserving maintenance. Please refer the following for details about memory preserving maintenance.

https://docs.microsoft.com/en-us/azure/virtual-machines/linux/maintenance-and-updates

Therefore, it is recommended to set **Heartbeat Timeout** parameter on **Timeout** tab in **Cluster Properties** more than 30 sec.

In addition to Heartbeat Timeout, please also note the following.

- Please set Heartbeat Timeout parameter less than OS reboot time.
- When changing **Shutdown Monitor Timeout** parameter on **Monitor** tab in **Cluster Properties** from the default value (Use Heartbeat Timeout), please set the parameter less than **Heartbeat Timeout**.

Please refer the following about the above:

EXPRESSCLUSTER X Getting Started Guide

• "Adjusting OS startup time" in "Notes and Restrictions"

EXPRESSCLUSTER X Reference Guide

- "Timeout tab"
- "Monitor tab"

8.2 HA cluster using a load balancer

8.2.1 Notes on Microsoft Azure

- There is a tendency for the performance difference (performance deterioration rate) to increase in a multitenant cloud environment compared to a physical environment or general virtualization environment (non-cloud environment). Therefore, pay careful attention to this point when designing a performance-oriented system.
- Even if a virtual machine is just shut down, its status is **Stopped** and billing continues. Execute **Stop** on the virtual machine setting window of the Microsoft Azure portal to change the virtual machine state to **Stopped** (**Deallocated**).
- An availability set can be set only when creating a virtual machine. To move a virtual machine to and from the availability set, it is necessary to create an availability set again.

8.2.2 Notes on EXPRESSCLUSTER

Please refer the following for notes for EXPRESSCLUSTER on Azure:

EXPRESSCLUSTER X Getting Started Guide

- "Communication port number" in "Notes and Restrictions"
- "Setting up Azure probe port resources" in "8. Notes and Restrictions"
- "Setting up Azure load balance monitor resources" in "Notes and Restrictions"

EXPRESSCLUSTER X Reference Guide

- "Notes on Azure probe port resources"
- "Notes on Azure probe port monitor resources"
- "Note on Azure load balance monitor resources"

Virtual machines are paused for up to 30 seconds for Azure memory preserving maintenance. Please refer the following for details about memory preserving maintenance. https://docs.microsoft.com/en-us/azure/virtual-machines/linux/maintenance-and-updates

Therefore, it is recommended to set **Heartbeat Timeout** parameter on **Timeout** tab in **Cluster Properties** more than 30 sec.

In addition to Heartbeat Timeout, please also note the following.

- Please set Heartbeat Timeout parameter less than OS reboot time.
- When changing **Shutdown Monitor Timeout** parameter on **Monitor** tab in **Cluster Properties** from the default value (Use Heartbeat Timeout), please set the parameter less than **Heartbeat Timeout**.

Please refer the following about the above:

EXPRESSCLUSTER X Getting Started Guide

• "Adjusting OS startup time" in "Notes and Restrictions"

EXPRESSCLUSTER X Reference Guide

- "Timeout tab"
- "Monitor tab"

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REVISION HISTORY

Edition	Revised Date	Description
1st	Apr 10, 2020	New Guide
2nd	Dec 25, 2020	DSR (Direct Server Return) is now supported.
		Added explanation about supported OS version.
		Shared disk type cluster is now supported.

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