

# Cloud Computing Basics



# Foreword

- Enterprises in the fast-growing ICT industry are posing higher requirements on compute, storage, and networking resources. Within this context, a new architecture - cloud computing - has emerged to meet the need for on-demand resources and accelerate business innovation.

# Objectives

- Upon completion of this course, you will be able to:
  - Understand what cloud computing is, what runs on the cloud, and what you can achieve with the cloud.
  - Understand cutting-edge cloud technologies, future cloud trends, application scenarios, and cases.
  - Understand the benefits and future breakthroughs of cloud computing.

# Contents

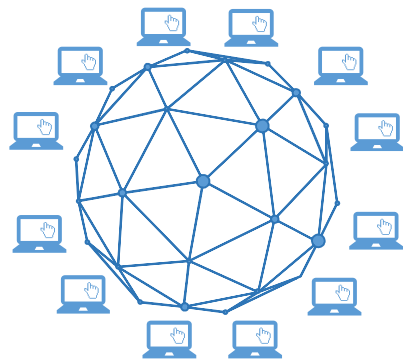
## **1. Cloud Computing Basics**

- Background of Cloud Computing
- Definition of Cloud Computing
- Cloud Computing Is Around Us
- Cloud Computing Models
- Benefits of Cloud Computing

## 2. Cloud Computing Technologies

# The Information Explosion Is Coming

- With the prevalence of the mobile Internet and fully connected era, more terminal devices are being used and data is exploding every day, posing unprecedented challenges on conventional ICT infrastructure.



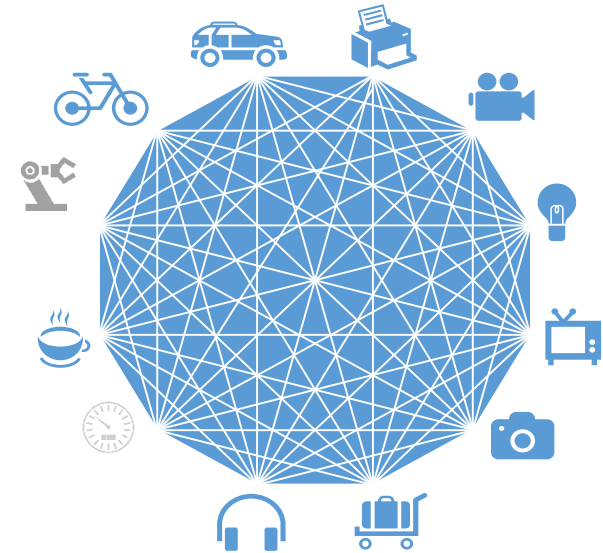
PC era  
Computers of the  
x86 architecture

**Windows/Linux**



Mobile Internet era  
Mobile phones of the ARM  
architecture

**Android/iOS**



IoT era  
x86, ARM, DSP, MIPS, FPGA, etc.

**IoT OS**



# Challenges Faced by Conventional IT Architecture

- The Internet era has brought a large amount of traffic, users, and data to enterprises, but conventional IT architecture cannot meet the requirements for rapid enterprise development.

Slow service rollout

Difficult expansion

Low reliability

Complex lifecycle management

Latency caused by I/O bottlenecks

High TCO

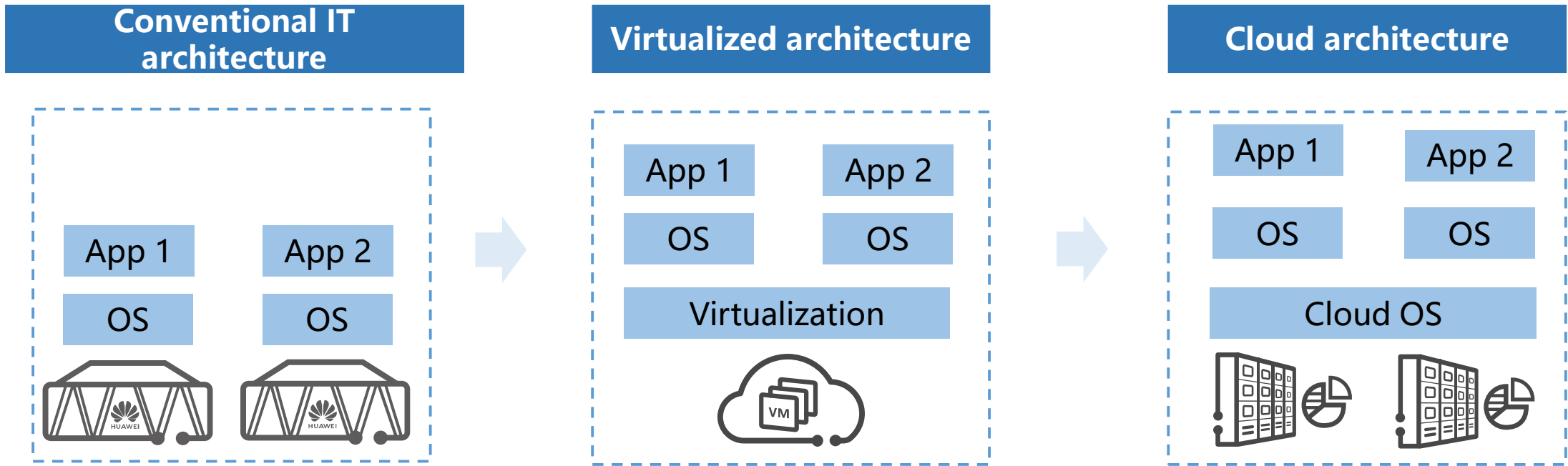
# Discussion:

- How can IT enterprises overcome these challenges?

- **IT infrastructure transformation**
- **Resource integration and comprehensive utilization**
- **Business collaboration and continuous optimization**



# Enterprises Are Migrating To the Cloud Architecture





# Contents

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- Background of Cloud Computing
- Definition of Cloud Computing
- Cloud Computing Is Around Us
- Cloud Computing Models
- Benefits of Cloud Computing

## 2. Cloud Computing Technologies

# Cloud Computing Definition

- Cloud computing is a model for enabling ubiquitous, convenient, **on-demand network access** to a **shared pool** of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be **rapidly provisioned** and released with **minimal management** effort or service provider interaction.

--National Institute of Standards and Technology (NIST)

- Simply put, the term "cloud" is a metaphor for networks and the Internet, and refers to an abstraction of the Internet and the infrastructure that underpins it. Computing refers to computing services provided by a powerful computer with a range of functionalities, resources, and storage. As such, cloud computing can be viewed as the delivery of on-demand, measured computing services over the Internet.

# Contents

## **1. Cloud Computing Basics**

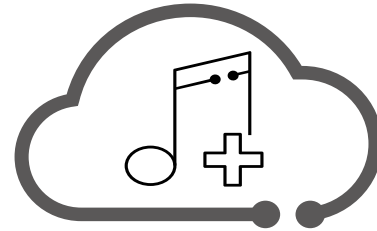
- Background of Cloud Computing
- Definition of Cloud Computing
- **Cloud Computing Is Around Us**
- Cloud Computing Models
- Benefits of Cloud Computing

## 2. Cloud Computing Technologies

# Cloud Services and Applications Around Us (Individuals)



Cloud albums



Cloud  
music



Cloud  
videos



Cloud documents

# Cloud Services and Applications Around Us (Enterprises)

- HUAWEI CLOUD Meeting allows interactive video and voice communications between people in two or more locations.



Videoconference

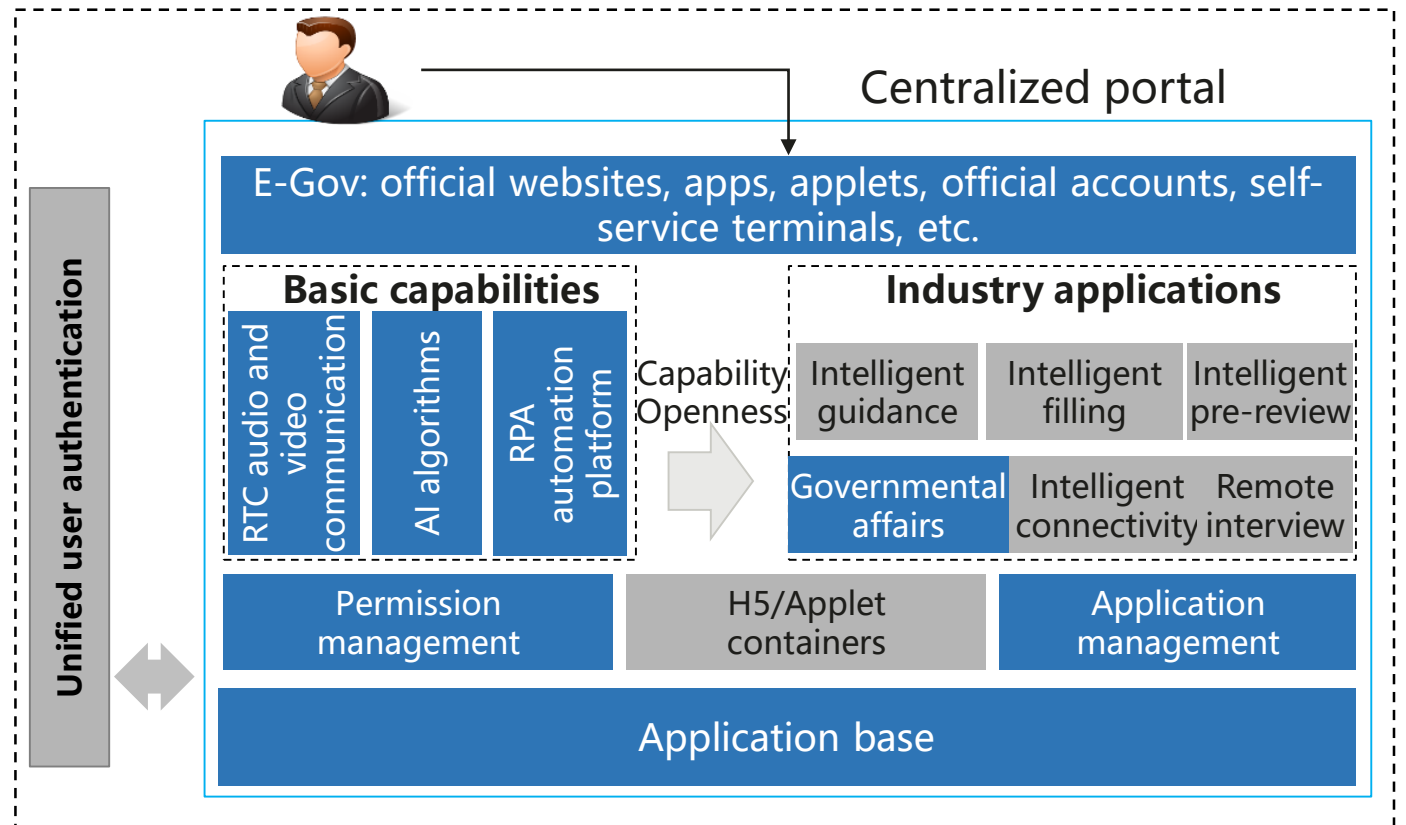


Livestream

# E-Gov Cloud - Online Services

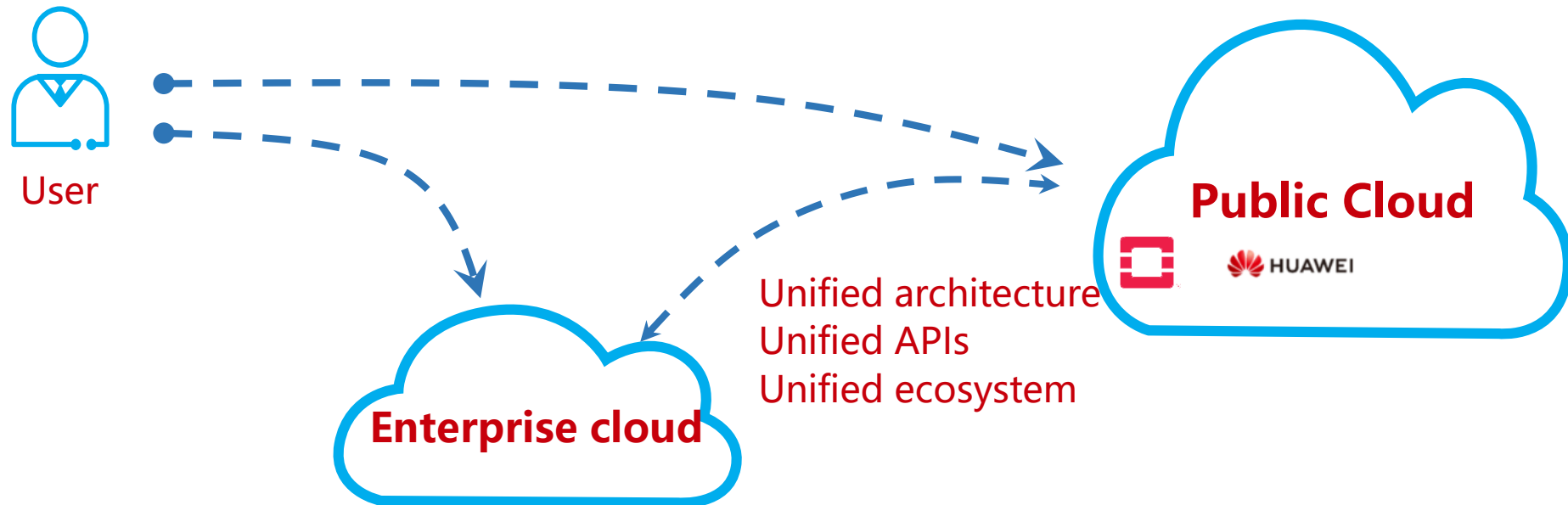
- The e-Government cloud enables access to comprehensive public services through the Internet and serves as an extensive service platform with software, application, and information resources provisioned for governmental bodies. It utilizes the compute, storage, network, security, and application resources in existing equipment rooms and leverages cloud computing to offer high reliability, availability, and elasticity.

- 24/7 e-Gov services:**  
Public services are available to citizens and enterprises online.
- One-stop shop for all services**  
The e-Gov cloud allows information sharing and makes collaborative approval possible.
- Virtual lobby managers**  
Virtual lobby managers are always ready to provide assistance.
- AI & RPA robots:**  
AI robots assist with intelligent pre-review and RPA robots assist with system data synchronization, reducing the pressure on staff and improving service efficiency.



# Public Cloud

- Simply put, the public cloud enables IT resources to be as accessible as electricity and water through the Internet.





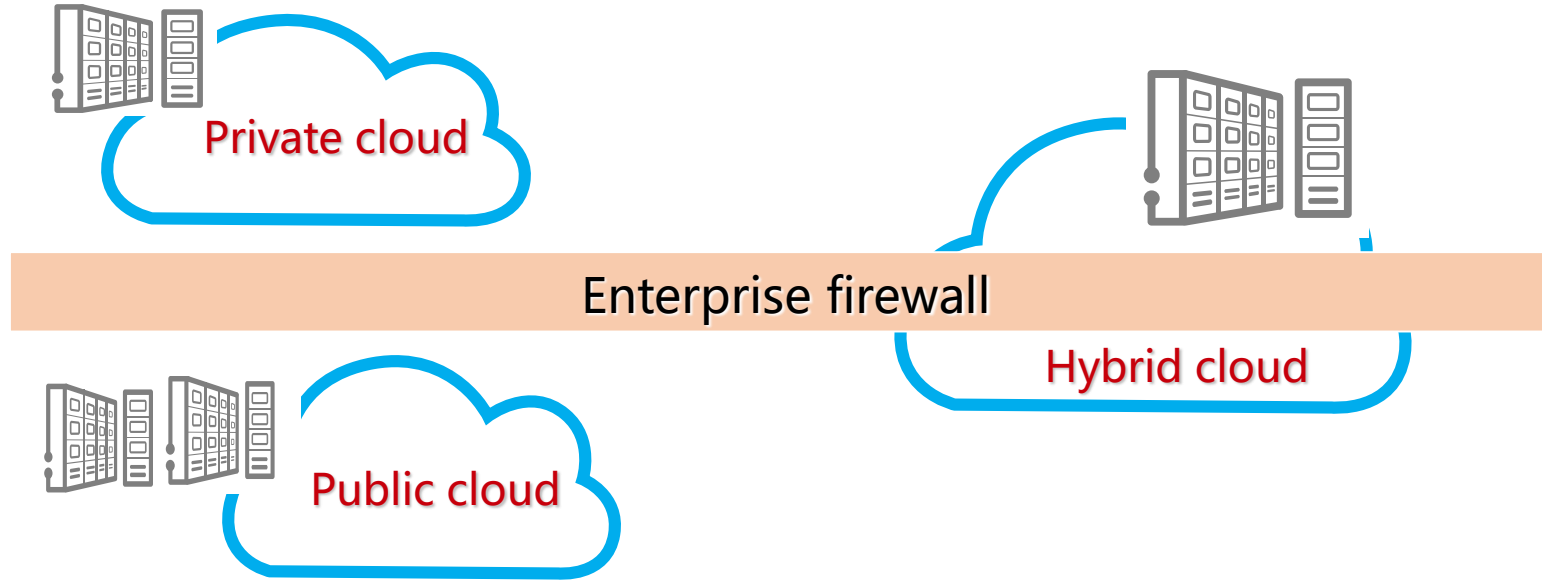
# Contents

## **1. Cloud Computing Basics**

- Background of Cloud Computing
- Definition of Cloud Computing
- Cloud Computing Is Around Us
- **Cloud Computing Models**
- Benefits of Cloud Computing

## 2. Cloud Computing Technologies

# Deployment Models for Cloud Computing

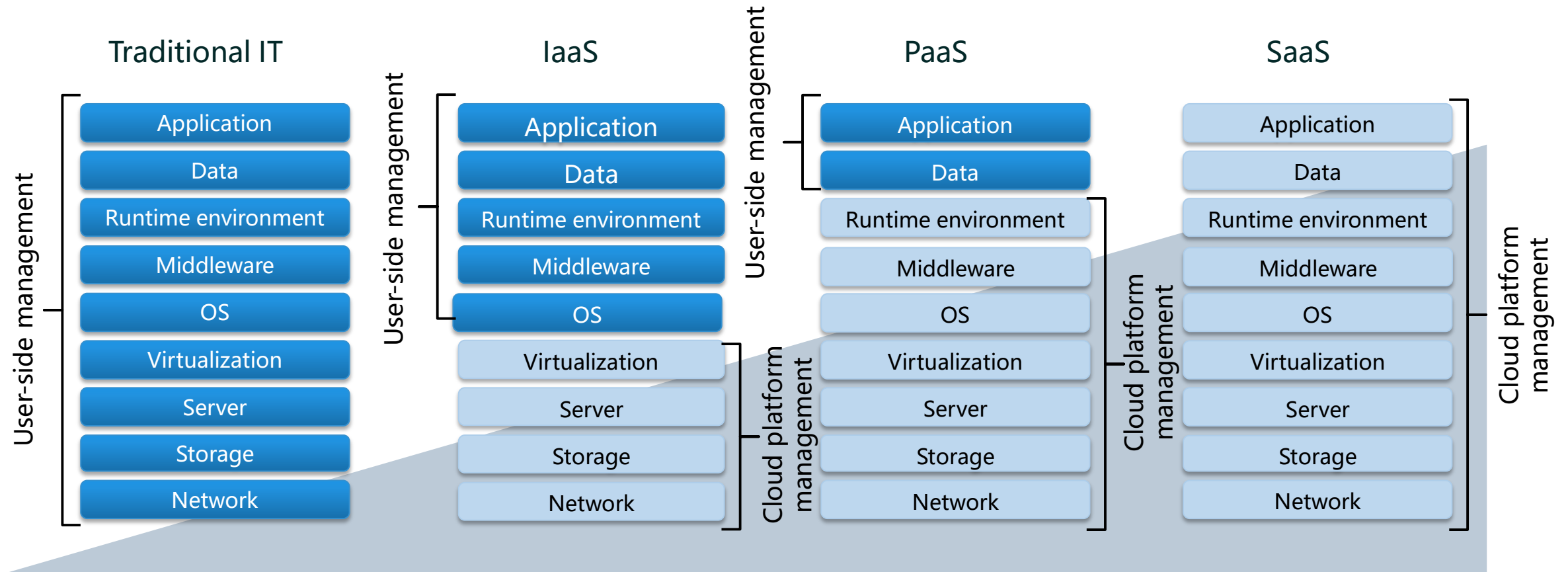


**Private cloud:** The cloud infrastructure is provisioned for exclusive use by a single organization.

**Public cloud:** The cloud infrastructure is owned and managed by a third-party provider and shared with multiple organizations using the public Internet.

**Hybrid cloud:** This is a combination of public and private clouds, viewed as a single cloud externally.

# Service Models for Cloud Computing



# Contents

## **1. Cloud Computing Basics**

- Background of Cloud Computing
- Definition of Cloud Computing
- Cloud Computing Is Around Us
- Cloud Computing Models
  - Benefits of Cloud Computing

## 2. Cloud Computing Technologies

# Benefits of Cloud Computing

On-demand self-service

Broad network access

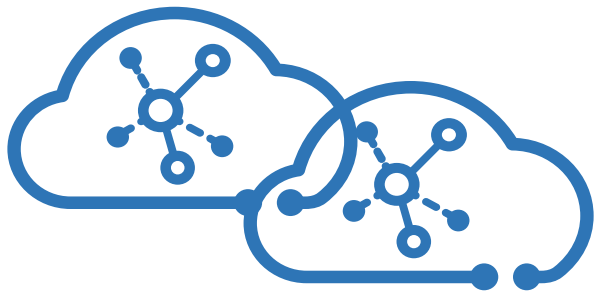
Resource pooling

Quick deployment and auto scaling

Metered services

# Eight Common Characteristics of Cloud Computing

- Massive scale
  - Homogeneity
    - Virtualization
      - Resilient computing
        - Low-cost software
          - Advanced security technologies
            - Geographical distribution
              - Service orientation



# Contents

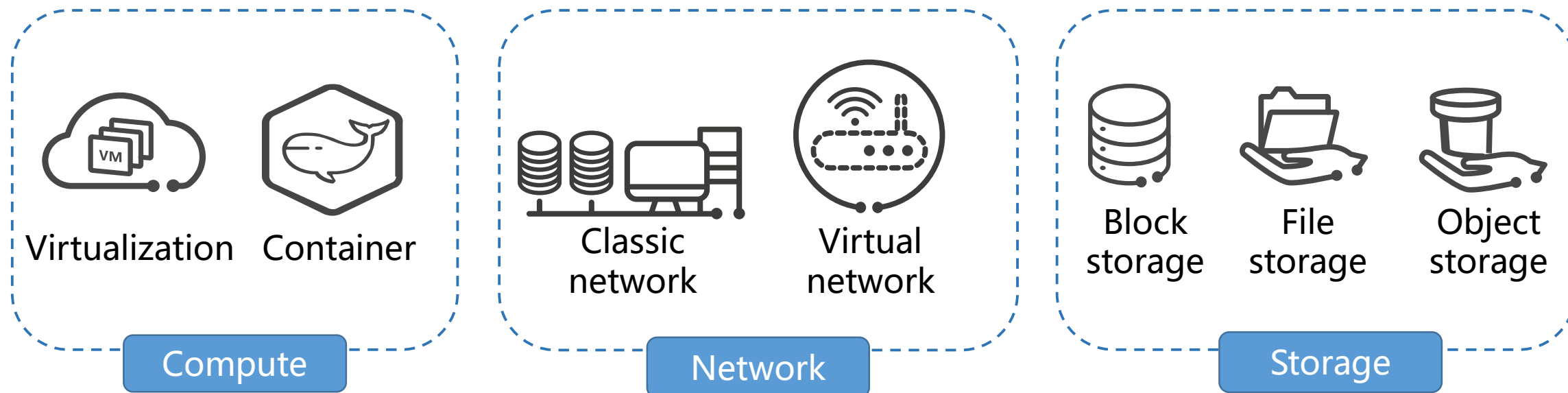
1. Cloud Computing Basics

## **2. Cloud Computing Technologies**

- Compute
- Network
- Storage

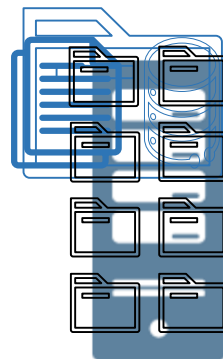


# Overview



# What Is Virtualization?

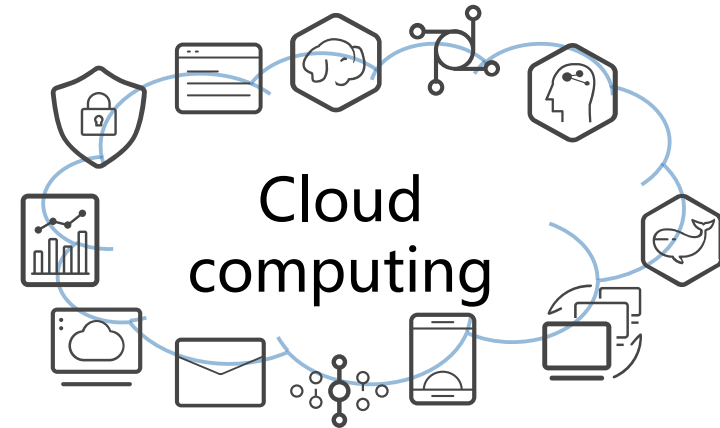
- The virtualization technology refers to the process of creating multiple VMs that share the hardware resources of a physical server.
  - A VM consists of **disk files** and **description files**, which are encapsulated in the same folder.
  - Multiple VMs running on the server are separately encapsulated in multiple folders and mutually isolated.
    - These folders can be stored in the **file system** provided by the underlying storage. Therefore, multiple VMs can be **stored** or **run** on a **shared medium**.



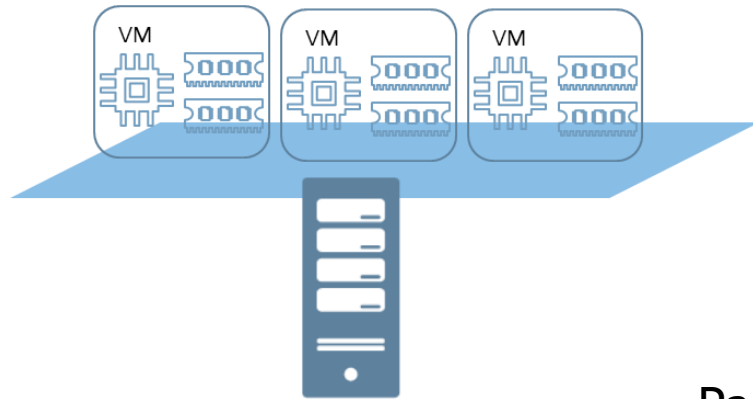
- The key concept behind virtualization involves separating software from hardware by converting "physical" devices into "logical" folders or files.

# Virtualization vs. Cloud Computing

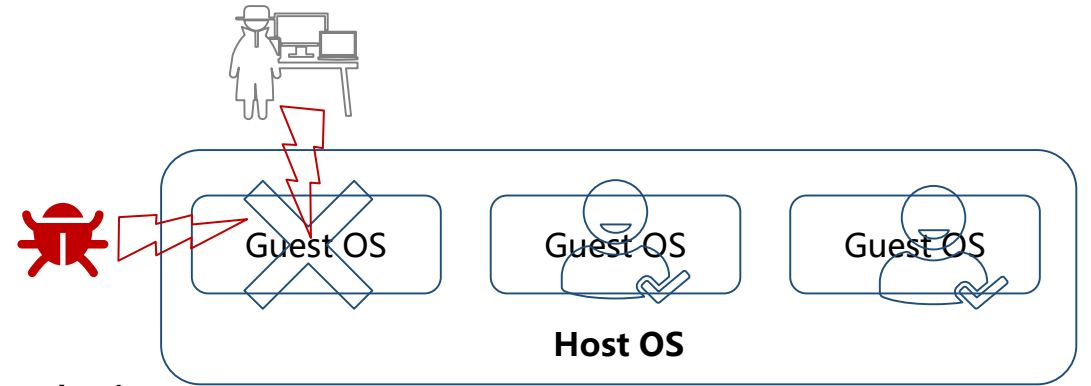
- Virtualization is the fundamental technology that powers cloud computing. It transforms physical hardware into virtual resources. On the other hand, the cloud is an environment that delivers virtualized resources on-demand through the internet.



# Main Features of Virtualization



Partitioning

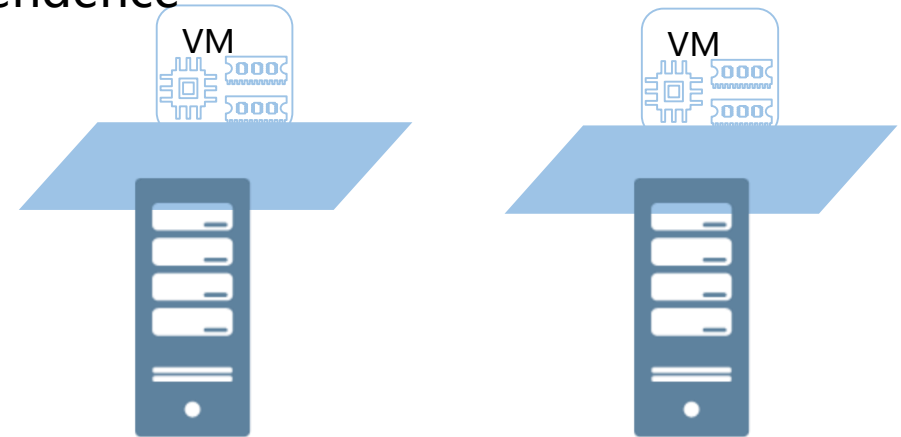


Isolation

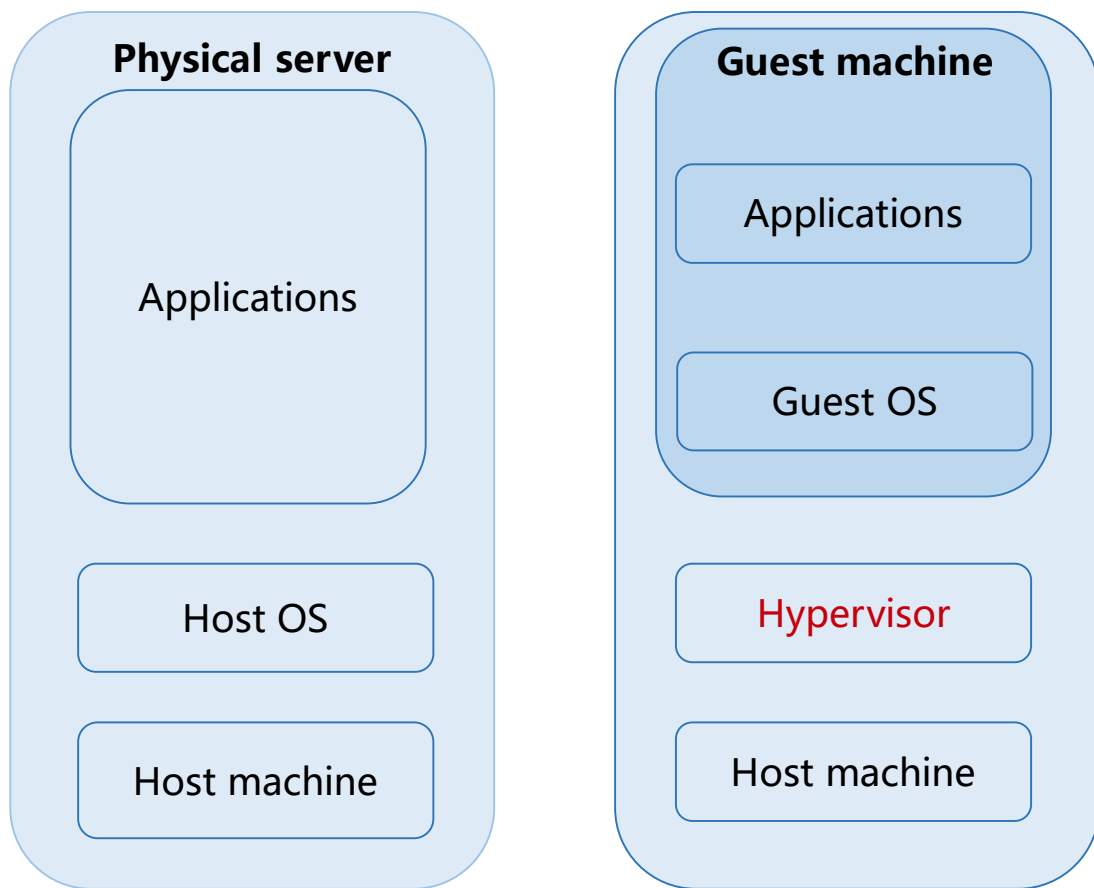
Encapsulation



Independence



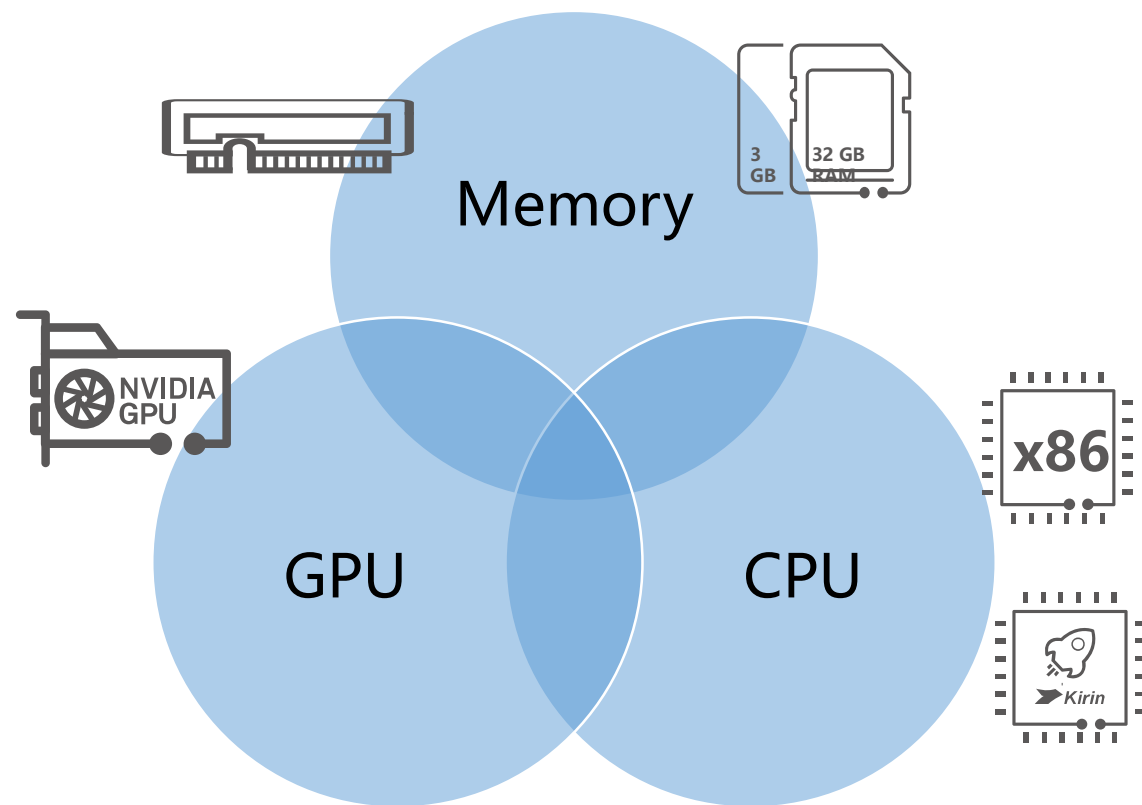
# Important Virtualization Concepts



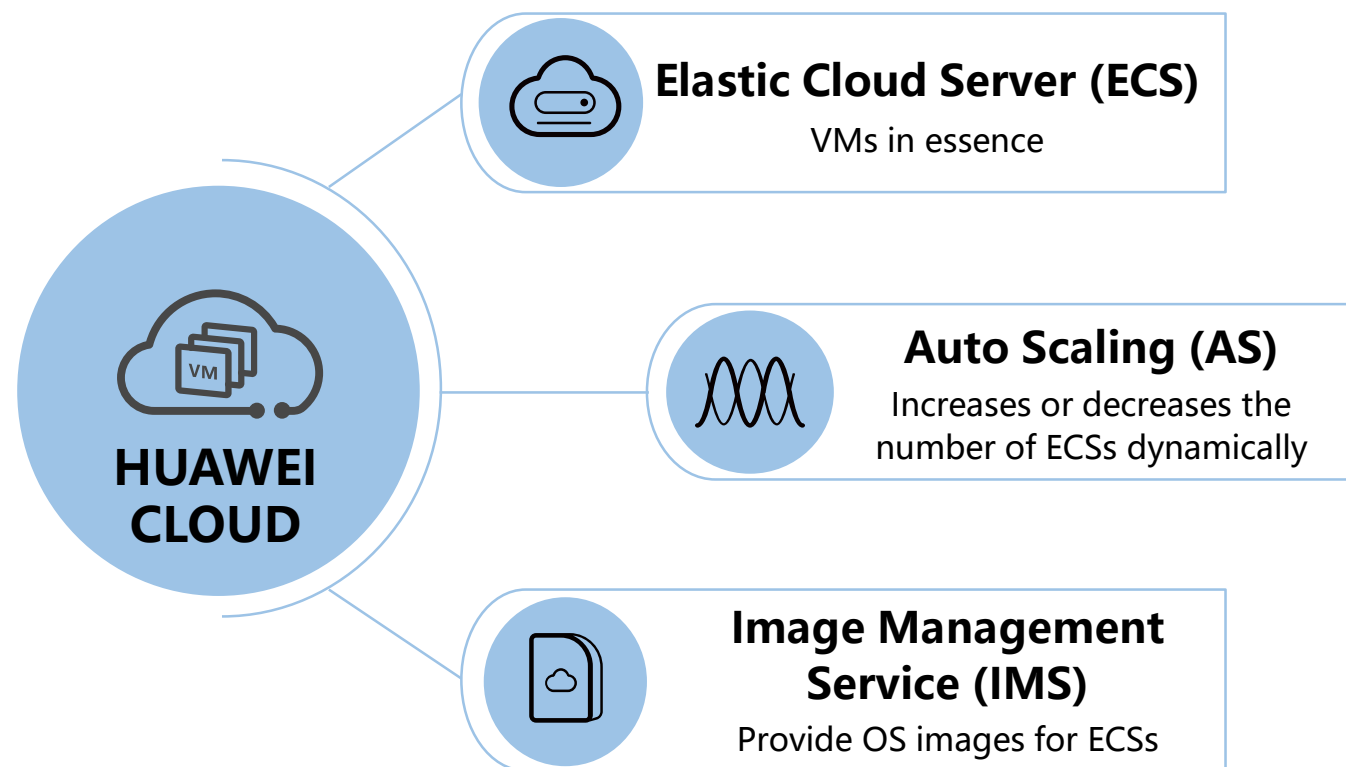
- **Guest OS:** Virtual machine (VM) OS
- **Guest Machine:** VM
- **Hypervisor:** Virtualization software layer/Virtual machine monitor (VMM)
- **Host OS:** OS running on a physical machine
- **Host machine:** physical machine

# Computing Resources Around Us

- Computing essentially refers to the process of obtaining information. In the ICT industry, several resources are needed to calculate data and obtain information.



# HUAWEI CLOUD Compute Services





# What Is a Container?

- A container is a lightweight, portable technology for application packaging. It is a standard unit that packages an application's code and all its dependencies, enabling the application to run across different computing environments. Simply put, containers are like standardized boxes that can hold different types of things and be put into different cabinets.

 **Static website**  
nginx 1.5 + modsecurity + openssl + bootstrap 2

 **User DB**  
postgresql + pgv8 + v8

 **Analytics DB**  
hadoop + hive + thrift + OpenJDK

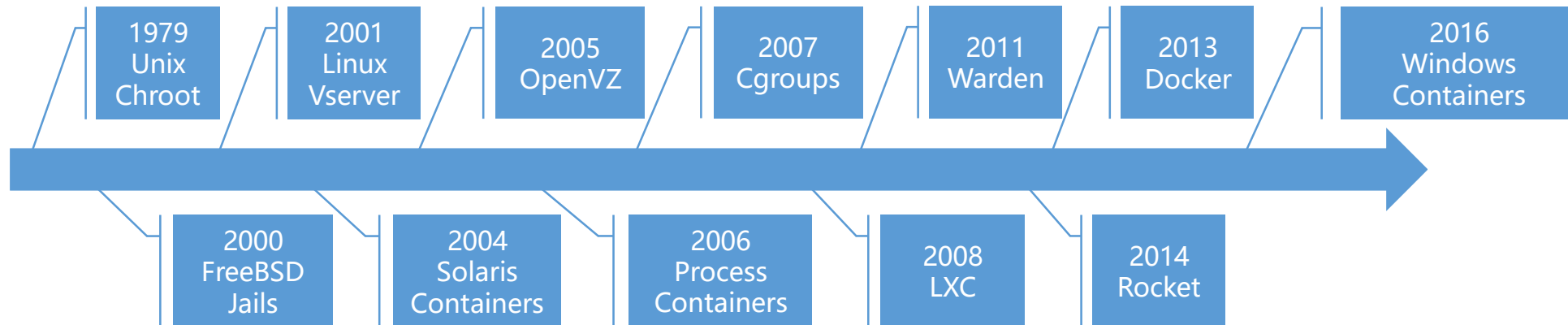
 **Web frontend**  
Ruby + Rails + sass + Unicorn  
+ nodejs +



 **API endpoint**  
Python 2.7 + Flask + pyredis + celery + pycopg + postgresql-client

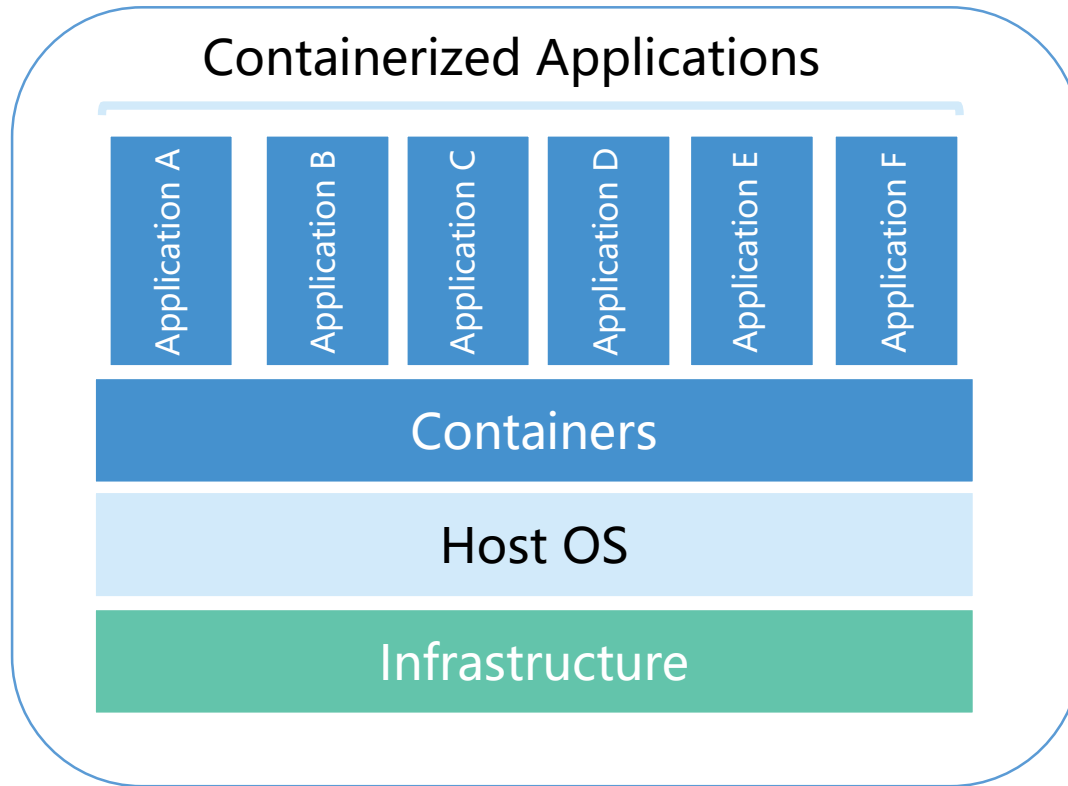
# Container Technology Development

- Two challenges in the development of container technology:
  - Unified platform
  - Usability

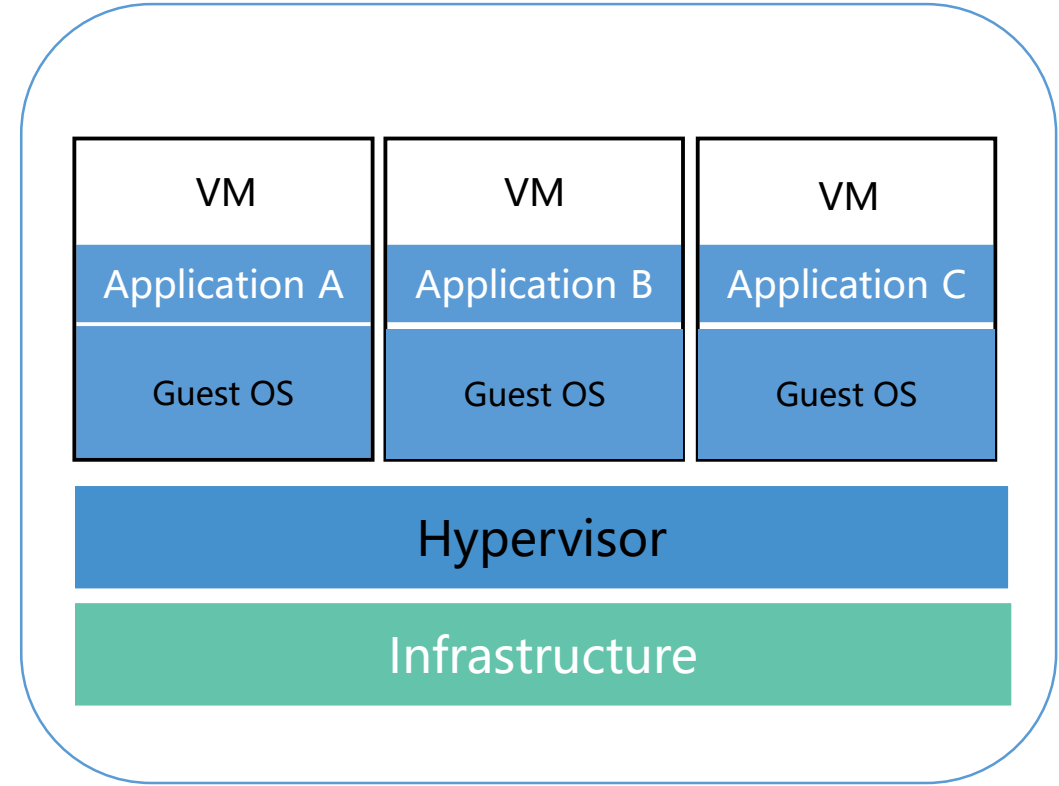


Container development panorama

# Difference Between Containers and VMs (1)



Container architecture

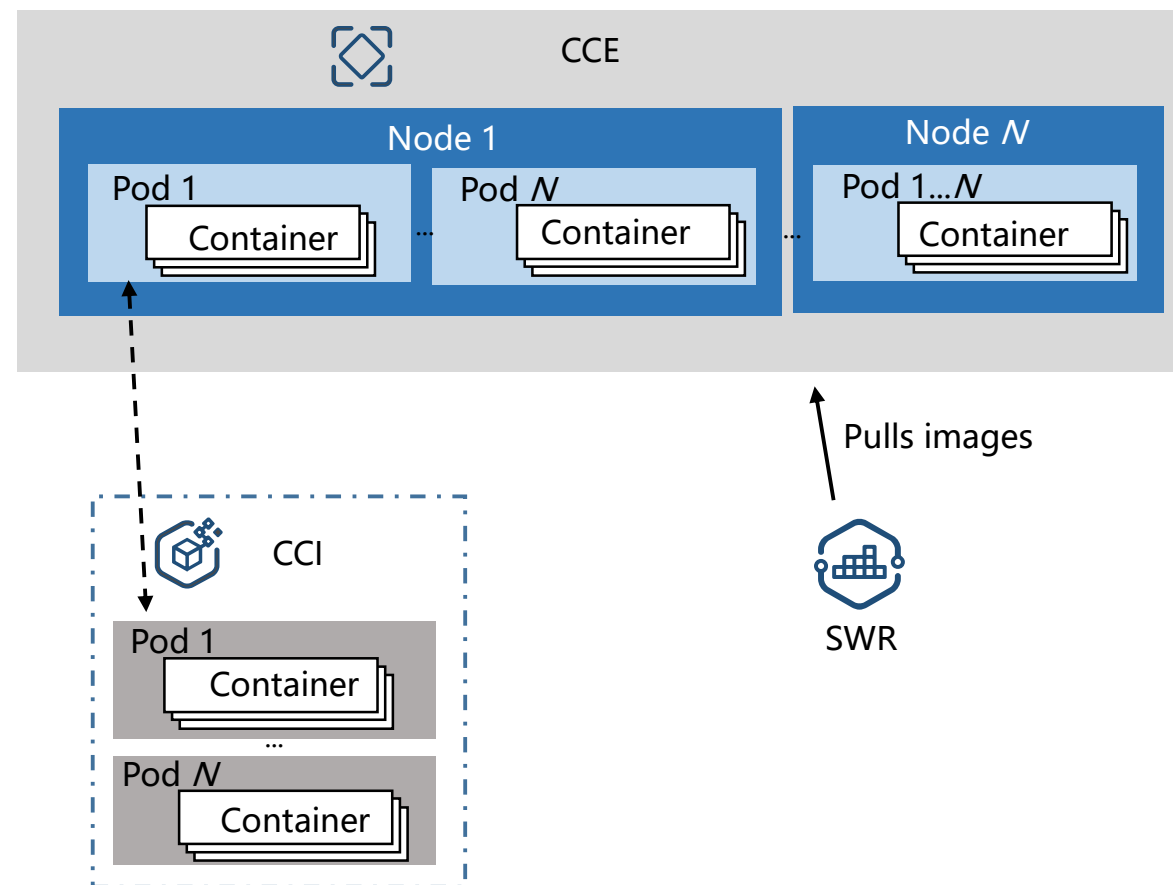
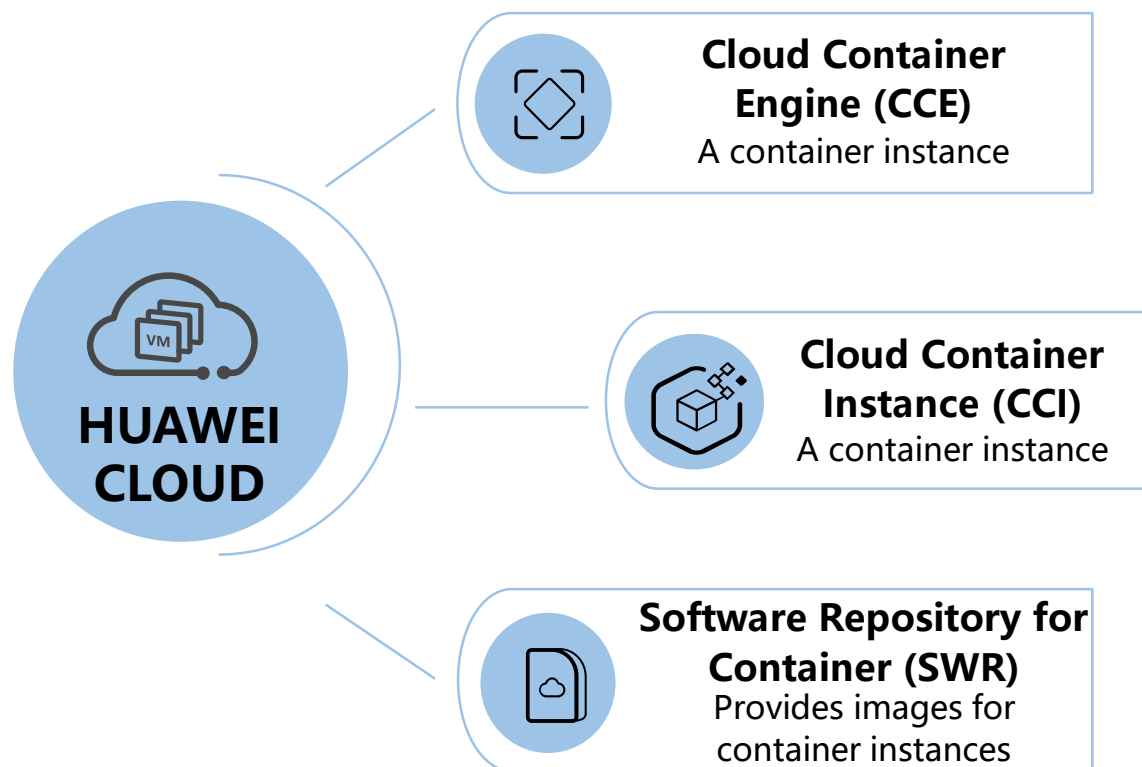


Virtualization architecture

# Difference Between Containers and VMs (2)

Item	Container	VM
Startup speed	Seconds	Minutes
Virtualization type	OS virtualization	Hardware virtualization
OS dependency	All containers share the host OS.	Each VM runs in its own guest OS.
Security	Process isolation with security risks	Complete isolation, which is more secure
Isolation strategy	Hypervisor	Cgroups
Image size	KB to MB	GB to TB
Virtualization performance	On par with physical servers	Limited
Per-machine capacity	Over 1,000 containers for each physical machine	Dozens of VMs

# HUAWEI CLOUD Container Services



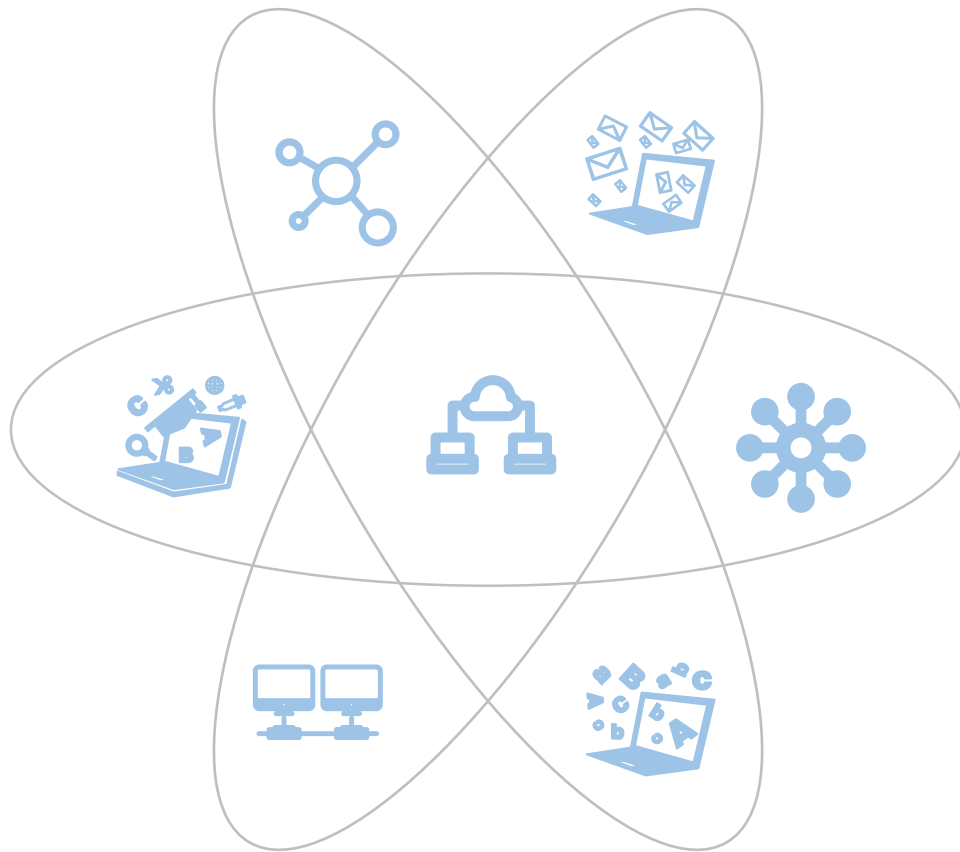
# Contents

1. Cloud Computing Basics

## **2. Cloud Computing Technologies**

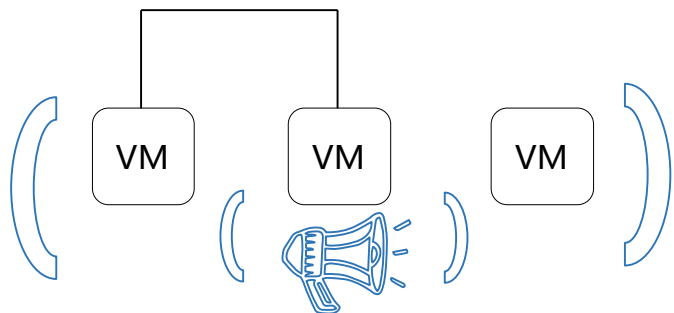
- Compute
- Network
- Storage

# What Does a Network Do?



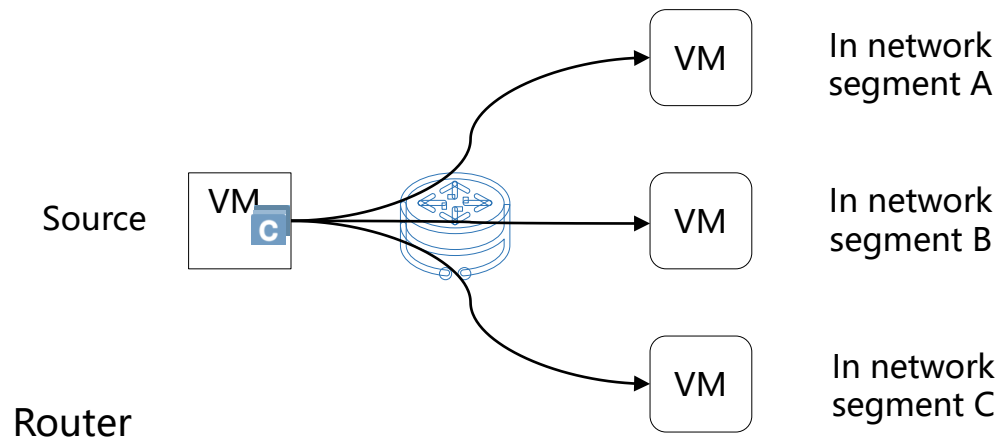
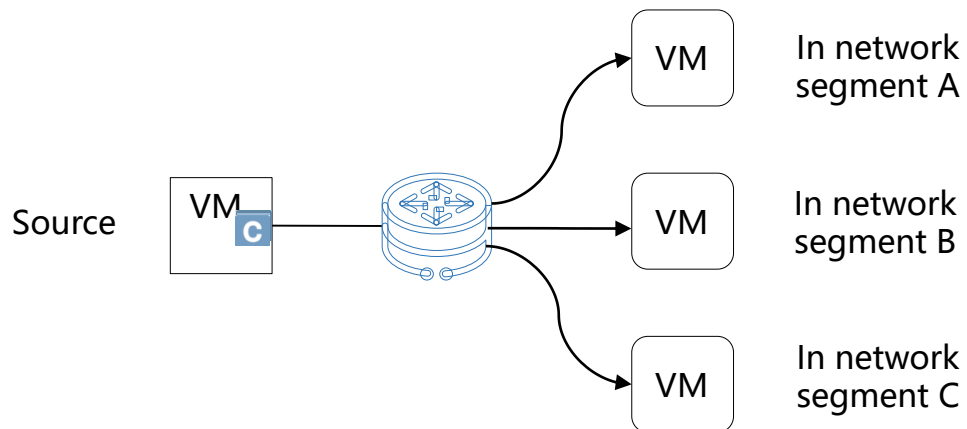


# Basic Concepts of Conventional Networks

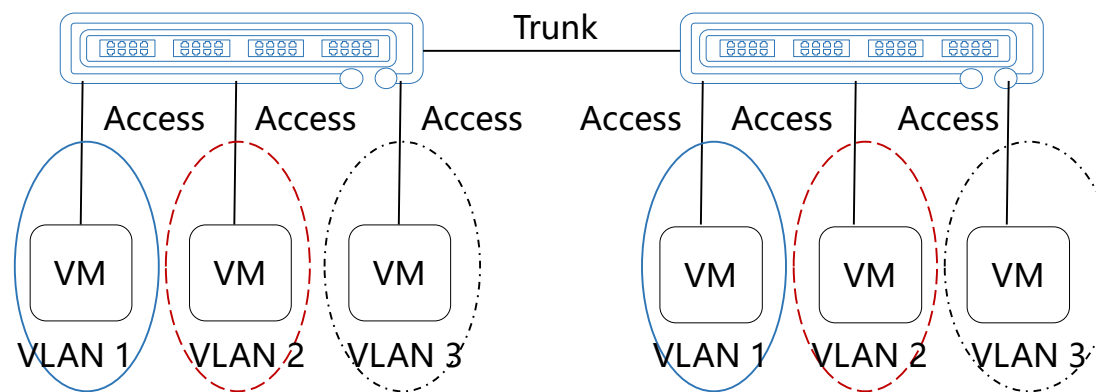


Broadcast and Unicast

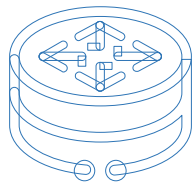
Default Gateway



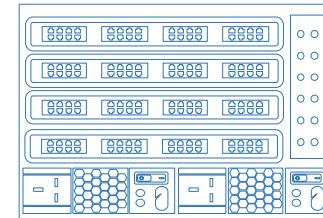
VLAN



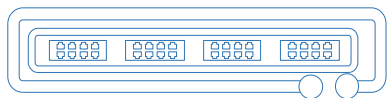
# Conventional Network Devices



Router



Layer 3 switch

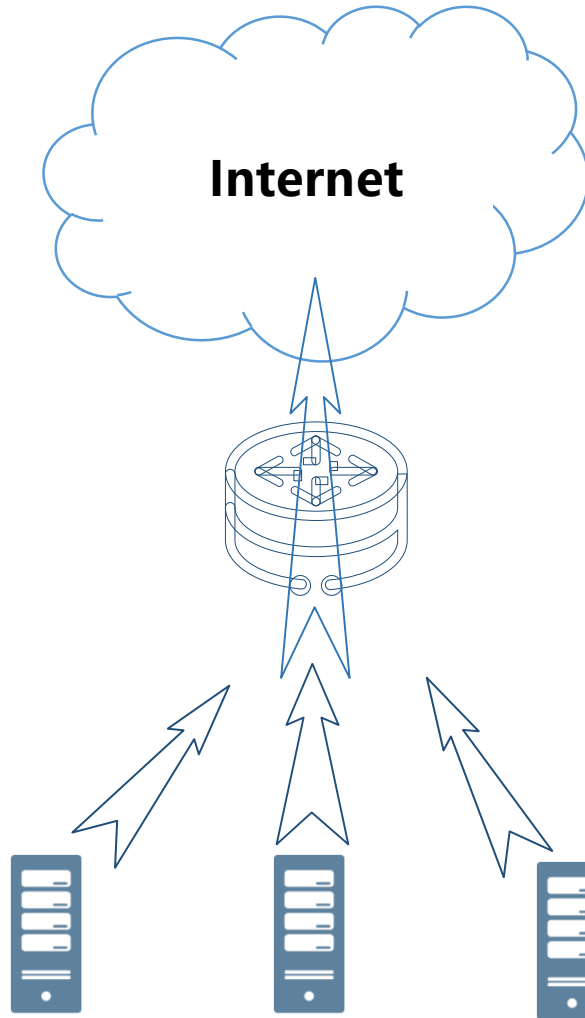


Layer 2 switch

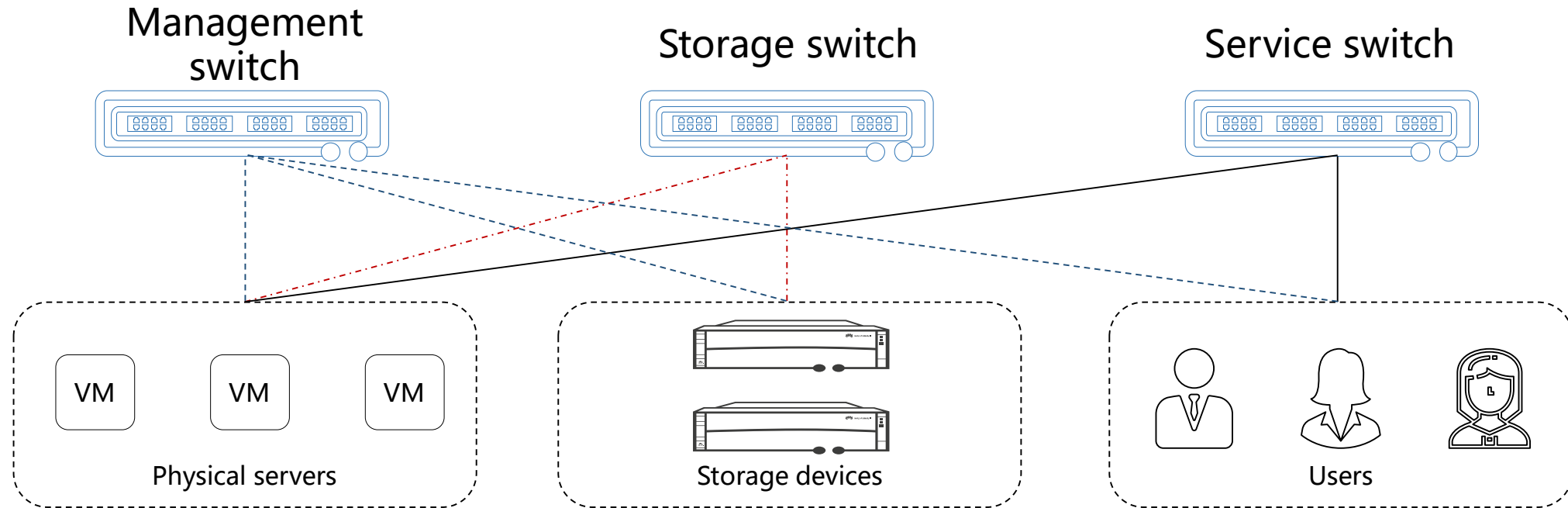


Network interface card (NIC)

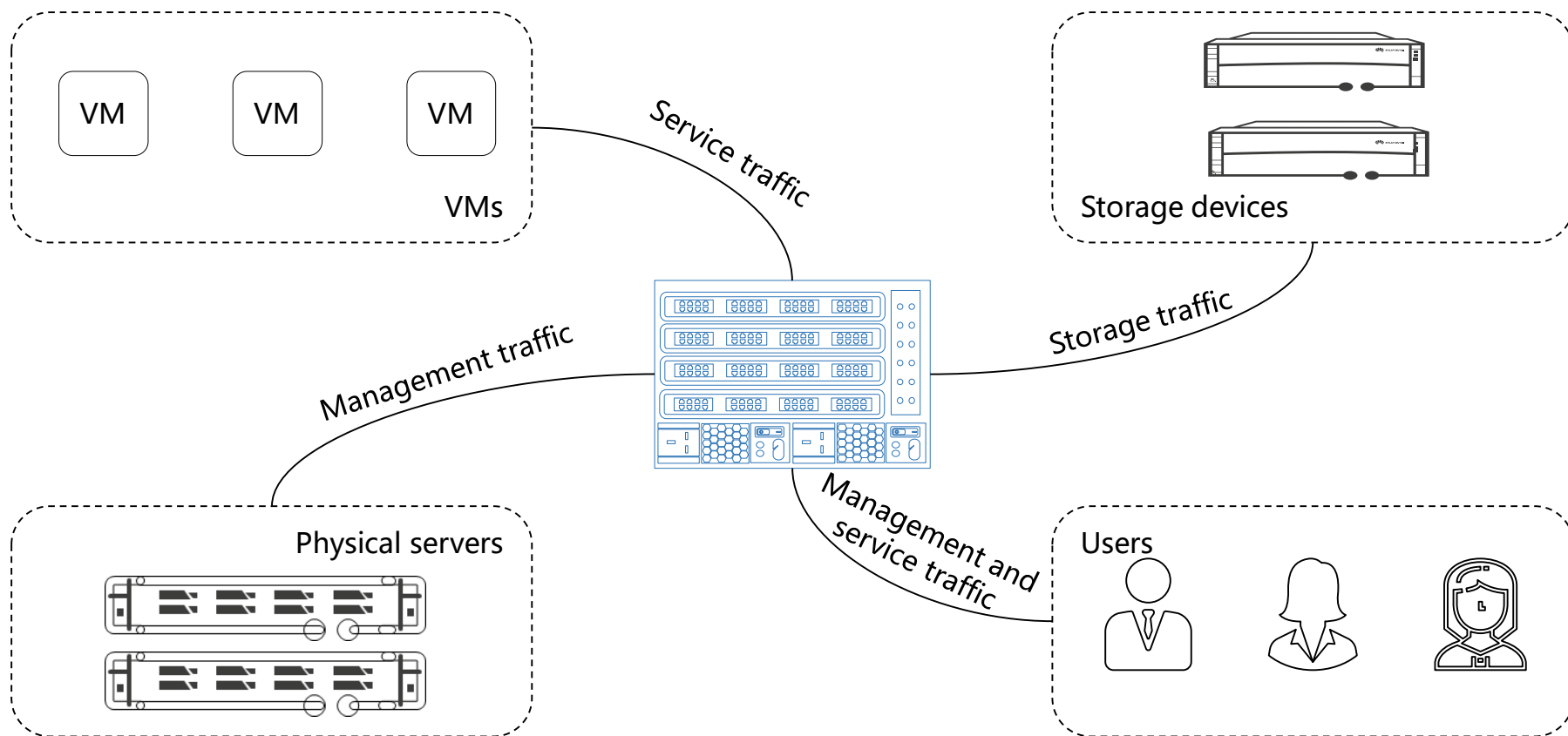
# What Does a Router Do?



# What Does a Layer 2 Switch Do?

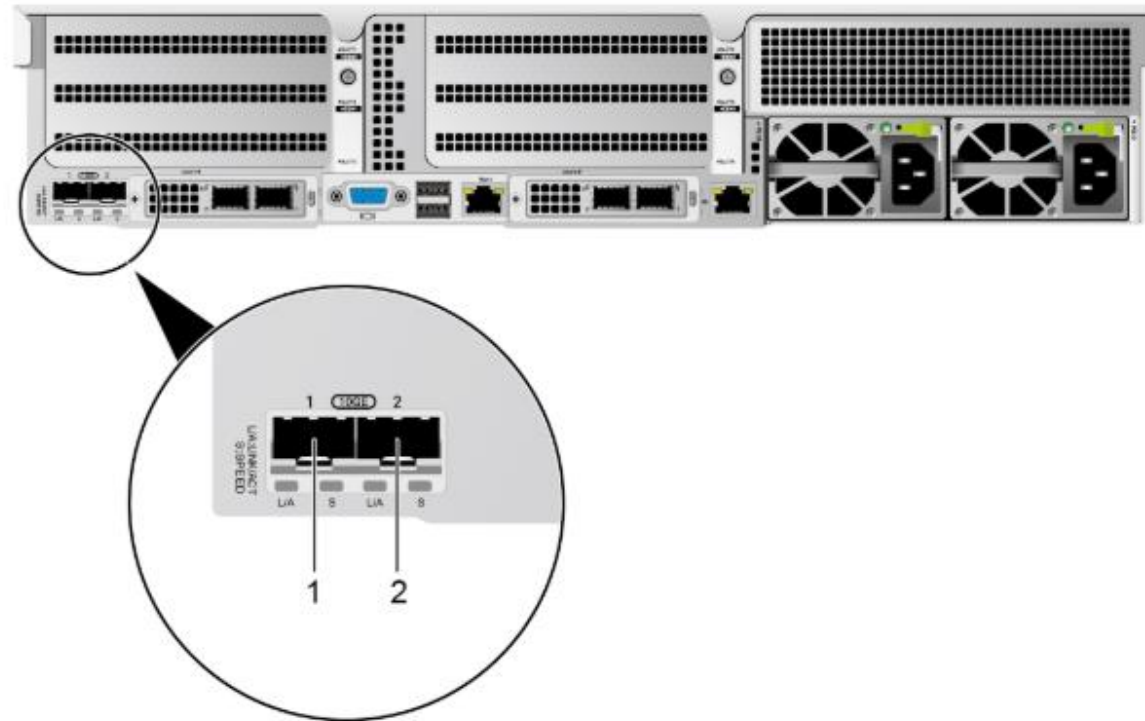


# What Does a Layer 3 Switch Do?

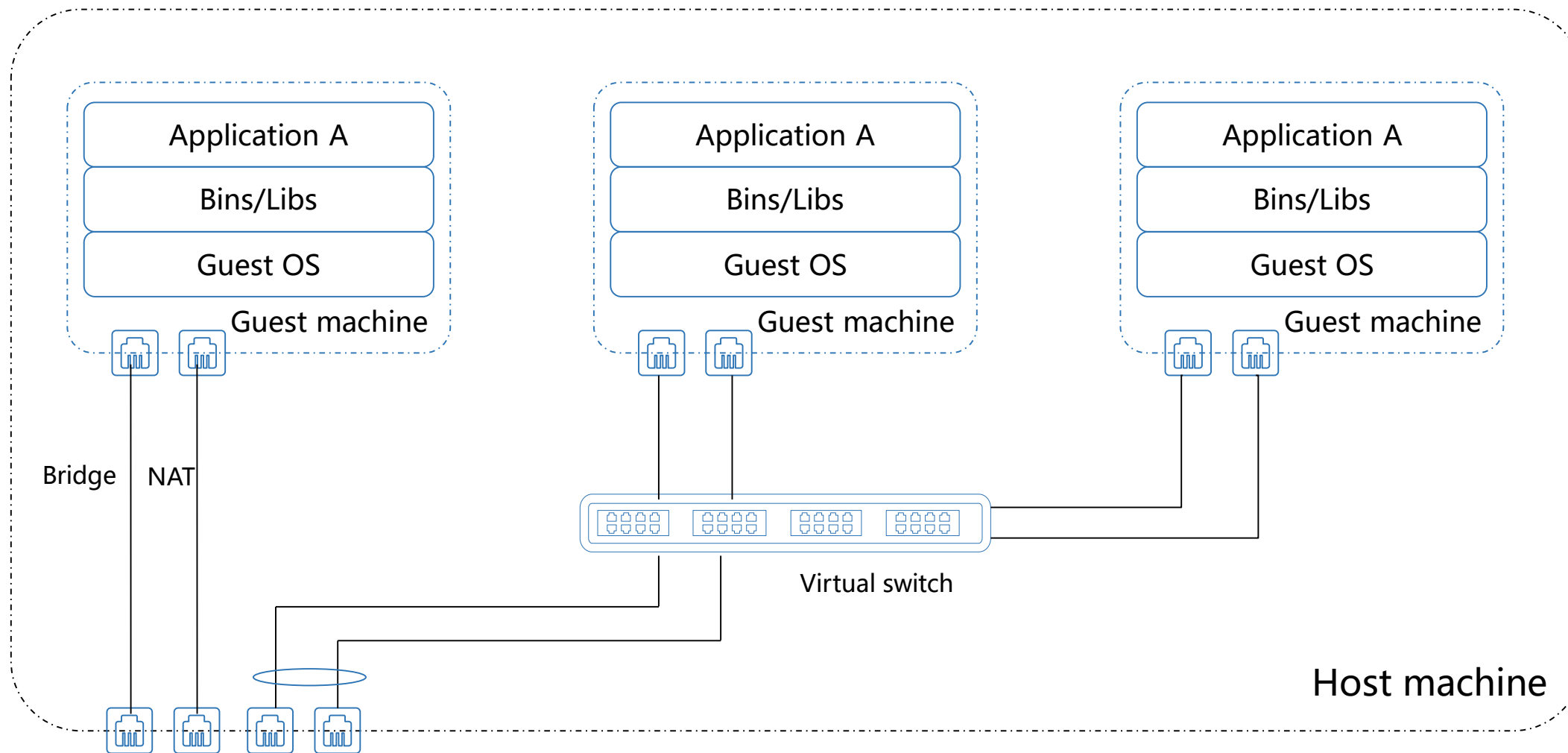


# What Does a NIC Do?

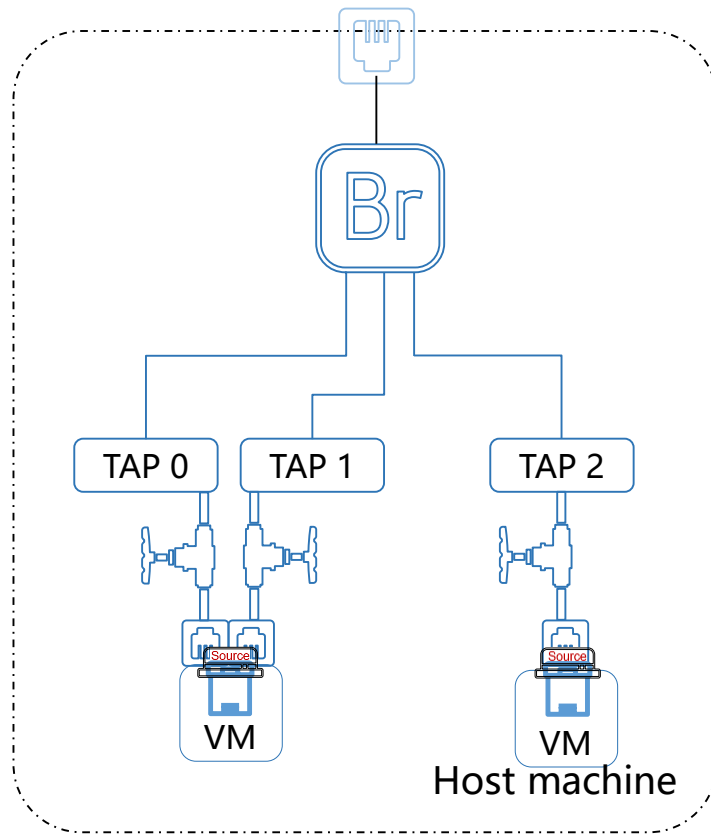
- NICs are mainly used to connect different devices. Like a telephone card, they ensure devices can communicate. In addition, NICs can be bound to deliver higher reliability and better network performance.



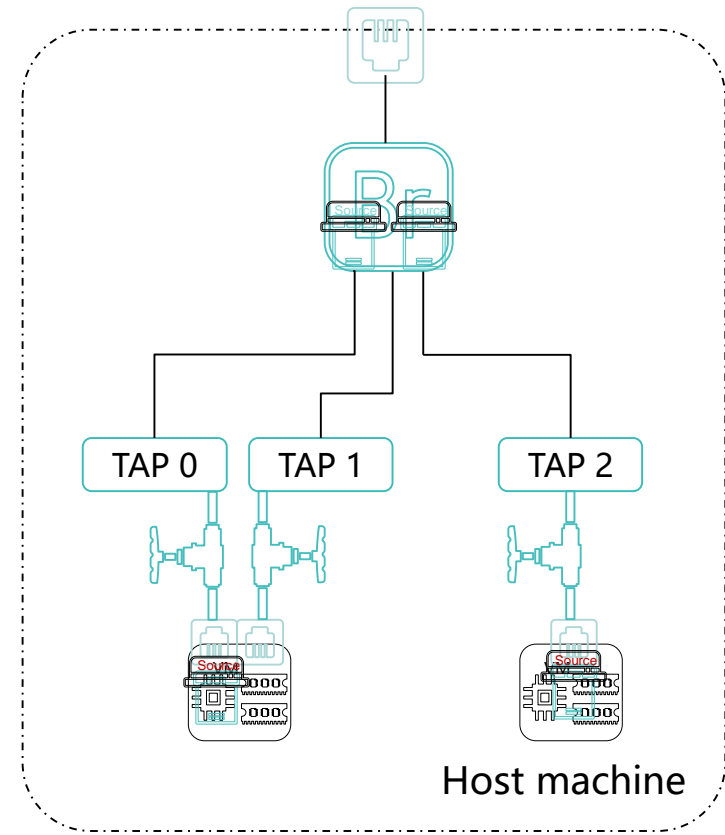
# Basic Concepts of Virtual Networks



# What Do Bridge and NAT do?



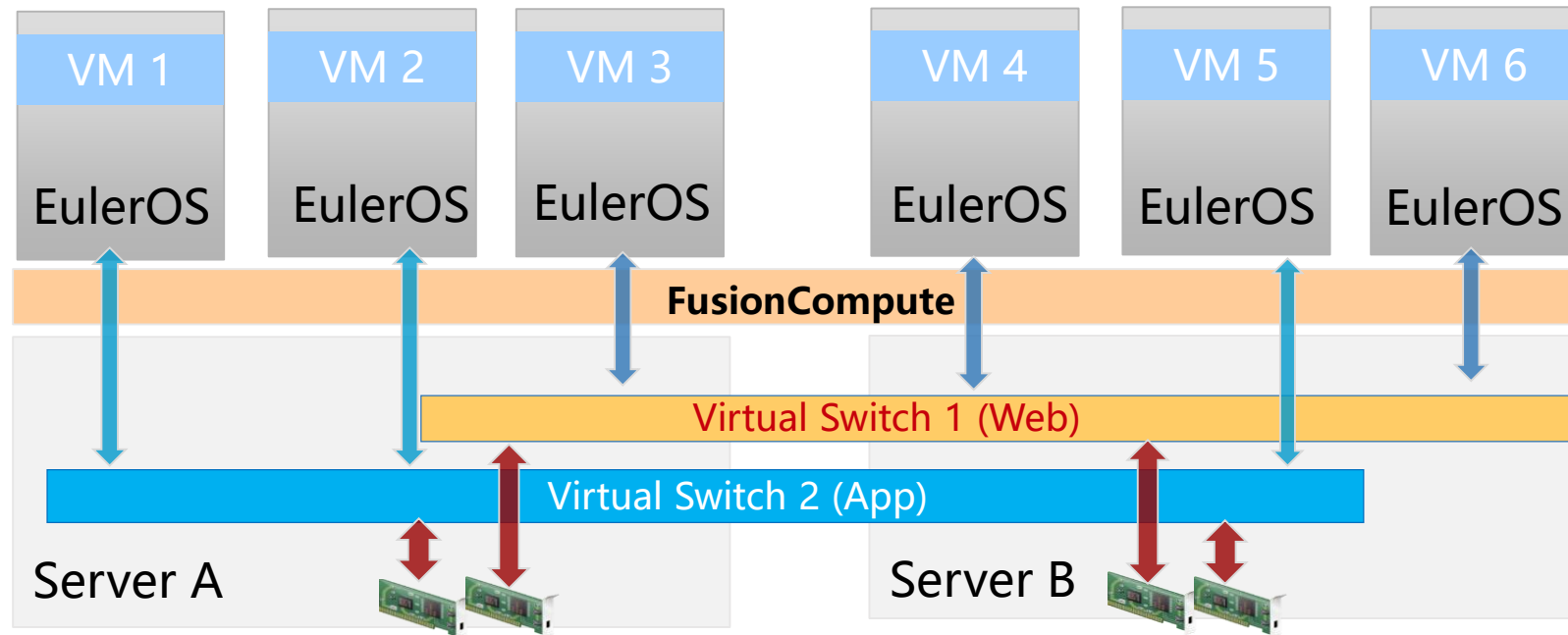
Bridge NAT



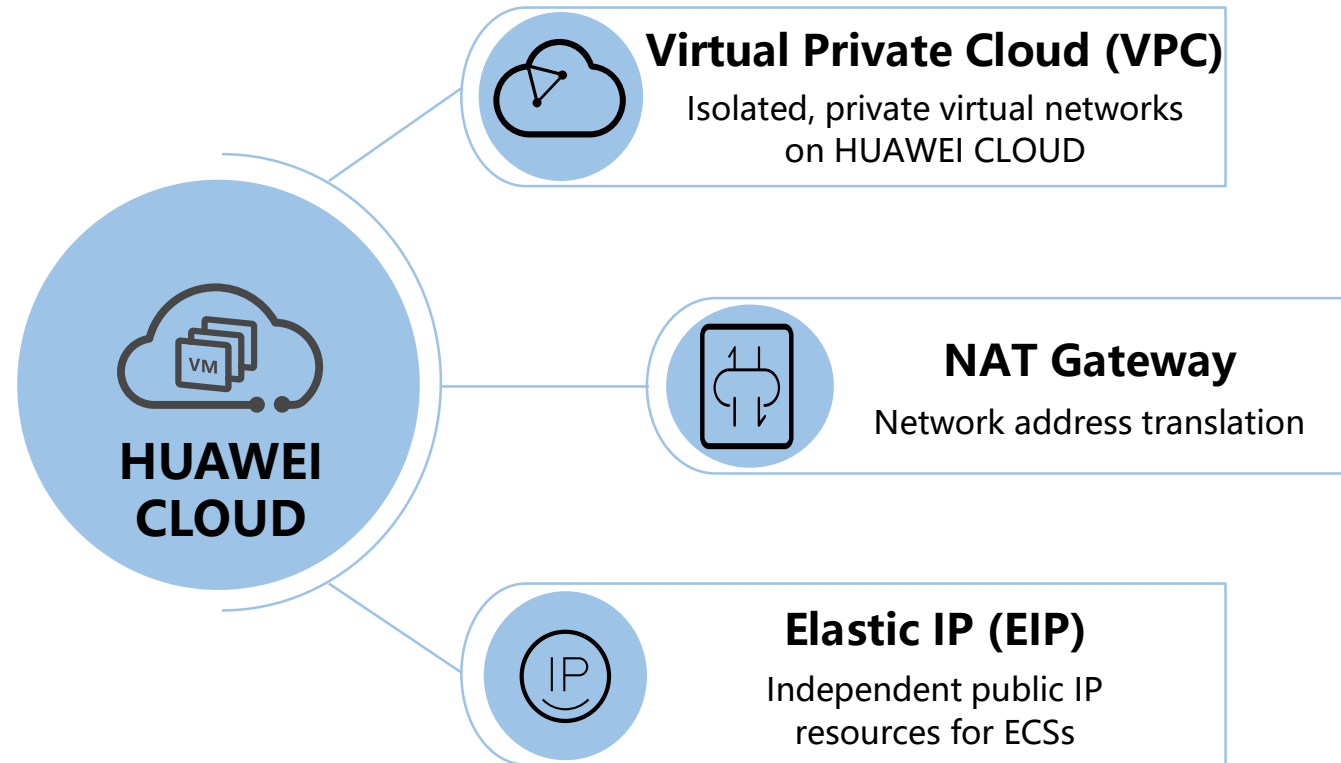


# What Does a Virtual Switch Do?

- Like the bridge and NAT, virtual switches are used to transmit the internal traffic of VMs to the external network through the network port of the physical server where the VMs reside. The common virtual switch models include OVS and EVS.



# HUAWEI CLOUD Network Services



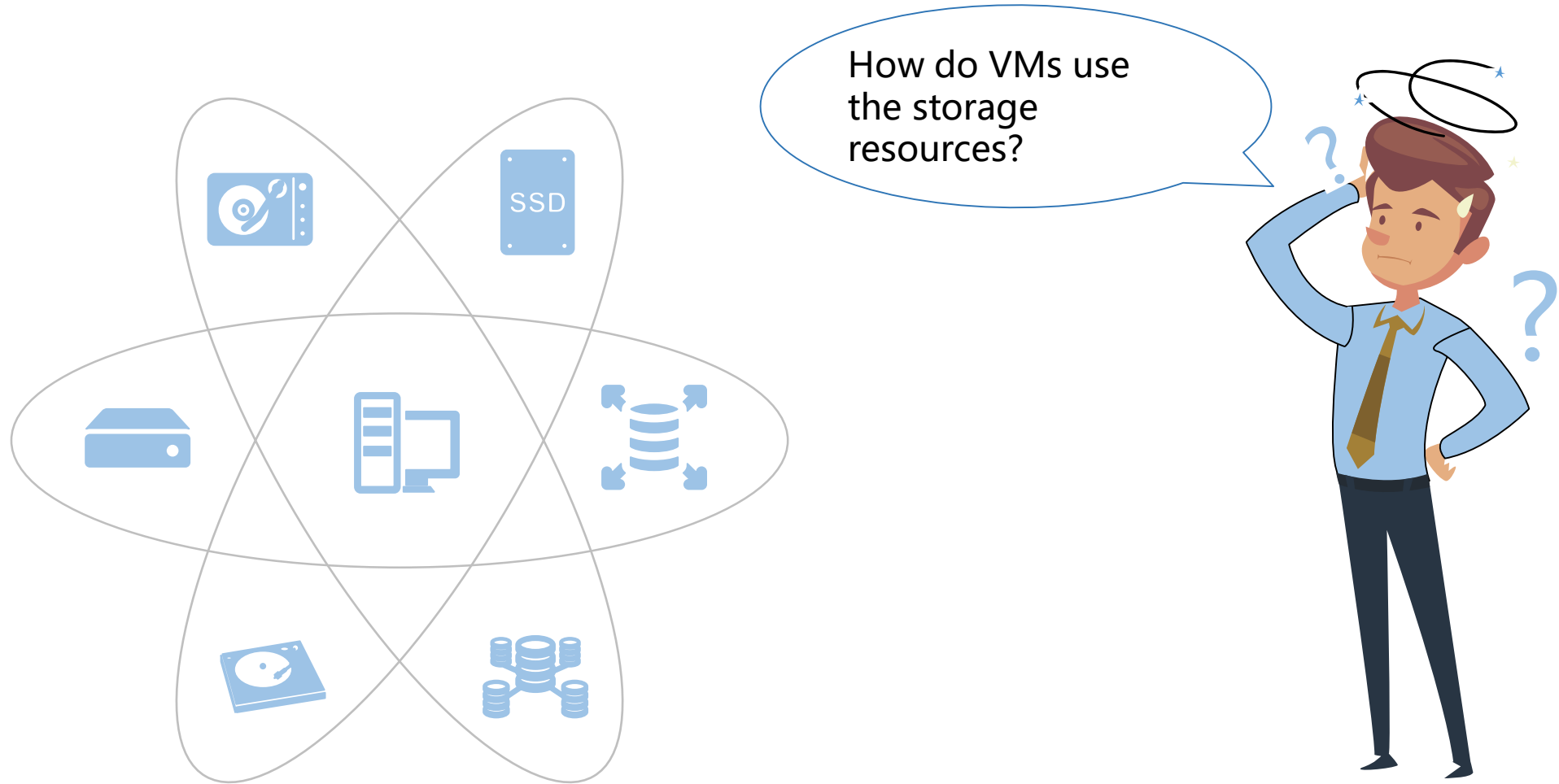
# Contents

1. Cloud Computing Basics

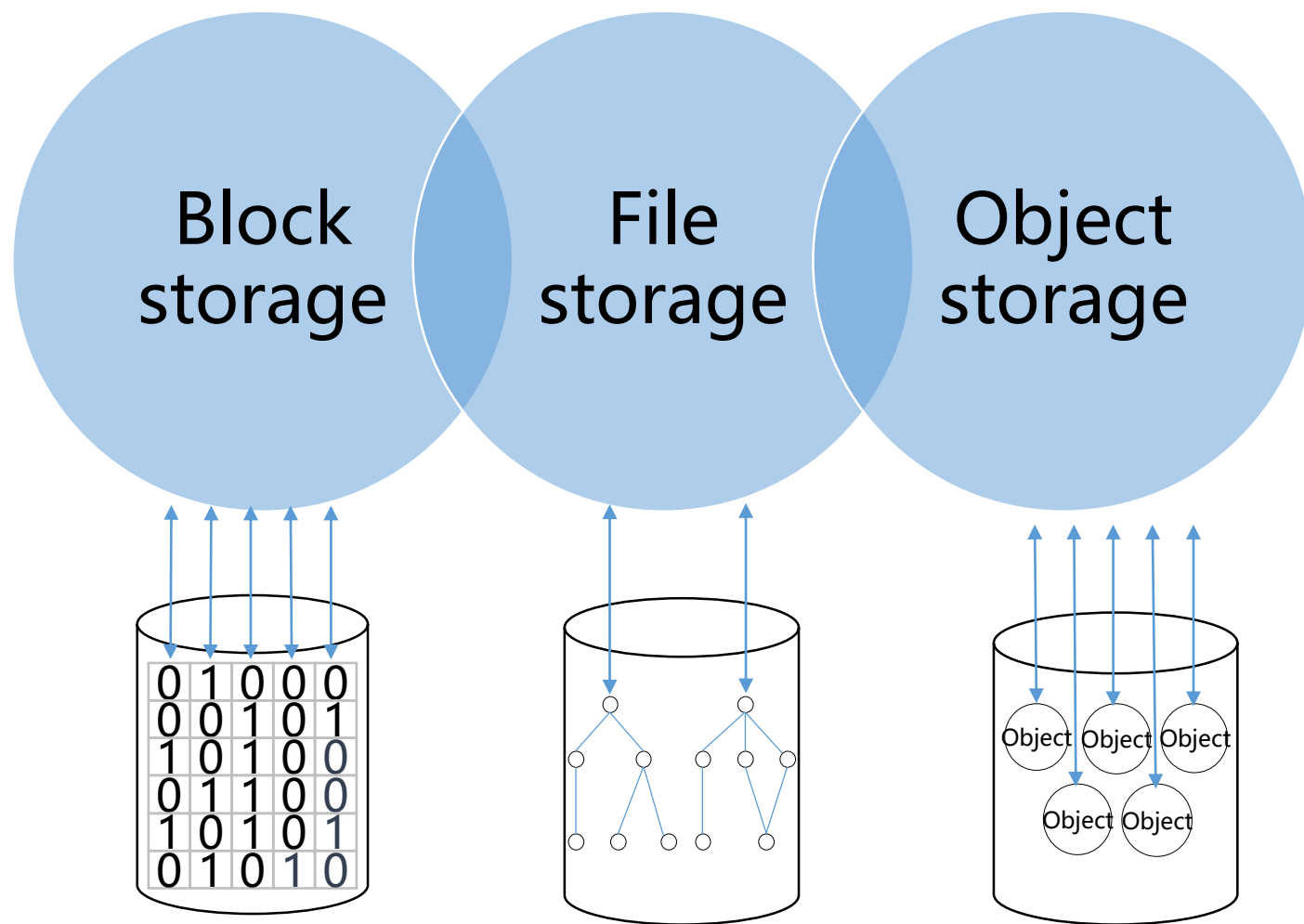
## **2. Cloud Computing Technologies**

- Compute
- Network
- Storage

# How Does Cloud Storage Work?



# Mainstream Storage Types



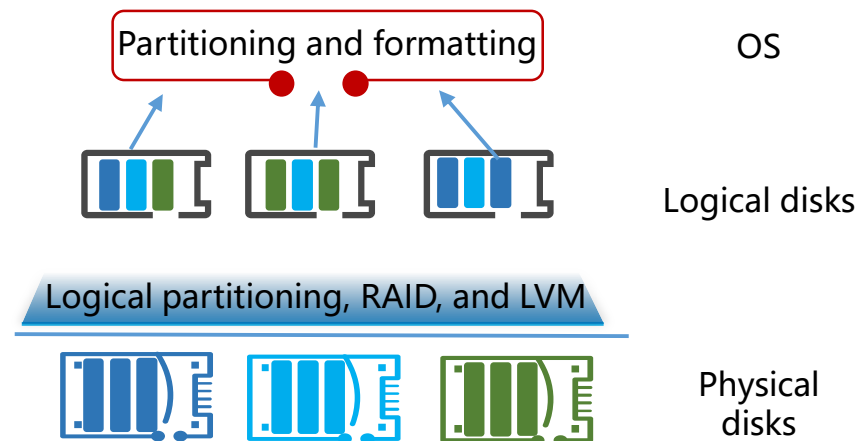
# Block Storage

## Definition

- Block storage maps the entire raw disk space to a server. For example, five disks in a disk array can be divided into several logical disks, which are then mapped to the server. After partitioning, formatting, and mounting on the server, the data is successfully stored.

## Application Scenario

- Block storage is ideal for most data storage scenarios.



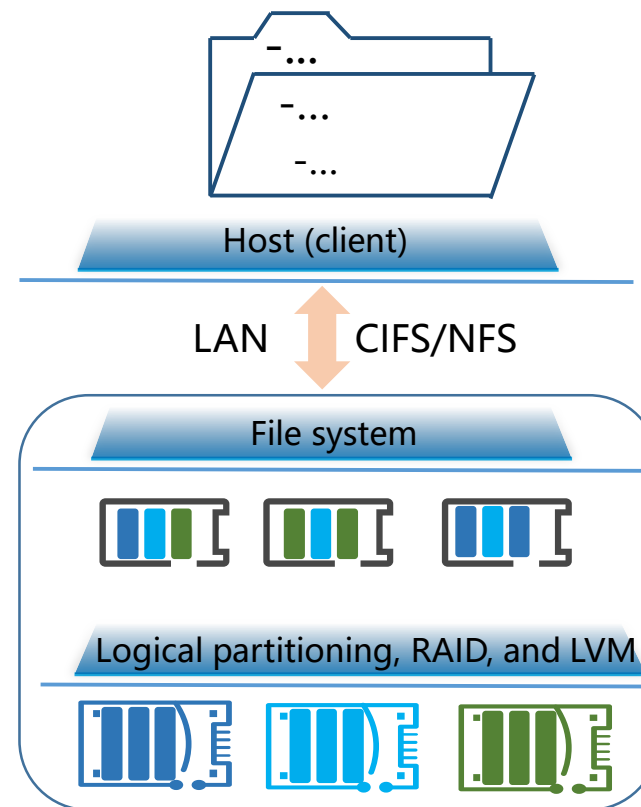
# File Storage

## Definition

- File storage is like a shared folder in a file system. Users can directly store data on the file storage device over file system access protocols, such as NFS and CIFS.

## Application Scenario

- File storage is widely used in scenarios such as data backup and archive, image and video data storage, and file sharing.



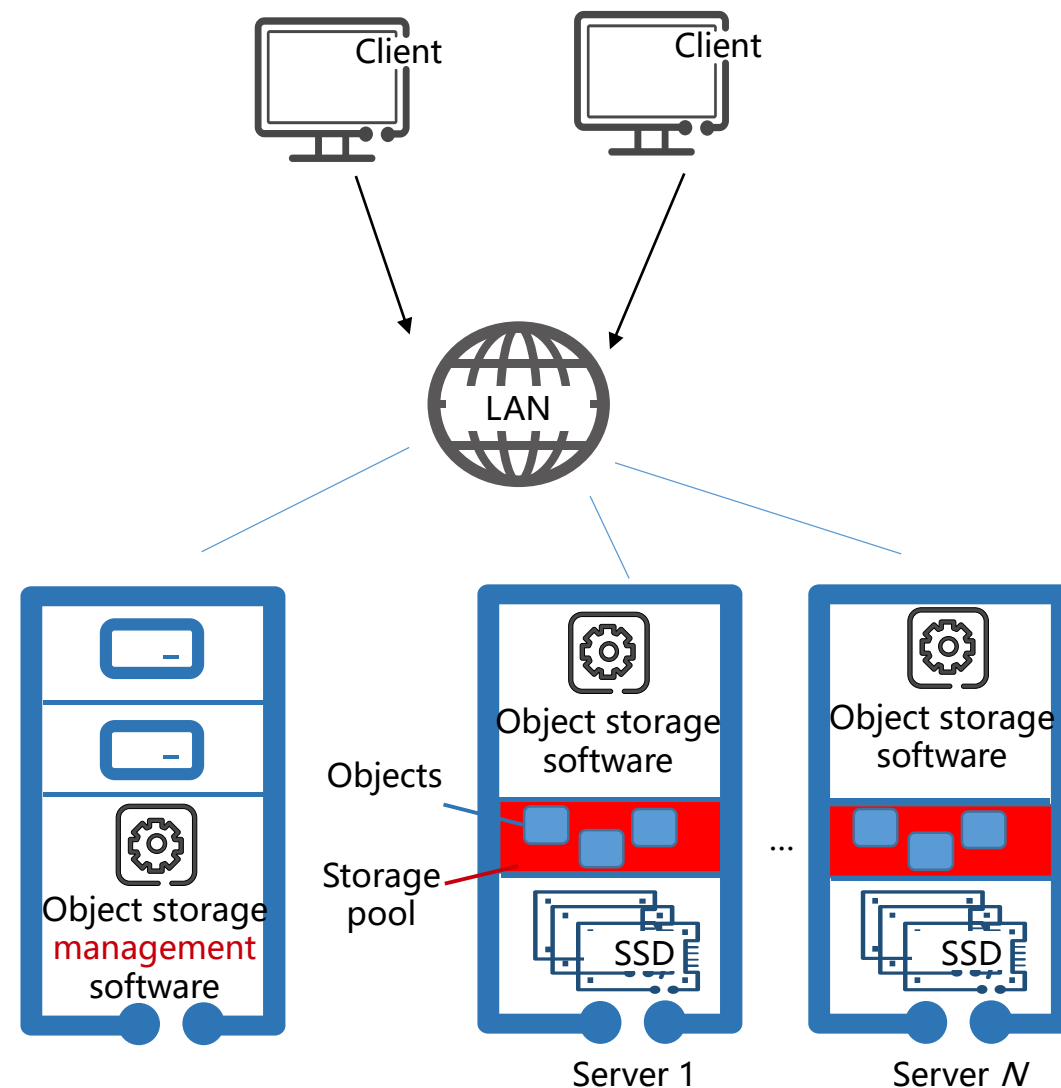
# Object Storage

## Definition

- Object storage leverages both block storage and file storage. It offers fast, direct disk access, and distributed file sharing. Generally, object storage outperforms file storage.

## Application Scenario

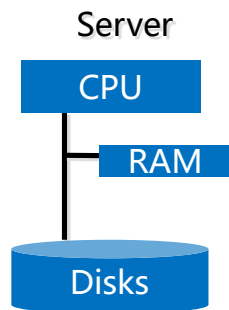
- Object storage is widely used in scenarios such as data backup, image and video data storage, and website hosting.





# Enterprise Storage

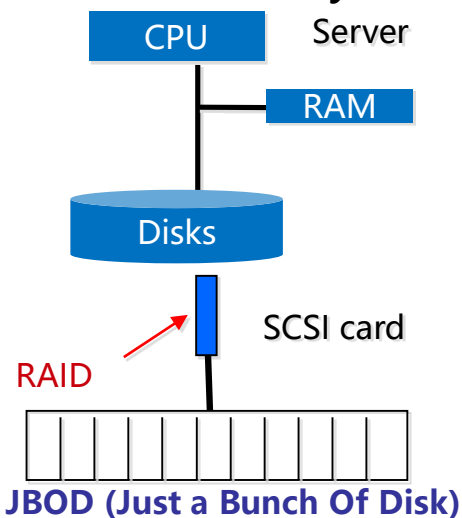
## Disks in a server



### Known issues:

- Disks have become a system performance bottleneck.
- The number of disk slots is limited, resulting in small capacity.
- Data is stored on a single disk, lowering data reliability.
- Storage utilization is low.
- Data is scattered in local storage systems.

## External disk array (DAS)

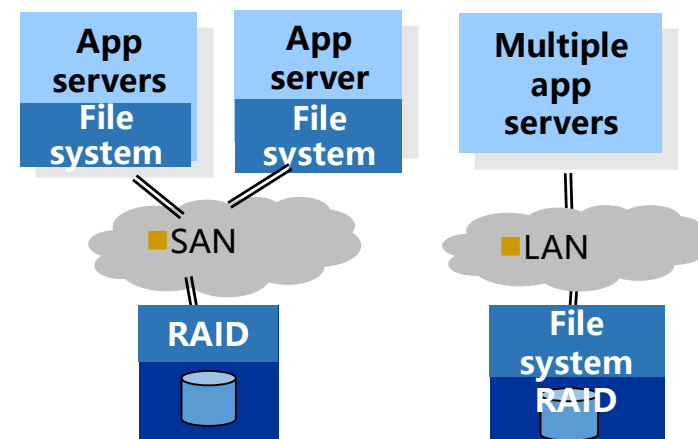


JBOD combines multiple physical disks into a logical unit to increase capacity, without providing any data protection.

### Resolved issues:

- The number of disk slots is limited, resulting in small capacity.
- Data is stored on a single disk, lowering data reliability.

## Storage area network (SAN/NAS)

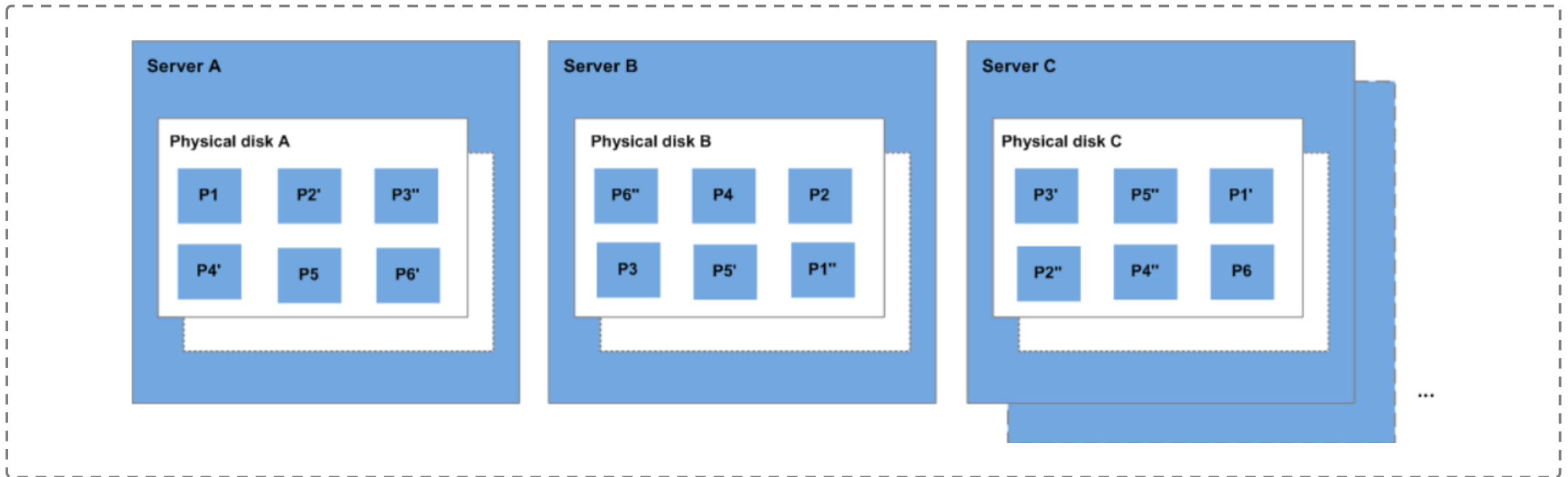


### Resolved issues:

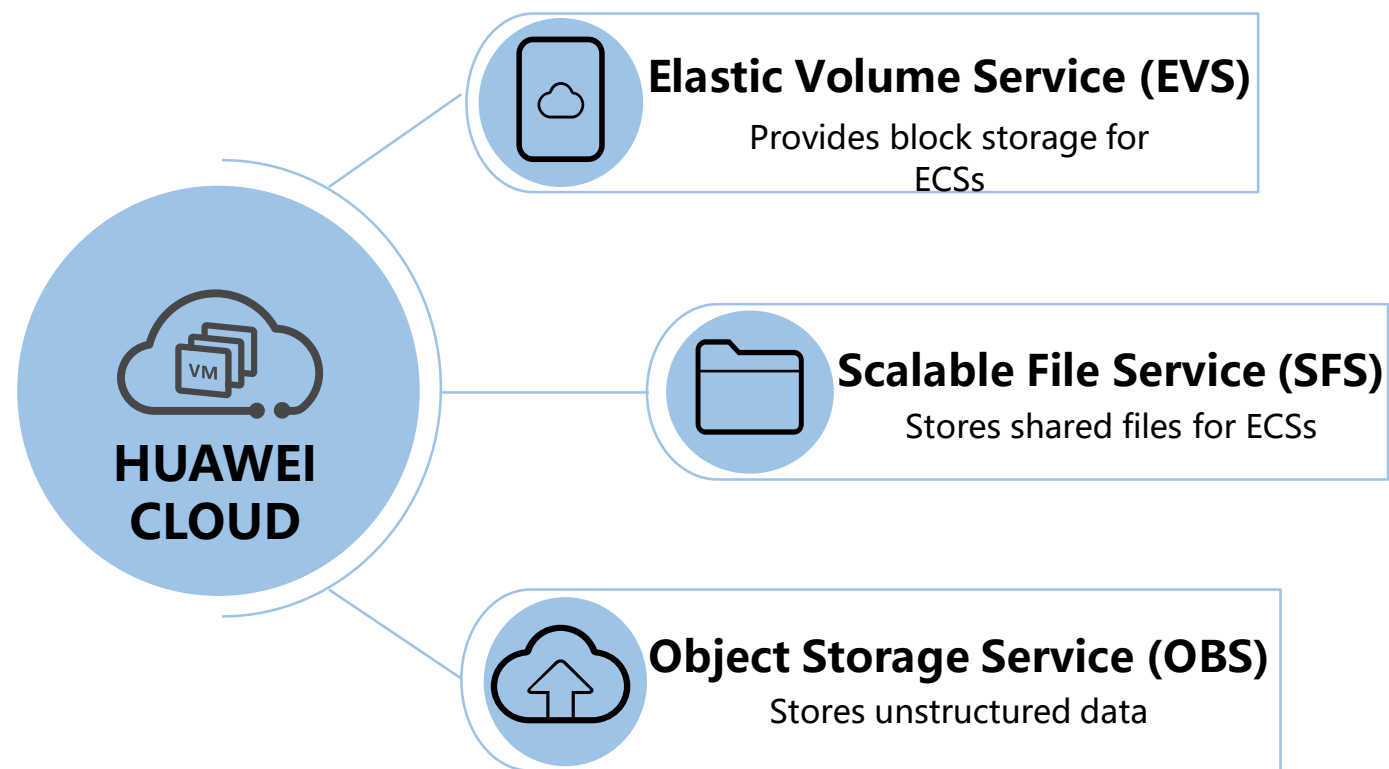
- Disks have become a system performance bottleneck.
- The number of disk slots is limited, resulting in small capacity.
- Data is stored on a single disk, lowering data reliability.
- Storage utilization is low.
- Data is scattered in local storage systems.

# Distributed Storage

- Distributed storage systems virtualize the available storage resources across all hosts of an enterprise to a virtual storage device. This way, data is stored in different locations on the storage network, improving system reliability, availability, and access efficiency.



# HUAWEI CLOUD Storage Services



# Quiz

1. (Single-answer question) Do the bridge and NAT have the same working principles?
  - A. Yes
  - B. No
2. (Single-answer question) Which of the following is NOT a mainstream storage type?
  - A. Block storage
  - B. Object storage
  - C. Tape library
  - D. File storage

# Summary

This chapter described:

- Cloud computing basics
- Compute, network, and storage technologies
- HUAWEI CLOUD services

# Recommendations

- Huawei iLearning
  - <https://e.huawei.com/en/talent/#/search?productTags=&productName=&navType=learningNavKey>
- Huawei Technical Support Website
  - <https://support.huaweicloud.com/intl/en-us/help-novicedocument.html>
- HUAWEI CLOUD Academy
  - <https://e.huawei.com/en/talent/#/ict-academy/home>

# Acronyms and Abbreviations

APP: Application

AS: Auto Scaling

CPU: Central Processing Unit

CCE: Cloud Container Engine

CCI: Cloud Container Instance

CIFS: Common Internet File System

ECS: Elastic Cloud Server

EIP: Elastic IP

EVS: Elastic Volume Service

# Acronyms and Abbreviations

GPU: Graphics Processing Unit

ICT: Information and Communications Technology

I/O: Input/Output

IaaS: Infrastructure as a Service

IBM: International Business Machines Corporation

KVM: Kernel-based Virtual Machine

IMS: Image Management Service

LXC: Linux Container

LVM: Logical Volume Manager



# Acronyms and Abbreviations

NAT: Network Address Translation

NFS: Network File System

NIST: National Institute of Standards and Technology

OS: Operation System

OBS: Object Storage Service

PC: Personal Computer

PaaS: Platform as a Service

RAID: Redundant Arrays of Independent Disks

SFS: Scalable File Service

# Acronyms and Abbreviations

SWR: SoftWare Repository for Container

SaaS: Software as a Service

TCO: Total Cost of Ownership

TAP: Test Access Point

VM: Virtual Machine

VLAN: Virtual Local Area Network

VPC: Virtual Private Cloud

# Thank you.

把数字世界带入每个人、每个家庭、  
每个组织,构建万物互联的智能世界.

Bring digital to every person, home, and  
organization for a fully connected,  
intelligent world.

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