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Elastic Compute Service

Network

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Generic conventions

Table -1: Style conventions

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

Style	Description	Example
{} or {a|b}	It indicates that it is a required value, and only one item can be selected.	`swich {stand | slave}`

Contents

1 Network types

Alibaba Cloud provides classic network and Virtual Private Cloud (VPC) network types.

Virtual Private Cloud (VPC)

VPCs are logically isolated networks established in Alibaba Cloud. You can customize the topology and IP addresses in a VPC. We recommend that the VPC network type is used if have high network security requirements.

For more information about VPC, see Virtual Private Cloud documentation.

Classic network

A classic network is deployed in the public infrastructure of Alibaba Cloud, which is responsible for its planning and management. We recommend that the classic network type is used if your business requirements are high in terms of network usability.

 Note:
If you purchased an ECS instance after 17:00 (UTC+8) on June 14, 2017, you cannot choose the classic network type.

VPC vs. Classic networks

The following table describes key network functions and indicates whether they are supported within VPCs and classic networks.

Items	VPC	Classic network
Two-layer logic isolation	Supported	Not supported
Custom private network blocks	Supported	Not supported
Private IP addresses	Unique within one VPC. Replicable between VPCs.	Unique in the global Classic network
Communicate within or between private networks	Able to communicate within a VPC, but isolated between VPCs	Able to communicate in one region and under one account
Tunneling	Supported	Not supported
Custom router	Supported	Not supported

Items	VPC	Classic network
Routing table	Supported	Not supported
Switches	Supported	Not supported
SDN	Supported	Not supported
Self-built NAT gateway	Supported	Not supported
Self-built VPN	Supported	Not supported

2 Instance IP addresses

2.1 IP addresses of VPC-Connected ECS instances

Each VPC-Connected ECS instance can communicate within an intranet by using a private IP address, or communicate over the Internet by using a public IP address.

Private IP addresses

Each VPC-Connected ECS instance is assigned a private IP address when it is created . That address is determined by the VPC and the CIDR block of the VSwitch to which the instance is connected.

Scenarios

A private IP address can be used in the following scenarios:

- Load balancing
- Communication among ECS instances within an intranet
- Communication between an ECS instance and other cloud products (such as OSS and RDS) within an intranet

For more information, see Intranet.

Modify a private IP address

You can modify the private IP address of a VPC-Connected ECS instance in the ECS console. For more information, see Change the private IP of an ECS instance.

Public IP addresses

VPC-Connected ECS instances support two public IP address types:

- NatPublicIp, which is assigned to a VPC-Connected ECS instance, can be released only, and cannot be disassociated from the instance.
- Elastic public IP (EIP). For more information, see What is an EIP address.

When a VPC-Connected ECS instance accesses the Internet, its public IP address is mapped to its private IP address through network address translation (NAT).

You cannot find a network interface for Internet access by running commands within the operating system.

Scenarios

NatPublicIp and EIP are applicable to different scenarios:

- NatPublicIp: If you want to assign a public IP address to a VPC-Connected ECS instance when creating the instance, and do not want to retain the public IP address when the instance is released, you can use a NatPublicIp address.
- EIP: If you want to keep a public IP address and associate it to any of your VPC-Connected ECS instances in the same region, you can use an EIP address.

Obtain a public IP address

- NatPublicIp: When creating a VPC-Connected ECS instance, if you select Assign a public IP, a NatPublicIp is assigned to the instance when it is created.
- EIP: You can apply for an EIP address and bind it to a VPC-Connected ECS instance. In this case, do not assign a NatPublicIp to an instance. For more information, see Apply for an EIP address.

Release a public IP address

- NatPublicIp: When a NatPublicIp address is assigned to an instance, you can only release the IP address, but cannot disassociate it. Only a NatPublicIp address that is assigned to a Subscription instance can be released. For more information, see Renew for configuration downgrade.
- EIP: If you do not need an EIP address, disassociate it from a VPC-Connected ECS instance and release it in the EIP console. For more information, see Unbind and release an EIP address.

Billing

You are billed for outbound Internet traffic usage only. For more information, see Billing of Internet bandwidth.

2.2 IP addresses of a classic network-connected ECS instance

Currently, for ECS instances of the classic network type, IP addresses are distributed in a unified way and divided into public and private IP addresses. Private IP address

are mainly used for remote access to your instance or to the services deployed on your instance.

Intranet IP addresses

Each classic network-connected ECS instance is assigned a private, that is intranet, IP address.

Scenarios

Intranet IP addresses can be used in the following scenarios:

- Load balancing
- Mutual intranet access between ECS instances
- Mutual intranet access between ECS instances and other cloud services, such as OSS and RDS

Traffic generated through intranet IP addresses within an intranet is free of charge. For more information, see Intranet.

Modify an intranet IP address

Once a classic network-connected ECS instance is created, you cannot change its intranet IP address.

> Note:
> Do not change an intranet IP address within a guest operating system. Otherwise, communication within an intranet is interrupted.

Public IP addresses

If you purchase bandwidth for Internet access, a public IP address is assigned to your classic network-connected ECS instance. You cannot change the public IP address once it is assigned.

Scenarios

A public IP address is used in the following scenarios:

- Mutual access between an ECS instance and the Internet
- Mutual Internet access between ECS instances and other Alibaba Cloud services

Assign a public IP address

When you create an ECS instance, a public IP address is assigned to it if Assign public IP is selected.

For a Subscription instance with no public IP address, you can use the Upgrade Configuration or the Renew for Configuration Downgrade feature to purchase public network bandwidth.

Note:

- For a Pay-As-You-Go classic network-connected ECS instance with no public IP address, you cannot assign a public IP address after the instance is created.
- For a classic network-connected ECS instance, you cannot disassociate or release its public IP address once the IP address is assigned. If you set the bandwidth to 0 Mbit/s when renewing an instance for configuration downgrade, in the next purchase cycle, the public IP address is retained, but the instance cannot access the Internet.

Billing

You are billed for usage of Internet outbound traffic only. For more information, see Billing of network bandwidth.

Multicast and broadcast

Intranet IP addresses cannot be used for multicasting or broadcasting.

2.3 Intranet

If you need to transmit data between two ECS instances in the same region, use an intranet connection. Intranet connections can also be used to connect any combination of ECS, RDS, SLB, and OSS if they are deployed in the same region. However, the network speed is limited to one gigabit of shared bandwidth for non I/O optimized instances.

Alibaba Cloud instances can communicate over an intranet. The instances use one gigabit of shared bandwidth for non I/O optimized instances, and 10 gigabits of shared bandwidth for I/O optimized instances, with no special restrictions. However, because the intranet is a shared network, the bandwidth may fluctuate.

The following table describes how to enable intranet communication between ECS instances across different network types, depending on the number of accounts and whether the target regions and security groups are the same or different.

Network type	Accounts used	Regions	Security groups	How to enable intranet communication
VPC, same VPC	One account or multiple accounts	Same	Same	Enabled by default.
			Different	Authorize security groups for each other.
VPC, different VPCs	One account or multiple accounts	Same	Either the same or different	Use Express Connect. For more information, see Application scenarios from Product Introduction to Express Connect.
		Different	Different	
Classic	One account	Same	Same	Enabled by default.
	Multiple accounts		Either the same or different	Authorize security groups for each other. For more information, see Scenarios of security groups.

Private IP addresses are used for intranet communication. You cannot change the private IP address of an instance of the Classic network type, but you can change the private IP address of a VPC-Connected ECS instance. Private and public addresses of ECS instances do not support virtual IP (VIP) configuration.

By default, instances of different network types cannot communicate with one another in one intranet. However, VPC provides the ClassicLink function, which allows you to link an ECS instance in the classic network to cloud resources in a VPC through the intranet.

3 Change IPv4 addresses

3.1 Change the private IP of an ECS instance

After creating an ECS instance in a VPC network, you can change the private IP address and can change the VSwitch of the ECS instance.

Procedure

1. Log on to the ECS console.
2. In the left-side navigation pane, click Instances.
3. Select the target region.
4. In the Actions column, click More > Instance Status > Stop.
5. When the instance is stopped, click the instance ID to go to its Instance Details page.
6. In the Configuration Information panel, click More > Modify Private IP Address.
7. In Modify Private IP Address dialog, select a VSwitch, and then click Modify.

   Make sure the current VSwitch and the selected VSwitch are in the same zone.

   Note:
   Enter a new IP address if you do not want to change the VSwitch of the ECS instance.

8. Go back to the instance page and, in the Actions column, click More > Instance Status > Restart to make the new private IP address take effect.

3.2 Change the public IP address of an ECS instance

If your ECS instance is assigned a public IP address, you can change the IP address within six hours after the instance is created regardless of whether the instance is in a classic network or in a VPC network.

Limits

- You can change the public IP address of an instance a maximum of three times.

- Changes to a public IP address must be made within six hours after the corresponding instance is created.

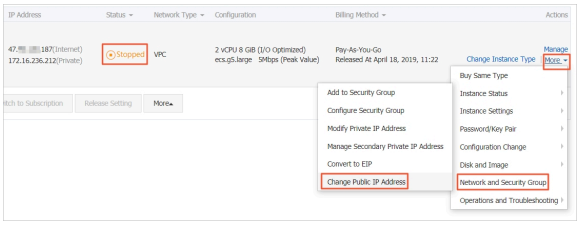
Prerequisites

- The instance must be in the Stopped state. For information about how to start or stop an instance, see Start or stop an instance.
- The instance must be assigned a public IP address. You can view the IP address in the IP Address column of the Instance List in the ECS console.

Procedure

To change the public IP address, follow these steps:

1. Log on to the ECS console.
2. In the left-side navigation pane, choose Instances & Images > Instances.
3. Find the target instance and then choose More > Network and Security Group > Change Public IP Address in the Actions column.



4. Click Start Now.

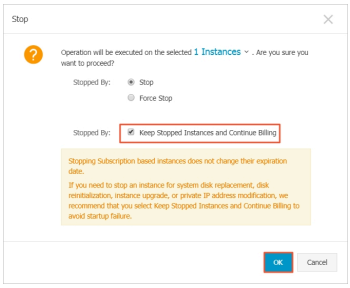
   A new public IP address is displayed.

5. Click OK.

FAQ

- Can I change the public IP address of an instance if it was created more than six hours ago?
  - For instances in a VPC network, the public IP address can be converted into an Elastic IP Address (EIP). For information about how to convert the IP address, see Convert public IP address to EIP address.
  - For instances in a classic network, the public IP address cannot be changed if an instance has been created for more than six hours.

- Why is the Change Public IP Address option under Network and Security Group not displayed?
  - By default, the Change Public IP Address option is not displayed for instances that were created more than six hours ago.
  - If you enable the no fees for stopped VPC instances feature for an instance, make sure that this feature is disabled when you stop the instance. Otherwise, the instance will be temporarily released and the Change Public IP Address option is not displayed. You can disable this feature by selecting the Keep Stopped Instances and Continue Billing check box in the Stop dialog box.



- Can I change the private IP address of an instance?
  - This operation is allowed for instances in a VPC network. For information about how to change the private IP address, see #unique_25.
  - This operation is not allowed for instances in a classic network.
- How do I obtain the public IP address of a created instance if the IP address is not assigned during instance creation?
  - For a Subscription instance, you can obtain the public IP address by upgrading or downgrading the network bandwidth configuration. For more information, see Overview of configuration changes.
  - For a Pay-As-You-Go instance, you cannot obtain the public IP address after the instance is created. You can only bind an EIP address.

3.3 Convert public IP address to EIP address

This topic describes how to convert the assigned public IP address of an ECS instance in a VPC network (hereinafter referred to as VPC instance) to an elastic public IP (EIP)

address. After conversion, you can retain the public IP address and bind it to another ECS instance.

Limits

To convert a public IP address to an EIP address, consider the following limits:

- You cannot undo this action. Exercise caution when converting an assigned public IP address to an EIP address.
- Only a VPC instance assigned a public IP address is supported.
- Only a VPC instance in the Stopped or Running state is supported.
- Only a VPC instance that does not have any inactivated specification changes is supported.
- Only a VPC instance that is not within the last 24 hours of its life cycle is supported.

> Note:
>
> - The conversion has no effect on the Internet access of the VPC instance. It does not cause transient traffic interruption.
> - The billing method of the public traffic remains unchanged.
> - After conversion, the EIP address is charged separately. For more information about billing of EIP addresses, see EIP billing. You can go to the Usage Records page in the Billing Management to download the Elastic Public IP usage record.

Procedure

To convert a public IP address to an elastic public IP (EIP) address, follow these steps:

1. Log on to the ECS console.
2. In the left-side navigation pane, choose Instances & Images > Instances.
3. Find the target VPC instance to convert the public IP address, and then choose More > Network and Security Group > Convert to EIP from the Actions column.
4. In the Convert to EIP dialog box, read the note and click OK.
5. Refresh the instance list.

After the public IP address is converted to an EIP address, the IP address is followed by (Elastic IP Address).

You can click the IP address to go to the EIP console to manage the EIP address.

What to do next

After the public IP address is converted to an EIP address, you can unbind the EIP address from the instance and bind it to another instance, or release the EIP address. For more information, see Disassociate an EIP from a cloud instance.

Related API

You can call ConvertNatPublicIpToEip to convert a public IP address to an EIP address. Currently, only SDK 4.3.0 or a later version supports this API action.

Download the latest SDK.

4 Elastic Network Interfaces

4.1 ENI overview

An Elastic Network Interface (ENI) is a virtual network interface that can be attached to an ECS instance in a VPC. You can use an ENI to deploy a high-availability cluster, and perform low-cost failover and fine-grained network management in all Alibaba Cloud regions.

Scenarios

ENIs can be used in the following scenarios:

- Deploying a high-availability cluster

  An ENI is suitable for high-availability architecture for multiple network interfaces on a single instance.
- Providing a low-cost failover solution

  You can detach an ENI from a failed ECS instance and then attach it to another ECS instance to quickly redirect traffic from the failed instance to a backup instance, thereby quickly restoring your services.
- Managing the network with refined controls

  You can configure multiple ENIs for an instance in any Alibaba Cloud region. For example, you can use some ENIs for internal management and other ENIs for Internet business access, so as to isolate confidential data from business data. You can also configure specific security group rules for each ENI based on the source IP address, protocols, ports, and more to achieve secured traffic control.

ENI types

ENIs are classified into two types:

- Primary ENI

  The ENI created by default upon the creation of an instance in a VPC. The life cycle of the primary ENI is the same as that of the instance, and you cannot remove the primary ENI from the instance.

- Secondary ENI

  You can create a secondary ENI and attach it to an instance or detach it from the instance. The maximum number of ENIs that you can attach to one instance varies with the instance type. For more information, see Instance type families.

ENI attributes

The following table describes ENI attributes.

Attribute	Quantity
Private IP address	Varies with instance types
MAC address	1
Security group	1 to 5
ENI name	1

Limits

ENIs have the following limits:

- One account can create up to 100 ENIs per region. The quota increases with the membership level. If you require a higher quota, open a ticket.
- The ECS instance and its attached secondary ENI must be in the same zone, region, and VSwitch, but can be in different security groups.
- The number of secondary ENIs that can be attached to an ECS instance depends on the instance type. For more information, see Instance type families.
- Only I/O-optimized instance types support ENIs.
- ECS instances in a classic network do not support ENIs.
- The instance bandwidth varies with the instance type. You cannot increase the bandwidth of an ECS instance by attaching multiple ENIs to the instance.

Related operations

For images that cannot identify secondary ENIs, log on to the instance to configure the ENI.

Console operations

In the ECS console, you can view information of an attached ENI. You can also perform the following actions with a secondary ENI only (a primary ENI is not supported):

- Attach an ENI.
- Create an ENI.
- Delete an ENI.
- Detach an ENI from an instance.
- Modify an ENI.

API operations

You can call DescribeNetworkInterfaces to query an ENI list, and call DescribeInstances to query the information of a specific ENI attached to an instance. Additionally, you can call the following API actions as needed for a secondary ENI only (a primary ENI is not supported):

- CreateNetworkInterface
- DeleteNetworkInterface
- AttachNetworkInterface
- DetachNetworkInterface
- ModifyNetworkInterfaceAttribute

4.2 Create an ENI

This topic describes how to create an elastic network interface (ENI) in the ECS console. You can use an ENI to deploy a high-availability cluster, and perform low-cost failover and fine-grained network management.

Background information

You can create an ENI by using either of the following two methods:

- Attach an ENI when you create an instance. For more information, see Attach an ENI. You can attach a maximum of two ENIs. One is the primary ENI and the other is the secondary ENI. A secondary ENI created in this way will be released with the instance if it is not detached from the instance. For information about how to detach an ENI, see Detach an ENI from an instance.
- Create a separate ENI. The created ENI can be attached to an instance. For more information, see Attach an ENI. An ENI created in this way can only be used as a secondary ENI.

Limits

Before you create an ENI, note the following limits:

- Each ENI must be in a VSwitch of a VPC.
- Each ENI must belong to at least one security group.

Prerequisites

- A VPC and a VSwitch are created in the VPC.
- A security group is created in the same VPC.

Procedure

To create an ENI, follow these steps:

1. Log on to the ECS console.
2. In the left-side navigation pane, choose Network & Security > ENI.
3. Click Create ENI.
4. In the displayed dialog box, complete the following configurations:
   a. Network Interface Name: Enter a name for the ENI.
   b. VPC: Select a VPC. When you attach an ENI to an instance, they must be in the same VPC.

      Note:
      After an ENI is created, you cannot change the VPC.
   c. VSwitch: Select a VSwitch. When you attach an ENI to an instance, they must be in the same zone, but they do not have to be in the same VSwitch.

      Note:
      After an ENI is created, you cannot change the VSwitch.
   d. Primary Private IP: Specify an IPv4 address as the private IP address of the ENI. The IPv4 address must be available in the CIDR block of the specified VSwitch. If you do not specify one, a private IP address is automatically assigned to your ENI after the ENI is created.
   e. Security Group: Select a security group in the selected VPC.
   f. Description: Optional. Enter a description for the ENI.
   g. Click OK.

On the Network Interfaces page, refresh the table. When the new ENI is in the Available state, it is created.

What to do next

After you create an ENI, you can:

- Attach an ENI to an instance.
- Modify attributes of the ENI.
- Delete the ENI.

4.3 Attach an ENI

This topic describes how to attach an Elastic Network Interface (ENI). Specifically, you either attach an ENI when you create an ECS instance, or you can alternatively create an ENI separately and then attach it to an ECS instance. Attaching an ENI allows you to build clusters with higher availability, perform failovers with lower costs, and manage your network with finer granularity.

Attach an ENI when you create an ECS instance

Limits

If you attach a secondary ENI, as opposed to a primary ENI, to an ECS instance and do not detach it from the ECS instance, the secondary ENI will be released when you release the ECS instance. For more information, see Detach an ENI from an instance.

Procedure

Before you begin, make sure that you have created an ECS instance. For the specific procedure, see Step 2: Create an instance.

When you attach an ENI to an ECS instance during the process of creating an ECS instance, configure the following parameters:

1. Basic configurations
   - Region: ENIs are supported in all regions.
   - Instance type: Select an I/O-optimized instance type that supports ENIs. For more information, see Instance type families.
   - Image: The following image types support ENIs without any manual configuration required:
     - CentOS 7.3 64-bit
     - CentOS 6.8 64-bit
     - Windows Server 2016 Datacenter Edition 64-bit
     - Windows Server 2012 R2 Datacenter Edition 64-bit

      Note:

     For other image types, after you create an ECS instance, you must configure the ENI to enable the instance to support ENIs.
2. Networking
   - Network: Select VPC, and then select a VPC and VSwitch that you created.
   - ENI: Click Add ENI to attach the target ENI. The ENI and the instance must belong to the same VSwitch.

      Note:

     When you create an instance in the ECS console, you can attach up to two ENIs to the instance. One is the primary ENI, and the other is the secondary ENI. You can attach more secondary ENIs to the instance by using one of the following two methods:
     - Create an ENI in the ECS console, and then attach the ENI to the instance.
     - Call the API action AttachNetworkInterface to attach more ENIs to the instance.

Attach an ENI to an existing ECS instance

Limits

- The ENI can only be attached to the existing ECS instance as a secondary ENI, rather than a primary ENI.
- The ENI must be in the Available state.
- The ECS instance must be in the Stopped or Running state.

- The ENI can only be attached to a VPC ECS instance. The ENI and the instance must be in the same VPC.
- The VSwitch to which the ENI belongs must be in the same zone as the ECS instance to which the ENI is attached.
- The ENI can only be attached to an I/O-optimized instance.
- One ENI can be attached to only one VPC ECS instance, but one instance can be attached with multiple ENIs. For more information, see Instance type families.

Prerequisites

- An ENI is created. For more information, see Create an ENI.
- The ENI is in the Available state.
- The instance can be attached with secondary ENIs and is in the Stopped or Running state. For more information, see Instance type families.

Procedure

1. Log on to the ECS console.
2. In the left-side navigation pane, choose Network & Security > ENI.
3. Locate an available ENI, and then click Bind to Instance.
4. In the displayed dialog box, select the target instance, and then click OK.

Refresh the list. When the ENI is in the Bound state, the ENI is attached to the instance.

 Notice:
If the last time your instance was started or restarted is earlier than April 1, 2018, then you must use the ECS console or call the API action RebootInstance to Restart the instance, as opposed to logging on to the instance to restart it. Otherwise, the ENI cannot be attached to the instance.

What to do next

After you attach an ENI to an ECS instance, you can perform the following operations:

- Detach the ENI from the instance or Delete the ENI.
- Configure the ENI if the image cannot identify the ENI.

4.4 Configure an ENI

This topic describes how to configure an ENI. For some images used by your instances, you may need to manually configure an ENI for these images so that the ENIs attached to your instances can be identified by the system.

Background information

If your instance is running one of the following images, ENIs are supported and you do not need to configure any ENIs manually.

- Centos 7.3 64-bit
- Centos 6.8 64-bit
- Windows Server 2008 R2 or later

If your instance is running an image not shown in the preceding list, and you want to attach an ENI to your instance, you must manually configure the ENI to be supported . This topic uses an instance running CentOS 7.2 64-bit as an example to describe how to configure an ENI manually.

Prerequisite

You have attached an ENI to an ECS instance.

Procedure

To configure an ENI manually, follow these steps:

1. Use the #unique_38 interface or log on to the ECS console to obtain the following attributes of the ENI: the primary private IP address, subnet mask, the default route, and the MAC address. To obtain these attributes in the ECS console, follow these steps:
   a. Log on to the ECS console.
   b. Find the target ENI and obtain its primary private IP address, subnet mask, default route, and MAC address. Example:

```
eth1   10 . 0 . 0 . 20 / 24   10 . 0 . 0 . 253   00 :  16 :  12
:  E7 :  27
eth2   10 . 0 . 0 . 21 / 24   10 . 0 . 0 . 253   00 :  16 :  12
:  16 :  EC
```

2. Connect to the ECS instance.

3. Run the following command to generate the config file: `cat / etc / sysconfig / network - scripts / ifcfg -[ network interface name in the OS ]`.

Note:

- Pay attention to the relation between the network interface name in the OS and the MAC address.
- Pay attention to the relation between the network interface name in the OS and the MAC address. The default route must be set to `DEFROUTE = no`. Other editions must have the same configuration. Note that running the `ifup` command may change the active default route configuration after configuring the network interface.
- Example:

```
# cat / etc / sysconfig / network - scripts / ifcfg - eth1
 DEVICE = eth1
 BOOTPROTO = dhcp
 ONBOOT = yes
 TYPE = Ethernet
 USERCTL = yes
 PEERDNS = no
 IPV6INIT = No
 PERSISTENT _DHCLIENT = Yes
 HWADDR = 00 : 16 : 3e : 12 : e7 : 27
 DEFROUTE = noDefroute = No
```

4. To start the network interface, follow these steps:

   a. Run the `ifup [ network interface name in the OS ]` command to start the dhclient process, and initiate a DHCP request. Example:

```
# ifup eth1
# ifup eth2
```

   b. After a response is received, run the `ip a` a command to check the IP allocation on the network interfaces, which must match with the information displayed on the ECS console. Example:

```
# ip a
 1 : lo : mtu 65536 qdisc noqueue state UNKNOWN qlen
   1
 link / loopback 00 : 00 : 00 : 00 : 00 : 00 brd 00 : 00 :
 00 : 00 : 00 : 00
 inet 127 . 0 . 0 . 1 / 8 scope host loInet 125 . 0 . 0
 . 1 / 8 Scope host Lo
 valid_lft forever preferred_ lft forever
```

```
2 : eth0 : mtu 1500 qdisc pfifo_fast state UP qlen
  10002 : eth0 : MTU 1500 qdisc glasstate up qlen
1000
link / ether 00 : 16 : 3e : 0e : 16 : 21 brd ff : ff : ff :
ff : ff : ff
Inet 10 . 0 . 0 . 19 / 24 BRD glasscope Global Dynamic
  eth0
valid_lft 31506157se c preferred_ lft 31506157se
cValid_lft 31506157se c preferred_ lft 31506157se c
3 : eth1 : MTU 1500 qdisc glasstate up qlen 1000
link / ether 00 : 16 : 3e : 12 : e7 : 27 brd ff : ff : ff :
ff : ff : ff
inet 10 . 0 . 0 . 20 / 24 brd 10 . 0 . 0 . 255 scope
  global dynamic eth1Inet 10 . 0 . 0 . 20 / 24 BRD
glasscope Global Dynamic eth1
Valid_lft 31525994se c preferred_ lft 31525994se c
4 : eth2 : MTU 1500 qdisc glasstate up qlen 1000
Link / ether 00 : 16 : Rye : 12 : 16 : ec brd ff : FF
: FF
inet 10 . 0 . 0 . 21 / 24 brd 10 . 0 . 0 . 255 scope
global dynamic eth2
valid_lft 31526009se c preferred_ lft 31526009se c
```

5. **Set the metric for each network interface in the route table. In this example, set the metric parameters of eth1 and eth2 as follows.**

```
eth1 : gw : 10 . 0 . 0 . 253 metric : 1001
eth2 : gw : 10 . 0 . 0 . 253 metric : 1002
```

   a. **Run the following command to set the metric parameters.**

```
# Ip - 4 route add default via glasdev eth1 metric
  1001
# ip - 4 route add default via 10 . 0 . 0 . 253 dev
  eth2 metric 1002
```

   b. **Run the `route - n` command to check whether the configuration is successful. Example:**

```
# route - n
Kernel IP routing table
Destinatio n Gateway Genmask Flags Metric Ref Use
Iface
0 . 0 . 0 . 0 10 . 0 . 0 . 253 0 . 0 . 0 . 0 UG 0 0 0
  eth0
0 . 0 . 0 . 0 10 . 0 . 0 . 253 0 . 0 . 0 . 0 UG 1001 0
  0 eth1
0 . 5 . 0 . 0 10 . 0 . 0 . 253 ug ub1002 0 0 eth2
10 . 0 . 0 . 0 0 . 5 . 0 . 0 255 . 25 . 25 . 0 u 0 0
0 eth0
10 . 0 . 0 . 0 0 . 0 . 0 . 0 255 . 255 . 255 . 0 U 0 0
  0 eth1
10 . 0 . 0 . 0 0 . 5 . 0 . 0 255 . 25 . 25 . 0 u 0 0
0 eth2
169 . 254 . 0 . 0 0 . 0 . 0 255 . 0 . 0 U 1002 0 0
eth0
169 . 254 . 0 . 0 0 . 0 . 0 . 0 255 . 255 . 0 . 0 U 1003
  0 0 eth1
```

```
169 . 254 . 0 . 0   0 . 0 . 0 . 0   255 . 255 . 0 . 0   U   1004
  0   0   eth2169 . 254 . 0 . 0   0 . 0 . 0   255 . 0 . 0   U
1004   0   0   eth2
```

6. To build a route table, follow these steps:

Note:

We recommend that you use the metric value as the route table name.

a. Run the following command to build a route table.

```
#  ip  - 4   route   add   default   via   10 . 0 . 0 . 253   dev
   eth1   table   1001
#  Ip - 4   route   add   default   via   glasdev   eth2   table
 1002
```

b. Run the following command to check whether the route table is built successfully.

```
#  ip   route   list   table   1001
 default   via   10 . 0 . 0 . 253   dev   eth1
#  ip   route   list   table   1002
 default   via   10 . 0 . 0 . 253   dev   eth2
```

7. Configure the policy routing.

a. Run the following command to configure the policy routing.

```
#  ip  - 4   rule   add   from   10 . 0 . 0 . 20   lookup   1001
#  ip  - 4   rule   add   from   10 . 0 . 0 . 21   lookup   1002
```

b. Run `ip rule list` to view the routing rules.

```
#  ip   rule   list
 0 :  from   all   lookup   local
 32764 :  from   10 . 0 . 0 . 21   lookup   1002
 32765 :  from   10 . 0 . 0 . 20   lookup   1001
 32766 :  from   all   lookup   main
 32767 :  from   all   lookup   default
```

What to do next

After you have configured an ENI, you can perform the following operations:

- Modify attributes of an ENI.
- Detach an ENI from an instance.
- Delete an ENI.

4.5 Modify an ENI

This topic describes how to modify primary and secondary Elastic Network Interfaces (ENIs). You can only modify the primary ENI by configuring its associated instance with a different security group as needed, and you can modify a secondary ENI by changing its attributes (such as the name, associated security group, and description).

Limits

Before you can modify the security group to which an ENI belongs, the ENI and its associated ECS instance must meet the following limits:

- An ECS instance cannot be added to a basic security group and an advanced security group at the same time.
- An ENI cannot be added to a basic security group and an advanced security group at the same time.
- An ENI can be attached to an ECS instance only if they belong to the same type of security group.

For more information, see Overview.

Modify a primary ENI

To modify a primary ENI, follow these steps:

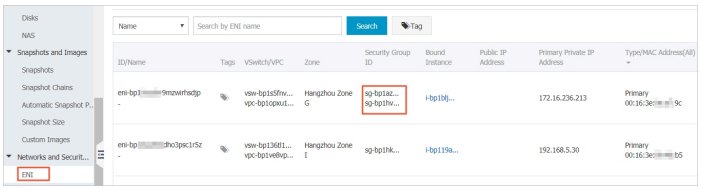
> **Note:**
> The primary ENI and the secondary ENIs of an ECS instance can belong to different security groups. This means that if you associate the ECS instance with another security group, the primary ENI will also be associated with this security group, but the secondary ENIs will remain in the previous security group.

1. Log on to the ECS console.
2. In the left-side navigation pane, choose Network & Security > Security Groups.
3. Find the target security group, and then click Manage Instances in the Actions column.

4. On the Instances in Security Group page, modify the security group with which the primary ENI is associated.
   - To add the primary ENI to a new security group, follow these steps:
     a. In the upper-right corner of the Instances in Security Group page, click Add Instance.
     b. In the displayed dialog box, select an instance ID to which the primary ENI is attached, and then click OK.

        The primary ENI is added to the new security group along with the corresponding ECS instance.
   - To remove the primary ENI from the current security group, follow these steps:
     a. On the Instances in Security Group page, select one or more instances, and then click Remove from Security Group.
     b. In the displayed dialog box, click OK.

        The primary ENI is removed from the current security group along with the corresponding ECS instance. Note that the primary ENI and the ECS instance must belong to at least one security group.
5. Go back to the Security Groups page and find the target primary ENI to verify that the settings have taken effect.



Related APIs:

- JoinSecurityGroup
- LeaveSecurityGroup

Modify a secondary ENI

To modify a secondary ENI, follow these steps:

1. Log on to the ECS console.
2. In the left-side navigation pane, choose Network & Security > ENI.
3. Find the target secondary ENI, and then click Modify in the Actions column.

4. In the displayed dialog box, modify the ENI attributes as follows:
   - Network Interface Name: Set a new ENI name according to the rules displayed under this field.
   - Security Group: Select a new security group for the ENI, or remove the ENI from a security group. Note that the ENI must be associated with at least one security group.
   - Description: Modify the description according to the rules displayed under this field.
5. Click OK.

Related API: ModifyNetworkInterfaceAttribute

4.6 Assign a secondary private IP address

This topic describes how to assign secondary private IP addresses to an Elastic Network Interface (ENI).

Scenarios

- Optimize application usage

  If your ECS instance hosts multiple applications, you can assign multiple secondary private IP addresses to the corresponding ENI. In this way, each application uses a separate IP address for services, which optimizes the usage of the ECS instance.
- Avoid service disruptions

  You can attach the ENI of an active ECS instance to another instance to direct traffic to the standby instance if the active instance fails, enabling service continuity.

Limits

- You can only attach an ENI to an ECS instance in a VPC. The ENI and the instance must be in the same VPC, VSwitch, and zone.
- Each VPC security group can contain a maximum of 2,000 private IP addresses, and the quota is shared among all corresponding primary and secondary ENIs.

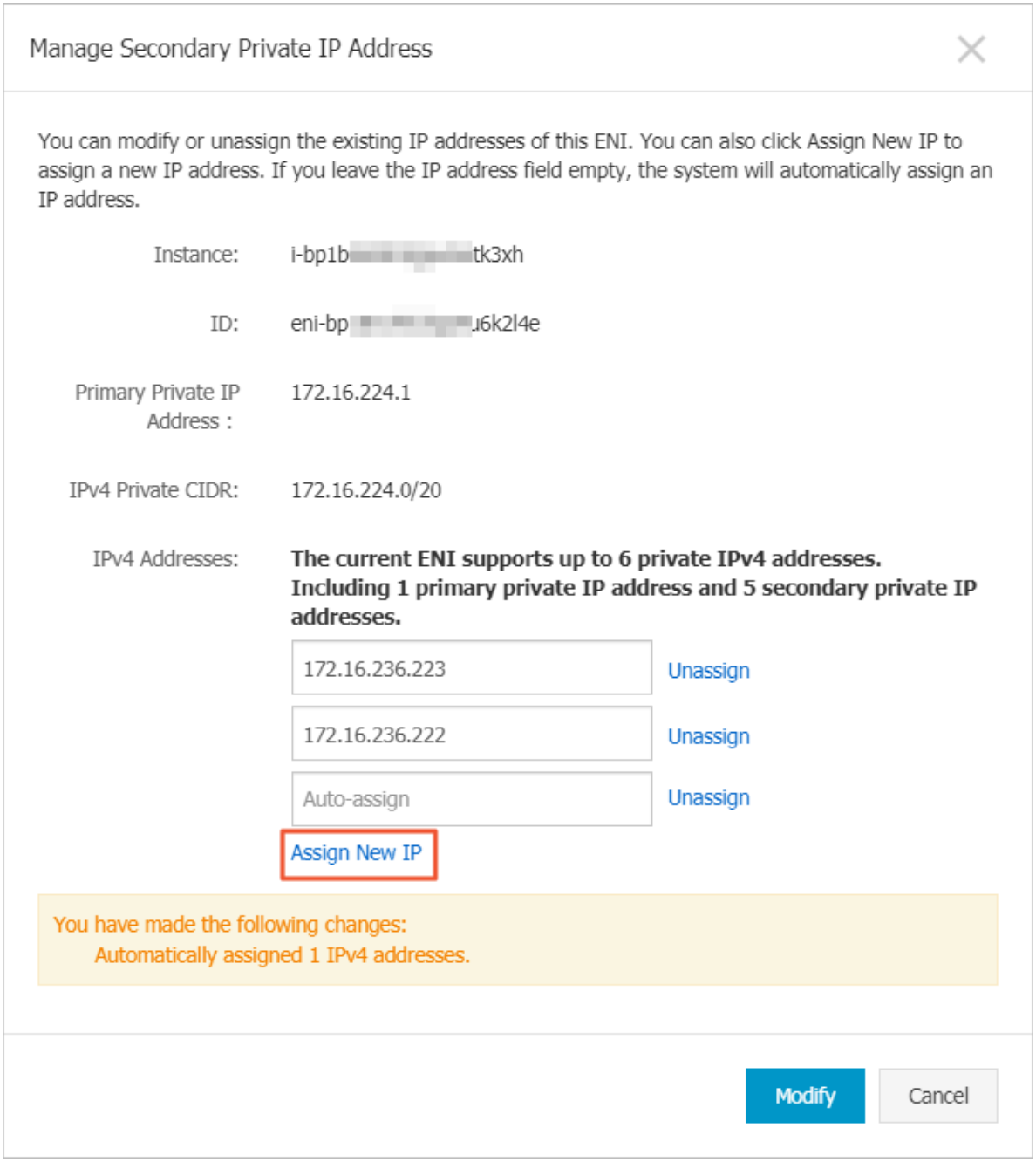
- You can assign a maximum of 20 private IP addresses to an ENI.
  - If the target ENI is in the `Available` state, you can assign a maximum of 10 private IP addresses to the ENI.
  - If the target ENI is in the `InUse` state, the number of private IP addresses that you can assign to the ENI depends on the instance type. For more information, see Instance type families.
- Your instance type must be able to support being assigned multiple secondary private IP addresses. For more information, see Instance type families or call the DescribeInstanceTypes API action.
- If you assign multiple secondary private IP addresses to a primary ENI, the instance to which the primary ENI is attached must be in the `Running` or `Stopped` state.

Assign a secondary private IP address to an ENI

1. Log on to the ECS console.
2. In the left-side navigation pane, choose Network & Security > ENI.
3. On the Network Interfaces page, locate the target ENI, and then click Manage Secondary Private IP Address in the Actions column.

4. In the displayed dialog box, click Assign New IP once or multiple times if additional IP addresses are needed.

   You can also enter one or more secondary private IP addresses that are within the IPv4 Private CIDR. If you do not enter any secondary private IP address, the system randomly assigns IP addresses that are within the IPv4 Private CIDR.



5. Click Modify.
6. Optional. If you use automatic assignment of a secondary private IP address, click Manage Secondary Private IP Address in the Actions column to view the

assigned secondary private IP address, and then configure this IP address for an ECS instance.

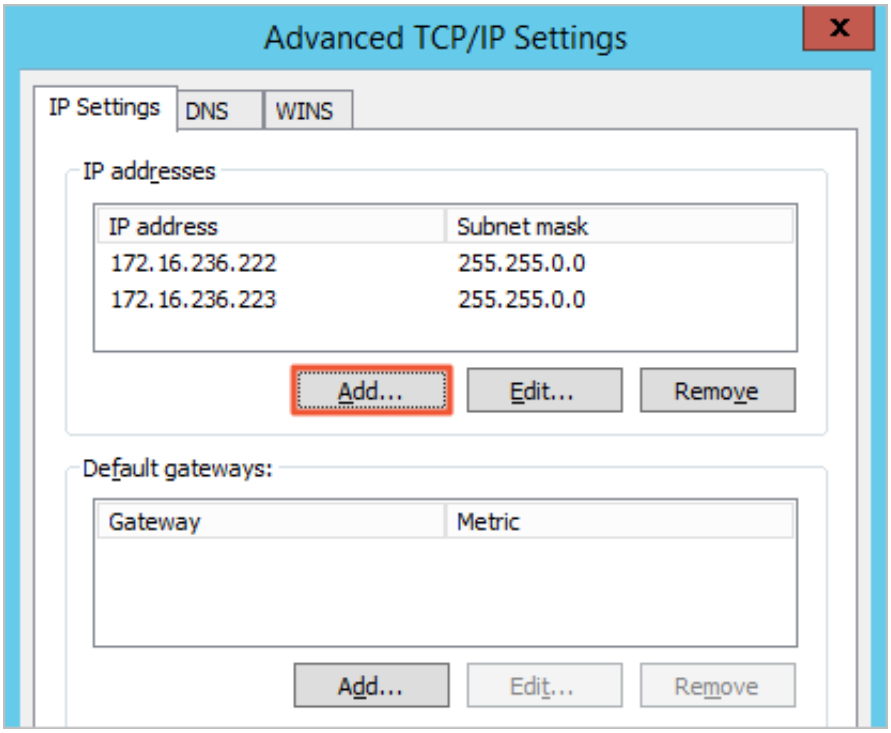
7. Optional. If the target ENI is not attached, attach it to an ECS instance. For more information, see Attach an ENI.

Related API: AssignPrivateIpAddresses

Assign a secondary private IP address to a Windows instance

1. Connect to the target instance. For more information, see Overview.
2. Open the Network and Sharing Center.
3. Click Change adapter settings.
4. Double-click the current network connection name, and then click Properties.
5. Double-click Internet Protocol Version 4 (TCP/IPv4).
6. Select Use the following IP address, and then click Advanced.
7. Click Add, and then enter the assigned IP Address and set the Subnet Mask.

   You can add multiple IP addresses to the same adapter.



8. Click OK.

Assign a secondary private IP address to a Linux instance

1. Connect to the target instance. For more information, see Overview.

2. Follow the instructions in the method that corresponds to the OS of your instance to assign a secondary private IP address.

   In the following example, a primary ENI named `eth0` are used. If you use a secondary ENI, you must modify the ENI identifier as needed.

   - RHEL series: CentOS 6/7, Red Hat 6/7, and Aliyun Linux 17

     a. Run the `vi /etc/sysconfig/network-scripts/ifcfg-eth0:0` command to open the network configuration file and add the following configuration items:

     ```
     DEVICE=eth0:0
     TYPE=Ethernet
     BOOTPROTO=static
     ONBOOT=yes
     IPADDR=<IPv4 address 1>
     NETMASK=<IPv4 mask>
     GATEWAY=<IPv4 gateway>
     ```

     If you assign multiple IP addresses, run the `vi /etc/sysconfig/network-scripts/ifcfg-eth0:1` command to open the network configuration file and add the following configuration items:

     ```
     DEVICE=eth0:1
     TYPE=Ethernet
     BOOTPROTO=static
     ONBOOT=yes
     IPADDR=<IPv4 address 2>
     NETMASK=<IPv4 mask>
     GATEWAY=<IPv4 gateway>
     ```

     b. Run the `service network restart` or `systemctl restart network` command to restart the network service.

   - Debian series: Ubuntu 14/16 and Debian/8/9

     a. Run the `vi /etc/network/interfaces` command to open the network configuration file and add the following configuration items:

     ```
     auto eth0:0
     iface eth0:0 inet static
     address <IPv4 address 1>
     netmask <IPv4 mask>
     gateway <IPv4 gateway>

     auto eth0:1
     iface eth0:1 inet static
     address <IPv4 address 2>
     netmask <IPv4 mask>
     ```

```
gateway < IPv4 gateway >
```

b. Run the `service networking restart` or `systemctl restart networking` command to restart the network service.

- SLES series: SUSE 11/12 and OpenSUSE 42

a. Run the `vi /etc/sysconfig/network/ifcfg-eth0` command to open the network configuration file and add the following configuration items:

```
IPADDR_0 =< IPv4 address 1 >
NETMASK_0 =< subnet prefix length >
LABEL_0 =' 0 '

IPADDR_1 =< IPv4 address 2 >
NETMASK_1 =< subnet prefix length >
LABEL_1 =' 1 '
```

b. Run the `service network restart` or `systemctl restart network` command to restart the network service.

What to do next

If you no longer require the current number of secondary private IP addresses, you can revoke one or more of them from the target ENI. For more information, see Revoke a secondary private IP address.

4.7 Revoke a secondary private IP address

This topic describes how to revoke a secondary private IP address from an Elastic Network Interface (ENI).

Limits

The primary private IP address cannot be revoked.

Prerequisites

- At least one secondary private IP addresses is assigned to the target ENI.
- The target ENI is in the `Available` or `InUse` state.
- If the secondary private IP addresses to be revoked is assigned to the primary ENI, the instance to which the primary ENI is attached must be in the `Running` or `Stopped` state.

Procedure

1. Log on to the ECS console.
2. In the left-side navigation pane, choose Network & Security > ENI.
3. In the upper-left corner, select the target region.
4. On the Network Interfaces page, locate the target ENI, and then click Manage Secondary Private IP Address in the Actions column.
5. In the Manage Secondary Private IP Address dialog box, click Unassign once or multiple times if additional IP addresses need to be revoked.
6. Click Modify.

Related API: UnassignPrivateIpAddresses

What to do next

If your application requirements change, you can assign multiple secondary private IP address to an ENI. For more information, see Assign a secondary private IP address.

4.8 Detach an ENI from an instance

You can only detach a secondary ENI from an instance. You cannot detach the primary ENI.

Limits

Before you detach a secondary ENI from an instance, note the following limits:

- The secondary ENI must be in the Bound state.
- The instance to which the ENI belongs must be in the Stopped or Running state.

Prerequisites

The secondary ENI is attached to an instance. Before you detach a secondary ENI from an instance, the instance must be in the Stopped or Running state.

Procedure

To detach a secondary ENI from an instance, follow these steps:

1. Log on to the ECS console.
2. In the left-side navigation pane, choose Network & Security > ENI.
3. Find the target ENI, and in the Actions column, click Unbind.

4. In the displayed dialog box, confirm the information, and then click OK.

After, in the Network Interfaces page, refresh the table. When the selected ENI is in the Available state, it is detached from the instance.

What to do next

After an ENI is detached from an instance, you can:

- Attach the ENI to another instance.
- Delete the ENI.
- Modify attributes of the ENI.

4.9 Delete an ENI

You can only delete a secondary ENI. You cannot delete the primary ENI of an instance.

After a secondary ENI is deleted:

- The primary private IP address of the secondary ENI is released automatically.
- The deleted secondary ENI is automatically removed from all associated security groups.

If you release an instance, any attached ENIs will be deleted along with its release. You can choose to detach the ENI first and then release the corresponding instance separately.

Limits

You can only delete an ENI in the Available status.

Prerequisite

If an ENI is attached to an instance, you must first detach it from the instance to delete it separately.

Procedure

To delete an ENI, follow these steps:

1. Log on to the ECS console.
2. In the left-side navigation pane, select Networks and Security > ENI.
3. Select the target region.
4. Find the target ENI, and in the Actions column, click Delete.

5. Click OK.

In the Network Interfaces page, refresh the table. If the ENI is no longer displayed, it is deleted successfully.

5 Multiqueue for NICs

Multiqueued NICs route NIC interruptions in ECS instances to different CPUs. Results of network PPS and bandwidth tests show that a solution that uses two queues instead of one queue can enhance network performance by between 50% to 100%.

ECS instance types supporting multiqueue

See #unique_75 to find instance types that support multiqueue and the number of queues that are supported.

Images supporting multi-queue

The following public images officially provided by Alibaba Cloud support multiqueue :

Note:
Whether an image supports multiqueue is not related to the memory address width of the operating system.

- CentOS 6.8/6.9/7.2/7.3/7.4
- Ubuntu 14.04/16.04
- Debian 8.9
- SUSE Linux Enterprise Server 12 SP1
-

Support for SUSE Linux Enterprise Server 12 SP2 edition is in development. Support for Windows 2012 R2 and Windows 2016 is by invitation.

Configure multi-queue support for NICs on a Linux ECS instance

We recommend that you use one of the latest Linux distributions, such as CentOS 7.2, to configure multi-queue for the NICs.

Here we take CentOS 7.2 as an example to illustrate how to configure multi-queue for the NIC. In this example, two queues are configured, and the NIC name is eth0.

- To check whether the NIC supports multi-queue, run the command: `ethtool -l eth0`.
- To enable multi-queue for the NIC, run the command: `ethtool -L eth0 combined 2`.

- If you are using more than one NIC, configure each NIC.

```
[ root @ localhost ~]# ethtool - l eth0
Channel parameters for eth0 :
Pre - set maximums :
RX : 0
TX : 0
Other : 0
Combined : 2 # This line indicates that a maximum
of two queues can be configured
Current hardware settings :
RX : 0
TX : 0
Other : 0
Combined : 1 # It indicates that one queue is
currently taking effect
[ root @ localhost ~]# ethtool - L eth0 combined 2 #
It sets eth0 to use two queues currently
```

- We recommend that you enable the irqbalance service so that the system can automatically adjust the allocation of the NIC interrupts on multiple CPU cores. Run the command: `systemctl start irqbalance` (this feature is enabled by default in CentOS 7.2).
- If the network performance is not improved as expected after the multi-queue feature is enabled, you can enable the RPS feature. To do so, see the following Shell script:

```
#!/ bin / bash
cpu_num =$( grep - c processor / proc / cpuinfo )
quotient =$(( cpu_num / 8 ))
if [ $ quotient - gt 2 ]; then
    quotient = 2
elif [ $ quotient - lt 1 ]; then
    quotient = 1
fi
for i in $( seq $ quotient )
do
    cpuset ="${ cpuset } f "
done
for rps_file in $( ls / sys / class / net / eth */ queues
/ rx -*/ rps_cpus )
do
    echo $ cpuset > $ rps_file
done
```

Configure multi-queue support for NICs on a Windows ECS instance

> **Note:**
> We are inviting Windows users to sign up and test multiqueue support for performance improvement. Note that the overall performance increase is not as great when compared with performance increase of Linux systems.

If you are using a Windows instance, you must install the driver to use the multiqueue feature for NICs.

To install the driver for Windows systems, follow these steps:

1. Open a ticket to request and download the driver installation package.
2. Unzip the driver installation package. For Windows 2012/2016 systems, use the driver in the Win8/amd64 folder.
3. Upgrade the NIC driver:
   a. Select Device Manager > Network adapters.
   b. Right click Red Hat VirtIO Ethernet Adapter and select Update Driver.
   c. Select the Win8/admin64 directory of the driver directory that you have unzipped, and update the driver.
4. Restart the Windows system after the driver is upgraded for the multiqueue feature to take effect.

6 Connect a classic network to a VPC

This topic describes how to connect a classic network to a VPC. You can set up a ClassicLink connection so that ECS instances of the classic network type can access cloud resources in a VPC through the intranet.

Prerequisites

Make sure that you are aware of the limits of ClassicLink. For more information, see ClassicLink overview.

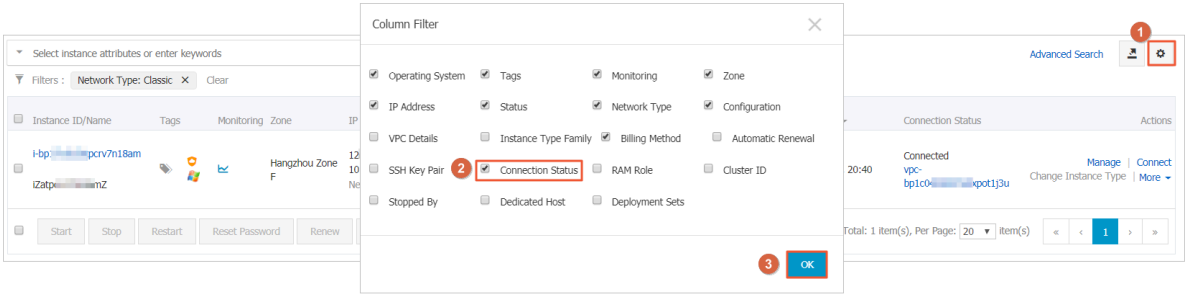
Procedure

1. Log on to the VPC console.
2. Select the region of the target VPC, and click the ID of the target VPC.
3. On the VPC Details page, click Enable ClassicLink. In the displayed dialog box, click OK.
4. Log on to the ECS console.
5. In the left-side navigation pane, choose Instances & Images > Instances.
6. Find the target ECS instance of the classic network type, and then choose More > Network and Security Group > Connect to VPC.
7. In the displayed dialog box, select the target VPC and click OK, and then click the security group configuration link.

8. Click Add ClassicLink Rules and configure the security rule according to the following information. Then, click OK.

Configuration	Description
Classic Security Group	Display the classic network security group.
Select VPC Security Group	Select a security group to use. Up to five security groups can be selected.
Mode	Select one of the following modes: · `Classic <=> VPC` : The connected resources can access each other (recommended). · `Classic => VPC` : Authorize the classic ECS instance to access cloud resources in the connected VPC. · `VPC => Classic` : Authorize the cloud resources in the connected VPC to access the classic ECS instance.
Protocol Type and Port Range	Select the protocol and port used for the communication. The port must be in the form of xx/xx. For example, if port 80 is used, enter `80/80`.
Priority	Set the priority for the rule. A smaller number represents a higher priority, for example, `1`.
Description	Enter a description for the security rule.

9. Return to the ECS console. On the Instance List page, click the Column Filter icon in the upper-right corner, and then select the Connection Status check box. Then, click OK.



If Connection Status is Connected, ECS instances of the classic network are connected to the VPC network.