

# Cloud-Enabling Technology

# Enabling technologies

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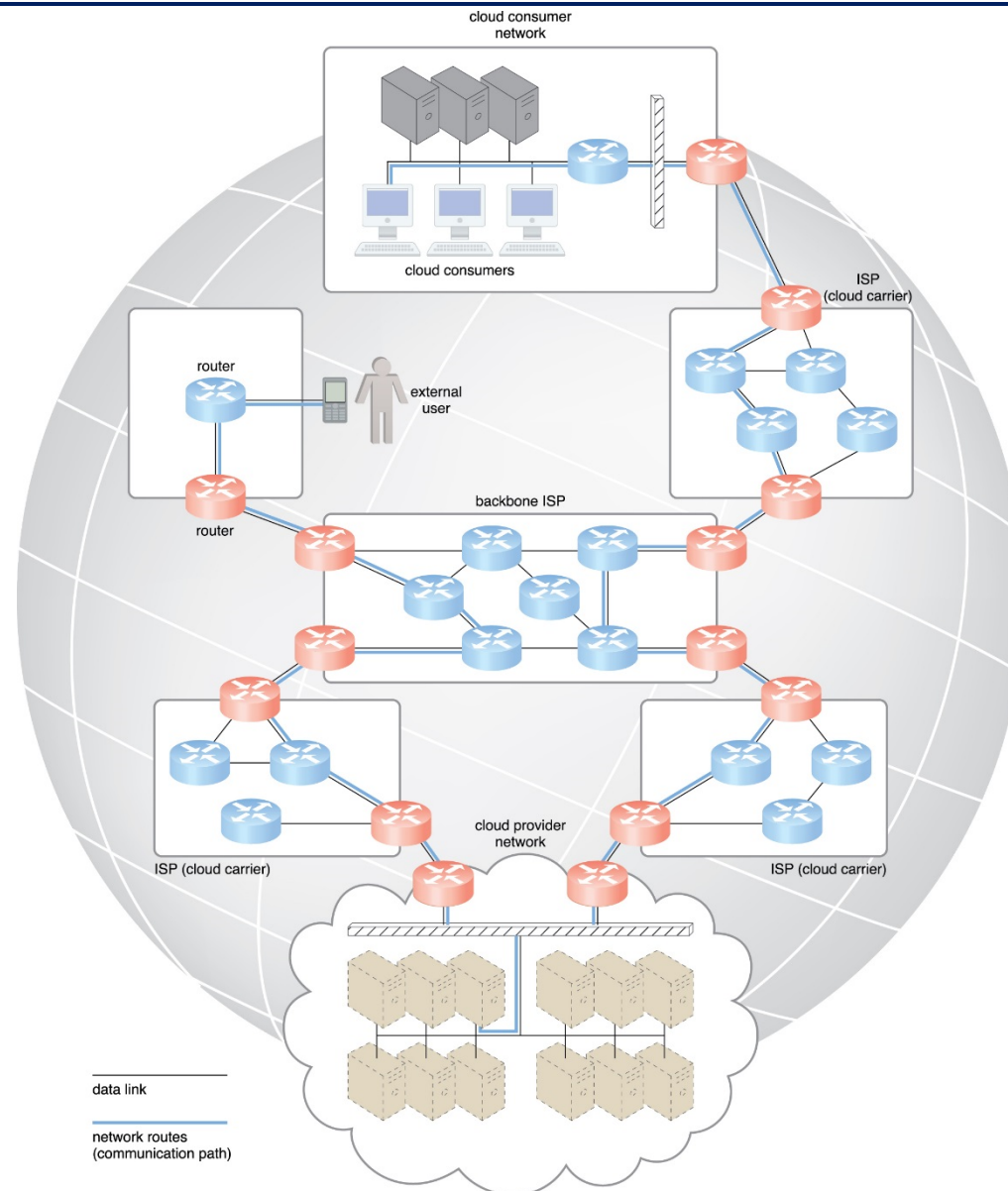
1. Broadband networks and internet architecture
2. Data center technology
3. Virtualization technology
4. Web technology
5. Multitenant technology

# 1. Broadband networks & Internet architecture

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- All clouds must be connected to a network
- Internet's largest backbone networks, established and deployed by ISPs, are interconnected by core routers
  - ISP: internet service provider

# Internet connecting provider and consumer

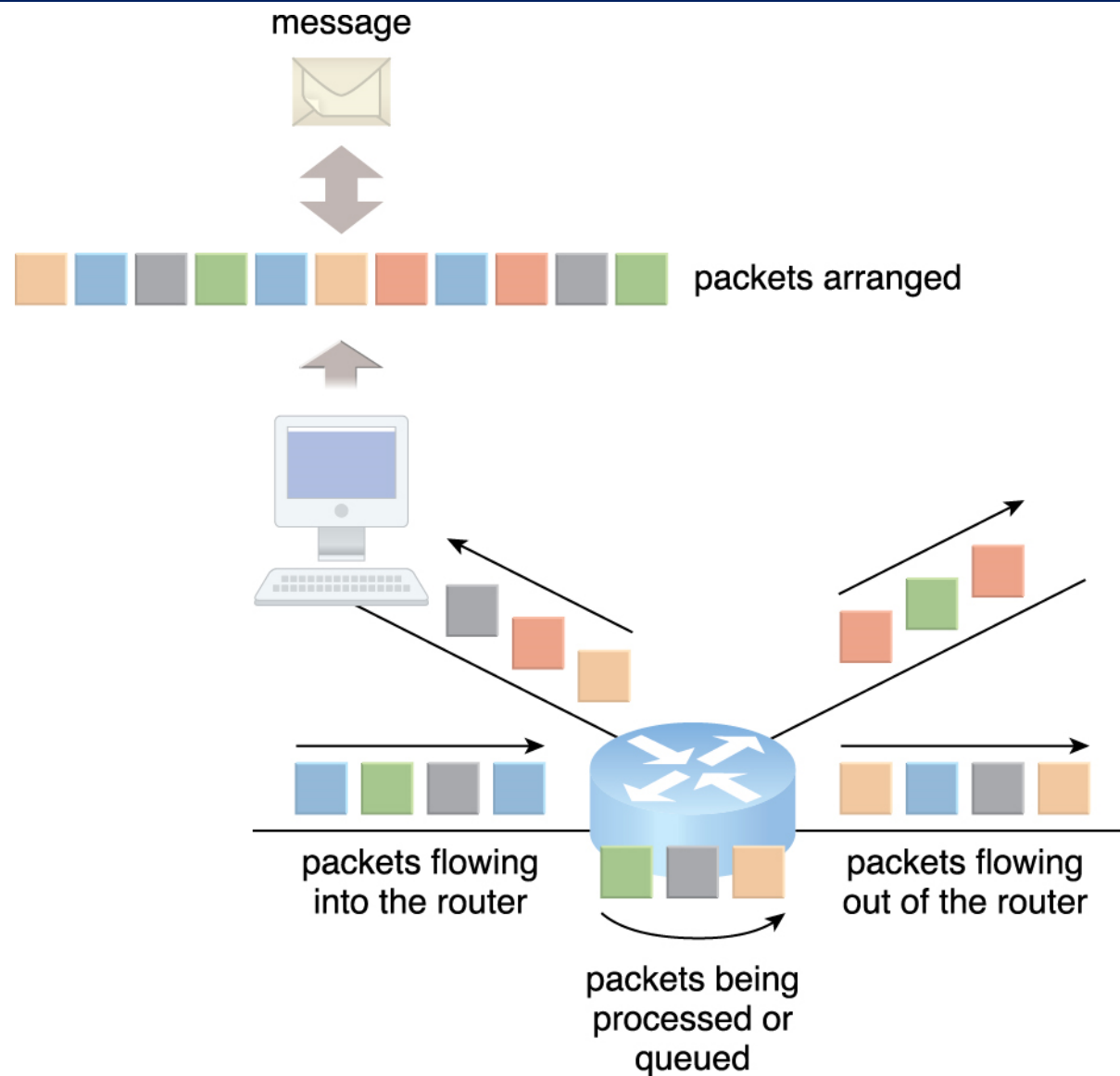


# Two fundamental components

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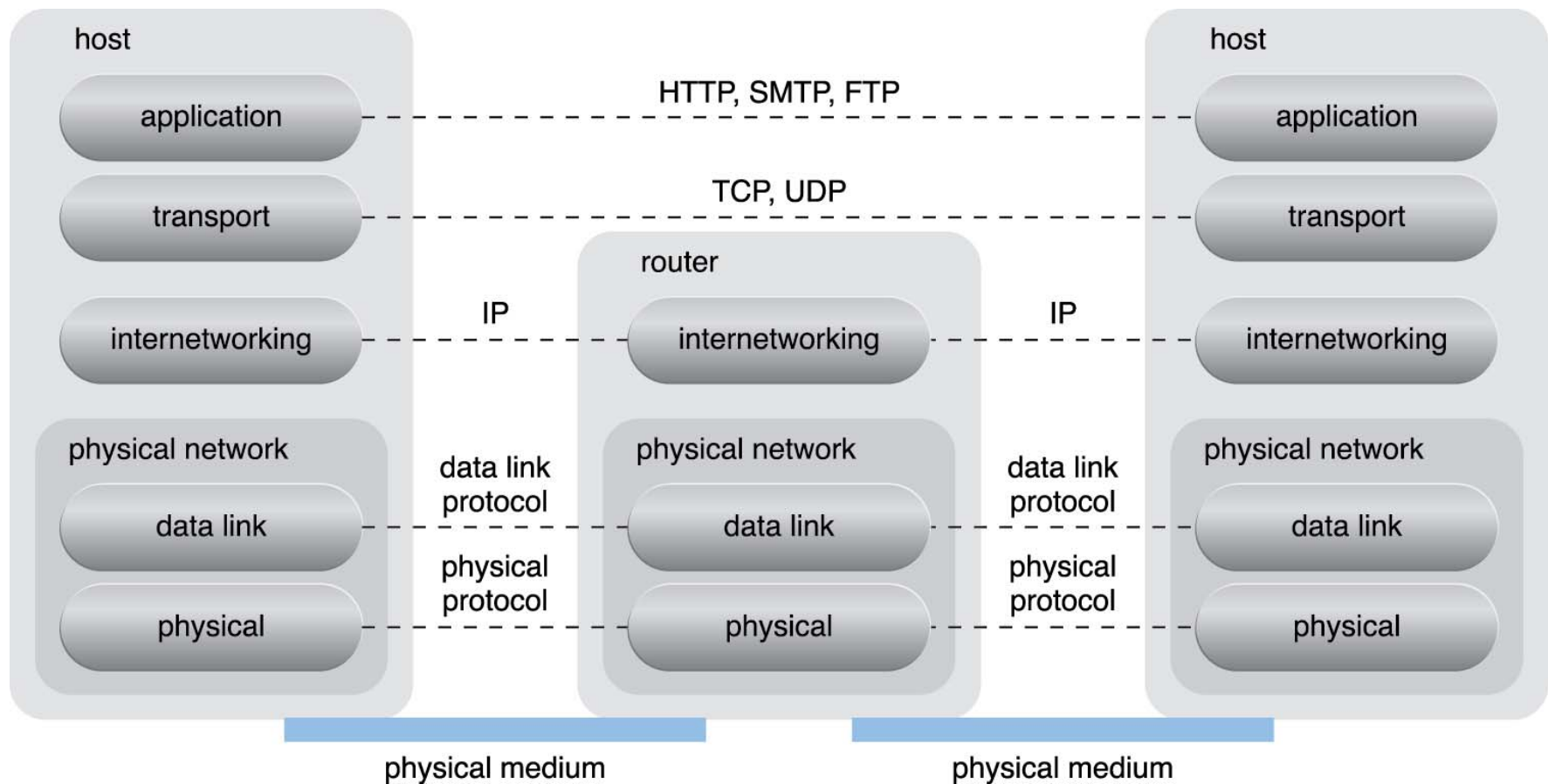
- Connectionless packet switching
  - End-to-end (sender-receiver pair) data flows are divided into packets of a limited size
  - Packets are processed through network switches and routers, then queued and forwarded from one intermediary node to the next
- Router-based interconnectivity
  - A router is a device that is connected to multiple networks through which it forwards packets
    - ❖ Each packet is individually processed
  - Use multiple alternative network routes

# Packets travelling through Internet



# Internet reference model

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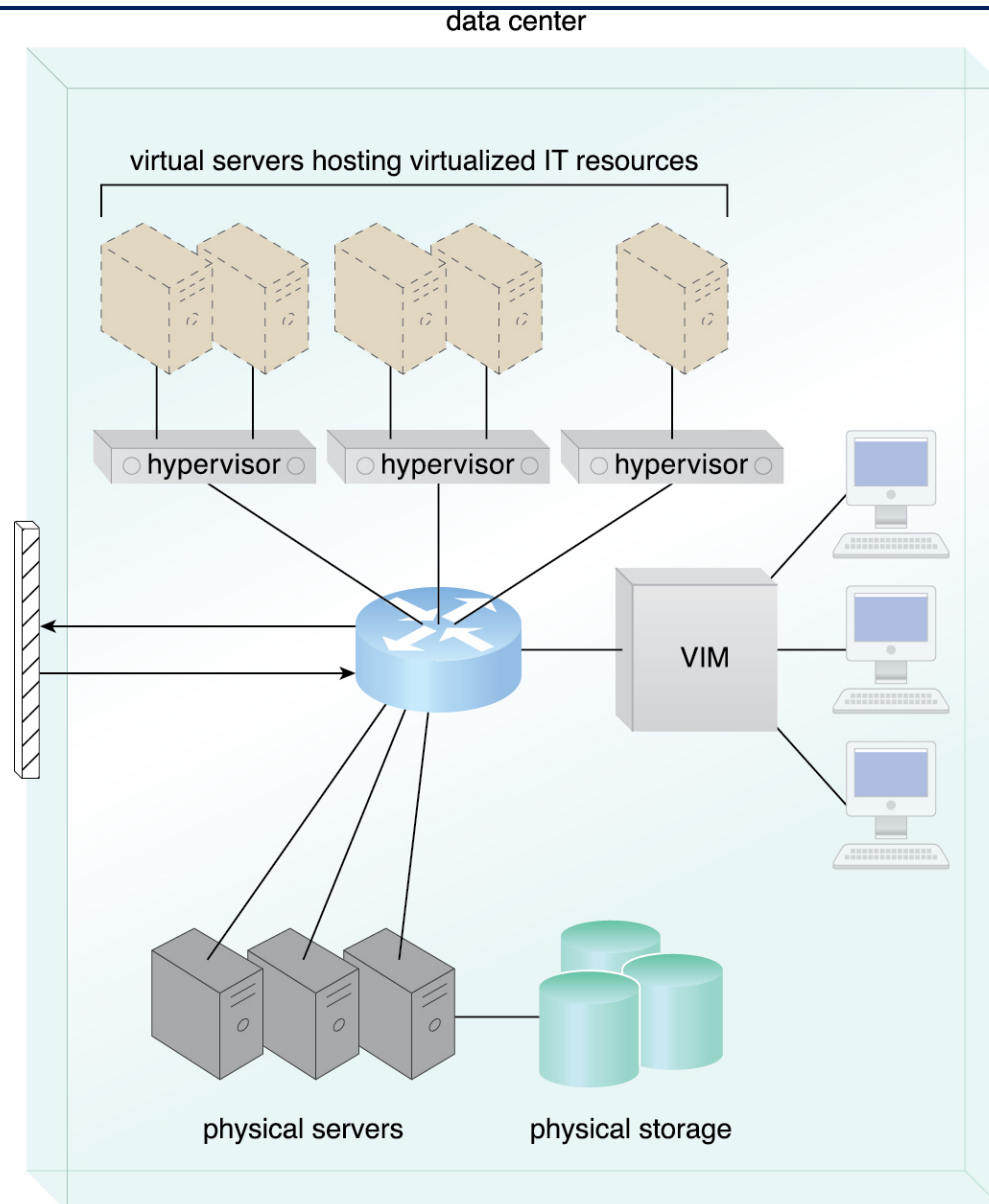
## 2. Data Center Technology

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- A data center is a facility used to house computer systems and associated components, such as telecommunications and storage systems
  - Virtualization
  - Standardization and Modularity
  - Automation
  - Remote Operation and Management



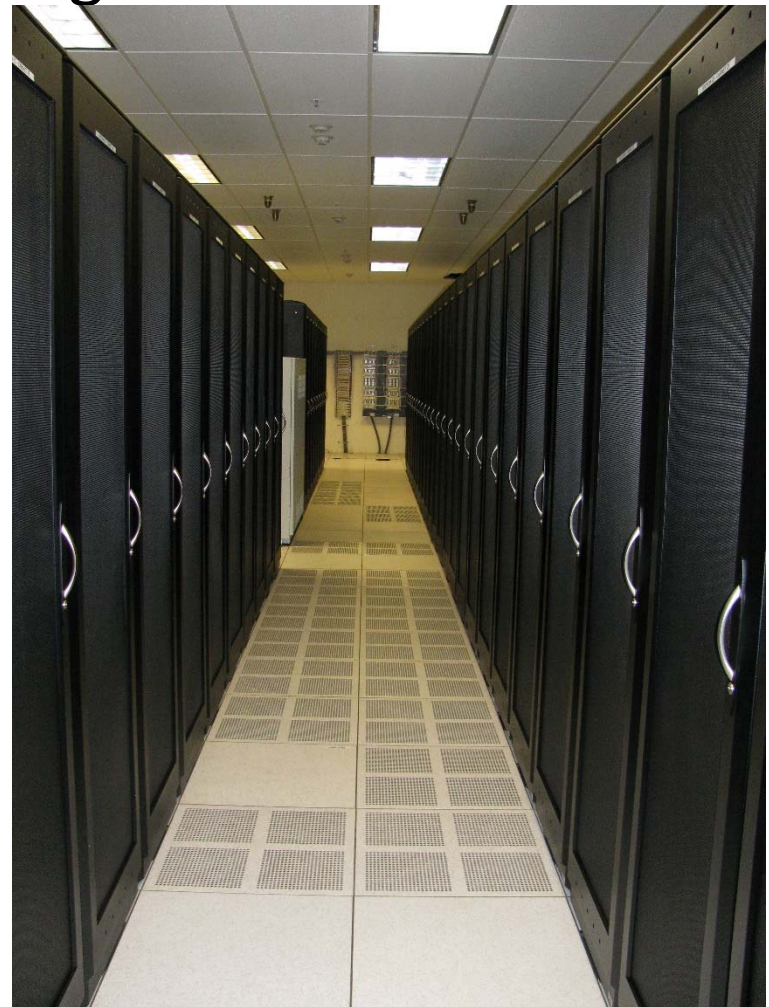
# Virtualization



# Standardization and Modularity

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- Data centers are built upon standardized commodity hardware and designed with modular architecture.



# Supercomputer vs. data center

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- Handouts

# 3. Virtualization technology

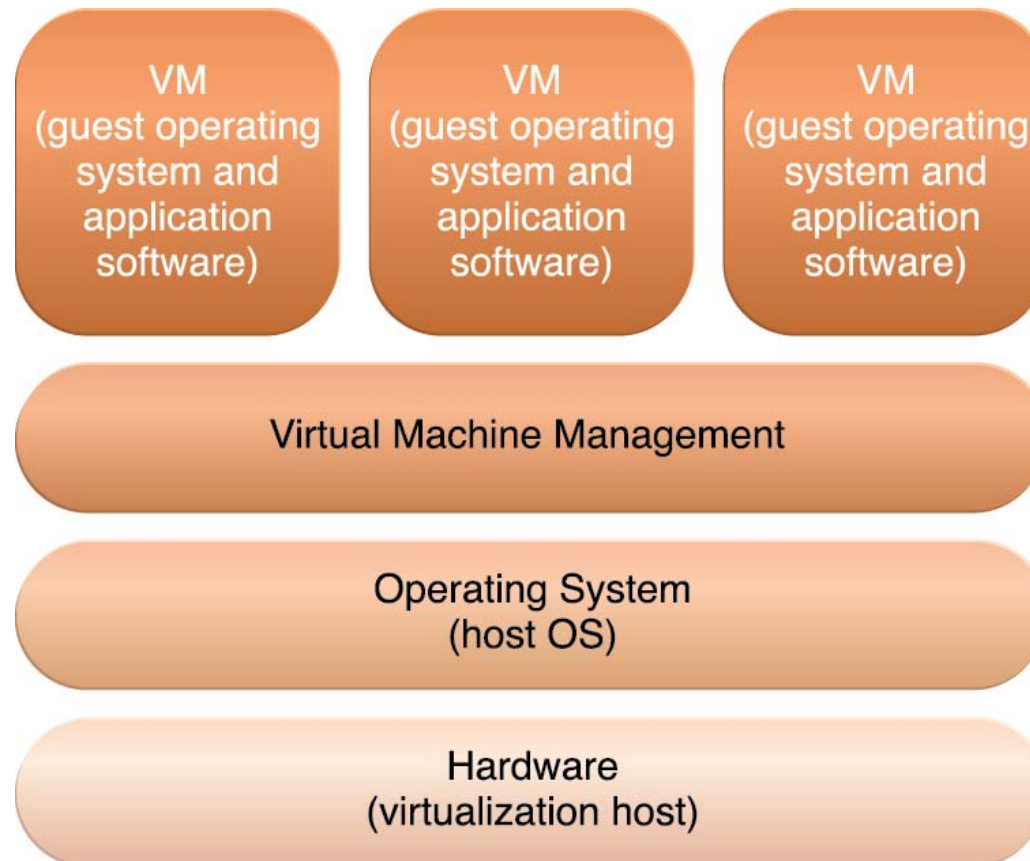
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- Virtualization is a process of converting a physical IT resource into a virtual IT resource
  - Server
    - ❖ Virtual server  $\leftrightarrow$  virtual machine
  - Storage
  - Network
  - Power

# Creating a new virtual server

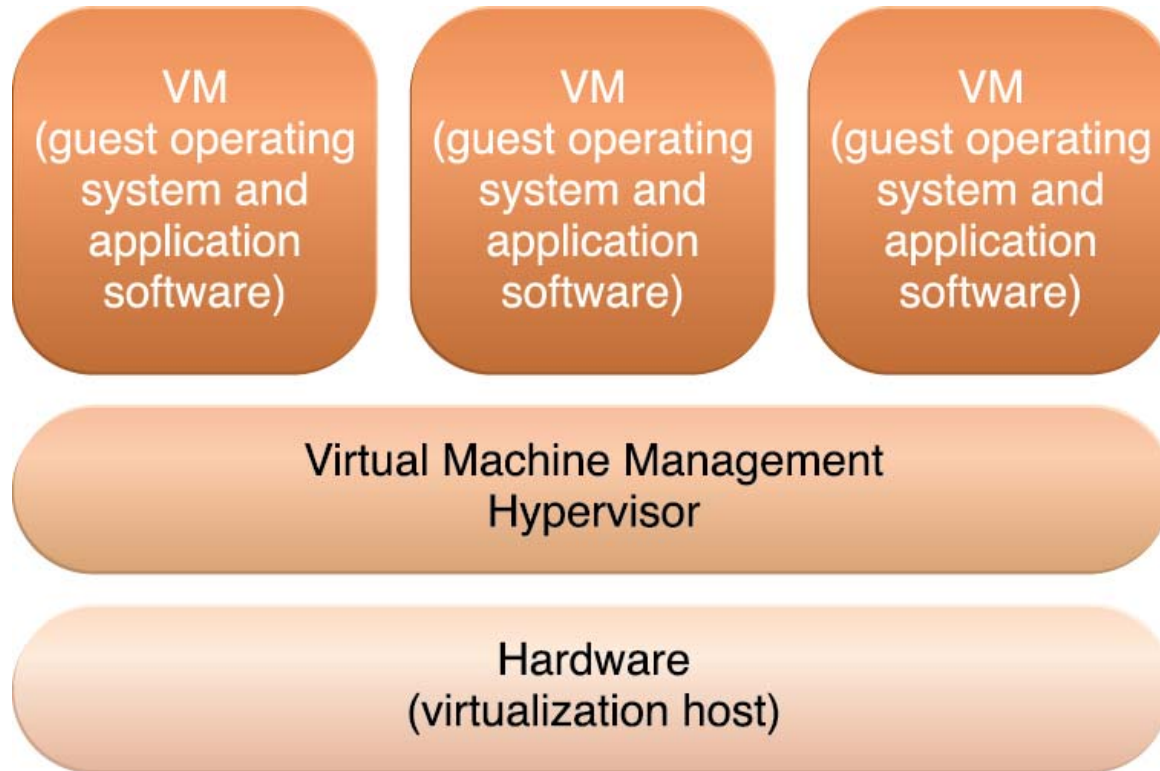
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- Allocation of physical IT resources
- Installation of an operating system, i.e., guest operating system



# Hardware based virtualization

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- Reduce the overhead
- May introduce compatibility issue

## 4. Web technology

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- Cloud computing relies on internet.
- Web technology is generally used as both the implementation medium and the management interface for cloud services

# Basic web technology

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- Uniform resource locator (URL)
  - Commonly informally referred to as a **web address**
  - a reference to a web resource that specifies its location on a computer network and a mechanism for retrieving it
  - Example: <http://www.example.com/index.html>
- Hypertext transfer protocol (HTTP)
  - Primary communication protocol used to exchange content
- Markup languages (HTML, XML)
  - Express Web-centric data and metadata



# Web applications

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- Applications running in a web browser
  - Rely on web browsers for the presentation of user-interfaces

## 5. Multitenant technology

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- Enable multiple users (tenants) to access the same application simultaneously
- Multitenant applications ensure that tenants do not have access to data and configuration information that is not their own

# A simple example

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