Cloud Container Engine

FAQs

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1 Common Questions

Cluster Management

- Why Cannot I Create a CCE Cluster?
- Is Management Scale of a Cluster Related to the Number of Master Nodes?
- How Do I Locate the Fault When a Cluster Is Unavailable?

Node/Node Pool Management

- What Should I Do If a Cluster Is Available But Some Nodes Are Unavailable?
- What Should I Do If I/O Suspension Occasionally Occurs When SCSI EVS Disks Are Used?

Workload Management

- What Should I Do If Pod Scheduling Fails?
- What Should I Do If a Pod Fails to Pull the Image?
- What Should I Do If Container Startup Fails?
- What Should I Do If Pods in the Terminating State Cannot Be Deleted?
- What Is the Image Pull Policy for Containers in a CCE Cluster?

Networking

Why Does the Browser Return Error Code 404 When I Access a Deployed Application?

What Should I Do If a Node Fails to Connect to the Internet (Public Network)?

How Do I Optimize the Configuration If the External Domain Name Resolution Is Slow or Times Out?

2 Billing

2.1 How Is CCE Billed/Charged?

Billing Modes

There are yearly/monthly and pay-per-use billing modes to meet your requirements. For details, see **Billing Modes**.

- Yearly/Monthly is a prepaid billing mode. You pay in advance for a subscription term. Before purchasing yearly/monthly resources, make sure you have a top-up account with a sufficient balance.
- Pay-per-use is a postpaid billing mode. You pay as you go and just pay for what you use.

After purchasing CCE clusters or cluster resources, you can change their billing modes if the current billing mode cannot meet your service requirements. For details, see **Billing Mode Changes**.

Billing Items

You will be billed for clusters, nodes, and other cloud service resources. For details about the billing factors and formulas for each billed item, see **Billing Items**.

For more information about the billing samples and the billing for each item, see **Billing Examples**.

2.2 How Do I Change the Billing Mode of a CCE Cluster from Pay-per-Use to Yearly/Monthly?

Currently, clusters support **pay-per-use** and **yearly/monthly** billing modes. A pay-per-use cluster can be converted to a yearly/monthly-billed cluster.

Constraints and Limitations

- Only nodes in the default node pool **DefaultPool** can be changed to the yearly/monthly billing mode.

- Nodes whose billing mode is changed to yearly/monthly do not support auto scaling.

Changing to Yearly/Monthly Billing Mode

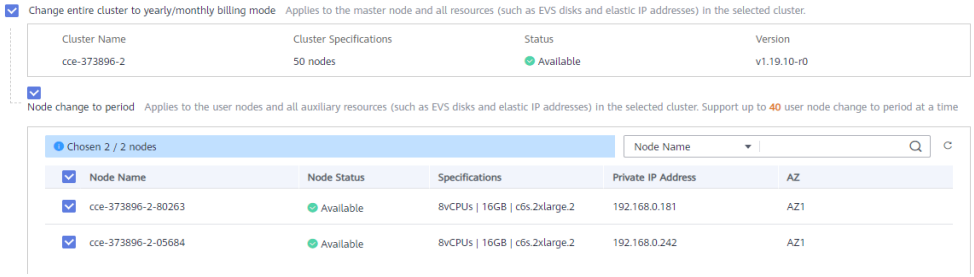
To change the billing mode of the clusters you have purchased from pay-per-use to yearly/monthly, perform the following steps:

Step 1 Log in to the CCE console. In the navigation pane, choose **Clusters**.

Step 2 Locate the target cluster, and click **Change Billing Mode** in the upper right corner.

Step 3 On the **Change Billing Mode** page, select the target cluster. You can also select the nodes whose billing mode you want to change.

Figure 2-1 Changing the billing mode of a cluster to yearly/monthly



Step 4 Click **OK**. Wait until the order is processed and the payment is complete.

----End

2.3 Can I Change the Billing Mode of CCE Nodes from Pay-per-Use to Yearly/Monthly?

Currently, nodes support **pay-per-use** and **yearly/monthly** billing modes.

Constraints and Limitations

- You cannot change the nodes from pay-per-use to yearly/monthly on the ECS console.
- Only nodes in the default node pool **DefaultPool** can be changed to the yearly/monthly billing mode.
- Nodes whose billing mode is changed to yearly/monthly do not support auto scaling.

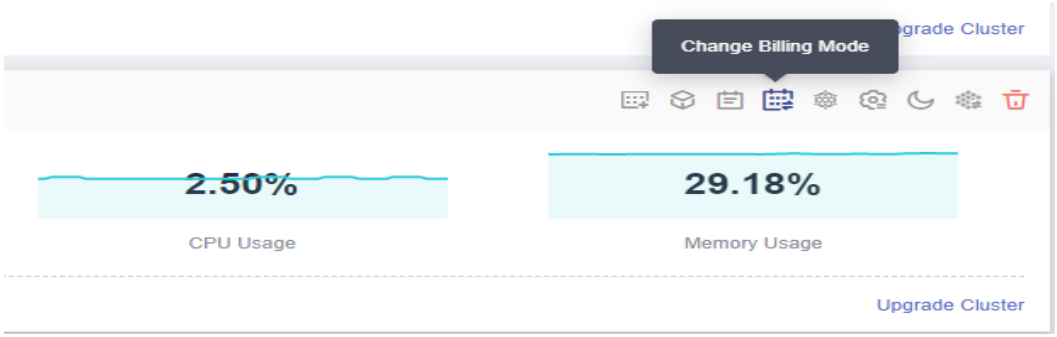
Procedure

To change the billing mode of the nodes you have purchased from pay-per-use to yearly/monthly, perform the following steps:

Step 1 Log in to the CCE console. In the navigation pane, choose **Clusters**.

Step 2 Click  next to the target cluster.

Figure 2-2 Changing to the yearly/monthly billing mode

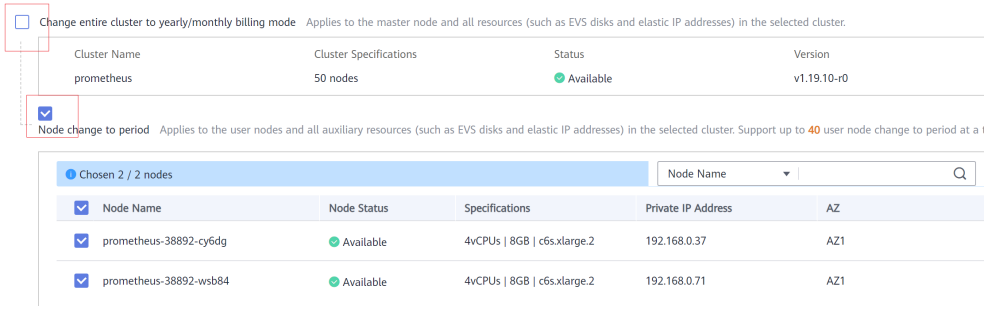


Step 3 On the **Change Billing Mode** page, choose the nodes that will be changed to the yearly/monthly billing mode.

NOTE

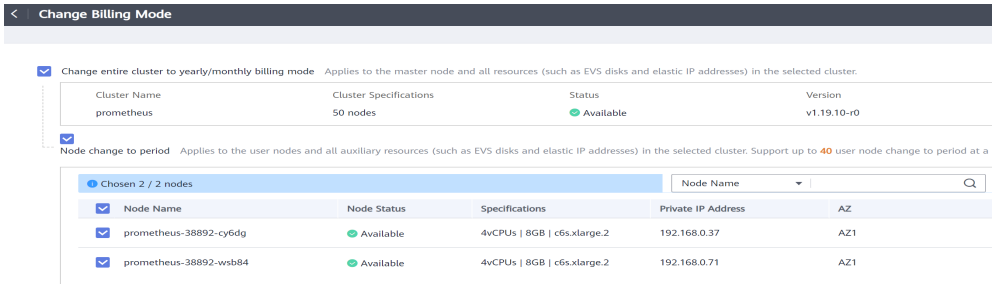
By default, the **Change entire cluster to yearly/monthly billing mode** is selected. If you want to change certain nodes of the cluster to the yearly/monthly billing mode, deselect this option.

Figure 2-3 Changing nodes to the yearly/monthly billing mode



If you want to change the whole cluster to the yearly/monthly billing mode, select this option and the nodes that need to be changed to the yearly/monthly billing mode.

Figure 2-4 Changing the cluster and nodes of the cluster to the yearly/monthly billing mode



Step 4 Click **OK**. Wait until the order is processed and the payment is complete.

----End

2.4 Can I Delete a Yearly/Monthly-Billed CCE Cluster Directly When It Expires?

After a yearly/monthly-billed cluster expires, you can delete the cluster after all data is backed up.

If you do not renew or delete the cluster after it expires, the system will delete the cluster based on the resource expiration time. You are advised to renew the cluster and back up data in a timely manner.

3 Cluster

3.1 Cluster Creation

3.1.1 Why Cannot I Create a CCE Cluster?

Overview

This section describes how to locate and rectify the fault if you fail to create a CCE cluster.

Details

Possible causes:

1. The Network Time Protocol daemon (ntpd) is not installed or fails to be installed, Kubernetes components fail to pass the pre-verification, or the disk partition is incorrect. The current solution is to create a cluster again. For details about how to locate the fault, see **Locating the Failure Cause**.

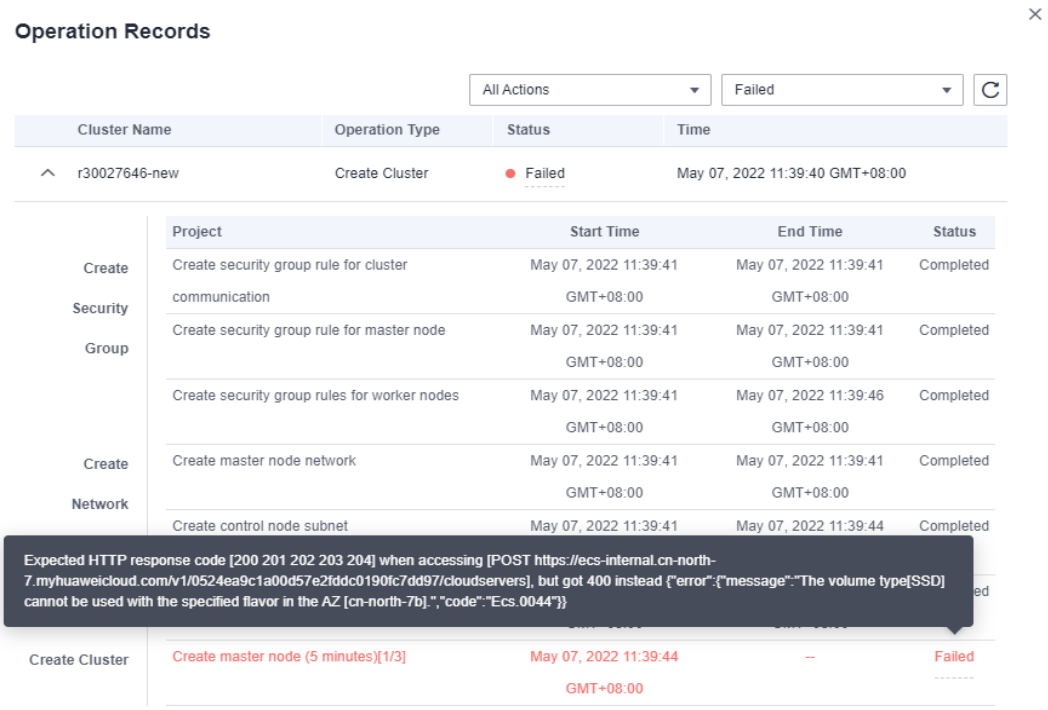
Locating the Failure Cause

View the cluster logs to identify the cause and rectify the fault.

Step 1 Log in to the CCE console. In the navigation pane, click **Operation Records** above the cluster list to view operation records.

Step 2 Click the record of the **Failed** status to view error information.

Figure 3-1 Viewing the operation details



Step 3 Rectify the fault based on the error information and create a cluster again.

----End

3.1.2 Is Management Scale of a Cluster Related to the Number of Master Nodes?

Management scale indicates the maximum number of nodes that can be managed by a cluster. If you select **50 nodes**, the cluster can manage a maximum of 50 nodes.

The number of master nodes varies according to the cluster specification, but is not affected by the management scale.

After the multi-master node mode is enabled, three master nodes will be created. If a master node is faulty, the cluster can still be available without affecting service functions.

3.1.3 How Do I Update the Root Certificate When Creating a CCE Cluster?

The root certificate of CCE clusters is the basic certificate for Kubernetes authentication. Both the Kubernetes cluster control plane and the certificate are hosted on Huawei Cloud CCE. CCE will periodically update the certificate. This certificate is not open to users but will not expire.

The X.509 certificate is enabled on Kubernetes clusters by default. CCE will automatically maintain and update the X.509 certificate.

Obtaining a Cluster Certificate

You can obtain a cluster certificate on the CCE console to access Kubernetes. For details, see **Obtaining a Cluster Certificate**.

3.1.4 Which Resource Quotas Should I Pay Attention To When Using CCE?

CCE restricts **only the number of clusters**. However, when using CCE, you may also be using other cloud services, such as Elastic Cloud Server (ECS), Elastic Volume Service (EVS), Virtual Private Cloud (VPC), Elastic Load Balance (ELB), and SoftWare Repository for Containers (SWR).

What Is Quota?

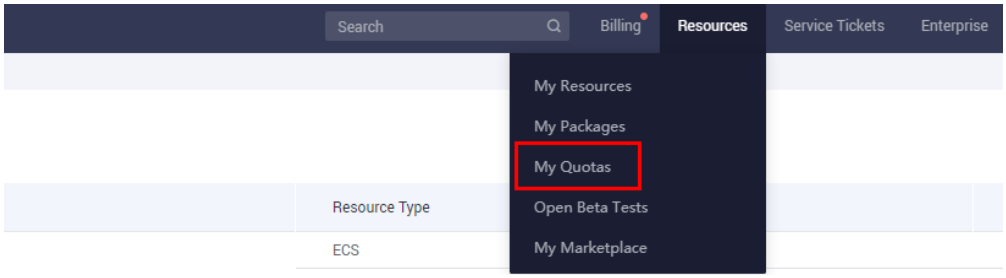
Quotas can limit the number or amount of resources available to users, such as the maximum number of ECSs or EVS disks that can be created.

If the existing resource quota cannot meet your service requirements, you can apply for a higher quota.

How Do I View My Quota?

1. Log in to the management console.
2. Click in the upper left corner to select a region and a project.
3. In the upper right corner of the page, choose **Resources** > **My Quotas**.
   The **Service Quota** page is displayed.

   Figure 3-2 My Quotas

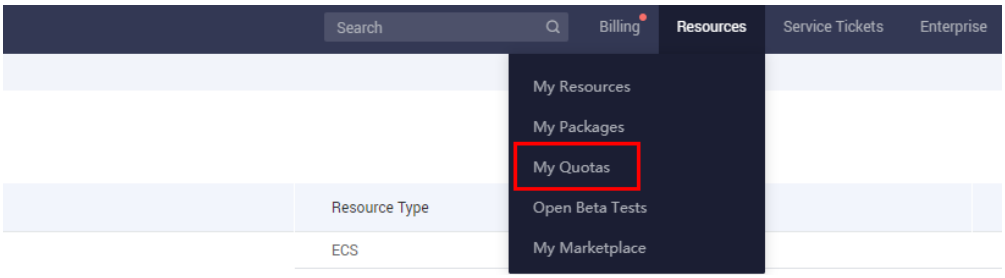


4. On this page, you can view the total quota and used quota of resources.
   If a quota cannot meet your business requirements, click **Increase Quota**.

How Do I Increase My Quota?

1. Log in to the management console.
2. In the upper right corner of the page, choose **Resources** > **My Quotas**.
   The **Service Quota** page is displayed.

Figure 3-3 My Quotas



3. Click **Increase Quota**.
4. On the **Create Service Ticket** page, configure parameters as required and submit a service ticket.

   In the **Problem Description** area, enter the required quota and reason for the adjustment.
5. Select **I have read and agree to the Tenant Authorization Letter** and click **Submit**.

3.2 Cluster Running

3.2.1 How Do I Locate the Fault When a Cluster Is Unavailable?

If a cluster is **Unavailable**, perform the following operations to locate the fault.

Troubleshooting Process

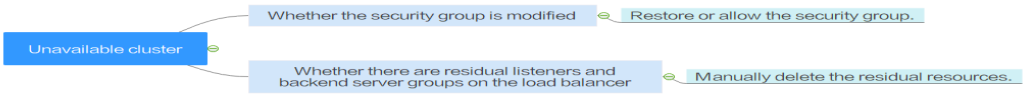
The issues here are described in order of how likely they are to occur.

Check these causes one by one until you find the cause of the fault.

- **Check Item 1: Whether the Security Group Is Modified**
- **Check Item 2: Whether There Are Residual Listeners and Backend Server Groups on the Load Balancer**

If the fault persists, and contact the customer service to help you locate the fault.

Figure 3-4 Fault locating



Check Item 1: Whether the Security Group Is Modified

Step 1 Log in to the management console, and choose **Service List** > **Networking** > **Virtual Private Cloud**. In the navigation pane on the left, choose **Access Control** > **Security Groups** to find the security group of the master node in the cluster.

The name of this security group is in the format of *Cluster name*-cce-**control**-*ID*.

Step 2 Click the security group. On the details page displayed, ensure that the security group rules of the master node are correct.

For details, see **Configuring Cluster Security Group Rules**.

----End

Check Item 2: Whether There Are Residual Listeners and Backend Server Groups on the Load Balancer

Reproducing the Problem

A cluster exception occurs when a LoadBalancer Service is being created or deleted. After the fault is rectified, the Service is deleted successfully, but there are residual listeners and backend server group.

Step 1 Pre-create a CCE cluster. In the cluster, use the official Nginx image to create workloads, preset load balancers, Services, and ingresses.

Step 2 Ensure that the cluster is running properly and the Nginx workload is stable.

Step 3 Create and delete 10 LoadBalancer Services every 20 seconds.

Step 4 An injection exception occurs in the cluster. For example, the etcd pod is unavailable or the cluster is hibernated.

----End

Possible Causes

There are residual listeners and backend server groups on the load balancer.

Solution

Manually clear residual listeners and backend server groups.

Step 1 Log in to the management console and choose **Network** > **Elastic Load Balance** from the service list.

Step 2 In the load balancer list, click the name of the target load balancer to go to the details page. On the **Listeners** tab page, locate the target listener and delete it.

Step 3 On the **Backend Server Groups** tab page, locate the target backend server group and delete it.

----End

3.2.2 How Do I Retrieve Data After a Cluster Is Deleted?

After a cluster is deleted, the workload on the cluster will also be deleted and cannot be restored. Therefore, exercise caution when deleting a cluster.

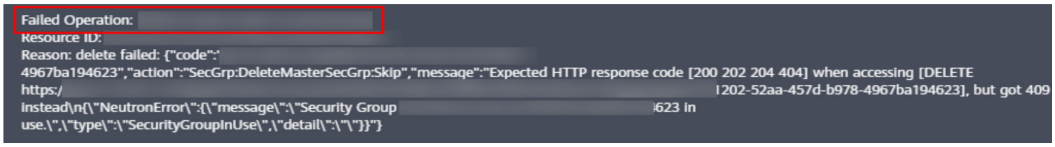
3.3 Cluster Deletion

3.3.1 Failed to Delete a Cluster: Residual ENIs

When deleting a cluster, CCE obtains the cluster's resources through kube-apiserver of the cluster. If the cluster is unavailable, frozen, or hibernated, the resources may fail to be obtained, and the cluster may not be deleted.

Symptom

Failed to delete a cluster.

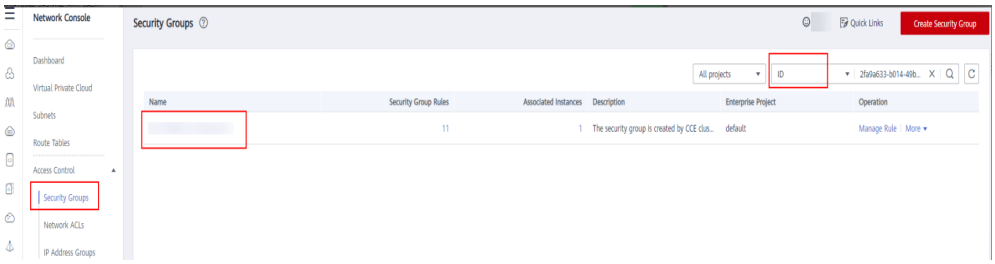


Possible Causes

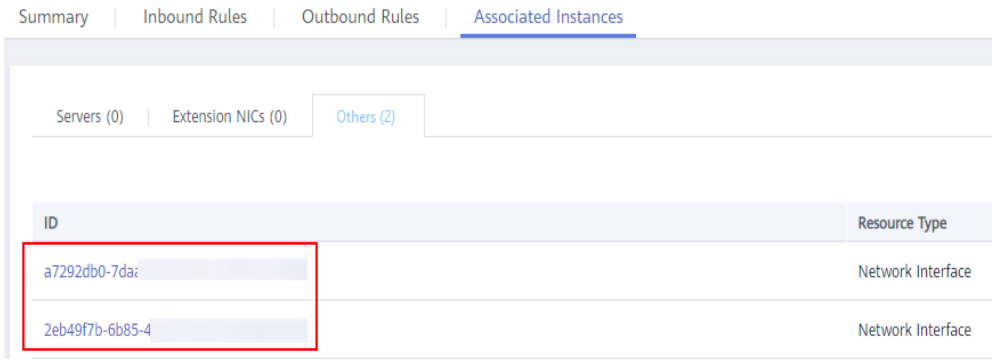
In this example, the ENI cannot be deleted because kube-apiserver of the cluster fails to obtain the ENI or sub ENI of the cluster. The security group created by CCE for the ENI or sub ENI reports the error code **409**. As a result, the cluster fails to be deleted.

Procedure

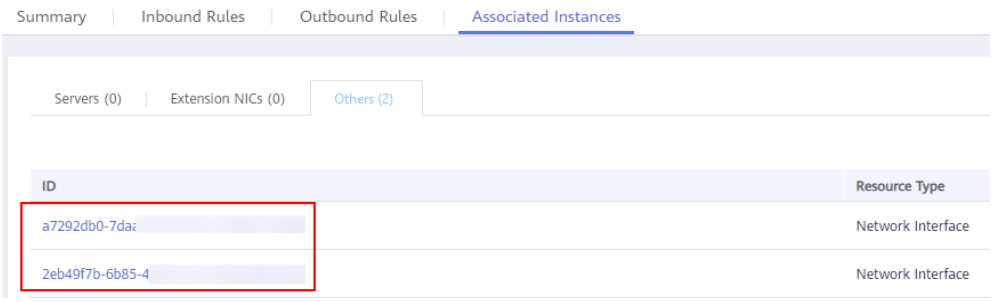
Step 1 Copy the resource ID in the error information, go to the **Security Groups** page of the VPC console, and obtain security groups by ID.



Step 2 Click the security group to view its details, and click the **Associated Instances** tab.

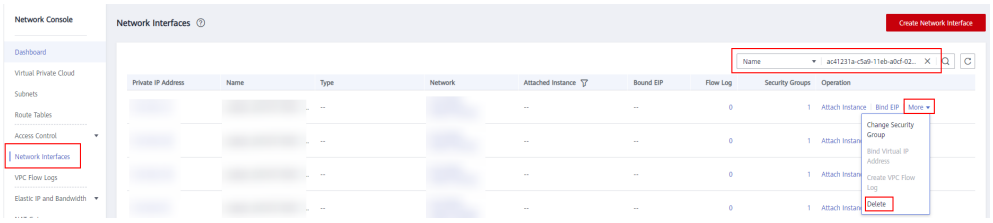


A security group remains after the deletion, because it is attached to an ENI or a sub ENI. Click the **Others** tab to view the residual ENIs. Delete the residual ENIs, and the sub ENI will be automatically deleted.



Step 3 Choose **Network Interfaces** in the navigation pane to delete the ENIs obtained in the previous step.

You can search for the ENIs to be deleted by ID or name.



Step 4 Go to the **Security Groups** page, and confirm that *Cluster name*-**cce-eni-***xxx* is not attached to any ENIs. Then, you can delete the cluster on the CCE console.

----End

3.3.2 How Do I Clear Residual Resources After a Non-Running Cluster Is Deleted?

If a cluster is not in the running state (for example, frozen or unavailable), resources such as PVCs, Services, and ingresses in the cluster cannot be obtained. After the cluster is deleted, residual network and storage resources may exist. In this case, manually delete these resources on their respective service console.

Deleting Residual ELB Resources

Step 1 Log in to the ELB console.

Step 2 Search for load balancers in the VPC by VPC ID.

Step 3 View the listener details of the load balancer. If the description contains the cluster ID and Service ID, the listener is created in the cluster.

Step 4 Delete residual load balancer-related resources from the cluster based on the preceding information.

----End

Deleting Residual EVS Resources

An EVS disk dynamically created using a PVC is named in the format of "pvc-{uid}". The **metadata** field in the API contains the cluster ID. You can use this cluster ID to obtain these EVS disks in the cluster and delete them as required.

Step 1 Go to the EVS console.

Step 2 Obtain EVS disks by name ("pvc-{uid}") to obtain all automatically created EVS disks in the CCE clusters.

Step 3 Press **F12** to open the developer tools. Check whether the **metadata** field in the **detail** interface contains the cluster ID. If yes, the EVS disk is automatically created in this cluster.

Step 4 Delete the residual EVS resources from the cluster based on the preceding information.

NOTE

Deleted data cannot be restored. Exercise caution when performing this operation.

----End

Deleting Residual SFS Resources

An SFS system dynamically created using a PVC is named in the format of "pvc-{uid}". The **metadata** field in the API contains the cluster ID. You can use this cluster ID to obtain these SFS systems automatically created in the cluster, and delete them as required.

Step 1 Log in to the SFS console.

Step 2 Search for SFS systems by name ("pvc-{uid}") to obtain all automatically created SFS systems in CCE clusters.

Step 3 Press **F12** to open the developer tools. Check whether the **metadata** field in the **detail** interface contains the cluster ID. If yes, the SFS system is automatically created in the cluster.

Step 4 Delete the residual SFS resources from the cluster based on the preceding information.

NOTE

Deleted data cannot be restored. Exercise caution when performing this operation.

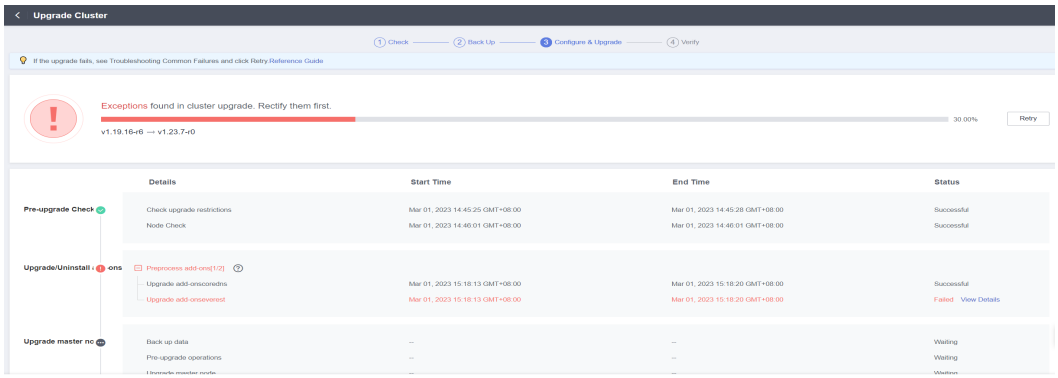
----End

3.4 Cluster Upgrade

3.4.1 What Do I Do If a Cluster Add-On Fails to be Upgraded During the CCE Cluster Upgrade?

Overview

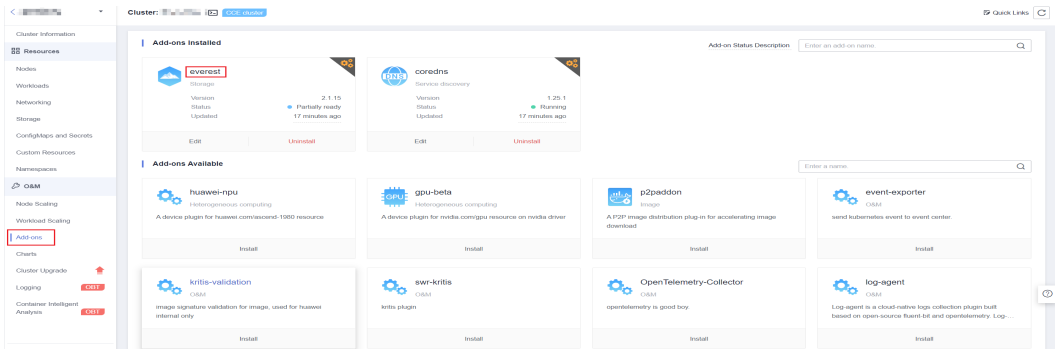
This section describes how to locate and rectify the fault if you fail to upgrade an add-on during the CCE cluster upgrade.



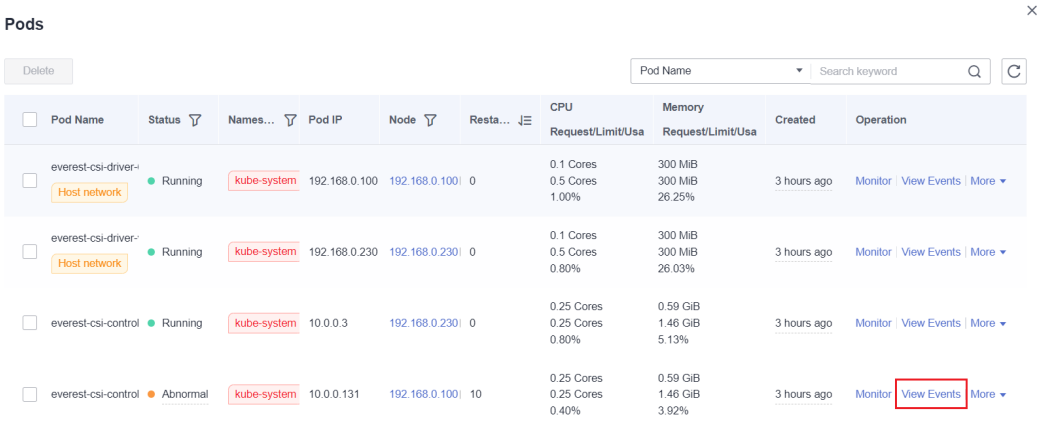
Procedure

Step 1 If the add-on fails to be upgraded, try again first. If the retry fails, perform the following steps to rectify the fault.

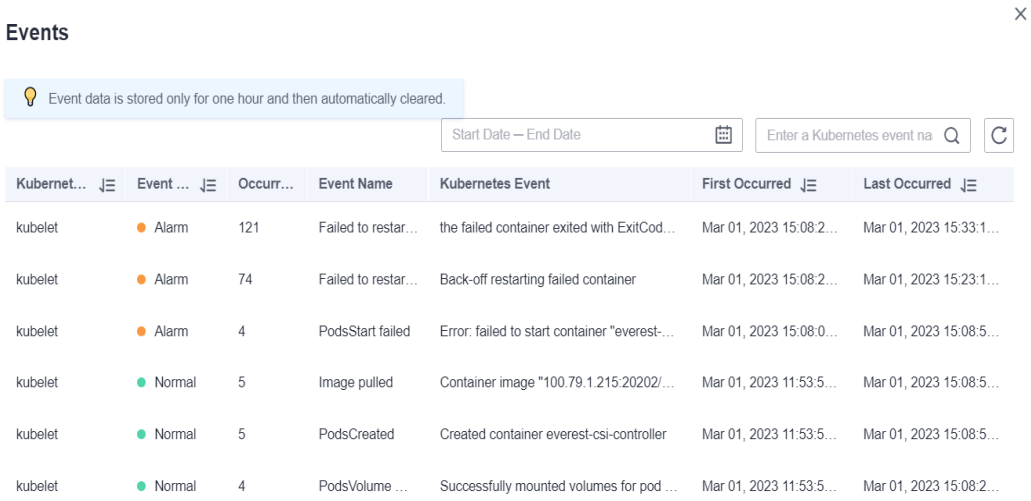
Step 2 If a failure message is displayed on the upgrade page, go to the **Add-ons** page to view the add-on status. For an abnormal add-on, click the add-on name to view details.



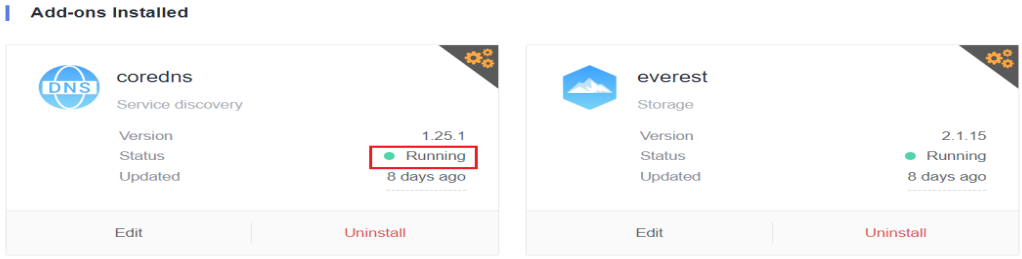
Step 3 On the pod details page, click **View Events** in the **Operation** column of the abnormal pod.



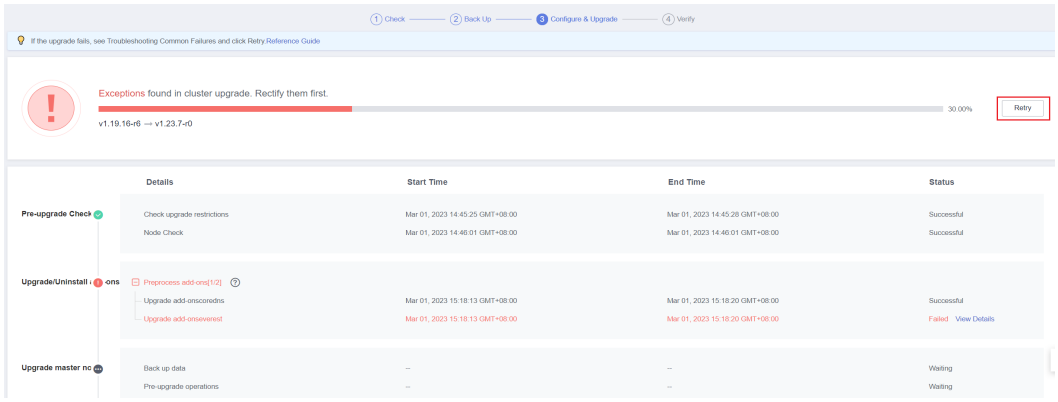
Step 4 Rectify the fault based on the exception information. For example, delete the pod that is not started or restart it.



Step 5 After the processing is successful, the add-on status changes to **Running**. Ensure that all add-ons are in the **Running** status.



Step 6 Go to the cluster upgrade page and click **Retry**.



----End

4 Node

4.1 Node Creation

4.1.1 How Do I Troubleshoot Problems Occurred When Adding Nodes to a CCE Cluster?

Note

- The node images in the same cluster must be the same. Pay attention to this when creating, adding, or accepting nodes in a cluster.
- If you need to allocate user space from the data disk when creating a node, do not set the data storage path to any key directory. For example, to store data in the **/home** directory, set the directory to **/home/test** instead of **/home**.

  NOTE

  Do not set **Path inside a node** to the root directory **/**. Otherwise, the mounting fails. Set **Path inside a node** to any of the following:

  - /opt/xxxx (excluding **/opt/cloud**)
  - /mnt/xxxx (excluding **/mnt/paas**)
  - /tmp/xxx
  - /var/xxx (excluding key directories such as **/var/lib**, **/var/script**, and **/var/paas**)
  - /xxxx (It cannot conflict with the system directory, such as **bin**, **lib**, **home**, **root**, **boot**, **dev**, **etc**, **lost+found**, **mnt**, **proc**, **sbin**, **srv**, **tmp**, **var**, **media**, **opt**, **selinux**, **sys**, and **usr**.)

  Do not set it to **/home/paas**, **/var/paas**, **/var/lib**, **/var/script**, **/mnt/paas**, or **/opt/cloud**. Otherwise, the system or node installation will fail.

Check Item 1: Subnet Quota

Symptom

New nodes cannot be added to a CCE cluster, and a message is displayed indicating that the subnet quota is insufficient.

Cause Analysis

Example:

VPC CIDR block: 192.168.66.0/24

Subnet CIDR block: 192.168.66.0/24

In 192.168.66.0/24, all 251 private IP addresses have been used.

Solution

Step 1 Expand the VPC.

Log in to the console and choose **Virtual Private Cloud** from the service list. Click **Edit CIDR Block** in the **Operation** column of the target VPC.

Step 2 Change the subnet mask to **16** and click **OK**.

Step 3 Click the VPC name. On the **Summary** tab page, click the number next to **Subnets** on the right and click **Create Subnet** to create a subnet.

Step 4 Return to the page for adding a node on the CCE console, and select the newly created subnet.

NOTE

1. Adding subnets to the VPC does not affect the use of the existing 192.168.66.0/24 CIDR block.

   You can select a new subnet when creating a CCE node. The new subnet has a maximum of 251 private IP addresses. If the number of private IP addresses cannot meet service requirements, you can add more subnets.
2. Subnets in the same VPC can communicate with each other.

----End

Check Item 2: EIP Quota

Symptom

When a node is added, **EIP** is set to **Automatically assign**. The node cannot be created, and a message indicating that EIPs are insufficient is displayed.

Solution

Two methods are available to solve the problem.

- **Method 1:** Unbind the VMs bound with EIPs and add a node again.
  a. Log in to the management console.
  b. Choose **Computing** > **Elastic Cloud Server**.
  c. In the ECS list, locate the target ECS and click its name.
  d. On the ECS details page, click the **EIPs** tab. In the EIP list, click **Unbind** at the row of the target ECS and click **Yes**.
  e. Return to the page for adding a node on the CCE console, select **Use existing** for **EIP**, and add the node again.
- **Method 2:** Increase the EIP quota.

Check Item 3: Security Group

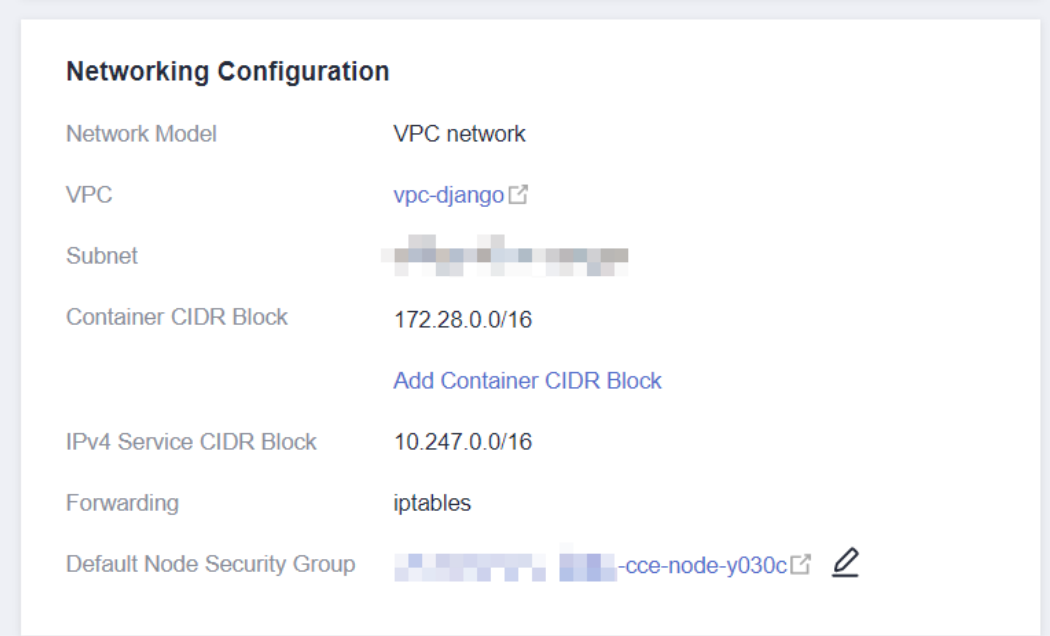
Symptom

A node cannot be added to a CCE cluster.

Solution

You can click the cluster name to view the cluster details. In the **Networking Configuration** area, click the icon next to **Default security group of the node** to check whether the default security group is deleted and whether the security group rules comply with **Configuring Cluster Security Group Rules**.

If your account has multiple clusters and you need to manage network security policies of nodes in a unified manner, you can specify custom security groups.



4.2 Node Running

4.2.1 What Should I Do If a Cluster Is Available But Some Nodes Are Unavailable?

If the cluster status is available but some nodes in the cluster are unavailable, perform the following operations to rectify the fault:

Mechanism for Detecting Node Unavailability

Kubernetes provides the heartbeat mechanism to help you determine node availability. For details about the mechanism and interval, see **Heartbeats**.

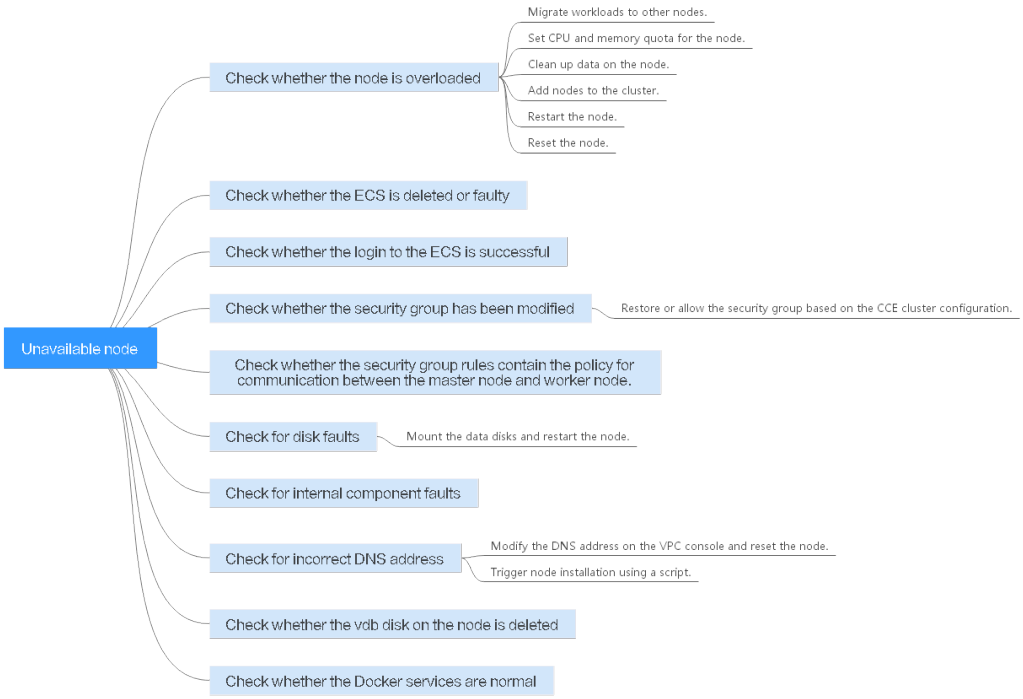
Troubleshooting Process

The issues here are described in order of how likely they are to occur.

Check these causes one by one until you find the cause of the fault.

- **Check Item 1: Whether the Node Is Overloaded**
- **Check Item 2: Whether the ECS Is Deleted or Faulty**
- **Check Item 3: Whether You Can Log In to the ECS**
- **Check Item 4: Whether the Security Group Is Modified**
- **Check Item 5: Whether the Security Group Rules Contain the Security Group Policy for the Communication Between the Master Node and the Worker Node**
- **Check Item 6: Whether the Disk Is Abnormal**
- **Check Item 7: Whether Internal Components Are Normal**
- **Check Item 8: Whether the DNS Address Is Correct**
- **Check Item 9: Whether the vdb Disk on the Node Is Deleted**
- **Check Item 10: Whether the Docker Service Is Normal**

Figure 4-1 Troubleshooting process for an unavailable node



Check Item 1: Whether the Node Is Overloaded

Symptom

The node connection in the cluster is abnormal. Multiple nodes report write errors, but services are not affected.

Fault Locating

Step 1 Log in to the CCE console and click the cluster name to access the cluster console. In the navigation pane, choose **Nodes** and click the **Nodes** tab. Locate the row that contains the unavailable node and click **Monitor**.

Step 2 On the top of the displayed page, click **View More** to go to the AOM console and view historical monitoring records.

A too high CPU or memory usage of the node will result in a high network latency or trigger system OOM. Therefore, the node is displayed as unavailable.

----End

Solution

1. You are advised to migrate services to reduce the workloads on the node and set the resource upper limit for the workloads.
2. Clear data on the CCE nodes in the cluster.
3. Limit the CPU and memory quotas of each container.
4. Add more nodes to the cluster.
5. You can also restart the node on the ECS console.
6. Add nodes to deploy memory-intensive containers separately.
7. Reset the node.

After the node becomes available, the workload is restored.

Check Item 2: Whether the ECS Is Deleted or Faulty

Step 1 Check whether the cluster is available.

Log in to the CCE console and check whether the cluster is available.

- If the cluster is unavailable, for example, an error occurs, perform operations described in **How Do I Locate the Fault When a Cluster Is Unavailable?**
- If the cluster is running but some nodes in the cluster are unavailable, go to **Step 2**.

Step 2 Log in to the ECS console and view the ECS status.

- If the ECS status is **Deleted**, go back to the CCE console, delete the corresponding node from the node list of the cluster, and then create another one.
- If the ECS status is **Stopped** or **Frozen**, restore the ECS first. It takes about 3 minutes to restore the ECS.
- If the ECS is **Faulty**, restart the ECS to rectify the fault.
- If the ECS status is **Running**, log in to the ECS to locate the fault according to **Check Item 7: Whether Internal Components Are Normal**.

----End

Check Item 3: Whether You Can Log In to the ECS

Step 1 Log in to the ECS console.

Step 2 Check whether the node name displayed on the page is the same as that on the VM and whether the password or key can be used to log in to the node.

If the node names are inconsistent and the password and key cannot be used to log in to the node, Cloud-Init problems occurred when an ECS was created. In this

case, restart the node and submit a service ticket to the ECS personnel to locate the root cause.

----End

Check Item 4: Whether the Security Group Is Modified

Log in to the VPC console. In the navigation pane, choose **Access Control** > **Security Groups** and locate the security group of the cluster master node.

The name of this security group is in the format of *Cluster name*-cce-**control**-*ID*. You can search for the security group by cluster name.

Check whether the rules in the security group are modified. For details, see **Configuring Cluster Security Group Rules**.

Check Item 5: Whether the Security Group Rules Contain the Security Group Policy for the Communication Between the Master Node and the Worker Node

Check whether such a security group policy exists.

When a node is added to an existing cluster, if an extended CIDR block is added to the VPC corresponding to the subnet and the subnet is an extended CIDR block, you need to add the following three security group rules to the master node security group (the group name is in the format of ***Cluster name*-cce-control-*Random number***). These rules ensure that the nodes added to the cluster are available. (This step is not required if an extended CIDR block has been added to the VPC during cluster creation.)

For details about security, see **Configuring Cluster Security Group Rules**.

Check Item 6: Whether the Disk Is Abnormal

A 100 GiB data disk dedicated for Docker is attached to the new node. If the data disk is uninstalled or damaged, the Docker service becomes abnormal and the node becomes unavailable.

Click the node name to check whether the data disk mounted to the node is uninstalled. If the disk is uninstalled, mount a data disk to the node again and restart the node. Then the node can be recovered.

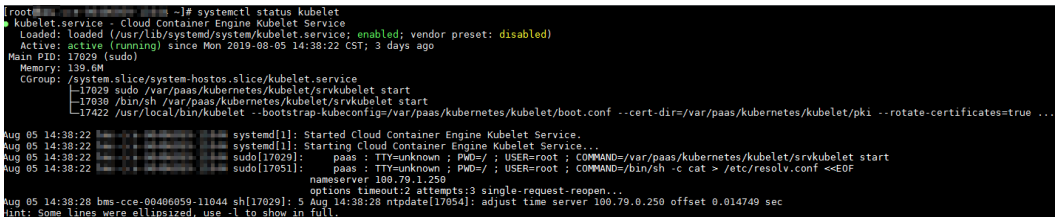
Check Item 7: Whether Internal Components Are Normal

Step 1 Log in to the ECS where the unavailable node is located.

Step 2 Run the following command to check whether the PaaS components are normal:

systemctl status kubelet

If the command is successfully executed, the status of each component is displayed as **active**, as shown in the following figure.



If the component status is not **active**, run the following commands (using the faulty component **canal** as an example):

Run **systemctl restart canal** to restart the component.

After restarting the component, run **systemctl status canal** to check the status.

Step 3 If the restart command fails to be run, run the following command to check the running status of the monitrc process:

ps -ef | grep monitrc

If the monitrc process exists, run the following command to kill this process. The monitrc process will be automatically restarted after it is killed.

kill -s 9 `ps -ef | grep monitrc | grep -v grep | awk '{print $2}'`

----End

Check Item 8: Whether the DNS Address Is Correct

Step 1 After logging in to the node, check whether any domain name resolution failure is recorded in the **/var/log/cloud-init-output.log** file.

cat /var/log/cloud-init-output.log | grep resolv

If the command output contains the following information, the domain name cannot be resolved:

Could not resolve host: Unknown error

Step 2 On the node, ping the domain name that cannot be resolved in the previous step to check whether the domain name can be resolved on the node.

- If not, the DNS cannot resolve the IP address. Check whether the DNS address in the **/etc/resolv.conf** file is the same as that configured on the VPC subnet. In most cases, the DNS address in the file is incorrectly configured. As a result, the domain name cannot be resolved. Correct the DNS configuration of the VPC subnet and reset the node.
- If yes, the DNS address configuration is correct. Check whether there are other faults.

----End

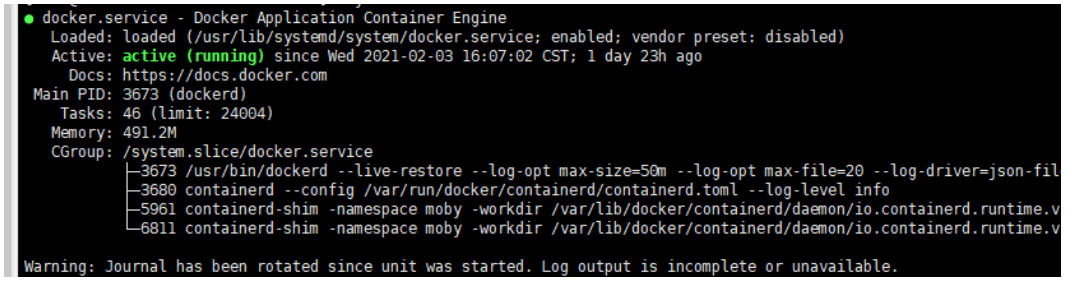
Check Item 9: Whether the vdb Disk on the Node Is Deleted

If the vdb disk on a node is deleted, you can refer to **this topic** to restore the node.

Check Item 10: Whether the Docker Service Is Normal

Step 1 Run the following command to check whether the Docker service is running:

```
systemctl status docker
```



If the command fails or the Docker service status is not active, locate the cause or contact technical support if necessary.

Step 2 Run the following command to check the number of containers on the node:

```
docker ps -a | wc -l
```

If the command is suspended, the command execution takes a long time, or there are more than 1000 abnormal containers, check whether workloads are repeatedly created and deleted. If a large number of containers are frequently created and deleted, a large number of abnormal containers may occur and cannot be cleared in a timely manner.

In this case, stop repeated creation and deletion of the workload or use more nodes to share the workload. Generally, the nodes will be restored after a period of time. If necessary, run the **docker rm** {*container_id*} command to manually clear abnormal containers.

----End

4.2.2 How Do I Log In to a Node Using a Password and Reset the Password?

Context

When creating a node on CCE, you selected a key pair or specified a password for login. If you forget your key pair or password, you can log in to the ECS console to reset the password of the node. After the password is reset, you can log in to the node using the password.

Procedure

Step 1 Log in to the ECS console.

Step 2 In the ECS list, select the cloud server type of the node. In the same row as the node, choose **More** > **Stop**.

Step 3 After the node is stopped, choose **More** > **Reset Password**, and follow on-screen prompts to reset the password.

Step 4 After the password is reset, choose **More** > **Start**, and click **Remote Login** to log in to the node using the password.

----End

4.2.3 How Do I Collect Logs of Nodes in a CCE Cluster?

The following tables list log files of CCE nodes.

Table 4-1 Node logs

Name	Path
kubelet log	• For clusters of v1.21 or later: **/var/log/cce/kubernetes/kubelet.log** • For clusters of v1.19 or earlier: **/var/paas/sys/log/kubernetes/kubelet.log**
kube-proxy log	• For clusters of v1.21 or later: **/var/log/cce/kubernetes/kube-proxy.log** • For clusters of v1.19 or earlier: **/var/paas/sys/log/kubernetes/kube-proxy.log**
yangtse log (networking)	• For clusters of v1.21 or later: **/var/log/cce/yangtse** • For clusters of v1.19 or earlier: **/var/paas/sys/log/yangtse**
canal log	• For clusters of v1.21 or later: **/var/log/cce/canal** • For clusters of v1.19 or earlier: **/var/paas/sys/log/canal**
System logs	**/var/log/messages**
Container engine Logs	• For Docker nodes: **/var/lib/docker** • For containerd nodes: **/var/log/cce/containerd**

Table 4-2 Add-on logs

Name	Path
everest log	• For v2.1.41 or later: – everest-csi-driver: **/var/log/cce/kubernetes** – everest-csi-controller: **/var/paas/sys/log/kubernetes** • For version earlier than v2.1.41: – everest-csi-driver: **/var/log/cce/everest-csi-driver** – everest-csi-controller: **/var/paas/sys/log/everest-csi-controller**
npd log	• For v1.18.16 or later: **/var/paas/sys/log/kubernetes** • For versions earlier than v1.18.16: **/var/paas/sys/log/cceaddon-npd**

Name	Path
cce-hpa-controller log	• For v1.3.12 or later: **/var/paas/sys/log/kubernetes** • For versions earlier than v1.3.12: **/var/paas/sys/log/ccehpa-controller**

4.2.4 What Should I Do If the vdb Disk of a Node Is Damaged and the Node Cannot Be Recovered After Reset?

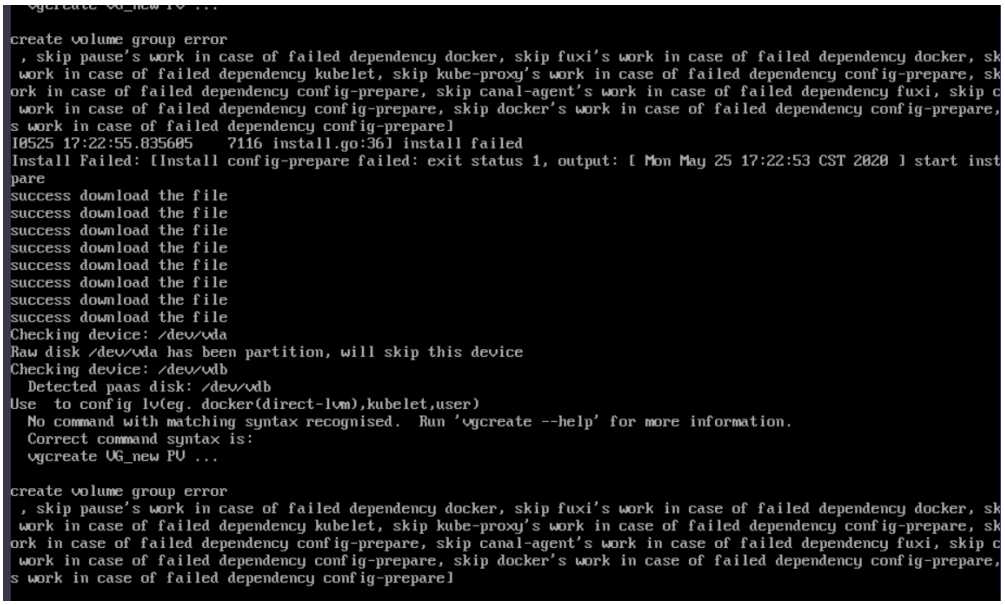
Symptom

The vdb disk of a node is damaged and the node cannot be recovered after reset.

Error Scenarios

- On a normal node, delete the LV and VG. The node is unavailable.
- Reset an abnormal node, and a syntax error is reported. The node is unavailable.

  The following figure shows the details.



Fault Locating

If the volume group (VG) on the node is deleted or damaged and cannot be identified, you need to manually restore the VG first to prevent your data disks from being formatted by mistake during the reset.

Solution

Step 1 Log in to the node.

Step 2 Create a PV and a VG again. In this example, the following error message is displayed:


```
root@host1:~# pvcreate /dev/vdb
Device /dev/vdb excluded by a filter
```

This is because the added disk is created on another VM and has a partition table. The current VM cannot identify the partition table of the disk. You need to run the **parted** commands for three times to re-create the partition table.

```
root@host1:~# parted /dev/vdb
GNU Parted 3.2
Using /dev/vdb
Welcome to GNU Parted! Type 'help' to view a list of commands.
(parted) mklabel msdos
Warning: The existing disk label on /dev/vdb will be destroyed and all data on this disk will be lost. Do you want to continue?
Yes/No? yes
(parted) quit
Information: You may need to update /etc/fstab.
```

Run **pvcreate** again. When the system asks you whether to erase the DOS signature, enter **y**. The disk is created as a PV.

```
root@host1:~# pvcreate /dev/vdb
WARNING: dos signature detected on /dev/vdb at offset 510. Wipe it? [y/n]: y
Wiping dos signature on /dev/vdb.
Physical volume "/dev/vdb" successfully created
```

Step 3 Create a VG.

Check the Docker disks of the node. If the disks are **/dev/vdb** and **/dev/vdc**, run the following command:

```
root@host1:~# vgcreate vgpaas /dev/vdb /dev/vdc
```

If there is only the **/dev/vdb** disk, run the following command:

```
root@host1:~# vgcreate vgpaas /dev/vdb
```

After the creation is complete, reset the node.

----End

4.2.5 What Should I Do If I/O Suspension Occasionally Occurs When SCSI EVS Disks Are Used?

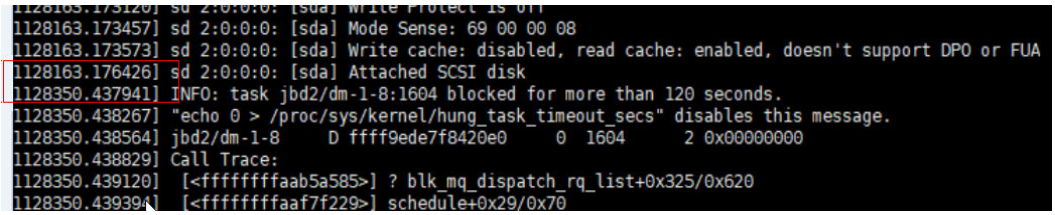
Symptom

When SCSI EVS disks are used and containers are created and deleted on a CentOS node, the disks are frequently mounted and unmounted. The read/write rate of the system disk may instantaneously surge. As a result, the system is suspended, affecting the normal node running.

When this problem occurs, the following information is displayed in the dmesg log:

```
Attached SCSI disk
task jdb2/xxx blocked for more than 120 seconds.
```

Example:



Possible Cause

After a PCI device is hot added to BUS 0, the Linux OS kernel will traverse all the PCI bridges mounted to BUS 0 for multiple times, and these PCI bridges cannot work properly during this period. During this period, if the PCI bridge used by the device is updated, due to a kernel defect, the device considers that the PCI bridge is abnormal, and the device enters a fault mode and cannot work normally. If the front end is writing data into the PCI configuration space for the back end to process disk I/Os, the write operation may be deleted. As a result, the back end cannot receive notifications to process new requests on the I/O ring. Finally, the front-end I/O suspension occurs.

This problem is caused by a Linux kernel defect. For details, see the **defects in Linux distributions**.

Impact

CentOS Linux kernels of versions earlier than 3.10.0-1127.el7 are affected.

Solution

Upgrade the kernel to a later version **by resetting the node**.

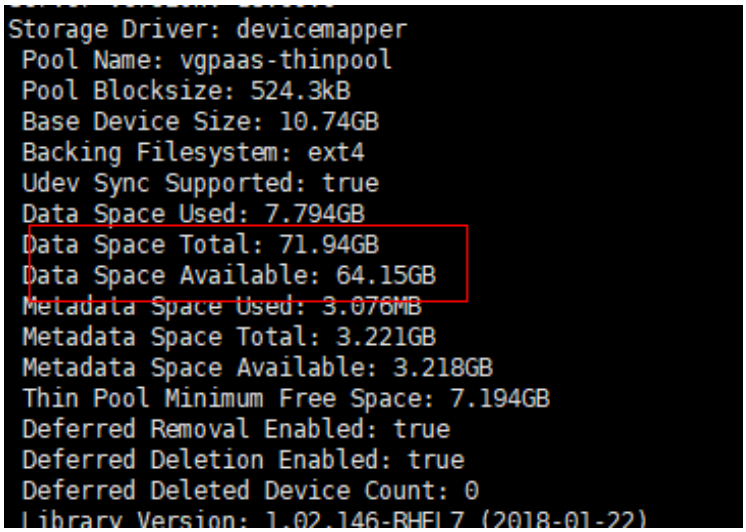
4.2.6 How Do I Fix an Abnormal Container or Node Due to No Thin Pool Disk Space?

Problem Description

When the disk space of a thin pool on a node is about to be used up, the following exceptions occasionally occur:

Files or directories fail to be created in the container, the file system in the container is read-only, the node is tainted disk-pressure, or the node is unavailable.

You can run the **docker info** command on the node to view the used and remaining thin pool space to locate the fault. The following figure is an example.



Possible Cause

When Docker device mapper is used, although you can configure the **basesize** parameter to limit the size of the **/home** directory of a single container (to 10 GB by default), all containers on the node still share the thin pool of the node for storage. They are not completely isolated. When the sum of the thin pool space used by certain containers reaches the upper limit, other containers cannot run properly.

In addition, after a file is deleted in the **/home** directory of the container, the thin pool space occupied by the file is not released immediately. Therefore, even if **basesize** is set to 10 GB, the thin pool space occupied by files keeps increasing until 10 GB when files are created in the container. The space released after file deletion will be reused only after a while. If **the number of service containers on the node multiplied by basesize** is greater than the thin pool space size of the node, there is a possibility that the thin pool space has been used up.

Solution

When the thin pool space of a node is used up, some services can be migrated to other nodes to quickly recover services. But you are advised to use the following solutions to resolve the root cause:

Solution 1:

Properly plan the service distribution and data plane disk space to avoid the scenario where **the number of service containers multiplied by basesize** is greater than the thin pool size of the node. To expand the thin pool size, perform the following steps:

Step 1 Expand the capacity of the data disk on the EVS console.

Step 2 Log in to the CCE console and click the cluster. In the navigation pane, choose **Nodes**. Click **More** > **Sync Server Data** in the row containing the target node.

Step 3 Log in to the target node.

Step 4 Run the **lsblk** command to check the block device information of the node.

A data disk is divided depending on the container storage **Rootfs**:

- Overlayfs: No independent thin pool is allocated. Image data is stored in the **dockersys** disk.

```
# lsblk
NAME                MAJ:MIN RM  SIZE RO TYPE MOUNTPOINT
vda                 8:0    0   50G  0 disk
└─vda1              8:1    0   50G  0 part /
vdb                 8:16   0  200G  0 disk
├─vgpaas-dockersys  253:0    0   90G  0 lvm  /var/lib/docker                # Space used by the container engine
└─vgpaas-kubernetes 253:1    0   10G  0 lvm  /mnt/paas/kubernetes/kubelet  # Space used by Kubernetes
```

  Run the following commands on the node to add the new disk capacity to the **dockersys** disk:

```
pvresize /dev/vdb
lvextend -l+100%FREE -n vgpaas/dockersys
resize2fs /dev/vgpaas/dockersys
```

- Devicemapper: A thin pool is allocated to store image data.


```
# lsblk
NAME                      MAJ:MIN RM  SIZE RO TYPE MOUNTPOINT
vda                       8:0    0   50G  0 disk
└─vda1                      8:1    0   50G  0 part /
vdb                       8:16   0  200G  0 disk
├─vgpaas-dockersys          253:0    0   18G  0 lvm  /var/lib/docker
├─vgpaas-thinpool_tmeta     253:1    0    3G  0 lvm
│ └─vgpaas-thinpool         253:3    0   67G  0 lvm              # Space used by thinpool
│ ...
├─vgpaas-thinpool_tdata      253:2    0   67G  0 lvm
│ └─vgpaas-thinpool          253:3    0   67G  0 lvm
│ ...
└─vgpaas-kubernetes          253:4    0   10G  0 lvm  /mnt/paas/kubernetes/kubelet
```

- Run the following commands on the node to add the new disk capacity to the **thinpool** disk:

  ```
  pvresize /dev/vdb
  lvextend -l+100%FREE -n vgpaas/thinpool
  ```

- Run the following commands on the node to add the new disk capacity to the **dockersys** disk:

  ```
  pvresize /dev/vdb
  lvextend -l+100%FREE -n vgpaas/dockersys
  resize2fs /dev/vgpaas/dockersys
  ```

----End

Solution 2:

Create and delete files in service containers in the local storage (such as emptyDir and hostPath) or cloud storage directory mounted to the container. Such files do not occupy the thin pool space.

Solution 3:

If the OS uses OverlayFS, services can be deployed on such nodes to prevent the problem that the disk space occupied by files created or deleted in the container is not released immediately.

4.2.7 How Do I Rectify Failures When the NVIDIA Driver Is Used to Start Containers on GPU Nodes?

Did a Resource Scheduling Failure Event Occur on a Cluster Node?

Symptom

A node is running properly and has GPU resources. However, the following error information is displayed:

0/9 nodes are available: 9 insufficient nvidia.com/gpu

Analysis

1. Check whether the node is attached with NVIDIA label.

2. Check whether the NVIDIA driver is running properly.

Log in to the node where the add-on is running and view the driver installation log in the following path:

```
/opt/cloud/cce/nvidia/nvidia_installer.log
```

View standard output logs of the NVIDIA container.

Filter the container ID by running the following command:

```
docker ps –a | grep nvidia
```

View logs by running the following command:

```
docker logs Container ID
```

What Should I Do If the NVIDIA Version Reported by a Service and the CUDA Version Do Not Match?

Run the following command to check the CUDA version in the container:

```
cat /usr/local/cuda/version.txt
```

Check whether the CUDA version supported by the NVIDIA driver version of the node where the container is located contains the CUDA version of the container.

Helpful Links

What Should I Do If an Error Occurs When Deploying a Service on the GPU Node?

4.3 Specification Change

4.3.1 How Do I Change the Node Specifications in a CCE Cluster?

Solution

CAUTION

If the node whose specifications need to be changed is accepted into the cluster for management, remove the node from the cluster and then change the node specifications to avoid affecting services.

Step 1 Log in to the CCE console and click the cluster. In the navigation pane, choose **Nodes**. Click the name of the node to display the ECS details page.

Step 2 In the upper right corner of the ECS details page, click **Stop**. After the ECS is stopped, choose **More** > **Modify Specifications**.

Step 3 On the **Modify ECS Specifications** page, select a flavor name and click **Submit** to finish the specification modification. Return to ECS list page and choose **More** > **Start** to start the ECS.

Step 4 Log in to the CCE console and click the cluster name to access the cluster console. In the navigation pane, choose **Nodes**. Locate the target node in the node list, and

click **Sync Server Data** in the **Operation** column. After the synchronization is complete, you can view that the node specifications are the same as the modified specifications of the ECS.

----End

Common Issues

After the specifications of a node configured with CPU management policies are changed, the node may fail to be rebooted or workloads may fail to be created. In this case, see **What Should I Do If I Fail to Restart or Create Workloads on a Node After Modifying the Node Specifications?** to rectify the fault.

4.3.2 What Should I Do If I Fail to Restart or Create Workloads on a Node After Modifying the Node Specifications?

Context

The kubelet option **cpu-manager-policy** defaults to **static**, allowing pods with certain resource characteristics to be granted increased CPU affinity and exclusivity on the node. If you modify CCE node specifications on the ECS console, the original CPU information does not match the new CPU information. As a result, workloads on the node cannot be restarted or created.

For more information, see **Control CPU Management Policies on the Node**.

Impact

The clusters that have enabled a CPU management policy will be affected.

Solution

Step 1 Log in to the CCE node (ECS) and delete the **cpu_manager_state** file.

Example command for the file deletion:

```
rm -rf /mnt/paas/kubernetes/kubelet/cpu_manager_state
```

Step 2 Restart the node or kubelet. The following is the kubelet restart command:

```
systemctl restart kubelet
```

Step 3 Verify that workloads on the node can be successfully restarted or created.

----End

5 Node Pool

5.1 What Should I Do If No Node Creation Record Is Displayed When the Node Pool Is Being Expanding?

Symptom

The node pool keeps being in the expanding state, but no node creation record is displayed in the operation record.

Troubleshooting

Check and rectify the following faults:

- Whether the specifications configured for the node pool are insufficient.
- Whether the ECS or memory quota of the tenant is insufficient.
- The ECS capacity verification of the tenant may fail if too many nodes are created at a time.

Solution

- If the resources of the ECS flavor cannot meet service requirements, use ECSs of another flavor.
- If the ECS or memory quota is insufficient, increase the quota.
- If the ECS capacity verification fails, perform the verification again.

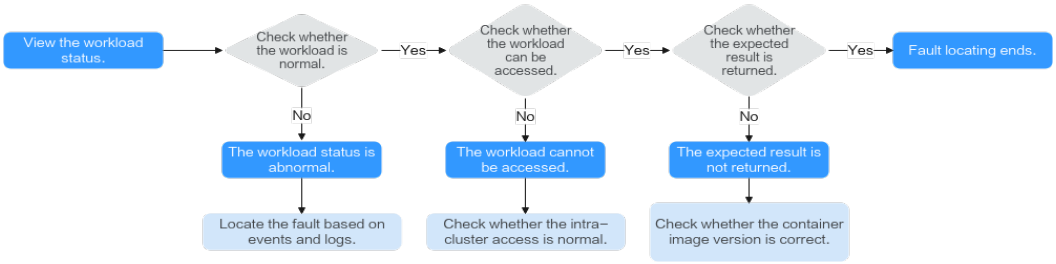
6 Workload

6.1 Workload Abnormalities

6.1.1 How Do I Use Events to Fix Abnormal Workloads?

If a workload is abnormal, you can check the pod events first to locate the fault and then rectify the fault.

Fault Locating



To check whether there is an abnormal pod in the workload, perform the following steps:

Step 1 Log in to the CCE console.

Step 2 Click the cluster name to access the cluster console. In the navigation pane, choose **Workloads**.

Step 3 In the upper left corner of the page, select a namespace, locate the target workload, and view its status.

- If the workload is not ready, view pod events and determine the cause. For details, see **Viewing Pod Events**.
- If the workload is processing, wait patiently.
- If the workload is running, no action is required. If the workload status is normal but it cannot be accessed, check whether intra-cluster access is normal.

Log in to the CCE console or use kubectl to obtain the pod IP address. Then, log in to the node where this pod locates and run **curl** or use other methods to manually call the APIs. Check whether the expected result is returned.

If *{Container IP address}*:*{Port}* cannot be accessed, log in to the service container and access **127.0.0.1**:*{Port}* to locate the fault.

----End

Viewing Pod Events

Method 1

On the CCE console, click the workload name to go to the workload details page, locate the row containing the abnormal pod, and click **View Events** in the **Operation** column.

Method 2

Run **kubectl describe pod** *{Pod name}* to view pod events. The following shows an example:

```
$ kubectl describe pod prepare-58bd7bdf9-fthrp
...
Events:
  Type     Reason            Age   From               Message
  ----     ------            ----  ----               -------
  Warning  FailedScheduling  49s   default-scheduler  0/2 nodes are available: 2 Insufficient cpu.
  Warning  FailedScheduling  49s   default-scheduler  0/2 nodes are available: 2 Insufficient cpu.
```

Table 6-1 Troubleshooting methods

Event Information	Pod Status	Solution
PodsScheduling failed	Pending	For details, see **What Should I Do If Pod Scheduling Fails?**.
PodsFailed to pull image Failed to re-pull image	FailedPullImage ImagePullBackOff	For details, see **What Should I Do If a Pod Fails to Pull the Image?**.
PodsCreation failed Failed to restart container	CreateContainerError CrashLoopBackOff	For details, see **What Should I Do If Container Startup Fails?**.
The pod status is **Evicted**, and the pod keeps being evicted.	Evicted	For details, see **What Should I Do If a Pod Fails to Be Evicted?**.
The storage volume fails to be mounted to the pod.	Pending	For details, see **What Should I Do If a Storage Volume Cannot Be Mounted or the Mounting Times Out?**.

Event Information	Pod Status	Solution
The pod stays **Creating**.	Creating	For details, see **What Should I Do If a Workload Remains in the Creating State?**.
The pod stays **Terminating**.	Terminating	For details, see **What Should I Do If Pods in the Terminating State Cannot Be Deleted?**.
The pod status is **Stopped**.	Stopped	For details, see **What Should I Do If a Workload Is Stopped Caused by Pod Deletion?**.

6.1.2 What Should I Do If Pod Scheduling Fails?

Fault Locating

If the pod is in the **Pending** state and the event contains pod scheduling failure information, locate the cause based on the event information. For details about how to view events, see **How Do I Use Events to Fix Abnormal Workloads?**

Troubleshooting Process

Determine the cause based on the event information, as listed in **Table 6-2**.

Table 6-2 Pod scheduling failure

Event Information	Cause and Solution
no nodes available to schedule pods.	No node is available in the cluster. **Check Item 1: Whether a Node Is Available in the Cluster**
0/2 nodes are available: 2 Insufficient cpu. 0/2 nodes are available: 2 Insufficient memory.	Node resources (CPU and memory) are insufficient. **Check Item 2: Whether Node Resources (CPU and Memory) Are Sufficient**
0/2 nodes are available: 1 node(s) didn't match node selector, 1 node(s) didn't match pod affinity rules, 1 node(s) didn't match pod affinity/anti-affinity.	The node and pod affinity configurations are mutually exclusive. No node meets the pod requirements. **Check Item 3: Affinity and Anti-Affinity Configuration of the Workload**

Event Information	Cause and Solution
0/2 nodes are available: 2 node(s) had volume node affinity conflict.	The EVS volume mounted to the pod and the node are not in the same AZ. **Check Item 4: Whether the Workload's Volume and Node Reside in the Same AZ**
0/1 nodes are available: 1 node(s) had taints that the pod didn't tolerate.	Taints exist on the node, but the pod cannot tolerate these taints. **Check Item 5: Taint Toleration of Pods**
0/7 nodes are available: 7 Insufficient ephemeral-storage.	The ephemeral storage space of the node is insufficient. **Check Item 6: Ephemeral Volume Usage**
0/1 nodes are available: 1 everest driver not found at node	The everest-csi-driver on the node is not in the running state. **Check Item 7: Whether everest Works Properly**
Failed to create pod sandbox: ... Create more free space in thin pool or use dm.min_free_space option to change behavior	The node thin pool space is insufficient. **Check Item 8: Thin Pool Space**
0/1 nodes are available: 1 Too many pods.	The number of pods scheduled to the node exceeded the maximum number allowed by the node. **Check Item 9: Number of Pods Scheduled onto the Node**

Check Item 1: Whether a Node Is Available in the Cluster

Log in to the CCE console and check whether the node status is **Available**. Alternatively, run the following command to check whether the node status is **Ready**:

```
$ kubectl get node
NAME          STATUS   ROLES    AGE   VERSION
192.168.0.37   Ready    <none>   21d   v1.19.10-r1.0.0-source-121-gb9675686c54267
192.168.0.71   Ready    <none>   21d   v1.19.10-r1.0.0-source-121-gb9675686c54267
```

If the status of all nodes is **Not Ready**, no node is available in the cluster.

Solution

- Add a node. If an affinity policy is not configured for the workload, the pod will be automatically migrated to the new node to ensure that services are running properly.

- Locate the unavailable node and rectify the fault. For details, see **What Should I Do If a Cluster Is Available But Some Nodes Are Unavailable?**
- Reset the unavailable node.

Check Item 2: Whether Node Resources (CPU and Memory) Are Sufficient

0/2 nodes are available: 2 Insufficient cpu. This means insufficient CPUs.

0/2 nodes are available: 2 Insufficient memory. This means insufficient memory.

If the resources requested by the pod exceed the allocatable resources of the node where the pod runs, the node cannot provide the resources required to run new pods and pod scheduling onto the node will definitely fail.

If the number of resources that can be allocated to a node is less than the number of resources that a pod requests, the node does not meet the resource requirements of the pod. As a result, the scheduling fails.

Solution

Add nodes to the cluster. Scale-out is the common solution to insufficient resources.

Check Item 3: Affinity and Anti-Affinity Configuration of the Workload

Inappropriate affinity policies will cause pod scheduling to fail.

Example:

An anti-affinity relationship is established between workload 1 and workload 2. Workload 1 is deployed on node 1 while workload 2 is deployed on node 2.

When you try to deploy workload 3 on node 1 and establish an affinity relationship with workload 2, a conflict occurs, resulting in a workload deployment failure.

0/2 nodes are available: 1 node(s) didn't match **node selector**, 1 node(s) didn't match **pod affinity rules**, 1 node(s) didn't match **pod affinity/anti-affinity**.

- **node selector** indicates that the node affinity is not met.
- **pod affinity rules** indicate that the pod affinity is not met.
- **pod affinity/anti-affinity** indicates that the pod affinity/anti-affinity is not met.

Solution

- When adding workload-workload affinity and workload-node affinity policies, ensure that the two types of policies do not conflict each other. Otherwise, workload deployment will fail.
- If the workload has a node affinity policy, make sure that **supportContainer** in the label of the affinity node is set to **true**. Otherwise, pods cannot be scheduled onto the affinity node and the following event is generated:
  ```
  No nodes are available that match all of the following predicates: MatchNode Selector, NodeNotSupportsContainer
  ```
  If the value is **false**, the scheduling fails.

Check Item 4: Whether the Workload's Volume and Node Reside in the Same AZ

0/2 nodes are available: 2 node(s) had volume node affinity conflict. An affinity conflict occurs between volumes and nodes. As a result, the scheduling fails.

This is because EVS disks cannot be attached to nodes across AZs. For example, if the EVS volume is located in AZ 1 and the node is located in AZ 2, scheduling fails.

The EVS volume created on CCE has affinity settings by default, as shown below.

```
kind: PersistentVolume
apiVersion: v1
metadata:
  name: pvc-c29bfac7-efa3-40e6-b8d6-229d8a5372ac
spec:
  ...
  nodeAffinity:
    required:
      nodeSelectorTerms:
        - matchExpressions:
            - key: failure-domain.beta.kubernetes.io/zone
              operator: In
              values:
                -
```

Solution

In the AZ where the workload's node resides, create a volume. Alternatively, create an identical workload and select an automatically assigned cloud storage volume.

Check Item 5: Taint Toleration of Pods

0/1 nodes are available: 1 node(s) had taints that the pod didn't tolerate. This means the node is tainted and the pod cannot be scheduled to the node.

Check the taints on the node. If the following information is displayed, taints exist on the node:

```
$ kubectl describe node 192.168.0.37
Name:               192.168.0.37
...
Taints:             key1=value1:NoSchedule
...
```

In some cases, the system automatically adds a taint to a node. The current built-in taints include:

- node.kubernetes.io/not-ready: The node is not ready.
- node.kubernetes.io/unreachable: The node controller cannot access the node.
- node.kubernetes.io/memory-pressure: The node has memory pressure.
- node.kubernetes.io/disk-pressure: The node has disk pressure. Follow the instructions described in **Check Item 4: Whether the Node Disk Space Is Insufficient** to handle it.
- node.kubernetes.io/pid-pressure: The node is under PID pressure.
- node.kubernetes.io/network-unavailable: The node network is unavailable.
- node.kubernetes.io/unschedulable: The node cannot be scheduled.

- node.cloudprovider.kubernetes.io/uninitialized: If an external cloud platform driver is specified when kubelet is started, kubelet adds a taint to the current node and marks it as unavailable. After **cloud-controller-manager** initializes the node, kubelet deletes the taint.

Solution

To schedule the pod to the node, use either of the following methods:

- If the taint is added by a user, you can delete the taint on the node. If the taint is **automatically added by the system**, the taint will be automatically deleted after the fault is rectified.
- Specify a toleration for the pod containing the taint. For details, see **Taints and Tolerations**.

```
apiVersion: v1
kind: Pod
metadata:
  name: nginx
spec:
  containers:
  - name: nginx
    image: nginx:alpine
  tolerations:
  - key: "key1"
    operator: "Equal"
    value: "value1"
    effect: "NoSchedule"
```

Check Item 6: Ephemeral Volume Usage

0/7 nodes are available: 7 Insufficient ephemeral-storage. This means insufficient ephemeral storage of the node.

Check whether the size of the ephemeral volume in the pod is limited. If the size of the ephemeral volume required by the application exceeds the existing capacity of the node, the application cannot be scheduled. To solve this problem, change the size of the ephemeral volume or expand the disk capacity of the node.

```
apiVersion: v1
kind: Pod
metadata:
  name: frontend
spec:
  containers:
  - name: app
    image: images.my-company.example/app:v4
    resources:
      requests:
        ephemeral-storage: "2Gi"
      limits:
        ephemeral-storage: "4Gi"
    volumeMounts:
    - name: ephemeral
      mountPath: "/tmp"
  volumes:
    - name: ephemeral
      emptyDir: {}
```

To obtain the total capacity (**Capacity**) and available capacity (**Allocatable**) of the temporary volume mounted to the node, run the **kubectl describe node** command, and view the application value and limit value of the temporary volume mounted to the node.

The following is an example of the output:

```
...
Capacity:
  cpu:                4
  ephemeral-storage:  61607776Ki
  hugepages-1Gi:      0
  hugepages-2Mi:      0
  localssd:           0
  localvolume:        0
  memory:             7614352Ki
  pods:               40
Allocatable:
  cpu:                3920m
  ephemeral-storage:  56777726268
  hugepages-1Gi:      0
  hugepages-2Mi:      0
  localssd:           0
  localvolume:        0
  memory:             6180752Ki
  pods:               40
...
Allocated resources:
  (Total limits may be over 100 percent, i.e., overcommitted.)
  Resource           Requests      Limits
  --------           --------      ------
  cpu                1605m (40%)   6530m (166%)
  memory             2625Mi (43%)  5612Mi (92%)
  ephemeral-storage  0 (0%)        0 (0%)
  hugepages-1Gi      0 (0%)        0 (0%)
  hugepages-2Mi      0 (0%)        0 (0%)
  localssd           0             0
  localvolume        0             0
Events:              <none>
```

Check Item 7: Whether everest Works Properly

0/1 nodes are available: 1 everest driver not found at node. This means the everest-csi-driver of everest is not started properly on the node.

Check the daemon named **everest-csi-driver** in the kube-system namespace and check whether the pod is started properly. If not, delete the pod. The daemon will restart the pod.

Check Item 8: Thin Pool Space

A data disk dedicated for kubelet and the container engine will be attached to a new node. If the data disk space is insufficient, the pod cannot be created.

Solution 1: Clearing images

Perform the following operations to clear unused images:

- Nodes that use containerd
  a. Obtain local images on the node.
     ```
     crictl images -v
     ```
  b. Delete the images that are not required by image ID.
     ```
     crictl rmi Image ID
     ```
- Nodes that use Docker
  a. Obtain local images on the node.
     ```
     docker images
     ```


b. Delete the images that are not required by image ID.

```
docker rmi Image ID
```

NOTE

Do not delete system images such as the cce-pause image. Otherwise, pods may fail to be created.

Solution 2: Expanding the disk capacity

To expand a disk capacity, perform the following steps:

Step 1 Expand the capacity of the data disk on the EVS console.

Step 2 Log in to the CCE console and click the cluster. In the navigation pane, choose **Nodes**. Click **More** > **Sync Server Data** in the row containing the target node.

Step 3 Log in to the target node.

Step 4 Run the **lsblk** command to check the block device information of the node.

A data disk is divided depending on the container storage **Rootfs**:

- Overlayfs: No independent thin pool is allocated. Image data is stored in the **dockersys** disk.

```
# lsblk
NAME                MAJ:MIN RM  SIZE RO TYPE MOUNTPOINT
vda                 8:0    0   50G  0 disk
└─vda1              8:1    0   50G  0 part /
vdb                 8:16   0  200G  0 disk
├─vgpaas-dockersys  253:0    0   90G  0 lvm  /var/lib/docker              # Space used by the container engine
└─vgpaas-kubernetes 253:1    0   10G  0 lvm  /mnt/paas/kubernetes/kubelet  # Space used by Kubernetes
```

  Run the following commands on the node to add the new disk capacity to the **dockersys** disk:

```
pvresize /dev/vdb
lvextend -l+100%FREE -n vgpaas/dockersys
resize2fs /dev/vgpaas/dockersys
```

- Devicemapper: A thin pool is allocated to store image data.

```
# lsblk
NAME                        MAJ:MIN RM  SIZE RO TYPE MOUNTPOINT
vda                         8:0    0   50G  0 disk
└─vda1                      8:1    0   50G  0 part /
vdb                         8:16   0  200G  0 disk
├─vgpaas-dockersys          253:0    0   18G  0 lvm  /var/lib/docker
├─vgpaas-thinpool_tmeta     253:1    0    3G  0 lvm
│ └─vgpaas-thinpool         253:3    0   67G  0 lvm                # Space used by thinpool
│   ...
├─vgpaas-thinpool_tdata     253:2    0   67G  0 lvm
│ └─vgpaas-thinpool         253:3    0   67G  0 lvm
│   ...
└─vgpaas-kubernetes         253:4    0   10G  0 lvm  /mnt/paas/kubernetes/kubelet
```

  – Run the following commands on the node to add the new disk capacity to the **thinpool** disk:

```
pvresize /dev/vdb
lvextend -l+100%FREE -n vgpaas/thinpool
```

  – Run the following commands on the node to add the new disk capacity to the **dockersys** disk:

```
pvresize /dev/vdb
lvextend -l+100%FREE -n vgpaas/dockersys
resize2fs /dev/vgpaas/dockersys
```

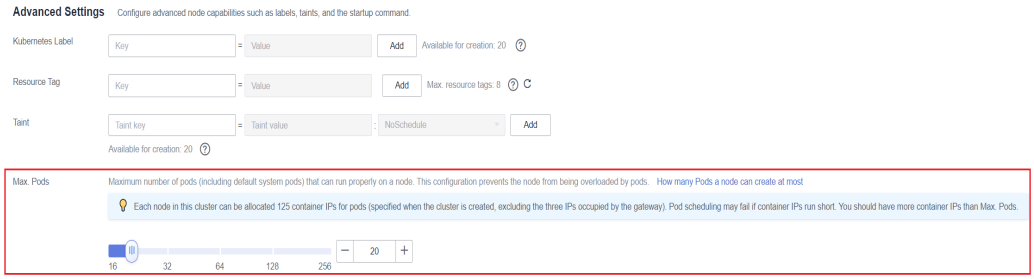
----End

Check Item 9: Number of Pods Scheduled onto the Node

0/1 nodes are available: 1 Too many pods. indicates excessive number of pods have been scheduled to the node.

When creating a node, configure **Max. Pods** in **Advanced Settings** to specify the maximum number of pods that can run properly on the node. The default value varies with the node flavor. You can change the value as needed.

Figure 6-1 Maximum number of pods

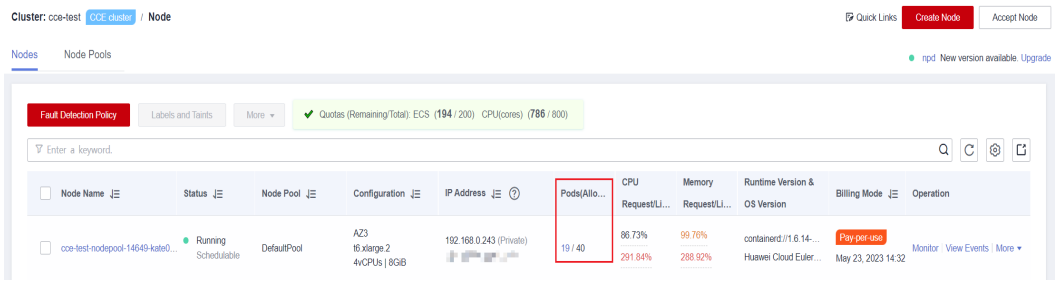


On the **Nodes** page, obtain the **Pods (Allocated/Total)** value of the node, and check whether the number of pods scheduled onto the node has reached the upper limit. If so, add nodes or change the maximum number of pods.

To change the maximum number of pods that can run on a node, do as follows:

- For nodes in the default node pool: Change the **Max. Pods** value when resetting the node.
- For nodes in a customized node pool: Change the value of the node pool parameter **max-pods**. For details, see **Configuring a Node Pool**.

Figure 6-2 Checking the number of pods



6.1.3 What Should I Do If a Pod Fails to Pull the Image?

Fault Locating

When a workload enters the state of "Pod not ready: Back-off pulling image "*xxxxx*", a Kubernetes event of **PodsFailed to pull image** or **Failed to re-pull image** will be reported. For details about how to view Kubernetes events, see **Viewing Pod Events**.

Troubleshooting Process

Determine the cause based on the event information, as listed in **Table 6-3**.

Table 6-3 FailedPullImage

Event Information	Cause and Solution
Failed to pull image "*xxx*": rpc error: code = Unknown desc = Error response from daemon: Get *xxx*: denied: You may not login yet	You have not logged in to the image repository. **Check Item 1: Whether imagePullSecret Is Specified When You Use kubectl to Create a Workload**
Failed to pull image "nginx:v1.1": rpc error: code = Unknown desc = Error response from daemon: Get https://registry-1.docker.io/v2/: dial tcp: lookup registry-1.docker.io: no such host	The image address is incorrectly configured. **Check Item 2: Whether the Image Address Is Correct When a Third-Party Image Is Used** **Check Item 3: Whether an Incorrect Secret Is Used When a Third-Party Image Is Used**
Failed create pod sandbox: rpc error: code = Unknown desc = failed to create a sandbox for pod "nginx-6dc48bf8b6-l8xrw": Error response from daemon: mkdir xxxxx: no space left on device	The disk space is insufficient. **Check Item 4: Whether the Node Disk Space Is Insufficient**
Failed to pull image "*xxx*": rpc error: code = Unknown desc = error pulling image configuration: *xxx* x509: certificate signed by unknown authority	An unknown or insecure certificate is used by the third-party image repository from which the image is pulled. **Check Item 5: Whether the Remote Image Repository Uses an Unknown or Insecure Certificate**
Failed to pull image "*xxx*": rpc error: code = Unknown desc = context canceled	The image size is too large. **Check Item 6: Whether the Image Size Is Too Large**
Failed to pull image "docker.io/bitnami/nginx:1.22.0-debian-11-r3": rpc error: code = Unknown desc = Error response from daemon: Get https://registry-1.docker.io/v2/: net/http: request canceled while waiting for connection (Client.Timeout exceeded while awaiting headers)	**Check Item 7: Connection to the Image Repository**

Event Information	Cause and Solution
ERROR: toomanyrequests: Too Many Requests. Or you have reached your pull rate limit, you may increase the limit by authenticating an upgrading	The rate is limited because the number of image pull times reaches the upper limit. **Check Item 8: Whether the Number of Public Image Pull Times Reaches the Upper Limit**

Check Item 1: Whether imagePullSecret Is Specified When You Use kubectl to Create a Workload

If the workload status is abnormal and a Kubernetes event is displayed indicating that the pod fails to pull the image, check whether the **imagePullSecrets** field exists in the YAML file.

Items to Check

- If an image needs to be pulled from SWR, the **name** parameter must be set to **default-secret**.

```
apiVersion: extensions/v1beta1
kind: Deployment
metadata:
  name: nginx
spec:
  replicas: 1
  selector:
    matchLabels:
      app: nginx
  strategy:
    type: RollingUpdate
  template:
    metadata:
      labels:
        app: nginx
    spec:
      containers:
      - image: nginx
        imagePullPolicy: Always
        name: nginx
      imagePullSecrets:
      - name: default-secret
```

- If an image needs to be pulled from a third-party image repository, the **imagePullSecrets** parameter must be set to the created secret name.

  When you use kubectl to create a workload from a third-party image, specify the **imagePullSecret** field, in which **name** indicates the name of the secret used to pull the image.

Check Item 2: Whether the Image Address Is Correct When a Third-Party Image Is Used

CCE allows you to create workloads using images pulled from third-party image repositories.

Enter the third-party image address according to requirements. The format must be **ip:port/path/name:version** or **name:version**. If no tag is specified, **latest** is used by default.

- For a private repository, enter an image address in the format of **ip:port/path/name:version**.
- For an open-source Docker repository, enter an image address in the format of **name:version**, for example, **nginx:latest**.

The following information is displayed when you fail to pull an image due to incorrect image address provided.

```
Failed to pull image "nginx:v1.1": rpc error: code = Unknown desc = Error response from daemon: Get https://registry-1.docker.io/v2/: dial tcp: lookup registry-1.docker.io: no such host
```

Solution

You can either edit your YAML file to change the image address or log in to the CCE console to replace the image on the **Upgrade** tab on the workload details page.

Check Item 3: Whether an Incorrect Secret Is Used When a Third-Party Image Is Used

Generally, a third-party image repository can be accessed only after authentication (using your account and password). CCE uses the secret authentication mode to pull images. Therefore, you need to create a secret for an image repository before pulling images from the repository.

Solution

If your secret is incorrect, images will fail to be pulled. In this case, create a new secret.

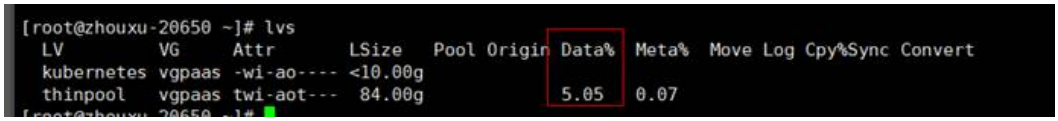
Check Item 4: Whether the Node Disk Space Is Insufficient

If the Kubernetes event contains information "no space left on device", there is no disk space left for storing the image. As a result, the image will fail to be pulled. In this case, clear the image or expand the disk space to resolve this issue.

```
Failed create pod sandbox: rpc error: code = Unknown desc = failed to create a sandbox for pod "nginx-6dc48bf8b6-l8xrw": Error response from daemon: mkdir xxxxx: no space left on device
```

Run the following command to obtain the disk space for storing images on a node:

```
lvs
```



Solution 1: Clearing images

Perform the following operations to clear unused images:

- Nodes that use containerd
  a. Obtain local images on the node.

```
crictl images -v
```

b. Delete the images that are not required by image ID.

```
crictl rmi Image ID
```

- Nodes that use Docker

a. Obtain local images on the node.

```
docker images
```

b. Delete the images that are not required by image ID.

```
docker rmi Image ID
```

NOTE

Do not delete system images such as the cce-pause image. Otherwise, pods may fail to be created.

Solution 2: Expanding the disk capacity

To expand a disk capacity, perform the following steps:

Step 1 Expand the capacity of the data disk on the EVS console.

Step 2 Log in to the CCE console and click the cluster. In the navigation pane, choose **Nodes**. Click **More** > **Sync Server Data** in the row containing the target node.

Step 3 Log in to the target node.

Step 4 Run the **lsblk** command to check the block device information of the node.

A data disk is divided depending on the container storage **Rootfs**:

- Overlayfs: No independent thin pool is allocated. Image data is stored in the **dockersys** disk.

```
# lsblk
NAME                MAJ:MIN RM  SIZE RO TYPE MOUNTPOINT
vda                 8:0    0   50G  0 disk
└─vda1              8:1    0   50G  0 part /
vdb                 8:16   0  200G  0 disk
├─vgpaas-dockersys  253:0    0   90G  0 lvm  /var/lib/docker             # Space used by the container engine
└─vgpaas-kubernetes 253:1    0   10G  0 lvm  /mnt/paas/kubernetes/kubelet  # Space used by Kubernetes
```

Run the following commands on the node to add the new disk capacity to the **dockersys** disk:

```
pvresize /dev/vdb
lvextend -l+100%FREE -n vgpaas/dockersys
resize2fs /dev/vgpaas/dockersys
```

- Devicemapper: A thin pool is allocated to store image data.

```
# lsblk
NAME                        MAJ:MIN RM  SIZE RO TYPE MOUNTPOINT
vda                         8:0    0   50G  0 disk
└─vda1                      8:1    0   50G  0 part /
vdb                         8:16   0  200G  0 disk
├─vgpaas-dockersys          253:0    0   18G  0 lvm  /var/lib/docker
├─vgpaas-thinpool_tmeta     253:1    0    3G  0 lvm
│ └─vgpaas-thinpool         253:3    0   67G  0 lvm                  # Space used by thinpool
│   ...
├─vgpaas-thinpool_tdata     253:2    0   67G  0 lvm
│ └─vgpaas-thinpool         253:3    0   67G  0 lvm
│   ...
└─vgpaas-kubernetes         253:4    0   10G  0 lvm  /mnt/paas/kubernetes/kubelet
```

  - Run the following commands on the node to add the new disk capacity to the **thinpool** disk:

```
pvresize /dev/vdb
lvextend -l+100%FREE -n vgpaas/thinpool
```

- Run the following commands on the node to add the new disk capacity to the **dockersys** disk:

```
pvresize /dev/vdb
lvextend -l+100%FREE -n vgpaas/dockersys
resize2fs /dev/vgpaas/dockersys
```

----End

Check Item 5: Whether the Remote Image Repository Uses an Unknown or Insecure Certificate

When a pod pulls an image from a third-party image repository that uses an unknown or insecure certificate, the image fails to be pulled from the node. The pod event list contains the event "Failed to pull the image" with the cause "x509: certificate signed by unknown authority".

NOTE

The security of EulerOS 2.9 images is enhanced. Some insecure or expired certificates are removed from the system. It is normal that this error is reported in EulerOS 2.9 but not or some third-party images on other types of nodes. You can also perform the following operations to rectify the fault.

Solution

Step 1 Check the IP address and port number of the third-party image server for which the error message "unknown authority" is displayed.

You can see the IP address and port number of the third-party image server for which the error is reported in the event information "Failed to pull image".

```
Failed to pull image "bitnami/redis-cluster:latest": rpc error: code = Unknown desc = error pulling image configuration: Get https://production.cloudflare.docker.com/registry-v2/docker/registry/v2/blobs/sha256/e8/e83853f03a2e792614e7c1e6de75d63e2d6d633b4e7c39b9d700792ee50f7b56/data?verify=1636972064-AQbl5RActnudDZV%2F3EShZwnqOe8%3D: x509: certificate signed by unknown authority
```

The IP address of the third-party image server is *production.cloudflare.docker.com*, and the default HTTPS port number is *443*.

Step 2 Load the root certificate of the third-party image server to the node where the third-party image is to be downloaded.

Run the following commands on the EulerOS and CentOS nodes with *{server_url}:{server_port}* replaced with the IP address and port number obtained in Step 1, for example, **production.cloudflare.docker.com:443**:

If the container engine of the node is containerd, replace **systemctl restart docker** with **systemctl restart containerd**.

```
openssl s_client -showcerts -connect {server_url}:{server_port} < /dev/null | sed -ne '/-BEGIN CERTIFICATE-/,/-END CERTIFICATE-/p' > /etc/pki/ca-trust/source/anchors/tmp_ca.crt
update-ca-trust
systemctl restart docker
```

Run the following command on Ubuntu nodes:

```
openssl s_client -showcerts -connect {server_url}:{server_port} < /dev/null | sed -ne '/-BEGIN CERTIFICATE-/,/-END CERTIFICATE-/p' > /usr/local/share/ca-certificates/tmp_ca.crt
update-ca-trust
systemctl restart docker
```

----End

Check Item 6: Whether the Image Size Is Too Large

The pod event list contains the event "Failed to pull image". This may be caused by a large image size.

```
Failed to pull image "XXX": rpc error: code = Unknown desc = context canceled
```

However, the image can be manually pulled by running the **docker pull** command.

Possible Causes

In Kubernetes clusters, there is a default timeout period for pulling images. If the image pulling progress is not updated within a certain period of time, the download will be canceled. If the node performance is poor or the image size is too large, the image may fail to be pulled and the workload may fail to be started.

Solution

- Solution 1 (recommended):
  a. Log in to the node and manually pull the image.
     - containerd nodes:
       ```
       crictl pull <image-address>
       ```
     - Docker nodes:
       ```
       docker pull <image-address>
       ```
  b. When creating a workload, ensure that **imagePullPolicy** is set to **IfNotPresent** (the default configuration). In this case, the workload uses the image that has been pulled to the local host.
- Solution 2 (applies to clusters of v1.25 or later): Modify the configuration parameters of the node pools. The configuration parameters for nodes in the **DefaultPool** node pool cannot be modified.
  a. Log in to the CCE console.
  b. Click the cluster name to access the cluster console. Choose **Nodes** in the navigation pane and click the **Node Pools** tab.
  c. Locate the row that contains the target node pool and click **Manage**.
  d. In the window that slides out from the right, modify the **image-pull-progress-timeout** parameter under **Docker/containerd**. This parameter specifies the timeout interval for pulling an image.
  e. Click **OK**.

Check Item 7: Connection to the Image Repository

Symptom

The following error message is displayed during workload creation:

```
Failed to pull image "docker.io/bitnami/nginx:1.22.0-debian-11-r3": rpc error: code = Unknown desc = Error response from daemon: Get https://registry-1.docker.io/v2/: net/http: request canceled while waiting for connection (Client.Timeout exceeded while awaiting headers)
```

Possible Causes

Failed to connect to the image repository due to the disconnected network. SWR allows you to pull images only from the official Docker repository. For image pulls from other repositories, you need to access the Internet.

Solution

- Bind a public IP address to the node which needs to pull the images.
- Upload the image to SWR and then pull the image from SWR.

Check Item 8: Whether the Number of Public Image Pull Times Reaches the Upper Limit

Symptom

The following error message is displayed during workload creation:

```
ERROR: toomanyrequests: Too Many Requests.
```

Or

```
you have reached your pull rate limit, you may increase the limit by authenticating an upgrading: https://www.docker.com/increase-rate-limits.
```

Possible Causes

Docker Hub sets the maximum number of container image pull requests. For details, see **Understanding Your Docker Hub Rate Limit**.

Solution

Push the frequently used image to SWR and then pull the image from SWR.

6.1.4 What Should I Do If Container Startup Fails?

Fault Locating

On the details page of a workload, if an event is displayed indicating that the container fails to be started, perform the following steps to locate the fault:

Step 1 Log in to the node where the abnormal workload is located.

Step 2 Check the ID of the container where the workload pod exits abnormally.

```
docker ps -a | grep $podName
```

Step 3 View the logs of the corresponding container.

```
docker logs $containerID
```

Rectify the fault of the workload based on logs.

Step 4 Check the error logs.

```
cat /var/log/messages | grep $containerID | grep oom
```

Check whether the system OOM is triggered based on the logs.

----End

Troubleshooting Process

Determine the cause based on the event information, as listed in **Table 6-4**.

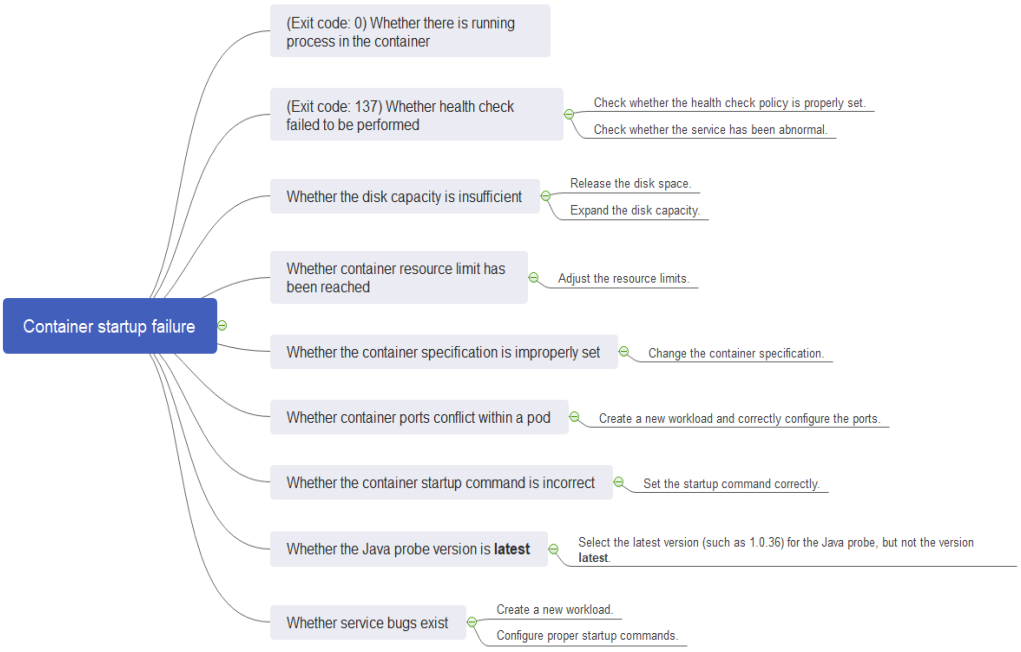
Table 6-4 Container startup failure

Log or Event	Cause and Solution
The log contains **exit(0)**.	No process exists in the container. Check whether the container is running properly. **Check Item 1: Whether There Are Processes that Keep Running in the Container (Exit Code: 0)**
Event information: **Liveness probe failed: Get http...** The log contains **exit(137)**.	Health check fails. **Check Item 2: Whether Health Check Fails to Be Performed (Exit Code: 137)**
Event information: Thin Pool has 15991 free data blocks which are less than minimum required 16383 free data blocks. Create more free space in thin pool or use dm.min_free_space option to change behavior	The disk space is insufficient. Clear the disk space. **Check Item 3: Whether the Container Disk Space Is Insufficient**
The keyword OOM exists in the log.	The memory is insufficient. **Check Item 4: Whether the Upper Limit of Container Resources Has Been Reached** **Check Item 5: Whether the Resource Limits Are Improperly Configured for the Container**
Address already in use	A conflict occurs between container ports in the pod. **Check Item 6: Whether the Container Ports in the Same Pod Conflict with Each Other**

In addition to the preceding possible causes, there are some other possible causes:

- **Check Item 7: Whether the Container Startup Command Is Correctly Configured**
- **Check Item 8: Whether the User Service Has a Bug**
- Use the correct image when you create a workload on an Arm node.

Figure 6-3 Troubleshooting process of the container restart failure



Check Item 1: Whether There Are Processes that Keep Running in the Container (Exit Code: 0)

Step 1 Log in to the node where the abnormal workload is located.

Step 2 View the container status.

docker ps -a | grep *$podName*

Example:

```
[root@xxx ~]# docker ps -a | grep test
1f59a7f4cf77        613055f01959                                                "/bin/bash"              10 seconds ago      Exited (0) 10 seconds ago
  k8s_container-0_test-66b79cbdb7-htcjf_default_5c388617-ac32-11e9-9168-fa163ec28742_1
2c73ac8717cc        cce-pause:2.0                                               "/pause"                 12 seconds ago      Up 12 seconds
  k8s_POD_test-66b79cbdb7-htcjf_default_5c388617-ac32-11e9-9168-fa163ec28742_0
```

If no running process exists in the container, the status code **Exited (0)** is displayed.

----End

Check Item 2: Whether Health Check Fails to Be Performed (Exit Code: 137)

The health check configured for a workload is performed on services periodically. If an exception occurs, the pod reports an event and the pod fails to be restarted.

If the liveness-type (workload liveness probe) health check is configured for the workload and the number of health check failures exceeds the threshold, the containers in the pod will be restarted. On the workload details page, if Kubernetes events contain **Liveness probe failed: Get http...**, the health check fails.

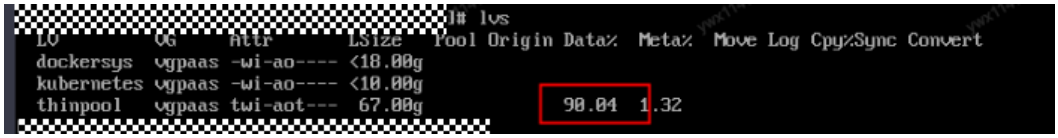
Solution

Click the workload name to go to the workload details page, click the **Containers** tab. Then select **Health Check** to check whether the policy is proper or whether services are running properly.

Check Item 3: Whether the Container Disk Space Is Insufficient

The following message refers to the thin pool disk that is allocated from the Docker disk selected during node creation. You can run the **lvs** command as user **root** to view the current disk usage.

```
Thin Pool has 15991 free data blocks which are less than minimum required 16383 free data blocks. Create more free space in thin pool or use dm.min_free_space option to change behavior
```



Solution

Solution 1: Clearing images

Perform the following operations to clear unused images:

- Nodes that use containerd
  a. Obtain local images on the node.
     ```
     crictl images -v
     ```
  b. Delete the images that are not required by image ID.
     ```
     crictl rmi Image ID
     ```
- Nodes that use Docker
  a. Obtain local images on the node.
     ```
     docker images
     ```
  b. Delete the images that are not required by image ID.
     ```
     docker rmi Image ID
     ```

NOTE

Do not delete system images such as the cce-pause image. Otherwise, pods may fail to be created.

Solution 2: Expanding the disk capacity

To expand a disk capacity, perform the following steps:

Step 1 Expand the capacity of the data disk on the EVS console.

Step 2 Log in to the CCE console and click the cluster. In the navigation pane, choose **Nodes**. Click **More** > **Sync Server Data** in the row containing the target node.

Step 3 Log in to the target node.

Step 4 Run the **lsblk** command to check the block device information of the node.

A data disk is divided depending on the container storage **Rootfs**:

- Overlayfs: No independent thin pool is allocated. Image data is stored in the **dockersys** disk.
  ```
  # lsblk
  NAME MAJ:MIN RM SIZE RO TYPE MOUNTPOINT
  vda 8:0 0 50G 0 disk
  ```



```
└─vda1              8:1    0   50G  0 part /
vdb                 8:16   0  200G  0 disk
├─vgpaas-dockersys  253:0    0   90G  0 lvm  /var/lib/docker             # Space used by the container engine
└─vgpaas-kubernetes 253:1    0   10G  0 lvm  /mnt/paas/kubernetes/kubelet  # Space used by Kubernetes
```

Run the following commands on the node to add the new disk capacity to the **dockersys** disk:

```
pvresize /dev/vdb
lvextend -l+100%FREE -n vgpaas/dockersys
resize2fs /dev/vgpaas/dockersys
```

- Devicemapper: A thin pool is allocated to store image data.

```
# lsblk
NAME                        MAJ:MIN RM  SIZE RO TYPE MOUNTPOINT
vda                         8:0    0   50G  0 disk
└─vda1                      8:1    0   50G  0 part /
vdb                         8:16   0  200G  0 disk
├─vgpaas-dockersys          253:0    0   18G  0 lvm  /var/lib/docker
├─vgpaas-thinpool_tmeta     253:1    0    3G  0 lvm
│ └─vgpaas-thinpool         253:3    0   67G  0 lvm                # Space used by thinpool
│   ...
├─vgpaas-thinpool_tdata     253:2    0   67G  0 lvm
│ └─vgpaas-thinpool         253:3    0   67G  0 lvm
│   ...
└─vgpaas-kubernetes         253:4    0   10G  0 lvm  /mnt/paas/kubernetes/kubelet
```

  - Run the following commands on the node to add the new disk capacity to the **thinpool** disk:

    ```
    pvresize /dev/vdb
    lvextend -l+100%FREE -n vgpaas/thinpool
    ```

  - Run the following commands on the node to add the new disk capacity to the **dockersys** disk:

    ```
    pvresize /dev/vdb
    lvextend -l+100%FREE -n vgpaas/dockersys
    resize2fs /dev/vgpaas/dockersys
    ```

----End

Check Item 4: Whether the Upper Limit of Container Resources Has Been Reached

If the upper limit of container resources has been reached, OOM will be displayed in the event details as well as in the log:

```
cat /var/log/messages | grep 96feb0a425d6 | grep oom
```

```
[root@xxx ~]#
[root@xxx ~]# cat /var/log/messages | grep 96feb0a425d6 | grep oom
2019-07-22T11:57:49.441756+08:00 xxx dockerd: time="2019-07-22T11:57:49.440755329+08:00" level=info msg=event OOMKilled=true containerID=96feb0a425d6669f8f062cf3a6096868617a10711334f6d5bce4a6ee6eadc82d module=libcontainerd namespace=moby topic=/tasks/oom
2019-07-22T11:59:55.828162+08:00 xxx [/bin/bash]: [2019-07-22T11:57:49.441756+08:00 xxx dockerd: time="2019-07-22T11:57:49.440755329+08:00" level=info msg=event OOMKilled=true containerID=96feb0a425d6669f8f062cf3a6096868617a10711334f6d5bce4a6ee6eadc82d module=libcontainerd namespace=moby topic=/tasks/oom] return code=[127], execute failed by [root(uid=0)] from [pts/0 (192.168.0.7)]
2019-07-22T12:01:47.621029+08:00 xxx [/bin/bash]: [cat /var/log/messages | grep 96feb0a425d6 | grep oom] return code=[0], execute success by [root(uid=0)] from [pts/0 (192.168.0.7)]
[root@xxx ~]#
```

When a workload is created, if the requested resources exceed the configured upper limit, the system OOM is triggered and the container exits unexpectedly.

Check Item 5: Whether the Resource Limits Are Improperly Configured for the Container

If the resource limits set for the container during workload creation are less than required, the container fails to be restarted.

Check Item 6: Whether the Container Ports in the Same Pod Conflict with Each Other

Step 1 Log in to the node where the abnormal workload is located.

Step 2 Check the ID of the container where the workload pod exits abnormally.

docker ps -a | grep *$podName*

Step 3 View the logs of the corresponding container.

docker logs *$containerID*

Rectify the fault of the workload based on logs. As shown in the following figure, container ports in the same pod conflict. As a result, the container fails to be started.

Figure 6-4 Container restart failure due to a container port conflict

```
[root@[redacted] ~]# docker ps -a|grep test2
aebc17c4d66c        94818572c4ef                                                          "nginx -g 'daemon ..."   8 se
conds ago        Exited (1) 5 seconds ago                     k8s_container-1_test2-65dbb945d6-xh9n2_defau
lt_38892324-94b7-11e9-aa5f-fa163e07fc60_3
0c43d629292e        nginx                                                                 "nginx -g 'daemon ..."   Abou
t a minute ago   Up About a minute                            k8s_container-0_test2-65dbb945d6-xh9n2_defau
lt_38892324-94b7-11e9-aa5f-fa163e07fc60_0
3484b34393ce        cfe-pause:11.23.1                                                     "/pause"                 Abou
t a minute ago   Up About a minute                            k8s_POD_test2-65dbb945d6-xh9n2_default_38892
324-94b7-11e9-aa5f-fa163e07fc60_0
[root@[redacted] ~]# docker logs aebc17c4d66c
2019/06/22 06:31:29 [emerg] 1#1: bind() to 0.0.0.0:80 failed (98: Address already in use)
nginx: [emerg] bind() to 0.0.0.0:80 failed (98: Address already in use)
2019/06/22 06:31:29 [emerg] 1#1: bind() to 0.0.0.0:80 failed (98: Address already in use)
nginx: [emerg] bind() to 0.0.0.0:80 failed (98: Address already in use)
2019/06/22 06:31:29 [emerg] 1#1: bind() to 0.0.0.0:80 failed (98: Address already in use)
nginx: [emerg] bind() to 0.0.0.0:80 failed (98: Address already in use)
2019/06/22 06:31:29 [emerg] 1#1: bind() to 0.0.0.0:80 failed (98: Address already in use)
nginx: [emerg] bind() to 0.0.0.0:80 failed (98: Address already in use)
2019/06/22 06:31:29 [emerg] 1#1: bind() to 0.0.0.0:80 failed (98: Address already in use)
nginx: [emerg] bind() to 0.0.0.0:80 failed (98: Address already in use)
2019/06/22 06:31:29 [emerg] 1#1: still could not bind()
nginx: [emerg] still could not bind()
```

----End

Solution

Re-create the workload and set a port number that is not used by any other pod.

Check Item 7: Whether the Container Startup Command Is Correctly Configured

The error messages are as follows:

```
[root@[redacted] ~]# docker ps -a|grep test1
2ae258d570c2        94818572c4ef                                                          "/bin/sh -c 'sleep..."   14 s
econds ago       Up 12 seconds                                k8s_container-0_test1-dbc59fc55-8gr9f_defau
lt_19f0d2a0-94ba-11e9-aa5f-fa163e07fc60_1
492b258c1e89        94818572c4ef                                                          "/bin/sh -c 'sleep..."   Abou
t a minute ago   Exited (1) 14 seconds ago                    k8s_container-0_test1-dbc59fc55-8gr9f_defau
lt_19f0d2a0-94ba-11e9-aa5f-fa163e07fc60_0
2fcd00990111        cfe-pause:11.23.1                                                     "/pause"                 Abou
t a minute ago   Up About a minute                            k8s_POD_test1-dbc59fc55-8gr9f_default_19f0d
2a0-94ba-11e9-aa5f-fa163e07fc60_0
[root@[redacted] ~]# docker logs 492b258c1e89
cat: /tmp/test: No such file or directory
```

Solution

Click the workload name to go to the workload details page, click the **Containers** tab. Choose **Lifecycle**, click **Startup Command**, and ensure that the command is correct.

Check Item 8: Whether the User Service Has a Bug

Check whether the workload startup command is correctly executed or whether the workload has a bug.

Step 1 Log in to the node where the abnormal workload is located.

Step 2 Check the ID of the container where the workload pod exits abnormally.

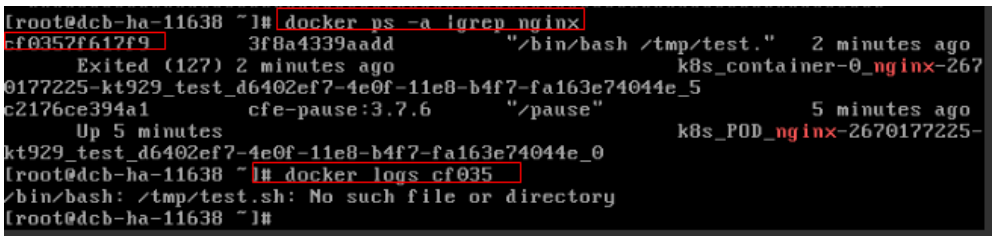
```
docker ps -a | grep $podName
```

Step 3 View the logs of the corresponding container.

```
docker logs $containerID
```

Note: In the preceding command, *containerID* indicates the ID of the container that has exited.

Figure 6-5 Incorrect startup command of the container



As shown in the figure above, the container fails to be started due to an incorrect startup command. For other errors, rectify the bugs based on the logs.

----End

Solution

Create a new workload and configure a correct startup command.

6.1.5 What Should I Do If a Pod Fails to Be Evicted?

Principle of Eviction

When a node is abnormal, Kubernetes will evict pods on the node to ensure workload availability.

In Kubernetes, both kube-controller-manager and kubelet can evict pods.

- **Eviction implemented by kube-controller-manager**

  kube-controller-manager consists of multiple controllers, and eviction is implemented by node controller. node controller periodically checks the status of all nodes. If a node is in the **NotReady** state for a period of time, all pods on the node will be evicted.

  kube-controller-manager supports the following startup parameters:

  – **pod-eviction-timeout**: indicates an interval when a node is down, after which pods on that node are evicted. The default interval is 5 minutes.

  - **node-eviction-rate**: indicates the number of nodes to be evicted per second. The default value is **0.1**, indicating that pods are evicted from one node every 10 seconds.
  - **secondary-node-eviction-rate**: specifies a rate at which nodes are evicted in the second grade. If a large number of nodes are down in the cluster, the eviction rate will be reduced to **secondary-node-eviction-rate**. The default value is **0.01**.
  - **unhealthy-zone-threshold**: specifies a threshold for an AZ to be considered unhealthy. The default value is **0.55**, meaning that if the percentage of faulty nodes in an AZ exceeds 55%, the AZ will be considered unhealthy.
  - **large-cluster-size-threshold**: specifies a threshold for a cluster to be considered large. The parameter defaults to **50**. If there are more nodes than this threshold, the cluster is considered as a large one. If there are more than 55% faulty nodes in a cluster, the eviction rate is reduced to 0.01. If a cluster is a small one, the eviction rate is reduced to 0, which means, nodes in the cluster will not be evicted.

- **Eviction implemented by kubelet**

  If resources of a node are to be used up, kubelet executes the eviction policy based on the pod priority, resource usage, and resource request. If pods have the same priority, the pod that uses the most resources or requests for the most resources will be evicted first.

  kube-controller-manager evicts all pods on a faulty node, while kubelet evicts some pods on a faulty node. kubelet periodically checks the memory and disk resources of nodes. If the resources are insufficient, it will evict some pods based on the priority. For details about the pod eviction priority, see **Pod selection for kubelet eviction**.

  There are soft eviction thresholds and hard eviction thresholds.

  - **Soft eviction thresholds**: A grace period is configured for node resources. kubelet will reclaim node resources associated with these thresholds if that grace period elapses. If the node resource usage reaches these thresholds but falls below them before the grace period elapses, kubelet will not evict pods on the node.

    You can configure soft eviction thresholds using the following parameters:

    - **eviction-soft**: indicates a soft eviction threshold. If a node's **eviction signal** reaches a certain threshold, for example, **memory.available<1.5Gi**, kubelet will not immediately evict some pods on the node but wait for a grace period configured by **eviction-soft-grace-period**. If the threshold is reached after the grace period elapses, kubelet will evict some pods on the node.
    - **eviction-soft-grace-period**: indicates an eviction grace period. If a pod reaches the soft eviction threshold, it will be terminated after the configured grace period elapses. This parameter indicates the time difference for a terminating pod to respond to the threshold being met. The default grace period is 90 seconds.
    - **eviction-max-pod-grace-period**: indicates the maximum allowed grace period to use when terminating pods in response to a soft eviction threshold being met.

- **Hard eviction thresholds**: Pods are immediately evicted once these thresholds are reached.

  You can configure hard eviction thresholds using the following parameters:

  eviction-hard: indicates a hard eviction threshold. When the **eviction signal** of a node reaches a certain threshold, for example, **memory.available<1Gi**, which means, when the available memory of the node is less than 1 GiB, a pod eviction will be triggered immediately.

  kubelet supports the following default hard eviction thresholds:

  - **memory.available<100Mi**
  - **nodefs.available<10%**
  - **imagefs.available<15%**
  - **nodefs.inodesFree<5%** (for Linux nodes)

kubelet also supports other parameters:

- **eviction-pressure-transition-period**: indicates a period for which the kubelet has to wait before transitioning out of an eviction pressure condition. The default value is 5 minutes. If the time exceeds the threshold, the node is set to **DiskPressure** or **MemoryPressure**. Then some pods running on the node will be evicted. This parameter can prevent mistaken eviction decisions when a node is oscillating above and below a soft eviction threshold in some cases.
- **eviction-minimum-reclaim**: indicates the minimum number of resources that must be reclaimed in each eviction. This parameter can prevent kubelet from repeatedly evicting pods because only a small number of resources are reclaimed during pod evictions in some cases.

Fault Locating

If the pods are not evicted when the node is faulty, perform the following steps to locate the fault:

After the following command is run, the command output shows that many pods are in the **Evicted** state.

```
kubectl get pods
```

Check results will be recorded in kubelet logs of the node. You can run the following command to search for the information:

```
cat /var/paas/sys/log/kubernetes/kubelet.log | grep -i Evicted -C3
```

Troubleshooting Process

The issues here are described in order of how likely they are to occur.

Check these causes one by one until you find the cause of the fault.

- **Check Item 1: Whether the Node Is Under Resource Pressure**
- **Check Item 2: Whether Tolerations Have Been Configured for the Workload**

- **Check Item 3: Whether the Conditions for Stopping Pod Eviction Are Met**
- **Check Item 4: Whether the Allocated Resources of the Pod Are the Same as Those of the Node**
- **Check Item 5: Whether the Workload Pod Fails Continuously and Is Redeployed**

Check Item 1: Whether the Node Is Under Resource Pressure

If a node suffers resource pressure, kubelet will change the **node status** and add taints to the node. Perform the following steps to check whether the corresponding taint exists on the node:

```
$ kubectl describe node 192.168.0.37
Name:               192.168.0.37
...
Taints:             key1=value1:NoSchedule
...
```

Table 6-5 Statuses of nodes with resource pressure and solutions

Node Status	Taint	Eviction Signal	Description
MemoryPressure	node.kubernetes.io/memory-pressure	memory.available	The available memory on the node reaches the eviction thresholds.
DiskPressure	node.kubernetes.io/disk-pressure	nodefs.available, nodefs.inodesFree, imagefs.available or imagefs.inodesFree	The available disk space and inode on the root file system or image file system of the node reach the eviction thresholds.
PIDPressure	node.kubernetes.io/pid-pressure	pid.available	The available process identifier on the node is below the eviction thresholds.

Check Item 2: Whether Tolerations Have Been Configured for the Workload

Use kubectl or locate the row containing the target workload and choose **More** > **Edit YAML** in the **Operation** column to check whether tolerance is configured for the workload. For details, see **Taints and Tolerations**.

Check Item 3: Whether the Conditions for Stopping Pod Eviction Are Met

In a cluster that runs less than 50 worker nodes, if the number of faulty nodes accounts for over 55% of the total nodes, the pod eviction will be suspended. In this case, Kubernetes will not attempt to evict the workload on the faulty node. For details, see **Rate limits on eviction**.

Check Item 4: Whether the Allocated Resources of the Pod Are the Same as Those of the Node

An evicted pod will be frequently scheduled to the original node.

Possible Causes

Pods on a node are evicted based on the node resource usage. The evicted pods are scheduled based on the allocated node resources. Eviction and scheduling are based on different rules. Therefore, an evicted container may be scheduled to the original node again.

Solution

Properly allocate resources to each container.

Check Item 5: Whether the Workload Pod Fails Continuously and Is Redeployed

A workload pod fails and is being redeployed constantly.

Analysis

After a pod is evicted and scheduled to a new node, if pods in that node are also being evicted, the pod will be evicted again. Pods may be evicted repeatedly.

If a pod is evicted by kube-controller-manager, it would be in the **Terminating** state. This pod will be automatically deleted only after the node where the container is located is restored. If the node has been deleted or cannot be restored due to other reasons, you can forcibly delete the pod.

If a pod is evicted by kubelet, it would be in the **Evicted** state. This pod is only used for subsequent fault locating and can be directly deleted.

Solution

Run the following command to delete the evicted pods:

```
kubectl get pods <namespace> | grep Evicted | awk '{print $1}' | xargs kubectl delete pod <namespace>
```

In the preceding command, *<namespace>* indicates the namespace name. Configure it based on your requirements.

References

Kubelet does not delete evicted pods

6.1.6 What Should I Do If a Storage Volume Cannot Be Mounted or the Mounting Times Out?

Troubleshooting Process

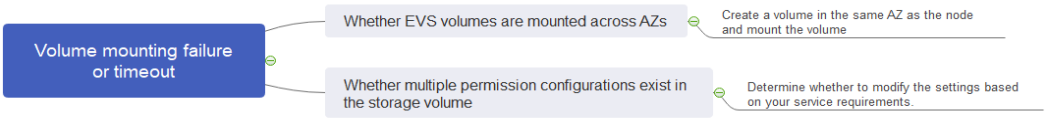
The issues here are described in order of how likely they are to occur.

Check these causes one by one until you find the cause of the fault.

- **Check Item 1: Whether EVS Volumes Are Mounted Across AZs**

- **Check Item 2: Whether Multiple Permission Configurations Exist in the Storage Volume**
- **Check Item 3: Whether There Is More Than One Replica for a Deployment with EVS Volumes**
- **Check Item 4: Whether the EVS Disk File System Is Damaged**

Figure 6-6 Troubleshooting for storage volume mounting failure or mounting timeout



Check Item 1: Whether EVS Volumes Are Mounted Across AZs

Symptom

Mounting an EVS volume to a StatefulSet times out.

Fault Locating

If your node is in **AZ 1** but the volume to be mounted is in **AZ 2**, the mounting times out and the volume cannot be mounted.

Solution

Create a volume in the same AZ as the node and mount the volume.

Check Item 2: Whether Multiple Permission Configurations Exist in the Storage Volume

If the volume to be mounted stores too many data and involves permission-related configurations, the file permissions need to be modified one by one, which results in mounting timeout.

Fault Locating

- Check whether the **securityContext** field contains **runAsuser** and **fsGroup**. **securityContext** is a Kubernetes field that defines the permission and access control settings of pods or containers.
- Check whether the startup commands contain commands used to obtain or modify file permissions, such as **ls**, **chmod**, and **chown**.

Solution

Determine whether to modify the settings based on your service requirements.

Check Item 3: Whether There Is More Than One Replica for a Deployment with EVS Volumes

Symptom

The pod fails to be created, and an event indicating that the storage fails to be added is reported.


```
Multi-Attach error for volume "pvc-62a7a7d9-9dc8-42a2-8366-0f5ef9db5b60" Volume is already used by pod(s) testttt-7b774658cb-lc98h
```

Fault Locating

Check whether the number of replicas of the Deployment is greater than 1.

If the Deployment uses an EVS volume, the number of replicas can only be 1. If you specify more than two pods for the Deployment on the backend, CCE does not restrict the creation of the Deployment. However, if these pods are scheduled to different nodes, some pods cannot be started because the EVS volumes used by the pods cannot be mounted to the nodes.

Solution

Set the number of replicas of the Deployment that uses an EVS volume to 1 or use other volume types.

Check Item 4: Whether the EVS Disk File System Is Damaged

Symptom

The pod fails to be created, and information similar to the following is displayed, indicating that the disk file system is damaged.

```
MountVolume.MountDevice failed for volume "pvc-08178474-c58c-4820-a828-14437d46ba6f" : rpc error: code = Internal desc = [09060def-afd0-11ec-9664-fa163eef47d0] /dev/sda has file system, but it is detected to be damaged
```

Solution

Back up the disk in EVS and run the following command to restore the file system:

fsck -y {Drive letter}

6.1.7 What Should I Do If a Workload Remains in the Creating State?

Symptom

The workload remains in the creating state.

Troubleshooting Process

The issues here are described in order of how likely they are to occur.

Check these causes one by one until you find the cause of the fault.

- **Check Item 1: Whether the cce-pause Image Is Deleted by Mistake**
- **Check Item 2: Modifying Node Specifications After the CPU Management Policy Is Enabled in the Cluster**

Check Item 1: Whether the cce-pause Image Is Deleted by Mistake

Symptom

When creating a workload, an error message indicating that the sandbox cannot be created is displayed. This is because the **cce-pause:3.1** image fails to be pulled.


```
Failed to create pod sandbox: rpc error: code = Unknown desc = failed to get sandbox image "cce-pause:3.1": failed to pull image "cce-pause:3.1": failed to pull and unpack image "docker.io/library/cce-pause:3.1": failed to resolve reference "docker.io/library/cce-pause:3.1": pulling from host **** failed with status code [manifests 3.1]: 400 Bad Request
```

Possible Causes

The image is a system image added during node creation. If the image is deleted by mistake, the workload cannot be created.

Solution

Step 1 Log in to the faulty node.

Step 2 Decompress the cce-pause image installation package.

```
tar -xzvf /opt/cloud/cce/package/node-package/pause-*.tgz
```

Step 3 Import the image.

- Docker nodes:
  ```
  docker load -i ./pause/package/image/cce-pause-3.1.tar
  ```
- containerd nodes:
  ```
  ctr -n k8s.io image import ./pause/package/image/cce-pause-3.1.tar
  ```

Step 4 Create a workload.

----End

Check Item 2: Modifying Node Specifications After the CPU Management Policy Is Enabled in the Cluster

The kubelet option **cpu-manager-policy** defaults to **static**. This allows granting enhanced CPU affinity and exclusivity to pods with certain resource characteristics on the node. If you modify CCE node specifications on the ECS console, the original CPU information does not match the new CPU information. As a result, workloads on the node cannot be restarted or created.

Step 1 Log in to the CCE node (ECS) and delete the **cpu_manager_state** file.

Example command for deleting the file:

```
rm -rf /mnt/paas/kubernetes/kubelet/cpu_manager_state
```

Step 2 Restart the node or kubelet. The following is the kubelet restart command:

```
systemctl restart kubelet
```

Verify that workloads on the node can be successfully restarted or created.

For details, see **What Should I Do If I Fail to Restart or Create Workloads on a Node After Modifying the Node Specifications?**.

----End

6.1.8 What Should I Do If Pods in the Terminating State Cannot Be Deleted?

Symptom

When a node is in the Unavailable state, CCE migrates container pods on the node and sets the pods running on the node to the **Terminating** state.

After the node is restored, the pods in the **Terminating** state are automatically deleted.

However, some pods remain in the **Terminating** state.

```
#kubectl get pod -n aos
NAME                          READY     STATUS        RESTARTS   AGE
aos-apiserver-5f8f5b5585-s9l92    1/1       Terminating    0          3d1h
aos-cmdbserver-789bf5b497-6rwrg   1/1       Running        0          3d1h
aos-controller-545d78bs8d-vm6j9   1/1       Running        3          3d1h
```

Running **kubectl delete pods <podname> -n <namespace>** cannot delete the pods.

kubectl delete pods **aos-apiserver-5f8f5b5585-s9l92** -n aos

Solution

You can run the following command to forcibly delete the pods created in any ways:

kubectl delete pods **<pod>** --grace-period=0 --force

Therefore, run the following command to delete the pod:

kubectl delete pods **aos-apiserver-5f8f5b5585-s9l92** --grace-period=0 --force

6.1.9 What Should I Do If a Workload Is Stopped Caused by Pod Deletion?

Problem

A workload is in **Stopped** state.

Cause:

The **metadata.enable** field in the YAML file of the workload is **false**. As a result, the pod of the workload is deleted and the workload is in the stopped status.

```
kind: Deployment
apiVersion: apps/v1
metadata:
  name: test
  namespace: default
  selfLink: /apis/apps/v1/namespaces/default/deployments/test
  uid: b130db9f-9306-11e9-a2a9-fa163eaff9f7
  resourceVersion: '7314771'
  generation: 1
  creationTimestamp: '2019-06-20T02:54:16Z'
  labels:
    appgroup: ''
  annotations:
    deployment.kubernetes.io/revision: '1'
    description: ''
  enable: false
spec:
```


Solution

Delete the **enable** field or set it to **true**.

6.1.10 What Should I Do If an Error Occurs When Deploying a Service on the GPU Node?

Symptom

The following exceptions occur when services are deployed on the GPU nodes in a CCE cluster:

1. The GPU memory of containers cannot be queried.
2. Seven GPU services are deployed, but only two of them can be accessed properly. Errors are reported during the startup of the remaining five services.
   - The CUDA versions of the two services that can be accessed properly are 10.1 and 10.0, respectively.
   - The CUDA versions of the failing services are also 10.0 and 10.1.
3. Files named **core.*** are found in the GPU service containers. No such files existed in any of the previous deployments.

Fault Locating

1. The driver version of the gpu add-on is too old. After a new driver is downloaded and installed, the fault is rectified.
2. The workloads do not declare that GPU resources are required.

Suggested Solution

After you install gpu-beta (gpu-device-plugin) on a node, nvidia-smi will be automatically installed. If an error is reported during GPU deployment, this issue is typically caused by an NVIDIA driver installation failure. Check whether the NVIDIA driver has been downloaded.

- GPU node:
  ```
  # If the add-on version is earlier than 2.0.0, run the following command:
  cd /opt/cloud/cce/nvidia/bin && ./nvidia-smi

  # If the add-on version is 2.0.0 or later and the driver installation path is changed, run the following command:
  cd /usr/local/nvidia/bin && ./nvidia-smi
  ```
- Container:
  ```
  cd /usr/local/nvidia/bin && ./nvidia-smi
  ```

If GPU information is returned, the device is available and the add-on has been installed.

If the driver address is incorrect, uninstall the add-on, reinstall it, and configure the correct address.

NOTE

You are advised to store the NVIDIA driver in the OBS bucket and set the bucket policy to public read.

Helpful Links

- **How Do I Rectify Failures When the NVIDIA Driver Is Used to Start Containers on GPU Nodes?**

6.1.11 How to Locate Faults Using an Exit Code?

When a container fails to be started or terminated, the exit code is recorded by Kubernetes events to report the cause. This section describes how to locate faults using an exit code.

Viewing an Exit Code

You can use kubectl to connect to the cluster and run the following command to check the pod:

```
kubectl describe pod {pod name}
```

In the command output, the **Exit Code** field indicates the status code of the last program exit. If the value is not **0**, the program exits abnormally. You can further analyze the cause through this code.

```
Containers:
  container-1:
    Container ID: ...
    Image: ...
    Image ID: ...
    Ports: ...
    Host Ports: ...
    Args: ...
    State: Running
      Started: Sat, 28 Jan 2023 09:06:53 +0000
    Last State: Terminated
      Reason: Error
      Exit Code: 255
      Started: Sat, 28 Jan 2023 09:01:33 +0000
      Finished: Sat, 28 Jan 2023 09:05:11 +0000
    Ready: True
    Restart Count: 1
```

Description

The exit code ranges from 0 to 255.

- If the exit code is 0, the container exits normally.
- Generally, the abnormal exit is caused by the program and such exit code ranges from 1 to 128. In special scenarios, the exit code ranges from 129 to 255.
- When a program exits due to external interrupts, the exit code ranges from 129 to 255. When the operating system sends **an interrupt signal** to the program, the exist code is the interrupt signal value plus 128. For example, if the interrupt signal value of **SIGKILL** is 9, the exit status code is 137 (9 + 128).
- If the exist code is not in the range of 0 to 255, for example, exit(-1), the exit code is automatically converted to a value that is within the range of 0 to 255.

  If the exist code is a positive number, the conversion formula is as follows:

  ```
  code % 256
  ```

  If the exit code is a negative number, the conversion formula is as follows:


```
256 - (|code| % 256)
```

For details, see **Exit Codes With Special Meanings**.

Common Exit Codes

Table 6-6 Common exit codes

Exit Code	Name	Description
0	Normal exit	The container exits normally. This status code does not necessarily indicate that an exception occurs. When there is no process in the container, it may also be displayed.
1	Common program error	There are many causes for this exception, most of which are caused by the program. You need to further locate the cause through container logs. For example, this error occurs when an x86 image is running on an Arm node.
125	The container is not running.	The possible causes are as follows: • An undefined flag is used in the command, for example, **docker run --abcd**. • The user-defined command in the image has insufficient permission on the local host. • The container engine is incompatible with the host OS or hardware.
126	Command calling error	The command called in the image cannot be executed. For example, the file permission is insufficient or the file cannot be executed.
127	The file or directory cannot be found.	The file or directory specified in the image cannot be found.
128	Invalid exit parameter	The container exits but no valid exit code is provided. There are multiple possible causes. You need to further locate the cause. For example, an application running on the containerd node attempts to call the docker command.

Exit Code	Name	Description
137	Immediate termination (SIGKILL)	The program is terminated by the **SIGKILL** signal. The common causes are as follows: • The memory usage of the container in the pod reaches the resource limit. For example, out of memory (OOM) causes cgroup to forcibly stop the container. • If OOM occurs, the kernel of the node stops some processes to release the memory. As a result, the container may be terminated. • If the container health check fails, kubelet stops the container. • Other external processes, such as malicious scripts, forcibly stop the container.
139	Segmentation error (SIGSEGV)	The container receives the **SIGSEGV** signal from the OS because the container attempts to access an unauthorized memory location.
143	Graceful termination (SIGTERM)	The container is correctly closed as instructed by the host. Generally, this exit code 143 does not require troubleshooting.
255	The exit code is out of range.	The container exit code is out of range. For example, exit(-1) may be used for abnormal exit, and -1 is automatically converted to 255. Further troubleshooting is required.

Linux Standard Interrupt Signal

You can run the **kill -l** command to view the signals and corresponding values in the Linux OS.

Table 6-7 Common Linux standard interrupt signals

Signal	Value	Action	Commit
SIGHUP	1	Term	Sent when the user terminal connection (normal or abnormal) ends.
SIGINT	2	Term	Program termination signal, which is sent by the terminal by pressing **Ctrl+C**.
SIGQUIT	3	Core	Similar to **SIGINT**, the exit command is sent by the terminal. Generally, the exit command is controlled by pressing **Ctrl+**.
SIGILL	4	Core	Invalid instruction, usually because an error occurs in the executable file.

Signal	Value	Action	Commit
SIGABRT	6	Core	Signal generated when the abort function is invoked. The process ends abnormally.
SIGFPE	8	Core	A floating-point arithmetic error occurs. Other arithmetic errors such as divisor 0 also occur.
SIGKILL	9	Term	Any process is terminated.
SIGSEGV	11	Core	Attempt to access an unauthorized memory location.
SIGPIPE	13	Term	The pipe is disconnected.
SIGALRM	14	Term	Indicates clock timing.
SIGTERM	15	Term	Process end signal, which is usually the normal exit of the program.
SIGUSR1	10	Term	This is a user-defined signal in applications.
SIGUSR2	12	Term	This is a user-defined signal in applications.
SIGCHLD	17	Ign	This signal is generated when a subprocess ends or is interrupted.
SIGCONT	18	Cont	Resume a stopped process.
SIGSTOP	19	Stop	Suspend the execution of a process.
SIGTSTP	20	Stop	Stop a process.
SIGTTIN	21	Stop	The background process reads the input value from the terminal.
SIGTTOU	22	Stop	The background process reads the output value from the terminal.

6.2 Container Configuration

6.2.1 When Is Pre-stop Processing Used?

Service processing takes a long time. Pre-stop processing makes sure that during an upgrade, a pod is killed only when the service in the pod has been processed.

6.2.2 How Do I Set an FQDN for Accessing a Specified Container in the Same Namespace?

Context

When creating a workload, users can specify a container, pod, and namespace as an FQDN for accessing the container in the same namespace.

FQDN stands for Fully Qualified Domain Name, which contains both the host name and domain name. These two names are combined using a period (.).

For example, if the host name is **bigserver** and the domain name is **mycompany.com**, the FQDN is **bigserver.mycompany.com**.

Solution

Solution 1: Use the domain name for service discovery. The host name and namespace must be pre-configured. The domain name of the registered service is in the format of *service name.namespace name***.svc.cluster.local**. The limitation of this solution is that the registration center must be deployed using containers.

Solution 2: Use the host network to deploy containers and then configure affinity between the containers and a node in the cluster. In this way, the service address (that is, the node address) of the containers can be determined. The registered address is the IP address of the node where the service is located. This solution allows you to deploy the registration center using VMs, whereas the disadvantage is that the host network is not as efficient as the container network.

6.2.3 What Should I Do If Health Check Probes Occasionally Fail?

When the liveness and readiness probes fail to perform the health check, locate the service fault first.

Common causes are as follows:

- The service processing takes a long time. As a result, the response times out.
- The Tomcat connection setup and waiting time are too long (for example, too many connections or threads). As a result, the response times out.
- The performance of the node where the container is located, such as the disk I/O, reaches the bottleneck. As a result, the service processing times out.

6.2.4 How Do I Set the umask Value for a Container?

Symptom

A container is started in **tailf /dev/null** mode and the directory permission is **700** after the startup script is manually executed. If the container is started by Kubernetes itself without **tailf**, the obtained directory permission is **751**.

Solution

The reason is that the umask values set in the preceding two startup modes are different. Therefore, the permissions on the created directories are different.

The umask value is used to set the default permission for a newly created file or directory. If the umask value is too small, group users or other users will have excessive permissions, posing security threats to the system. Therefore, the default umask value for all users is set to **0077**. That is, the default permission on directories created by users is **700**, and the default permission on files is **600**.

You can add the following content to the startup script to set the permission on the created directory to **700**:

1. 1. Add **umask 0077** to the **/etc/bashrc** file and all files in **/etc/profile.d/**.
2. Run the following command:
   ```
   echo "umask 0077" >> $FILE
   ```

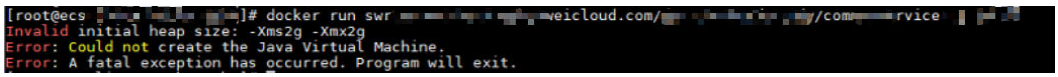
   NOTE

   FILE indicates the file name, for example, **echo "umask 0077" >> /etc/bashrc**.
3. Set the owner and group of the **/etc/bashrc** file and all files in **/etc/profile.d/** to **root**.
4. Run the following command:
   ```
   chown root.root $FILE
   ```

6.2.5 What Can I Do If an Error Is Reported When a Deployed Container Is Started After the JVM Startup Heap Memory Parameter Is Specified for ENTRYPOINT in Dockerfile?

Problem Description

After the JVM startup heap memory parameter is specified for ENTRYPOINT in the Dockerfile, an error message "invalid initial heap size" is displayed during the deployed container's startup, as shown in the following figure:



Answer

Check the ENTRYPOINT settings. The following settings are incorrect:

```
ENTRYPOINT ["java","-Xms2g -Xmx2g","-jar","xxx.jar"]
```

You can use either of the following methods to solve the problem:

- **(Recommended)** Write the container startup command in **Workloads > Container Settings > Lifecycle > Startup Command**, then the container can be started properly.
- Change the format of the **ENTRYPOINT** startup command to the following:
  ```
  ENTRYPOINT exec java -Xmx2g -Xms2g -jar xxxx.jar
  ```


6.2.6 What Is the Retry Mechanism When CCE Fails to Start a Pod?

CCE is a fully managed Kubernetes service and is fully compatible with Kubernetes APIs and kubectl.

In Kubernetes, the spec of a pod contains a **restartPolicy** field. The value of **restartPolicy** can be **Always**, **OnFailure**, or **Never**. The default value is **Always**.

- **Always**: When a container fails, kubelet automatically restarts the container.
- **OnFailure**: When a container stops running and the exit code is not **0** (indicating normal exit), kubelet automatically restarts the container.
- **Never**: kubelet does not restart the container regardless of the container running status.

restartPolicy applies to all containers in a pod.

restartPolicy only refers to restarts of the containers by kubelet on the same node. When containers in a pod exit, kubelet restarts them with an exponential back-off delay (10s, 20s, 40s, …), which is capped at five minutes. Once a container has been running for 10 minutes without any problems, kubelet resets the restart backoff timer for the container.

The settings of **restartPolicy** vary depending on the controller:

- **Replication Controller (RC)** and **DaemonSet**: **restartPolicy** must be set to **Always** to ensure continuous running of the containers.
- **Job**: **restartPolicy** must be set to **OnFailure** or **Never** to ensure that containers are not restarted after being executed.

6.3 Scheduling Policies

6.3.1 How Do I Evenly Distribute Multiple Pods to Each Node?

The kube-scheduler component in Kubernetes is responsible pod scheduling. For each newly created pod or other unscheduled pods, kube-scheduler selects an optimal node from them to run on. kube-scheduler selects a node for a pod in a 2-step operation: filtering and scoring. In the filtering step, all nodes where it is feasible to schedule the pod are filtered out. In the scoring step, kube-scheduler ranks the remaining nodes to choose the most suitable pod placement. Finally, kube-scheduler schedules the pod to the node with the highest score. If there is more than one node with the equal scores, kube-scheduler selects one of them at random.

BalancedResourceAllocation is only one of the scoring priorities. Other scoring items may also cause uneven distribution. For details about scheduling, see **Kubernetes Scheduler** and **Scheduling Policies**.

You can configure pod anti-affinity policies to evenly distribute pods onto different nodes.

Example:

```
kind: Deployment
apiVersion: apps/v1
```



```
metadata:
  name: nginx
  namespace: default
spec:
  replicas: 2
  selector:
    matchLabels:
      app: nginx
  template:
    metadata:
      labels:
        app: nginx
    spec:
      containers:
        - name: container-0
          image: nginx:alpine
          resources:
            limits:
              cpu: 250m
              memory: 512Mi
            requests:
              cpu: 250m
              memory: 512Mi
      affinity:
        podAntiAffinity:                # Workload anti-affinity
          preferredDuringSchedulingIgnoredDuringExecution:    # Ensure that the following conditions are met:
            - podAffinityTerm:
                labelSelector:                  # Select the label of the pod, which is anti-affinity with the
workload.
                  matchExpressions:
                    - key: app
                      operator: In
                      values:
                        - nginx
                namespaces:
                  - default
                topologyKey: kubernetes.io/hostname     # It takes effect on the node.
      imagePullSecrets:
        - name: default-secret
```

6.3.2 How Do I Prevent a Container on a Node from Being Evicted?

Context

During workload scheduling, two containers on a node may compete for resources. As a result, kubelet evicts both containers. This section describes how to set a policy to retain one of the containers.

Solution

kubelet uses the following criteria to evict a pod:

- Quality of Service (QoS) class: **BestEffort**, **Burstable**, and **Guaranteed**
- Consumed resources based on the pod scheduling request

Pods of different QoS classes are evicted in the following sequence:

BestEffort -> Burstable -> Guaranteed

- BestEffort pods: These pods have the lowest priority. They will be the first to be killed if the system runs out of memory.

- Burstable pods: These pods will be killed if the system runs out of memory and no BestEffort pods exist.
- Guaranteed pods: These pods will be killed if the system runs out of memory and no Burstable or BestEffort pods exist.

NOTE

- If processes in a pod are killed because of excessive resource usage (while the node resources are still sufficient), the system tends to restart the container or create a pod.
- If resources are sufficient, you can assign the QoS class of Guaranteed to all pods. In this way, more compute resources are used to improve service performance and stability, reducing troubleshooting time and costs.
- To improve resource utilization, assign the QoS class of Guaranteed to service pods and Burstable or BestEffort to other pods (for example, filebeat).

6.3.3 Why Are Pods Not Evenly Distributed to Nodes?

The kube-scheduler component in Kubernetes is responsible pod scheduling. For each newly created pod or other unscheduled pods, kube-scheduler selects an optimal node from them to run on. kube-scheduler selects a node for a pod in a 2-step operation: filtering and scoring. In the filtering step, all nodes where it is feasible to schedule the pod are filtered out. In the scoring step, kube-scheduler ranks the remaining nodes to choose the most suitable pod placement. Finally, kube-scheduler schedules the pod to the node with the highest score. If there is more than one node with the equal scores, kube-scheduler selects one of them at random.

BalancedResourceAllocation is only one of the scoring priorities. Other scoring items may also cause uneven distribution. For details about scheduling, see **Kubernetes Scheduler** and **Scheduling Policies**.

6.3.4 How Do I Evict All Pods on a Node?

You can run the **kubectl drain** command to safely evict all pods from a node.

NOTE

By default, the **kubectl drain** command retains some system pods, for example, everest-csi-driver.

Step 1 Use kubectl to connect to the cluster.

Step 2 Check the nodes in the cluster.

```
kubectl get node
```

Step 3 Select a node and view all pods on the node.

```
kubectl get pod --all-namespaces -owide --field-selector spec.nodeName=192.168.0.160
```

The pods on the node before eviction are as follows:

```
NAMESPACE     NAME                                  READY   STATUS    RESTARTS   AGE     IP
NODE          NOMINATED NODE   READINESS GATES
default       nginx-5bcc57c74b-lgcvh                1/1     Running   0          7m25s   10.0.0.140
192.168.0.160   <none>           <none>
kube-system   coredns-6fcd88c4c-97p6s               1/1     Running   0          3h16m   10.0.0.138
192.168.0.160   <none>           <none>
kube-system   everest-csi-controller-56796f47cc-99dtm   1/1     Running   0          3h16m   10.0.0.139
192.168.0.160   <none>           <none>
kube-system   everest-csi-driver-dpfzl              2/2     Running   2          12d     192.168.0.160
```



```
192.168.0.160   <none>          <none>
kube-system   icagent-tpfpv                    1/1     Running   1          12d     192.168.0.160
192.168.0.160   <none>          <none>
```

Step 4 Evict all pods on the node.

```
kubectl drain 192.168.0.160
```

If a pod mounted with local storage or controlled by a DaemonSet set exists on the node, the message "error: unable to drain node "192.168.0.160", aborting command... " will be displayed. The eviction command does not take effect. You can add the following parameters to the end of the preceding command to forcibly evict the pod:

- **--delete-emptydir-data**: forcibly evicts pods mounted with local storage, for example, coredns.
- **--ignore-daemonsets**: forcibly evicts the DaemonSet pods, for example, everest-csi-driver.

In the example, both types of pods exist on the node. Therefore, the eviction command is as follows:

```
kubectl drain 192.168.0.160 --delete-emptydir-data --ignore-daemonsets
```

Step 5 After the eviction, the node is automatically marked as unschedulable. That is, the node is tainted **node.kubernetes.io/unschedulable = : NoSchedule**.

After the eviction, only system pods are retained on the node.

```
NAMESPACE     NAME                       READY   STATUS    RESTARTS   AGE   IP              NODE
NOMINATED NODE   READINESS GATES
kube-system   everest-csi-driver-dpfzl   2/2     Running   2          12d   192.168.0.160   192.168.0.160
<none>           <none>
kube-system   icagent-tpfpv              1/1     Running   1          12d   192.168.0.160   192.168.0.160
<none>           <none>
```

----End

Related Operations

Drain, cordon, and uncordon operations of kubectl:

- **drain**: Safely evicts all pods from a node and marks the node as unschedulable.
- **cordon**: Marks the node as unschedulable. That is, the node is tainted **node.kubernetes.io/unschedulable = : NoSchedule**.
- **uncordon**: Marks the node as schedulable.

For more information, see the **kubectl documentation**.

6.4 Others

6.4.1 What Should I Do If a Scheduled Task Cannot Be Restarted After Being Stopped for a Period of Time?

If a scheduled task is stopped during running, before its restart, the system calculates the difference between the last time the task was successfully executed

and the current time and compares the time difference with the scheduled task period multiplied by 100. If the time difference is greater than the period multiplied by 100, the scheduled task will not be triggered again. For details, see **CronJob Limitations**.

For example, assume that a cron job is set to create a job every minute from 08:30:00 and the **startingDeadlineSeconds** field is not set. If the cron job controller stops running from 08:29:00 to 10:21:00, the job will not be started because the time difference between 08:29:00 and 10:21:00. 00 exceeds 100 minutes, that is, the number of missed scheduling times exceeds 100 (in the example, a scheduling period is 1 minute).

If the **startingDeadlineSeconds** field is set, the controller calculates the number of missed jobs in the last *x* seconds (*x* indicates the value of **startingDeadlineSeconds**). For example, if **startingDeadlineSeconds** is set to **200**, the controller counts the number of jobs missed in the last 200 seconds. In this case, if the cron job controller stops running from 08:29:00 to 10:21:00, the job will start again at 10:22:00, because only three scheduling requests are missed in the last 200 seconds (in the example, one scheduling period is 1 minute).

Solution

Configure the **startingDeadlineSeconds** parameter in a cron job. This parameter can be created or modified only by using kubectl or APIs.

Example YAML:

```
apiVersion: batch/v1
kind: CronJob
metadata:
  name: hello
spec:
  startingDeadlineSeconds: 200
  schedule: "* * * * *"
  jobTemplate:
    spec:
      template:
        spec:
          containers:
          - name: hello
            image: busybox:1.28
            imagePullPolicy: IfNotPresent
            command:
            - /bin/sh
            - -c
            - date; echo Hello
          restartPolicy: OnFailure
```

If you create a cron job again, you can temporarily avoid this issue.

6.4.2 What Is a Headless Service When I Create a StatefulSet?

The inter-pod discovery service of CCE corresponds to the headless Service of Kubernetes. Headless Services specify **None** for the cluster IP (spec:clusterIP) in YAML, which means no cluster IP is allocated.

Differences Between Headless Services and Common Services

- Common Services:

  One Service may be backed by multiple endpoints (pods). A client accesses the cluster IP address and the request is forwarded to the real server based on

the iptables or IPVS rules to implement load balancing. For example, a Service has two endpoints, but only the Service address is returned during DNS query. The iptables or IPVS rules determine the real server that the client accesses. The client cannot access the specified endpoint.

- Headless Services:

  When a headless Service is accessed, the actual endpoint (pod IP addresses) is returned. The headless Service points directly to each endpoint, that is, each pod has a DNS domain name. In this way, pods can access each other, achieving inter-pod discovery and access.

Headless Service Application Scenarios

If there is no difference between multiple pods of a workload, you can use a common Service and use the cluster kube-proxy to implement load balancing, for example, an Nginx Deployment.

However, in some application scenarios, pods of a workload have different roles. For example, in a Redis cluster, each Redis pod is different. They have a master/slave relationship and need to communicate with each other. In this case, a common Service cannot access a specified pod through the cluster IP address. Therefore, you need to allow the headless Service to directly access the real IP address of the pod to implement mutual access among pods.

Headless Services work with **StatefulSet** to deploy stateful applications, such as Redis and MySQL.

6.4.3 What Should I Do If Error Message "Auth is empty" Is Displayed When a Private Image Is Pulled?

Problem Description

When you replace the image of a container in a created workload and use an uploaded image on the CCE console, an error message "Auth is empty, only accept X-Auth-Token or Authorization" is displayed when the uploaded image is pulled.

```
Failed to pull image "IP address:Port number /magicdoom/tidb-operator:latest": rpc error: code = Unknown desc = Error response from daemon: Get https://IP address:Port number /v2/magicdoom/tidb-operator/manifests/latest: error parsing HTTP 400 response body: json: cannot unmarshal number into Go struct field Error.code of type errcode.ErrorCode: "{\"errors\":[{\"code\":400,\"message\":\"Auth is empty, only accept X-Auth-Token or Authorization.\"}]}"
```

Solution

You can select a private image to create an application on the CCE console. In this case, CCE automatically carries the secret. This problem will not occur during the upgrade.

When you create a workload using an API, you can include the secret in Deployments to avoid this problem during the upgrade.

```
imagePullSecrets:
- name: default-secret
```


6.4.4 Why Cannot a Pod Be Scheduled to a Node?

Step 1 Check whether the node and Docker are normal. For details, see **Check Item 7: Whether Internal Components Are Normal**.

Step 2 If the node and Docker are normal, check whether an affinity policy is configured for the pod. For details, see **Check Item 3: Affinity and Anti-Affinity Configuration of the Workload**.

Step 3 Check whether the resources on the node are sufficient. If the resources are insufficient, expand the capacity or add nodes.

----End

6.4.5 What Is the Image Pull Policy for Containers in a CCE Cluster?

A container image is required to create a container. Images may be stored locally or in a remote image repository.

The **imagePullPolicy** field in the Kubernetes configuration file is used to describe the image pull policy. This field has the following value options:

- **Always**: Always force a pull.
  ```
  imagePullPolicy: Always
  ```
- **IfNotPresent**: The image is pulled only if it is not already present locally.
  ```
  imagePullPolicy: IfNotPresent
  ```
- **Never**: The image is assumed to exist locally. No attempt is made to pull the image.
  ```
  imagePullPolicy: Never
  ```

Description

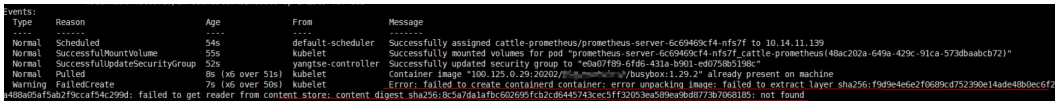
1. If this field is set to **Always**, the image is pulled from the remote repository each time a container is started or restarted.

   If **imagePullPolicy** is left blank, the policy defaults to **Always**.
2. If the policy is set to **IfNotPreset**:
   a. If the required image does not exist locally, it will be pulled from the remote repository.
   b. If the content, except the tag, of the required image is the same as that of the local image, and the image with that tag exists only in the remote repository, Kubernetes will not pull the image from the remote repository.

6.4.6 What Can I Do If a Layer Is Missing During Image Pull?

Symptom

When containerd is used as the container engine, there is a possibility that the image layer is missing when an image is pulled to a node. As a result, the workload container fails to be created.



Possible Cause

Docker earlier than v1.10 supports the layer whose **mediaType** is **application/octet-stream**. However, containerd does not support **application/octet-stream**. As a result, the layer is not pulled.

Solution

You can use either of the following methods to solve this problem:

- Use Docker v1.11 or later to repackage the image.
- Manually pull the image.
  a. Log in to the node.
  b. Run the following command to pull the image:
     ctr -n k8s.io images pull --user u:p images
  c. Use the newly pulled image to create a workload.

7 Networking

7.1 Network Planning

7.1.1 What Is the Relationship Between Clusters, VPCs, and Subnets?

A Virtual Private Cloud (VPC) is similar to a private local area network (LAN) managed by a home gateway whose IP address is 192.168.0.0/16. A VPC is a private network built on the cloud and provides basic network environment for running elastic cloud servers (ECSs), elastic load balances (ELBs), and middleware. Networks of different scales can be configured based on service requirements. Generally, you can set the CIDR block to 10.0.0.0/8–24, 172.16.0.0/12–24, or 192.168.0.0/16–24. The largest CIDR block is 10.0.0.0/8, which corresponds to a class A network.

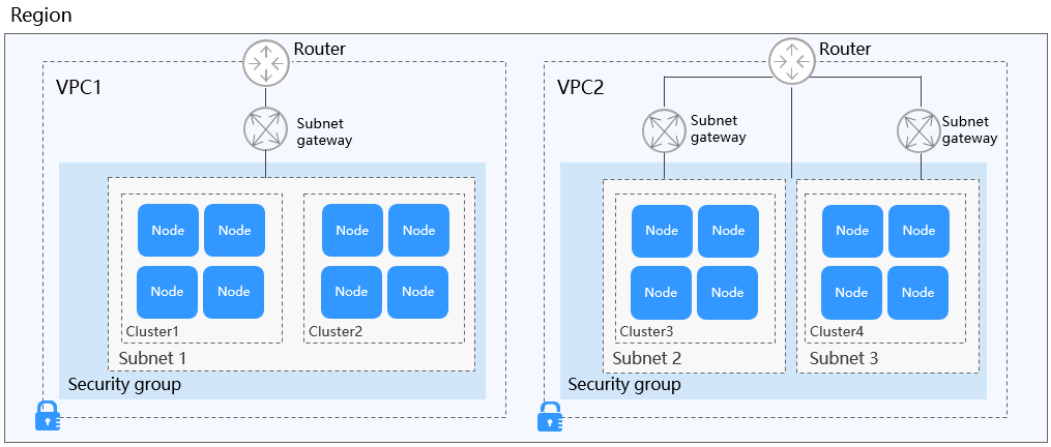
A VPC can be divided into multiple subnets. Security groups are configured to determine whether these subnets can communicate with each other. This ensures that subnets can be isolated from each other, so that you can deploy different services on different subnets.

A cluster is one or a group of cloud servers (also known as nodes) in the same VPC. It provides computing resource pools for running containers.

As shown in **Figure 7-1**, a region may comprise of multiple VPCs. A VPC consists of one or more subnets. The subnets communicate with each other through a subnet gateway. A cluster is created in a subnet. There are three scenarios:

- Different clusters are created in different VPCs.
- Different clusters are created in the same subnet.
- Different clusters are created in different subnets.

Figure 7-1 Relationship between clusters, VPCs, and subnets



7.1.2 Configuring Cluster Security Group Rules

CCE is a universal container platform. Its default security group rules apply to common scenarios. When a cluster is created, a security group is automatically created for the master node and worker node, separately. The security group name of the master node is *{Cluster name}*-**cce-control**-*{Random ID}*, and the security group name of the worker node is *{Cluster name}*-**cce-node**-*{Random ID}*.

You can log in to the management console, choose **Service List** > **Networking** > **Virtual Private Cloud**. On the page displayed, choose **Access Control** > **Security Groups** in the navigation pane, locate the security group of the cluster, and modify the security group rules as required.

The default security group rules of the clusters using different networks are as follows:

- **Security Group Rules of a Cluster Using a VPC Network**
- **Security Group Rules of a Cluster Using the Tunnel Network**

NOTICE

- Modifying or deleting security group rules may affect cluster running. Exercise caution when performing this operation. If you need to modify security group rules, do not modify the rules of the port on which CCE running depends.
- When adding a new security group rule to a cluster, ensure that the new rule does not conflict with the original rules. Otherwise, the original rules may become invalid, affecting the cluster running.

Security Group Rules of a Cluster Using a VPC Network

Security group of a worker node

A security group named *{Cluster name}*-**cce-node**-*{Random ID}* is automatically created for each worker node. For details about the default ports, see **Table 7-1**.

Table 7-1 Default ports in the security group for a worker node that uses a VPC network

Direction	Port	Default Source Address	Description	Modifiable	Modification Suggestion
Inbound rules	All UDP ports	VPC CIDR block	Used for mutual access between worker nodes and between a worker node and a master node.	No	N/A
	All TCP ports				
	All ICMP ports	Security group of the master node	Used for the master node to access worker nodes.	No	N/A
	TCP port range: 30000 to 32767	All IP addresses: **0.0.0.0/0**	Allow access from NodePort.	Yes	These ports must permit requests from VPC, container, and ELB CIDR blocks.
	UDP port range: 30000 to 32767				
	All	Container CIDR block	Used for mutual access between nodes and containers.	No	N/A
	All	Security group of worker nodes	Used for mutual access between worker nodes.	No	N/A
	TCP port 22	All IP addresses: **0.0.0.0/0**	Port that allows remote access to Linux ECSs using SSH.	**Recommended**	N/A
Outbound rule	All	All IP addresses: **0.0.0.0/0**	Allow traffic on all ports by default. You are advised to retain this setting.	Yes	If you want to harden security by allowing traffic only on specific ports, remember to allow such ports. For details, see **Hardening Outbound Rules**.

Security group of the master node

A security group named *{Cluster name}*-**cce-control-***{Random ID}* is automatically created for the master node. For details about the default ports, see **Table 7-2**.

Table 7-2 Default ports in the security group for the master node that uses a VPC network

Direction	Port	Default Source Address	Description	Modifiable	Modification Suggestion
Inbound rules	TCP port 5444	VPC CIDR block	Allow access from kube-apiserver, which provides lifecycle management for Kubernetes resources.	No	N/A
	TCP port 5444	Container CIDR block			
	TCP port 9443	VPC CIDR block	Allow the network add-on of a worker node to access the master node.	No	N/A
	TCP port 5443	All IP addresses: **0.0.0.0/0**	Allow kube-apiserver of the master node to listen to the worker nodes.	**Recommended**	The port must allow traffic from the CIDR blocks of the VPC, container, and the control plane of the hosted service mesh.
	TCP port 8445	VPC CIDR block	Allow the storage add-on of a worker node to access the master node.	No	N/A
	All	IP addresses of this security group	Allow traffic from all IP addresses of this security group.	No	N/A
Outbound rule	All	All IP addresses: **0.0.0.0/0**	Allow traffic on all ports by default.	No	N/A

Security Group Rules of a Cluster Using the Tunnel Network

Security group of a worker node

A security group named *{Cluster name}*-**cce-node-***{Random ID}* is automatically created for each worker node. For details about the default ports, see **Table 7-3**.

Table 7-3 Default ports in the security group for a worker node that uses a tunnel network

Direction	Port	Default Source Address	Description	Modifiable	Modification Suggestion
Inbound rules	UDP port 4789	All IP addresses: **0.0.0.0/0**	Allow access between containers.	No	N/A
	TCP port 10250	CIDR block of the master node	Allow the master node to access kubelet on a worker node, for example, by running **kubectl exec** *{pod}*.	No	N/A
	TCP port range: 30000 to 32767	All IP addresses: **0.0.0.0/0**	Allow access from NodePort.	Yes	These ports must permit requests from VPC, container, and ELB CIDR blocks.
	UDP port range: 30000 to 32767				
	TCP port 22	All IP addresses: **0.0.0.0/0**	Port that allows remote access to Linux ECSs using SSH.	**Recommended**	N/A
	All	IP addresses of this security group	Allow traffic from all IP addresses of this security group.	No	N/A

Direction	Port	Default Source Address	Description	Modifiable	Modification Suggestion
Outbound rule	All	All IP addresses: **0.0.0.0/0**	Allow traffic on all ports by default. You are advised to retain this setting.	Yes	If you want to harden security by allowing traffic only on specific ports, remember to allow such ports. For details, see **Hardening Outbound Rules**.

Security group of the master node

A security group named *{Cluster name}*-**cce-control-***{Random ID}* is automatically created for the master node. For details about the default ports, see **Table 7-4**.

Table 7-4 Default ports in the security group for the master node that uses a tunnel network

Direction	Port	Default Source Address	Description	Modifiable	Modification Suggestion
Inbound rules	UDP port 4789	All IP addresses: **0.0.0.0/0**	Allow access between containers.	No	N/A
	TCP port 5444	VPC CIDR block	Allow access from kube-apiserver, which provides lifecycle management for Kubernetes resources.	No	N/A
	TCP port 5444	Container CIDR block			
	TCP port 9443	VPC CIDR block	Allow the network add-on of a worker node to access the master node.	No	N/A

Direction	Port	Default Source Address	Description	Modifiable	Modification Suggestion
	TCP port 5443	All IP addresses: **0.0.0.0/0**	Allow kube-apiserver of the master node to listen to the worker nodes.	**Recommended**	The port must allow traffic from the CIDR blocks of the VPC, container, and the control plane of the hosted service mesh.
	TCP port 8445	VPC CIDR block	Allow the storage add-on of a worker node to access the master node.	No	N/A
	All	IP addresses of this security group	Allow traffic from all IP addresses of this security group.	No	N/A
Outbound rule	All	All IP addresses: **0.0.0.0/0**	Allow traffic on all ports by default.	No	N/A

Hardening Outbound Rules

By default, all security groups created by CCE allow all the **outbound** traffic. You are advised to retain this configuration. To harden outbound rules, ensure that the ports listed in the following table are enabled.

Table 7-5 Minimum configurations of outbound security group rules for a worker node

Port	Allowed CIDR	Description
UDP port 53	DNS server of the subnet	Allow traffic on the port for domain name resolution.
UDP port 4789 (required only for clusters that use the tunnel networks)	All IP addresses	Allow access between containers.
TCP port 5443	CIDR block of the master node	Allow kube-apiserver of the master node to listen to the worker nodes.

Port	Allowed CIDR	Description
TCP port 5444	CIDR blocks of the VPC and container	Allow access from kube-apiserver, which provides lifecycle management for Kubernetes resources.
TCP port 6443	CIDR block of the master node	None
TCP port 8445	VPC CIDR block	Allow the storage add-on of a worker node to access the master node.
TCP port 9443	VPC CIDR block	Allow the network add-on of a worker node to access the master node.
All ports	198.19.128.0/17	Allow a worker node to access the VPC Endpoint (VPCEP) service.

7.2 Network Fault

7.2.1 How Do I Locate a Workload Networking Fault?

Troubleshooting Process

The issues here are described in order of how likely they are to occur.

Check these causes one by one until you find the cause of the fault.

- **Check Item 1: Container and Container Port**
- **Check Item 2: Node IP Address and Node Port**
- **Check Item 3: ELB IP Address and Port**
- **Check Item 4: NAT Gateway + Port**
- **Check Item 5: Whether the Security Group of the Node Where the Container Is Located Allows Access**

Check Item 1: Container and Container Port

Log in to the CCE console or use kubectl to query the IP address of the pod. Then, log in to the node or container in the cluster and run the **curl** command to manually call the API. Check whether the expected result is returned.

If <container IP address>:<port> cannot be accessed, you are advised to log in to the application container and access <127.0.0.1>:<port> to locate the fault.

Common issues:

1. The container port is incorrectly configured (the container does not listen to the access port).

2. The URL does not exist (no related path exists in the container).
3. A Service exception (a Service bug in the container) occurs.
4. Check whether the cluster network kernel component is abnormal (container tunnel network model: openswitch kernel component; VPC network model: ipvlan kernel component).

Check Item 2: Node IP Address and Node Port

Only NodePort or LoadBalancer Services can be accessed using the node IP address and node port.

- **NodePort Services:**

  The access port of a node is the port exposed externally by the node.

- **LoadBalancer Service:**

  You can view the node port of a LoadBalancer Service by editing the YAML file.

Example:

nodePort: 30637 indicates the exposed node port. **targetPort: 80** indicates the exposed pod port. **port: 123** is the exposed Service port. LoadBalancer Services also use this port to configure the ELB listener.

```
spec:
  ports:
    - name: cce-service-0
      protocol: TCP
      port: 123
      targetPort: 80
      nodePort: 30637
```

After finding the node port (nodePort), access <IP address>:<port> of the node where the container is located and check whether the expected result is returned.

Common issues:

1. The service port is not allowed in the inbound rules of the node.
2. A custom route is incorrectly configured for the node.
3. The label of the pod does not match that of the Service (created using kubectl or API).

Check Item 3: ELB IP Address and Port

There are several possible causes if <IP address>:<port> of the ELB cannot be accessed, but <IP address>:<port> of the node can be accessed.

Possible causes:

- The backend server group of the port or URL does not meet the expectation.
- The security group on the node has not exposed the related protocol or port to the ELB.
- The health check of the layer-4 load balancing is not enabled.

- The certificate used for Services of layer-7 load balancing has expired.

Common issues:

1. When exposing a layer-4 ELB load balancer, if you have not enabled health check on the console, the load balancer may route requests to abnormal nodes.
2. For UDP access, the ICMP port of the node has not been allowed in the inbound rules.
3. The label of the pod does not match that of the Service (created using kubectl or API).

Check Item 4: NAT Gateway + Port

Generally, no EIP is configured for the backend server of NAT. Otherwise, exceptions such as network packet loss may occur.

Check Item 5: Whether the Security Group of the Node Where the Container Is Located Allows Access

Log in to the management console, choose **Service List** > **Networking** > **Virtual Private Cloud**. On the Network console, choose **Access Control** > **Security Groups**, locate the security group rule of the CCE cluster, and modify and harden the security group rule.

- CCE cluster:

  The security group name of the node is **{*Cluster name*}-cce-node-{*Random characters*}**.

Check the following:

- IP address, port, and protocol of an external request to access the workloads in the cluster. They must be allowed in the inbound rule of the cluster security group.
- IP address, port, and protocol of a request by a workload to visit external applications outside the cluster. They must be allowed in the outbound rule of the cluster security group.

For details about security group configuration, see **Configuring Cluster Security Group Rules**.

7.2.2 Why Does the Browser Return Error Code 404 When I Access a Deployed Application?

CCE does not return any error code when you fail to access your applications using a browser. Check your services first.

404 Not Found

If the error code shown in the following figure is returned, it indicates that the ELB cannot find the corresponding forwarding policy. Check the forwarding policies.

Figure 7-2 404:ALB

If the error code shown in the following figure is returned, it indicates that errors occur on Nginx (your services). In this case, check your services.

Figure 7-3 404:nginx/1.**.*

7.2.3 What Should I Do If a Container Fails to Access the Internet?

If a container cannot access the Internet, check whether the node where the container is located can access the Internet. Then check whether the network configuration of the container is correct. For example, check whether the DNS configuration can resolve the domain name.

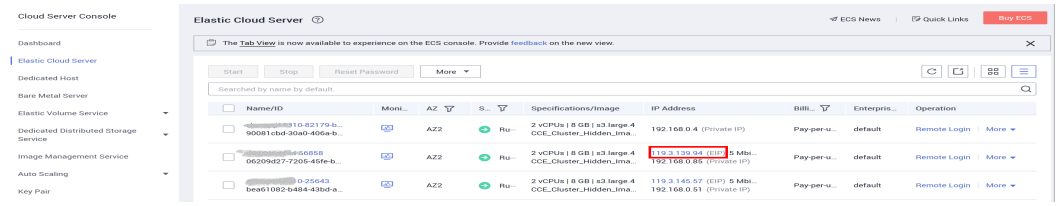
Check Item 1: Whether the Node Can Access the Internet

Step 1 Log in to the ECS console.

Step 2 Check whether the ECS corresponding to the node has been bound to an EIP or has a NAT gateway configured.

Figure 7-4 shows that an EIP has been bound. If no EIP is displayed, bind an EIP to the ECS.

Figure 7-4 Node with an EIP bound



----End

Check Item 2: Whether a Network ACL Has Been Configured for the Node

Step 1 Log in to the VPC console.

Step 2 In the navigation pane on the left, choose **Access Control** > **Network ACLs**.

Step 3 Check whether a network ACL has been configured for the subnet where the node is located and whether external access is restricted.

----End

Check Item 3: Whether the DNS Configuration of the Container Is Correct

Run the **cat /etc/resolv.conf command** command in the container to check the DNS configuration. An example is as follows:

```
nameserver 10.247.x.x
search default.svc.cluster.local svc.cluster.local cluster.local
options ndots:5
```

If **nameserver** is set to **10.247.x.x**, DNS is connected to the CoreDNS of the cluster. Ensure that the CoreDNS of the cluster is running properly. If another IP address is displayed, an in-cloud or on-premises DNS server is used. Ensure that the domain name resolution is correct.

7.2.4 What Should I Do If a Node Fails to Connect to the Internet (Public Network)?

If a node fails to be connected to the Internet, perform the following operations:

Check Item 1: Whether an EIP Has Been Bound to the Node

Log in to the ECS console and check whether an EIP has been bound to the ECS corresponding to the node.

If there is an IP address in the EIP column, an EIP has been bound. If there is no IP address in that column, bind one.

Check Item 2: Whether a Network ACL Has Been Configured for the Node

Log in to the VPC console. In the navigation pane, choose **Access Control** > **Network ACLs**. Check whether a network ACL has been configured for the subnet where the node is located and whether external access is restricted.

7.3 Security Hardening

7.3.1 How Do I Prevent Cluster Nodes from Being Exposed to Public Networks?

- If access to port 22 of a cluster node is not required, you can define a security group rule that disables access to port 22.
- Do not bind an EIP to a cluster node unless necessary.

7.4 Others

7.4.1 How Do I Change the Security Group of Nodes in a Cluster in Batches?

Notes and Constraints

Do not add more than 1000 instances to the same security group. Otherwise, the security group performance may deteriorate.

Procedure

Step 1 Log in to the VPC console and select the desired region and project in the upper left corner.

Step 2 In the navigation pane on the left, choose **Access Control** > **Security Groups**.

Step 3 On the **Security Groups** page, click **Manage Instance** in the **Operation** column.

Step 4 On the **Servers** tab page, click **Add**.

Step 5 Select the servers to be added to the security group and click **OK**. You can also search for servers by name, ID, private IP address, status, enterprise project, or tag.

You can change the maximum number of servers displayed on a page in the lower left corner to add a maximum of 20 servers to a security group at a time.

NOTE

After the node is added to a new security group, the original security group is retained. To remove the instance, click **Manage Instance** of the original security group and select the node servers to be removed.

----End

8 Storage

8.1 What Are the Differences Among CCE Storage Classes in Terms of Persistent Storage and Multi-node Mounting?

Container storage provides storage for container workloads. It supports multiple storage classes. A pod can use any amount of storage.

Currently, CCE supports local, EVS, SFS, SFS Turbo, and OBS volumes.

The following table lists the differences among these storage classes.

Table 8-1 Differences among storage classes

Storage Class	Persistent Storage	Automatic Migration with Containers	Multi-node Mounting
Local disks	Supported	Not supported	Not supported
EVS	Supported	Supported	Not supported
OBS	Supported	Supported	Supported. This type of volumes can be shared among multiple nodes or workloads.
SFS Turbo	Supported	Supported	Supported. This type of volumes can be shared among multiple nodes or workloads.

Selecting a Storage Class

You can use the following types of storage volumes when creating a workload. You are advised to store workload data on EVS volumes. If you store workload

data on a local volume, the data cannot be restored when a fault occurs on the node.

- Local volumes: Mount the file directory of the host where a container is located to a specified container path (corresponding to hostPath in Kubernetes). Alternatively, you can leave the source path empty (corresponding to emptyDir in Kubernetes). If the source path is left empty, a temporary directory of the host will be mounted to the mount point of the container. A specified source path is used when data needs to be persistently stored on the host, while emptyDir is used when temporary storage is needed. A ConfigMap is a type of resource that stores configuration data required by a workload. Its contents are user-defined. A Secret is an object that contains sensitive data such as workload authentication information and keys. Information stored in a Secret is determined by users.
- EVS volumes: Mount an EVS volume to a container path. When the container is migrated, the mounted EVS volume is migrated together. This storage class is applicable when data needs to be stored permanently.
- OBS volumes: Create OBS volumes and mount them to a container path. OBS volumes are applicable to scenarios such as cloud workload, data analysis, content analysis, and hotspot objects.
- SFS Turbo volumes: Create SFS Turbo volumes and mount them to a container path. SFS Turbo volumes are fast, on-demand, and scalable, which makes them suitable for DevOps, containerized microservices, and enterprise office applications.

8.2 Can I Add a Node Without a Data Disk?

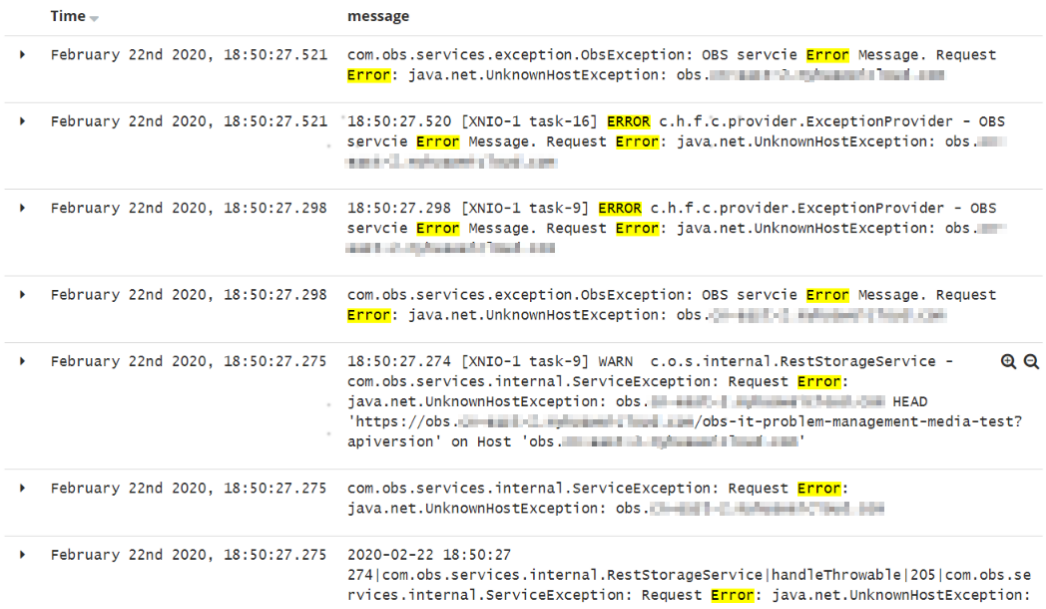
No. A data disk is mandatory.

A data disk dedicated for kubelet and the container engine will be attached to a new node. By default, CCE uses Logical Volume Manager (LVM) to manage data disks. With LVM, you can adjust the disk space ratio for different resources on a data disk.

If the data disk is uninstalled or damaged, the container engine will malfunction and the node becomes unavailable.

8.3 What Should I Do If the Host Cannot Be Found When Files Need to Be Uploaded to OBS During the Access to the CCE Service from a Public Network?

When a Service deployed on CCE attempts to upload files to OBS after receiving an access request from an offline machine, an error message is displayed, indicating that the host cannot be found. The following figure shows the error message.



Time	message
February 22nd 2020, 18:50:27.521	com.obs.services.exception.ObsException: OBS servcie Error Message. Request Error: java.net.UnknownHostException: obs.
February 22nd 2020, 18:50:27.521	18:50:27.520 [XNIO-1 task-16] ERROR c.h.f.c.provider.ExceptionProvider - OBS servcie Error Message. Request Error: java.net.UnknownHostException: obs.
February 22nd 2020, 18:50:27.298	18:50:27.298 [XNIO-1 task-9] ERROR c.h.f.c.provider.ExceptionProvider - OBS servcie Error Message. Request Error: java.net.UnknownHostException: obs.
February 22nd 2020, 18:50:27.298	com.obs.services.exception.ObsException: OBS servcie Error Message. Request Error: java.net.UnknownHostException: obs.
February 22nd 2020, 18:50:27.275	18:50:27.274 [XNIO-1 task-9] WARN c.o.s.internal.RestStorageService - com.obs.services.internal.ServiceException: Request Error: java.net.UnknownHostException: obs. HEAD 'https://obs./obs-it-problem-management-media-test?apiversion' on Host 'obs.'
February 22nd 2020, 18:50:27.275	com.obs.services.internal.ServiceException: Request Error: java.net.UnknownHostException: obs.
February 22nd 2020, 18:50:27.275	2020-02-22 18:50:27 274|com.obs.services.internal.RestStorageService|handleThrowable|205|com.obs.services.internal.ServiceException: Request Error: java.net.UnknownHostException:

Fault Locating

After receiving the HTTP request, the Service transfers files to OBS through the proxy.

If too many files are transferred, a large number of resources are consumed. Currently, the proxy is assigned 128 MiB memory. According to pressure test results, resource consumption is large, resulting in request failure.

The test results show that all traffic passes through the proxy. Therefore, if the service volume is large, more resources need to be allocated.

Solution

1. File transfer involves a large number of packet copies, which occupies a large amount of memory. In this case, increase the proxy memory based on the actual scenario and then try to access the Service and upload files again.
2. Additionally, remove the Service from the mesh because the proxy only forwards packets and does not perform any other operations. If requests pass through the ingress gateway, the grayscale release function of the Service is not affected.

8.4 How Can I Achieve Compatibility Between ExtendPathMode and Kubernetes client-go?

Application Scenarios

The Kubernetes pod structure does not contain **ExtendPathMode**. Therefore, when a user calls the API for creating a pod or deployment by using client-go, the created pod does not contain **ExtendPathMode**. CCE provides a solution to ensure compatibility with the Kubernetes client-go.

Solution

NOTICE

- When creating a pod, you need to add **kubernetes.io/extend-path-mode** to **annotation** of the pod.
- When creating a Deployment, you need to add **kubernetes.io/extend-path-mode** to **kubernetes.io/extend-path-mode** in the template.

The following is an example YAML of creating a pod. After the **kubernetes.io/extend-path-mode** keyword is added to **annotation**, the **containername**, **name**, and **mountpath** fields are matched, and the corresponding **extendpathmode** is added to **volumeMount**.

```
apiVersion: v1
kind: Pod
metadata:
  name: test-8b59d5884-96vdz
  generateName: test-8b59d5884-
  namespace: default
  selfLink: /api/v1/namespaces/default/pods/test-8b59d5884-96vdz
  labels:
    app: test
    pod-template-hash: 8b59d5884
  annotations:
    kubernetes.io/extend-path-mode:
'[{"containername":"container-0","name":"vol-156738843032165499","mountpath":"/
tmp","extendpathmode":"PodUID"}]'
    metrics.alpha.kubernetes.io/custom-endpoints: '[{"api":"","path":"","port":"","names":""}]'
  ownerReferences:
    - apiVersion: apps/v1
      kind: ReplicaSet
      name: test-8b59d5884
      uid: 2633020b-cd23-11e9-8f83-fa163e592534
      controller: true
      blockOwnerDeletion: true
spec:
  volumes:
    - name: vol-156738843032165499
      hostPath:
        path: /tmp
        type: ''
    - name: default-token-4s959
      secret:
        secretName: default-token-4s959
        defaultMode: 420
  containers:
    - name: container-0
      image: 'nginx:latest'
      env:
        - name: PAAS_APP_NAME
          value: test
        - name: PAAS_NAMESPACE
          value: default
        - name: PAAS_PROJECT_ID
          value: b6315dd3d0ff4be5b31a963256794989
      resources:
        limits:
          cpu: 250m
          memory: 512Mi
        requests:
          cpu: 250m
          memory: 512Mi
```



```
    volumeMounts:
      - name: vol-156738843032165499
        mountPath: /tmp
        extendPathMode: PodUID
      - name: default-token-4s959
        readOnly: true
        mountPath: /var/run/secrets/kubernetes.io/serviceaccount
    terminationMessagePath: /dev/termination-log
    terminationMessagePolicy: File
    imagePullPolicy: Always
restartPolicy: Always
terminationGracePeriodSeconds: 30
dnsPolicy: ClusterFirst
serviceAccountName: default
serviceAccount: default
nodeName: 192.168.0.24
securityContext: {}
imagePullSecrets:
  - name: default-secret
  - name: default-secret
affinity: {}
schedulerName: default-scheduler
tolerations:
  - key: node.kubernetes.io/not-ready
    operator: Exists
    effect: NoExecute
    tolerationSeconds: 300
  - key: node.kubernetes.io/unreachable
    operator: Exists
    effect: NoExecute
    tolerationSeconds: 300
priority: 0
dnsConfig:
  options:
    - name: timeout
      value: ''
    - name: ndots
      value: '5'
    - name: single-request-reopen
enableServiceLinks: true
```

Table 8-2 Descriptions of key parameters

Parameter	Type	Description
containername	String	Name of a container.
name	String	Name of a volume.
mountpath	String	Mount path.

Parameter	Type	Description
extendpathmode	String	A third-level directory is added to the created volume directory/subdirectory to facilitate the obtaining of a single pod output file. The following types are supported. • **None**: The extended path is not configured. • **PodUID**: ID of a pod. • **PodName**: Name of a pod. • **PodUID/ContainerName**: ID of a pod or name of a container. • **PodName/ContainerName**: Name of a pod or container.

8.5 Can CCE PVCs Detect Underlying Storage Faults?

CCE PersistentVolumeClaims (PVCs) are implemented as they are in Kubernetes. A PVC is defined as a storage declaration and is decoupled from underlying storage. It is not responsible for detecting underlying storage details. Therefore, CCE PVCs cannot detect underlying storage faults.

Cloud Eye allows users to view cloud service metrics. These metrics are built-in based on cloud service attributes. After users enable a cloud service on the cloud platform, Cloud Eye automatically associates its built-in metrics. Users can track the cloud service status by monitoring these metrics.

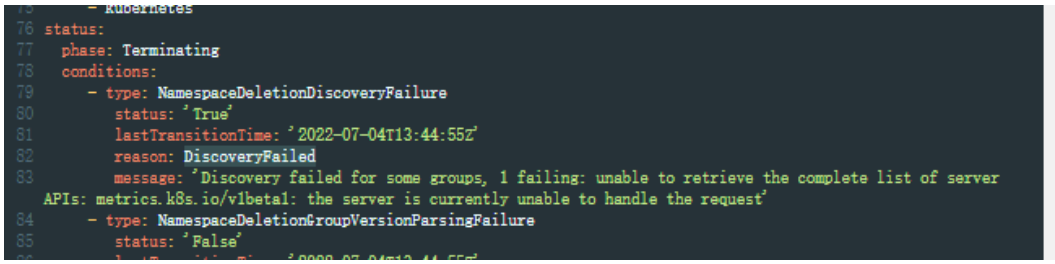
It is recommended that users who have storage fault detection requirements use Cloud Eye to monitor underlying storage and send alarm notifications.

9 Namespace

9.1 What Should I Do If a Namespace Fails to Be Deleted Due to an APIService Object Access Failure?

Symptom

The namespace remains in the Deleting state. The error message "DiscoveryFailed" is displayed in **status** in the YAML file.



In the preceding figure, the full error message is "Discovery failed for some groups, 1 failing: unable to retrieve the complete list of server APIs: metrics.k8s.io/v1beta1: the server is currently unable to handle the request".

This indicates that the namespace deletion is blocked when kube-apiserver accesses the APIService resource object of the metrics.k8s.io/v1beta1 API.

Possible Causes

If an APIService object exists in the cluster, deleting the namespace will first access the APIService object. If the access fails, the namespace deletion will be blocked. In addition to the APIService objects created by users, add-ons like metrics-server and prometheus in the CCE cluster automatically create APIService objects.

NOTE

For details, see https://kubernetes.io/docs/concepts/extend-kubernetes/api-extension/apiserver-aggregation/.

Solution

Use either of the following methods:

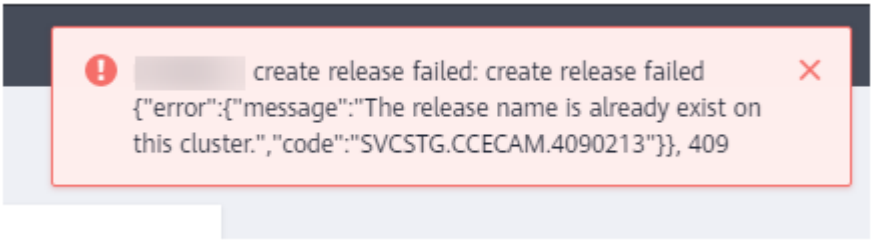
- Rectify the APIService object in the error message. If the object is created by an add-on, ensure that the pod where the add-on locates is running properly.
- Delete the APIService object in the error message. If the object is created by an add-on, uninstall the add-on.

10 Chart and Add-on

10.1 Why Does Add-on Installation Fail and Prompt "The release name is already exist"?

Symptom

When an add-on fails to be installed, the error message "The release name is already exist" is returned.



Possible Cause

The add-on release record remains in the Kubernetes cluster. Generally, it is because the cluster etcd has backed up and restored the add-on, or the add-on fails to be installed or deleted.

Solution

Use kubectl to connect to the cluster and manually clear the Secret and Configmap corresponding to add-on release. The following uses autoscaler add-on release as an example.

Step 1 Connect to the cluster using kubectl, and run the following command to view the Secret list of add-on releases:

kubectl get secret -A |grep cceaddon


```
[root@cce-123-vpc-node2 ~]# kubectl get secret -nkube-system |grep cceaddon
sh.helm.release.v1.cceaddon-autoscaler.v1       helm.sh/release.v1                    1      61s
sh.helm.release.v1.cceaddon-autoscaler.v2       helm.sh/release.v1                    1      47s
sh.helm.release.v1.cceaddon-coredns.v1          helm.sh/release.v1                    1      6h2m
sh.helm.release.v1.cceaddon-everest.v1          helm.sh/release.v1                    1      6h2m
[root@cce-123-vpc-node2 ~]#
```

The Secret name of an add-on release is in the format of **sh.helm.release.v1.cceaddon-{*add-on name*}.v***. If there are multiple release versions, you can delete their Secrets at the same time.

Step 2 Run the **release secret** command to delete the Secrets.

Example:

kubectl delete secret sh.helm.release.v1.cceaddon-autoscaler.v1 sh.helm.release.v1.cceaddon-autoscaler.v2 -nkube-system

```
[root@cce-123-vpc-node2 ~]# kubectl delete secret sh.helm.release.v1.cceaddon-autoscaler.v1 sh.helm.release.v1.cceaddon-autoscaler.v2 -nkube-system
secret "sh.helm.release.v1.cceaddon-autoscaler.v1" deleted
secret "sh.helm.release.v1.cceaddon-autoscaler.v2" deleted
[root@cce-123-vpc-node2 ~]#
```

Step 3 If the add-on is created when Helm v2 is used, CCE automatically bumps the v2 release in Configmaps to v3 release in Secrets when viewing the add-ons and their details. The v2 release in the original Configmap is not deleted. Run the following command to view the ConfigMap list of add-on releases:

kubectl get configmap -A | grep cceaddon

```
cluster-autoscaler-th-config           1      7d10h
[paas@192-168-0-64 ~]$ kubectl get configmap -nkube-system | grep cceaddon
cceaddon-autoscaler.v1                 1      7d10h
cceaddon-autoscaler.v2                 1      52m
cceaddon-coredns.v1                    1      14d
cceaddon-everest.v1                    1      14d
[paas@192-168-0-64 ~]$
```

The ConfigMap name of an add-on release is in the format of **cceaddon-{*add-on name*}.v***. If there are multiple release versions, you can delete their ConfigMaps at the same time.

Step 4 Run the **release configmap** command to delete the ConfigMaps.

Example:

kubectl delete configmap cceaddon-autoscaler.v1 cceaddon-autoscaler.v2 -nkube-system

```
[paas@192-168-0-64 ~]$ kubectl delete configmap cceaddon-autoscaler.v1 cceaddon-autoscaler.v2 -nkube-system
configmap "cceaddon-autoscaler.v1" deleted
configmap "cceaddon-autoscaler.v2" deleted
[paas@192-168-0-64 ~]$
```

CAUTION

Deleting resources in kube-system is a high-risk operation. Ensure that the command is correct before running it to prevent resources from being deleted by mistake.

Step 5 On the CCE console, install add-on and then uninstall it. Ensure that the residual add-on resources are cleared. After the uninstall is complete, install the add-on again.

> **NOTE**
>
> When installing the add-on for the first time, you may find it abnormal after the installation due to the residual resources of the previous add-on release, which is normal. In this case, you can uninstall the add-on on the console to ensure that the residual resources are cleared and the add-on can run properly after being installed again.

----End

11 API & kubectl FAQs

11.1 How Can I Access a Cluster API Server?

You can use either of the following methods to access a cluster API server:

- (Recommended) Through the cluster API. This access mode uses certificate authentication. It is suitable for API calls on scale thanks to its direct connection to the API Server. This is a recommended option.
- API Gateway. This access mode uses token authentication. You need to obtain a toke using your account. This access mode applies to small-scale API calls. API gateway flow control may be triggered when APIs are called on scale.

11.2 Can the Resources Created Using APIs or kubectl Be Displayed on the CCE Console?

The CCE console does not support the display of the following Kubernetes resources: DaemonSets, ReplicationControllers, ReplicaSets, and endpoints.

To query these resources, run the kubectl commands.

In addition, Deployments, StatefulSets, Services, and pods can be displayed on the console only when the following conditions are met:

- Deployments and StatefulSets: At least one label uses **app** as its key.
- Pods: Pods are displayed on the **Pods** tab page in the workload details only after a Deployment or StatefulSet has been created.
- Services: Services are displayed on the **Access Mode** tab page in the Deployment or StatefulSet details.

  The Services displayed on this tab page are associated with the workload.

  a. At lease one label of the workload uses **app** as its key.
  b. The label of a Service is the same as that of the workload.

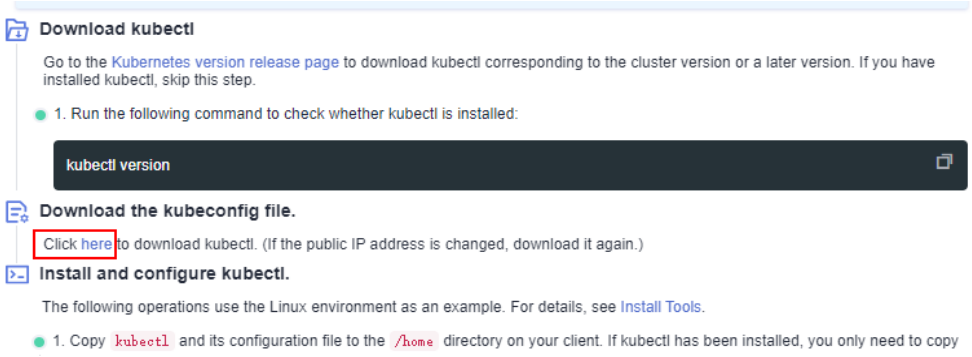
11.3 How Do I Download kubeconfig for Connecting to a Cluster Using kubectl?

Step 1 Log in to the CCE console. Click the target cluster to go to its details page.

Step 2 In the **Connection Information** area, view the kubectl connection mode.

Step 3 In the window that is displayed, download the kubectl configuration file (**kubeconfig.json**).

Figure 11-1 Downloading kubeconfig.json



----End

11.4 How Do I Rectify the Error Reported When Running the kubectl top node Command?

Symptom

The error message "Error from server (ServiceUnavailable): the server is currently unable to handle the request (get nodes.metrics.k8s.io)" is displayed after the **kubectl top node** command is executed.

Possible Causes

"Error from server (ServiceUnavailable)" indicates that the cluster is not connected. In this case, you need to check whether the network between kubectl and the master node in the cluster is normal.

Solution

- If the kubectl command is executed outside the cluster, check whether the cluster is bound to an EIP. If yes, download the **kubeconfig** file and run the kubectl command again.
- If the kubectl command is executed on a node in the cluster, check the security group of the node and check whether the TCP/UDP communication between the worker node and master node is allowed. For details about the security group, see **Configuring Cluster Security Group Rules**.

11.5 Why Is "Error from server (Forbidden)" Displayed When I Use kubectl?

Symptom

When you use kubectl to create or query Kubernetes resources, the following output is returned:

kubectl get deploy Error from server (Forbidden): deployments.apps is forbidden: User "0c97ac3cb280f4d91fa7c0096739e1f8" cannot list resource "deployments" in API group "apps" in the namespace "default"

Possible Cause

This user has no permissions to operate Kubernetes resources.

Solution

Assign permissions to the user.

Step 1 Log in to the CCE console. In the navigation pane, choose **Permissions**.

Step 2 Select a cluster for which you want to add permissions from the drop-down list on the right.

Step 3 Click **Add Permissions** in the upper right corner.

Step 4 Confirm the cluster name and select the namespace to assign permissions for. For example, select **All namespaces**, the target user or user group, and select the permissions.

NOTE

If you do not have IAM permissions, you cannot select users or user groups when configuring permissions for other users or user groups. In this case, you can enter a user ID or user group ID.

Permissions can be customized as required. After selecting **Custom** for **Permission Type**, click **Add Custom Role** on the right of the **Custom** parameter. In the dialog box displayed, enter a name and select a rule. After the custom rule is created, you can select a value from the **Custom** drop-down list box.

Custom permissions are classified into ClusterRole and Role. Each ClusterRole or Role contains a group of rules that represent related permissions. For details, see **Using RBAC Authorization**.

- A ClusterRole is a cluster-level resource that can be used to configure cluster access permissions.
- A Role is used to configure access permissions in a namespace. When creating a Role, specify the namespace to which the Role belongs.

Step 5 Click **OK**.

----End

12 DNS FAQs

12.1 What Should I Do If Domain Name Resolution Fails?

Check Item 1: Whether the coredns Add-on Has Been Installed

Step 1 Log in to the CCE console and click the cluster name to access the cluster console.

Step 2 In the navigation pane, choose **Add-ons** and check whether the CoreDNS add-on has been installed.

Step 3 If not, install the add-on. For details, see **Why Does a Container in a CCE Cluster Fail to Perform DNS Resolution?**.

----End

Check Item 2: Whether the coredns Instance Reaches the Performance Limit

CoreDNS QPS is positively correlated with the CPU usage. If the QPS is high, adjust the the coredns instance specifications based on the QPS.

Step 1 Log in to the CCE console and click the cluster name to access the cluster console.

Step 2 In the navigation tree, choose **Add-ons** and verify that CoreDNS is running.

Step 3 Click the coredns add-on name to view the add-on list.

Step 4 Click **Monitor** of the the coredns add-on to view the CPU and memory usage.

If the add-on performance reaches the bottleneck, adjust the coredns add-on specifications.

----End

Check Item 3: Whether the External Domain Name Resolution Is Slow or Times Out

If the domain name resolution failure rate is lower than 1/10000, optimize parameters by referring to **How Do I Optimize the Configuration If the External**

Domain Name Resolution Is Slow or Times Out? or add a retry policy in the service.

Check Item 4: Whether UnknownHostException Occurs

When service requests in the cluster are sent to an external DNS server, a domain name resolution error occurs due to occasional UnknownHostException. UnknownHostException is a common exception. When this exception occurs, check whether there is any domain name-related error or whether you have entered a correct domain name.

To locate the fault, perform the following steps:

Step 1 Check the host name carefully (spelling and extra spaces).

Step 2 Check the DNS settings. Before running the application, run the **ping hostname** command to ensure that the DNS server has been started and running. If the host name is new, you need to wait for a period of time before the DNS server is accessed.

Step 3 Check the CPU and memory usage of the coredns add-on to determine whether the performance bottleneck has been reached. For details, see **Check Item 2: Whether the coredns Instance Reaches the Performance Limit**.

Step 4 Check whether traffic limiting is performed on the coredns add-on. If traffic limiting is triggered, the processing time of some requests may be prolonged. In this case, you need to adjust the coredns add-on specifications.

Log in to the node where the coredns add-on is installed and view the following content:

```
cat /sys/fs/cgroup/cpu/kubepods/pod<pod_uid>/<coredns container ID>/cpu.stat
```

- *<pod uid>* indicates the pod UID of the coredns add-on, which can be obtained by running the following command:

  ```
  kubectl get po <pod name> -nkube-system -ojsonpath='{.metadata.uid}{"\n"}'
  ```

  In the preceding command, *<pod name>* indicates the name of the coredns add-on running on the current node.

- *<coredns container ID>* must be a complete container ID, which can be obtained by running the following command:

  Docker nodes:

  ```
  docker ps --no-trunc | grep k8s_coredns | awk '{print $1}'
  ```

  containerd nodes:

  ```
  crictl ps --no-trunc | grep k8s_coredns | awk '{print $1}'
  ```

Example:

```
cat /sys/fs/cgroup/cpu/kubepods/
pod27f58662-3979-448e-8f57-09b62bd24ea6/6aa98c323f43d689ac47190bc84cf4fadd23bd8dd25307f773df25003ef0eef0/cpu.stat
```

Pay attention to the following metrics:

- **nr_throttled**: number of times that traffic is limited.
- **throttled_time**: total duration of traffic limiting, in nanoseconds.

----End

If the host name and DNS settings are correct, you can use the following optimization policies.

Optimization policies:

1. Change the coredns cache time.
2. Configure the stub domain.
3. Modify the value of **ndots**.

NOTE

- **Increasing the cache time of coredns** helps resolve the same domain name for the N time, reducing the number of cascading DNS requests.
- **Configuring the stub domain** can reduce the number of DNS request links.

How to modify:

1. Modifying the coredns cache time and configuring the stub domain:

   Restart the coredns add-on after you modify the configurations.
2. Modifying **ndots**:

   How Do I Optimize the Configuration If the External Domain Name Resolution Is Slow or Times Out?

   Example:

   ```
   dnsConfig:
     options:
       - name: timeout
         value: '2'
       - name: ndots
         value: '5'
       - name: single-request-reopen
   ```

   You are advised to change the value of **ndots** to **2**.

12.2 Why Does a Container in a CCE Cluster Fail to Perform DNS Resolution?

Symptom

A customer bound its domain name to the private domain names in the DNS service and also to a specific VPC. It is found that the ECSs in the VPC can properly resolve the private domain name but the containers in the VPC cannot.

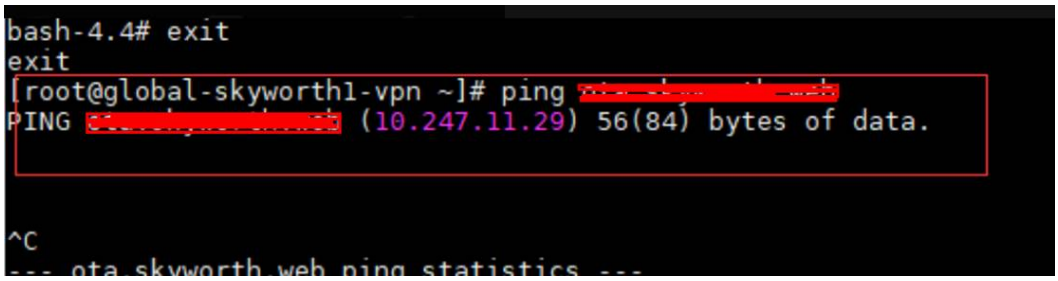
Application Scenario

Containers in a VPC cannot resolve domain names.

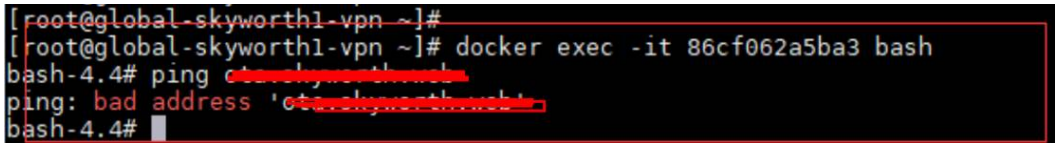
Solution

According to the resolution rules of private domain names, the subnet DNS in the VPC must be set to the cloud DNS. You can find the details of the private network DNS service on its console.

The customer can perform domain name resolution on the ECSs in the VPC subnet, which indicates that the preceding configuration has been completed in the subnet.



However, when the domain name resolution is performed in a container, the message "bad address" is displayed, indicating that the domain name cannot be resolved.



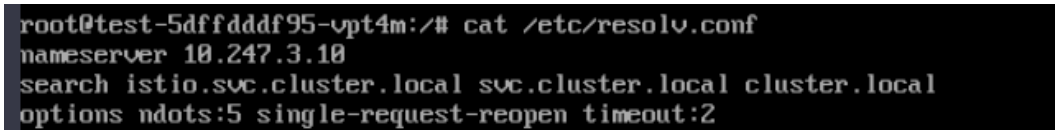
Log in to the CCE console and check the add-ons installed in the cluster.

If you find that the coredns add-on does not exist in **Add-ons Installed**, the coredns add-on may have been incorrectly uninstalled.

Install it and add the corresponding domain name and DNS service address to resolve the domain name.

12.3 How Do I Optimize the Configuration If the External Domain Name Resolution Is Slow or Times Out?

The following is an example **resolv.conf** file for a container in a workload:



In the preceding information:

- **nameserver**: IP address of the DNS. Set this parameter to the cluster IP address of CoreDNS.
- **search**: domain name search list, which is a common suffix of Kubernetes.
- **ndots**: If the number of dots (.) is less than the domain name, **search** is preferentially used for resolution.
- **timeout**: timeout interval.
- **single-request-reopen**: indicates that different source ports are used to send different types of requests.

By default, when you create a workload on the CCE console, the preceding parameters are configured as follows:

```
dnsConfig:
  options:
    - name: timeout
      value: '2'
    - name: ndots
      value: '5'
    - name: single-request-reopen
```

These parameters can be optimized or modified based on service requirements.

Scenario 1: Slow External Domain Name Resolution

Optimization Solution

1. If the workload does not need to access the Kubernetes Service in the cluster, see **How Do I Configure a DNS Policy for a Container?**.
2. If the number of dots (.) in the domain name used by the working Service to access other Kubernetes Services is less than 2, set **ndots** to **2**.

Scenario 2: External Domain Name Resolution Timeout

Optimization Solution

1. Generally, the timeout of a Service must be greater than the value of **timeout** multiplied by **attempts**.
2. If it takes more than 2s to resolve the domain name, you can set **timeout** to a larger value.

12.4 How Do I Configure a DNS Policy for a Container?

CCE uses **dnsPolicy** to identify different DNS policies for each pod. The value of **dnsPolicy** can be either of the following:

- **None:** No DNS policy is configured. In this mode, you can customize the DNS configuration, and **dnsPolicy** needs to be used together with **dnsConfig** to customize the DNS.
- **Default**: The pod inherits the name resolution configuration from the node where the pod is running. The container's DNS configuration file is the DNS configuration file that the kubelet's **--resolv-conf** flag points to. In this case, a cloud DNS is used for CCE clusters.
- **ClusterFirst:** In this mode, the DNS in the pod uses the DNS service configured in the cluster. That is, the kube-dns or CoreDNS service in the Kubernetes is used for domain name resolution. If the resolution fails, the DNS configuration of the host machine is used for resolution.

If the type of dnsPolicy is not specified, **ClusterFirst** is used by default.

- If the type of dnsPolicy is set to **Default**, the name resolution configuration is inherited from the worker node where the pod is running.
- If the type of dnsPolicy is set to **ClusterFirst**, DNS queries will be sent to the kube-dns service.

The kube-dns service responds to queries on the domains that use the configured cluster domain suffix as the root. All other queries (for example, www.kubernetes.io) are forwarded to the upstream name server inherited from the node. Before this feature was supported, stub domains were typically introduced by a custom resolver, instead of the upstream DNS. However, this causes the custom resolver itself to be the key path to DNS resolution, where scalability and availability issues can make the DNS functions unavailable to the cluster. This feature allows you to introduce custom resolvers without taking over the entire resolution path.

If a workload does not need to use CoreDNS in the cluster, you can use kubectl or call the APIs to set the dnsPolicy to Default.

13 Image Repository FAQs

13.1 How Do I Upload My Images to CCE?

SoftWare Repository for Container (SWR) manages images for CCE. It provides the following ways to upload images:

- **Uploading an Image Through the Client**
- **Uploading an Image Through the SWR Console**

14 Permissions

14.1 Can I Configure Only Namespace Permissions Without Cluster Management Permissions?

Namespace permissions and cluster management permissions are independent and complementary to each other.

- Namespace permissions: apply to clusters and are used to manage operations on cluster resources (such as creating workloads).
- Cluster management (IAM) permissions: apply to cloud services and used to manage CCE clusters and peripheral resources (such as VPC, ELB, and ECS).

Administrators of the IAM Admin user group can grant cluster management permissions (such as CCE Administrator and CCE FullAccess) to IAM users or grant namespace permissions on a cluster on the CCE console. However, the permissions you have on the CCE console are determined by the IAM system policy. If the cluster management permissions are not configured, you do not have the permissions for accessing the CCE console.

If you only run kubectl commands to work on cluster resources, you only need to obtain the kubeconfig file with the namespace permissions. For details, see **Can I Use kubectl If the Cluster Management Permissions Are Not Configured?**. Note that information leakage may occur when you use the kubeconfig file.

14.2 Can I Use CCE APIs If the Cluster Management Permissions Are Not Configured?

CCE has cloud service APIs and cluster APIs.

- Cloud service APIs: You can perform operations on the infrastructure (such as creating nodes) and cluster resources (such as creating workloads).

  When using cloud service APIs, the cluster management (IAM) permissions must be configured.

- Cluster APIs: You can perform operations on cluster resources (such as creating workloads) through the Kubernetes native API server, but not on cloud infrastructure resources (such as creating nodes).

  When using cluster APIs, you only need to add the cluster certificate. Only the users with the cluster management (IAM) permissions can download the cluster certificate. Note that information leakage may occur during certificate transmission.

14.3 Can I Use kubectl If the Cluster Management Permissions Are Not Configured?

IAM authentication is not required for running kubectl commands. Therefore, you can run kubectl commands without configuring cluster management (IAM) permissions. However, you need to obtain the kubectl configuration file (kubeconfig) with the namespace permissions. In the following scenarios, information leakage may occur during file transmission.

- Scenario 1

  If an IAM user has been configured with the cluster management permissions and namespace permissions, downloads the kubeconfig authentication file and then deletes the cluster management permissions (reserving the namespace permissions), kubectl can still be used to perform operations on Kubernetes clusters. Therefore, if you want to permanently delete the permission of a user, you must also delete the cluster management permissions and namespace permissions of the user.

- Scenario 2

  An IAM user has certain cluster management and namespace permissions and downloads the kubeconfig authentication file. In this case, CCE determines which Kubernetes resources can be accessed by kubectl based on the user information. That is, the authentication information of a user is recorded in kubeconfig. Anyone can use kubeconfig to access the cluster.

15 Reference

15.1 How Do I Expand the Storage Capacity of a Container?

Application Scenarios

The default storage size of a container is 10 GB. If a large volume of data is generated in the container, expand the capacity using the method described in this topic.

Solution

Step 1 Log in to the CCE console and click the cluster name to access the cluster console.

Step 2 Choose **Nodes** from the navigation pane.

Step 3 Click the Nodes tab, locate the row containing the target node, and choose **More** > **Reset Node** in the **Operation** column.

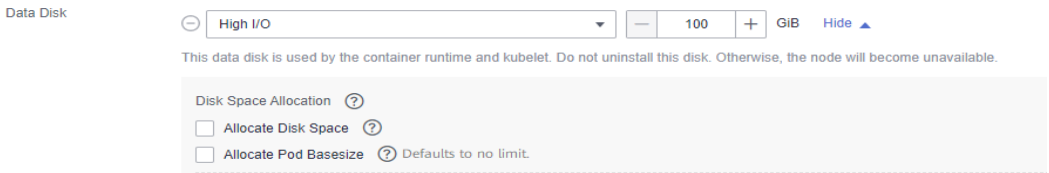
NOTICE

Resetting a node may make unavailable the node-specific resources (such as local storage and workloads scheduled to this node). Exercise caution when performing this operation to avoid impact on running services.

Step 4 Click **Yes**.

Step 5 Reconfigure node parameters.

If you need to adjust the container storage space, pay attention to the following configurations:



Storage Settings: Click **Expand** next to the data disk to set the following parameters:

- **Allocate Disk Space**: storage space used by the container engine to store the Docker/containerd working directory, container image data, and image metadata. Defaults to 90% of the data disk.
- **Allocate Pod Basesize**: CCE allows you to set an upper limit for the disk space occupied by each workload pod (including the space occupied by container images). This setting prevents the pods from taking all the disk space available, which may cause service exceptions. It is recommended that the value be smaller than or equal to 80% of the container engine space.

  NOTE

  - The capability of customizing pod basesize is related to the node OS and container storage rootfs.
    - When the rootfs uses Device Mapper, the node supports custom pod basesize. The default storage space of a single container is 10 GiB.
    - When the rootfs uses OverlayFS, most nodes do not support custom pod basesize. The storage space of a single container is not limited and defaults to the container engine space.

      Only EulerOS 2.9 nodes in clusters of 1.19.16, 1.21.3, 1.23.3, and later versions support custom pod basesize.
  - In the case of using Docker on EulerOS 2.9 nodes, **basesize** will not take effect if **CAP_SYS_RESOURCE** or **privileged** is configured for a container.

Step 6 After the node is reset, log in to the node and run the following command to access the container and check whether the container storage capacity has been expanded:

docker exec -it *container_id* **/bin/sh** or **kubectl exec -it** *container_id* **/bin/sh**

df -h

```
# df -h
Filesystem                                                                                                      Size  Used Avail Use% Mounted on
/dev/mapper/docker-253:1-787293-631c1bde2cbe82e39f32253b216ba914cb183b168b54700b3e5b9a54ee40a0d1   15G  229M   15G   2% /
tmpfs                                                                                                           32G     0   32G   0% /dev
tmpfs                                                                                                           32G     0   32G   0% /sys/fs/cgroup
/dev/mapper/vgpaas-kubernetes                                                                                  9.8G   37M  9.2G   1% /etc/hosts
/dev/vda1                                                                                                       40G  5.2G   33G  14% /etc/hostname
shm                                                                                                             64M     0   64M   0% /dev/shm
tmpfs                                                                                                           32G   16K   32G   1% /run/secrets/kubernetes.io/serviceaccount
tmpfs                                                                                                           32G     0   32G   0% /proc/acpi
tmpfs                                                                                                           32G     0   32G   0% /sys/firmware
tmpfs                                                                                                           32G     0   32G   0% /proc/scsi
tmpfs                                                                                                           32G     0   32G   0% /proc/kbox
tmpfs                                                                                                           32G     0   32G   0% /proc/oom_extend
```

----End

15.2 How Can Container IP Addresses Survive a Container Restart?

If Containers Will Run in a Single-Node Cluster

Add **hostNetwork: true** to the **spec.spec.** in the YAML file of the workload to which the containers will belong.

If Containers Will Run in a Multi-Node Cluster

Configure node affinity policies, in addition to perform the operations described in "If the Container Runs in a Single-Node Cluster". However, after the workload is created, the number of running pods cannot exceed the number of affinity nodes.

Expected Result

After the previous settings are complete and the workload is running, the IP addresses of the workload's pods are the same as the node IP addresses. After the workload is restarted, these IP addresses will keep unchanged.

