Cloud Computing

Presented by

Dr. Amany AbdElSamea

Outline

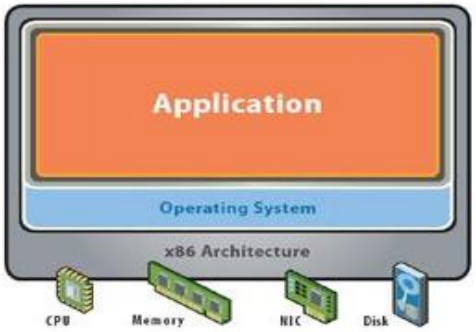
- Virtualization
- Types of Hypervisors
- Cloud Computing
- Cloud Computing Models
- Cloud Computing Open Source Tools
- Amazon Web Services
- Role of Cloud Computing in IoT

Virtualization

- Virtualization refers to the act of creating a virtual (rather than actual) version of something, including virtual computer hardware platforms, operating systems, storage devices, and computer network resources.
- Virtualization offers a layer of abstraction between the computing resources and the applications running over it.
- Virtualization is the ability to run multiple operating systems on a single physical system and share the underlying hardware resources.
- Virtualization is used to improve IT throughput and costs by using physical resources as a pool from which virtual resources can be allocated.

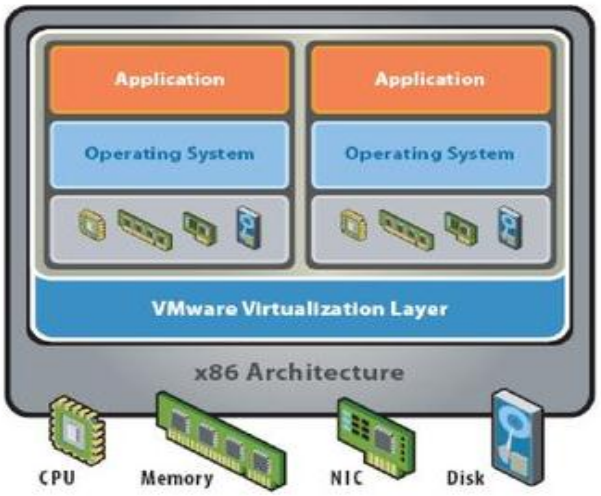
Before and After Virtualization

Before Virtualization



- Single OS image per machine
- Software and hardware tightly coupled
- Running multiple applications on same machine often creates conflict
- Underutilized resources
- Inflexible and costly infrastructure

After Virtualization

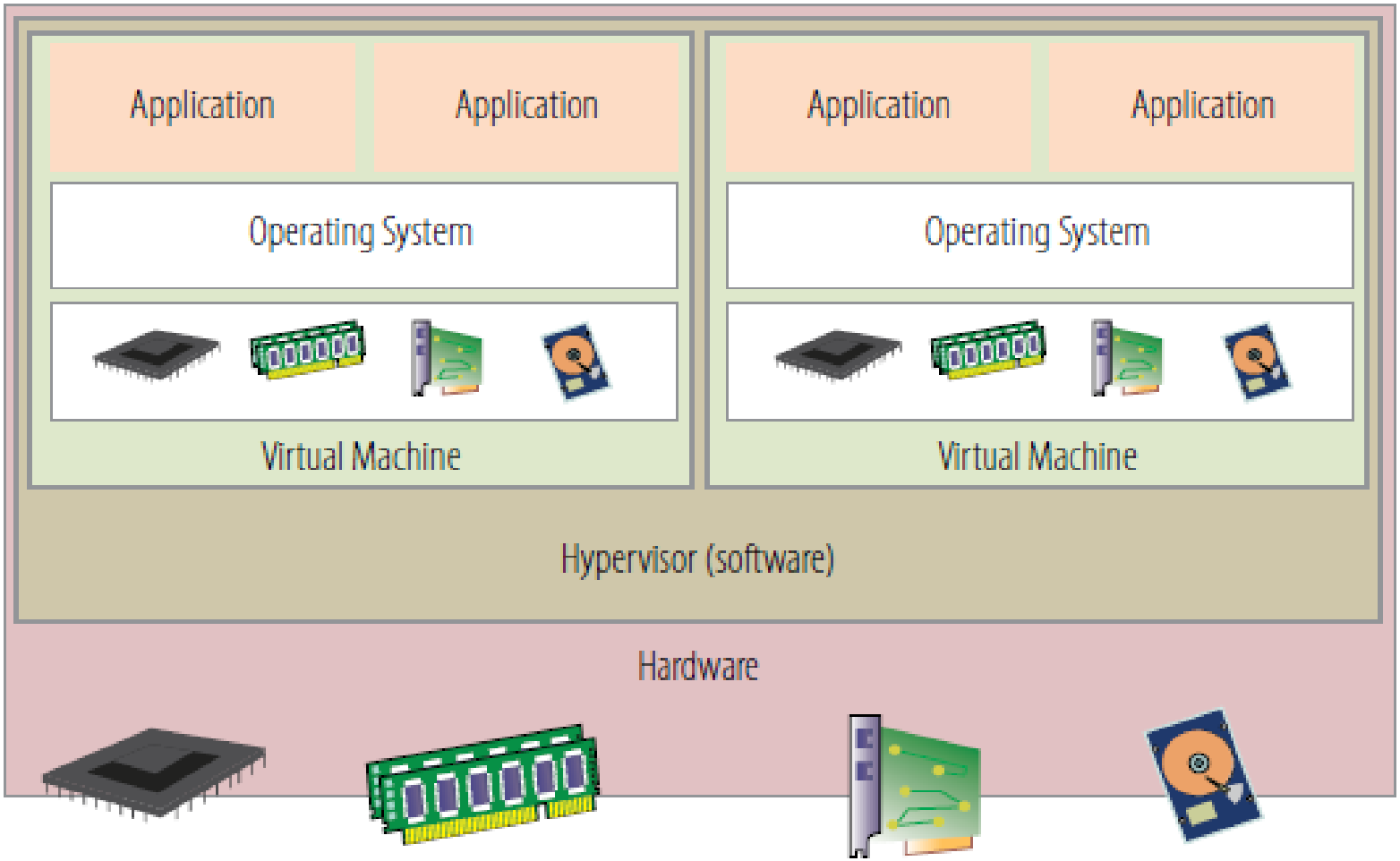


- Hardware-independence of operating system and applications
- Virtual machines can be provisioned to any system
- Can manage OS and application as a single unit by encapsulating them into virtual machines

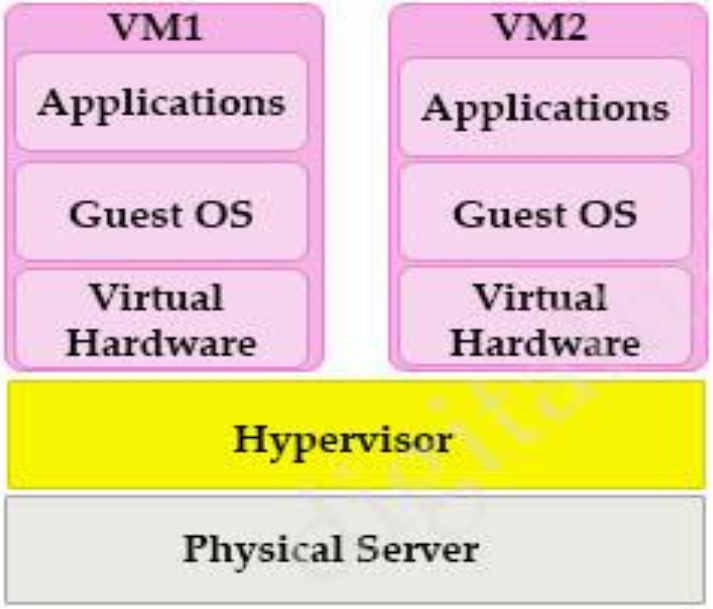
Various Terminologies

- Virtual machine: It is a closely detached software device that could run its own operating system and application as if it is running on a physical machine. It contains its own virtual RAM, CPU, Disk, and Network etc.,.
- Guest operating system: Operating system running in a VM environment.
- Virtual machine monitor: This can be a part of hypervisor or can be a separate software entity, that runs between the host operating system and hypervisor.
- Hosted virtualization: A method where virtualization and partitioning services run on top of a typical OS.
- Hypervisor: It is a thin layer of software that provides virtual partitioning abilities that run directly on hardware,, but underneath higher level virtualization services.

Virtualization Architecture

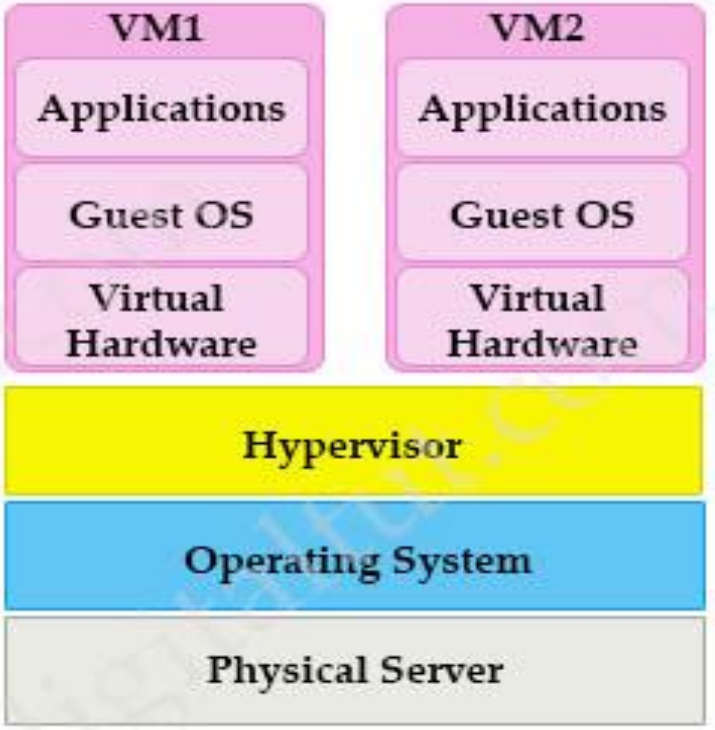


Types of Hypervisors



Type 1 Hypervisor

Bare metal/ Native Hypervisor



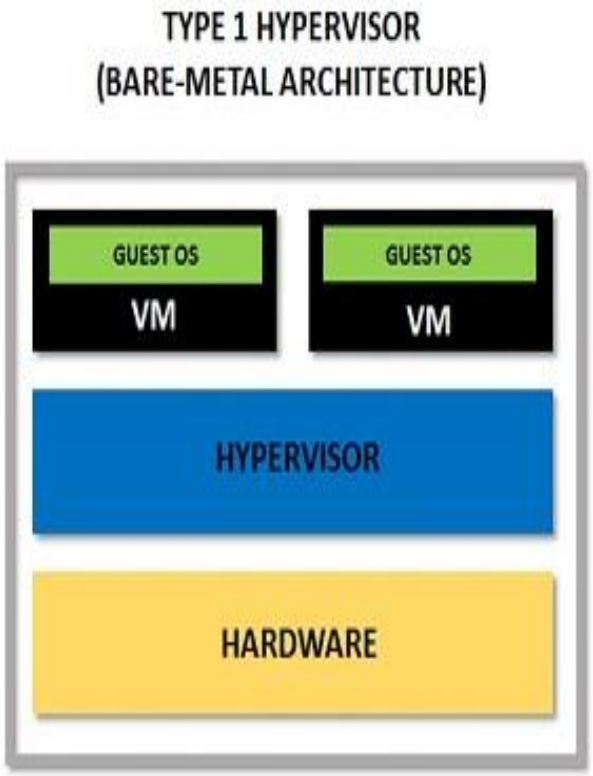
Type 2 Hypervisor

Hosted Hypervisor

Types of Hypervisors cont.,

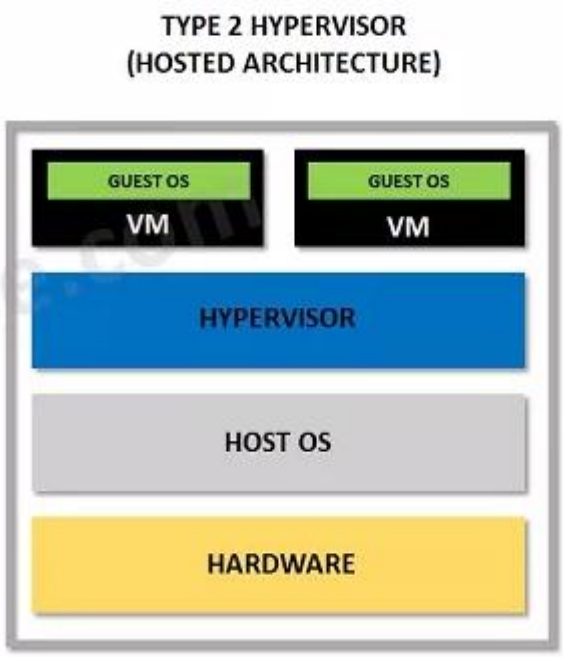
Criteria	Type1 hypervisor (Bare-metal or Native)	Type 2 hypervisor (Hosted)
Definition	Runs directly on the system with VMs running on them	Runs on a conventional operating system
Virtualization	Hardware virtualization	OS Virtualization
Scalability	Better scalability	Not so much, because of its reliance on the underlying OS
System Independence	Has direct access to hardware along with virtual machines it hosts	Are not allowed to directly access the host hardware and its resources
Speed	Faster	Slower because of the system's dependency
Security	More secure	Less secure, as any problem in the basic operating system affects the entire system including the protected hypervisor
Examples	- VMware ESXi - Microsoft Hyper-V - Citrix XenServer (Xen) - KVM	- VMware workstation player - Microsoft virtual PC - Sun's virtual Box

Top 5 Type 1 Hypervisors in Market



- VMware vSphere/ ESXi
- Microsoft Hyper-V
- Citrix XenServer
- Red Hat Enterprise Virtualization
- KVM (Kernel-based Virtual Machine)

Top 5 Type 2 Hypervisors in Market



vmware Workstation

VirtualBox

VMware Fusion

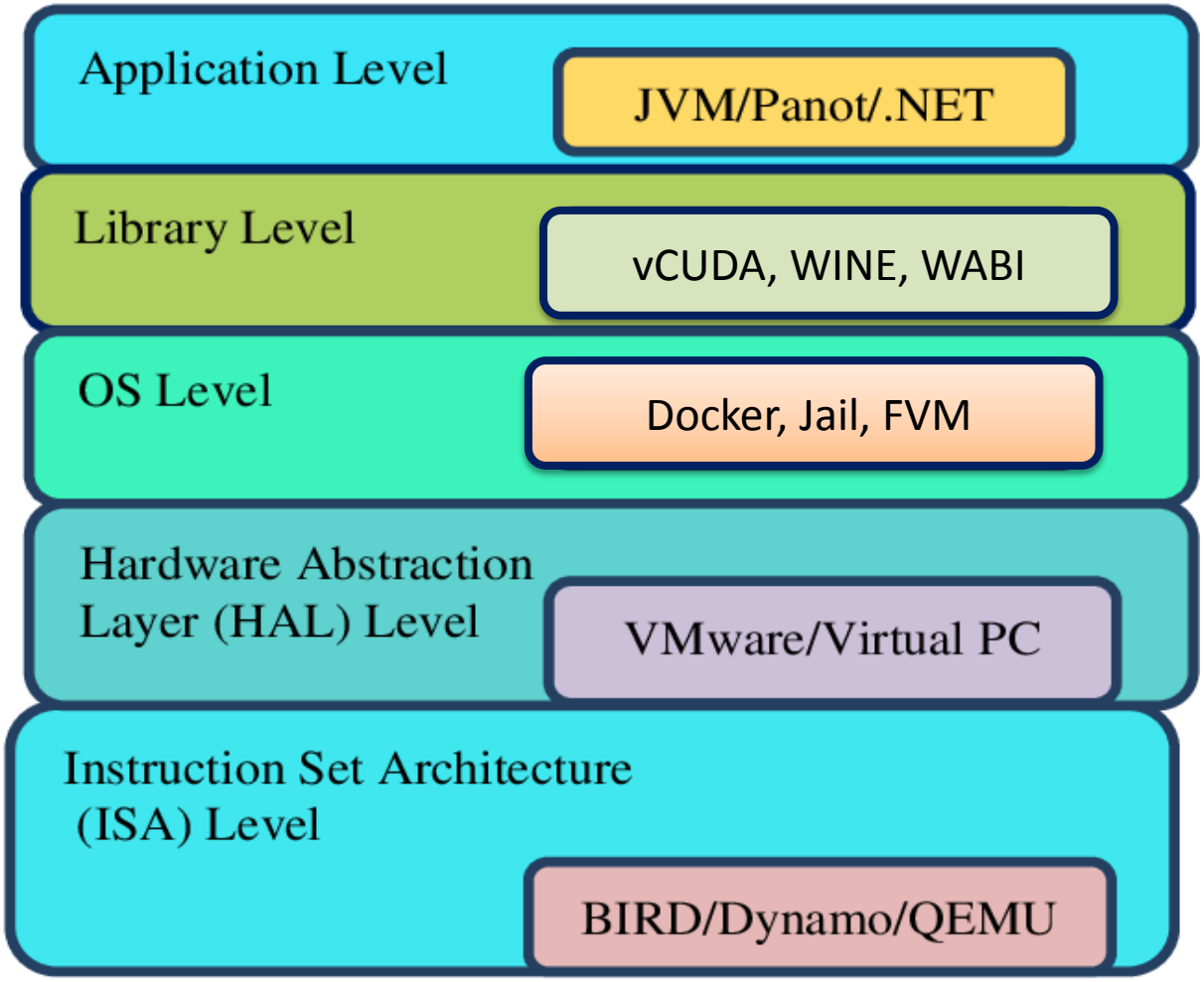
QEMU

Microsoft Virtual PC

Benefits of Virtualization

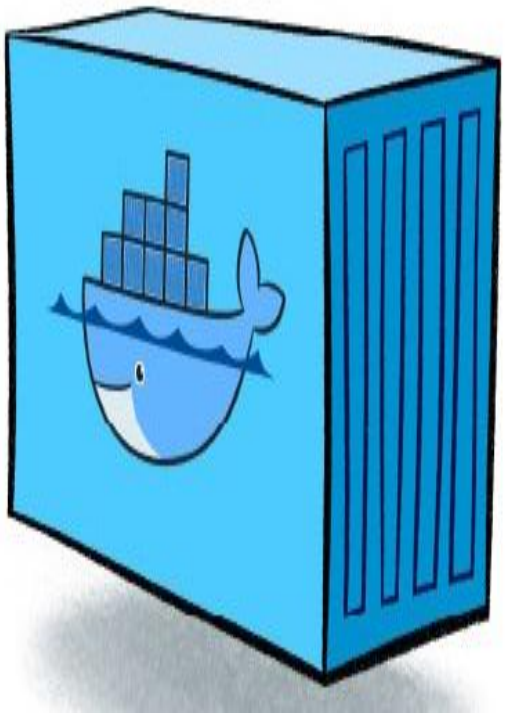
- Sharing of resources helps cost reduction.
- Isolation: Virtual machines are isolated from each other as if they are physically separated
- Encapsulation: Virtual machines encapsulate a complete computing environment
- Hardware Independence: Virtual machines run independently of underlying hardware
- Portability: Virtual machines can be migrated between different hosts.

Levels of Virtualization

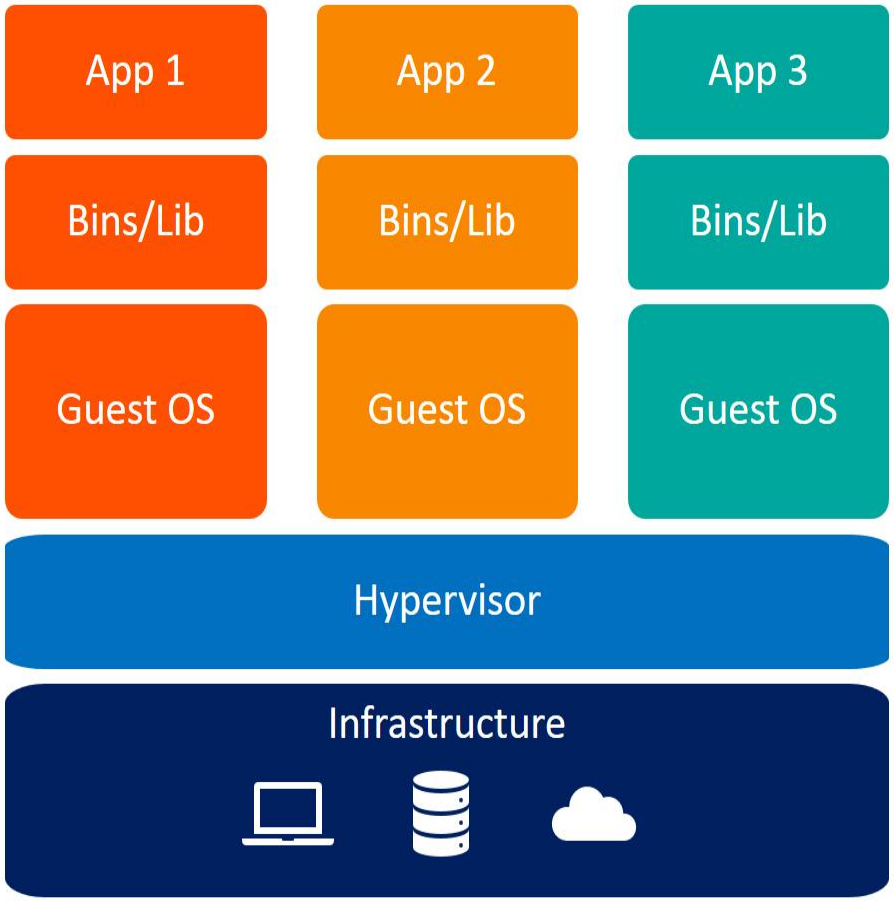


Containers

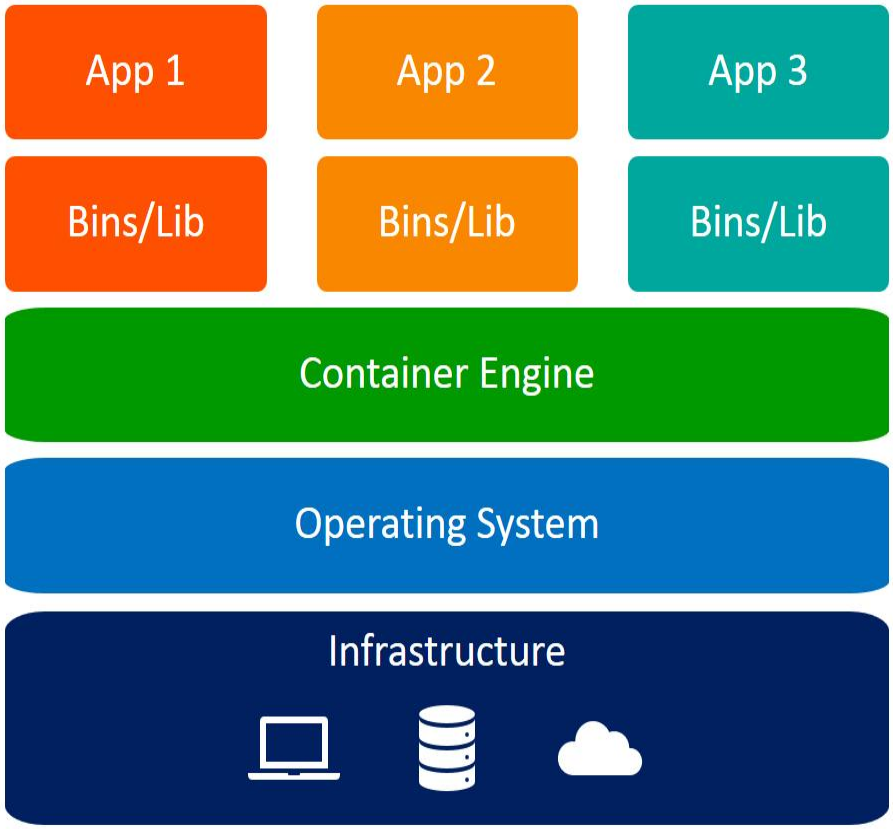
- Operating system virtualization.
- They are an abstraction at the app layer that package code and dependencies together.
- The containers share the host OS kernel and, usually, the binaries and libraries, too.
- Containers are exceptionally lightweight- they are only megabytes in size and take just seconds to boot



Virtualization and Containerization



Virtual Machines

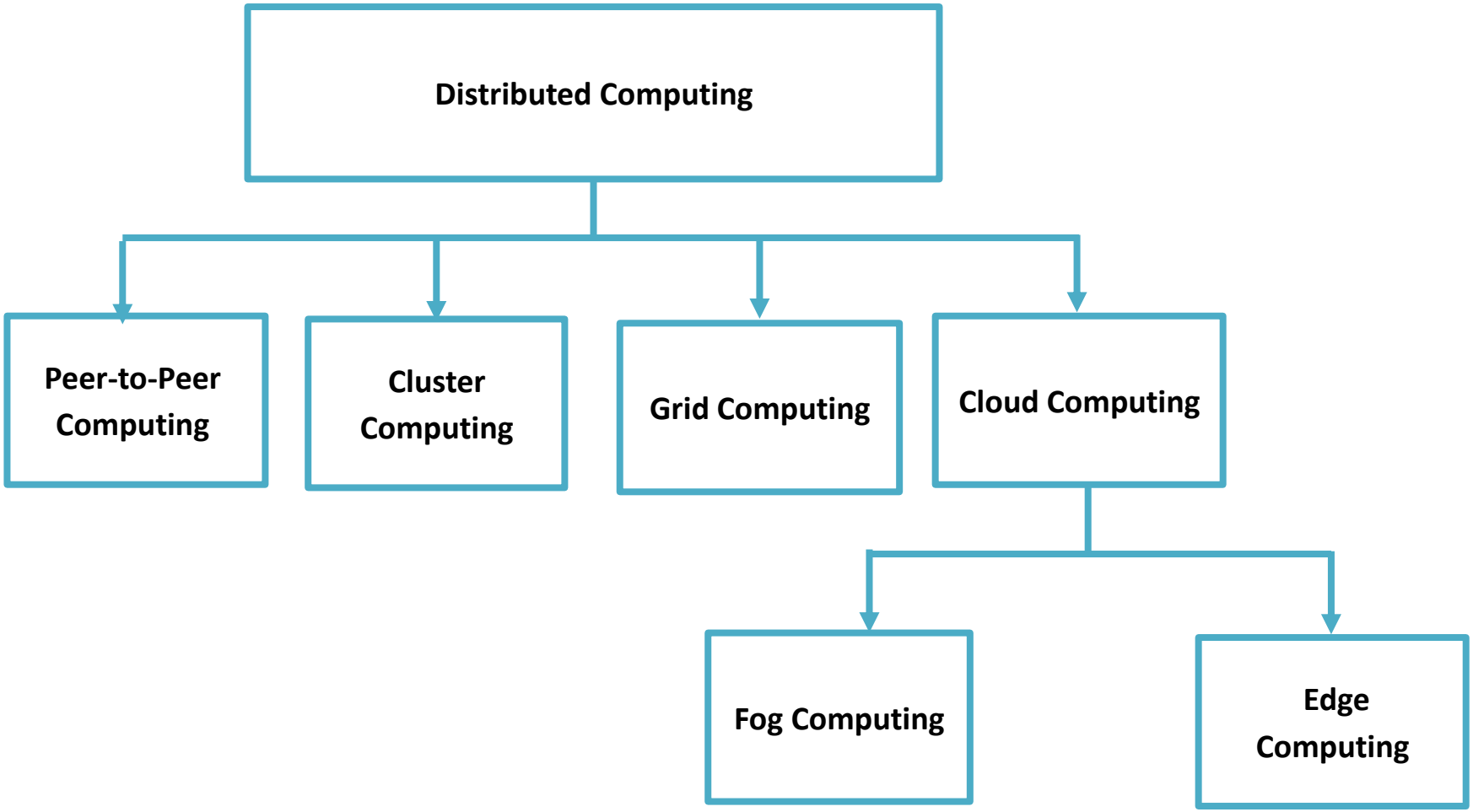


Containers

Virtual Machine vs. Container

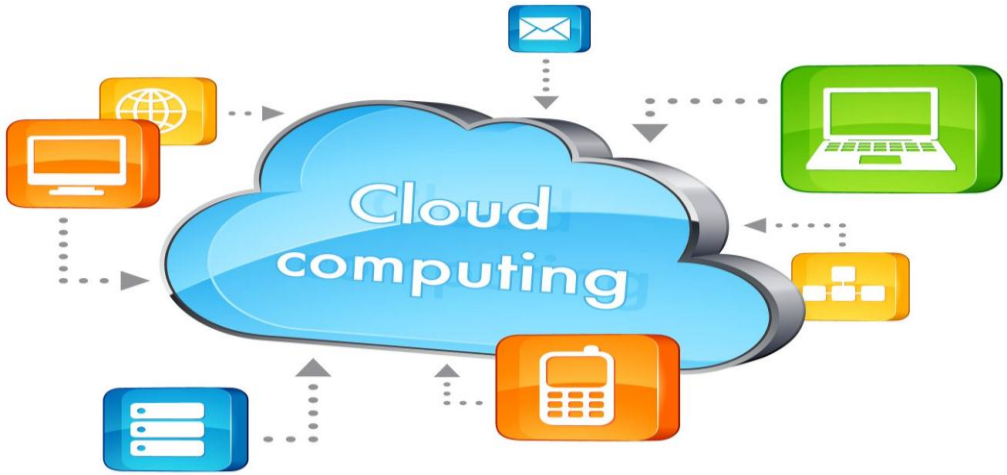
Virtual Machine	*Container*
• Heavyweight	• Lightweight
• Limited performance	• Native performance
• Each VM runs in its own OS	• All containers share the host OS
• Hardware-level virtualization	• OS virtualization
• Startup time in minutes	• Startup time in milliseconds
• Allocates required memory	• Requires less memory space
• Fully isolated and hence more secure	• Process-level isolation, possibly less secure

Distributed Computing



Cloud Computing

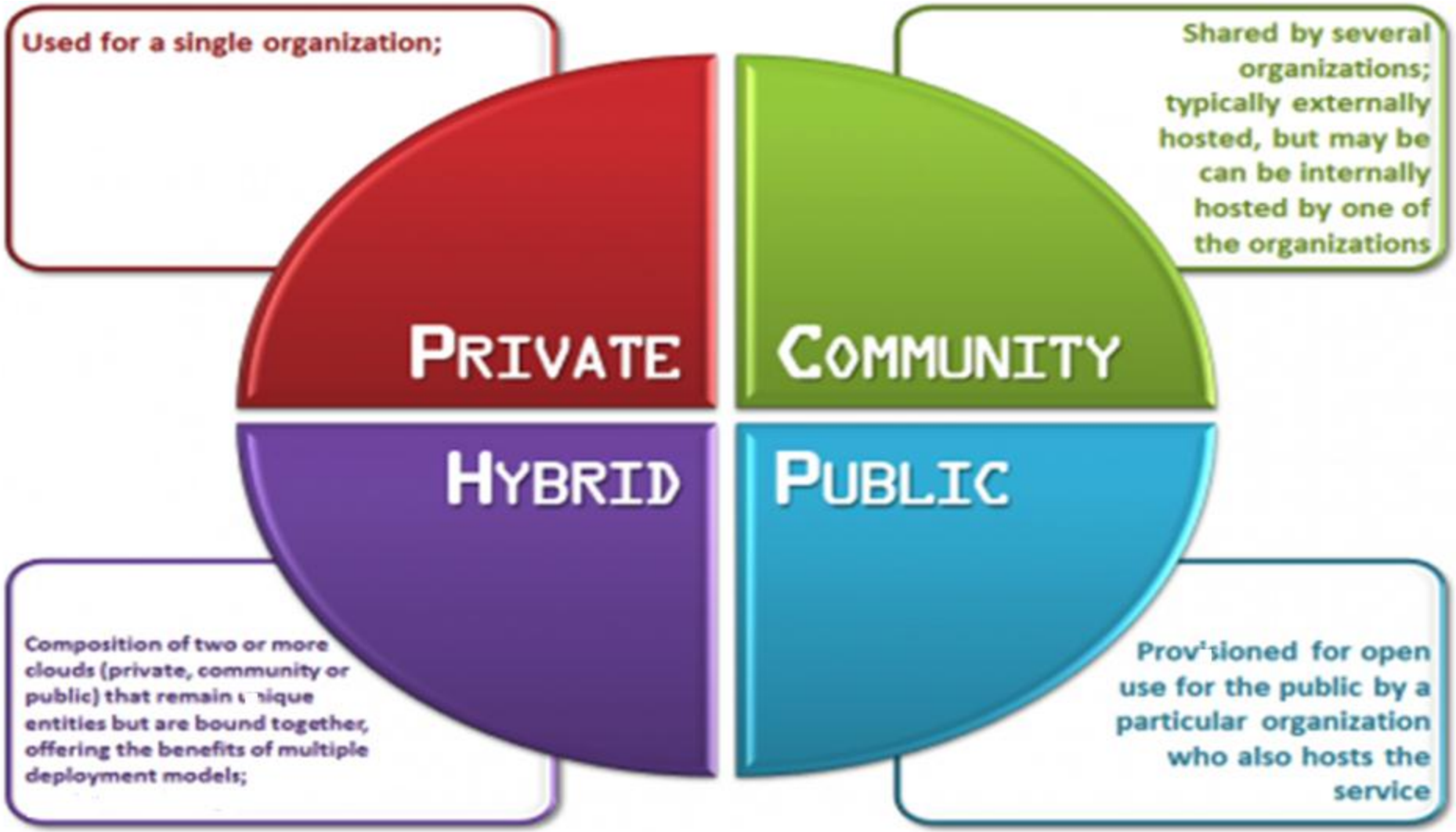
- Cloud computing is the **on-demand** delivery of compute power, database storage, applications, and other IT resources through a cloud services platform **via the internet** with **pay-as-you-go** pricing



Why Use Clouds?

- **Reduction of costs:**
  - The price of deploying applications in the cloud can be less due to lower hardware costs from more effective use of physical resources.
- **Universal access:**
  - Cloud can allow remotely located employees to access applications and work via the internet.
- **Flexibility:**
  - Users are allowed to switch applications easily and rapidly. However, migrating data between applications can be an issue.
- **Up to date software:**
  - A cloud provider will also be able to upgrade software
- **Big data analytics:**
  - Cloud can offer you the possibility of storing your big data and accessing it from anywhere at anytime.

Cloud Computing Deployment Model



Cloud Computing Service Model

Cloud Service Models

IaaS – Infrastructure as a Service

Cloud Service Provider provides infrastructure and resources

Manufacturing organization manages OS, data and software applications

PaaS – Platform as a Service

Cloud Service Provider provides infrastructure and development platform

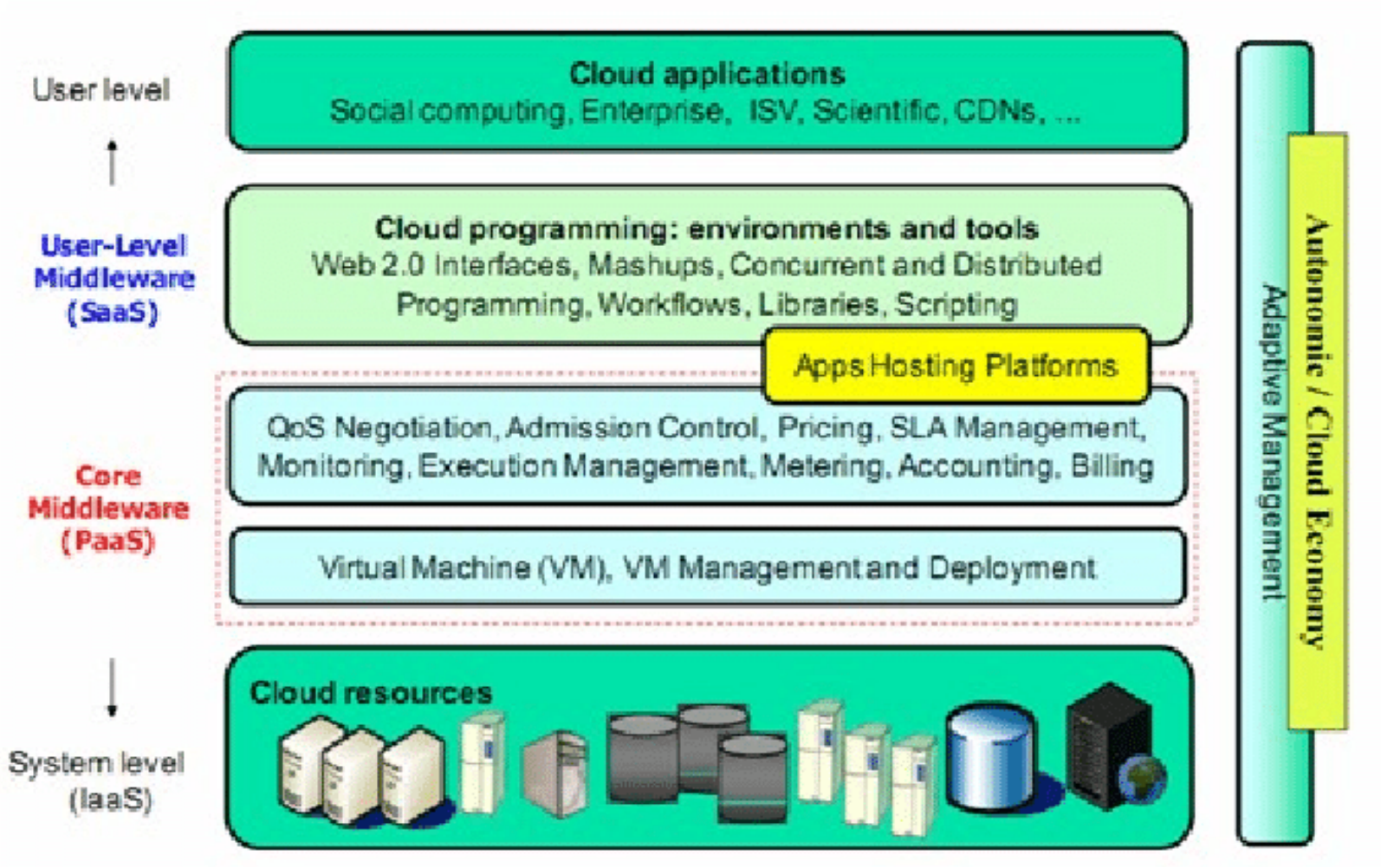
Manufacturing organization can develop its own software applications

SaaS – Software as a Service

Cloud Service Provider has a full control over cloud and software

Manufacturing organization rents software applications

Cloud Computing Layered Architecture



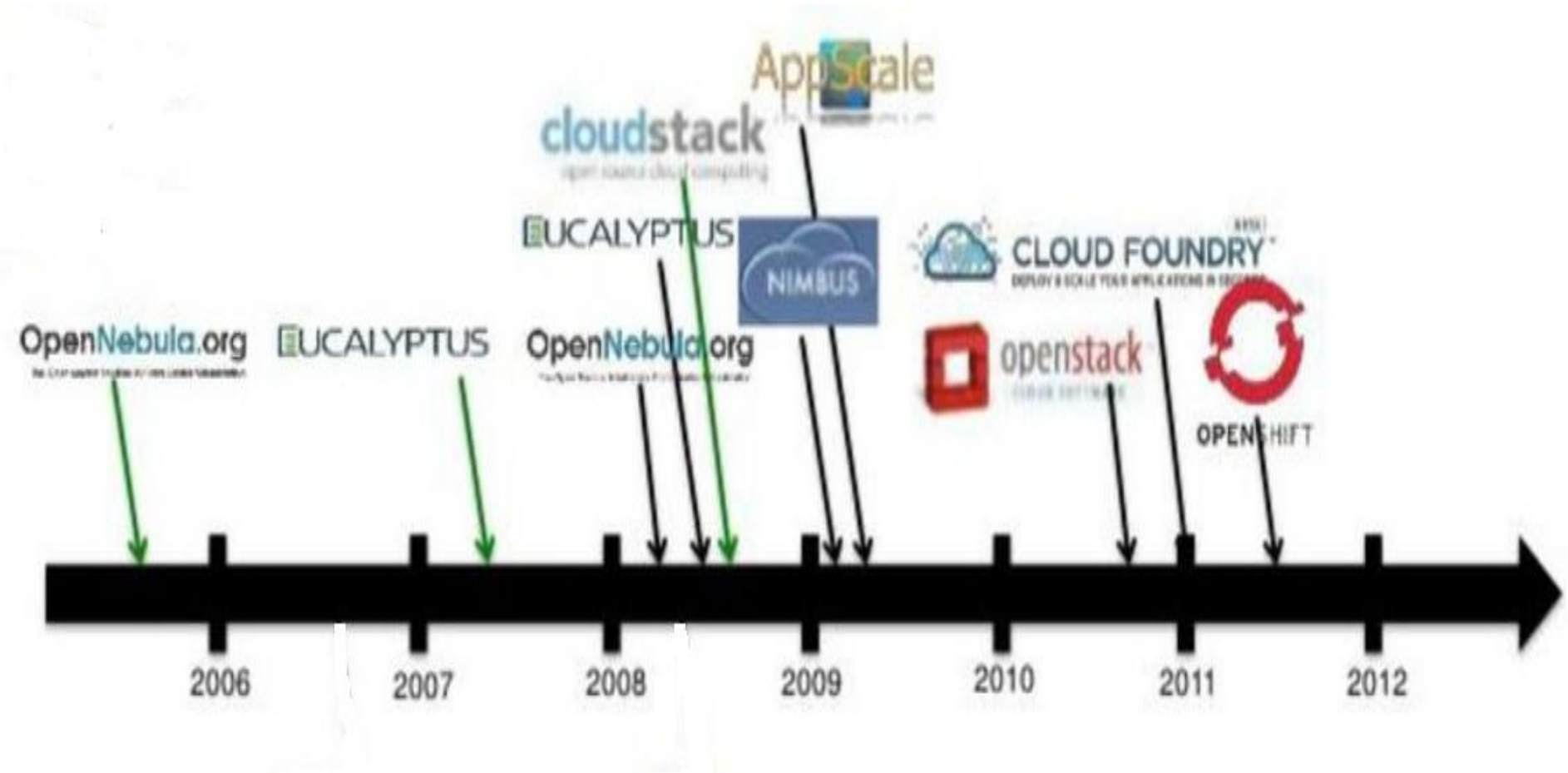
Cloud Computing Advantages

- Access your data at all times not just while in the office
- A physical storage center is no longer needed
- Easily scalable
- World-class service delivery
- No hardware or software to install
- Instant software updates

Cloud Computing Disadvantage

- Lost control comes with handling over your data and information
- Depending on third-party to ensure the security and confidentiality of data and information

Timeline for Cloud Open Source Tools



The Role of Cloud Computing in IoT

Cloud computing platforms offer the potential to use large amounts of resources, both in terms of the storage of data and also in the ability to bring flexible and scalable processing resources to the analysis of data.

1. Enables remote computing capabilities:
With a large storage capacity, IoT eliminates the dependencies on on-site infrastructure. With continued development and internet-based tech development such as the internet and devices supporting advanced cloud solutions, cloud technology has become mainstream.

2. Security & Privacy:
Tasks can be handled automatically with cloud tech & IoT, organizations are able to reduce security threats by a considerable amount.

3. Data Integration:
Cloud-based solutions with powerful data integration capabilities are able to handle a large amount of data generated from multiple sources along with its centralized storage, processing and analysis.

4. Minimal Hardware Dependency:
Presently, several IoT solutions offer plug-and-play hosting services that are enabled by integrating the cloud with the IoT.

Questions