Cloud-Enabling Technology

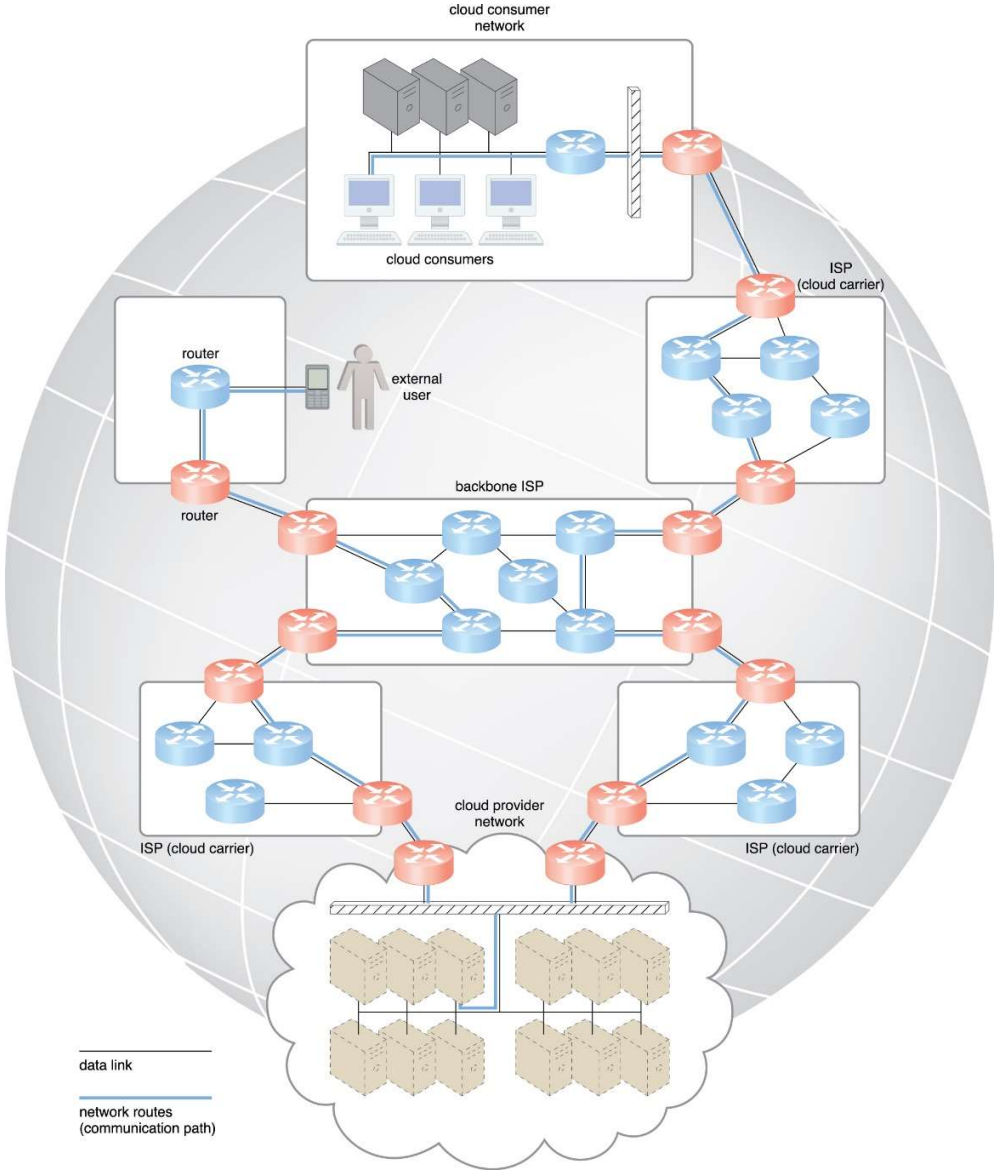
Enabling technologies

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

1. Broadband networks & Internet architecture

- 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

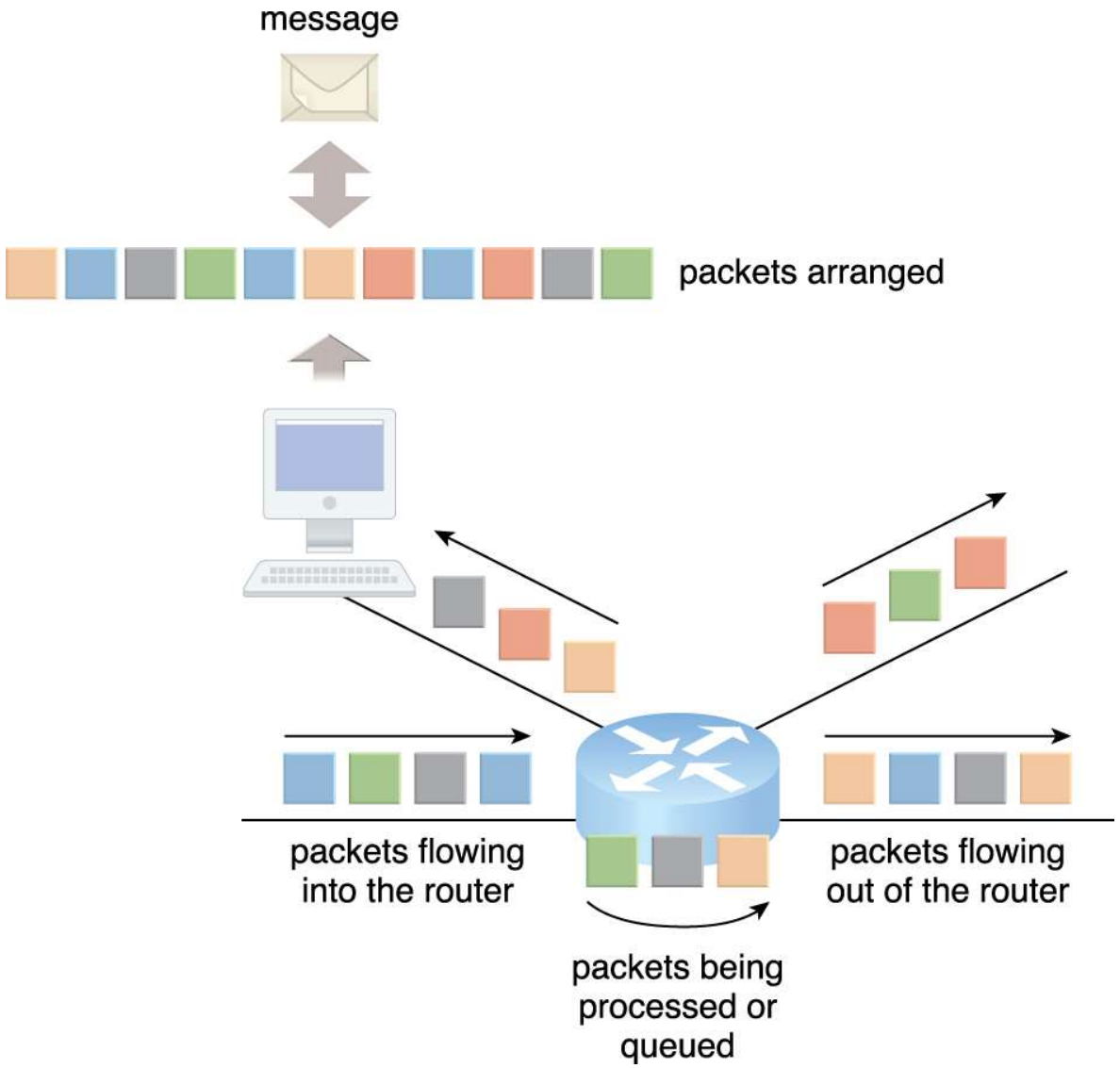
Internet connecting provider and consumer



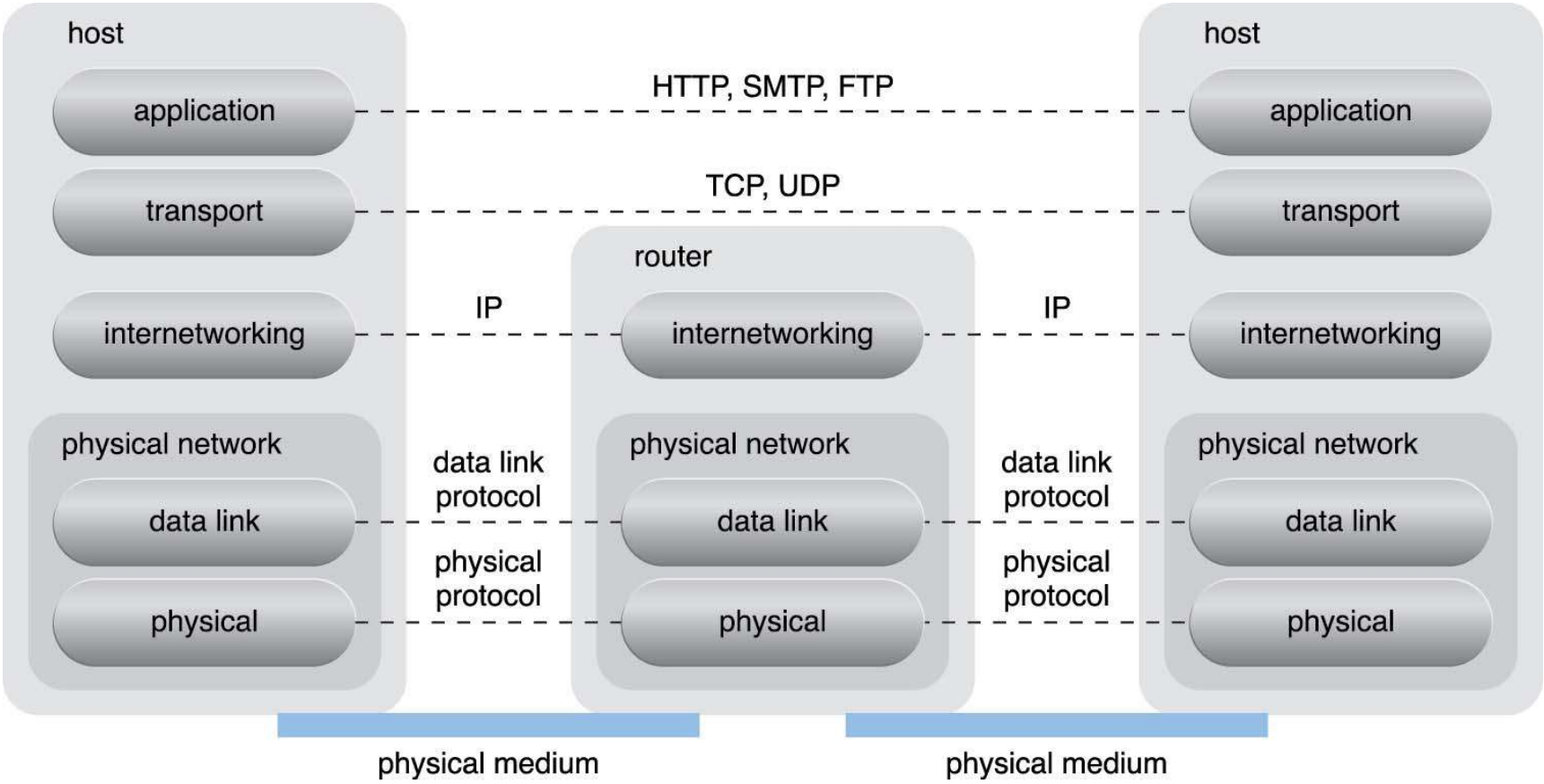
Two fundamental components

- 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



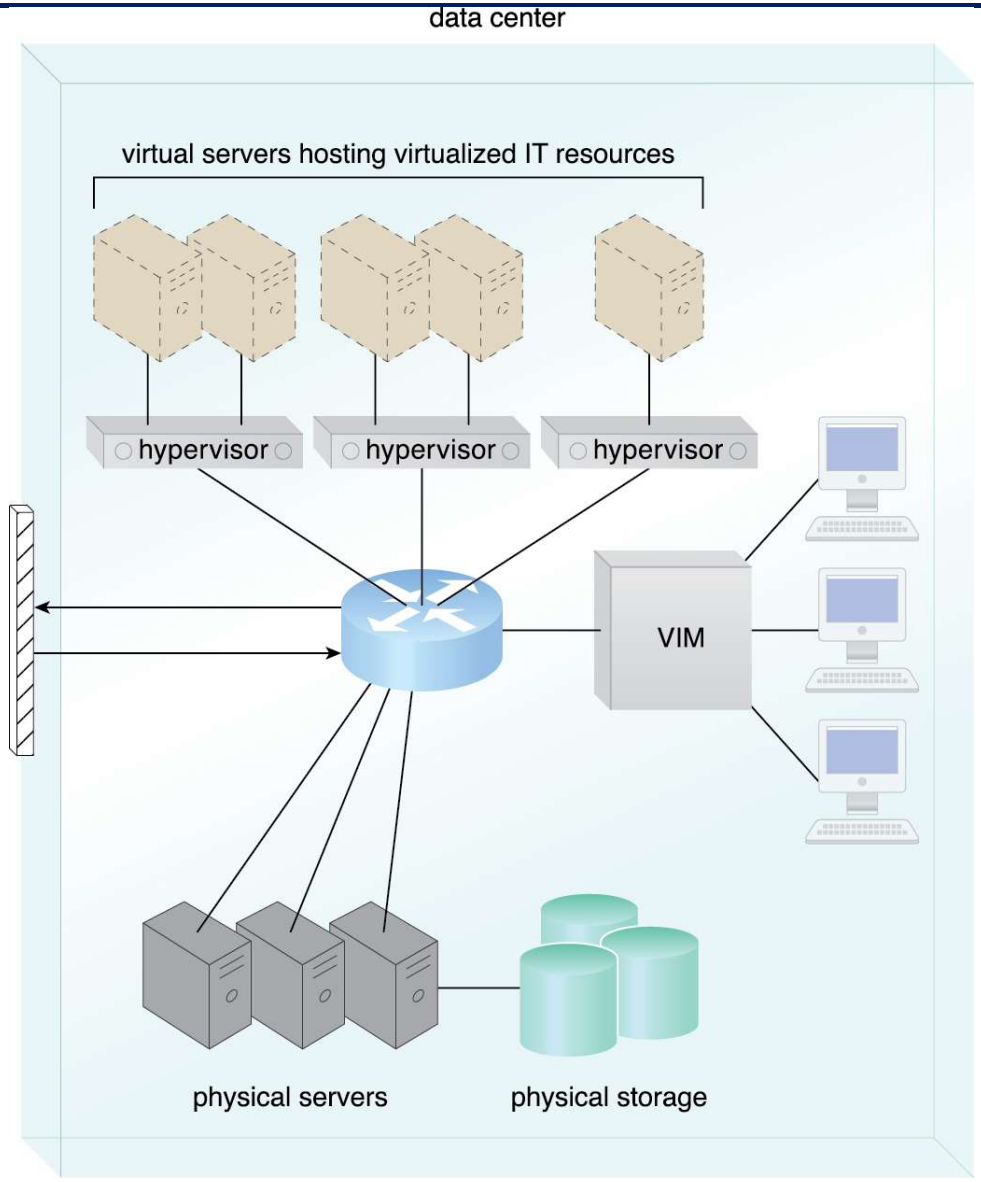
Internet reference model



2. Data Center Technology

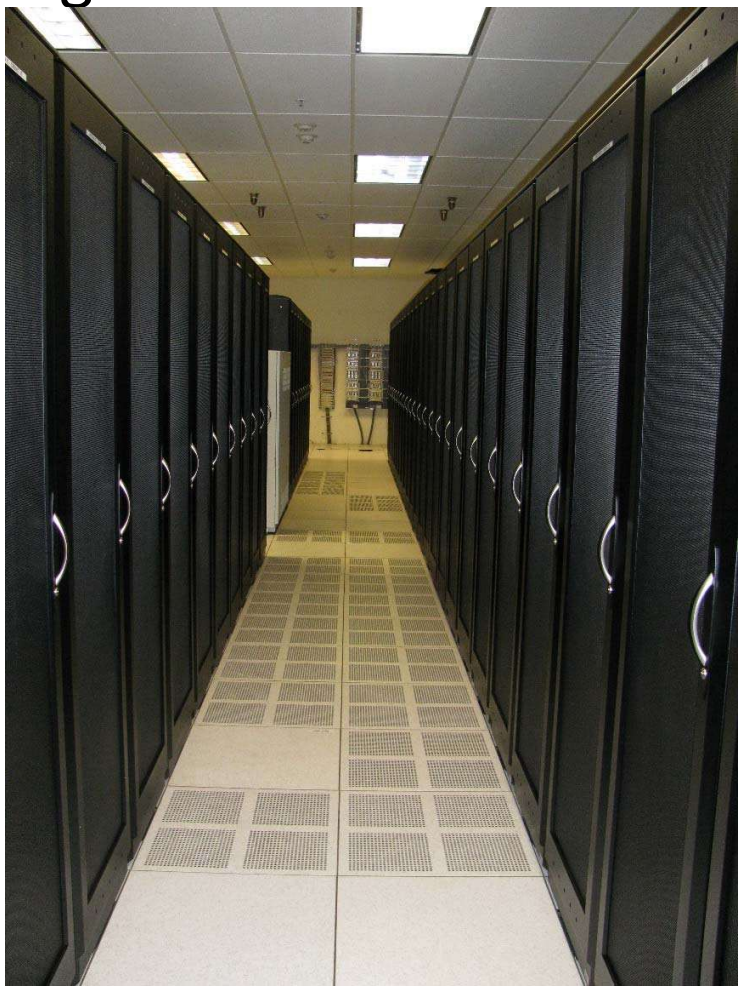
- A data center is a facility used to house computer systems and associated components, such as telecommunications and storage systems
  - Virtualization
  - Standardization and Modularity
  - Automation
  - Remote Operation and Management

Virtualization



Standardization and Modularity

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



Supercomputer vs. data center

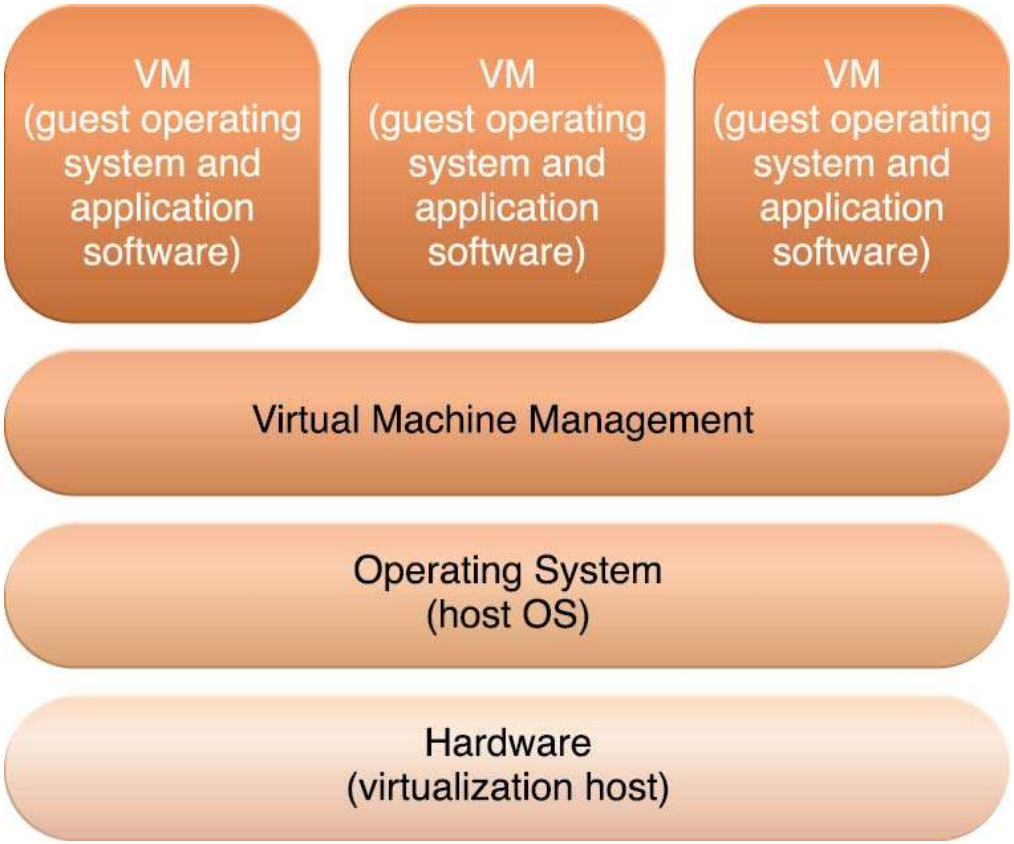
- Handouts

3. Virtualization technology

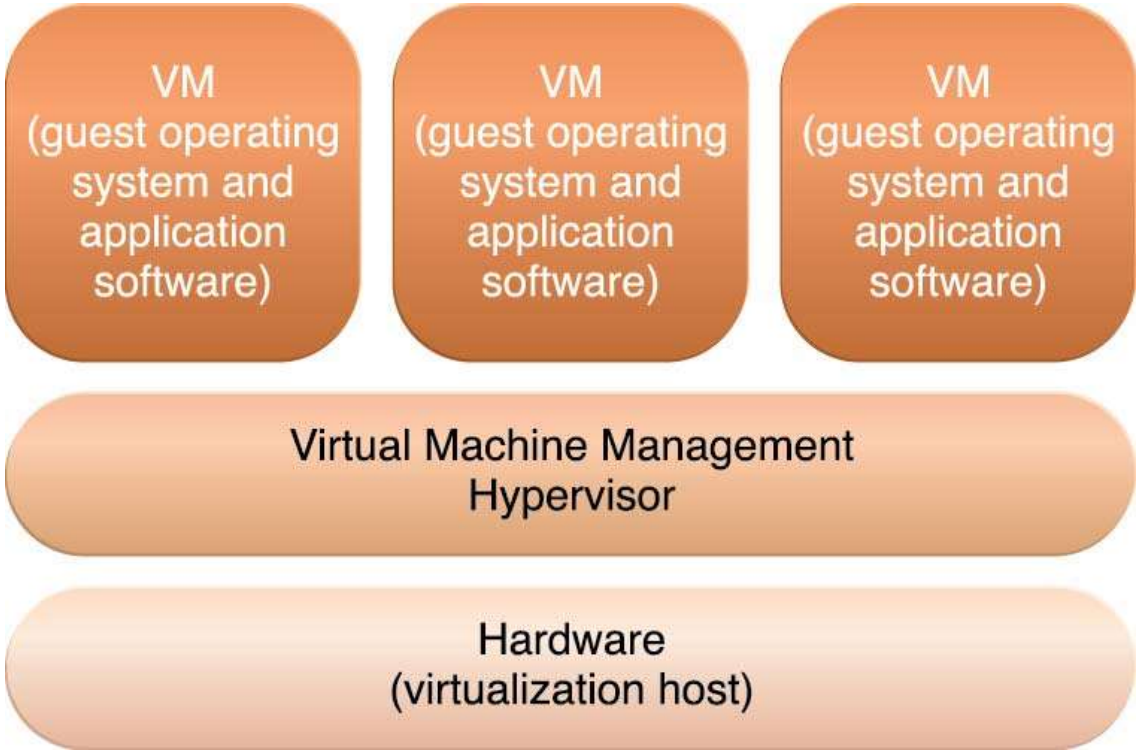
- Virtualization is a process of converting a physical IT resource into a virtual IT resource
  - Server
    - Virtual server ↔ virtual machine
  - Storage
  - Network
  - Power

Creating a new virtual server

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



Hardware based virtualization



- Reduce the overhead
- May introduce compatibility issue

4. Web technology

- 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

- 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

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

5. Multitenant technology

- 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