



Recommendations

- ▣ Huawei Learning Website
 - <http://learning.huawei.com/en>
- ▣ Huawei e-Learning
 - <https://ilearningx.huawei.com/portal/#/portal/ebg/51>
- ▣ Huawei Certification
 - http://support.huawei.com/learning/NavigationAction!createNavi?navId=_31&lang=en
- ▣ Find Training
 - http://support.huawei.com/learning/NavigationAction!createNavi?navId=_trainingsearch&lang=en



More Information

- Huawei learning APP





A Brief Introduction to Cloud Computing



Foreword

- IT is a fast-changing industry. Cloud computing has been developing rapidly in recent years and has become the foundation of a wide range of major applications. So, what is cloud computing? How has it evolved to what it is today? This chapter will offer you a brief introduction to the history and present of cloud computing.



Objectives

- Upon completion of this course, you will be able to:
 - Describe what cloud computing is.
 - Describe the history of cloud computing.
 - List a few use cases of cloud computing.
 - Describe the characteristics of cloud computing.

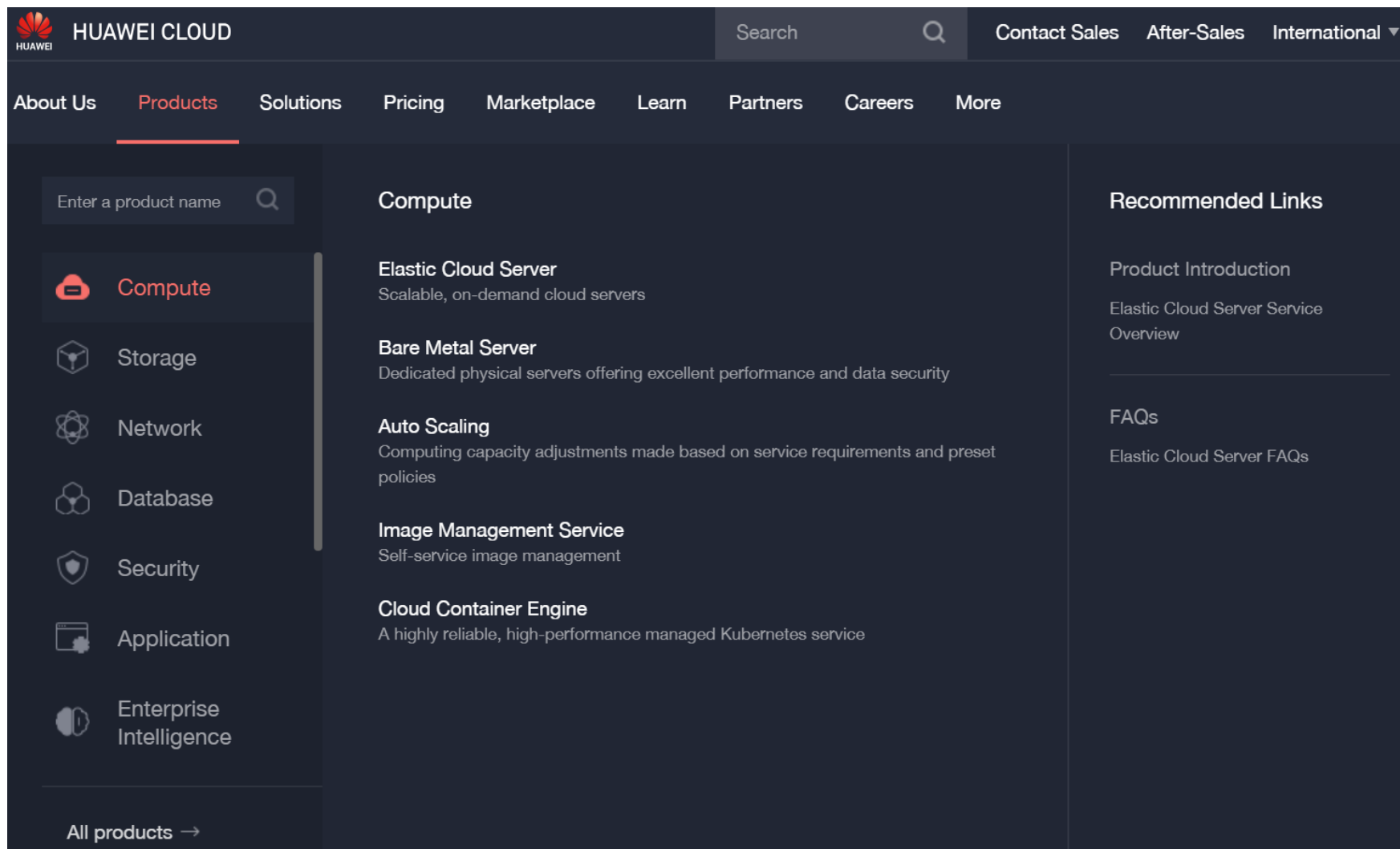


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- 1. Cloud Computing Is Around Us**
2. Cloud Computing Advantages
3. Cloud Computing Definition
4. Origin and Development of Cloud Computing
5. Cloud Computing Models

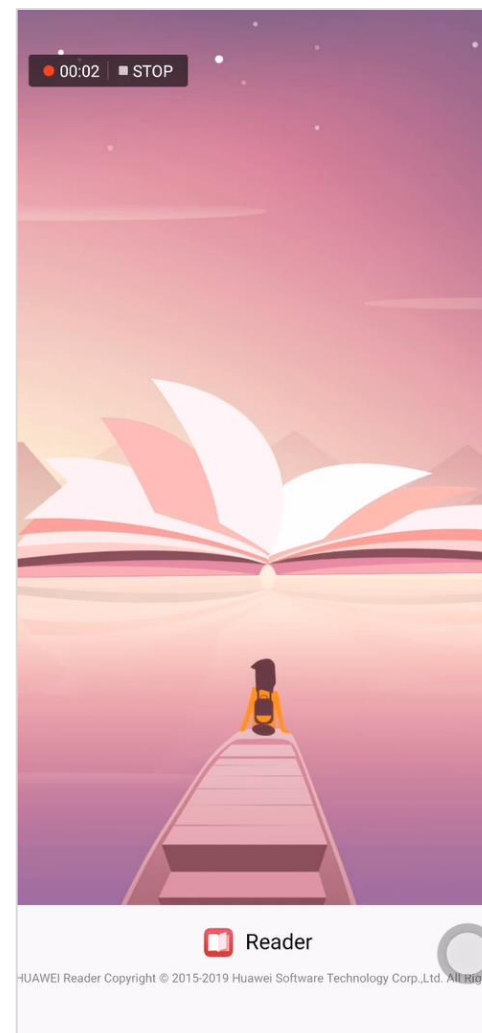
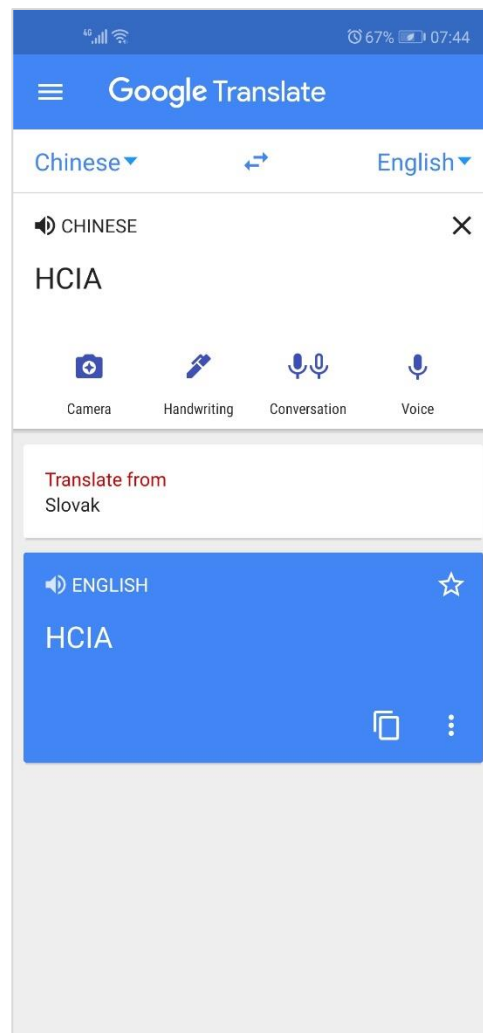
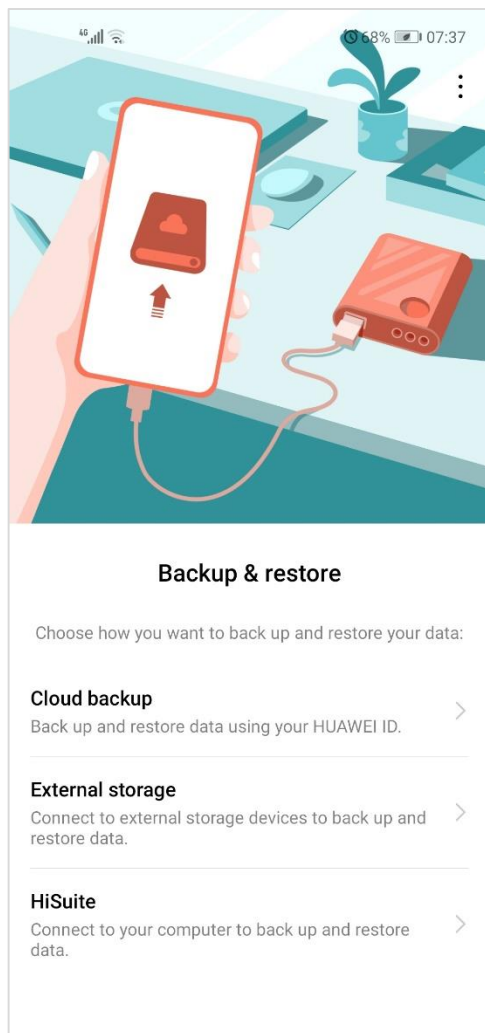


What Can Cloud Computing Do?





You May Be Using the Cloud Already





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5. Cloud Computing Models



Cloud Computing Advantages



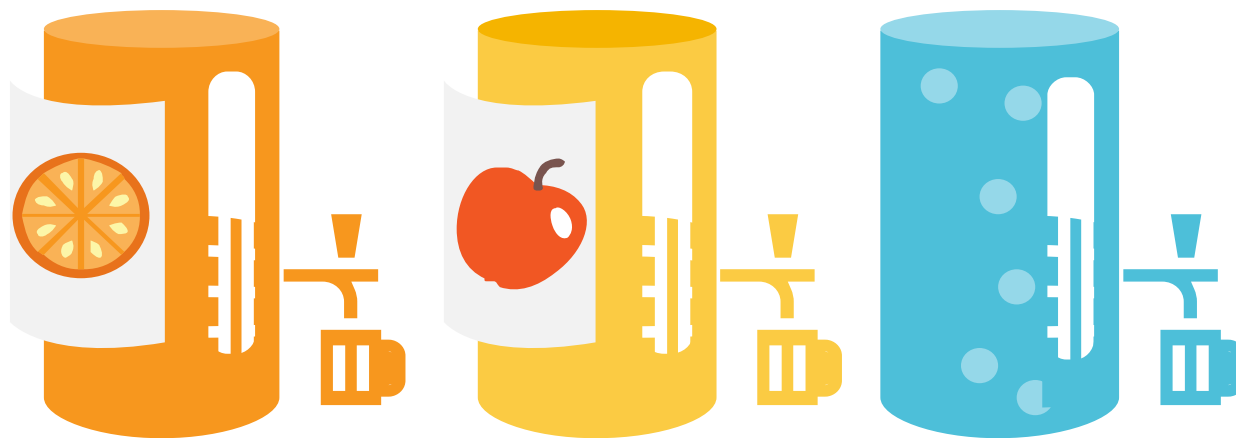
1. On-demand self-service



2. Broad network access



Cloud Computing Advantages



3. Resource pooling



Cloud Computing Advantages



L: 1.3 m, Φ : 1 m



L: 1 m, Φ : 0.7 m



L: 0.71 m, Φ : 0.5 m



4. Rapid elasticity

5. Measured service



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Cloud Computing Definition

- The National Institute of Standards and Technology (NIST) defines cloud computing as follows:
- 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.



Why the Term “Cloud Computing” ?

- The cloud is a metaphor for the Internet. It is an abstraction of the Internet and the infrastructure that underpins it. Computing refers to computing services provided by a sufficiently powerful computer capable of providing a range of functionalities, resources, and storage. Put together, cloud computing can be understood as the delivery of on-demand, measurable computing services over the Internet.

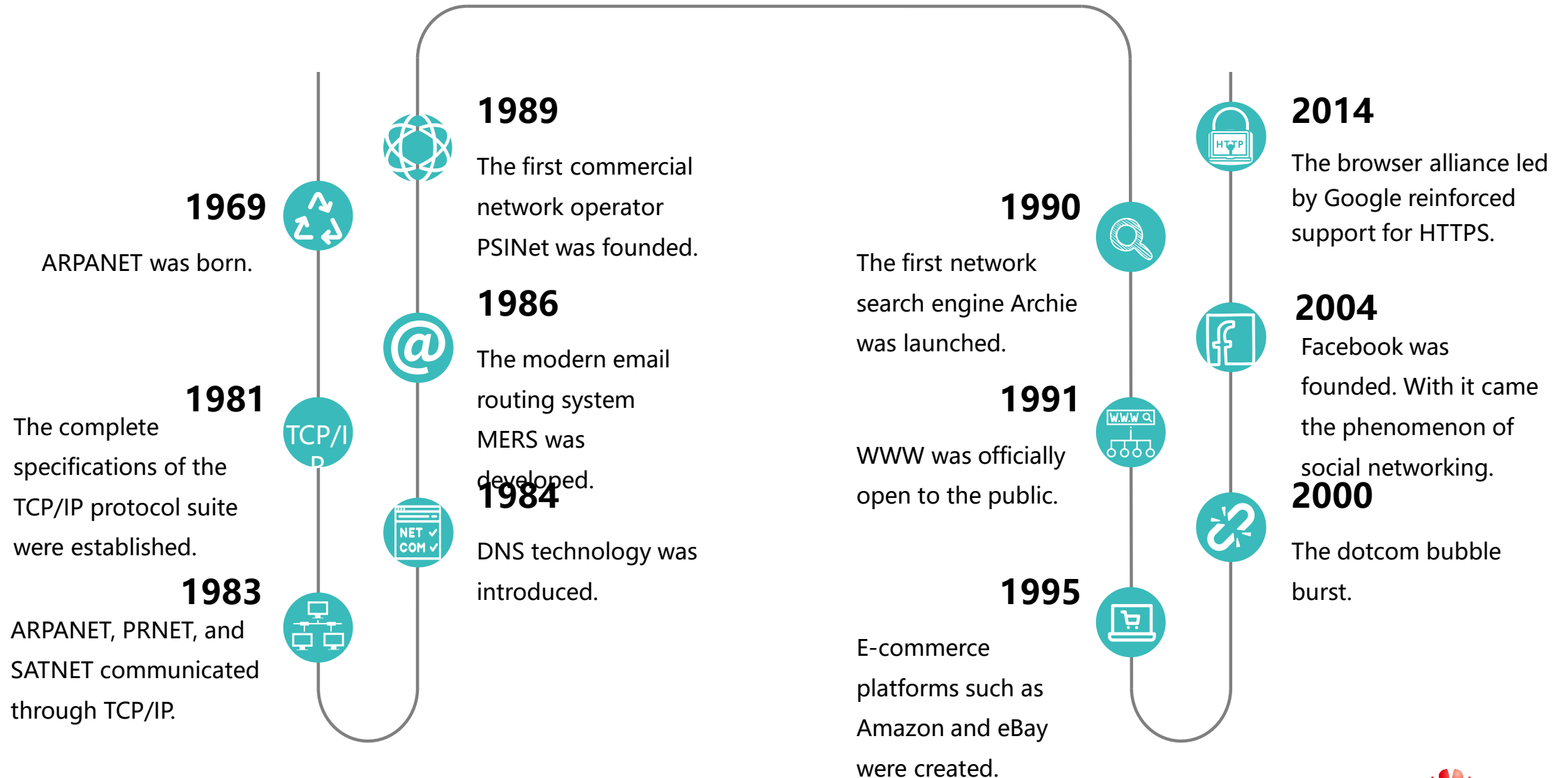


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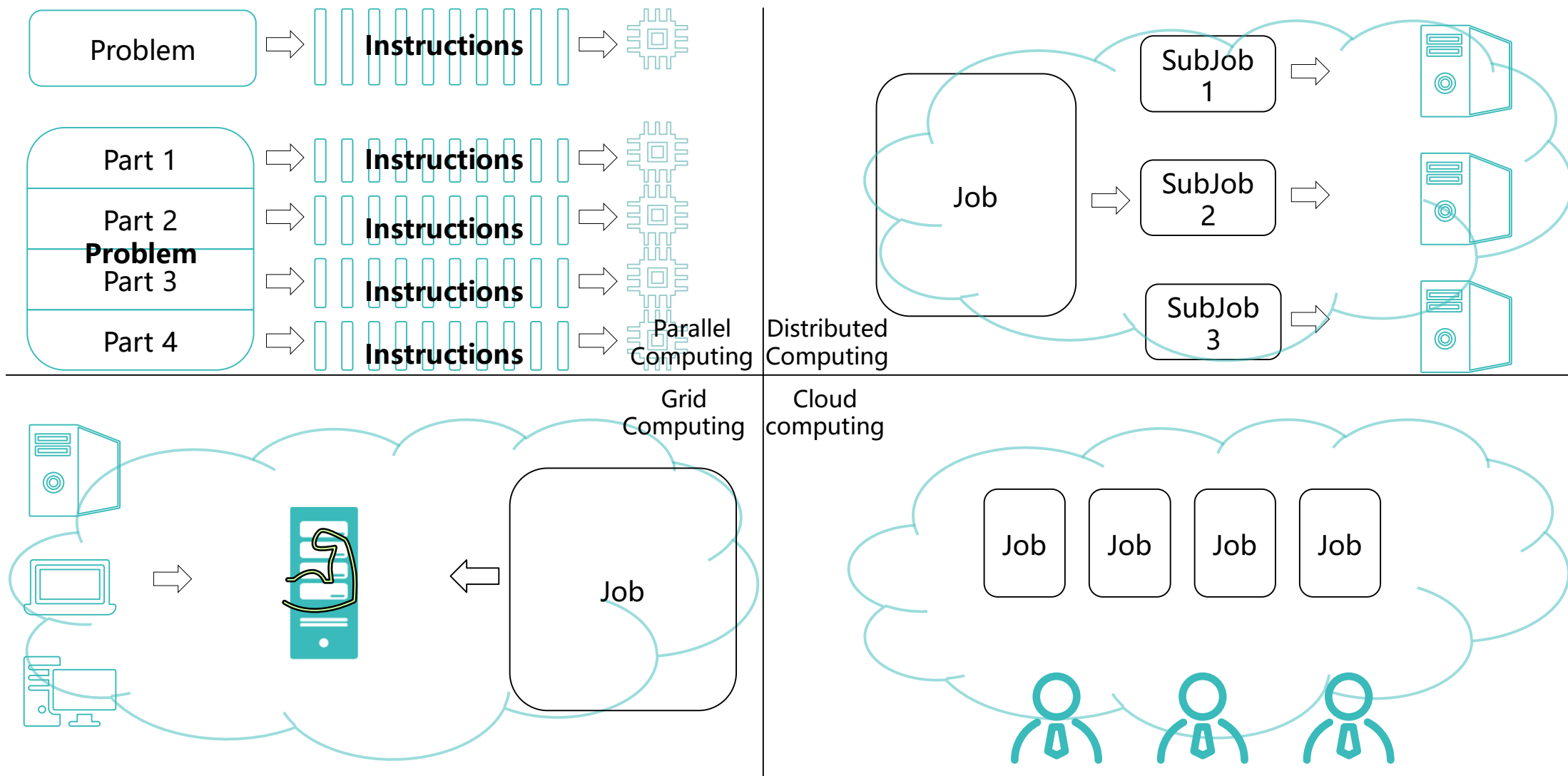


A Brief History of the Internet





A Brief History of Computing





Cloud Computing Evolution

Cloud computing 2.0

Cloud computing 1.0



Computing virtualization

Hyper-V
Xen KVM
VMware ESX

Virtualization
Higher resource utilization



Software-defined, integration

OpenStack
VMware AWS

Cloud-based infrastructure
Standardization and automation of
resource services

Cloud computing 3.0



Cloud native, app redesign

Docker
CoreOS
Cloud Foundry

Cloud-native applications
Agile application development and
lifecycle management

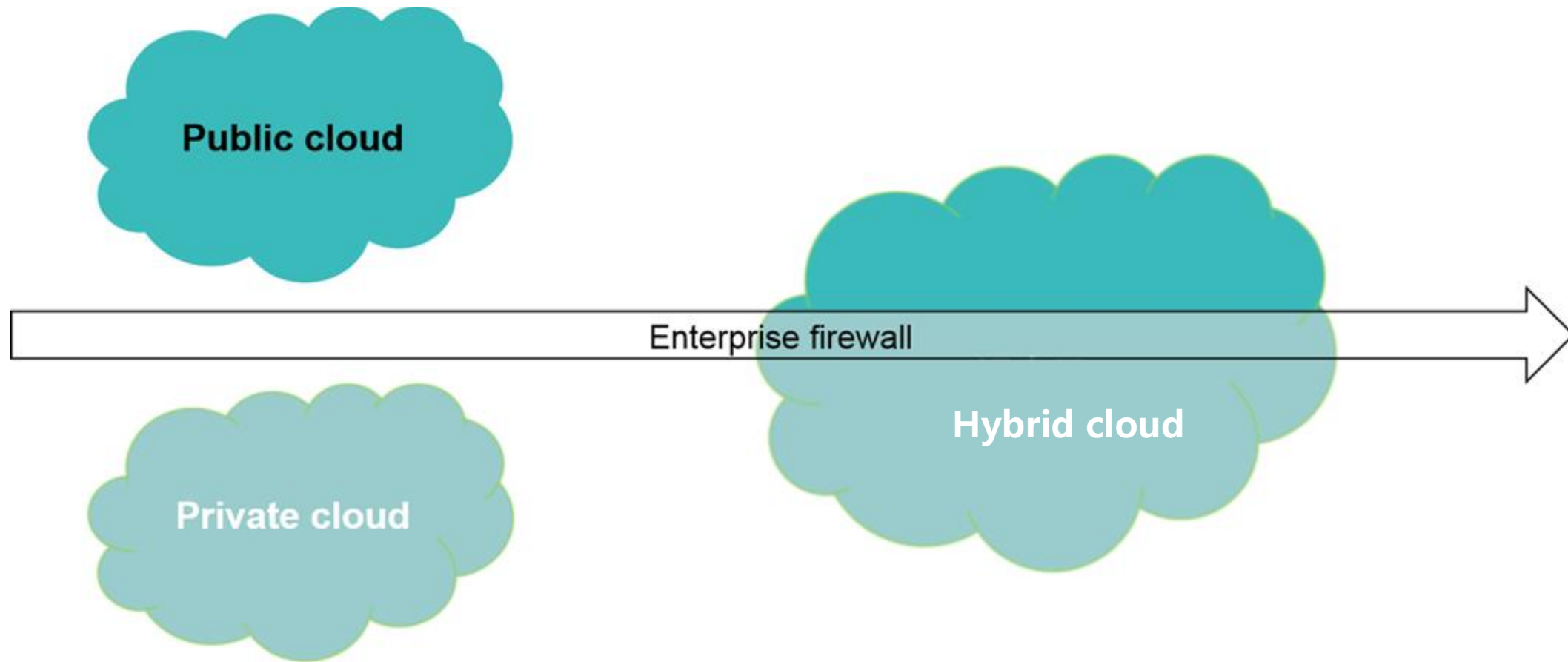


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Cloud Deployment Models





Cloud Deployment Models



**Transportation
cloud**



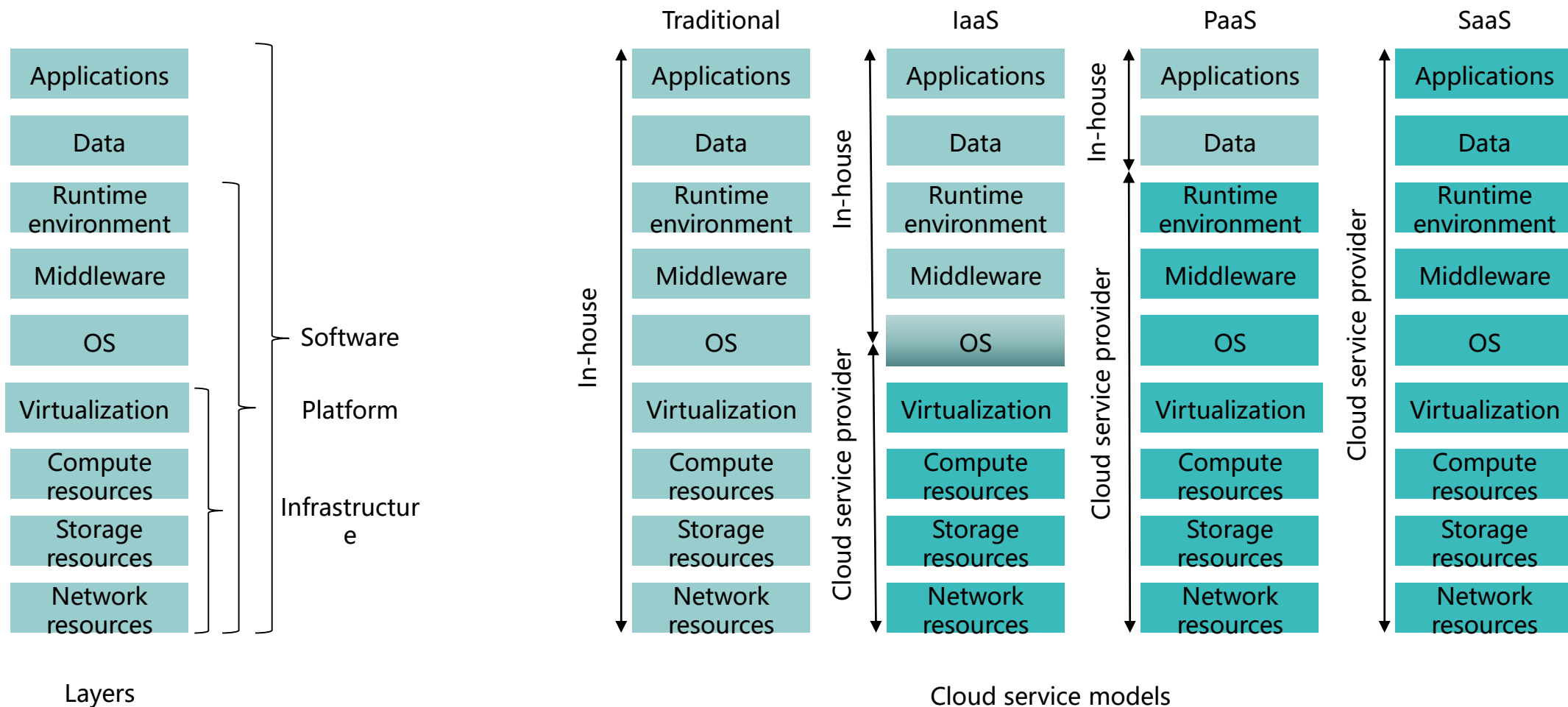
**Financial
cloud**



**Healthcare
cloud**



Cloud Service Models





Quiz

1. Which of the following services offered by HUAWEI CLOUD (public cloud) falls into the category of SaaS services?
 - A. Elastic Cloud Server (ECS)
 - B. Facial recognition
 - C. Elastic Volume Service (EVS)
 - D. Object Storage Service (OBS)
2. The measurable service characteristic of cloud computing means that users pay for how long and how much they use the cloud service.
 - A. TRUE
 - B. FALSE



Summary

- Describe what cloud computing is.
- Describe the brief history of cloud computing.
- List a few use cases of cloud computing.
- Describe the characteristics of cloud computing.



Recommendations

- Huawei e-Learning website:
 - <http://support.huawei.com/learning/Index!toTrainIndex>
- Huawei Support case library:
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Introduction to Compute Virtualization



Foreword

- Cloud computing 1.0 focused on virtualization which today has become the foundation of cloud computing. This chapter focuses on the architecture and technologies involved in compute virtualization.



Objectives

- Upon completion of this course, you will:
 - Be able to describe what virtualization is.
 - Understand the differences between virtualization and cloud computing.
 - Understand KVM technology.
 - Understand Huawei' s FusionSphere virtualization solution.

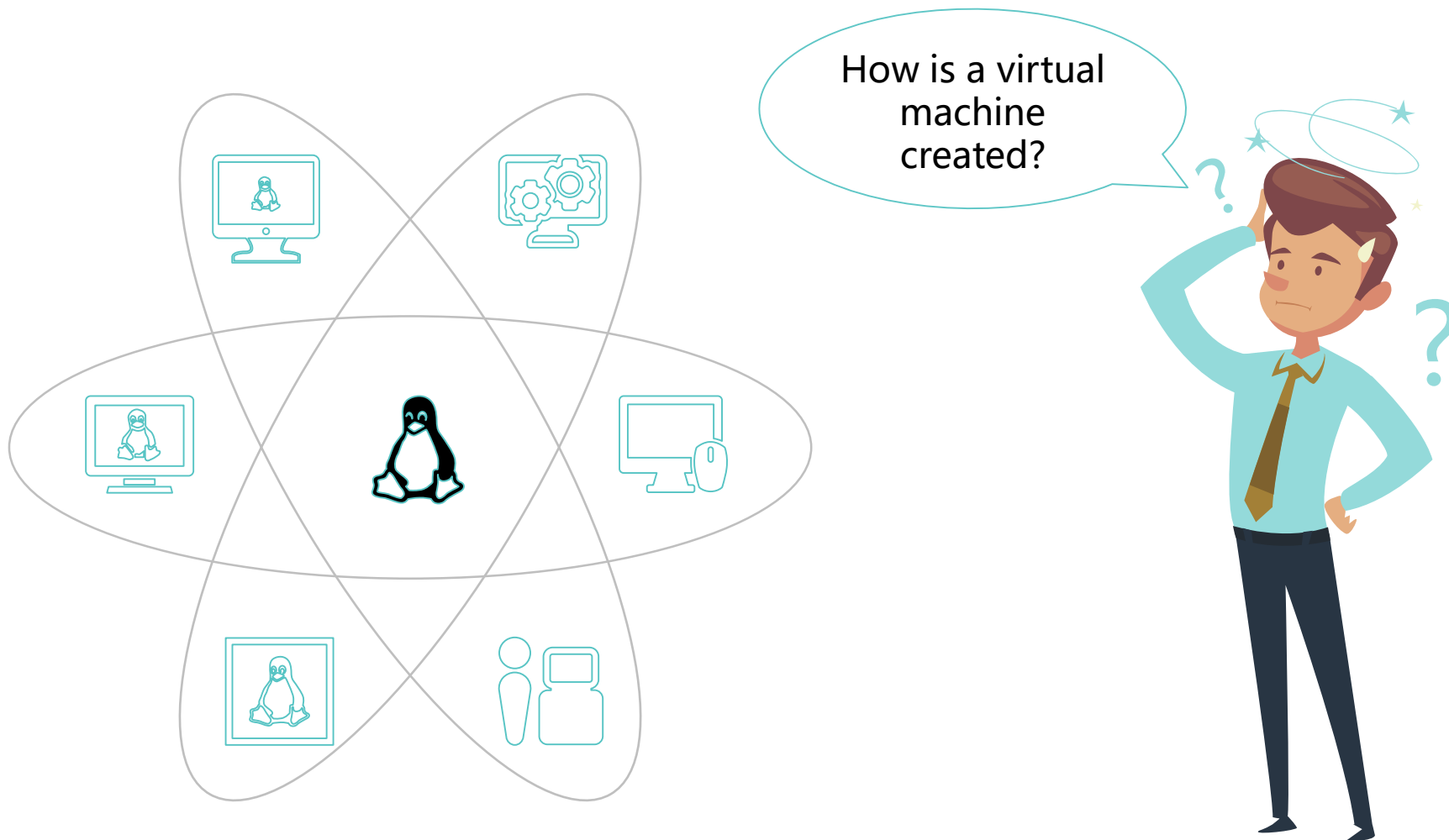


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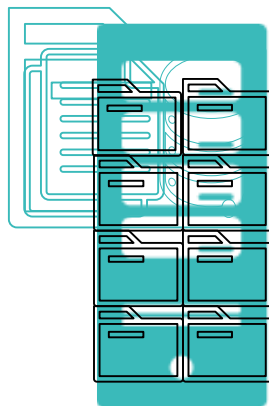


What's a Virtual Machine (VM)?



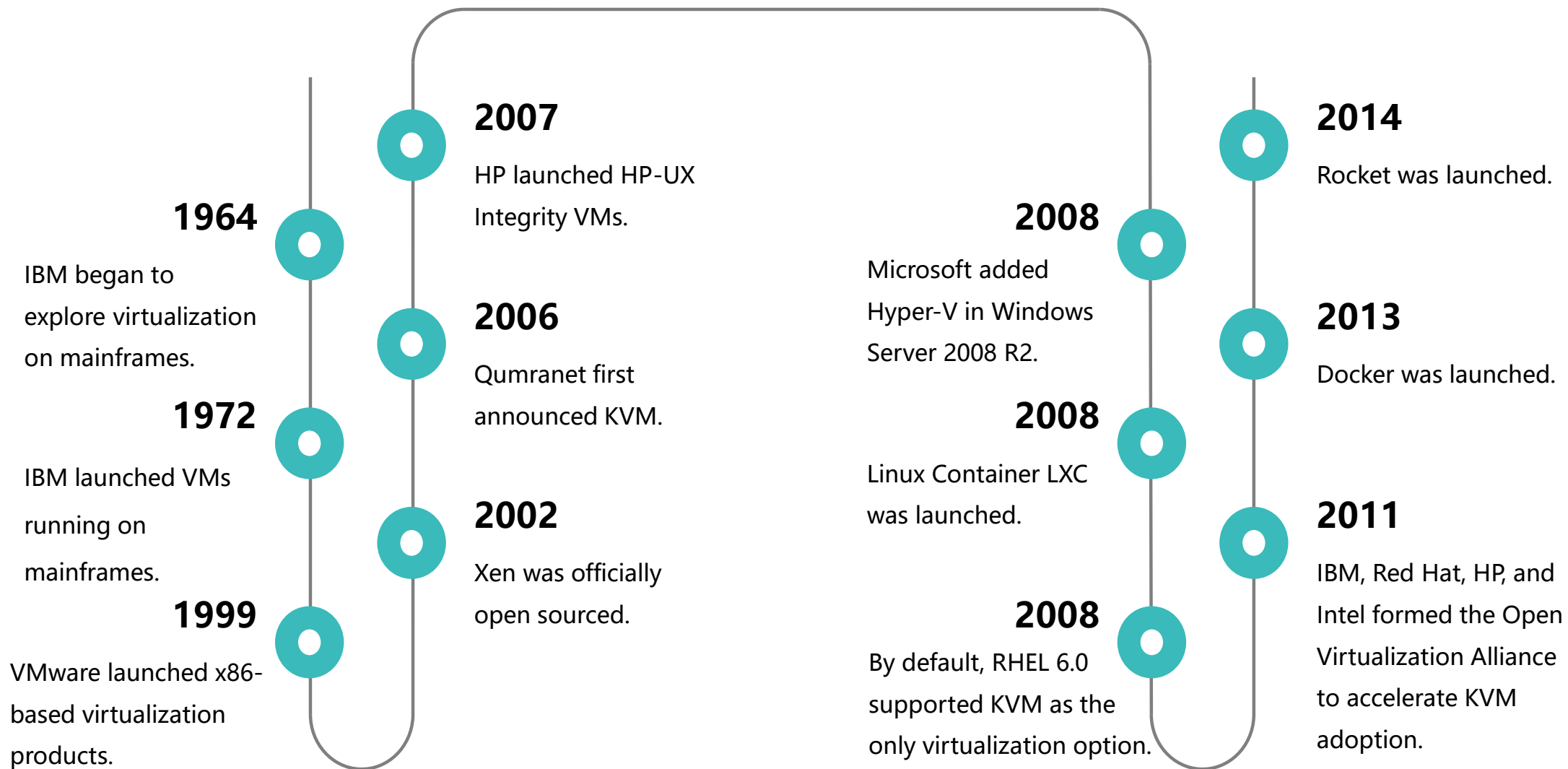


What's Virtualization?



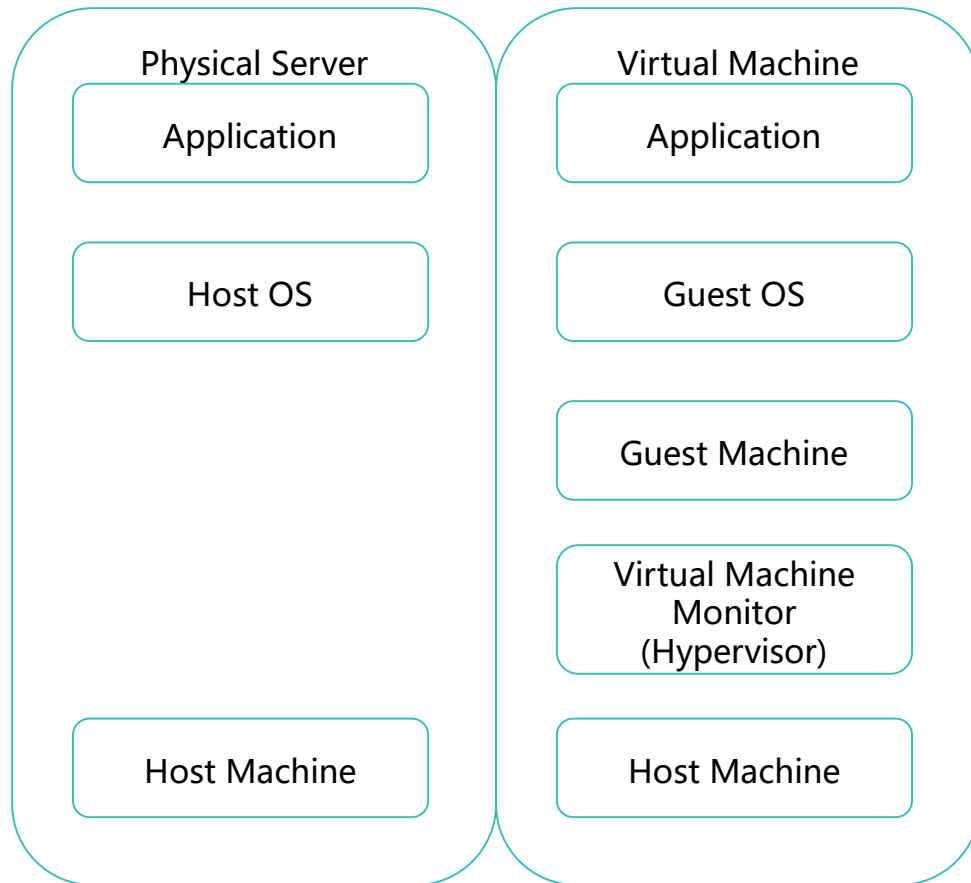


A Brief History of Compute Virtualization





Important Concepts in Compute Virtualization



Guest OS:

Operating system running in a virtual machine (VM)

Guest Machine:

Virtual machine created through virtualization

Hypervisor:

Virtualization software layer, or
Virtual Machine Monitor (VMM)

Host OS:

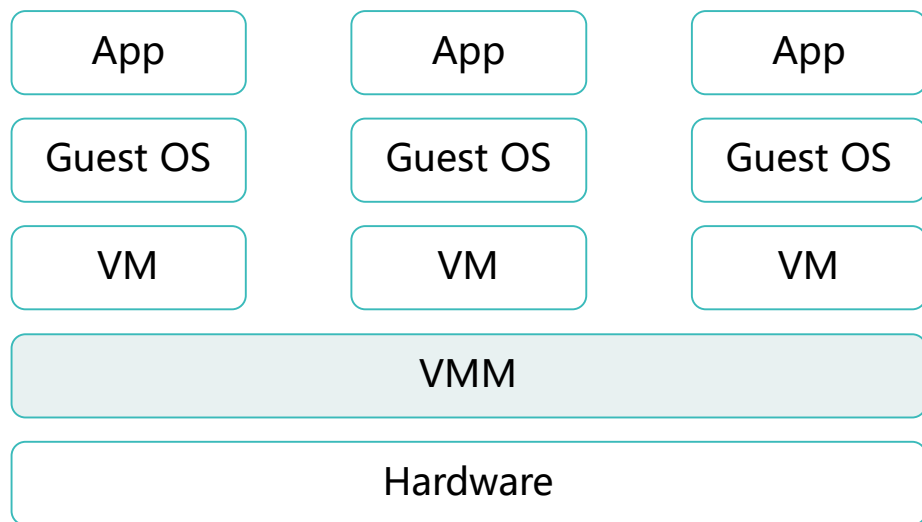
Operating system running in a physical machine

Host Machine:

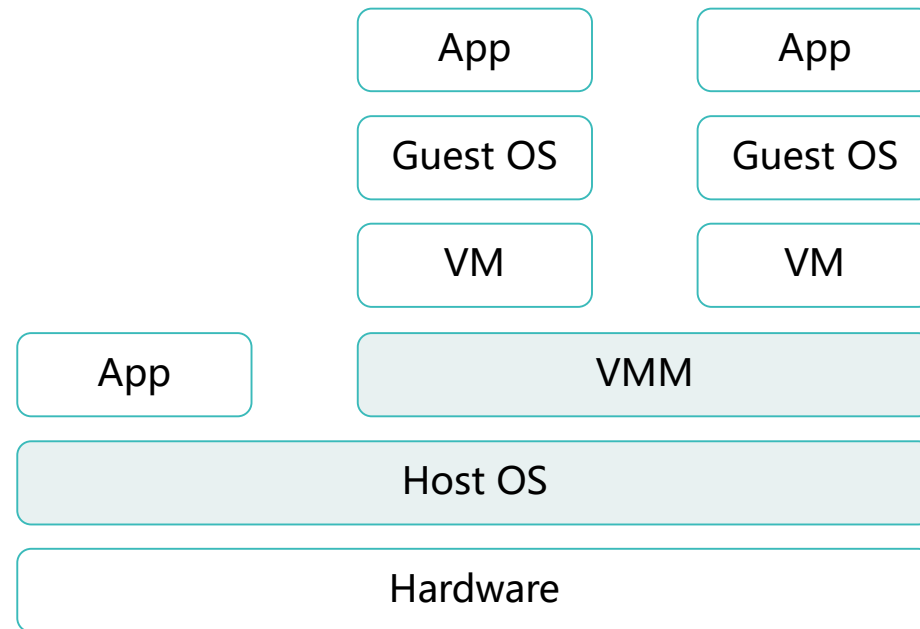
Physical machine



Types of Compute Virtualization



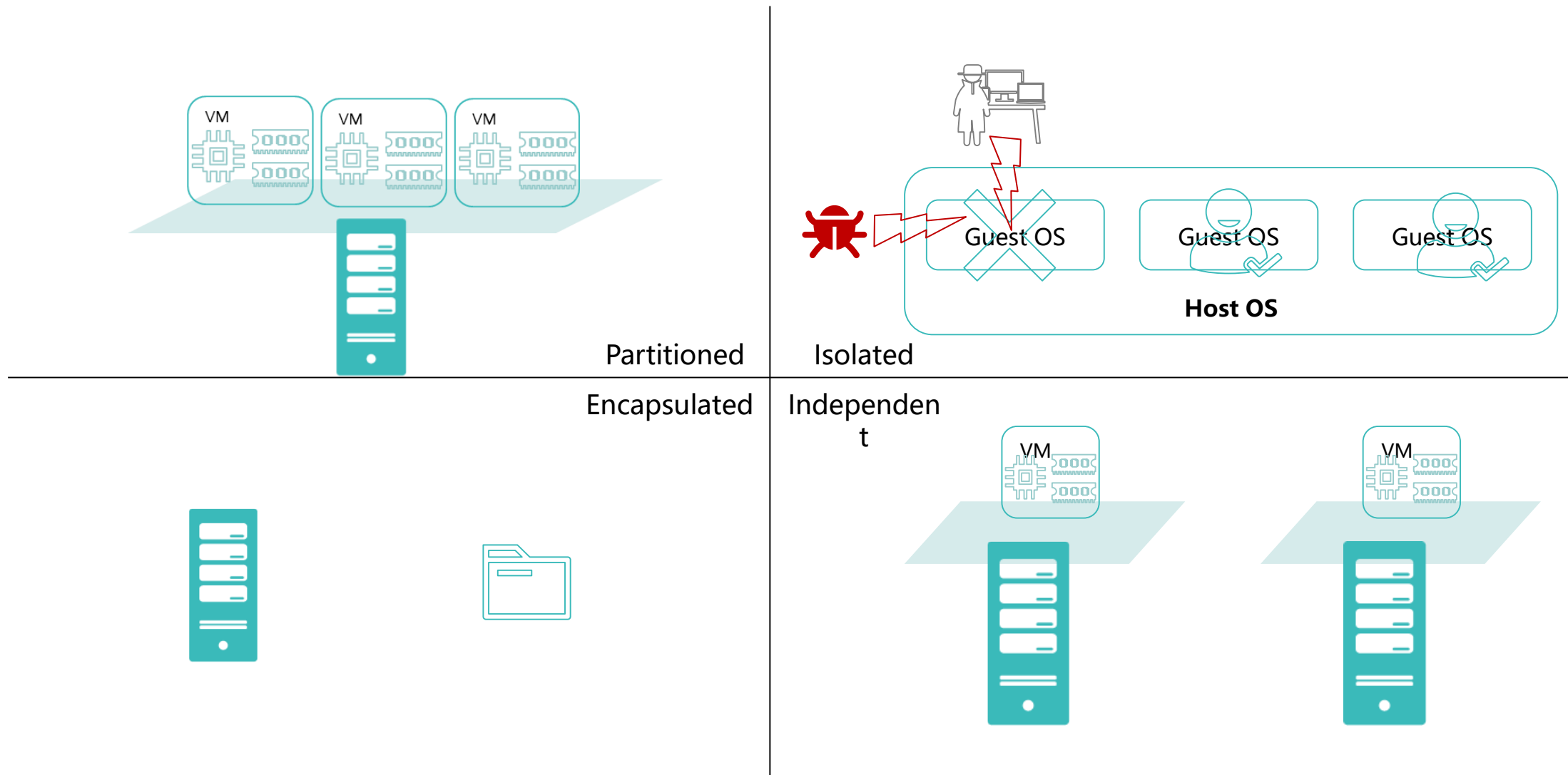
Bare-Metal Virtualization
(Type 1)



Hosted Virtualization
(Type 2)



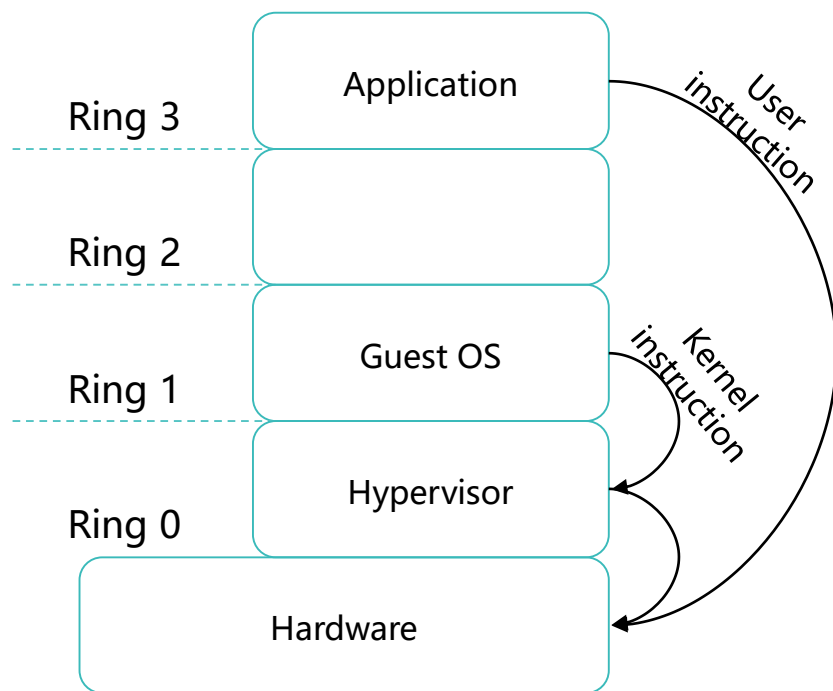
Characteristics of Virtualization



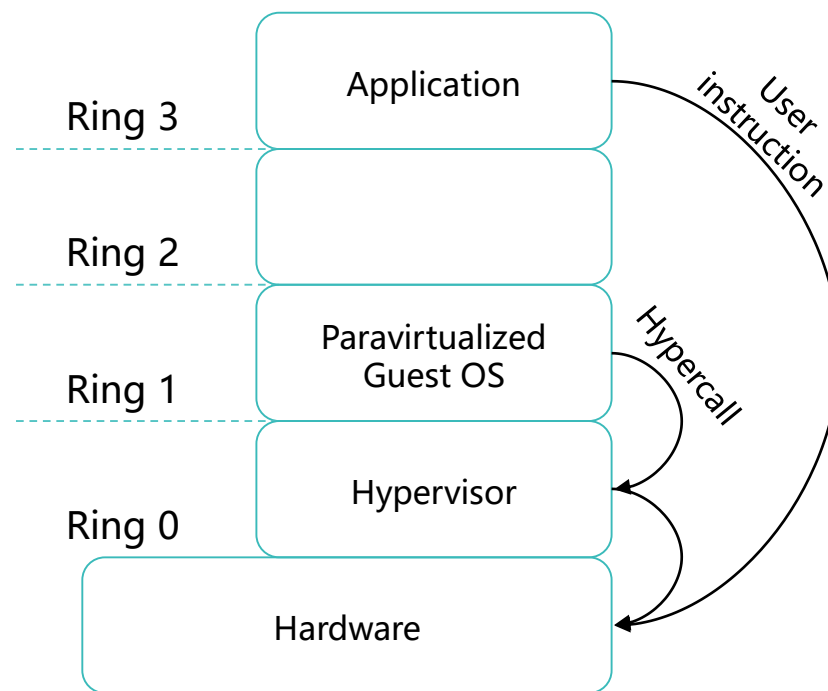


CPU Virtualization

Full virtualization

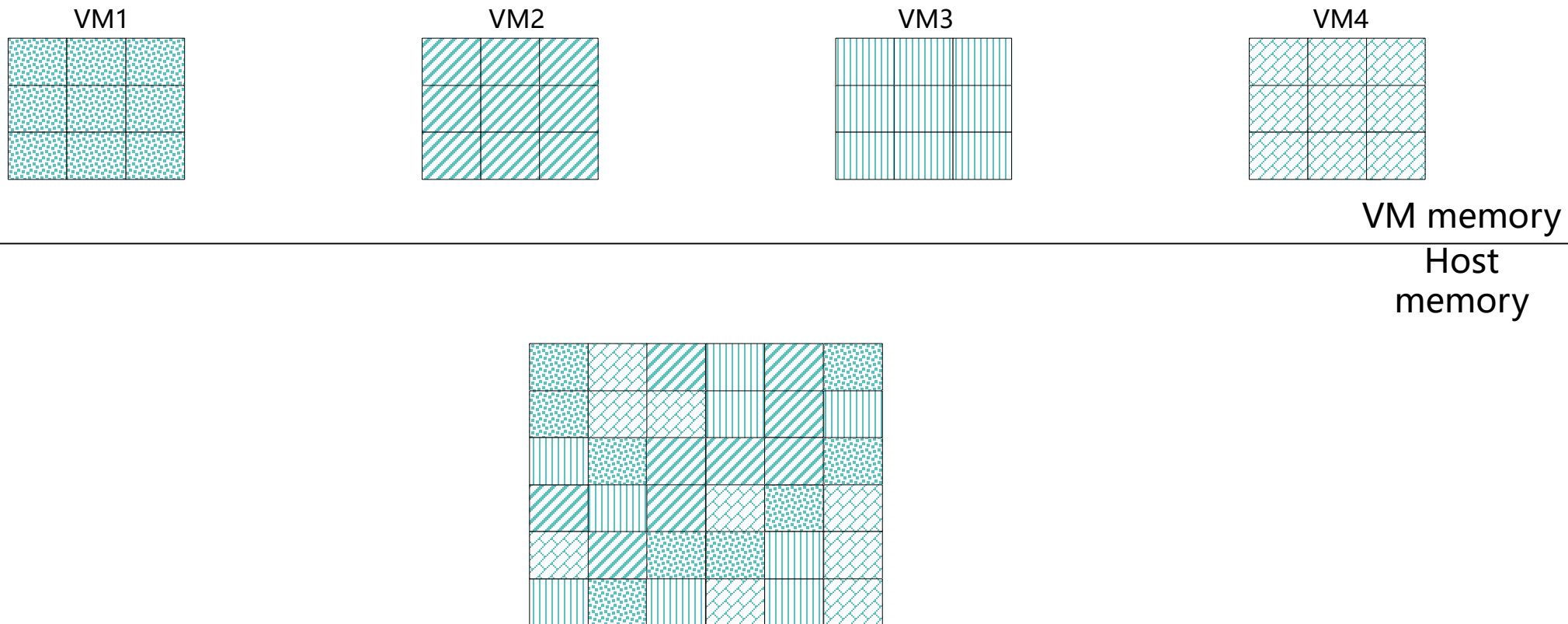


Paravirtualization





Memory Virtualization



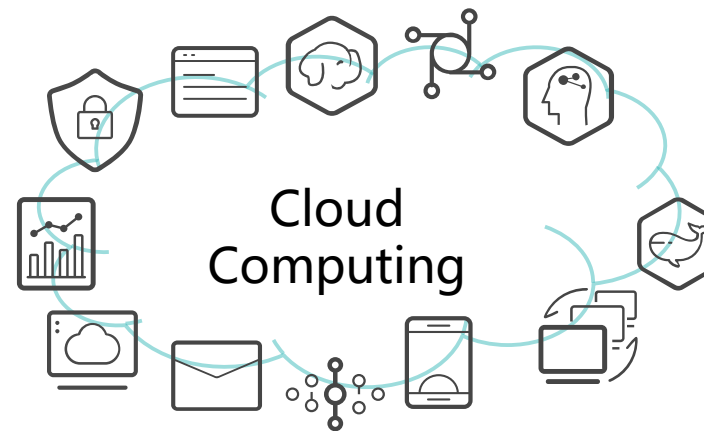


I/O Virtualization

- Emulation [Full Virtualization]: Complete simulation of the hardware, for example, keyboard and mouse. Access to such hardware depends on the capture of focus by the host, and leads to poor performance in some cases.
- Paravirtualization: Access to hardware drivers is transferred from the I/O frontend to the I/O backend. This mode is usually only used for hard disks and NICs, and delivers high performance.
- IO-through: Hardware devices capable of I/O passthrough, such as hard disks and NICs, are directly allocated to VMs. In Xen, Dom0 allocates hardware devices but does not take part in the access of the hardware. Hardware support is required.

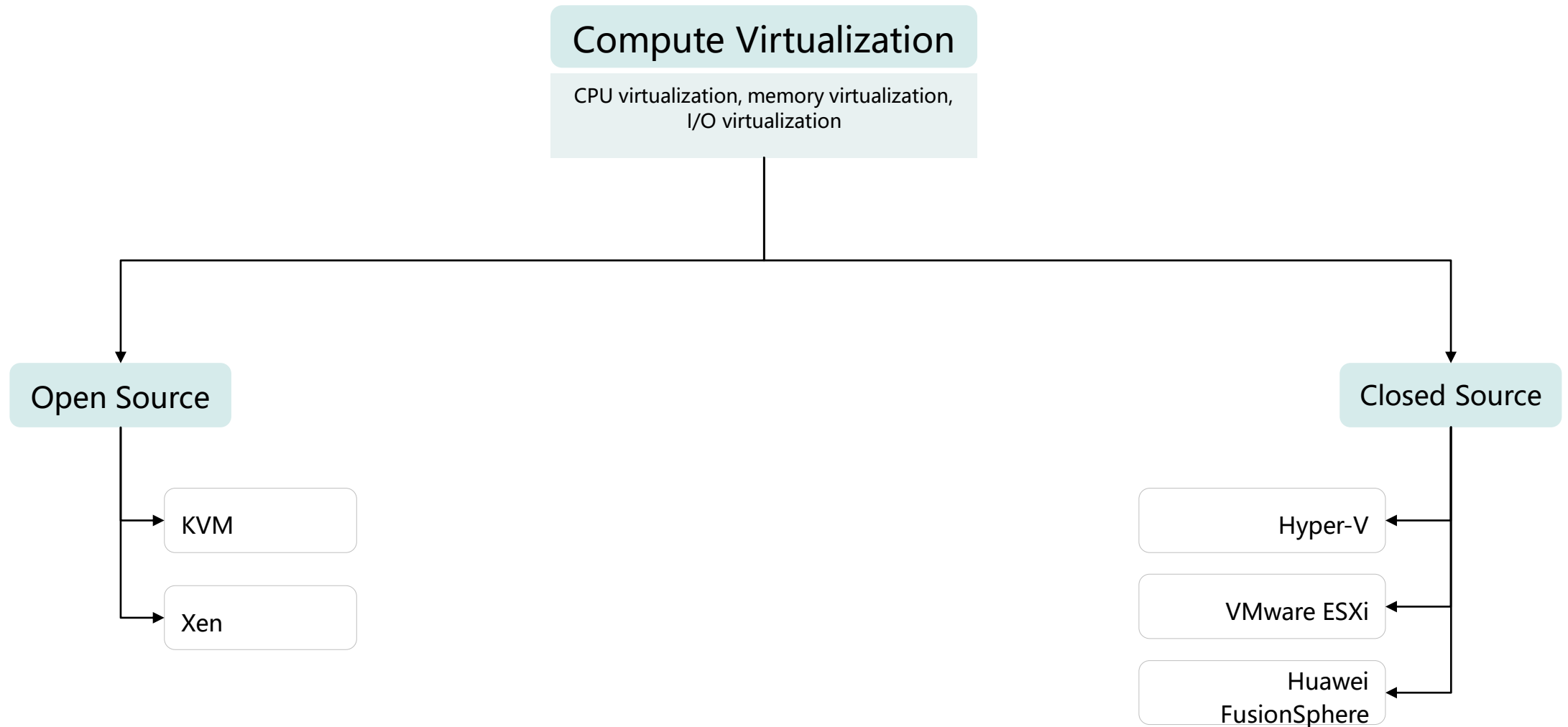


Cloud Computing and Virtualization



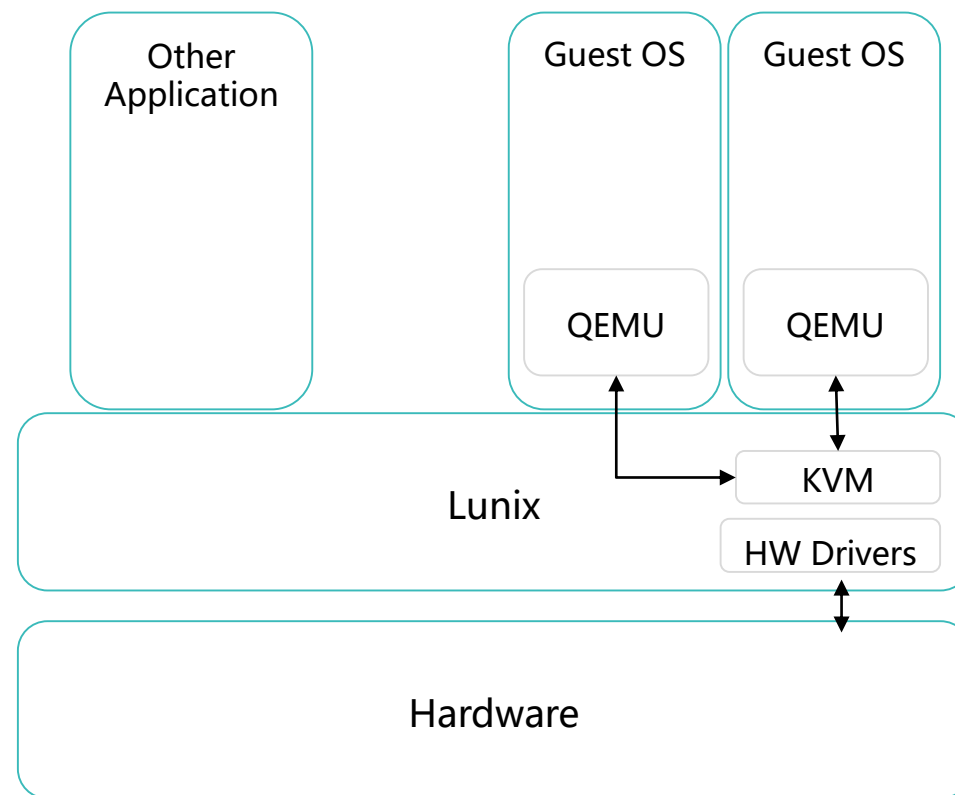
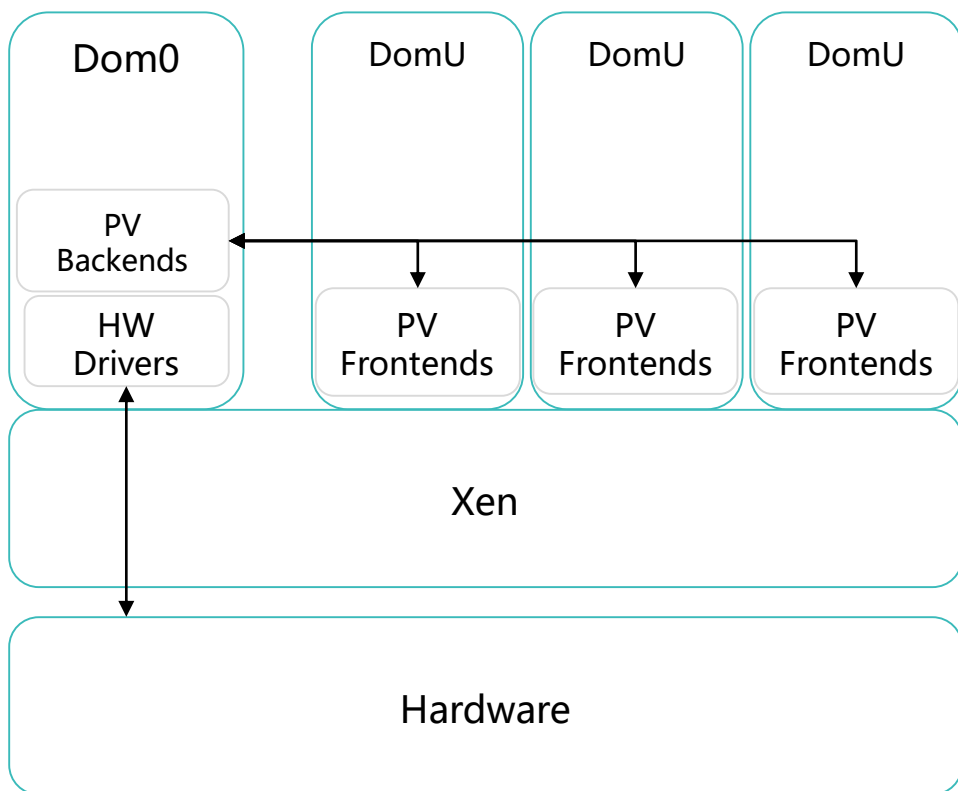


Mainstream Compute Virtualization Technologies





Xen vs. KVM



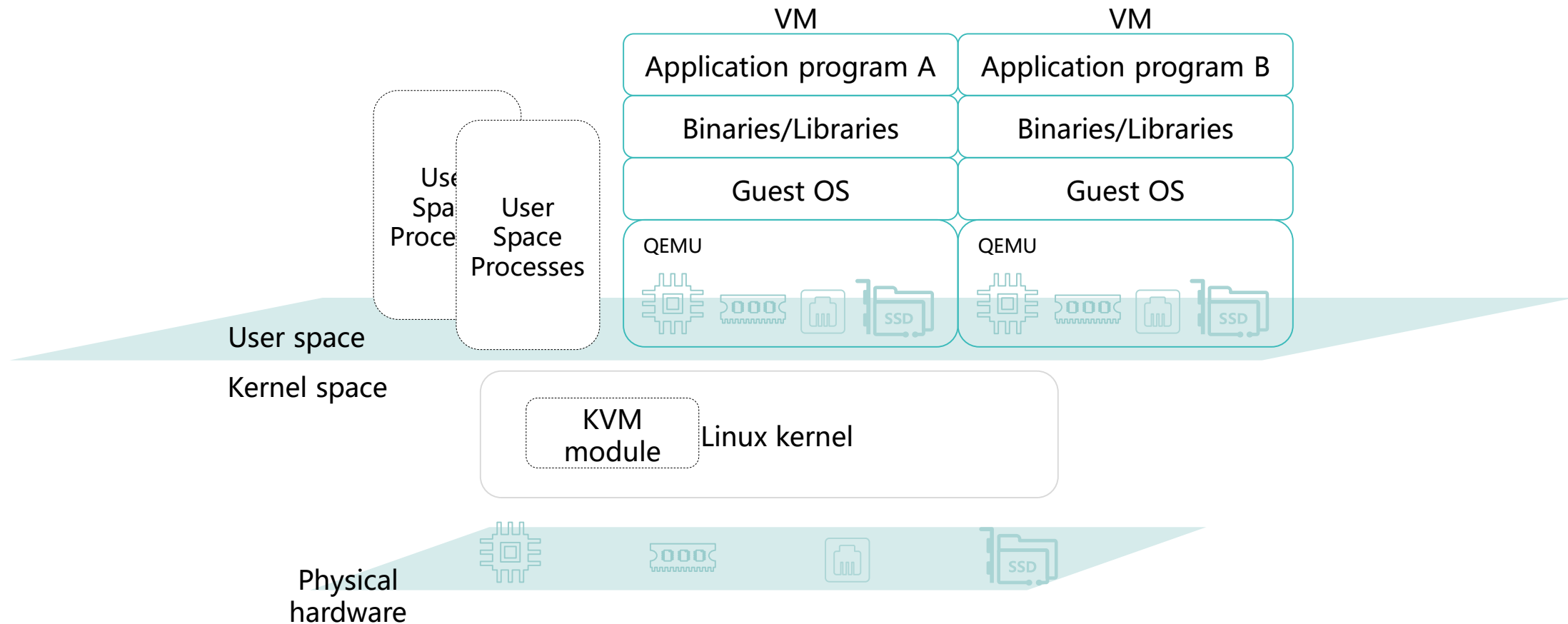


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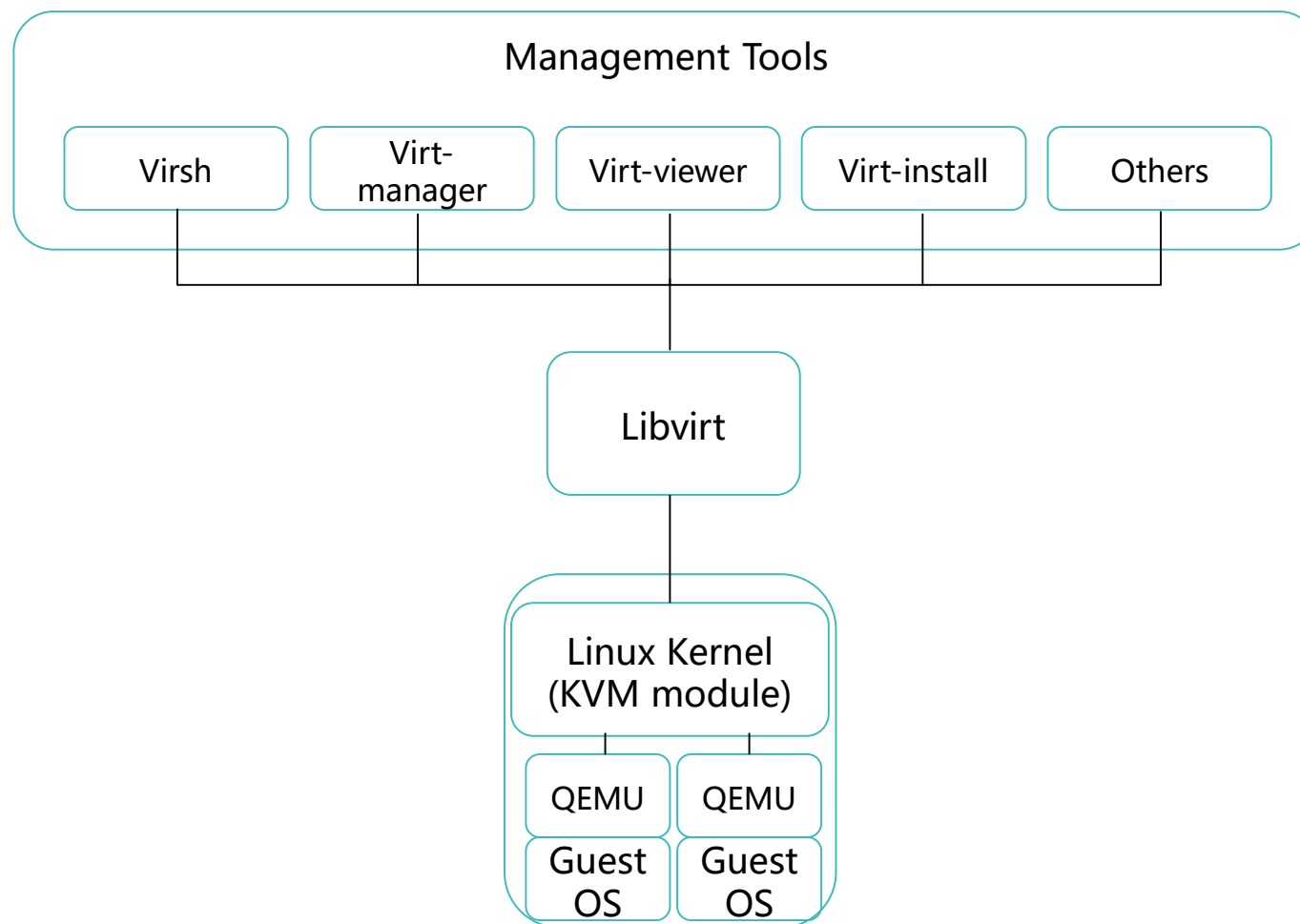


What's KVM?



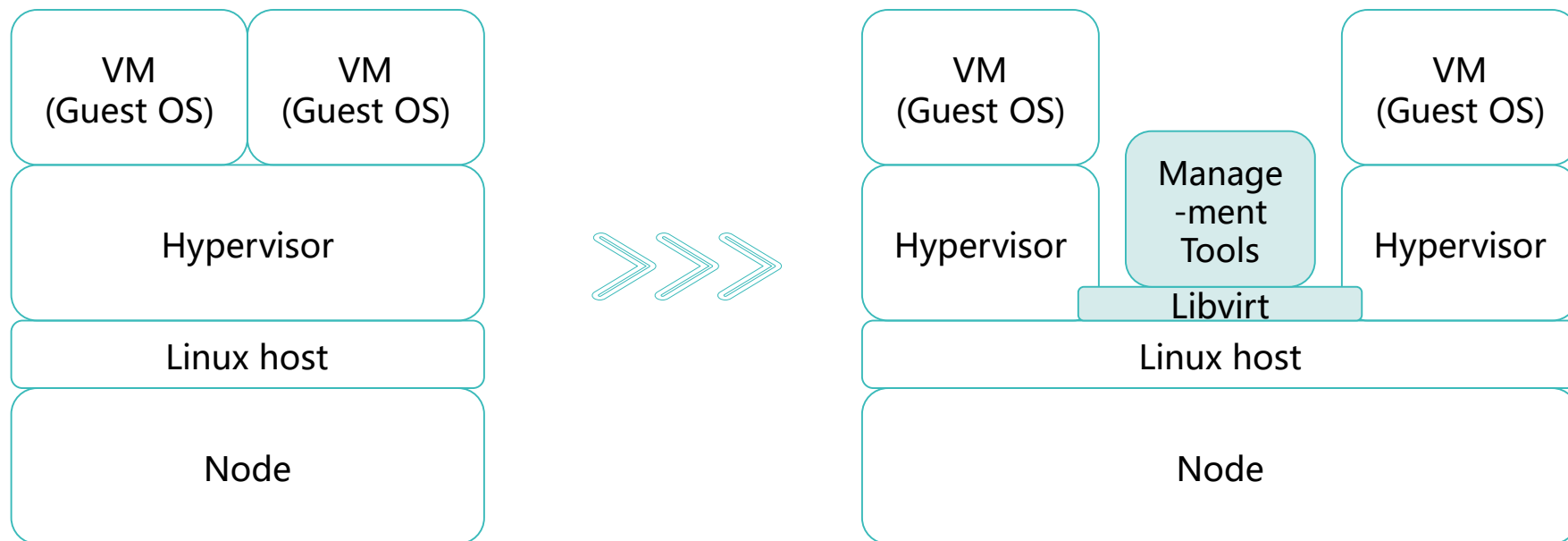


KVM Architecture



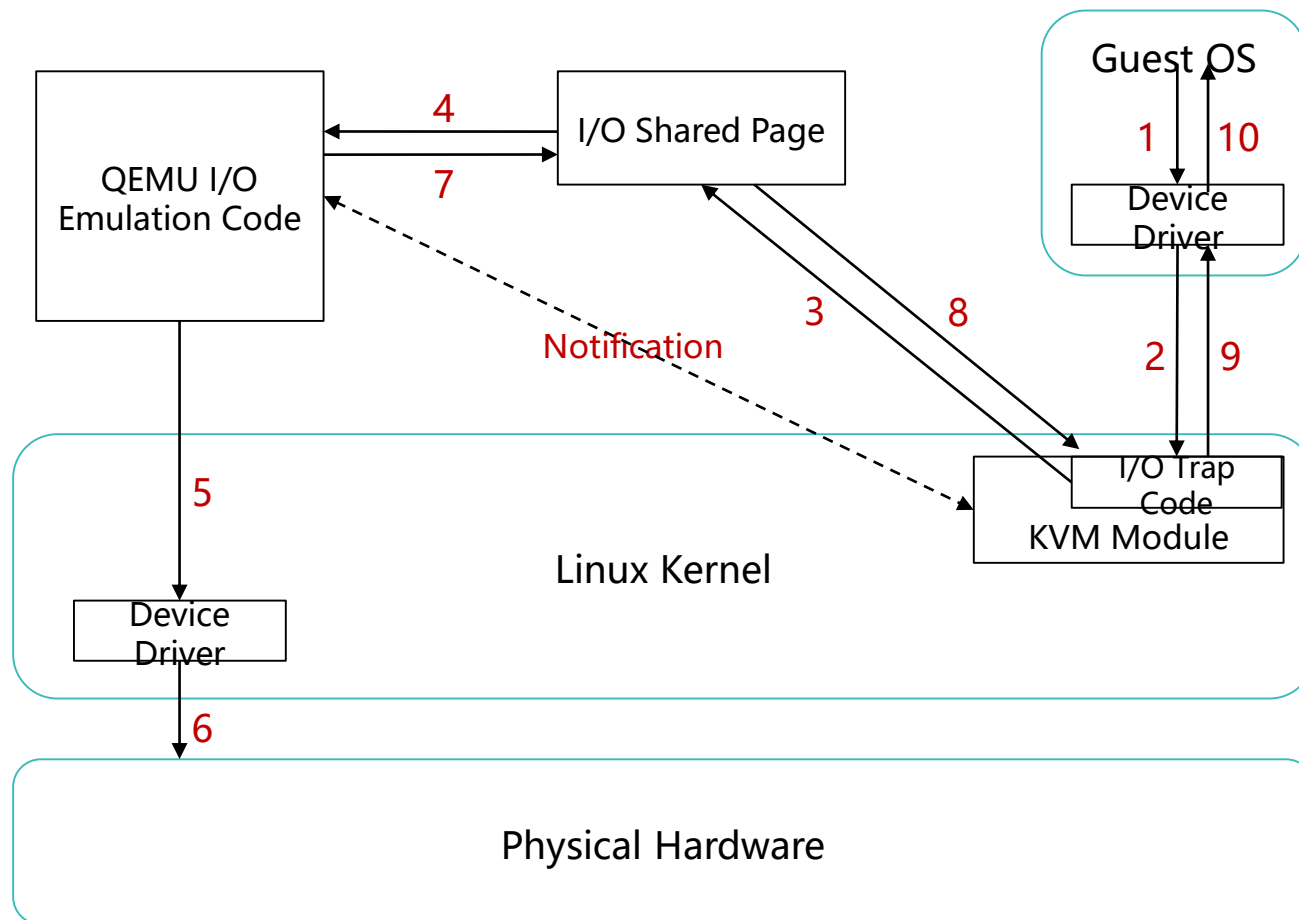


Libvirt



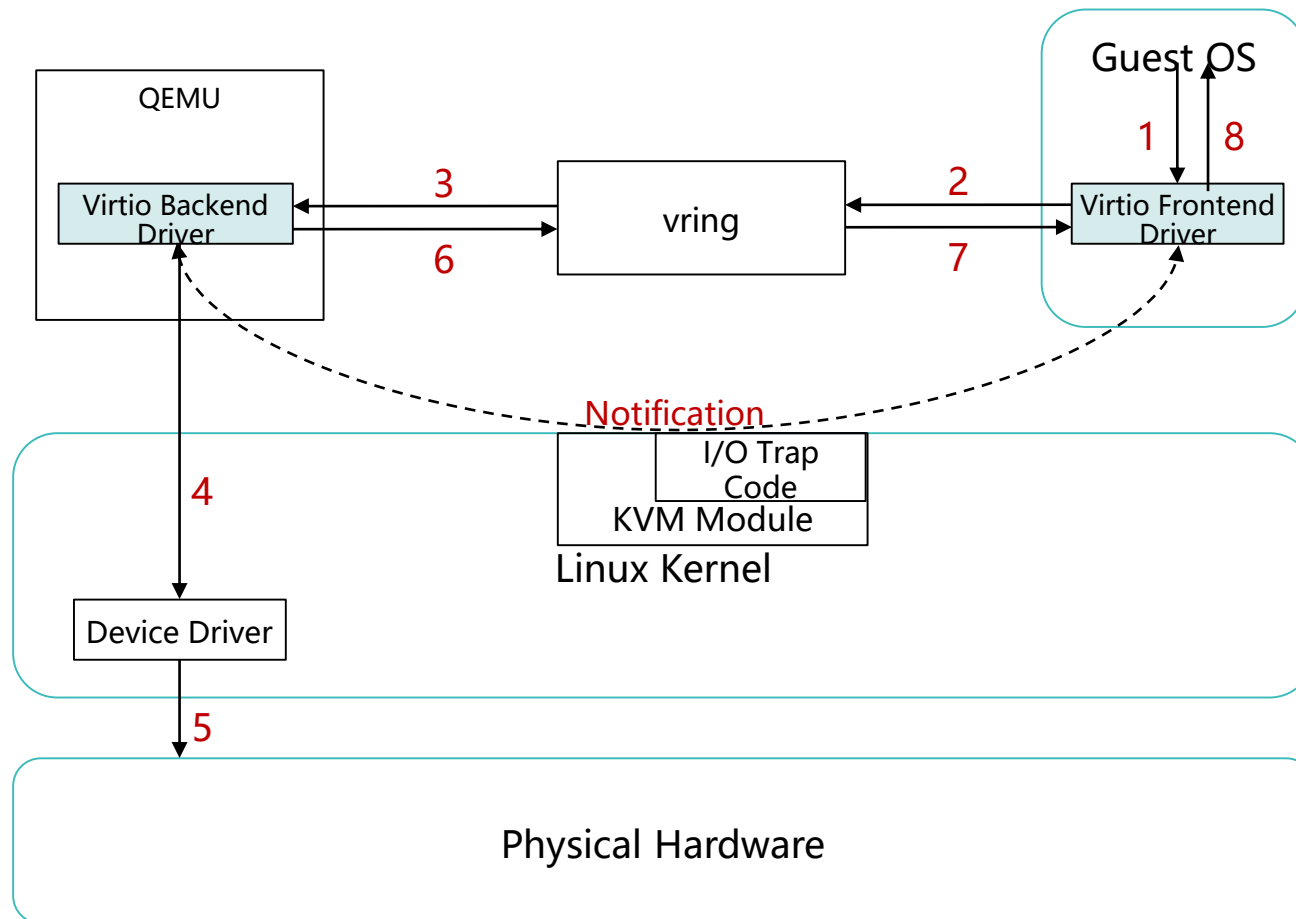


KVM I/O Process - Default





KVM I/O Process - Virtio



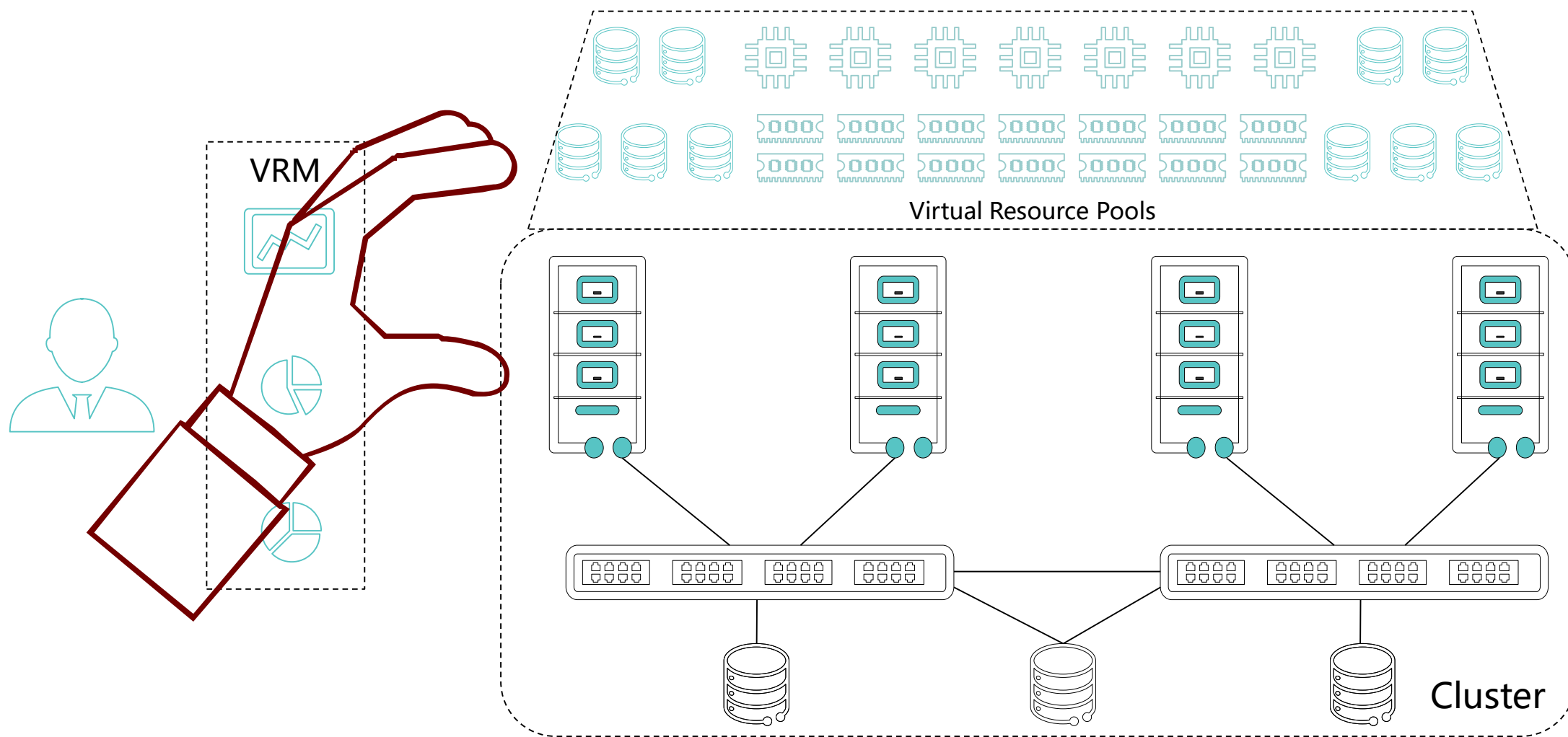


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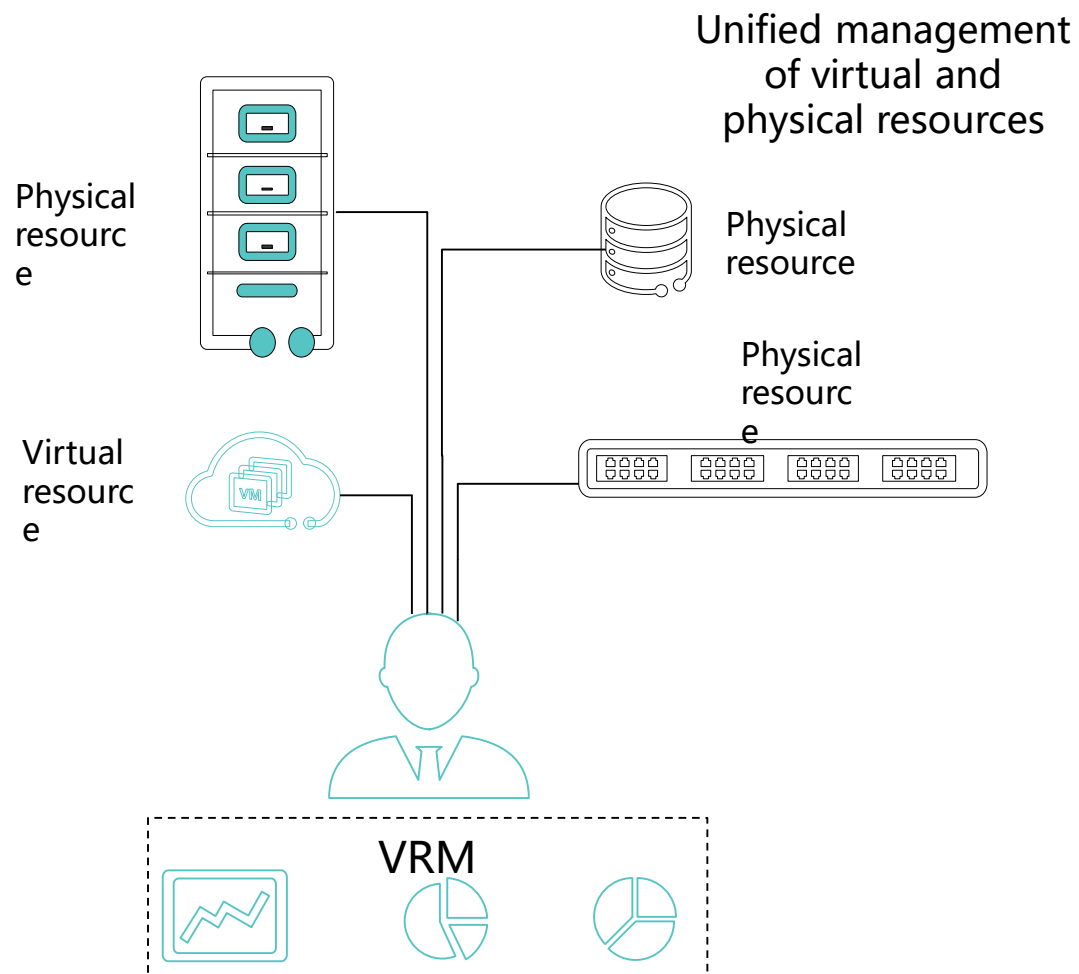


FusionCompute Architecture

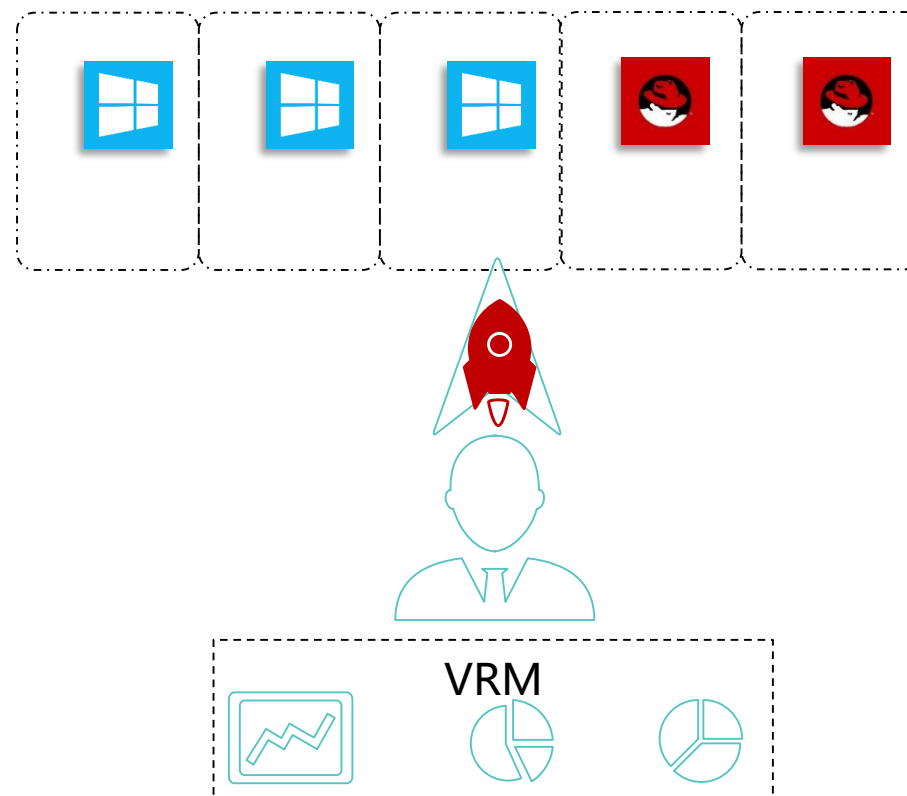




FusionCompute Advantages



Quick VM provisioning





Functions of FusionCompute Components

Component	Function
CNA	CNA provides the following functions: • Provides virtual computing functions. • Manages VMs on compute nodes. • Manages compute, storage, and network resources on compute nodes.
VRM	VRM provides the following functions: • Manages block storage resources in clusters. • Manages network resources, such as IP addresses and VLANs in clusters, and assigns IP addresses to VMs. • Manages the lifecycle of VMs in clusters, and allocates and migrates VMs across compute nodes. • Dynamically schedules resources in clusters. • Manages virtual resources and user data in a unified manner and provides elastic computing, storage, and IP address services. • Provides a unified Web UI portal, allowing O&M engineers to remotely access the FusionCompute system to monitor and manage resources, and create and view resource reports.



Quiz

1. In compute virtualization, which of the following allocates CPU and memory resources to VMs? ()
 - A. Guest OS
 - B. VMM
 - C. Hypervisor
 - D. Host OS
2. All open-source virtualization technologies are type 1 virtualization, while all closed-source ones are type 2 virtualization.
 - A. TRUE
 - B. FALSE



Summary

- This chapter provides basic knowledge about compute virtualization, including CPU, memory, and I/O virtualization. It introduces you to open-source virtualization technology by using KVM as an example, and also to commercial virtualization products by using FusionCompute as an example.



Recommendations

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 - <http://support.huawei.com/learning/Index!toTrainIndex>
- Huawei Support case library
 - <http://support.huawei.com/enterprise/servicecenter?lang=en>
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Network Basics for Cloud Computing



Foreword

- The network consists of a variety of networking devices. In addition to the traditional physical network, the networks for a virtualized environment also include invisible networks running inside servers. This chapter will cover basic knowledge about both types of networks.



Objectives

- Upon completion of this course, you will:
 - Understand how physical and virtual switches work.
 - Understand the network architecture used for virtualized environments.
 - Understand the traffic flows between VMs.
 - Understand concepts related to VLAN.

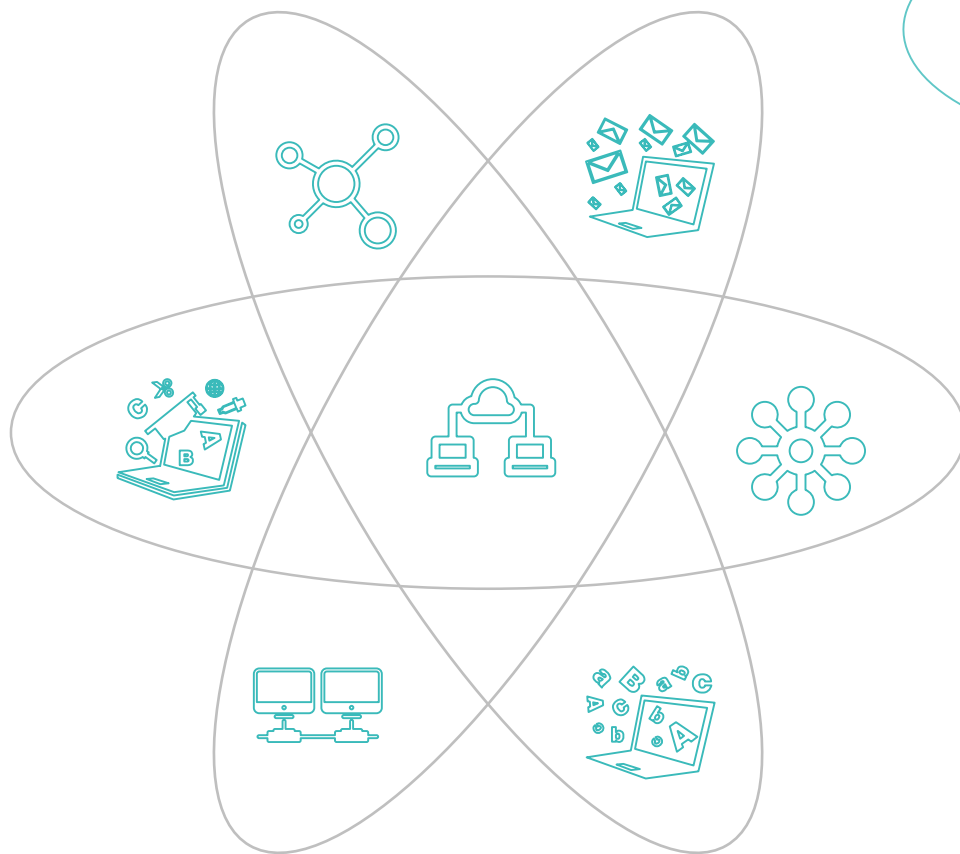


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How Do VMs Communicate?

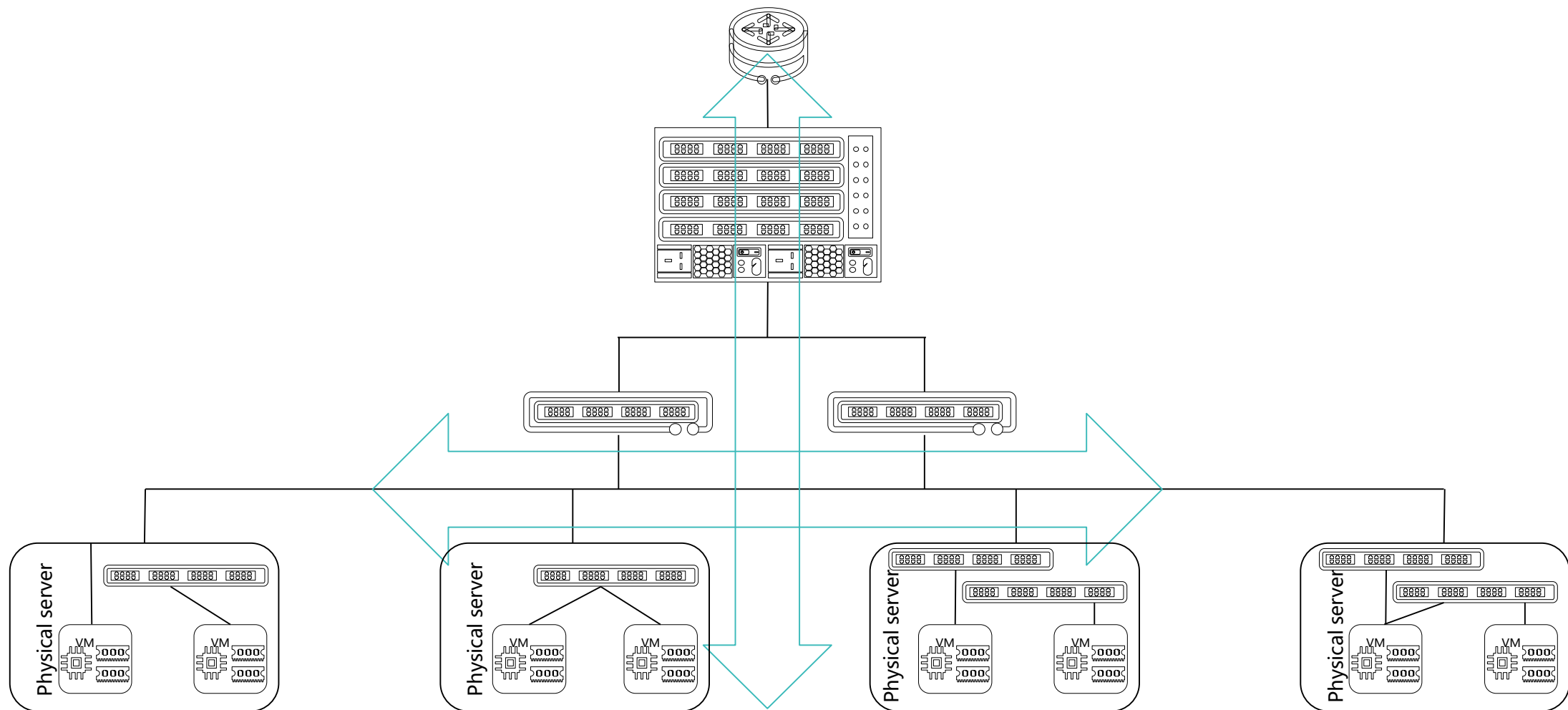


How do VMs
communicate
with each
other?



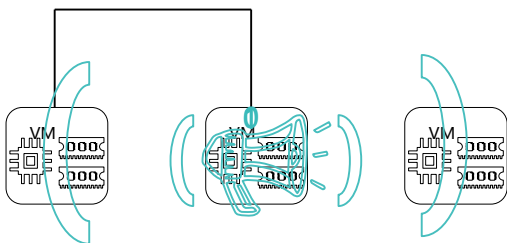


Network Architecture for Virtualization

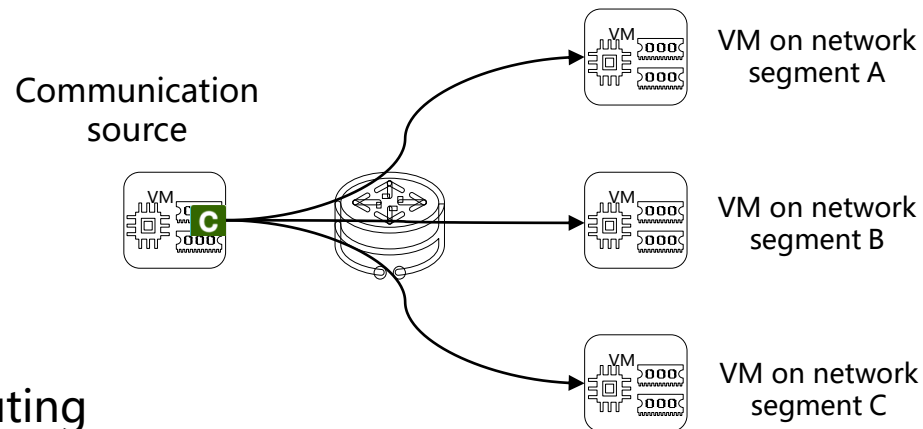




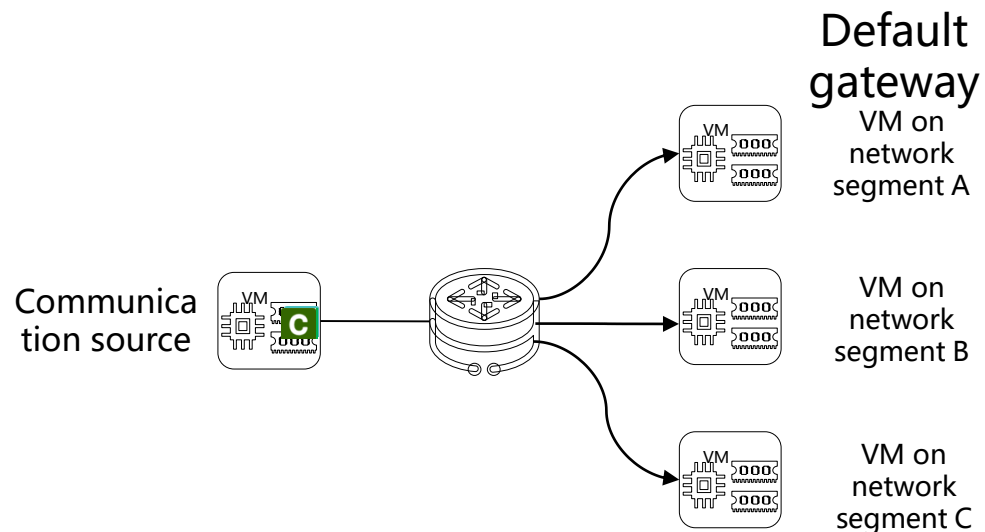
Basic Network Concepts



Broadcast & Unicast

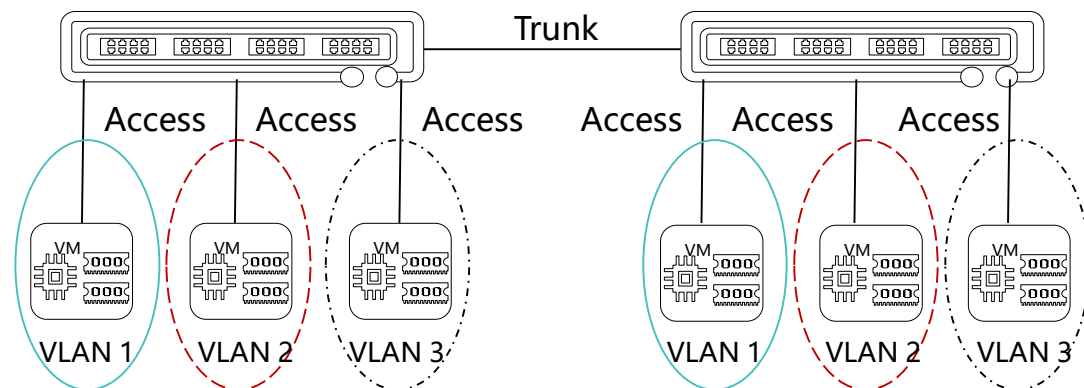


Routing



Default gateway

VLAN



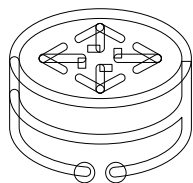


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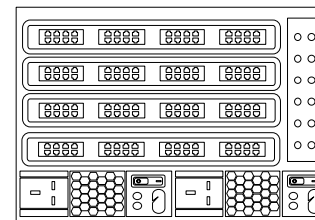
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Physical Network Devices

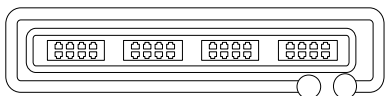


Router



Layer 3 switch

Layer 2 switch

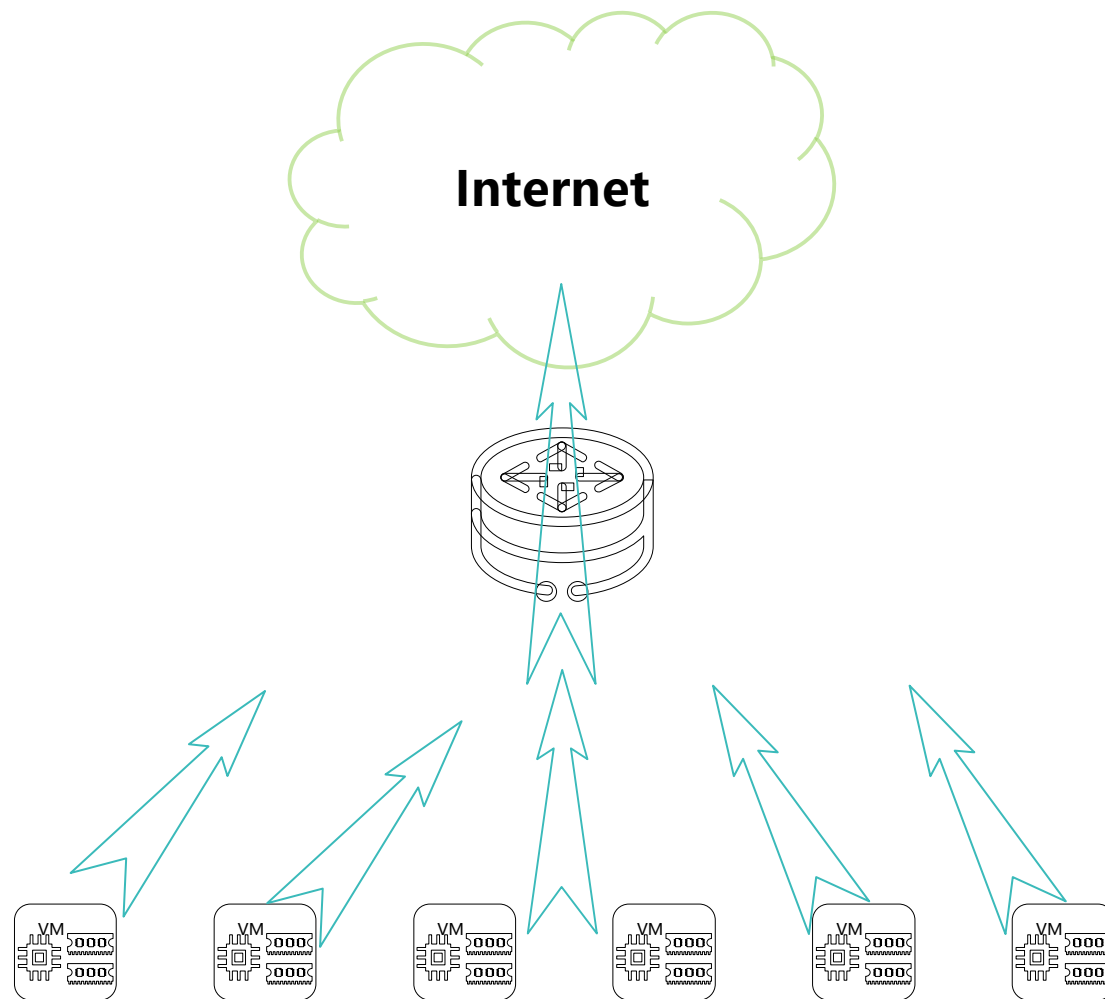


Server NIC



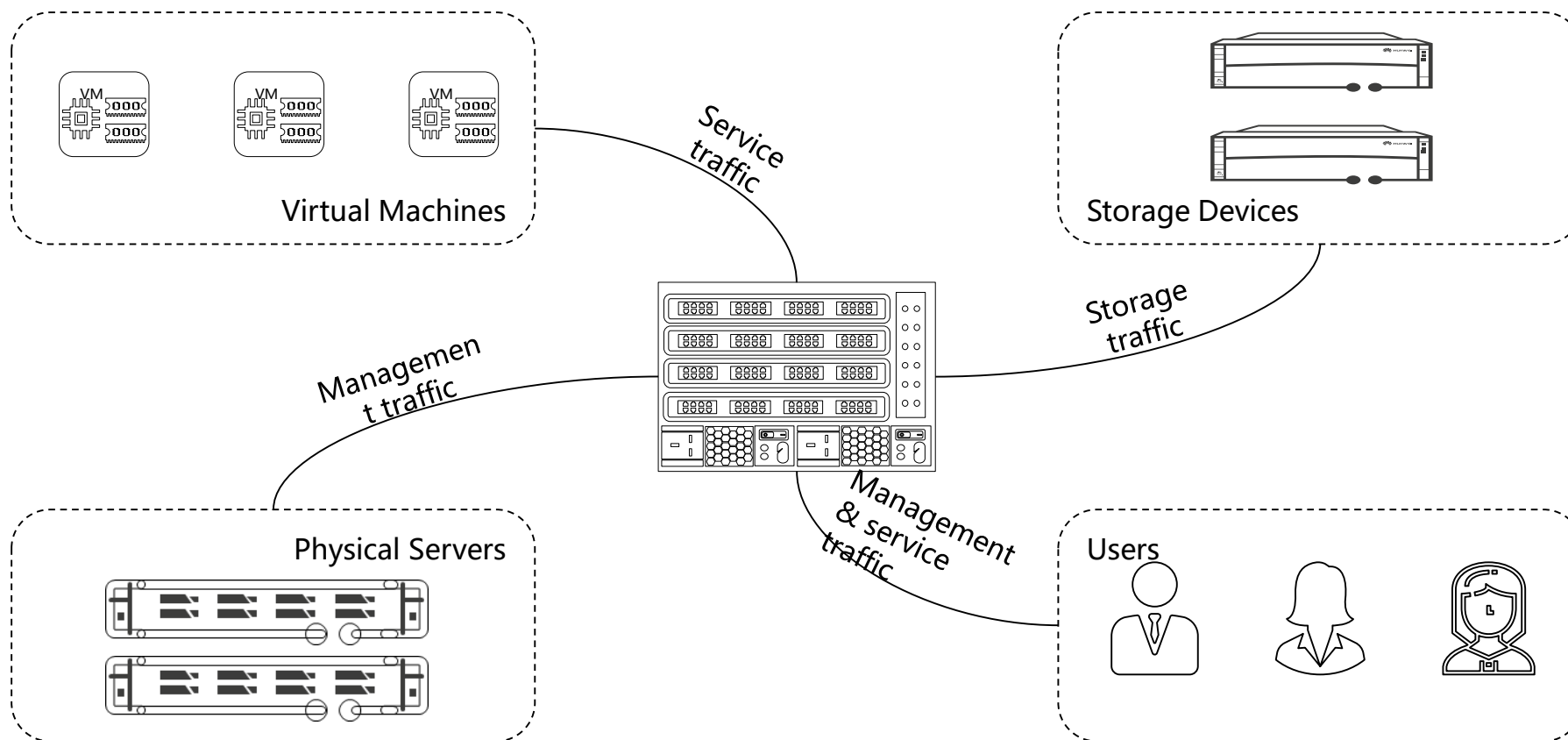


Router in a Virtualized Environment



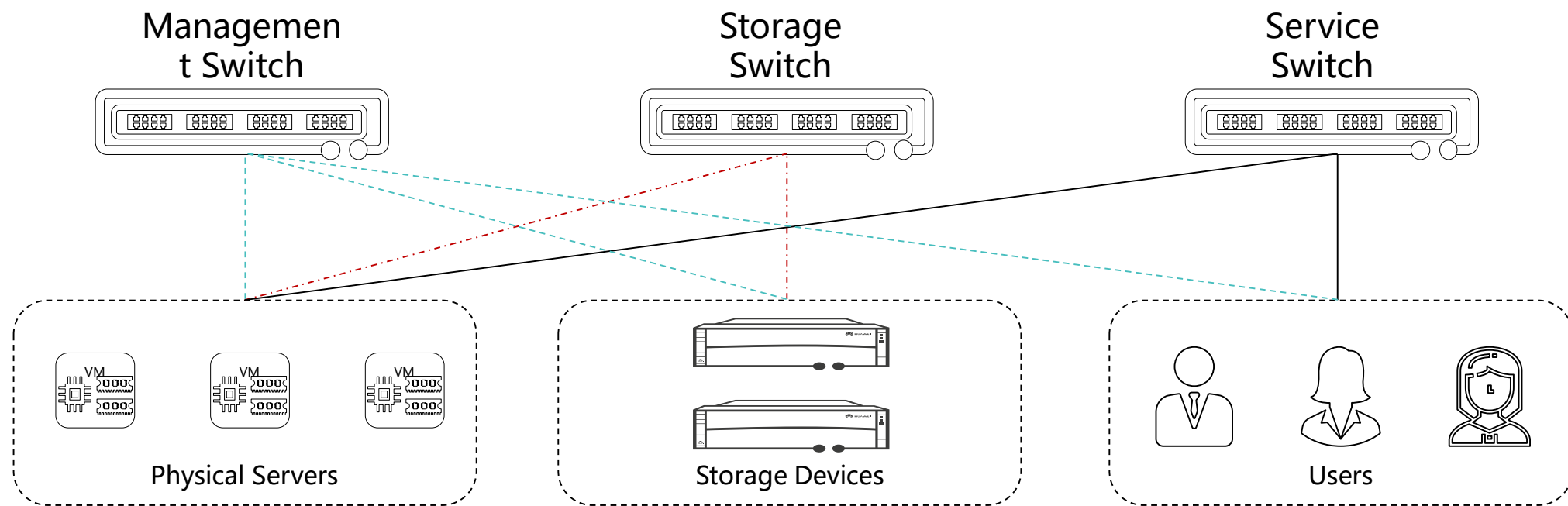


Layer 3 Switch in a Virtualized Environment



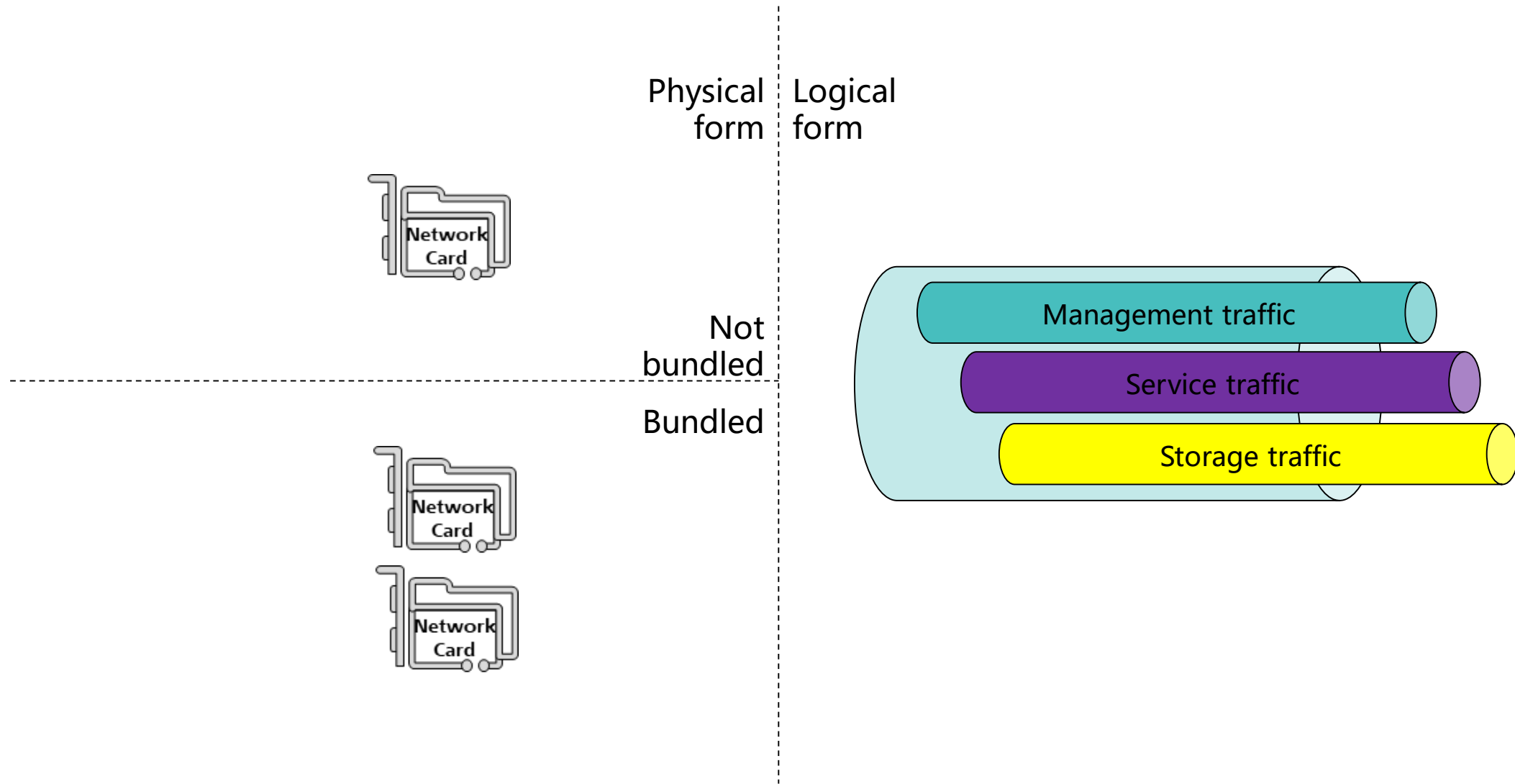


Layer 2 Switches in a Virtualized Environment





Physical NICs in a Virtualized Environment



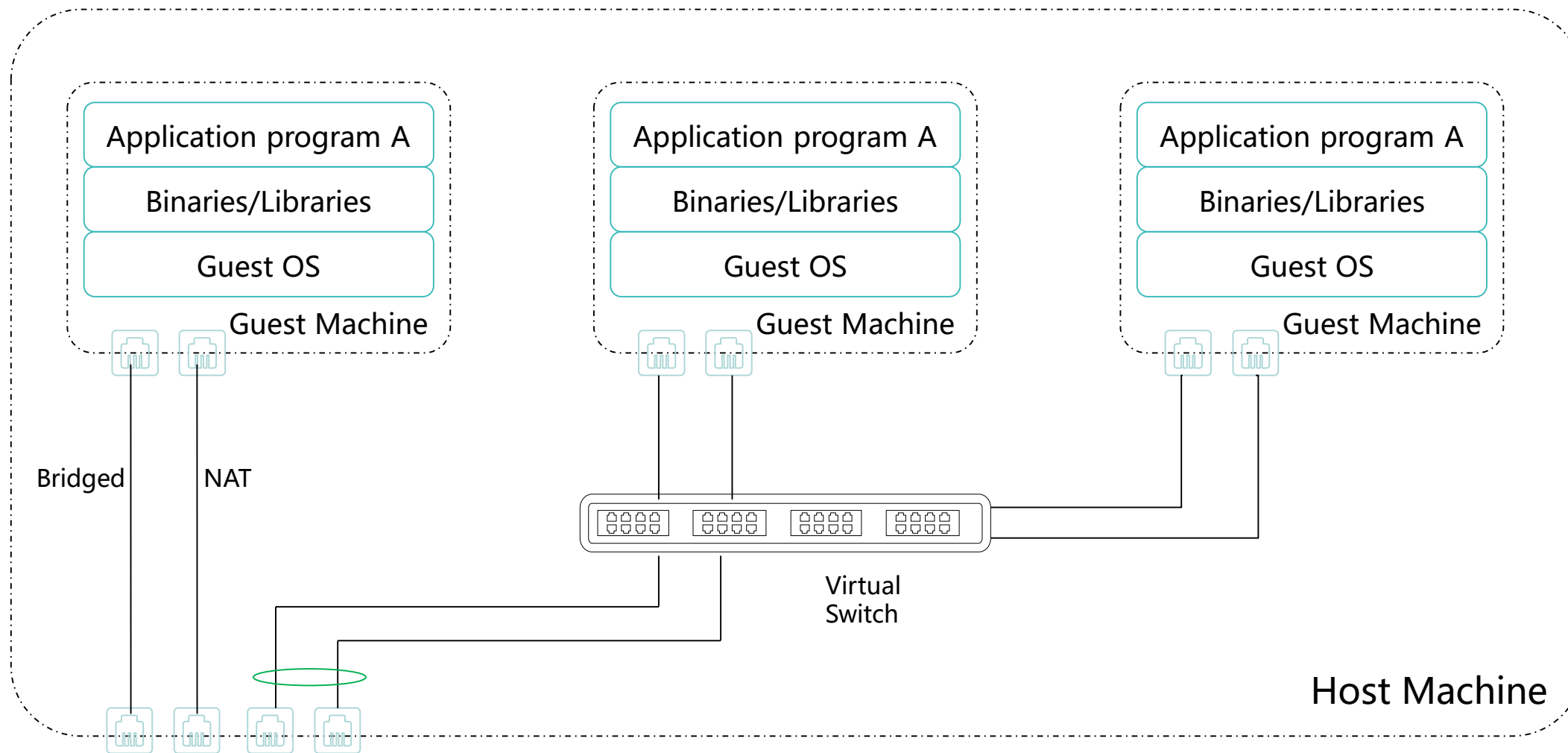


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Mainstream Virtual Network Architecture

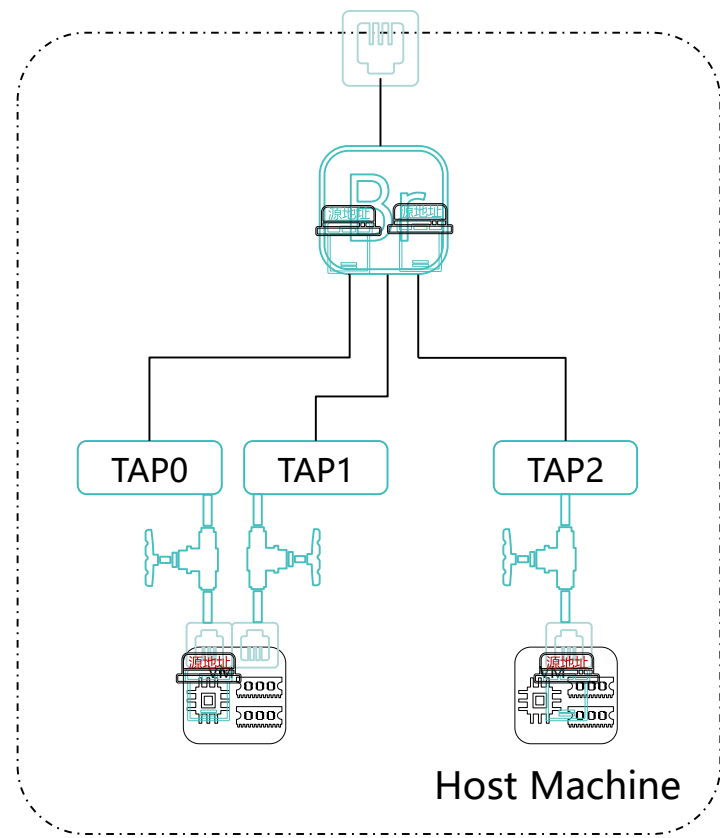
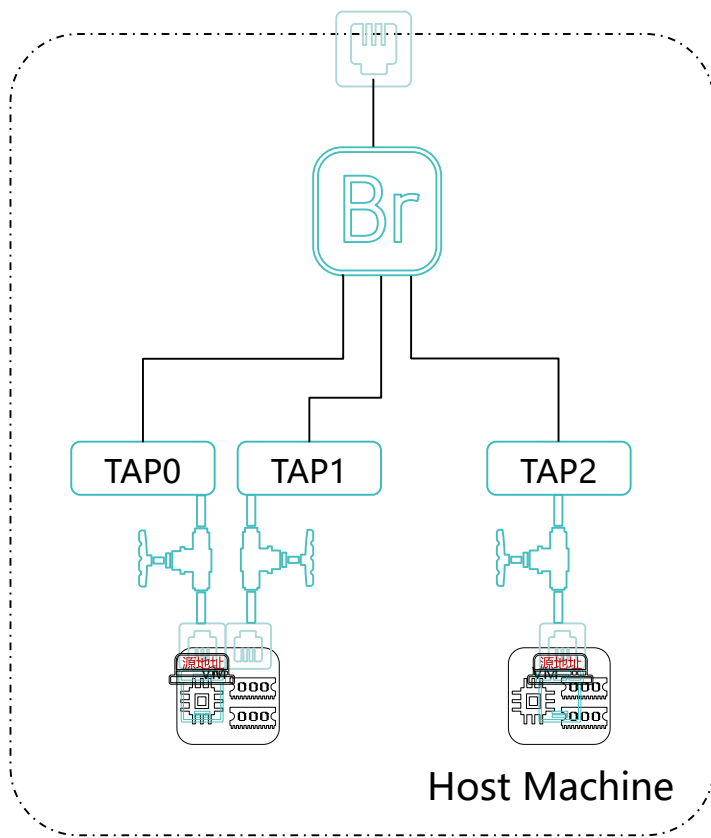




Bridged vs. NAT

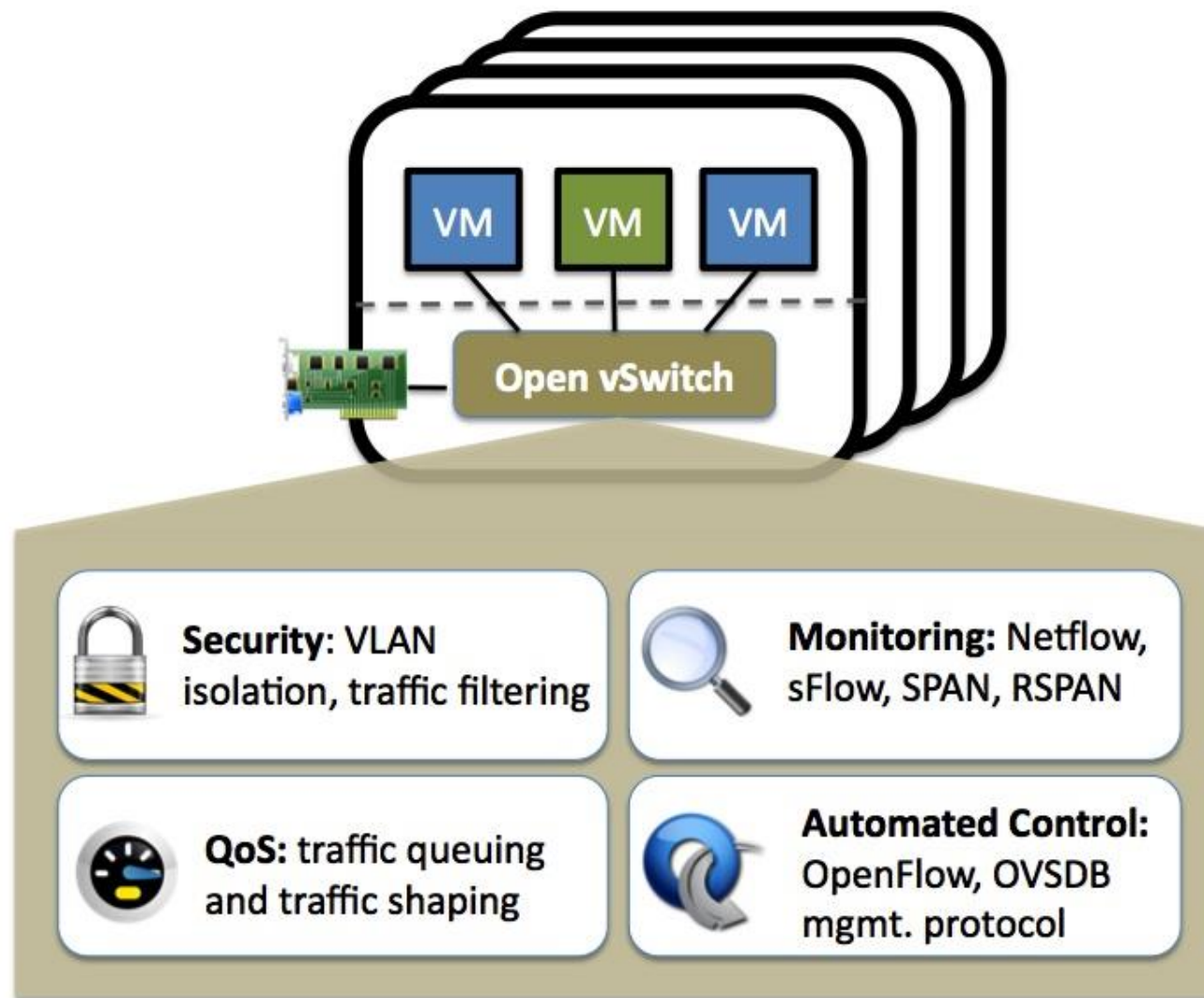
Bridge
d

NAT



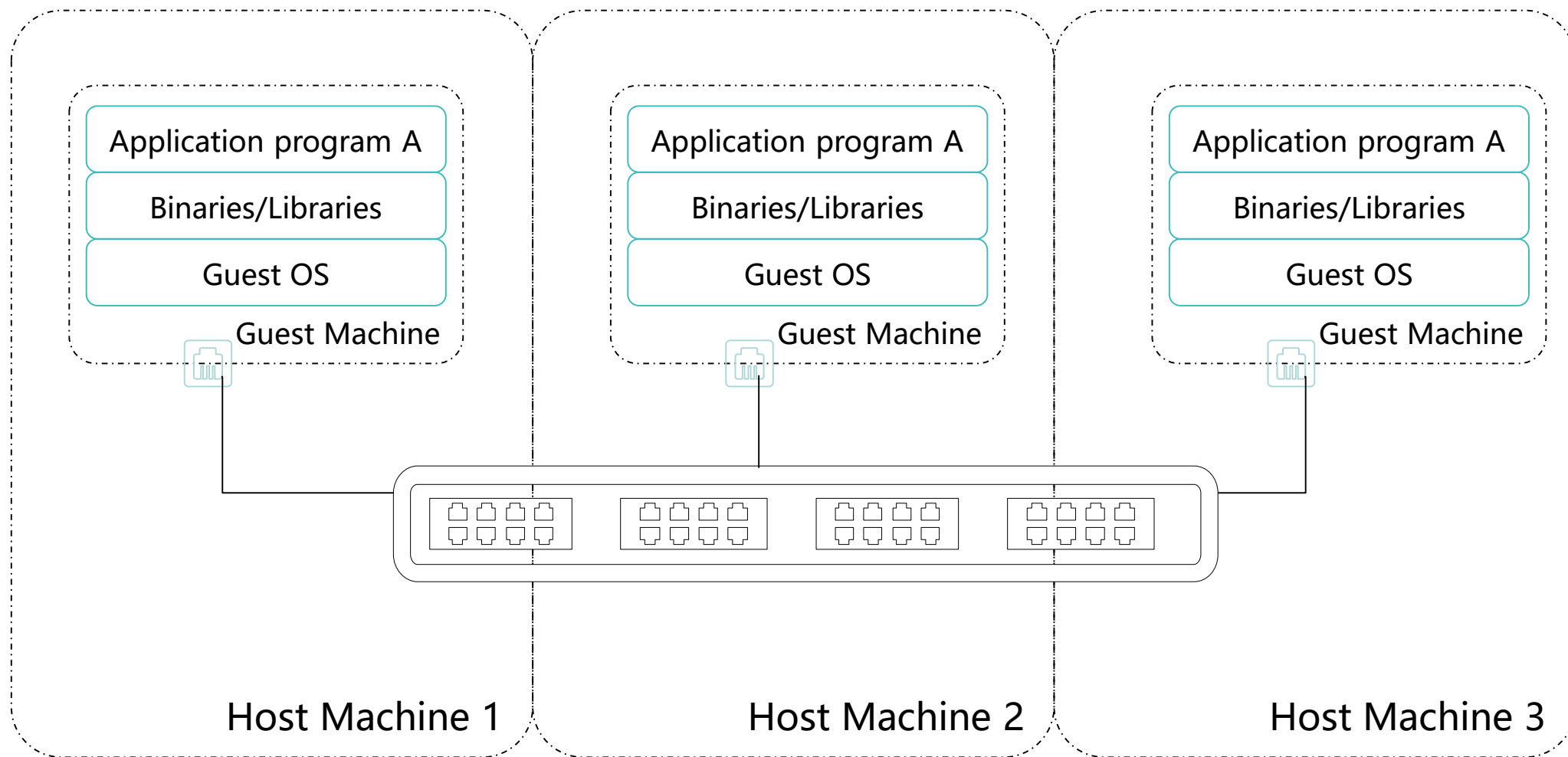


Virtual Switch - Open vSwitch





Distributed Virtual Switch



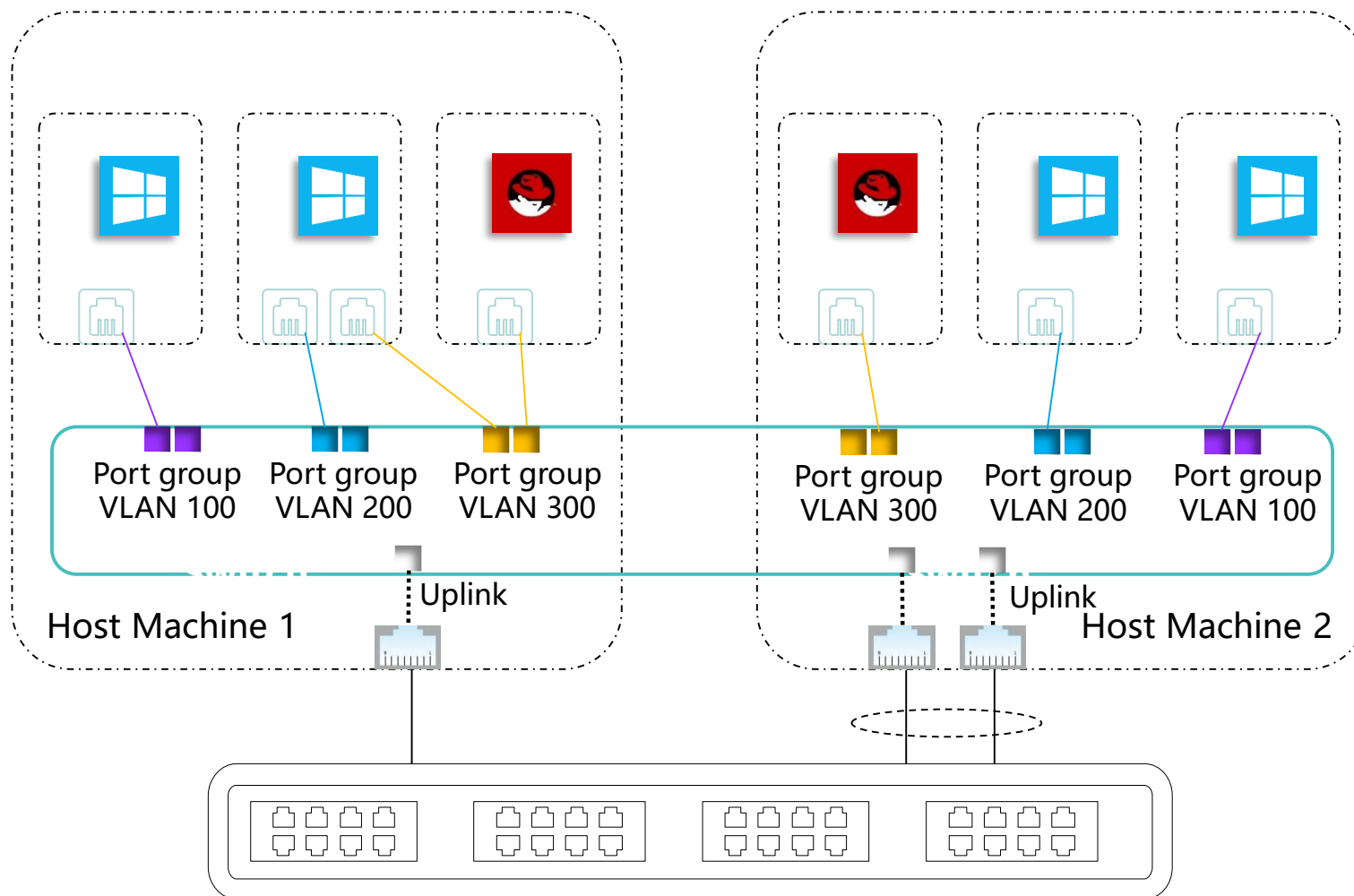


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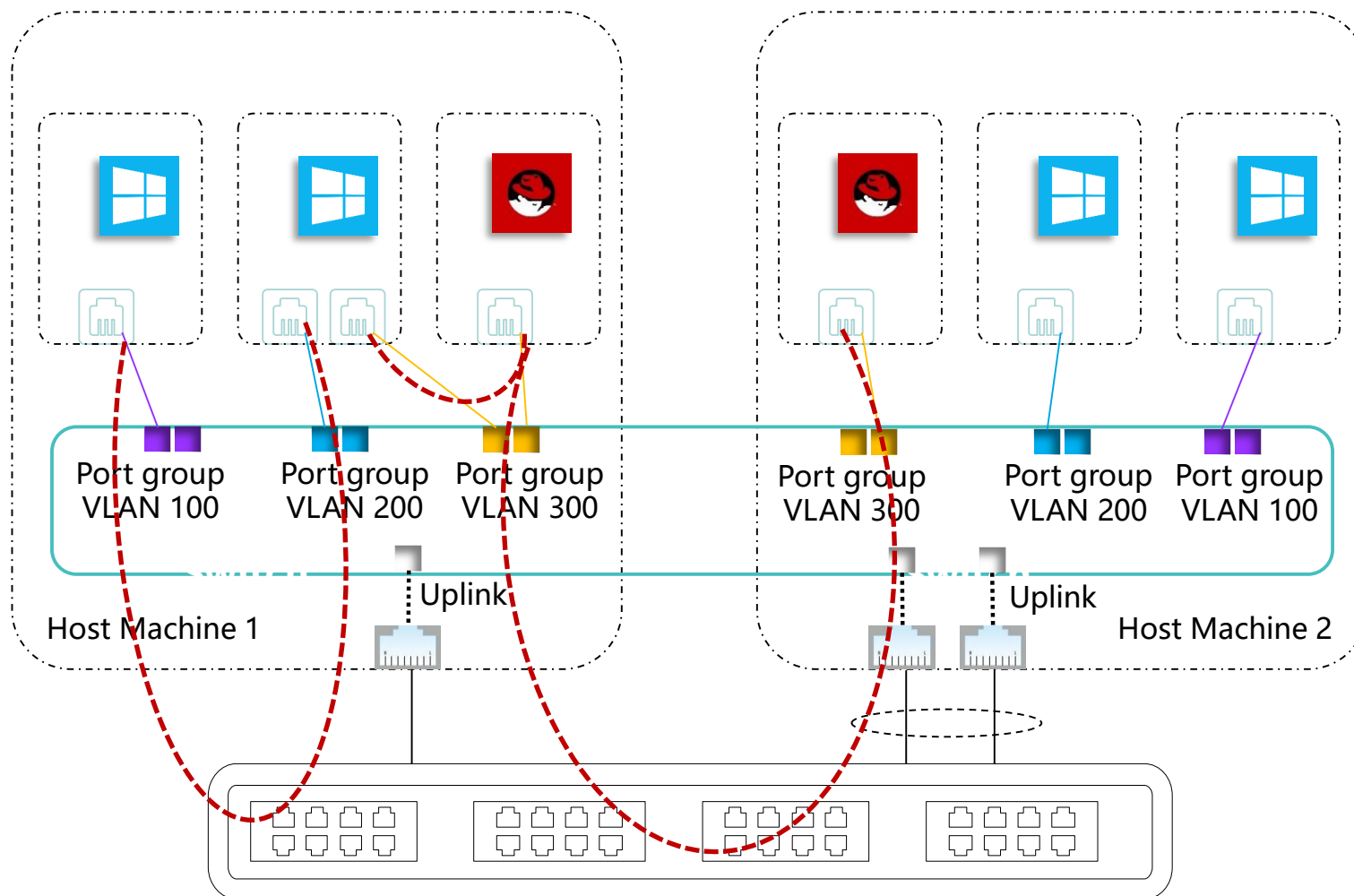


FusionCompute Network Architecture



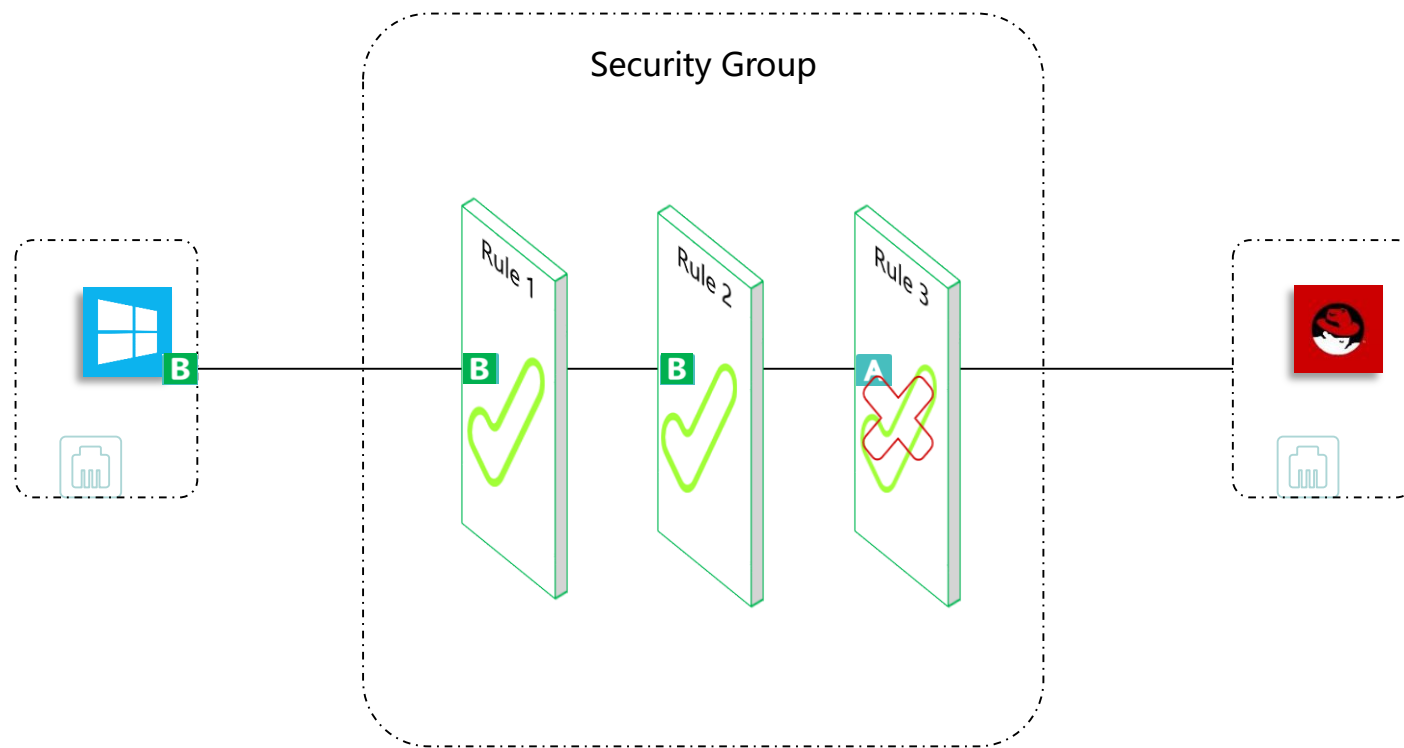


Traffic Flow





Security Group





Quiz

1. Which of the following falls into the category of “north-south traffic” ? ()
 - A. Traffic between VMs in a data center
 - B. Traffic generated when users access the data center through the Internet
 - C. Traffic generated during VM live migration
 - D. Traffic between VMs in different data centers
2. One VM can have multiple virtual NICs connecting it to different virtual switches.
 - A. TRUE
 - B. FALSE



Summary

- This chapter covers basic knowledge about the physical and virtual networks used in virtualized environments.



Recommendations

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Thank You

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Storage Virtualization Basics



Foreword

- Data has become an enterprise's most important asset. How is data stored on the cloud? How is this different from the way it is stored with traditional IT? This chapter will answer these questions.



Objectives

- Upon completion of this course, you will:
 - Understand Huawei's FusionSphere virtualization solution.
 - Understand the storage architecture used for virtualized environments.
 - Understand different types of disks.
 - Understand the differences between centralized and distributed storage.
 - Understand the differences between virtualized and non-virtualized storage.
 - Understand different types of VM disks.
 - Understand the storage features of Huawei's virtualization product.

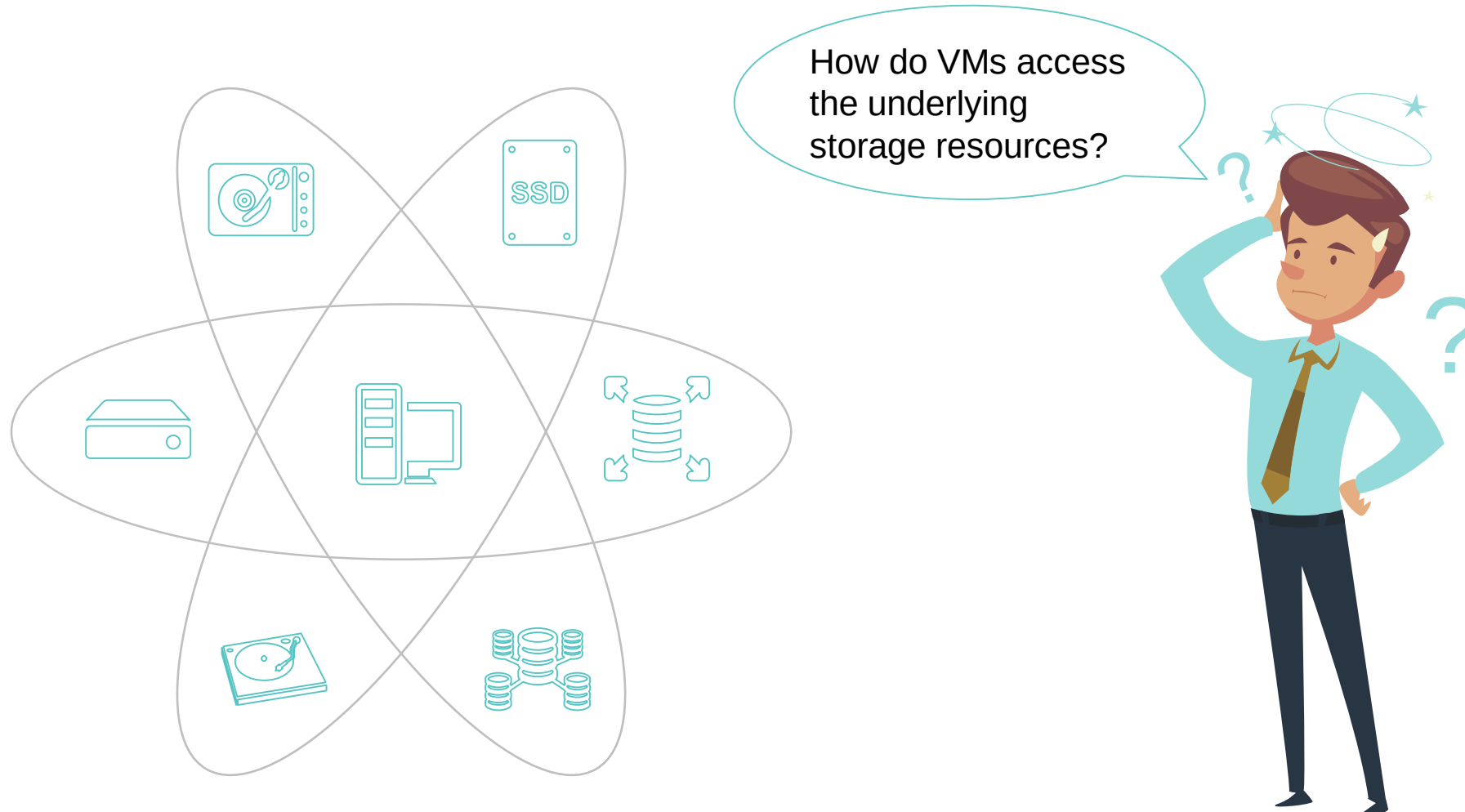


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5. Introduction to VM Disks
6. Storage Features of Huawei's Virtualization Product

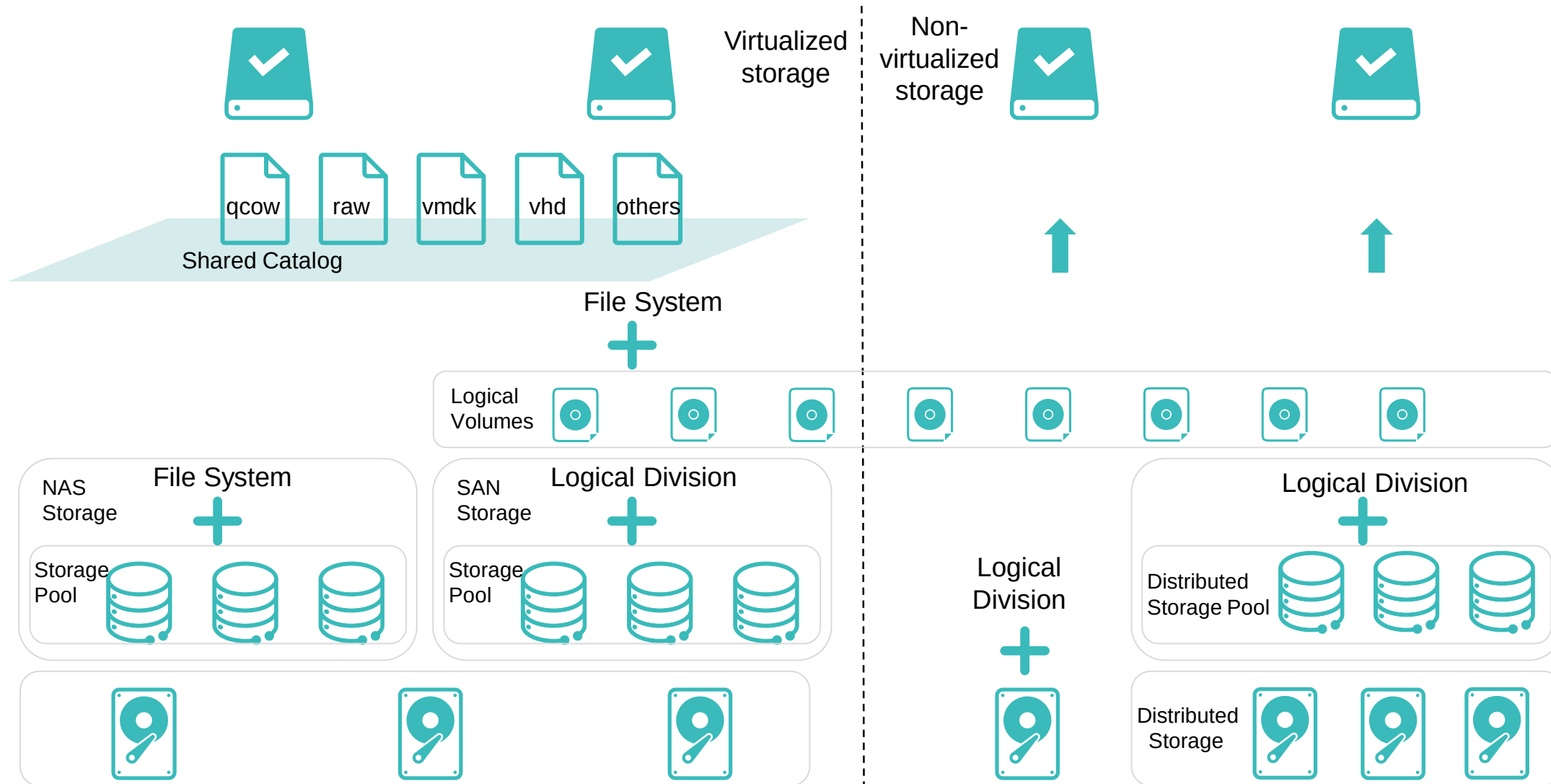


Where Do the Storage Resources Used by VMs Come From?





Storage Architecture for Virtualization





Virtualized Storage Conversion Path in Cloud Computing

Shared Catalog

Virtual file system



Logical volume

Attach to compute cluster and format



Physical volume



Logical division

NFS file system



RAID or Replication





Non-Virtualized Storage Conversion Path in Cloud Computing



Logical
volume



Attach to compute cluster



Physical
volume



Logical division



RAID or Replication





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- 2. Physical Disk Types and Related Techniques**
3. Centralized Storage vs. Distributed Storage
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6. Storage Features of Huawei's Virtualization Product



Physical Disk Type - SATA

- SATA (Serial Advanced Technology Attachment), also called serial ATA, is a computer bus interface that connects host bus adapters to mass storage devices. Using serial communication, the serial ATA bus uses embedded clock signals to check transmission commands (not only data) and automatically corrects detected errors, ensuring reliable data transmission for SATA disks. The SATA interface is simple and the disks are hot-swappable.





Physical Disk Type - SAS

- Serial Attached SCSI (SAS) is a new-generation SCSI technology, which, like the popular Serial ATA (SATA), also uses serial communication to achieve a higher transmission speed. Compared with the older parallel SCSI, SAS improves the efficiency, availability, and scalability of storage systems and offers optional compatibility with SATA.





Physical Disk Type - NL-SAS

- Nearline SAS (NL-SAS) disks are a combination of a SAS interface with SATA disks. The rotational speed of NL-SAS disks is only 7200 rpm, so performance is lower than that of SAS disks. However, with the SAS interface, addressing and speed are improved.





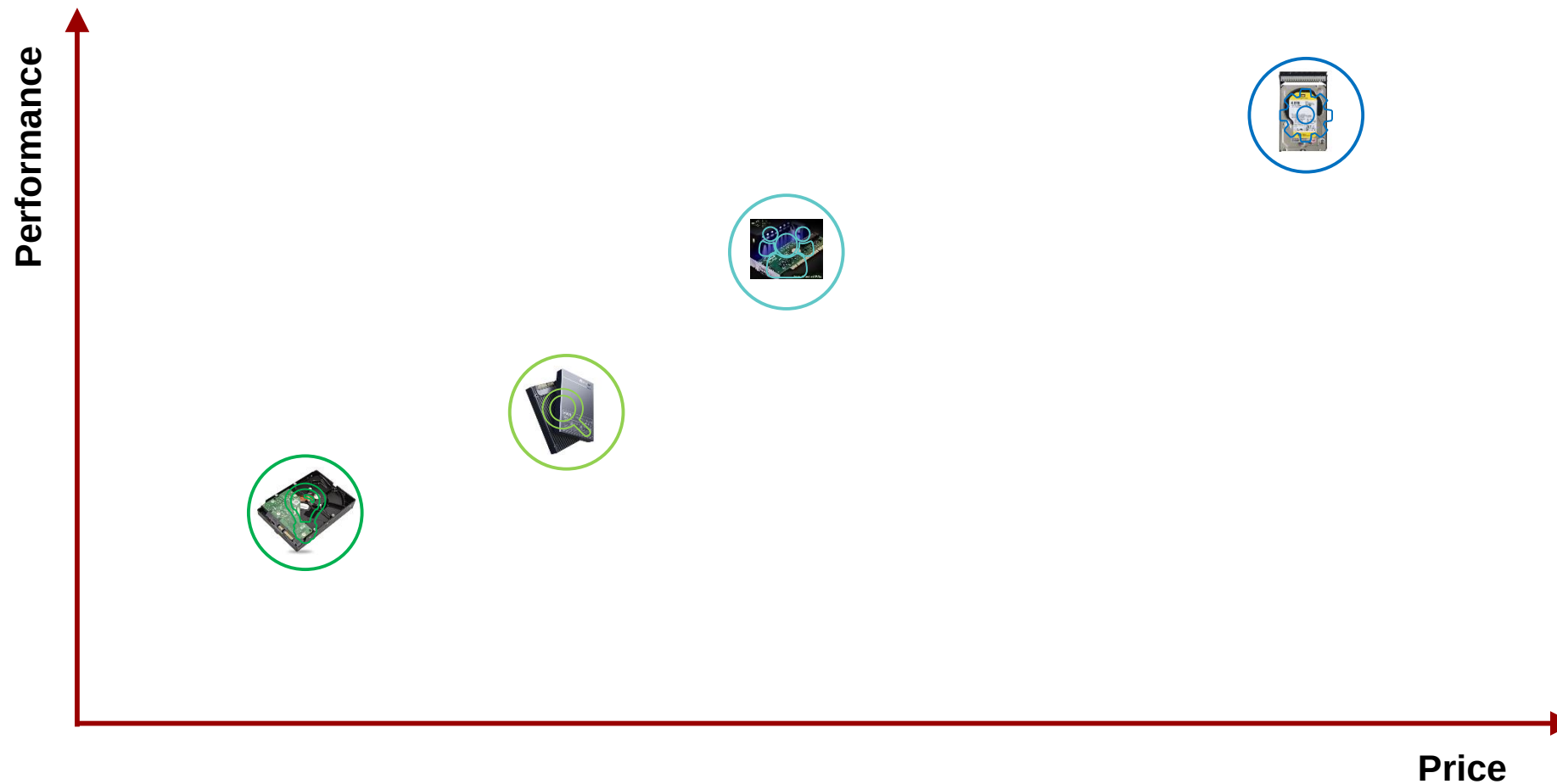
Physical Disk Type - SSD

- A solid-state drive (SSD) is a solid-state storage device that uses integrated circuit assemblies as non-volatile memory. An SSD consists of a control unit and a storage unit (flash or DRAM chip). An SSD is the same as a common hard disk drive (HDD) in terms of interface specifications and definition, functionality, usage, and product shape and size. Although SSDs deliver fast read/write performance, light weight, low power consumption, and compact sizes which traditional HDDs cannot rival, SSDs have a shorter lifespan and higher price.





Comparing Different Types of Physical Disks



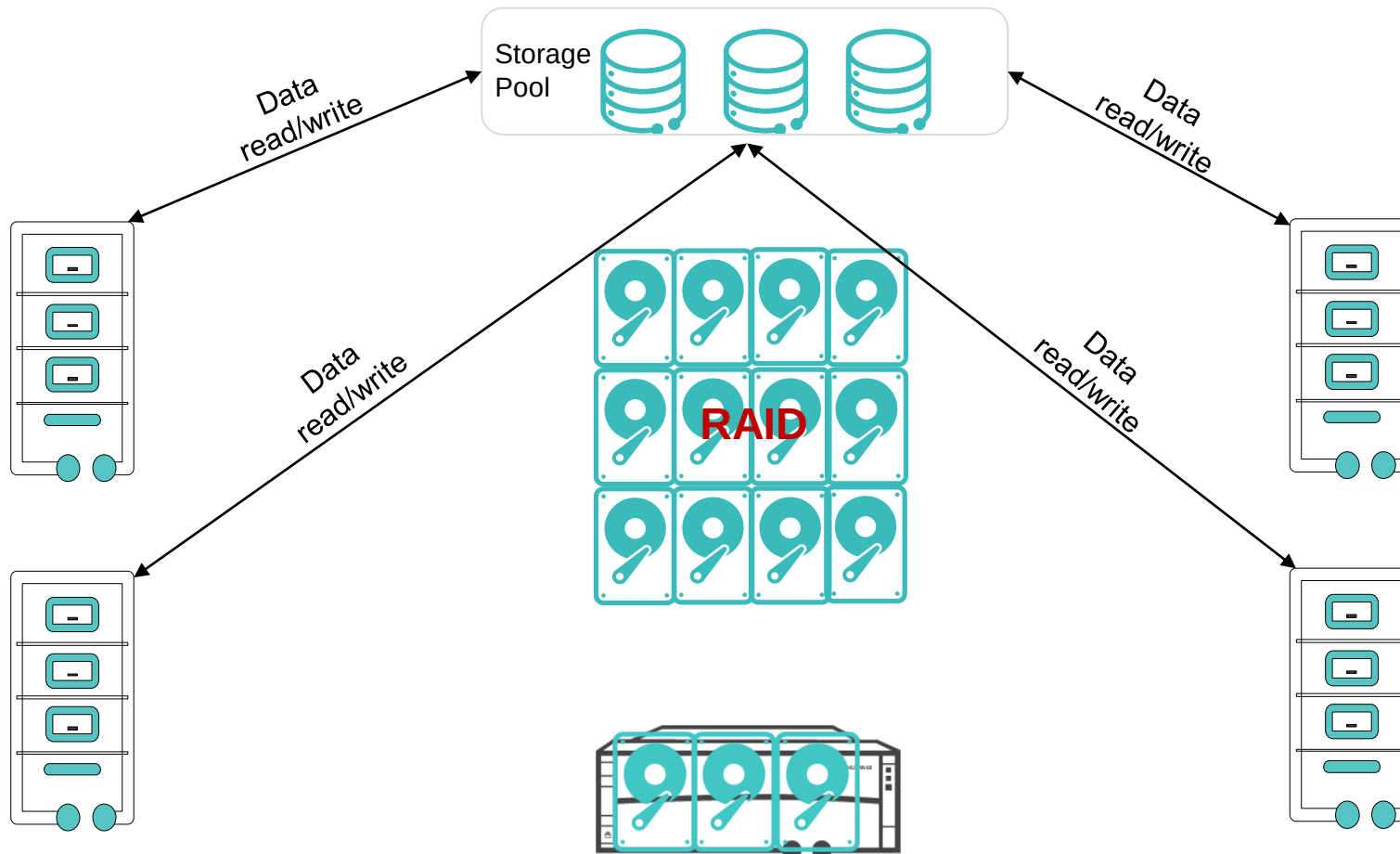


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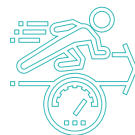
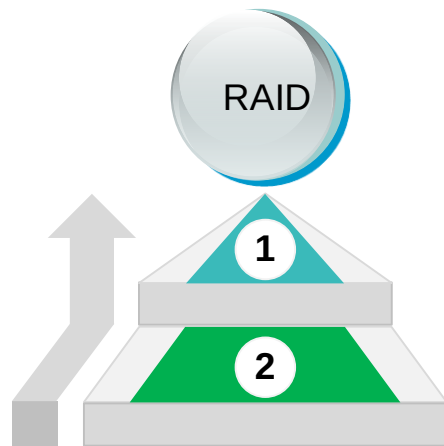


Centralized Storage





RAID Technology



Efficient

Parallel read and write on multiple disks

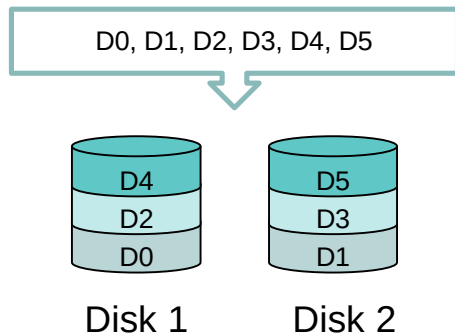
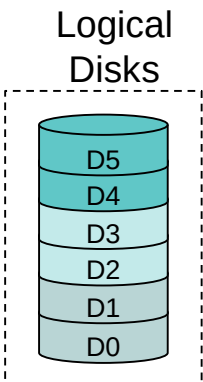


Safe

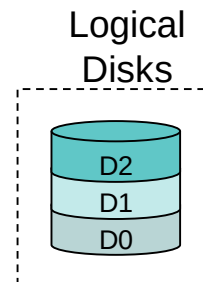
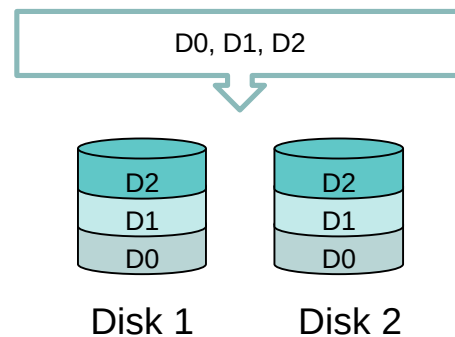
Parity check and hot backup



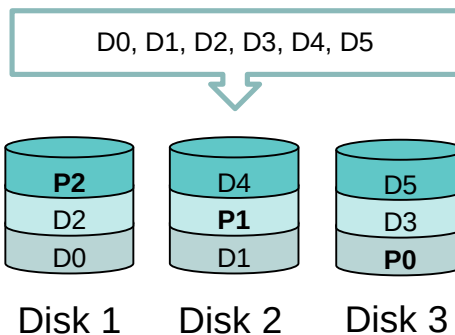
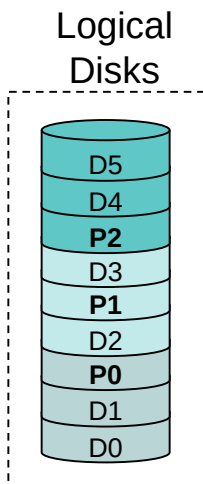
Common RAID Types



RAID 0

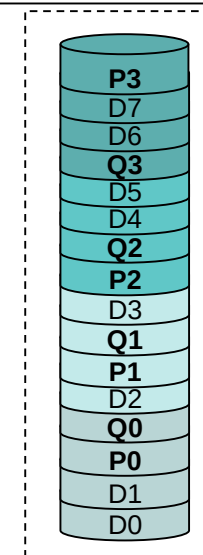
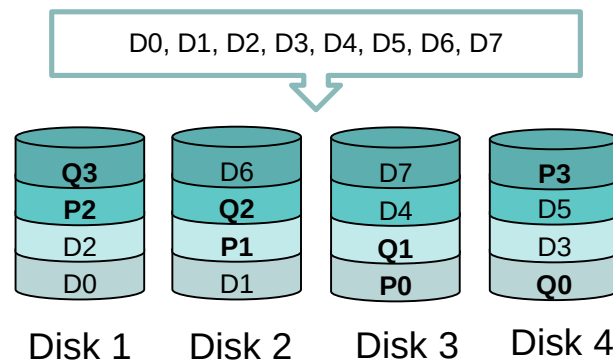


RAID 1



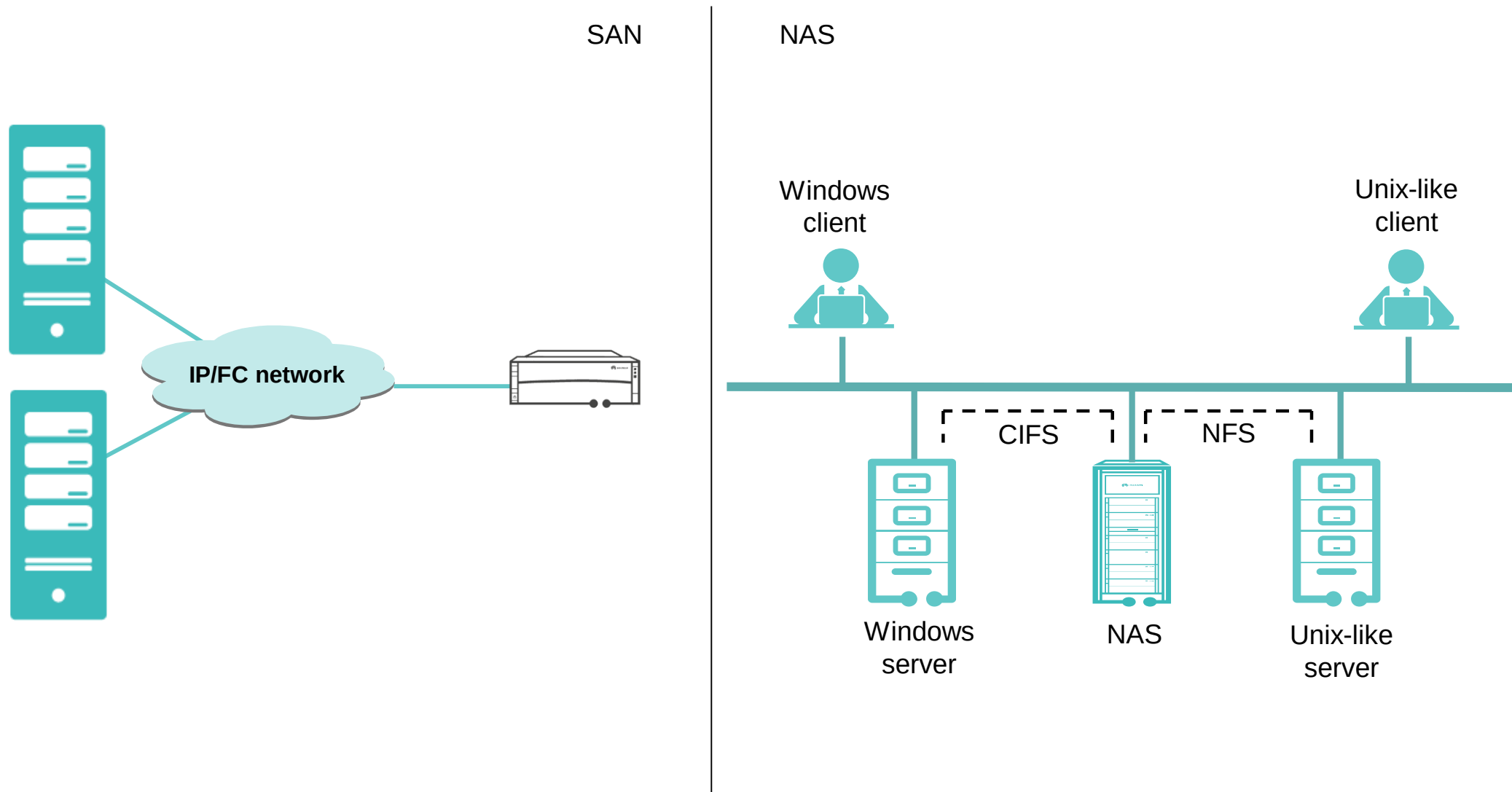
RAID 5

RAID 6



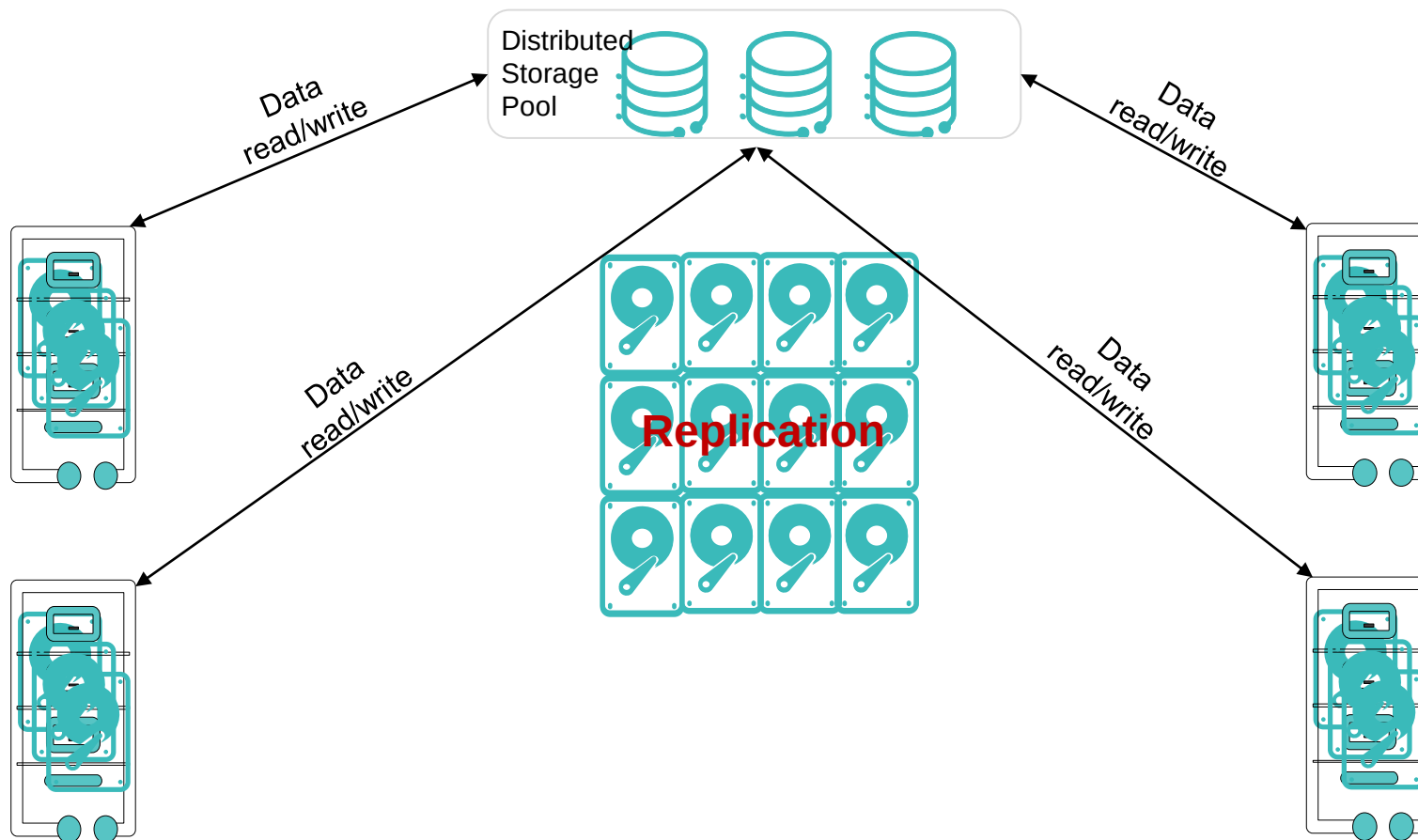


Centralized Storage Types





Distributed Storage





Replication



Data write

Distributed
Storage Pool





Replication



Data write

Data read

Distributed
Storage Pool



Distributed
Storage Pool





Popular Distributed Storage Products





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Virtualized Storage Conversion Path in Cloud Computing

Shared Catalog

Virtual file system



Logical volume

Attach to compute cluster and format



Physical volume



Logical division

NFS file system



RAID or Replication





Non-Virtualized Storage Conversion Path in Cloud Computing



Logical
volume

Attach to compute cluster

Physical
volume

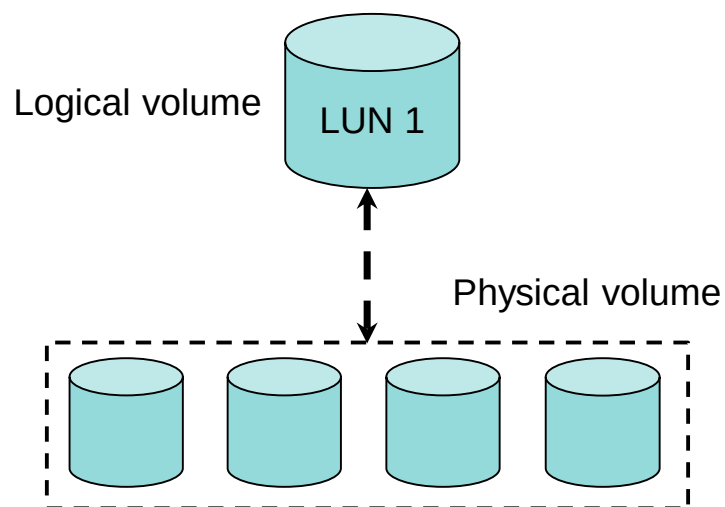
Logical division

RAID or Replication

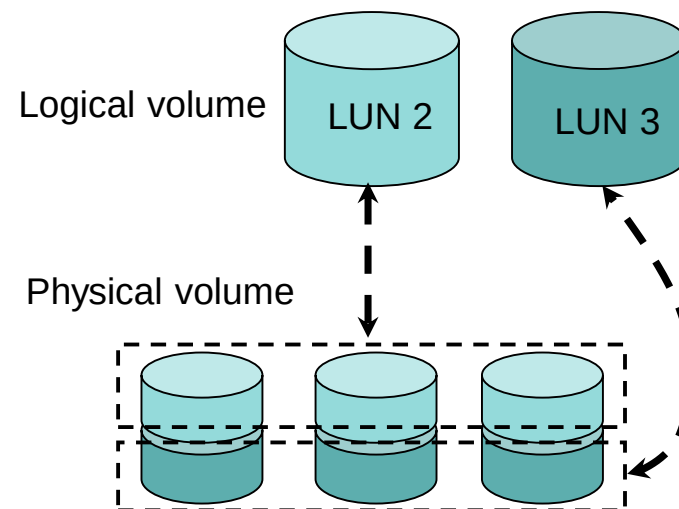


Relationship Between RAIDs and LUNs

- A RAID array can be seen as a large physical volume made up of a number of hard disks.
- On top of a physical volume, you can create one or more logical units of specified capacities. These logical units are called Logical Unit Numbers (LUNs) and can be mapped to hosts as basic block devices.



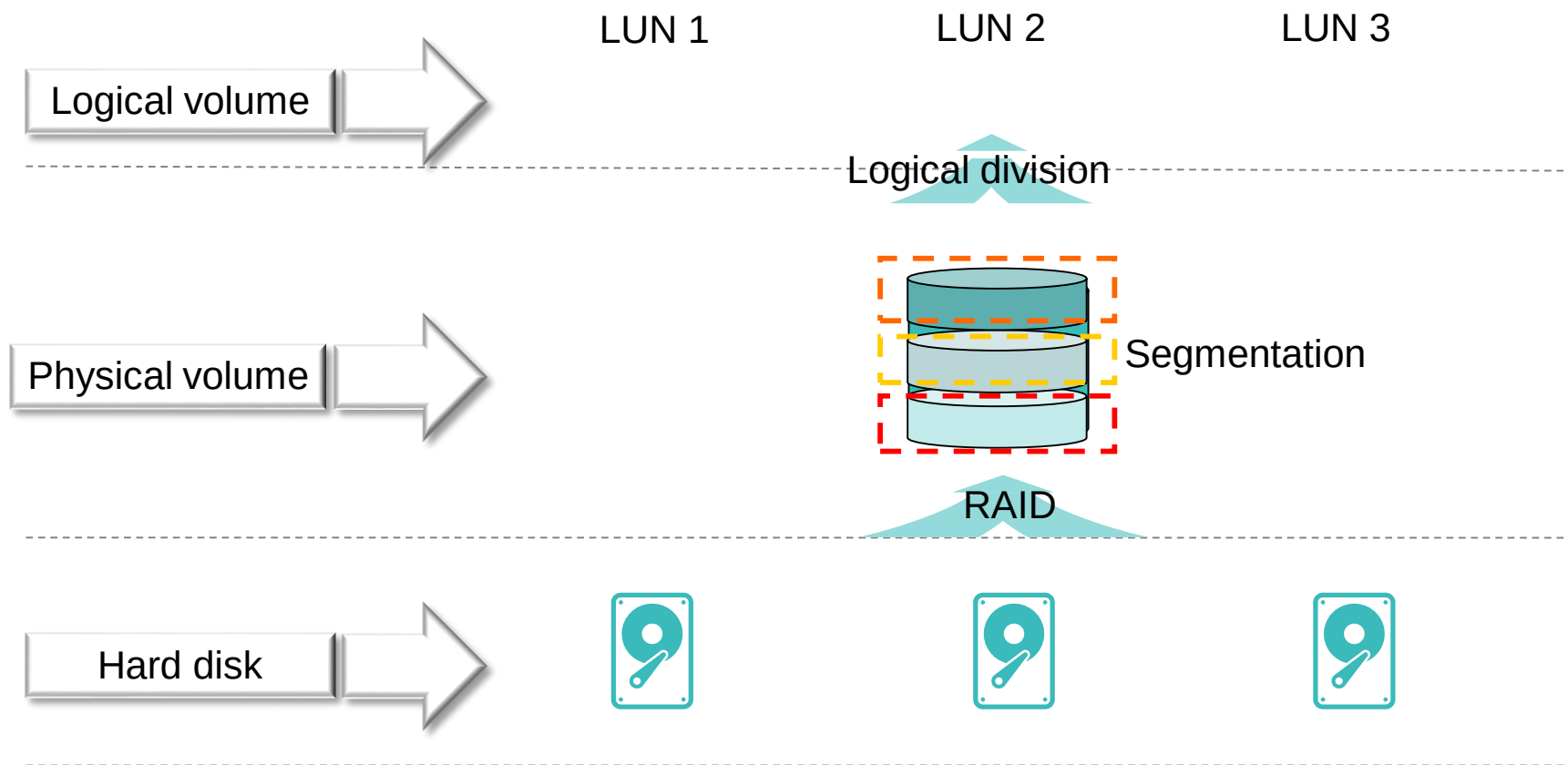
Create one logical volume on a single physical volume



Create multiple logical volumes on a single physical volume

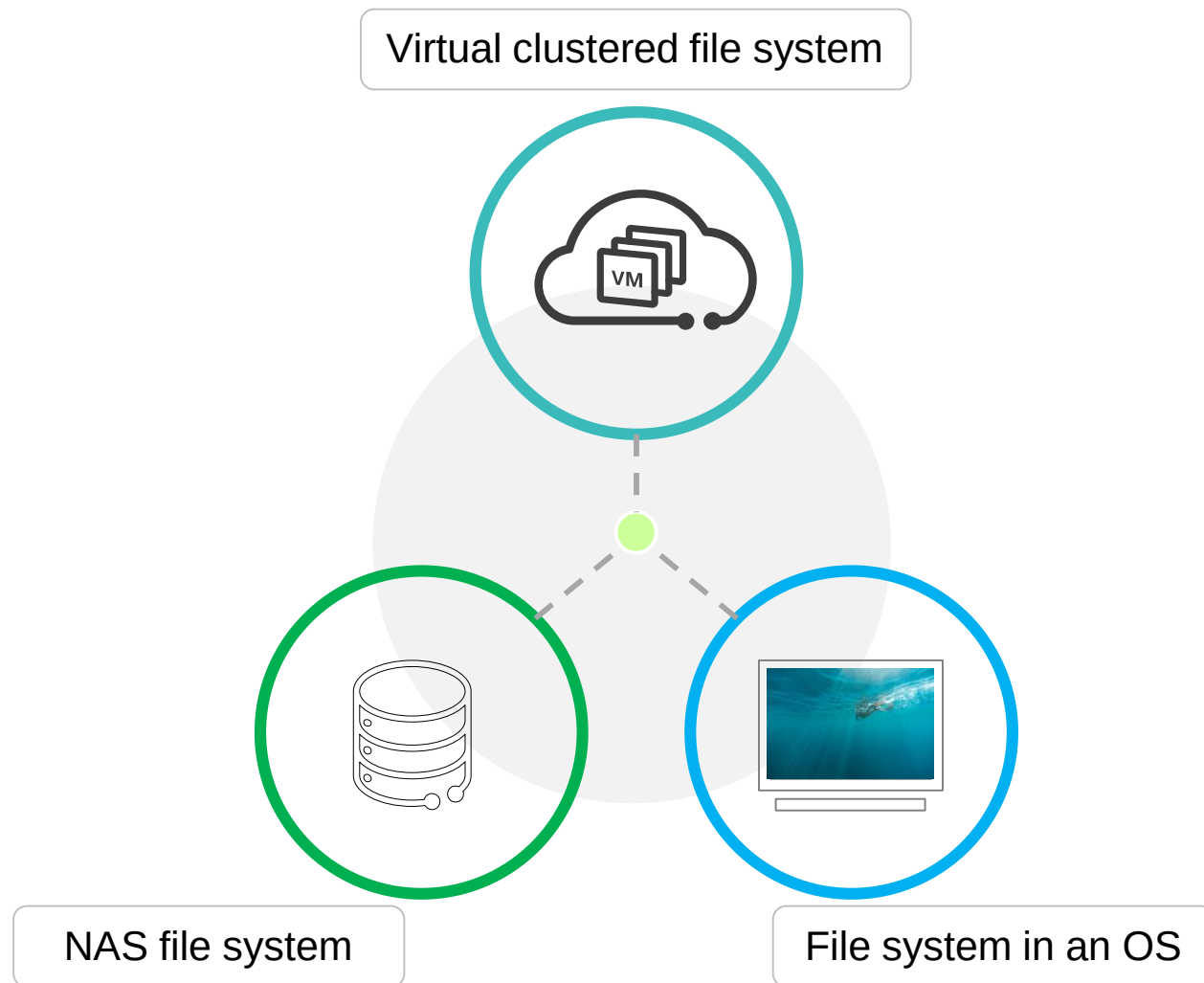


Process of Creating a LUN



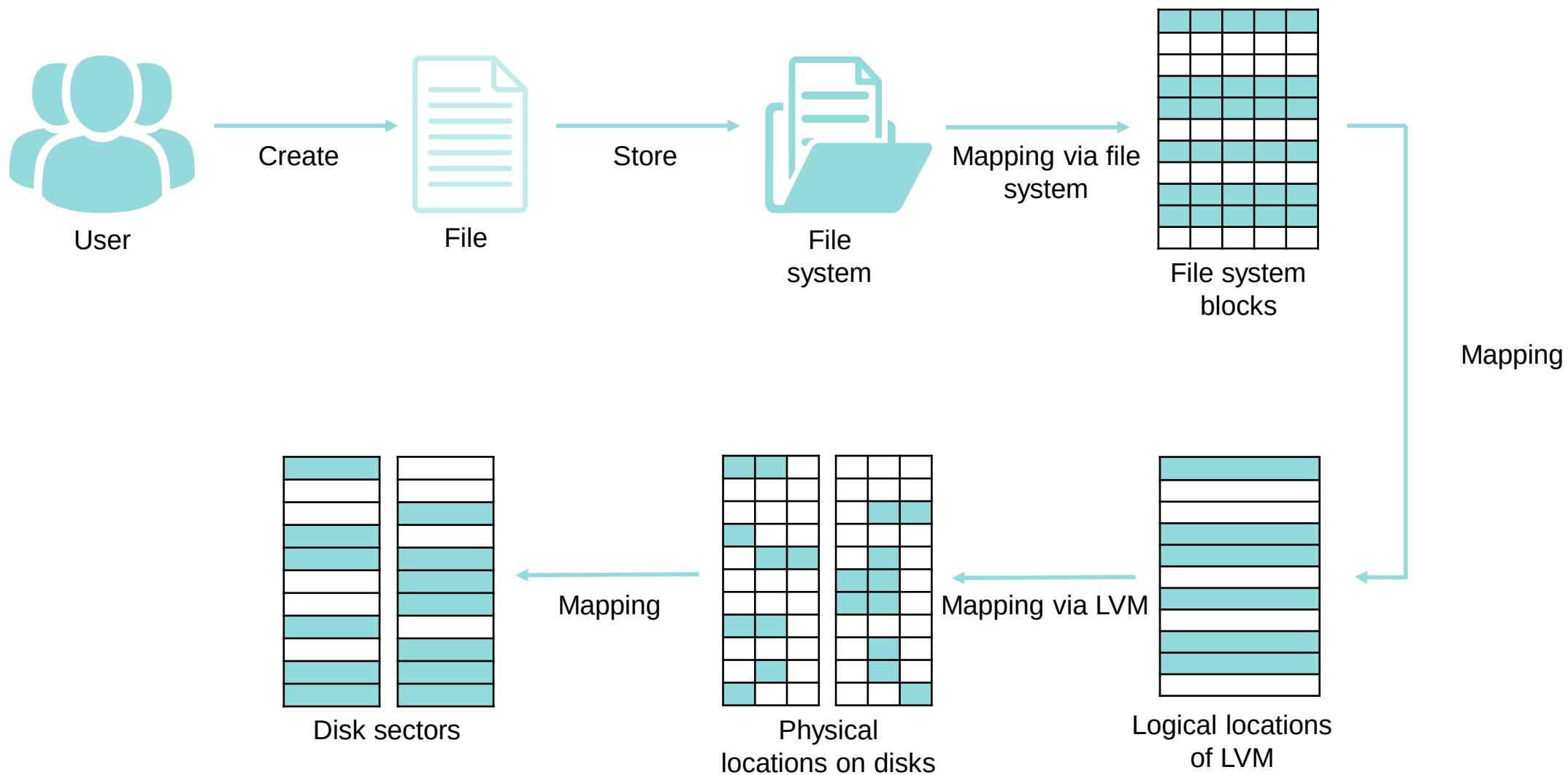


Common File Systems





Mapping a File to a Disk





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VM Disks

Volume	Layout	Type	File System	Status	Capacity	Free Space	% Free
(C:)	Simple	Basic	NTFS	Healthy (Boot, Page File, Crash Dump, Primary Partition)	39.46 GB	17.69 GB	45 %
CCCOMA_X64FRE_EN-US_DV9 (E:)	Simple	Basic	UDF	Healthy (Primary Partition)	4.38 GB	0 MB	0 %
System Reserved	Simple	Basic	NTFS	Healthy (System, Active, Primary Partition)	549 MB	171 MB	31 %

Disk 0	System Reserved	(C:)
Basic	549 MB NTFS	39.46 GB NTFS
40.00 GB	Healthy (System, Active, Primary Partition)	Healthy (Boot, Page File, Crash Dump, Primary Partition)
Online		

CD-ROM 0	
CD-ROM (D:)	
No Media	

CD-ROM 1	CCCOMA_X64FRE_EN-US_DV9 (E:)
DVD	4.38 GB UDF
4.38 GB	Healthy (Primary Partition)
Online	

User view

Administrator view

```
</disk>
<disk type='file' device='disk'>
  <driver name='qemu' type='raw' cache='none' io='native' iothread='1' />
  <source file='/POME/datastore_3/vol/vol_f6db8fbd-c0c8-4cc4-9252-a862767219d0/vol_f6db8fbd-c0c8-4cc4-9252-a862767219d0.img' />
  <target dev='vda' bus='virtio' />
  <boot order='1' />
  <address type='pci' domain='0x0000' bus='0x02' slot='0x01' function='0x0' />
</disk>
```



Common VM Disk Formats

VM Disk File Format	Vendor
RAW	All
VMDK	VMware
VHD	Microsoft Hyper-V, Huawei FusionCompute
QCOW	QEMU or KVM virtualization platforms only
QED	
VDI	Oracle

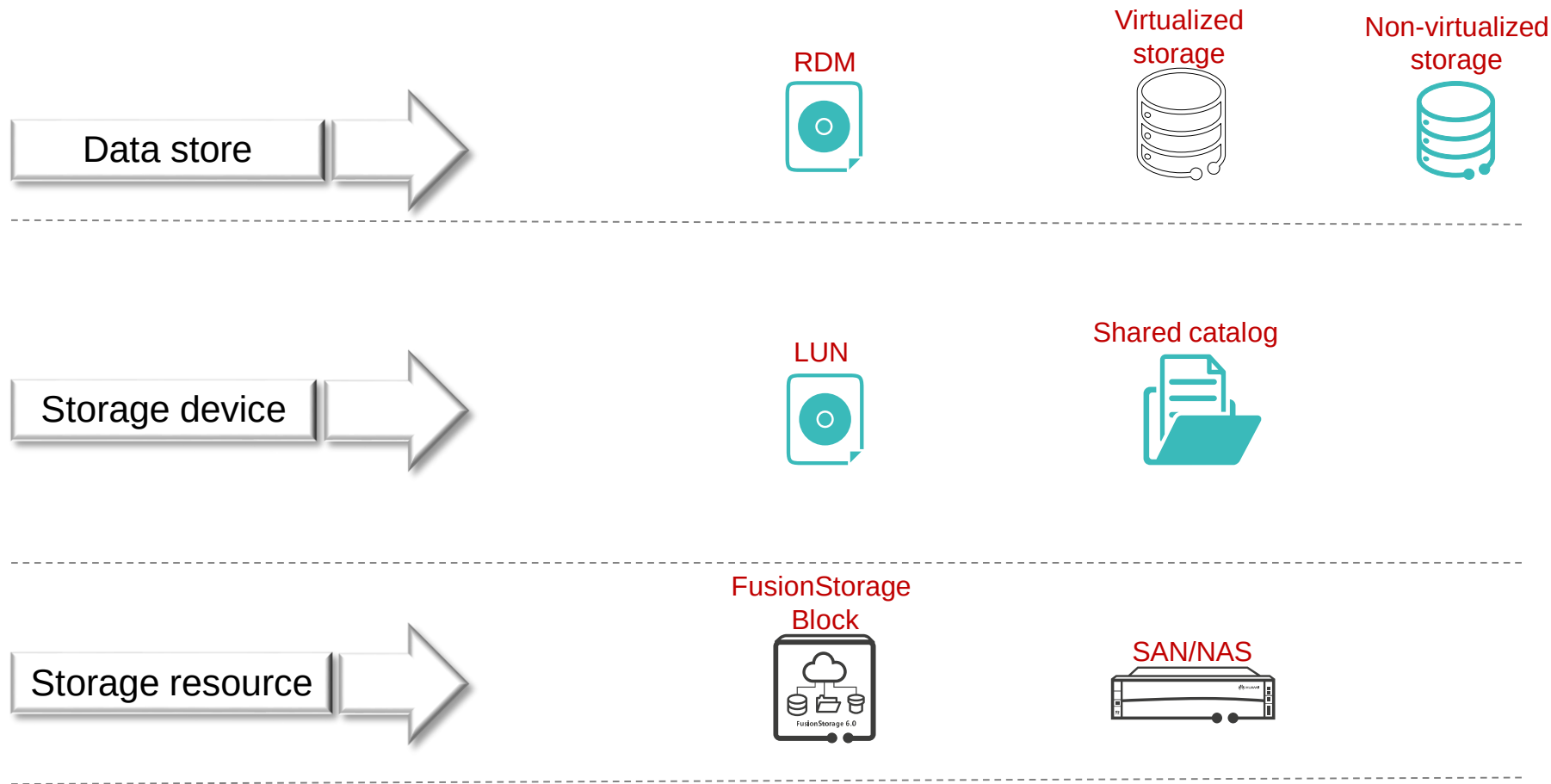


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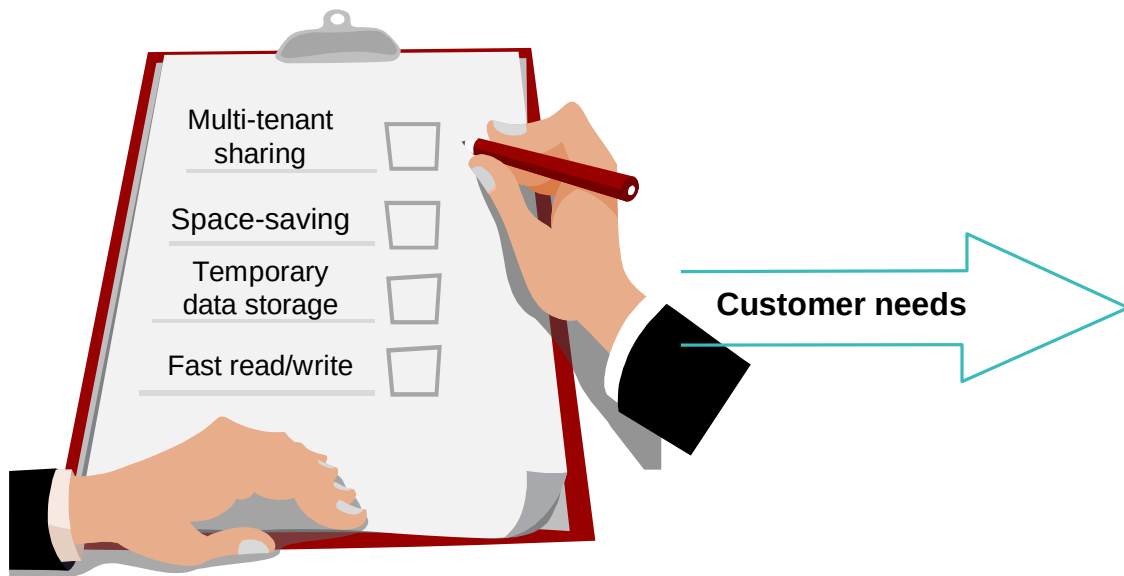


Storage Architecture for Huawei Virtualization Product





Huawei Virtual Disk Features



Type

- Common
- Shared



Configuration Mode

- Common
- Thin-provision



Disk Mode

- Dependent
- Independent & persistent
- Independent & nonpersistent



Summary

- At this point you should understand how data is written to storage devices in virtualization scenarios.



Quiz

1. Which of the following disk types is recommended for an archive room that needs to store large amounts of data that will be accessed infrequently over long periods of time? ()
 - A. SSD
 - B. SAS disk
 - C. SATA disk
 - D. NL-SAS disk
2. SATA disks use a parallel interface while SAS disks use a serial interface.
 - A. TRUE
 - B. FALSE



Recommendations

- Huawei e-Learning website
 - <http://support.huawei.com/learning/Index!toTrainIndex>
- Huawei Support case library
 - <http://support.huawei.com/enterprise/servicecenter?lang=en>
- HCIA-Cloud Computing v4.0 online forum
 - <https://forum.huawei.com/enterprise/en/Huawei-Official-Communication-Channel-HCNA-Cloud-Certification-Course/thread/456287-911>

The background of the image shows silhouettes of several groups of business professionals in a modern office environment. They are standing on a highly reflective floor, and their reflections are clearly visible. The entire scene is overlaid with a semi-transparent blue filter. In the center, the text "Thank You" is written in a large, white, sans-serif font, with the website address "www.huawei.com" in a smaller, white, sans-serif font directly below it.

Thank You

www.huawei.com



Introduction to Virtualization Features



Foreword

- Having attended previous courses about cloud computing, you may already have a good understanding of virtual machines (VMs) and the resources they use. This chapter focuses on when and where we would need to use VMs and what virtualization features VMs provide.

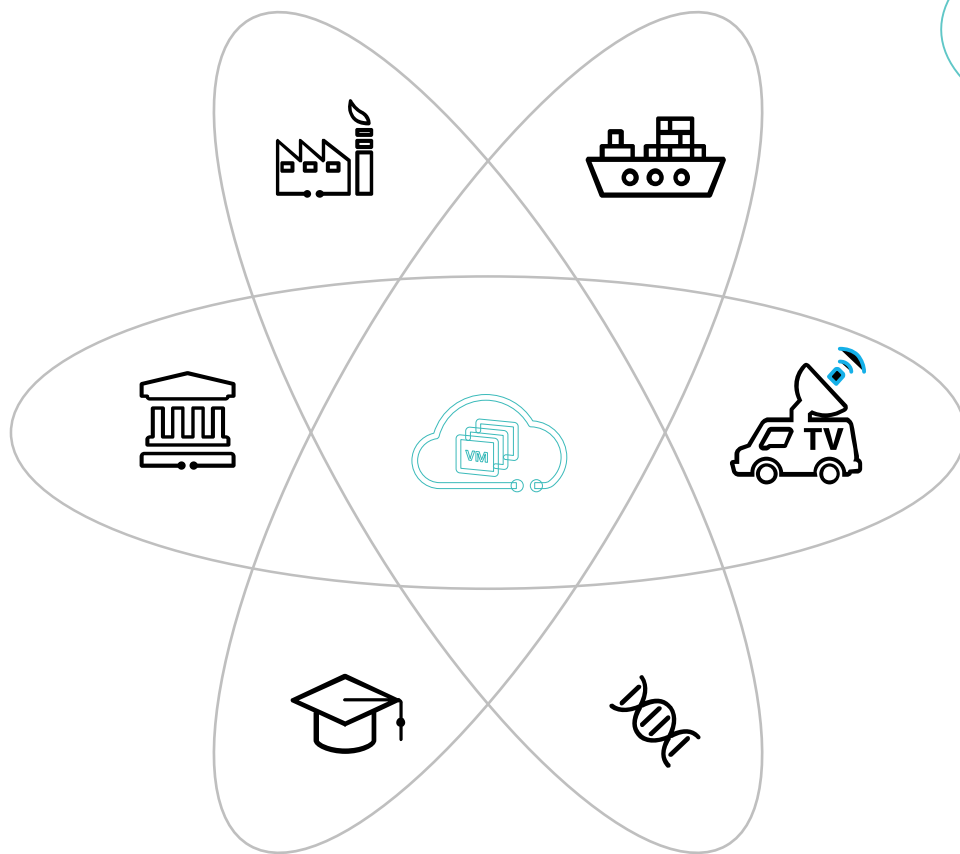


Objectives

- Upon completion of this course, you will:
 - Understand virtualization features.
 - Understand where and when virtualization features may be used.



What Are the Benefits of Virtualization?



What do I get
by using
virtualization?



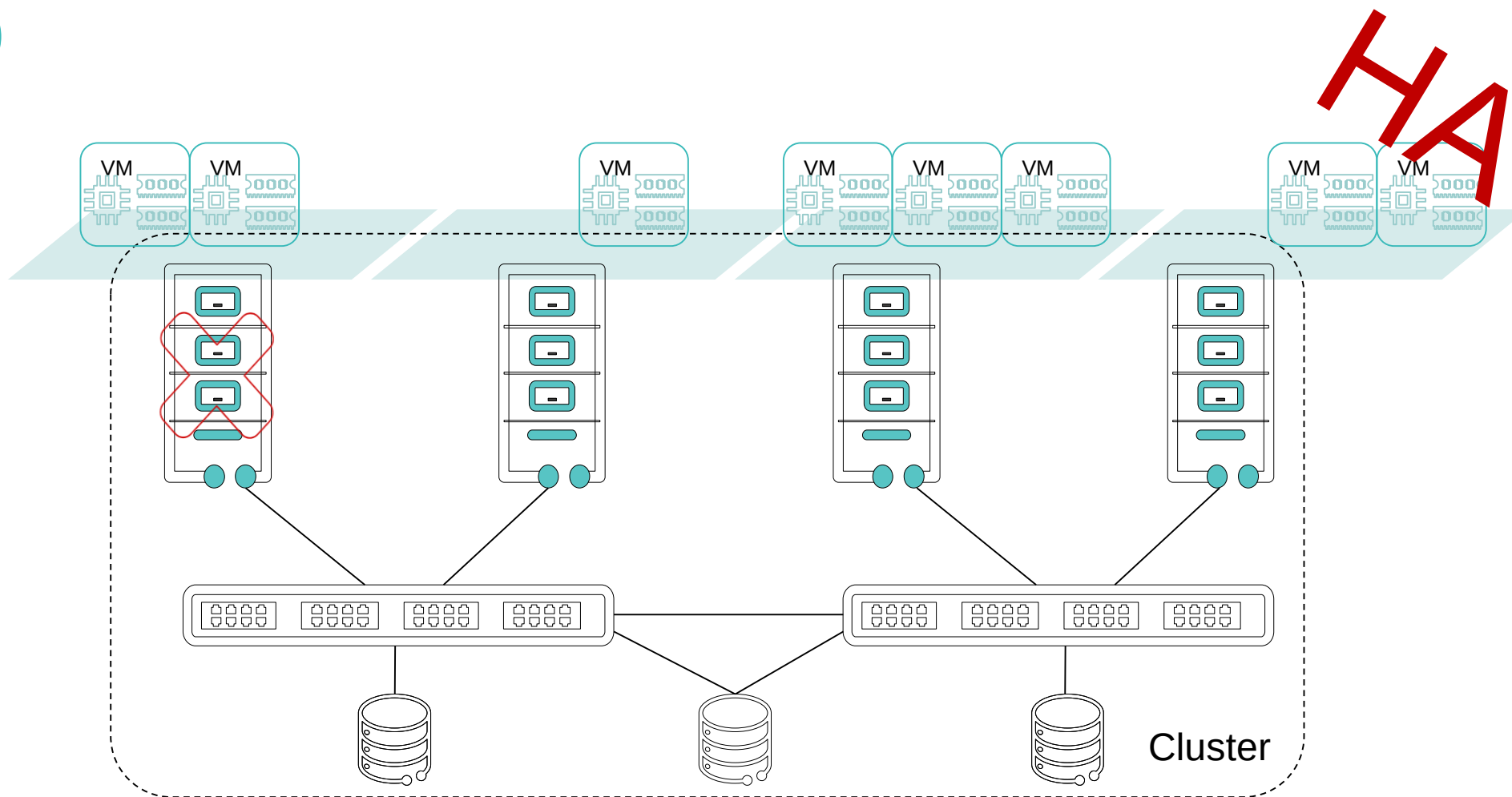


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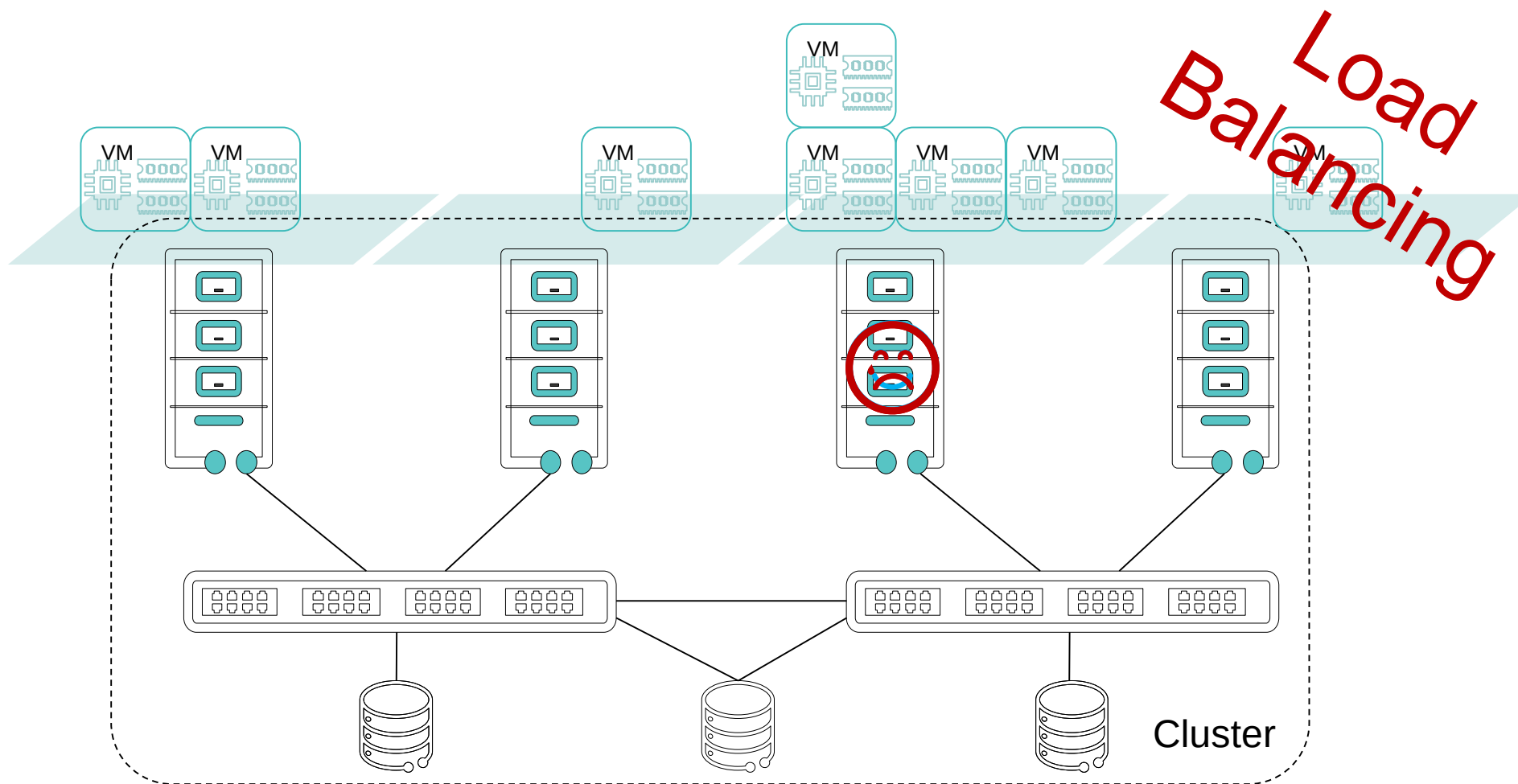


Virtual Cluster Features (1)



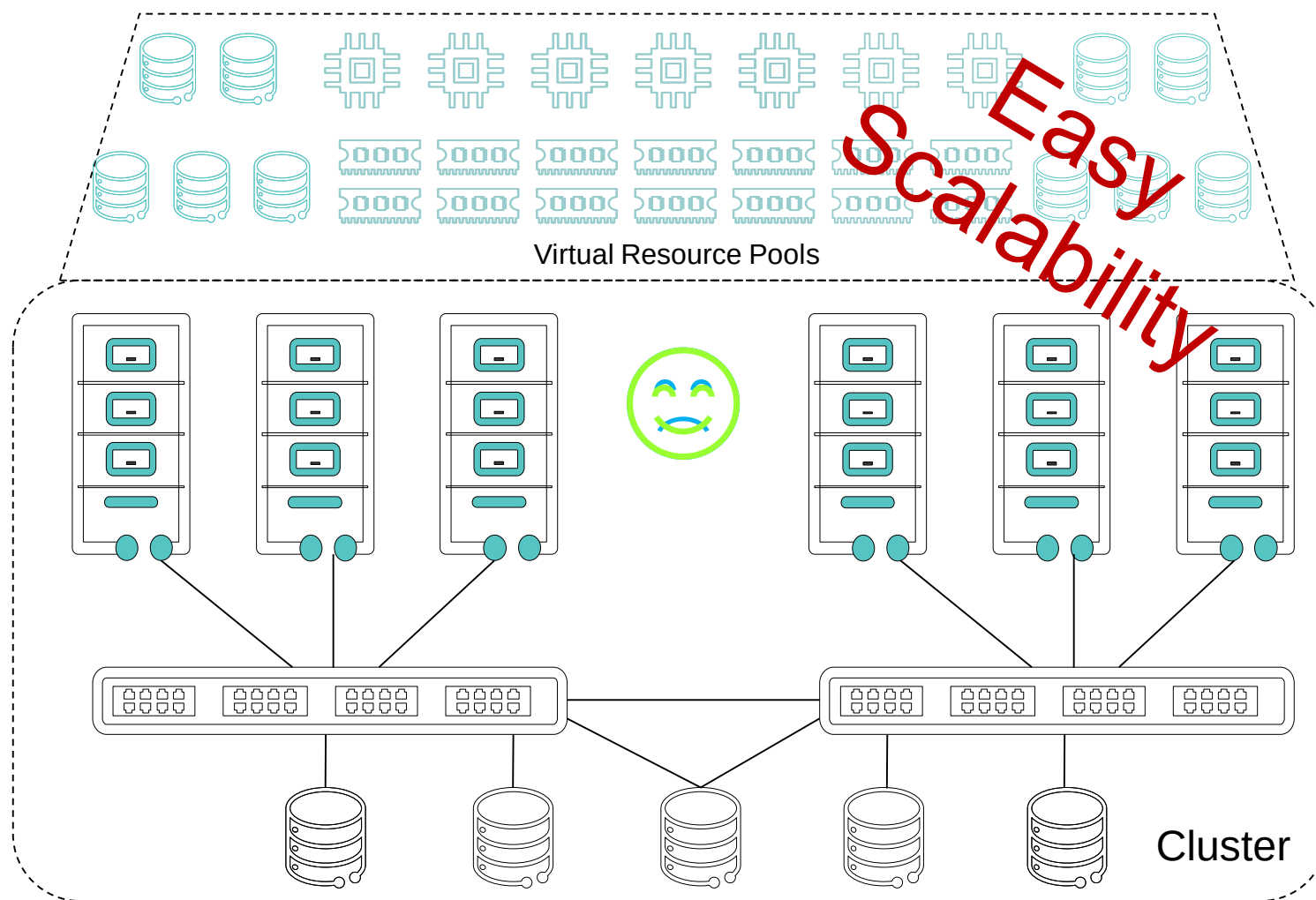
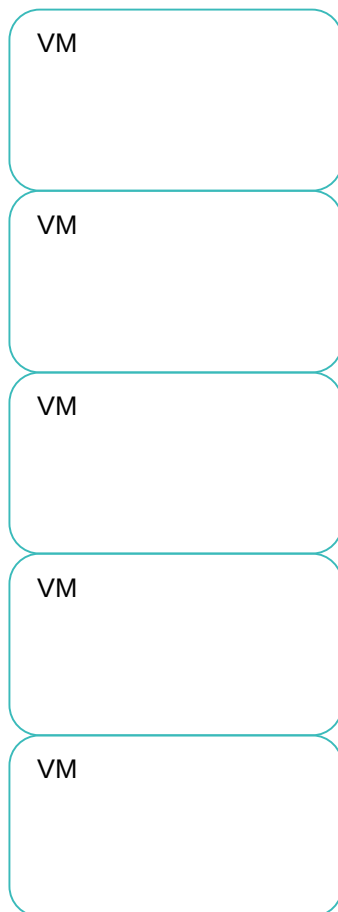


Virtual Cluster Features (2)





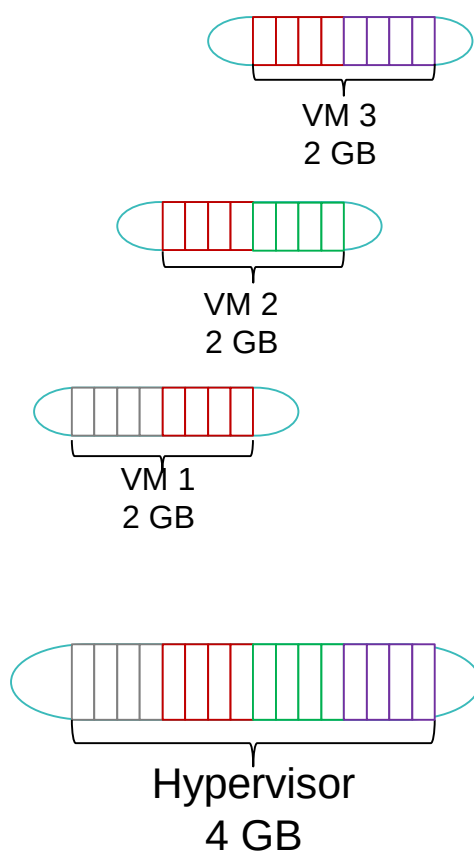
Virtual Cluster Features (3)



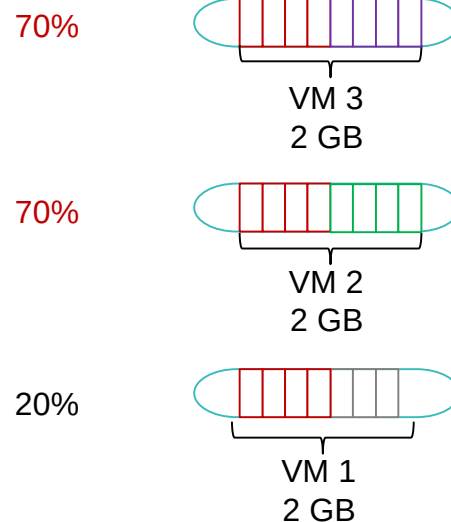


Virtual Cluster Features (4)

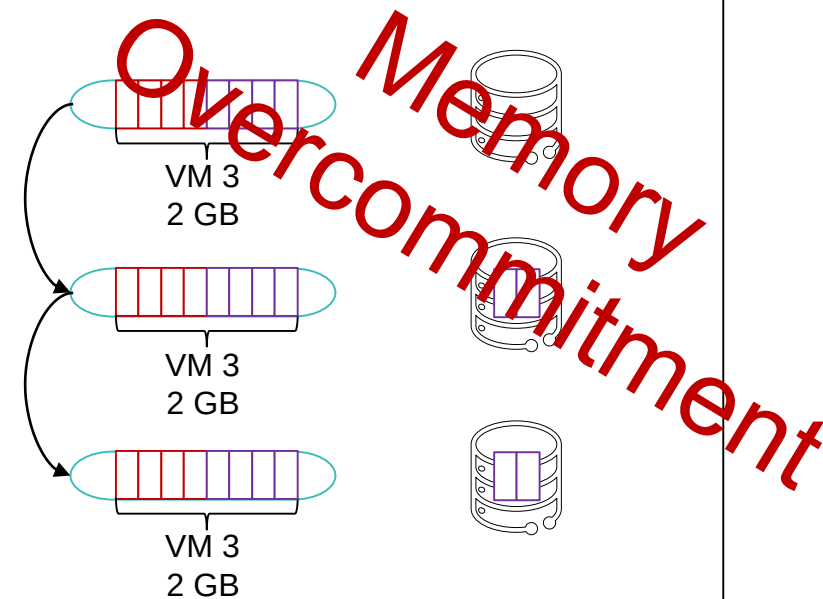
Memory Sharing



Memory Ballooning



Memory Swapping





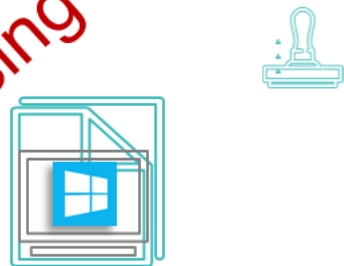
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Virtualization (VM) Features (1)

VM deployment
using a template

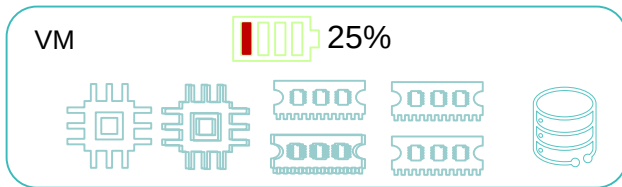
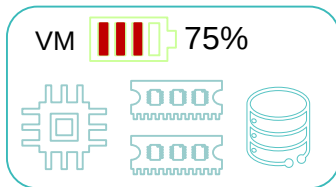
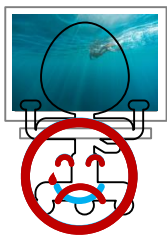


VM replication

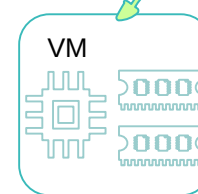


Virtualization (VM) Features (2)

Hot-add
resources

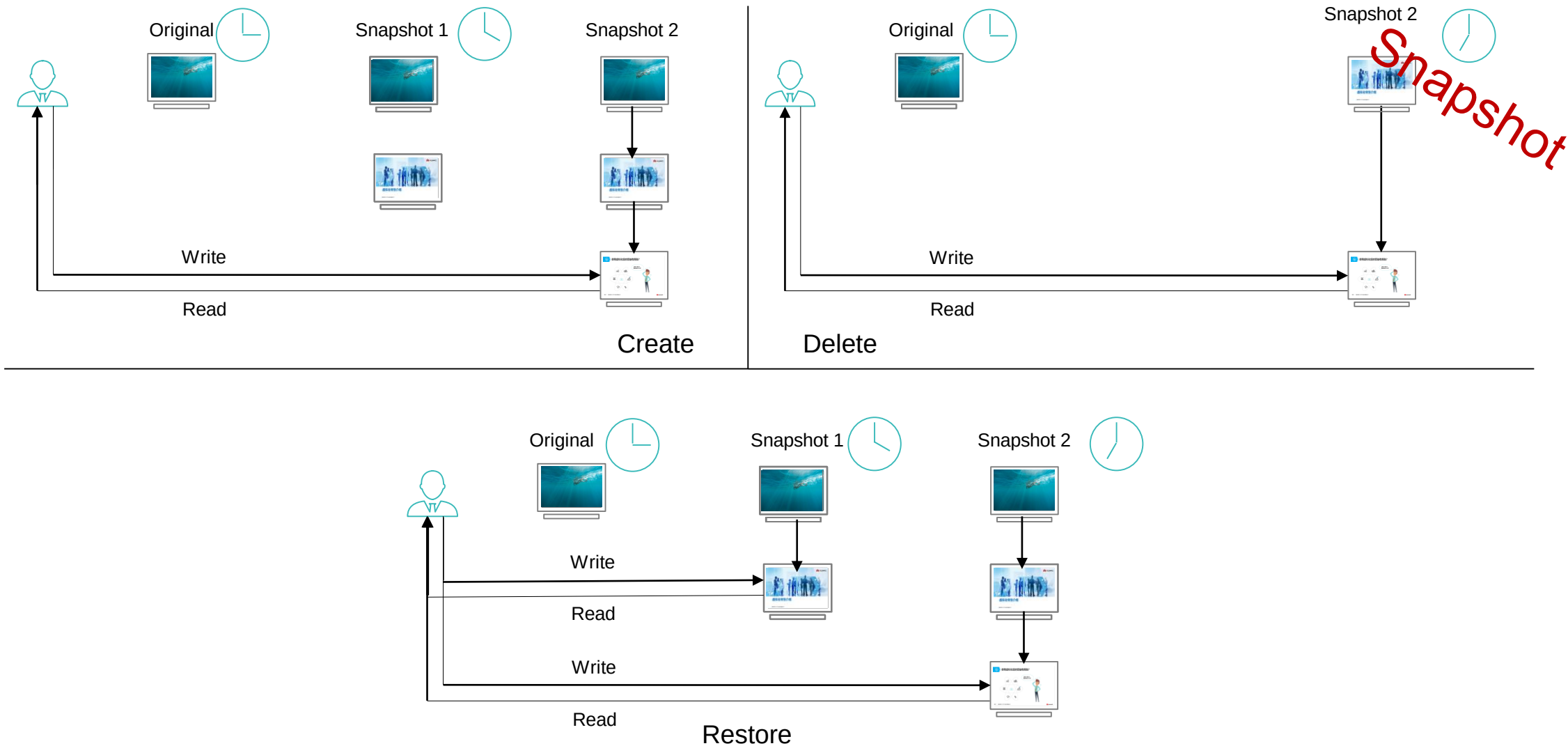


Console
control



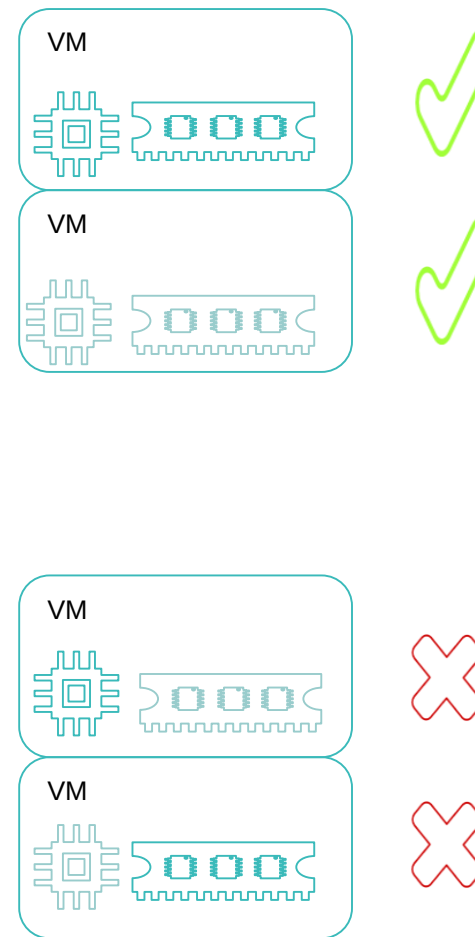
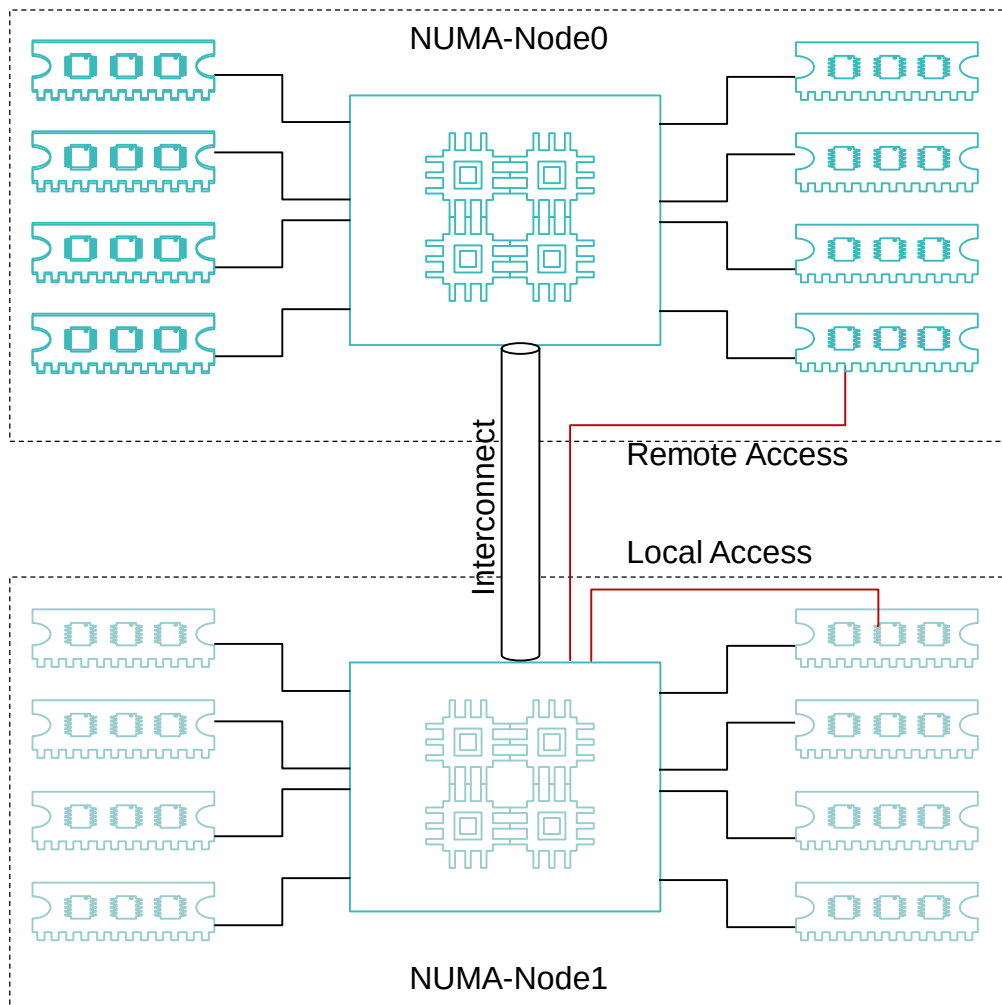


Virtualization (VM) Features (3)





NUMA



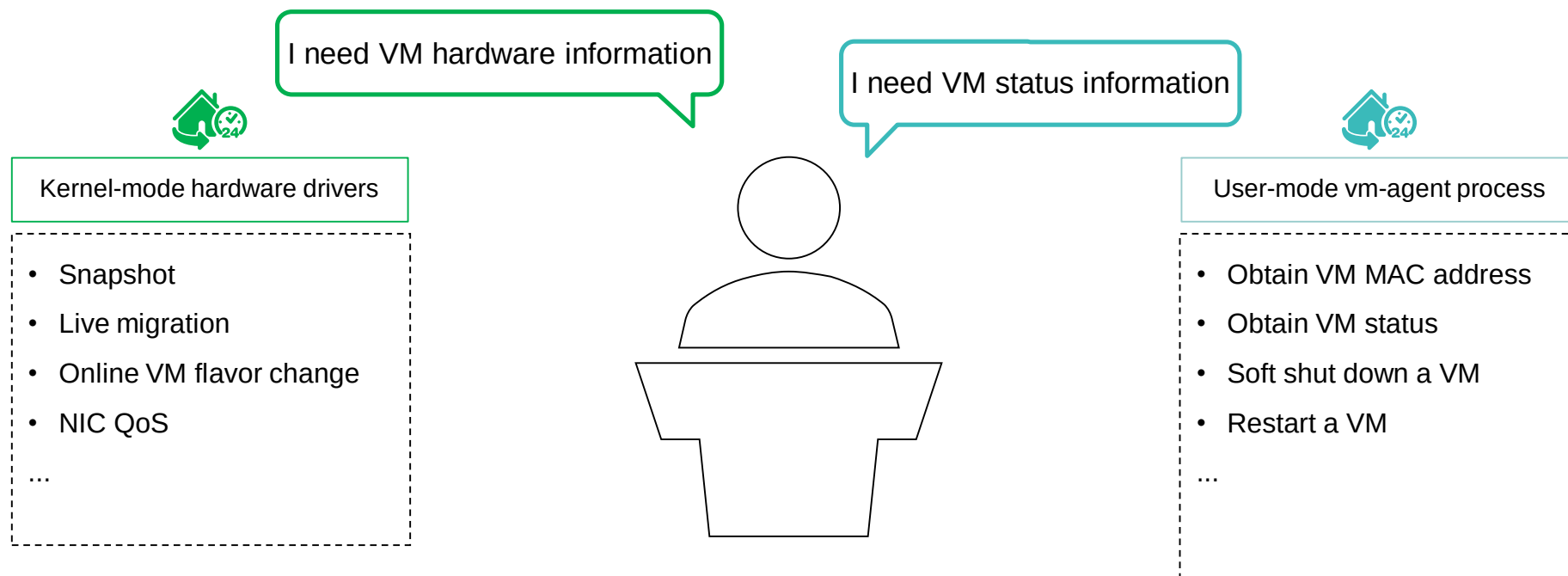


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Prerequisites for Enabling Advanced Features - Tools



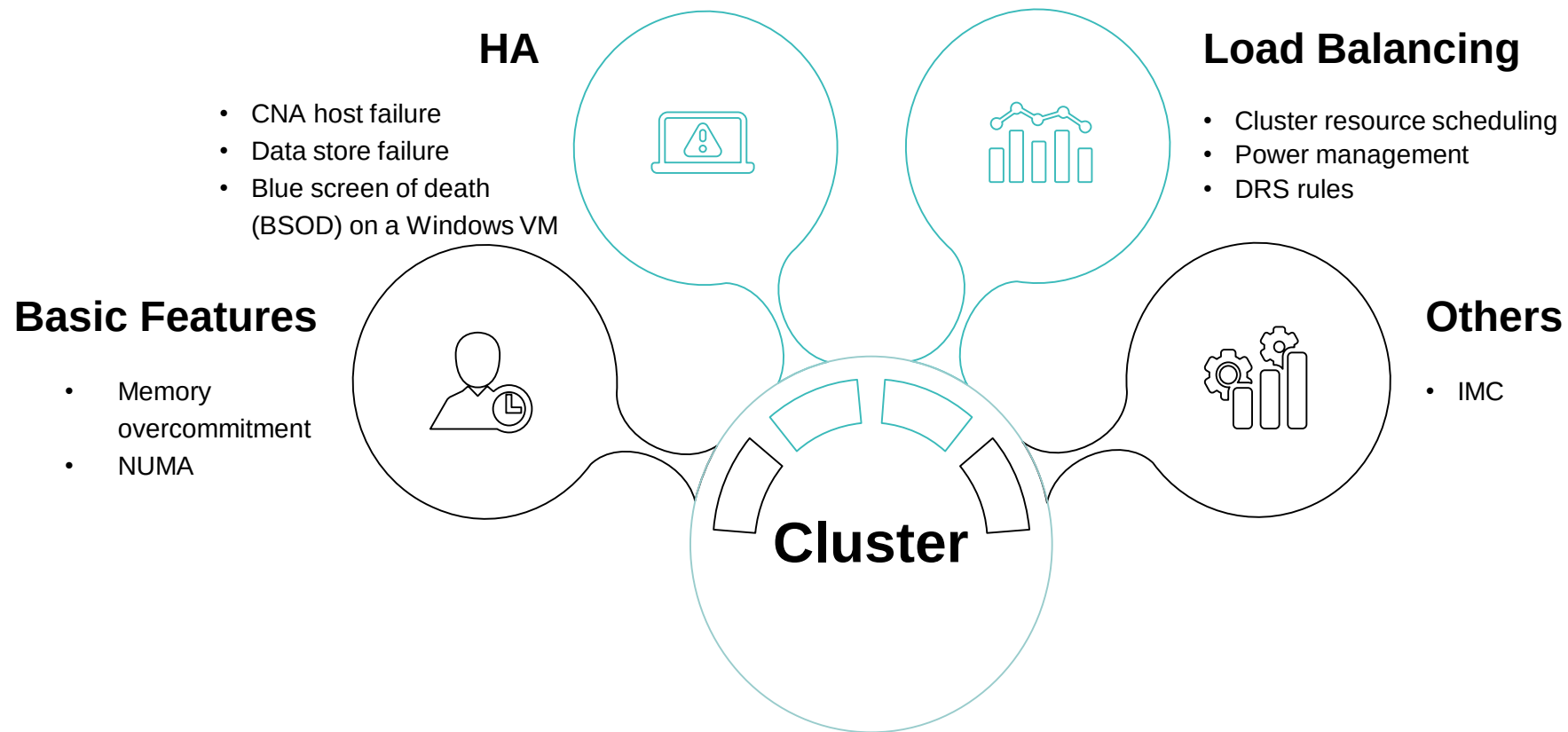


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 - ▣ VM Features

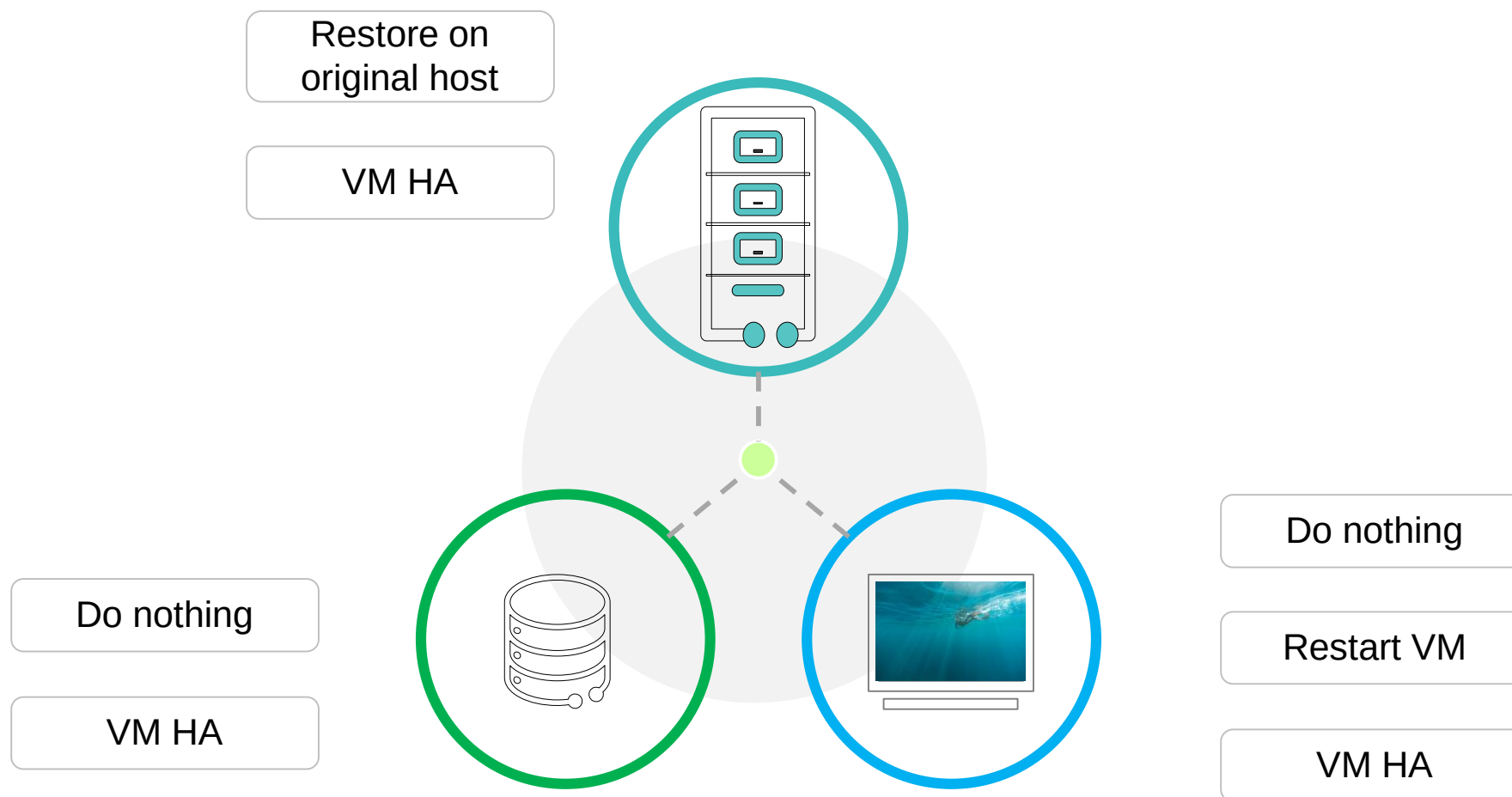


Cluster Features



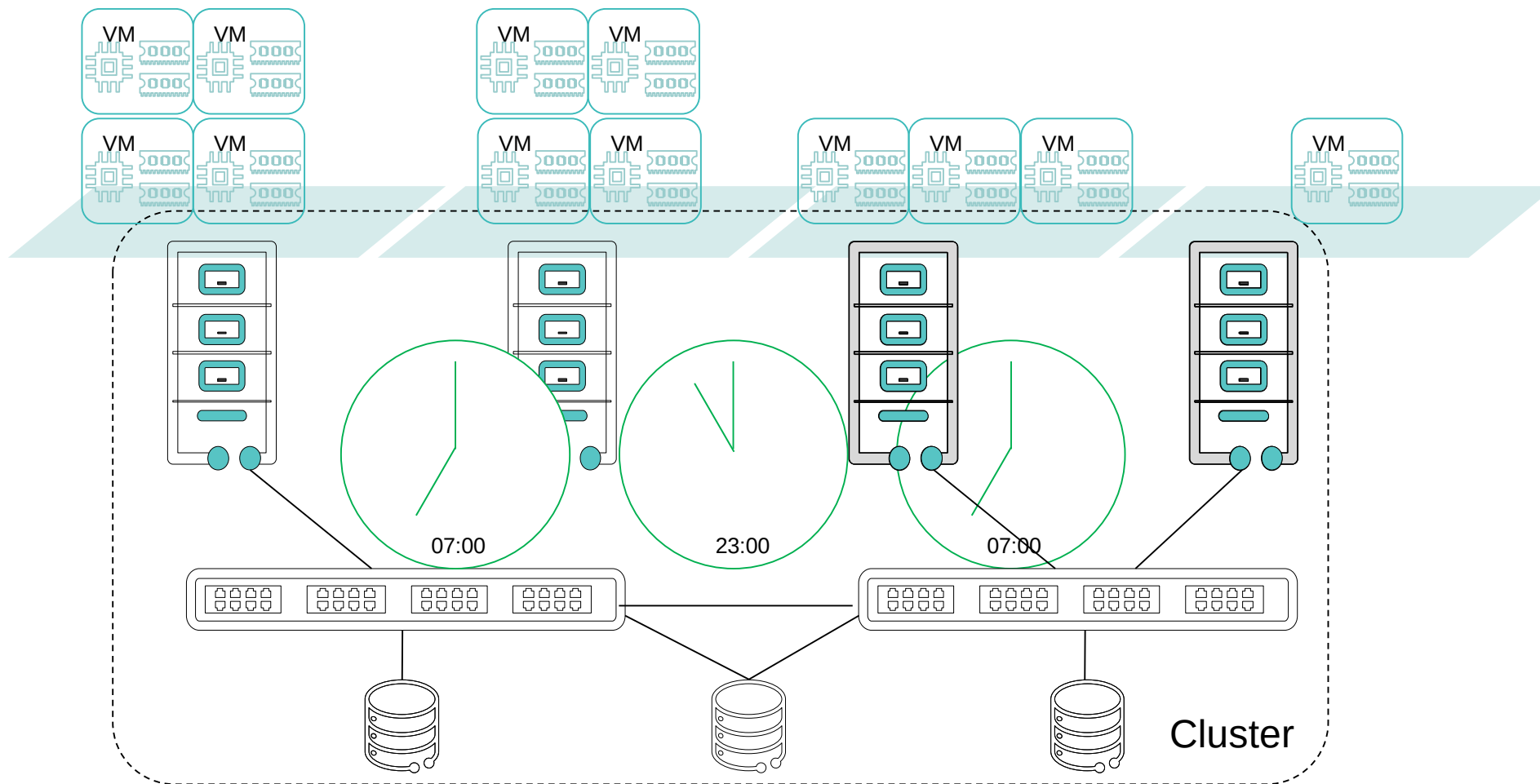


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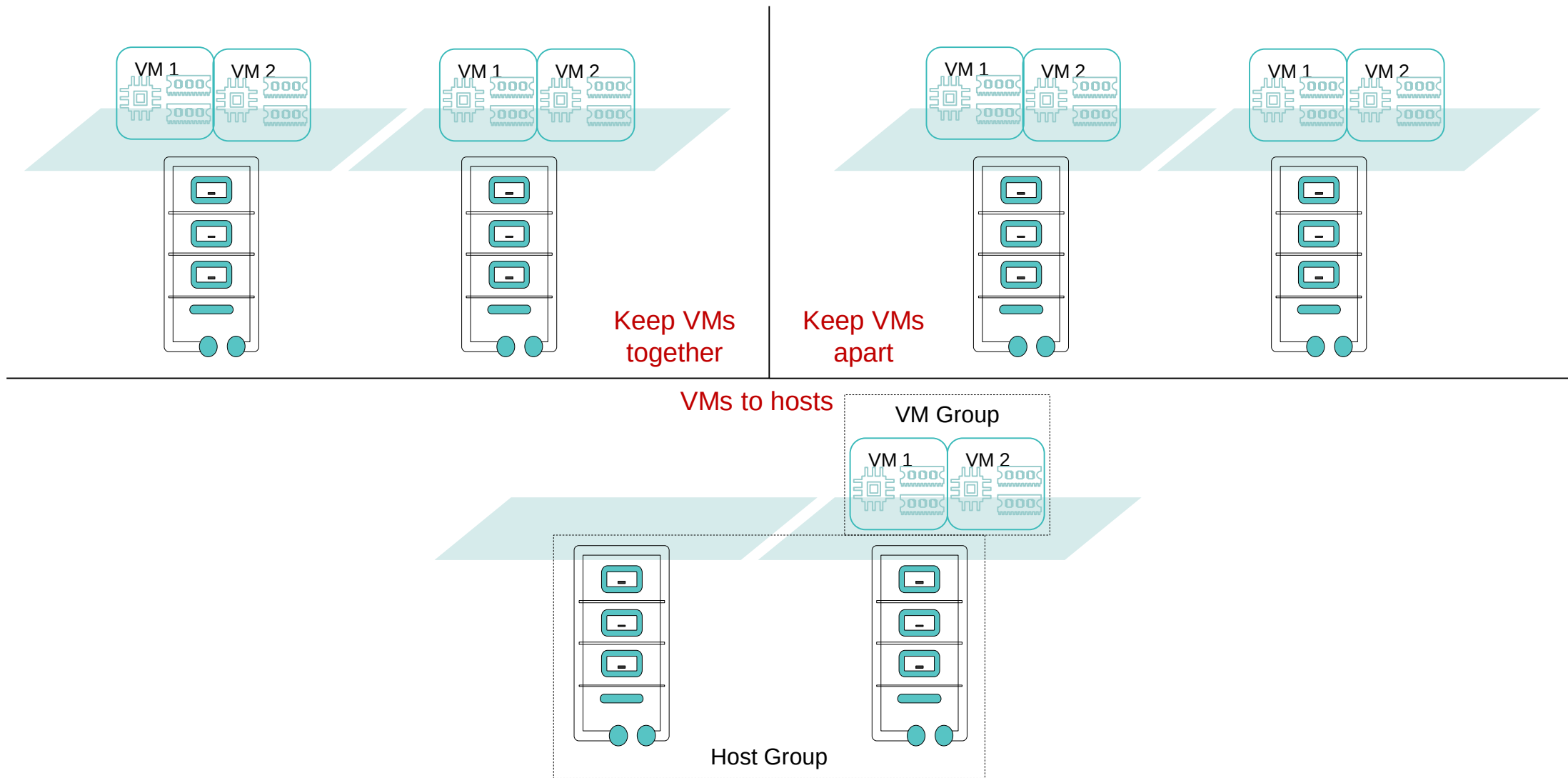


Power Management





DRS Rules





IMC

- On FusionCompute, enabling incompatible migration cluster (IMC) mode for a cluster allows VMs to migrate between hosts that are using CPUs with different performance baselines within this cluster.
- Currently, IMC mode only allows VM live migration between hosts using Intel CPUs.
- IMC mode allows the hosts in a cluster to present the same CPU function set to VMs running on them, despite the fact that these hosts may be using CPUs with different performance baselines.
- For the IMC mode to work for a cluster that already contains hosts and VMs, ensure that the following conditions are met:
 - The CPU generations of the hosts in the cluster are the same as or later than the target IMC mode.
 - The CPU generations of the running or hibernating VMs in the cluster are the same as or earlier than the target IMC mode. If any VM in the cluster does not meet this requirement, stop this VM or migrate it to another cluster.

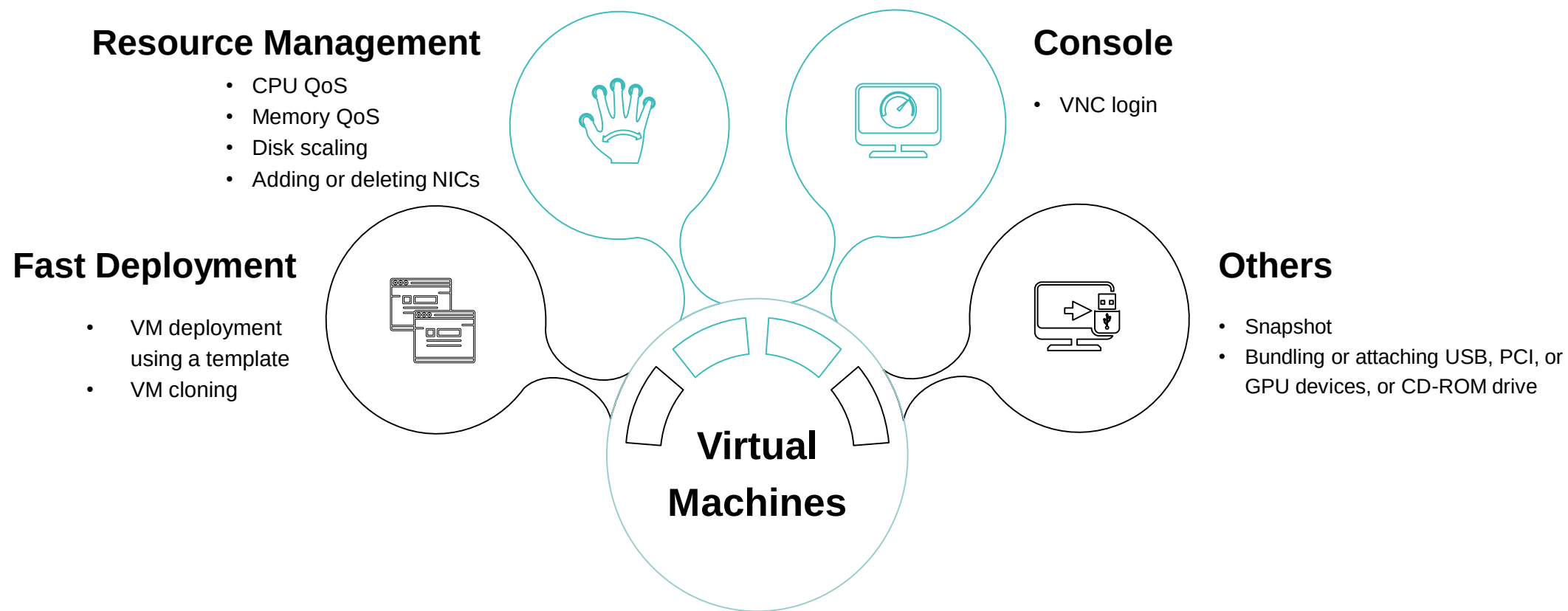


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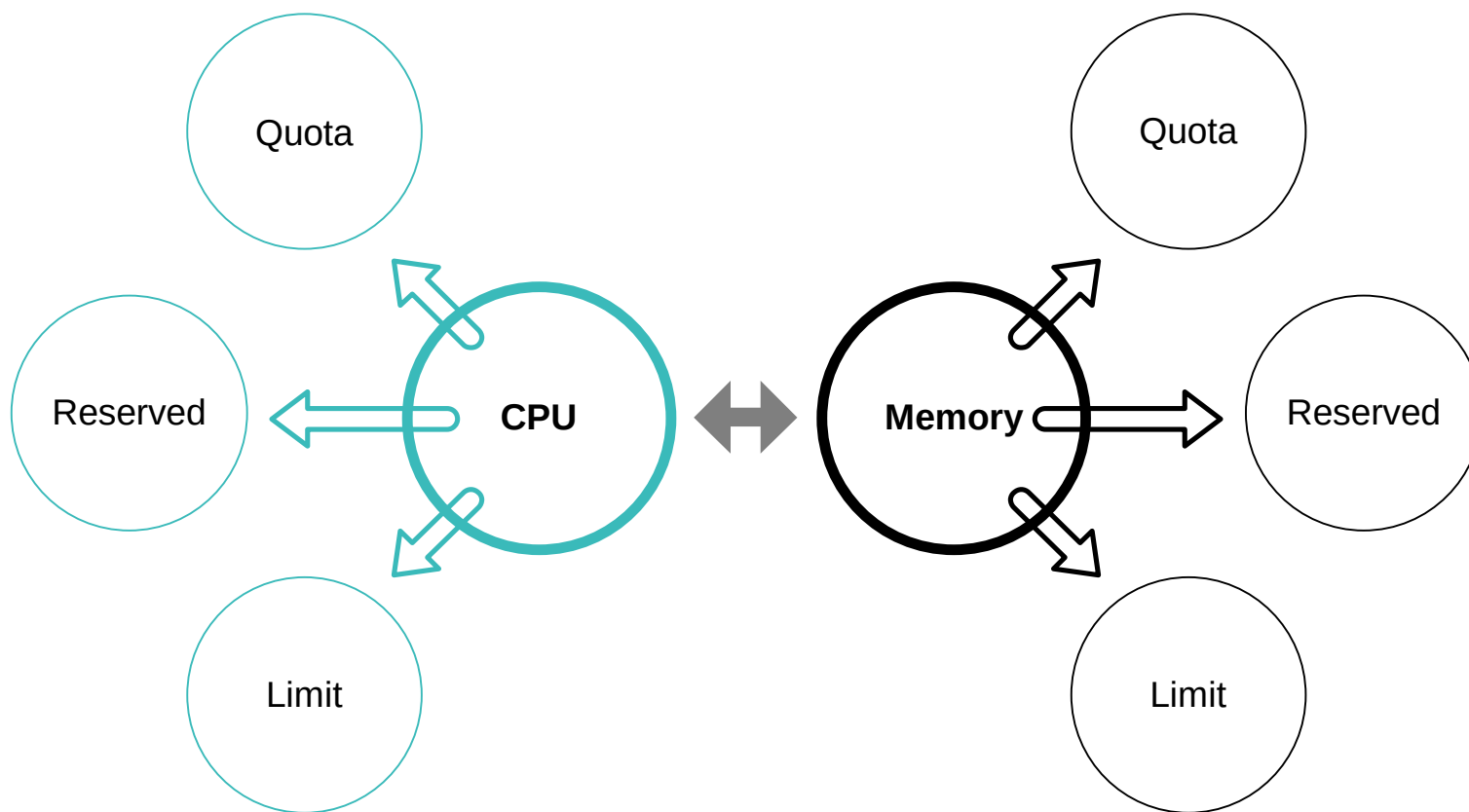


VM Features





CPU and Memory QoS





Quiz

1. Which of the following is not a snapshot management option?
 - A. Create a snapshot
 - B. Modify a snapshot
 - C. Restore a VM using one of its snapshots
 - D. Replicate a snapshot

2. Templates can be used to quickly deploy VMs. At present, templates can be created only by converting or cloning VMs.
 - A. TRUE
 - B. FALSE



Summary

At this point you should:

- Understand virtualization features.
- Understand where and when virtualization features may be used.



Recommendations

- Huawei e-Learning website
 - <http://support.huawei.com/learning/Index!toTrainIndex>
- Huawei Support case library
 - <http://support.huawei.com/enterprise/servicecenter?lang=en>
- HCIA-Cloud Computing v4.0 online forum
 - <https://forum.huawei.com/enterprise/en/Huawei-Official-Communication-Channel-HCNA-Cloud-Certification-Course/thread/456287-911>

The image features a blue-tinted background with silhouettes of several groups of business professionals. On the left, a group of four people is gathered around a table, looking at documents. In the center, a group of five people stands in a line, facing right. On the right, a group of five people is engaged in a discussion, with one person holding a folder. The background shows a modern office interior with large windows and glass partitions. The text "Thank You" and the website "www.huawei.com" are centered over the image.

Thank You
www.huawei.com



Cloud Computing Trends



Foreword

- Cloud computing has become the foundation of a range of important applications. At the same time, other technologies are also driving the further advancement of cloud computing. This chapter focuses on the relationship between cloud computing and related fields, and introduces you to some of the new technologies related to cloud computing.



Objectives

- Upon completion of this course, you will:
 - Be able to describe key technologies that underpin cloud computing.
 - Understand the relationship between cloud computing and other fields.
 - Understand some of the most prominent cloud computing trends.



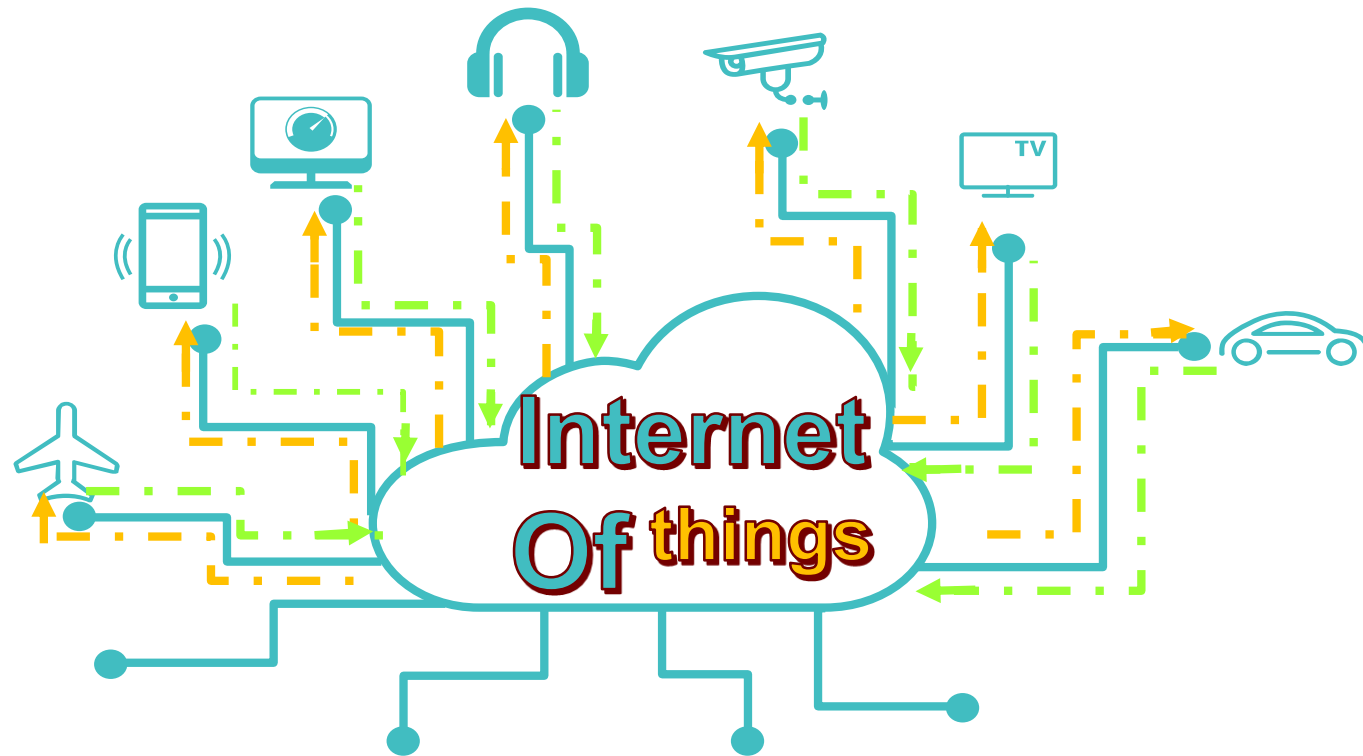
Contents

- 1. Fields Related to Cloud Computing**
2. Cloud Computing Technologies
3. Cloud Computing Trends
4. Other Emerging Technologies



IoT

- The Internet of Things (IoT) is the concept of connecting everything through the Internet, including all sorts of communication and interaction: people-people, people-things, and things-things.





Main IoT Technologies



RFID

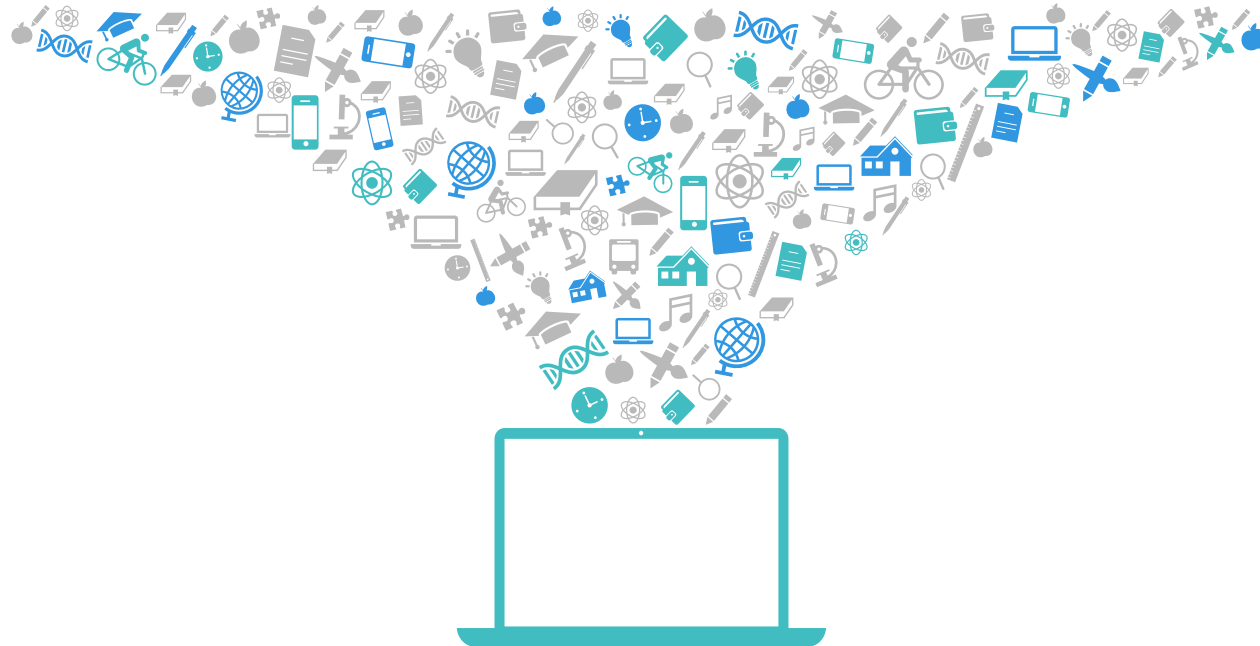
Sensors

Embedded Systems



Big Data

- Big data refers to data sets that are too large or complex to be handled by traditional data-processing application software.
- Such data sets are generated by the IoT. Due to a radical increase in total IoT connections, ever more massive data sets will be generated.





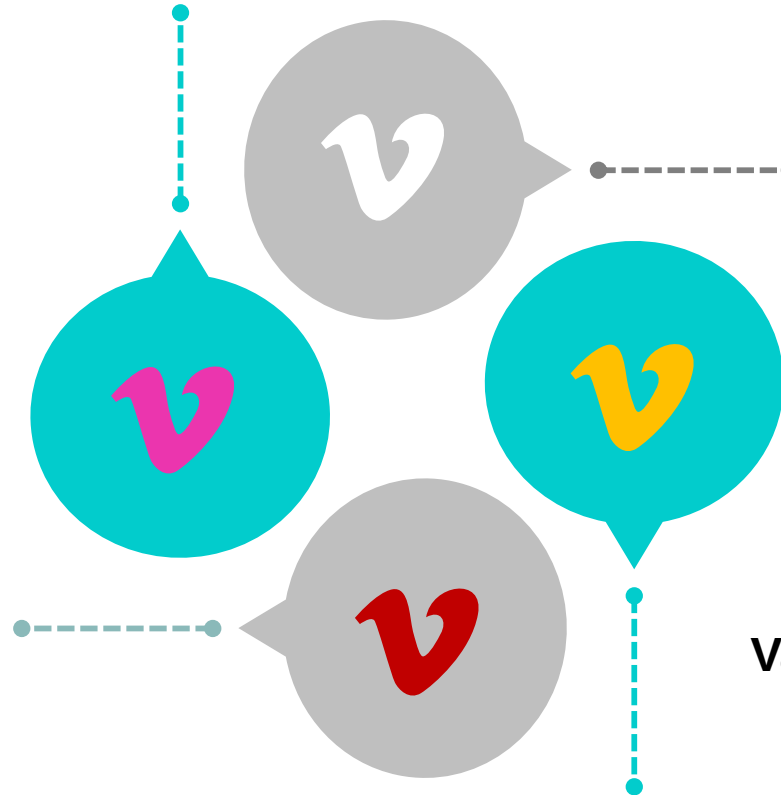
Characteristics of Big Data

Volume: the amount of data

Variety: the different types of data

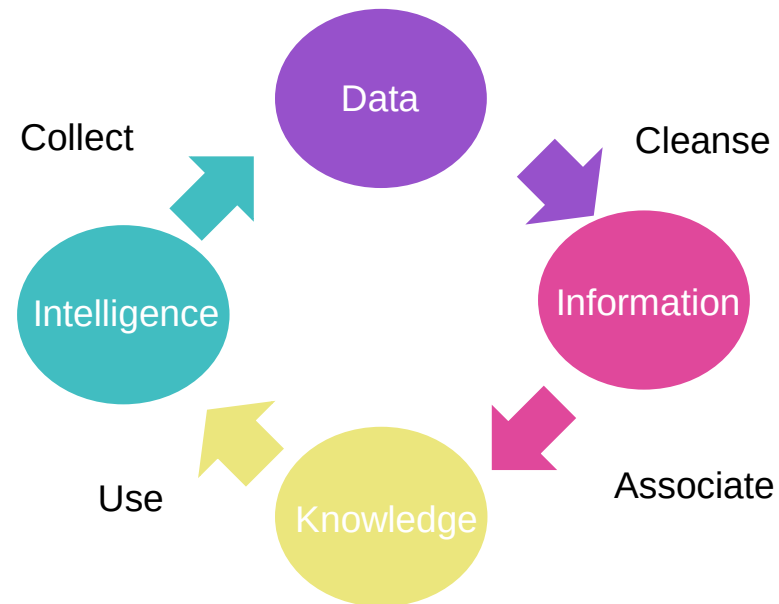
Velocity: the speed at which data is generated

Value: the value that can be extracted from data





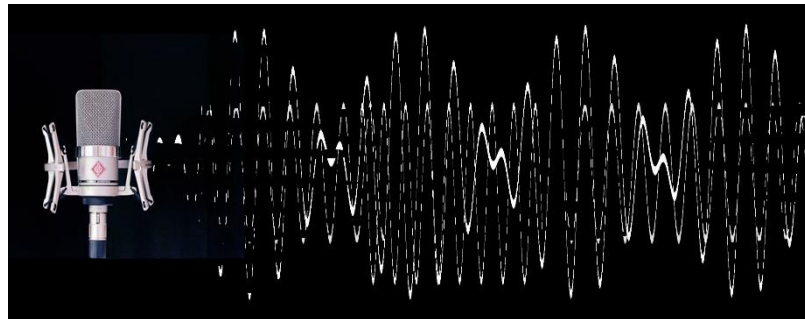
Big Data Processing





Artificial Intelligence

- Artificial intelligence (AI) is an area of computer science that focuses on the research into and development of theories, methodology, technology, and application systems for simulating and extending human intelligence with machines.
- Applications of AI include robotics, speech recognition, image recognition, natural language processing.





Elements of AI

● Big Data

Artificial intelligence is intelligence acquired and summarized by big data analytics.

● Algorithms

Algorithms are the fundamental way by which AI is realized, and an effective method to extract data intelligence.

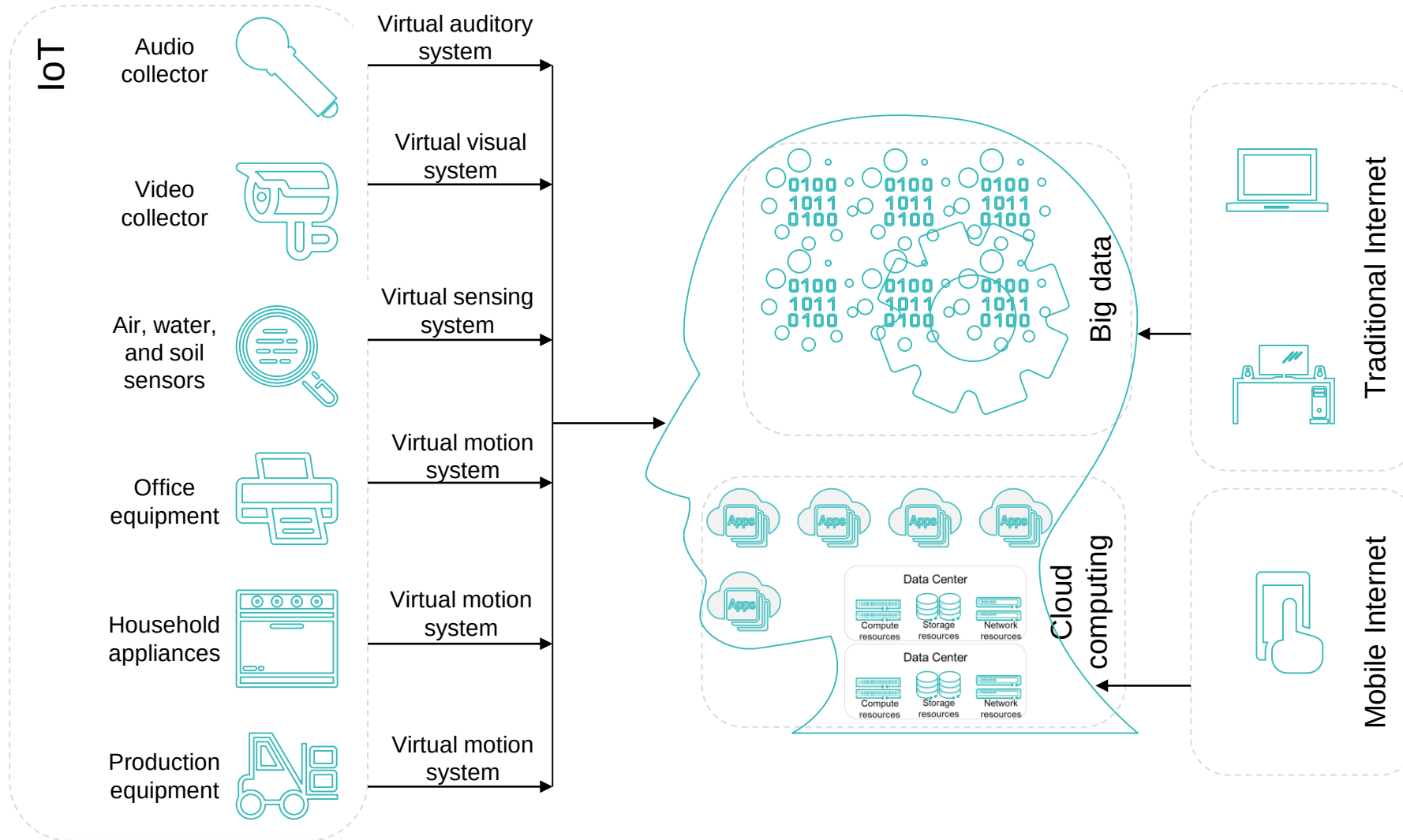
● Computing Power

Computing power is a prerequisite for applying AI algorithms to extract value from massive data sets.

● Scenario

Big data, computing power, and algorithms are input that will create meaningful output only if applied to practical business scenarios.

Cloud Computing, IoT, & Big Data





The 5G Era

- 5G refers to the 5th generation of mobile communications technologies and standards.

Enhanced mobile
broadband

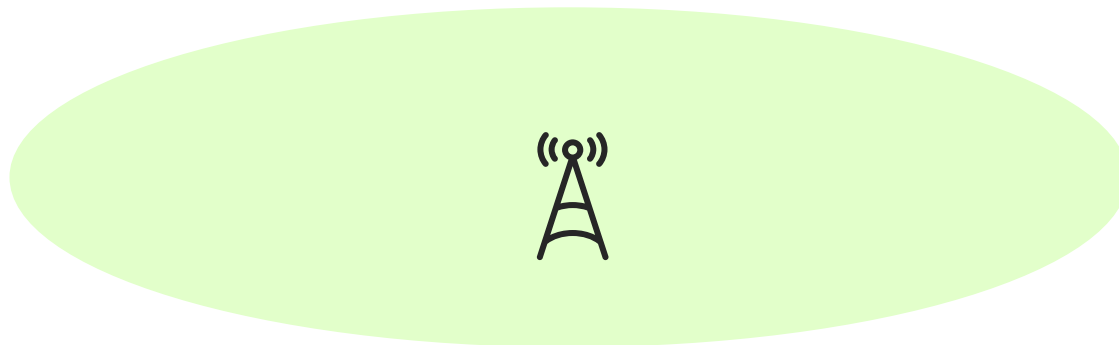
Reliable,
low-latency

Massive
number of
connections

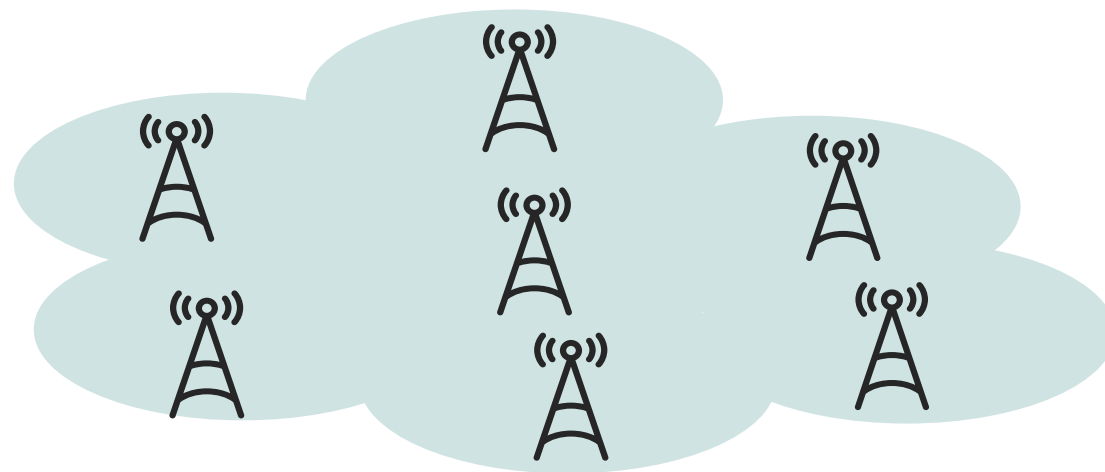


How 5G Works: Network Densification

4G



5G





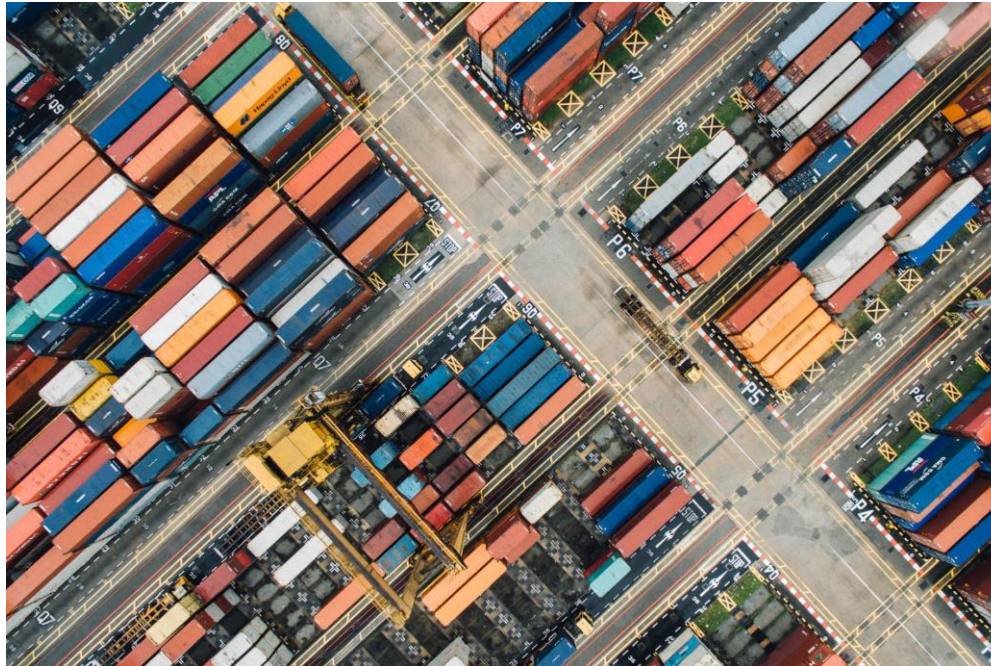
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Containers

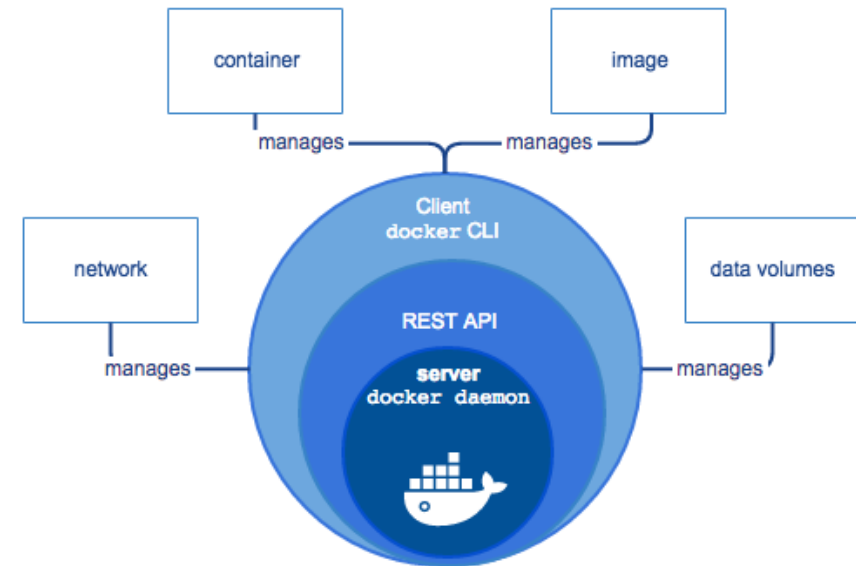
- Containerization is a lightweight virtualization technology that uses OS-level virtualization. Several containers (isolated user-space instances) can be created on each operating system, each of which is allocated only a subset of the computer's resources.





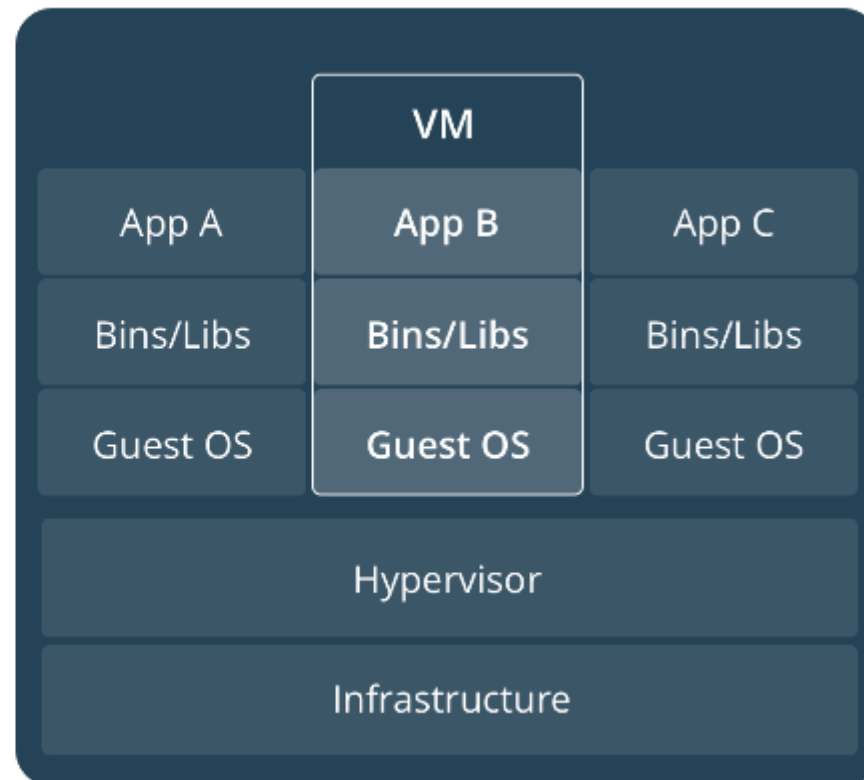
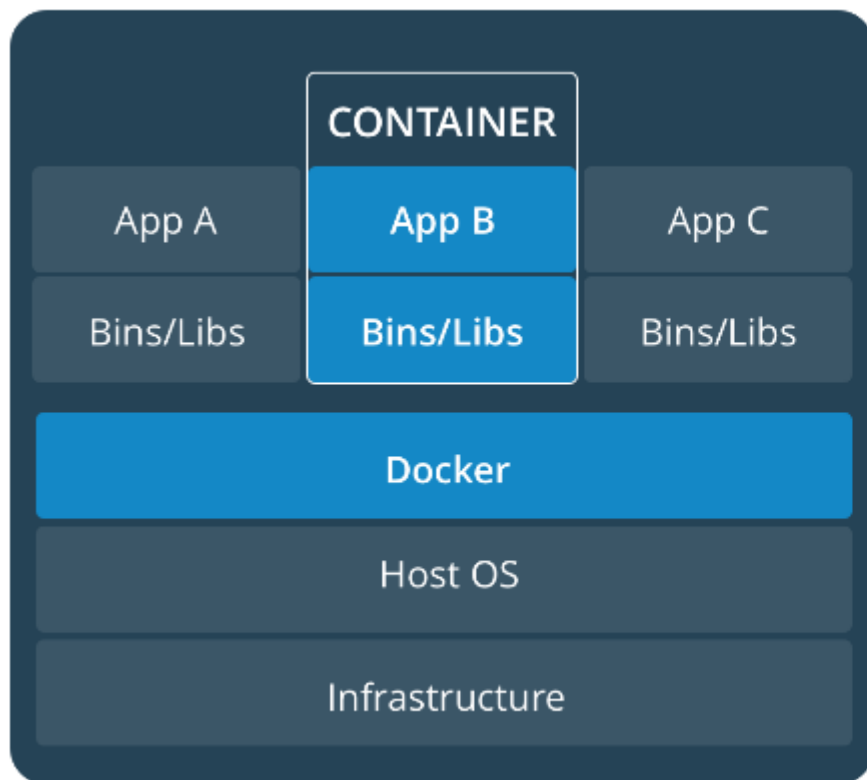
Docker

- Docker is an open source application container engine. It allows developers to pack their applications and dependency packages into a portable container, and later run them on any other Linux machine. The sandbox mechanism is used for containers, eliminating any interface between containers.



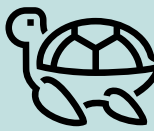


Docker Technology - Differences Between Containers and VMs (1)





Docker Technology - Differences Between Containers and VMs (2)

Difference	 VM	 Docker
Size		
Boot speed		
Integration		



Docker Elements

- **Image**

- A Docker image is a read-only template used to create Docker containers. Docker provides a simple mechanism to allow users to create images or update existing ones. Users can also download images created by others and use them without making any changes.

- **Container**

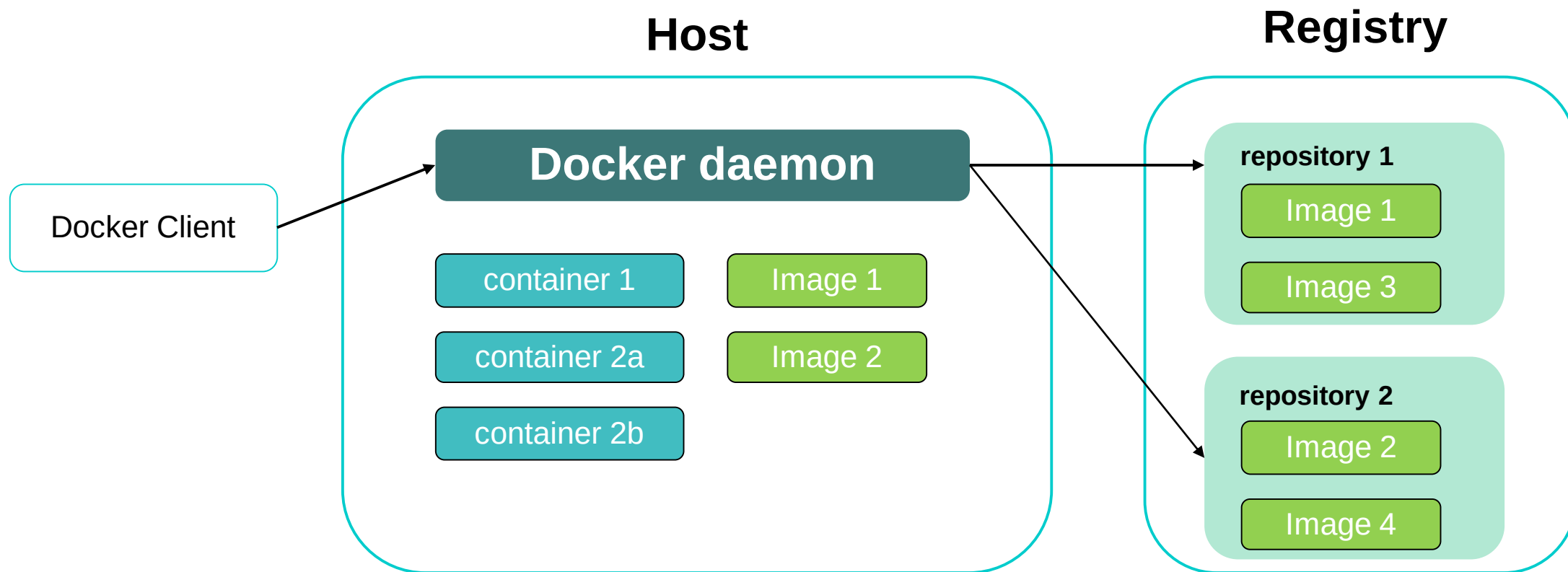
- Docker uses containers to run applications. A container is a runtime instance of a docker image. A container can be started, started, stopped, and deleted. Each container is an isolated and secure platform.

- **Repository**

- A repository is a set of Docker images. A Registry is a hosted service containing repositories of images. Each image has a unique tag.



Docker Architecture





OpenStack

- Began in 2010 as a joint project of Rackspace Hosting and NASA, OpenStack is a free open-source software platform for cloud computing. OpenStack requires contributions to be released under the Apache 2.0 license.

OpenStack is a free open-source software platform for cloud computing.





OpenStack Components

Nova

Compute

Swift

Object Storage

Cinder

Block Storage

Neutron

Network

Keystone

Authentication

Ceilometer

Metering

Glance

Image

Heat

Orchestration

Horizon

**Dashboard
(UI Console)**



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Cloud Computing Trends

Cloud giants are **strengthening cooperation**, leading to a **more concentrated** market.



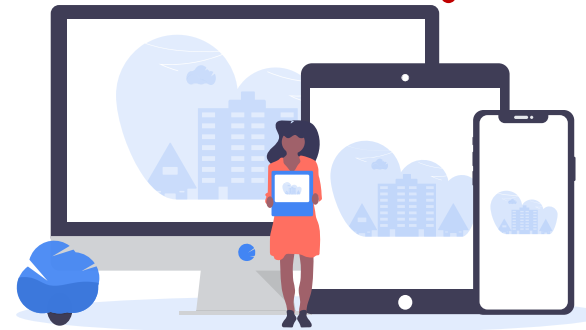
Cloud providers are using **more AI**.



Hybrid cloud and industry cloud are gaining momentum.



There is an emerging trend toward **cloud-device integration**.



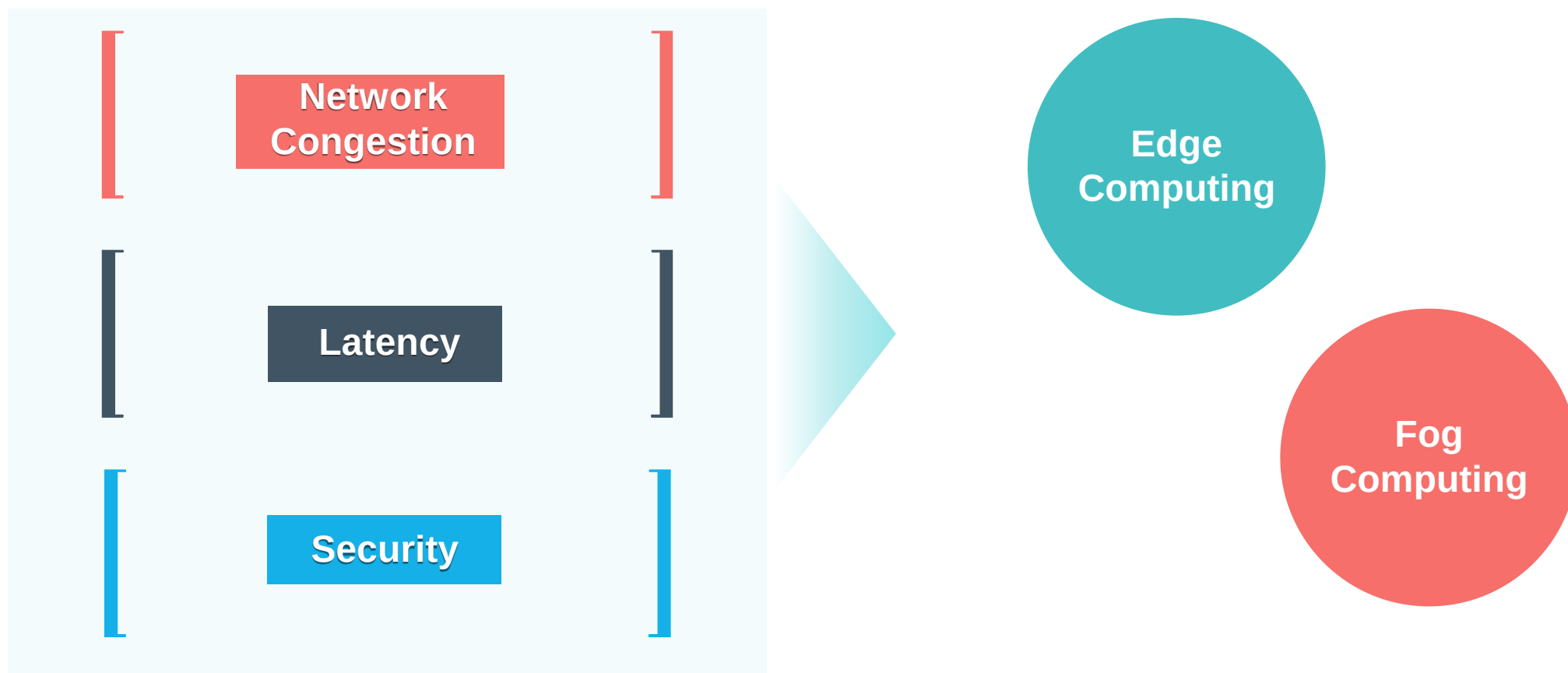


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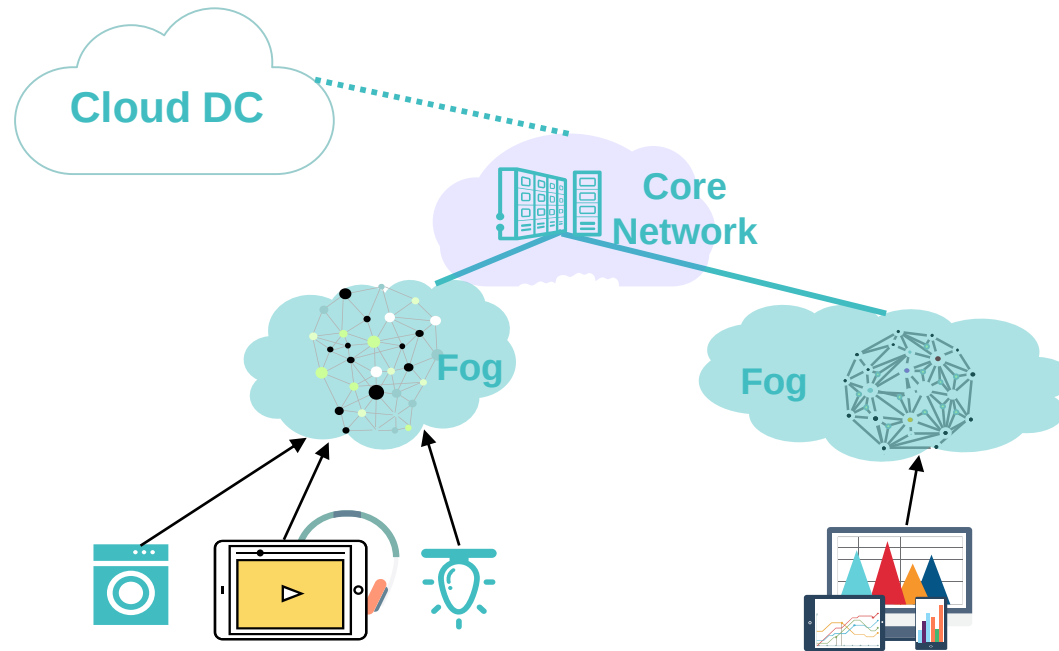
Cloud Computing Extensions





Fog Computing

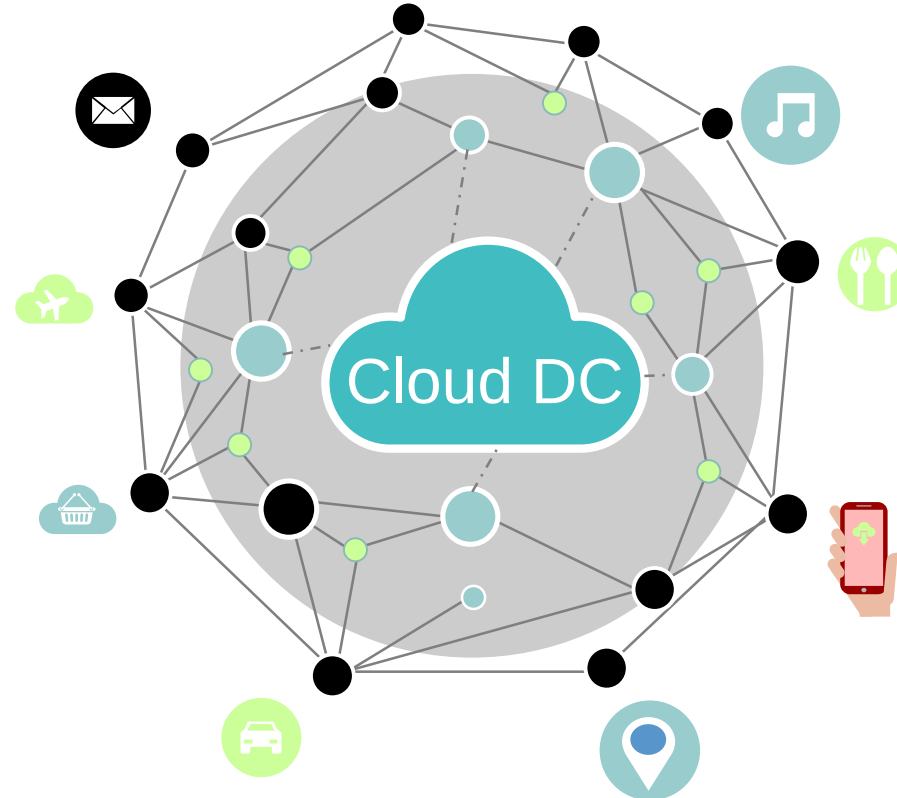
- Fog computing is an extension of cloud computing services to the edge of the network to decrease latency and network congestion. Fog computing uses edge devices to carry out a substantial amount of computation, storage, and communication locally, instead of storing all data in cloud data centers.





Edge Computing (1)

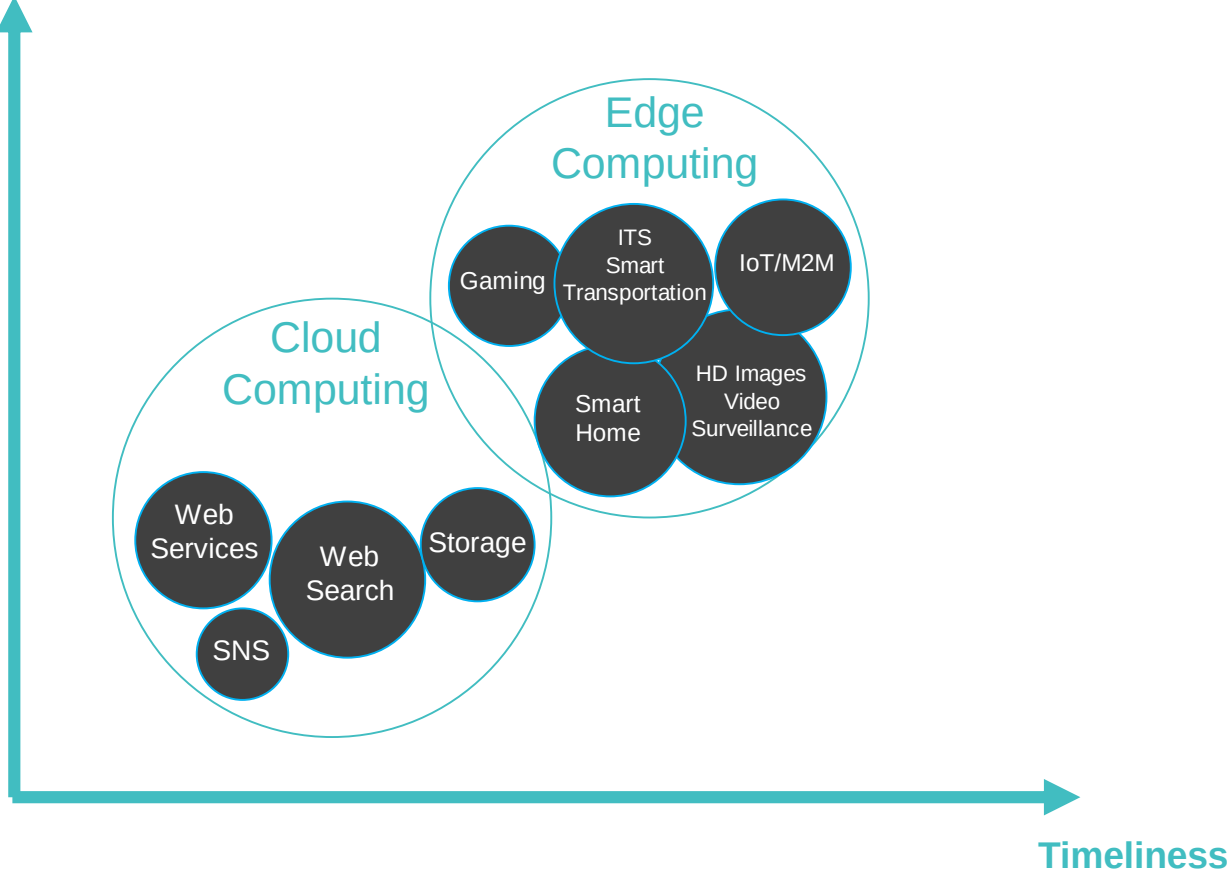
- Edge computing creates an open platform that integrates core capabilities including network, compute, storage, and applications at the edge of your network, to process data where it is being generated.





Edge Computing (2)

Bandwidth/Server Access
Frequency



Low latency

HD video, bandwidth-intensive

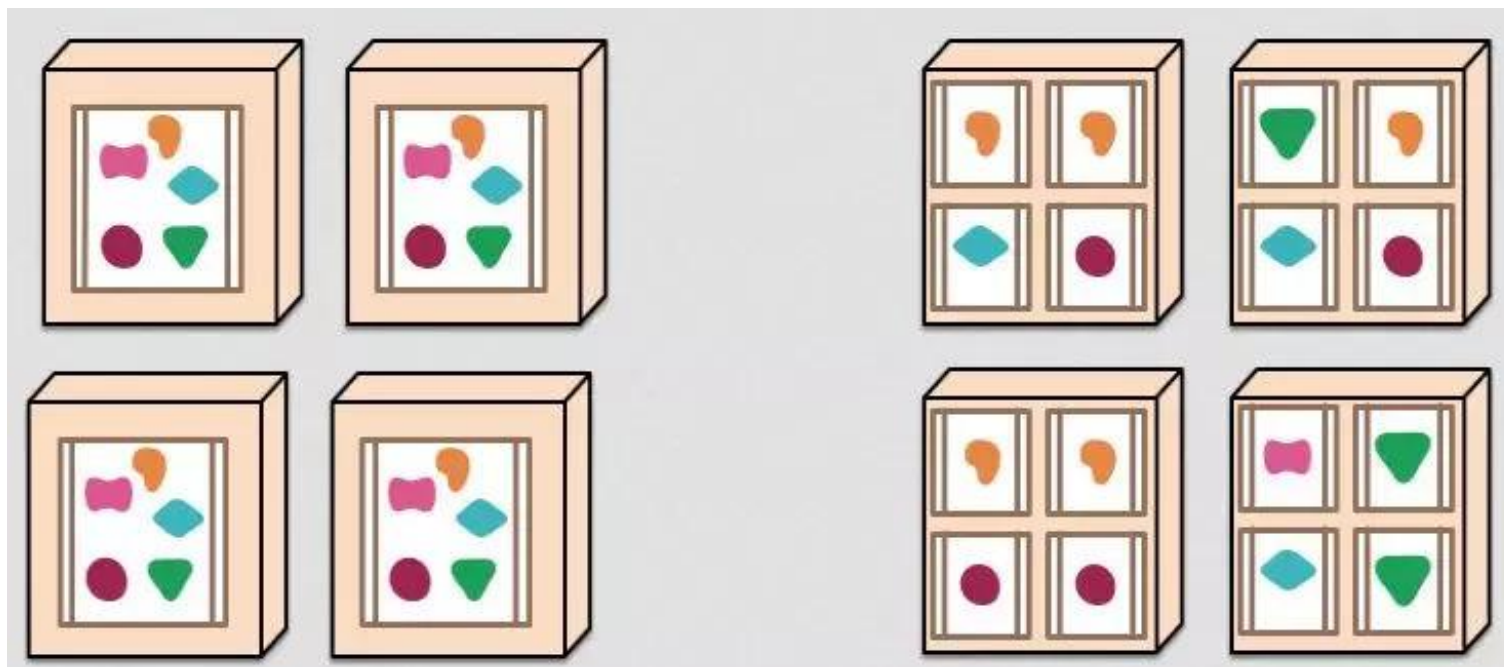
Transmission network efficiency

High-quality user experience



Microservices

- Microservices are a software development technique that structures an application as a collection of loosely coupled, fine-grained services. In a microservices architecture, lightweight communication protocols are used, often HTTP resource APIs. The services are built around functionalities and deployed independently and in a fully automated manner. The need for centralized management is minimized. The services can be written in different languages and use different storage types.





Pros and Cons of Microservices

Pros

Independent deployment, flexible scalability

Effective resource isolation

Optimized development teams

Cons

Complex development and testing process due to project splitting

Difficulty of ensuring data consistency between services



Serverless (1)

- Serverless computing is a model for building and managing microservices-based architectures. It allows you to manage your application deployment on a per-service level, rather than a per-server level.
 - **Function as a Service (FaaS):** The service provider provides a platform where the developer develops, runs, and manages their applications without the need to build and maintain an infrastructure.
 - **Backend as a Service (BaaS):** The service provider provides a serverless backend, also known as backend as a service for the mobile application developer. BaaS shifts backend functions including data/file storage, account management, data collection, operation analysis, message push, and social media integration to the cloud, allowing the developer to focus on their apps' frontend.



Serverless (2)

Previously

Build a framework that runs on a server to respond to multiple events.

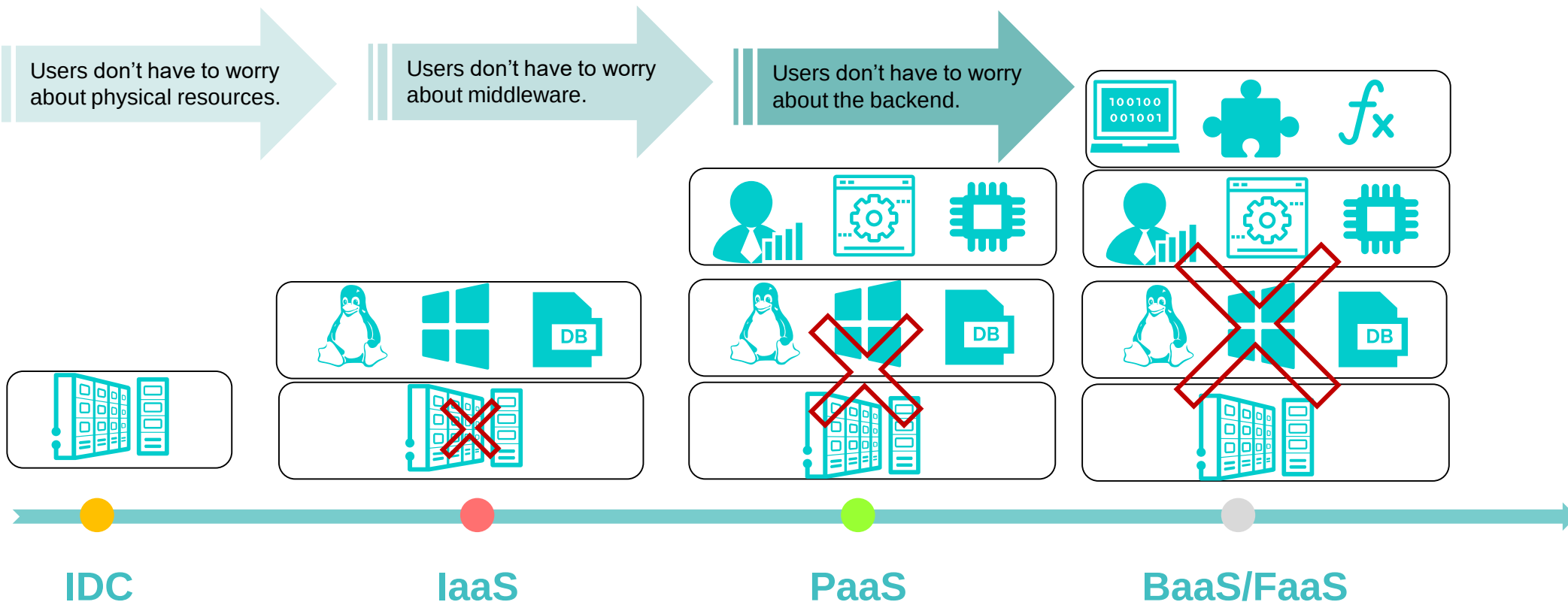
Now

Build or use a separate microservice or function to respond to each event.

Users don't have to worry about physical resources.

Users don't have to worry about middleware.

Users don't have to worry about the backend.





FaaS Characteristics

No need
for O&M

Able to
focus on
the code

Quick
boot,
short life
cycle

Infinite
elasticity

Automated



BaaS Benefits

Higher Efficiency

Reduces costs associated with mobile application development environments and improves efficiency.

Faster TTM

Allows developers to focus on their apps rather than backend functions, and reduces operational costs of apps after launching.

Reduce Resources Needed to Launch Apps

Fewer developers and IT resources are required.

Optimized for Mobile Phones and Tablets

BaaS providers have spent a considerable amount of time and resources on optimizing mobile application data and networks.

Secure and Elastic Infrastructure

BaaS provides bundled infrastructure services, relieving developers of the burden of ensuring elasticity, security, and performance.

A Full Collection of Common APIs

BaaS offers a full collection of commonly used third-party APIs, sparing developers the hassle of collecting these resources.



Quiz

1. Which of the following is not an element of artificial intelligence? ()
 - A. Big data
 - B. Cognitive analysis capability
 - C. Computing power
 - D. Scenario
2. The only function of the Internet of Things is to collect the data generated by connected objects.
 - A. True
 - B. False



Summary

- Fields Related to Cloud Computing
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Recommendations

- Huawei e-Learning website
 - <http://support.huawei.com/learning/Index!toTrainIndex>
- Huawei Support case library
 - <http://support.huawei.com/enterprise/servicecenter?lang=en>
- HCIA-Cloud Computing v4.0 online forum
 - <https://forum.huawei.com/enterprise/en/Huawei-Official-Communication-Channel-HCNA-Cloud-Certification-Course/thread/456287-911>

The image features a blue-tinted background showing silhouettes of several groups of business professionals in a modern office environment. They are standing on a reflective floor, and a city skyline is visible in the background. The overall mood is professional and collaborative.

Thank You
www.huawei.com



Recommendations

- ▣ Huawei Learning Website
 - <http://learning.huawei.com/en>
- ▣ Huawei e-Learning
 - <https://ilearningx.huawei.com/portal/#/portal/ebg/51>
- ▣ Huawei Certification
 - http://support.huawei.com/learning/NavigationAction!createNavi?navId=_31&lang=en
- ▣ Find Training
 - http://support.huawei.com/learning/NavigationAction!createNavi?navId=_trainingsearch&lang=en



More Information

- Huawei learning APP

