

Alibaba Cloud Virtual Private Cloud

Product Introduction

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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.	 Note: 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 <code>cd /d C:/windows</code> command to enter the Windows system folder.
<i>Italics</i>	It is used for parameters and variables.	<code>bae log list --instanceid Instance_ID</code>
[] or [a b]	It indicates that it is a optional value, and only one item can be selected.	<code>ipconfig [-all -t]</code>
{ } or {a b}	It indicates that it is a required value, and only one item can be selected.	<code>swich {stand / slave}</code>

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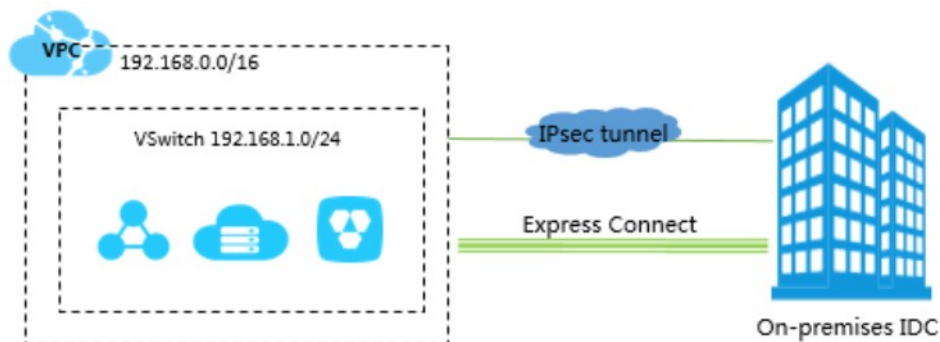
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1 What is VPC?

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 VPCs with a local network using a dedicated connection or VPN Gateway to form an on-demand customizable network environment. This allows you to smoothly migrate applications to the cloud with little effort.



Components

Each VPC consists of a private CIDR block, a VRouter and at least a VSwitch.

- CIDR block

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. For more information, see [Plan and design VPC](#).



Note:

To use a subnet of a standard CIDR block, you must use the [CreateVpc](#) API to create a VPC.

CIDR block	Number of available private IPs (system reserved ones not included)
192.168.0.0/16	65,532

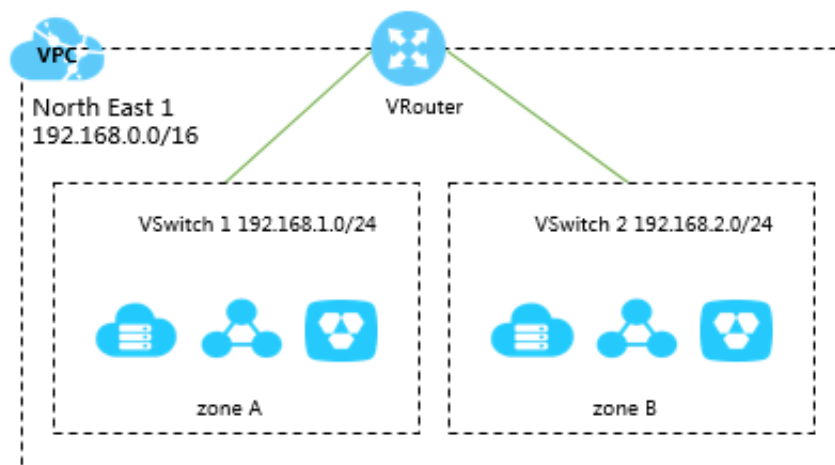
CIDR block	Number of available private IPs (system reserved ones not included)
172.16.0.0/12	1,048,572
10.0.0.0/8	16,777,212

- VRouter

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. Alibaba Cloud automatically creates VRouter after you create a VPC. A VRouter associates with a route table by default. For more information, see [Routing](#).

- VSwitch

VSwitch is a basic network module in a VPC 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 by default. Therefore, you can deploy different applications to VSwitches that are located in different zones to improve the service availability. For more information, see [Manage VSwitches](#).





2 VPC connection

Alibaba Cloud provides a lot of connectivity options to you to connect a VPC to the Internet, other VPCs, or local data centers.

Connect to Internet

The following table lists the products or functions that you can use to connect a VPC to the Internet.

Product	Function	Benefit
ECS public IP	The public IP allocated by Alibaba Cloud when creating an ECS instance of the VPC network. With this public IP, the ECS instance can access the Internet (SNAT) and also can be accessed from the Internet (DNAT). However, you cannot unbind the public IP from the ECS instance.	
Elastic IP Address (EIP)	With an EIP, the ECS instance can access the Internet (SNAT) and also can be accessed from the Internet (DNAT).	You can bind and unbind an EIP from an ECS instance at any time.
NAT Gateway	<p>NAT Gateway is an enterprise-class Internet gateway, supporting multiple ECS instances accessing the Internet with one EIP (SNAT) and being accessed from the Internet (DNAT).</p> <div> Note: Compared to Server Load Balancer, NAT Gateway itself does not provide the traffic balancing function.</div>	The core difference between NAT Gateway and EIP is that NAT Gateway supports Internet access of multiple ECS instances but EIP can only be used by an ECS instance.
Server Load Balancer	Port-based load balancing, Server Load Balancer provides Layer-4 (TCP and UDP protocols) and Layer-7 (HTTP and HTTPS protocols) load balancing. Server Load Balancer can forward the client requests from	In DNAT, Server Load Balancer supports forwarding an Internet request to multiple ECS instances. Server Load Balancer is a traffic distribution control service that distributes the incoming traffic among multiple ECS instances according

Product	Function	Benefit
	<p>the Internet to the backend ECS instances.</p> <div>  Note: The ECS instance without a public IP cannot access the Internet (SNAT) through Server Load Balancer. </div>	<p>to the configured forwarding rules . It expands application service capabilities and enhances application availability.</p>

Connect to a VPC

The following table lists the products or functions that you can use to connect a VPC to another VPC.

Product	Function	Benefit
VPN Gateway	<p>VPN Gateway allows you to create an IPsec-VPN connection to build an encrypted communication between two VPC networks.</p> <p>For more information, see Configure a VPC-to-VPC connection.</p>	<ul style="list-style-type: none"> • Low cost, secure and simple configuration. However, the quality of the network depends on the Internet. • IPsec-VPN supports IKEv1 and IKEv2 protocols. Any device that supports these two protocols can connect to Alibaba Cloud VPN Gateway. Supported devices include: Huawei, H3C, Cisco, ASN , Juniper, SonicWall, Nokia, IBM, and Ixia.
Cloud Enterprise Network (CEN)	<p>CEN allows you to connect VPCs in different regions and different accounts to build an interconnected network.</p> <p>For more information, see Tutorial overview.</p>	<ul style="list-style-type: none"> • Simple configuration, and automatic route learning and distribution. • Low latency and fast speed. • The networks (VPC/VBR) attached to a CEN instance are all connected with each other.

Product	Function	Benefit
		<ul style="list-style-type: none"> The network connection in the same region is free of charge.

Connect to a local IDC

The following table lists the products or functions that you can use to connect a VPC to a local IDC.

Table 2-1: Private network connection

Product	Function	Benefit
Express Connect	Express Connect allows you to connect to a local IDC with a dedicated physical connection. For more information, see Connect a local data center to a VPC through a physical connection .	<ul style="list-style-type: none"> Based on the backbone network, low latency. The leased line access features higher security and reliability, faster speed, and lower latency.
VPN Gateway	<ul style="list-style-type: none"> VPN Gateway allows you to create an IPsec-VPN connection to connect a VPC to a local IDC. Connect multiple local sites The VPN-Hub function of VPN Gateway allows you to connect multiple local sites to the VPC. The connected sites can communicate with the VPC, but also can communicate with one another. Remote access VPN Gateway allows you to create an SSL-VPN connection to let clients access the VPC from a remote computer. 	<ul style="list-style-type: none"> Low cost, secure and simple configuration. However, the quality of the network depends on the Internet. IPsec-VPN supports IKEv1 and IKEv2 protocols. Any device that supports these two protocols can connect to Alibaba Cloud VPN Gateway. Supported devices include: Huawei, H3C, Cisco, ASN, Juniper, SonicWall, Nokia, IBM, and Ixia. SSL-VPN connection supports connecting a VPC from a remote computer using the Linux, Windows, and Mac operating systems.

Product	Function	Benefit
Cloud Enterprise Network (CEN)	<ul style="list-style-type: none">• Connect to a local data center CEN allows you to attach the VBR associated with a local data center to a CEN instance to build an interconnected network.• Connect to multiple VPC and local networks CEN allows you to attach multiple networks (VPC/VBR) to a CEN instance. All the attached networks are all connected with each other.	<ul style="list-style-type: none">• Simple configuration, and automatic route learning and distribution.• Low latency and fast speed.• The networks (VPCs/VBRs) attached to a CEN instance are connected with each other.• The network connection in the same region is free of charge.
Smart Access Gateway	<ul style="list-style-type: none">• Smart Access Gateway allows you to connect local branches to the Alibaba Cloud to build a hybrid cloud for large organizations.• Connect local branches.	<ul style="list-style-type: none">• Highly automated configuration , out-of-box experience, and automatically and quickly adapts to network topology changes.• Access is provided from a nearby cities through the Internet . Additionally, multiple local branches can access Alibaba Cloud using the Smart Access Gateway devices with master-slave links.• The local branches and the Alibaba Cloud are connected through an encrypted private network and encryption authentication is implemented during the Internet transmission.

3 Architecture

Based on mainstream tunneling technologies, VPCs isolate virtual networks. Each VPC has a unique tunnel ID, and a tunnel ID corresponds to only one VPC.

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

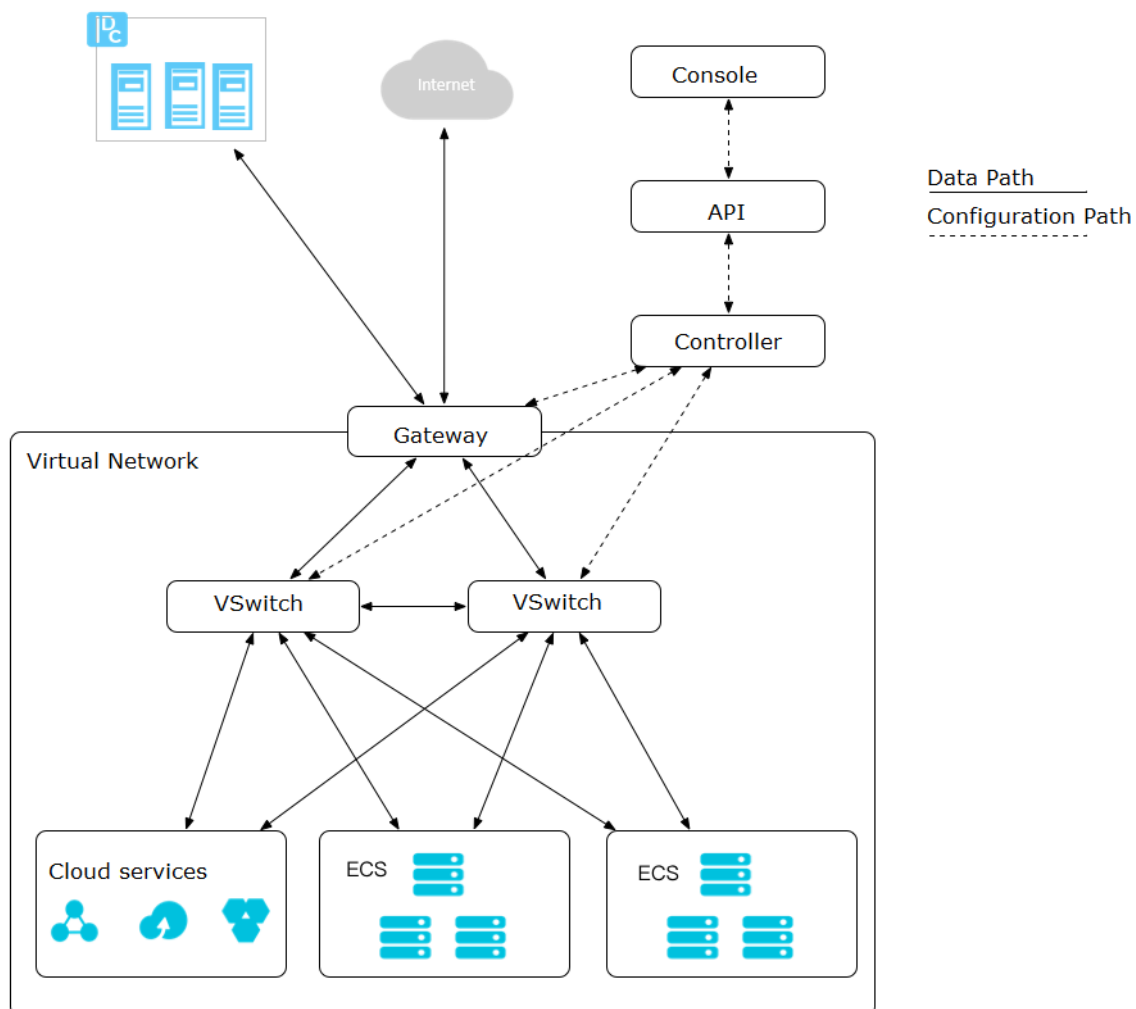
Based on mainstream tunneling technologies, VPCs isolate virtual networks. Each VPC has a unique tunnel ID, and a tunnel ID corresponds to only one VPC. A tunnel encapsulation carrying a unique tunnel ID is added to each data packet transmitted between the ECS instances within a VPC. Then, the data packet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

With the tunneling technology, Alibaba Cloud has developed VSwitch, Software Defined Network (SDN) and hardware gateway and thus created VPC.

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.



4 Benefits

VPC features high security and flexible configuration, and supports multiple connection methods.

Secure

Each VPC has a unique tunnel ID, and each tunnel ID corresponds to a virtual network. Different VPCs are isolated by tunnel IDs:

- Using VSwitches and VRouter, you can segment your VPC into subnets as you would in the traditional network environment. Different cloud resources in the same subnet use the VSwitch to communicate with each other, while cloud resources in different subnets within a VPC use VRouters to communicate with each other.
- The intranet communication between different VPCs is completely isolated and can only be interconnected by mapping an external IP (Elastic IP and NAT IP).
- The IP packets of ECS are encapsulated with the tunneling ID, the data link layer (two-layer MAC address) will not transfer to the physical network. Therefore, the two-layer network of different ECS is isolated. That is, the two-layer networks between different VPCs are isolated.
- ECS instances in VPC use security groups as firewalls to control the traffic to and from ECS instances. This is the third-layer isolation.

Controllable

You can use security groups or whitelists to control the inbound and outbound traffic going through the cloud resources in a VPC.

Ease of use

You can quickly create and manage your private network on the VPC console. After a VPC is created, the system automatically creates a VRouter and a route table for it.

Scalable

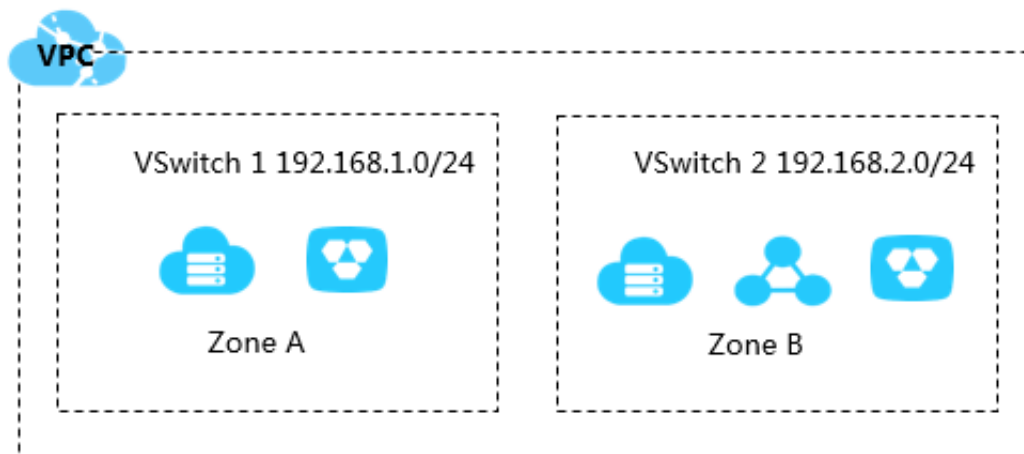
You can create multiple subnets in a VPC to deploy different services. Additionally, you can connect a VPC to a local data center or other VPCs to expand the network architecture.

5 Scenarios

VPC applies to scenarios with high requirement on communication security and service availability.

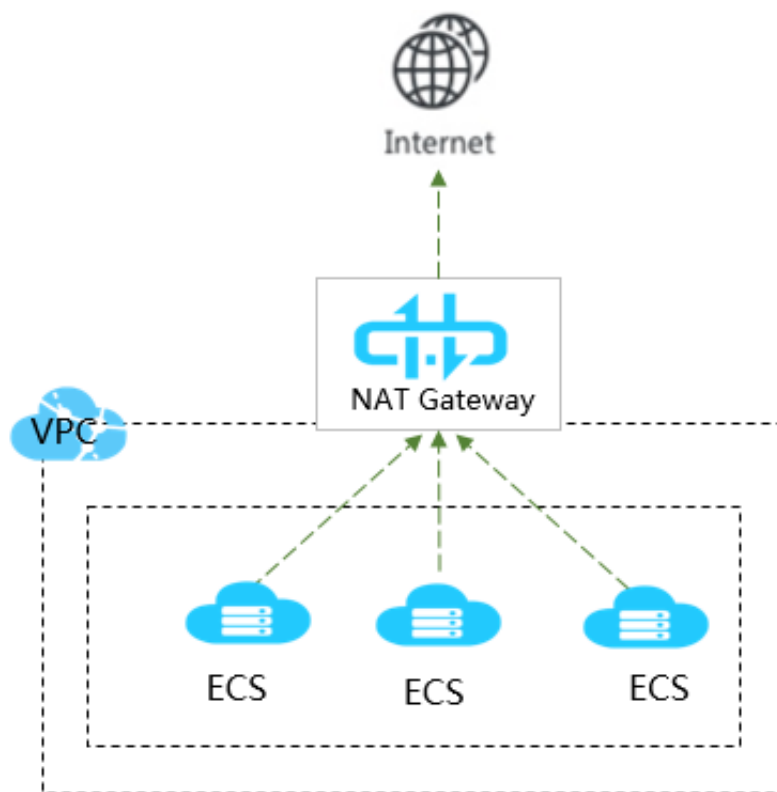
Host applications

You can host an application that provides external services in a VPC and control Internet access by creating security group rules and whitelist. You can also control the access by isolating the application server from the database. For example, deploy the web server in a subnet that can access the Internet and deploy the database of the application in a subnet without Internet access.



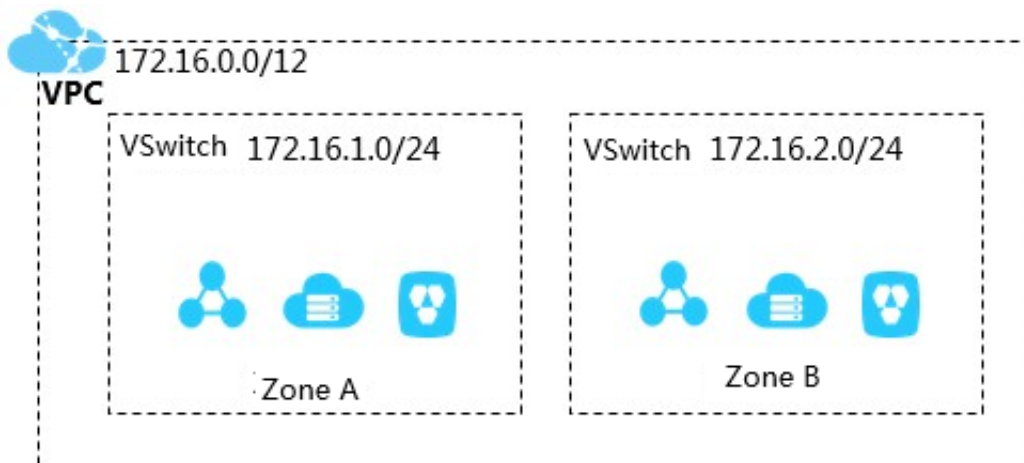
Host applications requiring the access to the Internet

You can host an application that requires to access the Internet in a subnet of a VPC and route the traffic through NAT Gateway. By configuring SNAT rules, the instance in the subnet can access the Internet without exposing its private IP address and the private IP address can be changed to a public IP address any time to avoid external attacks.



Cross-zone disaster tolerance

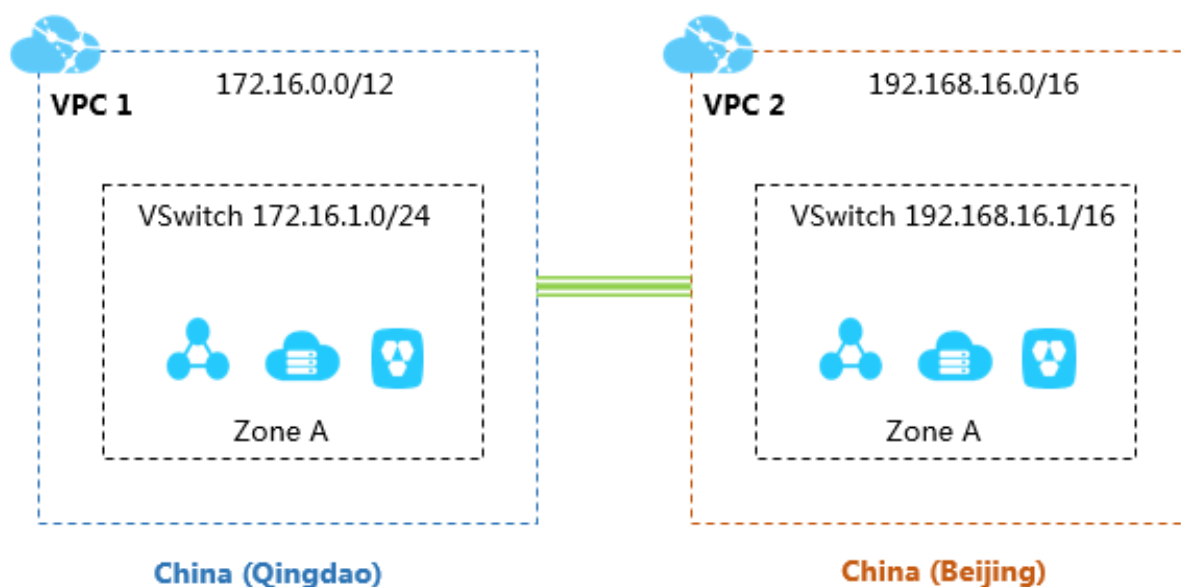
You can create one or multiple subnets in a VPC by creating VSwitches. Different VSwitches in a VPC can communicate with one another through the intranet. You can deploy resources in VSwitches of different zones to achieve cross-zone disaster tolerance.



Business system isolation

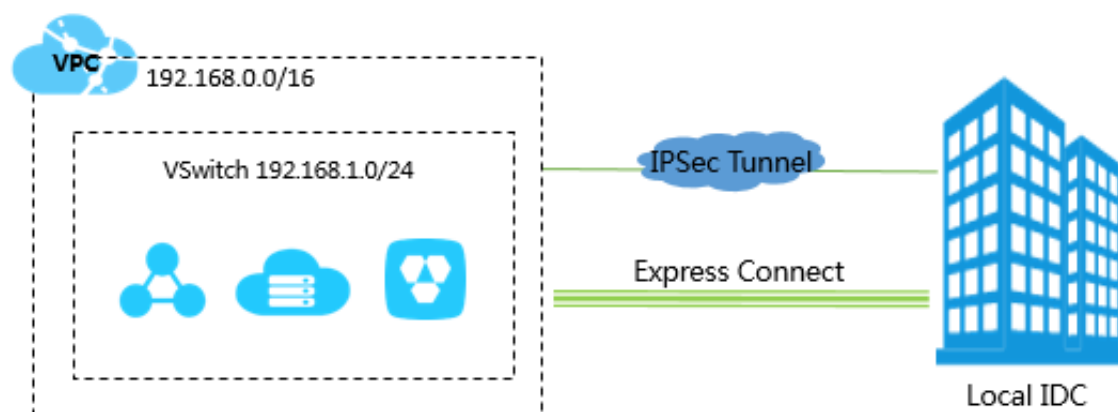
Different VPCs are logically isolated from one another. If you must isolate multiple business systems, such as isolating the production environment from the test environment, you can create

multiple VPCs. When the VPCs need to communicate with each other, you can create a peer connection between them.



Build hybrid cloud

You can create a dedicated connection to connect your VPC to a local data center to expand your local network. With the dedicated connection, you can seamlessly migrate your local applications to the cloud without changing the way of the application access.



6 Terms

Terms	Description
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, such as ECS, SLB, and RDS.
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 Table	A route table is a list of route entries in a VRouter.
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.