# Alibaba Cloud Container Service

User Guide

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## **Generic conventions**

#### Table -1: Style conventions

Style	Description	Example			
•	This warning information indicates a situation that will cause major system changes, faults, physical injuries, and other adverse results.	<b>Danger:</b> Resetting will result in the loss of user configuration data.			
	This warning information indicates a situation that may cause major system changes, faults, physical injuries, and other adverse results.	Warning: Restarting will cause business interruption. About 10 minutes are required to restore business.			
	This indicates warning information, supplementary instructions, and other content that the user must understand.	<b>Note:</b> Take the necessary precautions to save exported data containing sensitive information.			
	This indicates supplemental instructio ns, best practices, tips, and other content that is good to know for the user.	Note: You can use Ctrl + A to select all files.			
>	Multi-level menu cascade.	Settings > Network > Set network type			
Bold	It is used for buttons, menus, page names, and other UI elements.	Click <b>OK</b> .			
Courier font	It is used for commands.	Run the cd /d C:/windows command to enter the Windows system folder.			
Italics	It is used for parameters and variables.	bae log listinstanceid Instance_ID			
[] or [a b]	It indicates that it is a optional value, and only one item can be selected.	ipconfig [-all/-t]			
{} or {a b}	It indicates that it is a required value, and only one item can be selected.	<pre>swich {stand   slave}</pre>			

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## **1** Authorizations

## 2 Clusters

### 2.1 Cluster lifecycle

 Table 2-1: A complete cluster lifecycle includes the following statuses.

Status	Description				
inactive	The successfully created cluster does not contain any node.				
initial	The cluster is applying for corresponding cloud resources.				
running	The cluster successfully applied for the cloud resources.				
updating	The cluster is upgrading the Agent.				
scaling	Change the number of cluster nodes.				
failed	The cluster application for cloud resources failed.				
deleting	The cluster is being deleted.				
delete_failed	The cluster failed to be deleted.				
deleted (invisible to users)	The cluster is successfully deleted.				

#### Figure 2-1: Cluster status flow



### 2.2 Add an existing ECS instance

You can add a purchased Elastic Compute Service (ECS) instance to a specified cluster.



At most 20 ECS instances can be added to a cluster by default. To add more ECS instances, *open a ticket*.

You can add an existing ECS instance in the following ways:

- Add ECS instances automatically: The image and system disk of the ECS instance are reset by using this method. You can add one or more ECS instances to the cluster at a time.
- Add the ECS instance manually: Manually add the ECS instance by running scripts on the ECS instance. You can only add one ECS instance to the cluster at a time.

#### Prerequisites

If you have not created a cluster before, create a cluster first. For information about how to create a cluster, see *Create a cluster*.

#### Instructions

- The ECS instance to be added must be in the same region and use the same network type ( Virtual Private Cloud (VPC)) as the cluster.
- When adding an existing ECS instance, make sure that your ECS instance has an Elastic IP ( EIP) for the network type VPC, or the corresponding VPC has configured the NAT gateway. In short, make sure the corresponding node can access public network normally. Otherwise, the ECS instance fails to be added.
- The ECS instance to be added must be under the same account as the cluster.
- If you select to manually add the ECS instance, note that:
  - If you have already installed Docker on your ECS instance, the ECS instance may fail to be added. We recommend that you uninstall Docker and remove the Docker folders before adding the ECS instance by running the following command:

```
Ubuntu: apt-get remove -y docker-engine, rm -fr /etc/docker/ /var/lib/
docker /etc/default/docker
```

```
CentOS: yum remove -y docker-engine, rm -fr /etc/docker /var/lib/
docker
```

Container Service nodes have special requirements for the operating system of the ECS instance. We recommend that you use Ubuntu 14.04/16.04 or CentOS 7 as the operating system. We have strictly tested the stability and compatibility of these operating systems.

#### Procedure

- 1. Log on to the Container Service console.
- 2. Click Swarm > Clusters in the left-side navigation pane.
- Click More at the right of the cluster that you want to add ECS instances and then select Add Existing Instances from the drop-down list.

Container Service	Cluster List			You can create up to 5 cluster	rs and can a	dd up to 20 nod	es in each cluster	Subaccount A	uthorization	Refresh	Create Cluster
Overview											
Applications	Help: Create cluster How to add ex	isting ECS instance	es Cross-zone node	e management Log Service int	tegration	Connect to clust	er through Docke	er Client			
Services	Name 💌										
Clusters	Cluster Name/ID	Cluster Type	Region	Network Type	Cluster Status	Node Status	Number of Nodes	Time Created	Docker Version		Action
Nodes Data Volumes Configurations	routing-test-online ccf530ee2b1c1400e96425b05846fa35c	Alibaba Cloud Cluster	China East 1 (Hangzhou)	VPC vpc- bp1659u1p811058ea3npd	Ready	No node status 🕽	1	2017-03-31 22:32:40	17.03.1-ce	Manage	View Logs Delete More•
<ul> <li>Images and Temp</li> </ul>									Update R Upgrade /	AM Authorizat Agent	ion Information
Operation Logs									Upgrade (	Docker	
Getting Started									Upgrade 9	System Service	e
									Expand		
								3	Add Exist	ng Instances	
								-	Create Ap	plication	

#### 4. Add ECS instances.

The ECS instances displayed are filtered and synchronized from your ECS instance list according to the region and network type defined by the cluster.

Add the ECS instances in the following ways:

• Add ECS instances automatically.

### Note:

As this method will reset the image and system disk of the ECS instance, proceed with caution. Create a snapshot to back up your data before adding the ECS instance. For information about how to create a snapshot, see *Create a snapshot*.

1. Select the ECS instances you want to add to the cluster and click Next Step.

You can add one or more ECS instances at a time.

- Configure the instance information. Click Next Step and then click Confirm in the confirmation dialog box.
- 3. Click Finish.
- Manually add the ECS instance by running scripts on the ECS instance.
  - 1. Select Manually Add. Select an ECS instance, and then click Next Step.

You can only add one ECS instance at a time.

- 2. Confirm the instance information and click Next Step.
- The scripts unique to this ECS instance are displayed. Click log on to the ECS instance xxxxxx.

	Select Existing ECS Instance(s)	Enter Instance Information	Added Successfully
$\bigotimes$	Token generated. Pleas log on to the curl -Ls http://ali 3ace0e4678953d192 -	and execute the following command:	
	Go and execute this command		
			Done

**4.** The VNC connection password is displayed in the dialog box. Copy the password and click **Close**.

VNC Con	nection Password	×
	VNC Connection Password:	
	<b>Warning!</b> The VNC connection password is viewable only once. Ensure you record this password and keep it in a secure location for subsequent login attempts.	
	Close	

5. In the dialog box, enter the VNC connection password and click OK.

Enter VNC Password	×
*Please enter VNC password:	•••••
	OK Cancel

**6.** Enter the logon account (root) and password of the ECS instance, and press Enter to log on to the ECS instance.

Send Remote Command+ Su	accessfully connected to the instance.	Note: A black screen indicates that the system is in sleep mode. Press any key to activate the system.	Input Commands	Modify Management Terminal Password
	Ubuntu 16.04.2 LTS ttyl 12ag login: root Parsoord: Belcome to Ubuntu 16.04.2 LTS (ONL/Linux 4.4.0-4 Belcomentation: https://achatoge.com/cation. Assagement: https://achatoge.com/cation. Basagement: https://achatoge.com/cation. Belcome to Allbhab Cloud Elastic Compute Servic root#: "#	1 82-generic x86_64) 		

 Click Input Commands. Paste the preceding scripts into the dialog box, click OK and press Enter.

Copy Commands		×
Copy and paste cont keyboard characters	ent into the text box. Up to 2000 characters are allowed. Non-standard are not supported.	
* Commands Content:	curl -Ls http://alivuncontainerservice.oss-cn- hangzhou.alivuncs.com/17.03.1-ce/attachNodeScript   sudo -H bash -s	
	OK Cance	

The system runs the scripts. Wait until the scripts are successfully run. A success message is displayed. The ECS instance is successfully added.

发送远程命令+	成功连接到实例i-bp	提示:如果出现持续黑屏,说明系统处于休眠状态,按任意键	可以激活。 复制命令输入: 修改远程连接密码
	The following MEM packages will be installed: unctp 0 upgraded, 1 neuly installed, 0 to renove and 18 not upgraded. Need to get 158 kM of archives. After this operation, 530 kM of additional disk space will be used. Get; http://nirrow.lign.com/dustal and/of unctp and/of 6.0-200 Selecting previously unselected package uncip. Geneding database. 124231 files and directories currently installed.) Frequering to unpack,uncip. 60-200kuntul, Mupacking uncip. 60-200kuntul, Processing triggers for anne-support (3.55kuntul) Processing triggers for anne-support (3.55kuntul) Setting up uncip (6.0-200kuntul) Setting up uncip (6.0-200kuntul) Setting up uncip (6.0-200kuntul) Mathematical and	Wantul (150 kB)	
	<pre>eth -c 'irr'i 'Asg'd''', 'rtc/docker/damon_jon   true'</pre>	ry' linit nay be dangerous. appentio.9-33ba369' locally thi nvacs/tunnel-agent:0.9-30ba369 ry' linit nay be dangerous. 3-3792afad' locally zvacs/agent:0.9-979afad	

#### **Related operation**

You can modify the VNC connection password of the ECS instance in the remote terminal connection page. Click **Modify Management Terminal Password**, enter the new password and click **OK** in the dialog box.

Modify Managemer	nt Terminal Password	×
Note: The modified V console.	NC password will not take effect until the instance is restarted at the	
*Please enter a new		
password:	Password character limit is 6 characters. Only uppercase letters, lowercase letters, and numbers are supported.	
*Confirm the new password:	•••••	
	OK Cance	əl

### 2.3 Download cluster certificate

#### Context

With the downloaded certificate, you can connect to the endpoint exposed from the cluster by using Docker Swarm API or Docker client. For more information, see *Connect to a cluster by using Docker tools*.

#### Procedure

- **1.** Obtain the access address.
  - a) Log on to the Container Service console.
  - b) Log on to the Container Service console.
  - c) Click **Clusters** in the left-side navigation pane. On the Cluster List page, click **Manage** at the right of a cluster.

Container Service	Louster List			,	/ou can create	up to 5 cluste	rs and can add	up to 10 nodes in each o	cluster. Refre	rsh Creat	e Cluster 🕞
Overview	Help: & Create cluster & How to add	existing ECS instar	ices 🔗 Cross-zone i	node management 🔗 Lo	g Service integ	ration 🔗 Co	nnect to cluster	through Docker Client			
Applications	Name 🔻										
Services		-	m i (11)		Cluster	Node	Number of		Docker	3	
Clusters 2	Cluster Name/ID	Cluster Type	Region (All) +	Network Type	Status	Status 🕐	Nodes	Time Created	Version		Action
Nodes Networks	test-swarm coll?sid.ac?#be#0.4880404501babbd25.ke	Alibaba Cloud Cluster	China East 1 (Hangzhou)	VPC vpc- lool.kd?v=kamtaamueva	Running	Healthy 🕽	1	05/21/2018,10:29:11	17.06.2- ce	Manage I Mor	View Logs   Delete hitor   More +

d) The cluster details page is displayed, showing the cluster connection information.

Connection Information	
To access and manage clusters, certificates granted by Albaba Cloud are required. Each cluster has its own certificate. If you have not yet downloaded the certificate for the current cluster, click Download Certificate Revoke Downloaded Certificate	
Cluster Access Point:	
tcp://master4g5.cs-cn-hangzhou.aliyun.com:21003	
User Guide:	
Configure Environment Variable (Linux or Mac):	
export DOCKER_TL5_VERIFY="1" export DOCKER_HOSI="tcp://master4g5.cs-cn-hangzhou.aliyun.com:21003" #Set the current path as the storage path for the cluster certificate file.	
export DOCKER_CERT_PATH="\$PMD"	
Notice:	
1. The certificate allows secure access to the container cluster. Please keep it secure. Each cluster certificate is unique. You must configure the correct certificate in order to use Docker Clent or Docker Compose to access the cluster.	e
2. If your downloaded certificate is accidentally leaked, you can revoke it and download a new one.	

2. Download and save the TLS certificate.

Configure a TLS certificate before you use the preceding access address to access the Docker cluster.

Click **Download Certificate** in the cluster details page to download the TLS certificate. The certFiles.zip file is downloaded. In the following example, the downloaded certificate is saved to the ~/.acs/certs/ClusterName / directory. ClusterName indicates the name of your cluster. You can save the certificate to a different directory, but we recommend using the ~/.acs/certs/ClusterName/ directory for easy management.

```
mkdir ~/.acs/certs/ClusterName/ #Replace ClusterName with your
cluster name
  cd ~/.acs/certs/ClusterName/
  cp /path/to/certFiles.zip .
  unzip certFiles.zip
```

The certFiles.zip file contains ca.pem, cert.pem, and key.pem.

### 2.4 Migrate a cluster

For a Swarm cluster created earlier, you can guarantee the performance and stability of the cluster by migrating the cluster.

#### Context

- The latest time for migrating a cluster is displayed through SMS, station message, or email
   Complete the Swarm cluster migration before the latest time. The system automatically migrates the cluster if you do not migrate the cluster before the latest time.
- Cluster migration rebuilds connections from cluster nodes to the container server without
  affecting applications deployed in the cluster, nor adding or modifying any data. Make sure that
  you perform this operation during the low peak period of your business because unpredictable
  risks might still exist throughout the migration process.

#### **Procedure**

- 1. Log on to the Container Service console.
- 2. Under the Swarm menu, click Clusters.
- 3. Click **Cluster Migration** in the action column at the right of the cluster to be migrated.

 Alibaba Cloud Cluster	US Western 1 (Silicon Valley)	VPC	Running	Healthy 🕽	2	08/21/2018,21:46:39	17.06.2- ce	Manage   View Logs   Delete Monitor   Cluster Migration   More▼
Alibaba Cloud Cluster	US Western 1 (Silicon Valley)	VPC	Running	Healthy 🕽	2	08/21/2018,21:46:32	17.06.2- ce	Manage   View Logs   Delete Monitor   More <del>v</del>

4. Click OK in the Prompt dialog box.



During cluster migration:

- Information query, deployment, upgrade, and other operations cannot be performed in the console.
- The cluster cannot be connected to through the cluster access point API.
- · The data and application status in the cluster remain unchanged. Applications deployed on the cluster are still accessible.
- · The migration process takes about three minutes.

On the Cluster List page, Migrating is displayed in the Cluster Status column.

 Alibaba Cloud Cluster	US Western 1 (Silicon Valley)	VPC	: Migrating	Healthy	2	08/21/2018,21:46:47	17.06.2- ce	Manage   View Logs   Delete Monitor   More ▼
Alibaba Cloud Cluster	US Western 1 (Silicon Valley)	VPC	Running	Healthy 🕽	2	08/21/2018,21:46:39	17.06.2- ce	Manage   View Logs   Delete Monitor   More▼

#### Result

After cluster migration is completed, on the **Cluster List** page, **Running** is displayed in the Cluster Status column.



Note:

- The cluster ID, access point address, and other attributes remain unchanged.
- Please be sure to confirm that your business is running properly.
- During the migration process, if you have any questions, please open a ticket in which you include the cluster ID and state whether your deployed applications are normal.

 Alibaba Cloud Cluster	US Western 1 (Silicon Valley)	VPC	Running	Healthy $\mathfrak{S}$	2	08/21/2018,21:46:47	17.06.2- ce	Manage   View Logs   Delete Monitor   More▼
 Alibaba Cloud Cluster	US Western 1 (Silicon Valley)	VPC	Running	Healthy 🕽	2	08/21/2018,21:46:39	17.06.2- ce	Manage   View Logs   Delete Monitor   More <del>▼</del>

## 3 Nodes

### 3.1 View containers running on a node

#### Context

You can view containers running on a node on the Node List page.

#### Procedure

- 1. Log on to the Container Service console.
- 2. Click Swarm > Nodes in the left-side navigation pane.
- **3.** On the Node List page, select a cluster from the Cluster drop-down list.
- 4. Click the node ID.

Container Service		Node List										fresh
Kubernetes	Swarm											
Overview	s	Help: Ø Postpay instan Cluster: swarm-test	ve to Prepay									
Services		IP Address	Instance Type	Instance ID/Name	Status	Number of Containers	Configuration	Operating System	Docker Version	Agent		Action
Clusters	1	3 (eip)	Alibaba Cloud Node	9.02017	Normal	7	CPU:2core(s) Memory:3.702 GB	CentOS Linux 7 (Core)	17.06.2-ce	0.10-98812ae	Monitor	More 🗸

You can see the list of containers running on the node.

<	Node:17											
Container List												
Node Monitoring	Instance ID: i-bp1bn Instance Name: c9b0	Labels:		Status: N	lormal		Region: China East 1 (Hangzhou)		Cluster: swarmmode-cluster			
		com.docker.swarm.node.id:j	js8ghfwj5m1sc9vet									
	Name/ID	e8/402lz com.docker.stack.namespace:acslogging	e8/402lz com.docker.stack.namespace:acslogging		e8/402lz com.docker.stack.namespace:acslogging	com.docker.stack.namespace:acslogging	com.docker.stack.namespace:acslogging	Port Container IP			Node IP	Action
	acs-agent () system	aliyun.addon:acslogging com.docker.compose.project com.docker.swarm.service.n	t:acslogging name:acslogging_lo			172.1		172.	Monitor Logs			
	acslogging_logsp () default	gspout com.docker.swarm.task.id:izp2ab29r7e6hplv23 dkq40en com.docker.swarm.service.id:9bagr23bz1hdw7 8z53swkifr. diyun.cap.oom_kill_disable:true			acslo		172.	Monitor   Logs   Web Terminal				
	acslogging_logta Ø default		com.docker.swarm.service.id:9bagrz3bz1hdw7 8z53swkifvx aliyun.cap.oom_kill_disable:true	n.docker.swarm.service.id:9bagrz3bz1hdw7 53swkifvx yun.cap.oom_kill_disable:true			172.1		172.	Monitor   Logs   Web Terminal		
=	acsmonitoring_ac () default	com.docker.swarm.task.nam pout.js8ghfwj5m1sc9vete87 6hplv23dkq40en	swarm.task.name:acslogging_logs vj5m1sc9vete874b2lz.izp2ab29r7e 40en			172.1		172.	Monitor   Logs   Web Terminal			
	acsrouting_routi () default	srouting_routi  running registry sha256			80/tcp	10.25 ingre multi		172.	Monitor   Logs   Web Terminal			
						acsro						
	acsvolumedriver	csvolumedriver         running         registry-vpc.or sha256:4030133dc           unnelagent         running         registry-vpc.or sha256:644001fe1				172.1		172.	Monitor Logs			
	tunnel-agent 🕼 system			<b>pc.cn</b> 44001fe1		172.1		172.	Monitor Logs			

#### What's next

In the list, you can view the labels, images, the image SHA256 values, logs, and monitoring information of containers and perform operations on containers, including starting and stopping containers, deleting containers, and operating on containers on a remote terminal.

### 3.2 Update a node certificate

You can update a node certificate of a Swarm cluster to avoid node certificate expiration.

#### Prerequisites

- 1. You have created a swarm cluster, see Create a cluster.
- **2.** Updating a node certificate reboots the node Docker Daemon. Make sure that containers on the node are all configured to restart automatically.

## Note:

You can configure a container restart policy when creating an application. When you create an application by using an image, select the **Always** check box for **Restart**. When you create an application by using a template, configure a container restart policy in the template restart : always.

**3.** If a node certificate expires within 60 days, a prompt is displayed. You must timely update the node certificate.

#### Context

Each cluster node has a certificate used to access system control services. Each issued certificat e has a valid period. When the valid period of a certificate is about to expire, you must manually renew the certificate. Otherwise, the service of the node is affected.

#### Procedure

- 1. Log on to the Container Service console.
- 2. Under the Swarm menu, click **Nodes** in the left-side navigation pane. The certificate expiration information of each cluster node is displayed.



The certificate expiration time is displayed in the status column only if the node certificate expires within 60 days.

 Select a node in the node list, and click More > Update Certificate on the right to reissue the node certificate.

### Note:

We recommend that you upgrade the cluster agent to the latest version before updating the node certificate.

- 4. Optional: If the system prompts you to upgrade the cluster agent after you click Update Certificate, the current cluster agent does not support this feature. You need to upgrade the cluster agent to the new version first, see Upgrade Agent. If no prompt is displayed, go to the next step.
- **5.** If no prompt is displayed or the cluster agent is updated, click **Update Certificate**. Confirm updating information and then update the node cluster certificate.



- When the node certificate update is completed, the Docker Daemon node is automatically restarted about 1 minute later.
- To guarantee that containers on the node can automatically restart, make sure that an automatic restart policy is configured.
- **6.** After the cluster node certificate is updated, the node certificate information is no longer displayed.

## 4 Service orchestrations

### 4.1 routing

The routing label configures the access domain name of a service.

#### Format:

```
aliyun.routing.port_$container_port: [http://]$domain|$domain_prefix[:
$context_path]
```

Field description:

- \$container\_port: container port. Note: This is not the host port.
- \$domain: domain name. Enter a domain name.
- \$domain\_prefix: domain name prefix. If you enter a domain name prefix, Container Service
  provides you with a test domain name and the domain name suffix is .<cluster\_id>.<
  region\_id>.alicontainer.com.
- \$context\_path: requested service path. You can select services according to the requested path.

#### Domain name selection:

- If the HTTP protocol is used to expose the service, you can use the internal domain name (the top-level domain is alicontainer.com) provided by Container Service for testing, or use your own domain name.
- If the HTTPS protocol is used, you can use only your own domain name. For example, www.
   example.com. You must modify the DNS settings to assign the domain name to the Server
   Load Balancer service provided by the container cluster.

#### Format requirements of the label statement:

- Container Service allocates a subdomain name to each cluster, and you only need to provide the domain name prefix to bind the internal domain name. The domain name prefix only indicates a domain name level and cannot be separated with periods (.).
- If you do not specify scheme, the HTTP protocol is used by default.
- The length of the domain name cannot exceed 128 characters. The length of the context root cannot exceed 128 characters.
- When you bind multiple domain names to the service, use semicolons (;) to separate them.

 A backend service can have multiple ports. These ports are exposed by the container. A port can only be assigned one label. Therefore, a service with multiple ports must be assigned multiple labels.

#### Example:

Use the routing label.

Bind the internal domain namewordpress.<cluster\_id>.<region\_id>.alicontainer .com provided by Container Service and your own domain name http://wp.sample.com/ context to port 80 of the Web service.

```
web:
    image: wordpress:4.2
    links:
        - db:mysql
    labels:
        aliyun.routing.port_80: wordpress;http://wp.sample.com/context
    db:
        image: mysql
        environment:
            - MYSQL_ROOT_PASSWORD=password
```

The internal domain name that you finally get is wordpress.cd3dfe269056e4543acb ec5e19b01c074.cn-beijing.alicontainer.com.

After starting the Web service, you can access the corresponding Web services by using the URL: http://wordpress.cd3dfe269056e4543acbec5e19b01c074.cn-beijing.alicontain er.com Orhttp://wp.sample.com/context.

To support the HTTPS service, upload the HTTPS certificate by using the Server Load Balancer console on the Alibaba Cloud website, and then bind the corresponding cluster to access the Server Load Balancer terminal.

#### routing.session\_sticky

By using this feature, you can determine whether to maintain session sticky (session persistence) when you set the routing for a routing request. With session persistence, during the session, each request is routed to the same backend container instead of being randomly routed to different containers.



#### Note:

 The setting takes effect only when you have configured aligun.routing.port\_\$ contaienr\_port.

- Simple routing session persistence is based on the Cookie mechanism. By default, the maximum expiration time of Cookie is 8 hours and the idle expiration time is 30 minutes.
- Simple routing session persistence is enabled by default.

The setting methods are as follows:

• Enable session persistence

aliyun.routing.session\_sticky: true

• Disable session persistence

aliyun.routing.session\_sticky: false

Example of a template orchestration file:

```
web:
    image: wordpress:4.2
    links:
        - db:mysql
    labels:
        aliyun.routing.port_80: wordpress;http://wp.sample.com/context
        aliyun.routing.session_sticky: true
db:
    image: mysql
    environment:
        - MYSQL_ROOT_PASSWORD=password
```

## 5 Data volumes

### 6 DevOps

### 6.1 Jenkins-based continuous delivery

As an important step in agile development, continuous integration aims to maintain high quality while accelerating product iteration. Every time codes are updated, an automated test is performed to test the codes and function validity. The codes can only be delivered and deployed after they pass the automated test. This document mainly introduces how to integrate Jenkins, one of the most popular continuous integration tools, with Alibaba Cloud Container Service to realize automated test and image building push.

The following example demonstrates how to perform automated test and build a Docker image by using Alibaba Cloud Container Service Jenkins, which realizes high-quality continuous integration.

#### **Background information**

Every time codes are submitted to nodejs project in GitHub, Alibaba Cloud Container Service Jenkins will automatically trigger a unit test. If the test is successful, Jenkins continues to build images and then pushes them to a target image repository. Finally, Jenkins notifies you of the results by email.

A general process is as follows.



Slave-nodejs is a slave node used for unit test and building and pushing the image.

#### Jenkins introduction

Jenkins is an open-sourced continuous integration tool developed on Java. It monitors and triggers continuously repeated work and supports expansion of multiple platforms and plug-ins. Jenkins is an open-sourced tool featuring easy installation and interface-based management. It uses job to describe every work step, and node is a project execution environment. The master node is a default execution environment of a Jenkins job and also the installation environment for Jenkins applications.

#### Master/slave

Master/slave is equivalent to the server/agent concept. A master provides Web interface with which you manage the job and slave. The job can run on the master or be assigned to the slave . One master can be associated with several slaves to serve different jobs or different configurat ions of the same job.

Several slaves can be configured to prepare a separate test and building environment for different projects.

### Note:

The Jenkins job and project mentioned in this document all refer to a build unit of Jenkins, namely, an execution unit.

#### Step 1 Deploy Jenkins applications and slave nodes

The building and testing of different applications need different dependencies. The best practice is to use different slave containers with corresponding runtime dependencies and tools to perform the test and building. By using the slave images and sample templates provided by Alibaba Cloud Container Service for different environments such as Python, Node.js, and Go, you can quickly and easily generate Jenkins applications and various slave nodes, configure node information in Jenkins applications, and specify the execution nodes in the build projects so as to implement the entire continuous integration process.

### Note:

For images provided by Alibaba Cloud Container Service for developing slave nodes, see *https://github.com/AliyunContainerService/jenkins-slaves*.

#### 1.1 Create a Jenkins orchestration template

Create a template and create the orchestration based on the following contents.

The labels supported by Alibaba Cloud Container Service Jenkins master are: 1.651.3, 2.19.2, and 2.32.2.

Note:

For how to create an orchestration template, see *#unique\_21*.

```
jenkins:
    image: 'registry.aliyuncs.com/acs-sample/jenkins:1.651.3'
    volumes:
        - /var/lib/docker/jenkins:/var/jenkins_home
    restart: always
    labels:
        aliyun.scale: '1'
        aliyun.probe.url: 'tcp://container:8080'
        aliyun.probe.initial_delay_seconds: '10'
        aliyun.routing.port_8080: jenkins
    links:
        - slave-nodejs
slave-nodejs:
    image: 'registry.aliyuncs.com/acs-sample/jenkins-slave-dind-nodejs
ī
    volumes:
        - /var/run/docker.sock:/var/run/docker.sock
    restart: always
    labels:
        aliyun.scale: '1'
```

#### 1.2 Use the template to create Jenkins application and slave node

Use the orchestration template created in the preceding section or the Jenkins sample template provided by Alibaba Cloud Container Service to create the Jenkins application and slave node.



After a successful creation, the Jenkins application and slave node are displayed in the service list.

Application:	jenkins								Refresh			
Overview												
Name: jen	nkins				Time Created:	2018-01-16	Time Updated: 2018-01-16	Cluster: test				
Trigger 1.	Trigger 1. You can only have one of each trigger type.											
No trigger is available at the moment. Click "Create Trigger" in the upper-right corner.												
Services	Containers	Logs	Events	Routes								
Name	App	lication	Stat	us	Container Status	Image		Action				
jenkins	jeni	kins	●R	eady	Ready:1 Stop:0	registry.cn-hangzhou	aliyuncs.com/acs-sample/jen		Stop   Restart   Reschedule   Update   Delete   Events			
slave-golang jenkins Ready Ready:1 Stop:0			Ready:1 Stop:0	registry.aliyuncs.com	/acs-sample/jenkins-slave-d		Stop   Restart   Reschedule   Update   Delete   Events					
slave-java	jen	kins	●R	eady	Ready:1 Stop:0	registry.aliyuncs.com	/acs-sample/jenkins-slave-d		Stop   Restart   Reschedule   Update   Delete   Events			
slave-nodej:	s jen	kins	• R	eady	Ready:1 Stop:0	registry.aliyuncs.com	/acs-sample/jenkins-slave-d		Stop   Restart   Reschedule   Update   Delete   Events			

Open the access endpoint provided by Container Service to use the deployed Jenkins application.

Service:	jenkin	s_jenkins										R	efresh Scale
Overvie	Overview												
Service	Service Name: jenkins Application: jenkins Image: registry.cn-hangzhou.aliyuncs.com/acs-sample/jenkins:2.60.3								Number: 1	Ready			
Access	Access Endpoint: http://jenkins.												
Contain	ners	Logs	Configura	tions	Events								
Name/II	C		Status		Health Check	Image	Port	Cor	ontainer IP	Node IP			Action
jenkins_ 8402cbd	jenkin 157131	ns () 1355b	runnir	g	Normal	registry.cn-hang sha256:a33929a9c	8080/tcp 50000/tc	p IN	0.18.68	192,168,161,129	Delete   Stop	Monitor Logs	Web Terminal

#### Step 2 Realize automated test and automated build and push of image

#### 2.1 Configure the slave container as the slave node of the Jenkins application

Open the Jenkins application. Click Manage Jenkins in the left-side navigation pane. Click Manage Nodes on the right pane. Click New Node in the left-side navigation pane. Enter the node name and then click OK. Then, complete the parameters as follows.

Name	slave-nodejs-ut	0
Description	slave-nodejs-ut	Ð
# of executors	1	0
Remote root directory	/home/jenkins	Ð
Labels	slave-nodejs-ut	0
Usage	Utilize this node as much as possible	Ð
Launch method	Launch slave agents on Unix machines via SSH	0
	Host 172.180.0	
	Credentials jenkins/***** V Add -	Ð
	Advanced	
Availability	Keep this slave on-line as much as possible	0
Node Properties		
<ul> <li>Environment varial</li> <li>Tool Locations</li> <li>Save</li> </ul>	les	

Note:

- Label is the unique identifier of the slave.
- The slave container and Jenkins container run on the Alibaba Cloud platform at the same time
  . Therefore, enter a container node IP address that is inaccessible to the Internet to isolate the
  test environment.
- When adding the credentials, use the jenkins account and password (the initial password is jenkins) in Dockerfile for the creation of the slave-nodejs image. The image Dockerfile address is jenkins-slave-dind-nodejs.

#### 2.2 Create a project to implement automated test

- **1.** Go back to the Jenkins home page. Click New Item in the left-side navigation pane. Enter the item name, select Freestyle project, and then click OK.
- Enter the project name and select a node for running the project. In this example, enter the slave-nodejs-ut node prepared in the preceding section.

Project name	nodejs-ut	
Description		
	[Plain text] Preview	
GitHub project	· · · · · · · · · · · · · · · · · · ·	1
Project url	https://github.com/qinyujia/containerops/	
		Advanced
GitLab connection	gitlab	+
Discard Old Builds		
This build is parameteriz	ed	
Disable Build (No new b	uilds will be executed until the project is re-	enabled.)
Execute concurrent build	s if necessary	_
Restrict where this proje	ct can be run	
Label Expression	slave-nodejs-ut	
	Label is serviced by 1 node	

 Configure the source code management and code branch. In this example, use GitHub to manage source codes.

Source Code Management		
O None		
⊖ CVS		
O CVS Projectset		_
<ul> <li>Git</li> </ul>		
Repositories	Repository URL https://github.com/ginyujia/containerops.git	
	Credentials 756 Com/***** Com/***** Credentials	
	Advanced	?
	Add Repository Delete Repository	
Branches to build	Branch Specifier (blank for 'any') +/jenkins-test	
	Add Branch Delete Branch	

**4.** Configure the build trigger. In this example, automatically trigger project execution by combining GitHub Webhooks & services.

Bu	ild Triggers	
	Build after other projects are built	?
	Build periodically	?
<	Build when a change is pushed to GitHub	2
	Build when a change is pushed to GitLab. GitLab CI Service URL: http://jenkins.c11267d36daf04ee3960854773128225e.cn-hangzhou.alicontainer.com/project/test2	0
	Poll SCM	2

5. Add the Jenkins service hook to GitHub to implement automatic triggering.

On the GitHub project home page, click the **Settings**. Click **Webhooks & services**, click **Add Service**, and then select **Jenkins(Git plugin)** from the drop list. In the dialog box of **Jenkins hook url**, enter  $\{Jenkins IP\}/github-webhook/.$  For example:

http://jenkins.cd\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*.cn-beijing.alicontainer.com/github -webhook/ % qinyujia / containerops OUnwatch → 1 ★ Star 0 % Fork 3 orked from ringtail/conta <> Code 11 Pull requests 0 Projects 0 Wiki III Graphs C Settings Options Services / Add Jenkins (Git plugin) Collaborators **Install Notes** Branches Requires Git Plugin v1.1.18, released 2012-04-27, and the "Poll SCM" build trigger needs to be enabled. Webhooks (Though you can have it poll very infrequently, I recommend something like 0 \*/3 \* \* \*) • "Jenkins Url" is the base URL of your Jenkins server. For example: http://ci.jenkins-ci.org/. We will hit Integrations & services /git/notifyCommit under this URL. (See the Git plugin wiki page for more details.) Deploy keys Details Jenkins is a popular continuous integration server. If you're using the standard Jenkins Git plugin to poll & check out your repository, you can quickly and easily switch to a push model using this service. It will send a request to your Jenkins instance telling it about the repositories and branches that changed. Jenkins will then poll the repository and build if needed. See push notification from repository on the Jenkins wiki for information. Jenkins url -hang http://jenkins.c112 Active We will run this service when an event is triggered. Add service

6. Add a build step of Execute shell type and write shell scripts to perform the test.



The commands in this example are as follows:

pwd ls cd chapter2 npm test

#### SVN source code example:

Select **Subversion** in Source Code Management and enter the SVN repository address in the **Repository URL** field (if the Jenkins master and SVN server are in different time zones, add @ <u>HEAD</u> at the end of the repository address). Add the username and password of the SVN server in **Credentials**.

Source Code Management			
O None			
O CVS			
O CVS Projectset		_	
<ul> <li>Git</li> </ul>		1	
Repositories	Repository URL https://github.com/qinyujia/containerops.git	D	
	Credentials 756 - Add -		
	Advanced	0	
	Add Repository Delete Repository		
Branches to build	Branch Specifier (blank for 'any') •/jenkins-test	)	
	Add Branch Delete Branch		

Configure the build trigger. In this example, Post-commit hook is used to automatically trigger the project execution. Enter your configured token in **Token Name**.

Build Triggers		
<ul> <li>Build after other pr</li> </ul>	Build after other projects are built	
Projects to watch	nodejs-ut	
	Trigger only if build is stable	
	O Trigger even if the build is unstable	
	O Trigger even if the build fails	
Build periodically		?
<ul> <li>Build when a chan</li> </ul>	Build when a change is pushed to GitHub	
Build when a change is pushed to GitLab. GitLab CI Service URL: http://jenkins.c11267d36daf04ee3960854773128225e.cn-hangzhou.alicontainer.com/project/nodejs- build		2
Poll SCM		?

Log on to the SVN server. Create a *post-commit* file in the *hooks* directory of the code repository (svn-java-demo).

```
cd /home/svn/svn-java-demo/hooks
cp post-commit.tmpl post-commit
chmod 755 post-commit
```

Add the curl -u \${Jenkins\_account}:\${password}

```
${Jenkins_url}/job/svn/build?
```

token=\${token} command

in the <g id="1">post-commit</g> file. For example:

```
curl -u test:test
http://127.0.0.1:8080/jenkins/job/svn/build?token=qinyujia
```

.

#### 2.3 Create a project to automatically build and push images

- **1.** Go back to the Jenkins home page. Click New Item in the left-side navigation pane. Enter the item name, select Freestyle project, and then click OK.
- **2.** Enter the project name and select a node for running the project. In this example, enter the slave-nodejs-ut node prepared in the preceding section.
- **3.** Configure the source code management and code branch. In this example, use GitHub to manage source codes.
- **4.** Add the following trigger and set to automatically build the image only after the unit test is successful.

Build Triggers		
Build after other projects are built		?
Projects to watch	nodejs-ut	
	Trigger only if build is stable	
	O Trigger even if the build is unstable	
	O Trigger even if the build fails	
<ul> <li>Build periodically</li> </ul>		2
<ul> <li>Build when a chan</li> </ul>	Build when a change is pushed to GitHub	
Build when a change is pushed to GitLab. GitLab CI Service URL: http://jenkins.c11267d36daf04ee3960854773128225e.cn-hangzhou.alicontainer.com/project/nodejs- build		?
Poll SCM		?

5. Write the shell script for building and pushing images.



The commands in this example are as follows:

```
cd chapter2
sudo docker build -t registry.aliyuncs.com/qinyujia-test/nodejs-
demo .
sudo docker login -u ${yourAccount} -p ${yourPassword} registry.
aliyuncs.com
```

sudo docker push registry.aliyuncs.com/qinyujia-test/nodejs-demo

#### Step 3 Automatically redeploy the application

#### 3.1 Deploy the application for the first time

Use the orchestration template to deploy the image created in step 2.3 to Container Service and create the nodejs-demo application.

Example:

```
express:
image: 'registry.aliyuncs.com/qinyujia-test/nodejs-demo'
expose:
    - '22'
    - '3000'
restart: always
labels:
    aliyun.routing.port_3000: express
```

#### 3.2 Automatic redeployment

1. Select the created application **nodejs-demo** and create the trigger.



Trigger 1. You can only have one of each trigger type.		Cr	eate Trigger 🔷 🔺
Trigger Link (move mouse over to copy)	Secret (move mouse over to copy)	Туре	Action
https://undefined/hook/triager?triagerUrl=Y2kNW11NTkM2hIZTOXM2hNIJhNigYY2axNiY3NzhfGpbmtpbnN8cmVkZXBsb318MTjjYTNMTYyBAxNiY3NzhfGpbmtpbnN8cmVkZXBsb318MTjjYTNMTYyBAxNiY3NzhfGpbmtpbnN8cmVkZXBsb318MTjjYTNMTYYBAxNiY3NzhfGpbmtpbnN8cmVkZXBsb318MTjjYTNMTYYBAxNiY3NzhfGpbmtpbnN8cmVkZXBsb318MTjjYTNMTYYBAxNiY3NzhfGpbmtpbnN8cmVkZXBsb318MTjjYTNMTYYBAxNiY3NzhfGpbmtpbnN8cmVkZXBsb318MTjjYTNMTYYBAxNiY3NzhfGpbmtpbnN8cmVkZXBsb318MTjjYTNMTYYBAxNiY3NzhfGpbmtpbnN8cmVkZXBsb318MTjjYTNMTYYBAxNiY3NzhfGpbmtpbnN8cmVkZXBsb318MTjjYTNMTYYBAxNiY3NzhfGpbmtpbnN8cmVkZXBsb318MTjjYTNMTYYBAxNiY3NzhfGpbmtpbnN8cmVkZXBsb318MTjjYTNMTYYBAxNiY3NzhfGpbmtpbnN8cmVkZXBsb318MTjjYTNMTYYBAxNiY3NzhfGpbmtpbnN8cmVkZXBsb318MTjjYTNMTYYBAxNiY3NzhfGpbmtpbnN8cmVkZXBsb318MTjjYTNMTYYBAxNiY3NzhfGpbmtpbnN8cmVkZXBsb318MTjjYTNMTYYBAxNiY3NzhfGpbmtpbnN8cmVkZXBsb318MTjjYTNMTYYBAxNiY3NzhfGpbmtpbnN8cmVkZXBsb318MTjjYTNMTYYBAxNiY3NzhfGpbmtpbnN8cmVkZXBsb318MTjjYTNMTYYBAxNiY3NzhfGpbmtpbnN8cmVkZXBsb318MTjjYTNMTYYBAxNiY3NzhfGpbmtpbnN8cmVkZXBsb318ATjjYTNMTYYBAxNiY3NzhfGpbmtpbnN8cmVkZXBsb318ATjjYTNMTYYBAXNIYANTYBAxNiY3NZhfGpbmtpbN8cmVkZXBsb318ATjjYTNMTYYBAXNIYANTYB	74386f737245553732703738674b7966439e	Redeploy	Delete Trigger

2. Add a line to the shell script in 2.3. The address is the trigger link of the created trigger.

```
curl `https://cs.console.aliyun.com/hook/trigger?triggerUrl=***==&
secret=***'
```

**3.** Change the command in the example of 2.3 as follows:

```
cd chapter2
sudo docker build -t registry.aliyuncs.com/qinyujia-test/nodejs-
demo .
sudo docker login -u ${yourAccount} -p ${yourPassword} registry.
aliyuncs.com
sudo docker push registry.aliyuncs.com/qinyujia-test/nodejs-demo
curl `https://cs.console.aliyun.com/hook/trigger?triggerUrl=***==&
secret=***'
```

After pushing the image, Jenkins automatically triggers the redeployment of the nodejs-demo application.

#### Step 4 Configure email notification of the results

To send the unit test or image building results to relevant developers or project execution initiators by email, perform the following configurations:

 On the Jenkins homepage, click Manage Jenkins > Configure System, and configure the Jenkins system administrator email.

Jenl	Jenkins Location			
	Jenkins URL	http://jenkins.c11267d36daf04ee3960854773128225e.cn-hangzhou.alicontainer.com/	0	
	System Admin e-mail address	jenkins-cs@alibaba-inc.com	0	

**2.** Install the Extended Email Notification plug-in, configure the SMTP server and other relevant information, and then set the default email recipient list, as shown in the following figure:

E-mail Notification				
	SMTP server	smtp.alibaba-inc.com		0
	Default user e-mail suffix			0
	Use SMTP Authentication			?
	User Name	jenkins-cs@alibaba-inc.com		
	Password	••••••		
	Use SSL			0
	SMTP Port	465		0
	Reply-To Address	on all the set		
	Charset	UTF-8		
	Test configuration by sending test e-mail			

The preceding example shows the parameter settings of the Jenkins application system. The following example shows the relevant configurations for Jenkins projects whose results are to be pushed by email.

**3.** Add post-building steps in the Jenkins project, select Editable Email Notification and enter the email recipient list.

Add build step 👻		
Post-build Actions		
Editable Email Notification		?
Disable Extended Email Publisher	0	0
	Allows the user to disable the publisher, while maintaining the settings	
Project Recipient List	@alibaba-inc.com	

**4.** Add a trigger to send emails.

Triggers	Always	0
	Send To	(2) Delete
	Developers	(i) Delete
	Requestor	Delete
	Add 👻	
		Advanced
		Remove Trigger

## 7 Service discovery and load balancing

# 7.1 Routing and Server Load Balancer between services in a cluster

Container Service can expose the HTTP service based on domain names by using acsrouting, and work with health check to enable the automatic Server Load Balancer and service discovery. When one container malfunctions, routing will automatically remove the container that failed the health check from the backend, which achieves the automatic service discovery. However, in this way, the service is exposed to the Internet.

Then, how can automatic service discovery and Server Load Balancer be achieved between services in a cluster by using this method? The routing container of Alibaba Cloud Container Service has the function of Server Load Balancer. Use the domain name ending with .local to make the container can only be accessed by the other containers in the cluster, and then work with the external\_links label to implement the inter-service discovery and Server Load Balancer in the cluster.

#### Implementation principle

- 1. Docker version later than 1.10 supports alias resolution in the container. In the restservice container that depends and loads on the restserver.local, the restserver.local domain name resolves the address of the routing container. When the restclient service initiates a request, the HTTP request is forwarded to the routing container, with HOST as the request header of restserver.local.
- 2. Routing container monitors the health status of the containers configured with aligun. routing.port\_xxx: restserver.local label and mounts the status to the backend of HAProxy. When HAProxy receives the HTTP request with the restserver.local HOST header, the request can be forwarded to the corresponding container.



#### **Advantages**

- Compared with the DNS-based method using link or hostname, the inconsistent handling of DNS cache by different clients will delay service discovery, and the DNS solution which only includes round robin cannot meet the requirements of microservice scenarios.
- Compared with other microservice discovery solutions, this solution provides a mechanism to achieve unrelated service discovery and Server Load Balancer, which can be used without any modification on the server side or client application.
- In decoupling service lifecycle, every microservice can adopt a Docker Compose template for independent deployment and update. Only a virtual domain name is required to achieve dynamic mutual binding.

#### **Orchestration example**

In the following orchestration example, add the aligun.routing.port\_80:restserver. local label to the restserver service to make sure only the containers in the cluster can access this domain name. Then, configure external\_links for the restclient service, pointing to the restserver.local domain name. The restclient service can use this domain name to access the

restserver service, and work with health check to implement automatic service discovery.

```
restserver: # Simulate the rest service.
  image: nginx
  labels:
    aliyun.routing.port_80: restserver.local # Use the local domain
name and only the containers in the cluster can access this domain
name.
   aliyun.scale: "2" # Expand two instances to simulate the Server
Load Balancer.
     aliyun.probe.url: "http://container:80" # Define the container
health check policy as http and the port as 80.
   aliyun.probe.initial_delay_seconds: "2" # The health check starts
two seconds after the container is started.
     aliyun.probe.timeout_seconds: "2" # The timeout for health check
. A container is considered as unhealthy if no result is returned in
two seconds.
restclient: # Simulate the rest service consumer.
  image: registry.aliyuncs.com/acs-sample/alpine:3.3
  command: "sh -c 'apk update; apk add curl; while true; do curl --
head restserver.local; sleep 1; done'" # Access the rest service and
test the Server Load Balancer.
 tty: true
  external_links:
      - "restserver.local" # Specify the link service domain name.
Make sure that you set external_links. Otherwise, the access fails.
```

The following restclient service logs show that the HTTP request of restclient curl is routed to the containers of different rest services. The container ID is 053cb232fdfbcb5405ff791650a074 6ab77f26cce74fea2320075c2af55c975f and b8c36abca525ac7fb02d2a9fcaba8d 36641447a774ea956cd93068419f17ee3f.

```
internal-loadbalance_restclient_1 | 2016-07-01T06:43:49.066803626Z
Server: nginx/1.11.1
internal-loadbalance_restclient_1 | 2016-07-01T06:43:49.066814507Z
Date: Fri, 01 Jul 2016 06:43:49 GMT
internal-loadbalance restclient 1 | 2016-07-01T06:43:49.066821392Z
Content-Type: text/html
internal-loadbalance_restclient_1 | 2016-07-01T06:43:49.066829291Z
Content-Length: 612
internal-loadbalance_restclient_1 | 2016-07-01T06:43:49.066835259Z
Last-Modified: Tue, 31 May 2016 14:40:22 GMT
internal-loadbalance_restclient_1 | 2016-07-01T06:43:49.066841201Z
ETaq: "574da256-264"
internal-loadbalance_restclient_1 | 2016-07-01T06:43:49.066847245Z
Accept-Ranges: bytes
internal-loadbalance_restclient_1 | 2016-07-01T06:43:49.066853137Z
 Set-Cookie: CONTAINERID=053cb232fdfbcb5405ff791650a0746ab77f26cc
e74fea2320075c2af55c975f; path=/
internal-loadbalance_restclient_1 | 2016-07-01T06:43:50.080502413Z
HTTP/1.1 200 OK
internal-loadbalance_restclient_1 | 2016-07-01T06:43:50.082548154Z
Server: nginx/1.11.1
internal-loadbalance_restclient_1 | 2016-07-01T06:43:50.0825591092
Date: Fri, 01 Jul 2016 06:43:50 GMT
```

internal-loadbalance\_restclient\_1 | 2016-07-01T06:43:50.082589299Z Content-Type: text/html internal-loadbalance\_restclient\_1 | 2016-07-01T06:43:50.082596541Z Content-Length: 612 internal-loadbalance\_restclient\_1 | 2016-07-01T06:43:50.082602580Z Last-Modified: Tue, 31 May 2016 14:40:22 GMT internal-loadbalance\_restclient\_1 2016-07-01T06:43:50.082608807Z ETag : "574da256-264" internal-loadbalance\_restclient\_1 | 2016-07-01T06:43:50.082614780Z Accept-Ranges: bytes internal-loadbalance\_restclient\_1 | 2016-07-01T06:43:50.082614780Z Set-Cookie: CONTAINERID=b8c36abca525ac7fb02d2a9fcaba8d36641447a7 74ea956cd93068419f17ee3f; path=/