Virtual Private Cloud

Product Introduction

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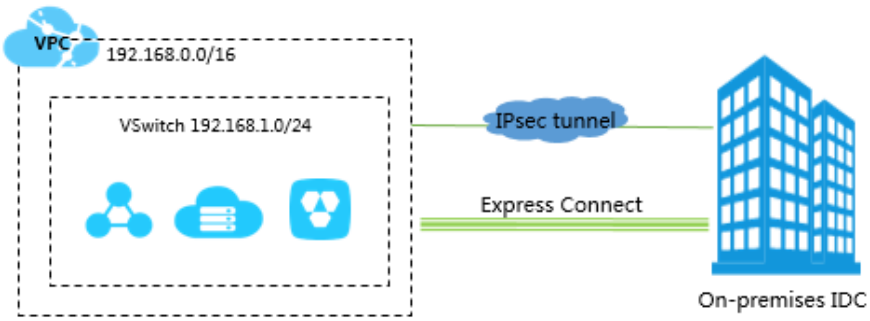
What is VPC

Virtual Private Cloud (VPC) is a private network established in Alibaba Cloud. VPCs are logically isolated from other virtual networks in Alibaba Cloud.

VPC is a private network dedicated to you in Alibaba Cloud. You have full control over your VPC, such as specifying its IP address range, and configuring route tables and network gateways. You can also use Alibaba Cloud resources such as ECS, RDS, and SLB in your own VPC.

Additionally, you can connect a VPC to another VPC or to an on-premises IDC network to form an on-demand network environment, which allows you to smoothly migrate applications to Alibaba Cloud and expand the on-premises IDC.

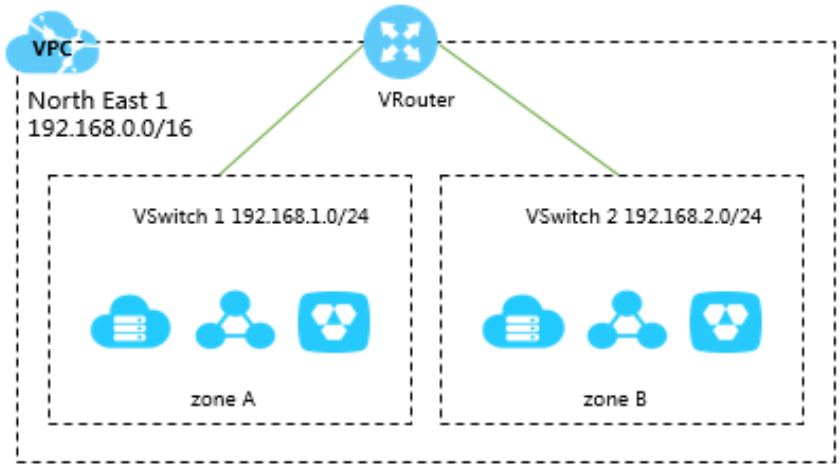


VRouter and VSwitch

VRouter is the hub of a VPC. As an important component of a VPC, it connects VSwitches in a VPC and serves as the gateway connecting the VPC with other networks. After you successfully create a VPC, the system automatically creates a VRouter, which is associated with a route table. For more information, see Routes.

VSwitch is a basic network device of a VPC and used to connect different cloud product instances. After creating a VPC, you can further segment your virtual private network to one or more subnets by creating VSwitches. The VSwitches within a VPC are interconnected. Therefore, you can deploy different an application in the different VSwitches of different zones to improve the service

availability.



IP address range

When creating a VPC or a VSwitch, you must specify the private IP address range in the form of Classless Inter-Domain Routing (CIDR) block. For more information, see Classless Inter-Domain Routing.

You can use any of the following standard CIDR blocks and their subnets as the IP address range of the VPC. After a VPC is created, you cannot change its CIDR block. We recommend that you use a large CIDR block to avoid subsequent expansion.

CIDR block	Number of available private IPs (system reserved ones not included)
192.168.0.0/16	65532
172.16.0.0/12	1048572
10.0.0.0/8	16777212

The CIDR block of a VSwitch can be the same as the CIDR block of the VPC to which it belongs or a subnet of the VPC CIDR block. The size of the subnet mask for the VSwitch CIDR block can be /16 to /29.

For more information, see Plan and design VPC.

Architecture

Background information

With the continuous development of cloud computing, virtual network requirements are getting higher and higher, such as scalability, security, reliability, privacy, and higher requirements of connection performance. This gives a rise to a variety of network virtualization technologies.

The earlier solutions combined the virtual machine's network with the physical network to form a flat network architecture, such as the large layer-2 network. With the increase of virtual network scalability, problems are getting more serious for the earlier solutions. These problems include ARP spoofing, broadcast storms, host scanning, and more. Various network isolation technologies emerged to resolve these problems by completely isolating the physical networks from the virtual networks. One technology isolates users with VLAN, but VLAN only supports up to 4096 nodes. It cannot support the huge amount of users in the cloud.

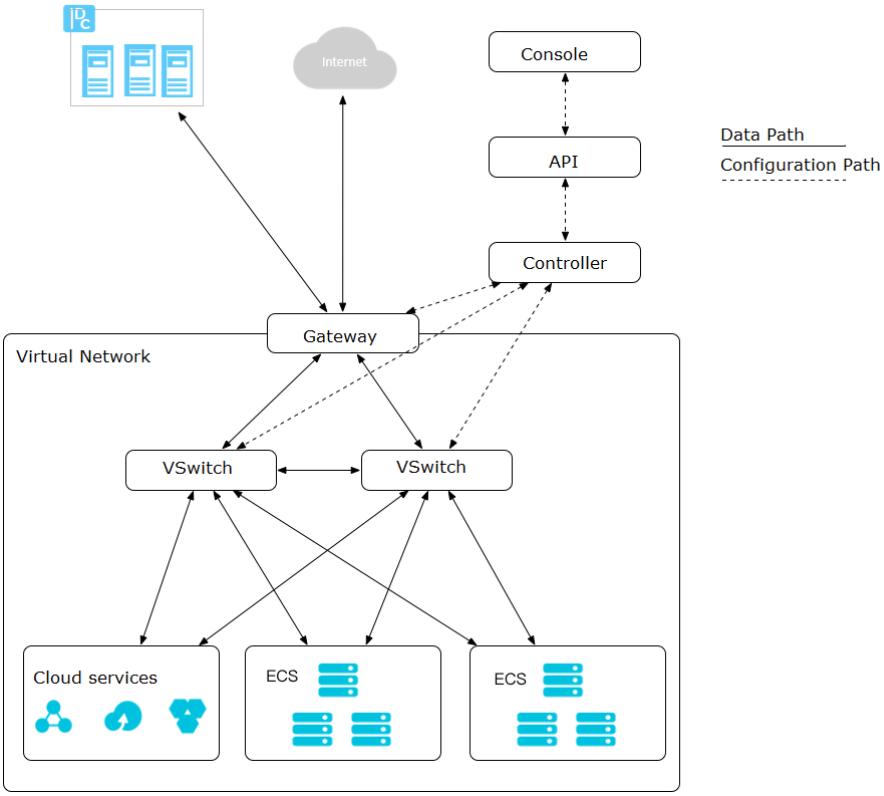
VPC theory

VPCs isolate virtual networks based on mainstream tunneling technologies. Each VPC has a unique tunnel ID, and a tunnel ID corresponds to only one VPC. A tunnel encapsulation carrying a unique tunnel ID is added to each data packet transmitted between the ECS instances within a VPC. Then, the data packet is transmitted over the physical network. Because the tunnel IDs are different for ECS instances in different VPCs and the IDs are located on two different routing planes, the ECS instances from different VPCs cannot communicate with each other and are isolated by nature.

Based on the tunneling and SDN technologies, the Alibaba Cloud research and development team has developed the VPC in the basis of hardware gateways and self-developed switch equipment.

Logical architecture

As shown in the following figure, the VPC architecture contains three main components: VSwitches, gateway, and controller.



VSwitches and gateways form the key data path. Controllers use the self-developed protocol to forward the forwarding table to the gateway and VSwitches, completing the key configuration path. In the overall architecture, the configuration path and data path are separated from each other.

VSwitches are distributed nodes, the gateway and controller are deployed in clusters, and all links have redundant disaster recovery. This improves the overall availability of the VPC. Alibaba Cloud's VSwitch and gateway performances are leaders in the field. The self-developed SDN protocol and controllers can easily control thousands of VPCs in the cloud.

Benefits

Security isolation

- The cloud servers of different users are located in different VPCs.
- Different VPCs are isolated by tunnel IDs. Using VSwitches and VRouters, you can segment your VPC into subnets as you would in the traditional network environment. Different cloud servers in the same subnet use the VSwitch to communicate with each other, while cloud servers in different subnets within a VPC use VRouters to communicate with each other.
- The intranet between different VPCs is completely isolated and can only be

interconnected by external mapping of IP (Elastic IP and NAT IP).
- Because the IP packets of cloud servers are encapsulated with the tunneling ID, the data link layer (two-layer MAC address) of the cloud server will not transfer to the physical network. Therefore, the two-layer network of different cloud servers is isolated. That is, the two-layer networks between different VPCs are isolated.
- ECS instances within a VPC use a security group firewall to control the network access. This is the third layer isolation.

Access control

- Security groups provide flexible access control rules.
- Compliant with security isolation rules of government and financial users.

Software Defined Network (SDN)

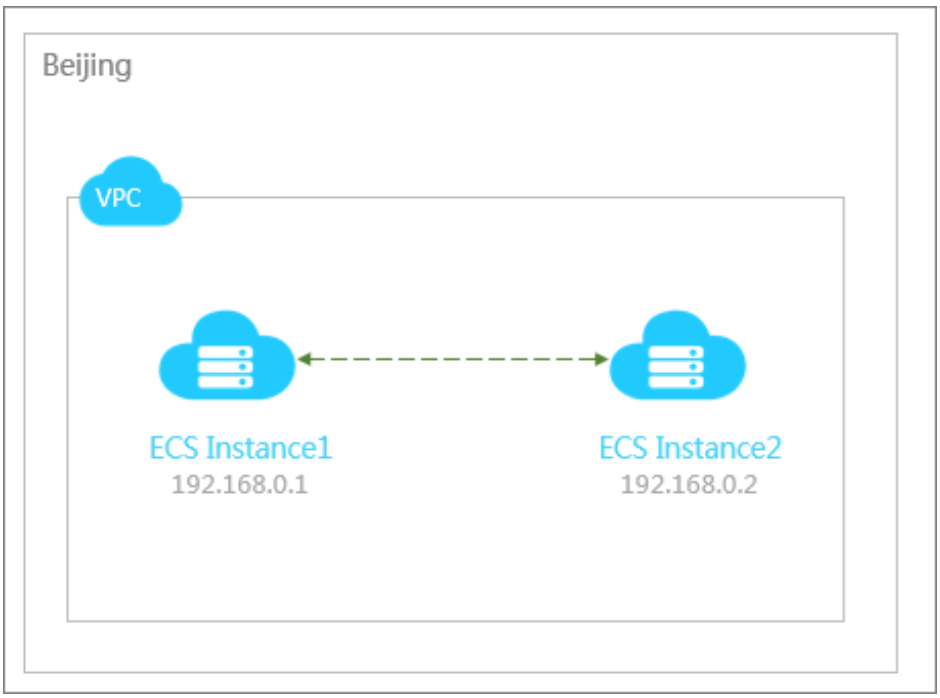
- SDN provides customized network configurations.
- Management operations take effect in real time.

Various network connection methods

- Software VPNs are supported.
- Lease line connection is supported.

VPC communication

VPC provides a completely isolated network environment. By default, intranet communications can be implemented between ECSs and cloud services within the same VPC, but the VPC itself cannot communicate with other VPCs, classic networks, or the Internet. You can use Internet-facing products such as the EIP, Express Connect, NAT, VPN Gateway, and Internet-facing SLB to implement communications between VPCs.

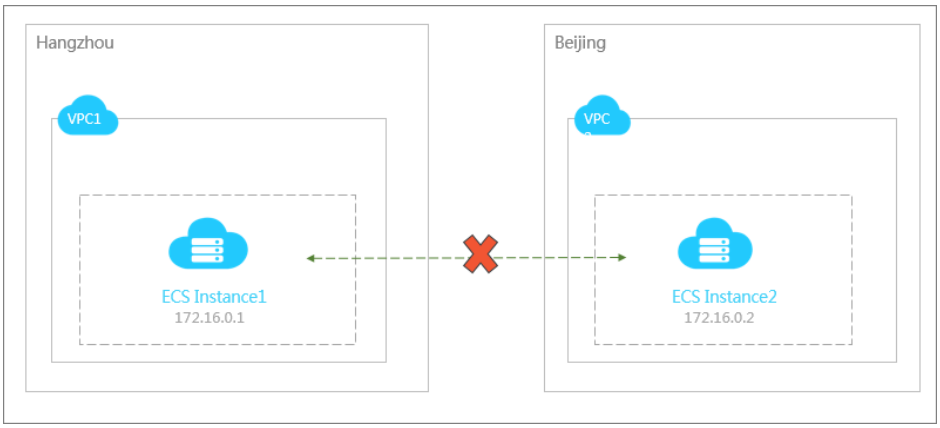


This article describes VPC communications in the following scenarios:

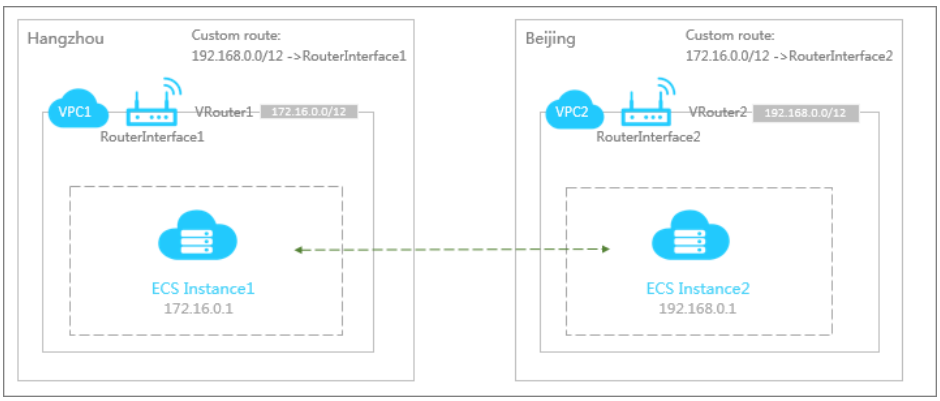
- Communications between VPCs
- Communications between VPC and Classic Network
- Communications between the VPC and the Internet
- Communications between the VPC and the local IDC

Communications between VPCs

By default, ECSs from different VPCs cannot communicate directly over the intranet.



By creating router interfaces on both sides of the VPCs to build a Express Connect on Alibaba’ s backbone transmission network, you can easily implement fast, secure, reliable, and convenient communications between VPCs. For detailed configurations, see Establish an intranet connection between VPCs in different regions.



Communications between VPC and Classic Network

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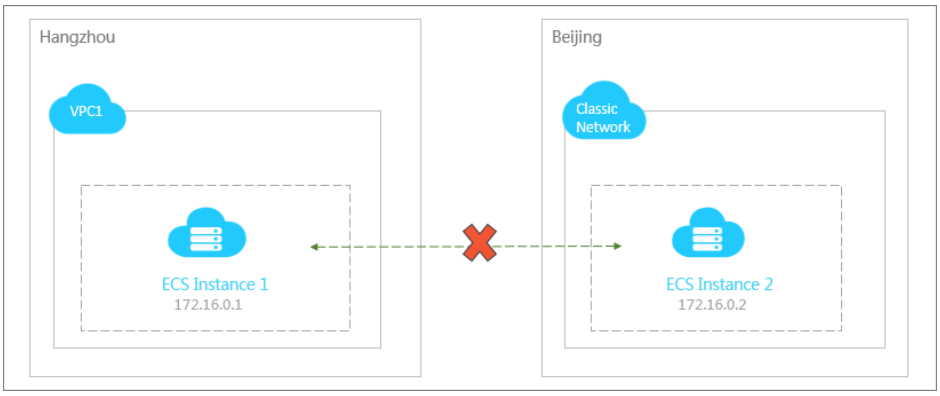


Access the classic network by the VPC

A VPC can communicate with a classic network using a public IP. A VPC can access cloud services of the classic network when the ECS instance of the VPC and the classic network or the public IP of the cloud instance complies with any one of the requirements listed in the following table.

Network Type	Configuration requirements
VPC	- Assign a public IP to the ECS instance when it is created. - Bind an EIP to the ECS instance. - Configure a NAT gateway (SNAT) on the ECS instance.
Classic network	- The ECS instance has an available public IP. - This ECS instance has been added to an Internet-facing SLB instance.

Access the VPC by the classic network

The classic network can also access the VPC using a public IP if the public IP has been configured on the ECS instance or cloud services of the VPC.

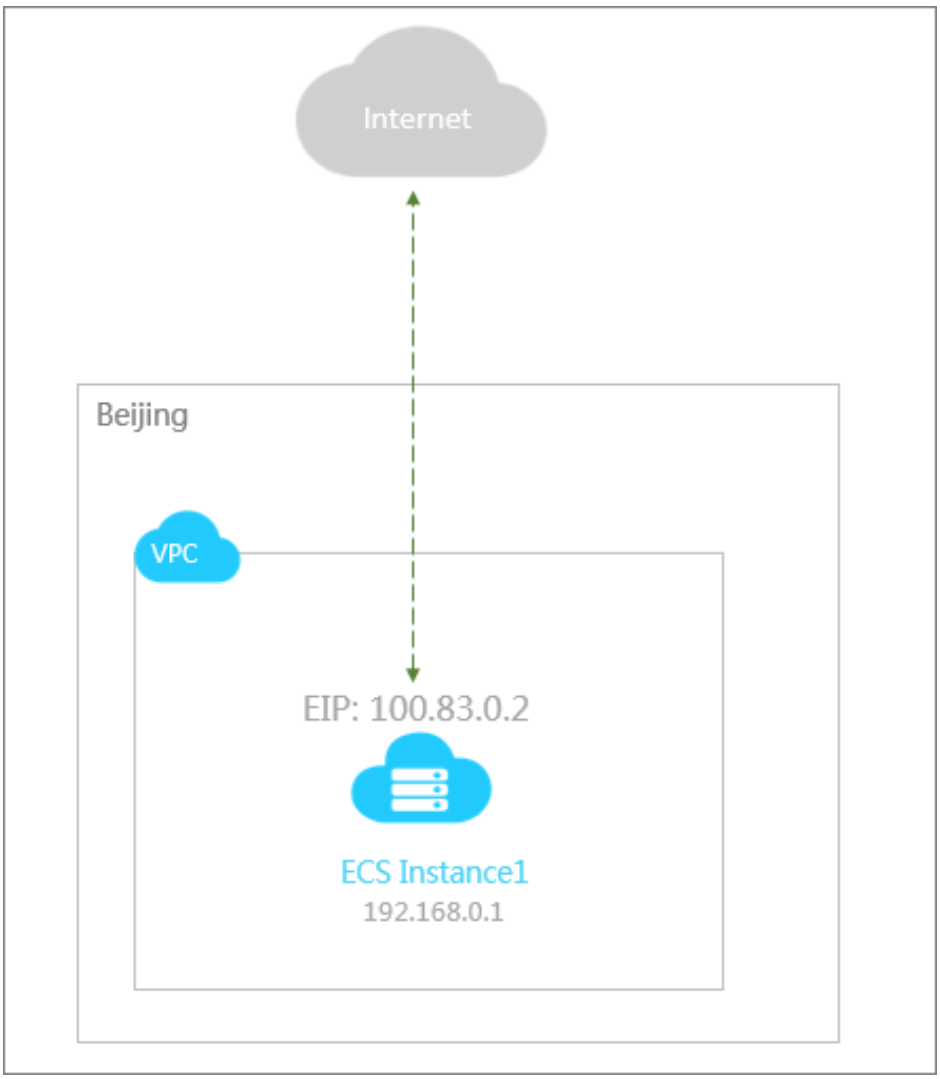
Network	Configuration requirements
Classic network	- The ECS instance has an available public IP.
VPC	- Assign a public IP to the ECS instance when it is created. - Bind an EIP to the ECS instance. - Configure a NAT gateway (DNAT) on the ECS instance. - This ECS instance has been added to an Internet-facing SLB instance.The request from the Internet is forwarded to the backend ECS using the Internet-facing SLB instance.

Communications between the VPC and the Internet

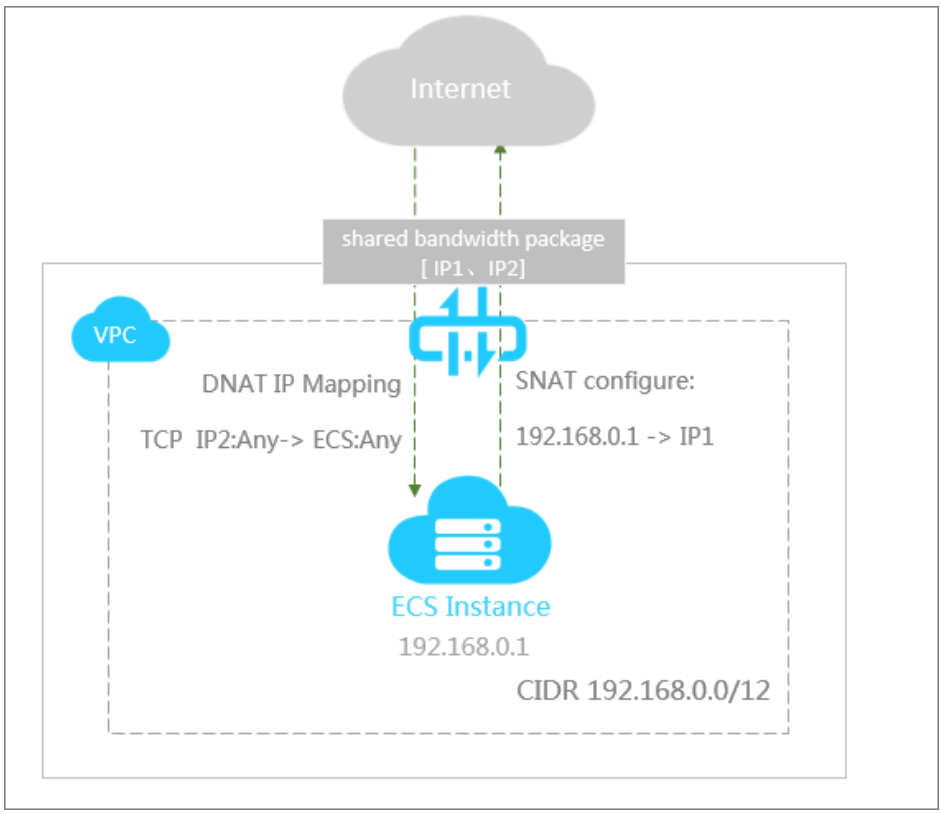
By default, the ECS in the VPC cannot communicate with the Internet. You can enable the communications between the VPC and the Internet in the following ways:

Assign a public IP to the ECS instance in the VPC to implement communications between the VPC and the Internet. For more information, see Allocate a public IP.

You can bind an EIP to the ECS to connect the VPC to the Internet. For more information, see Bind an EIP.



Configure the NAT gateway on the ECS in the VPC to implement communications between the VPC and the Internet. For more information, see Port Mapping and SNAT Configuration.



Note: If multiple ECSs need to communicate with the Internet, you can use the shared bandwidth package of the NAT gateway to share the bandwidth with all the ECS instances in the bandwidth package, thus saving your cost.

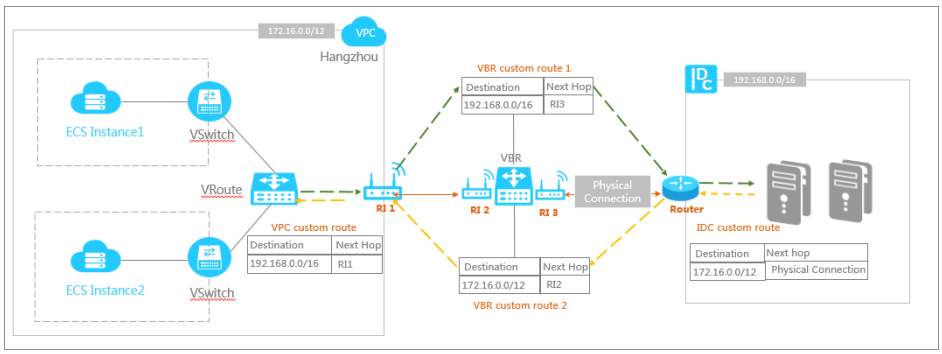
Add an ECS instance of the VPC to an Internet-facing SLB instance. For more information, see Configure an Internet-facing SLB.

Note: In this case, the ECS instance in the VPC cannot access the Internet. It can only receive the Internet request forwarded by the SLB.

Communications between the VPC and the local IDC

By default, the local IDC does not communicate with the VPC. You can implement communications between the local IDC and the VPC in the following ways:

You can use Express Connect (Physical Connection) to connect an on-premises IDC to the dedicated access points of Alibaba Cloud, and establish a virtual border router as a bridge that forwards your data from the VPC to the IDC. For more information, see Physical connection.



You can use the VPN gateway to implement communications between an on-premises IDC and a VPC. For more information, see Create a VPN gateway.

Terms

Terms	Descriptions
Virtual Private Cloud (VPC)	VPC is a private network established in Alibaba Cloud. It is logically isolated from other virtual networks in Alibaba Cloud. Alibaba Cloud VPC enables you to launch and use the Alibaba Cloud resources in your own VPC.
VSwitch	A VSwitch is a basic network device of a VPC and used to connect different cloud product instances. When creating a cloud product instance in a VPC, you must specify the VSwitch that the instance is located.
VRouter	A VRouter is a hub in the VPC that connects all VSwitches in the VPC and serves as a gateway device that connects the VPC to other networks. VRouter routes the network traffic according to the configurations of route entries.
Route Entry	Each entry in a route table is a route entry. A route entry specifies the next hop address for the network traffic destined to a CIDR block. It has two types of entries: system route entry and custom route entry.
Route Table	A route table is a list of route entries in a VRouter.

Limits

Items	Limits	Ticket submission permits exemption
Available CIDR blocks	192.168.0.0/16, 172.16.0.0/12, 10.0.0.0/8, and their subsets	Supported
Maximum number of VPCs per region	10	Supported
Maximum number of VRouters in a VPC	1	Unsupported
Maximum number of VSwitches in a VPC	24	Submit a ticket to apply for more quota
Maximum number of route tables in a VPC	1	Unsupported
Maximum number of route entries in a route table	48	Supported
Maximum number of cloud product instances that can run in a VPC	15,000	Unsupported

VRouter and VSwitch

Items	Limits
VRouter	- Each VPC can have only one VRouter. - VRouter does not support dynamic route protocols, such as BGP or OSPF. - Each VRouter has only one route table. - Route entries in a route table affect all the cloud product instances in the VPC. Currently, the source IP routing rules are not supported by VSwitches and cloud product instances.
VSwitch	- VSwitches are a layer-3 switch, therefore the layer-2 broadcast and multicast are not supported. - The number of instances that a VSwitch can have = 15,000 - the

	number of existing instances in the VPC. - The CIDR block cannot be modified.