CLOUD COMPUTING - UNIT 1

What is cloud computing?

The NIST Definition of Cloud Computing

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.

Cloud over traditional web hosting.

1. A cloud service has three distinct characteristics that differentiate it from traditional web hosting
- It is sold on demand, typically by the minute or the hour;
- It is elastic -- a user can have as much or as little of a service as they want at any given time;
- The service is fully managed by the provider (the consumer needs nothing but a personal computer and Internet access).
2. Amazon describes cloud computing as “the on-demand delivery of IT resources via the Internet with pay-as-you-go pricing”.
3. Cloud computing is about leasing servers and storage from a provider like Amazon. Tasks that traditionally took weeks of work, costing thousands of dollars, can be completed in minutes for fractions of a penny.
4. In addition, cloud computing offers inconceivable scalability. With a single line of code, you can provision thousands of servers. Most important, you pay only for what you need and give the equipment back when you’re done.
5. Furthermore, because you are paying by the hour, running one server for a thousand hours costs the same amount as running a thousand servers for one hour. This is unthinkable in a traditional data center.
6. Finally, cloud computing is often used in concert with automation. When we combine scalability with automation, we have the ability to build an application that responds to load.

Cloud Components

A cloud computing solution is made of several elements:
clients,the data center,and distributed servers.As shown in Figure 1-3,these components makeup the three parts of a cloud computing solution.
Each element has a purpose and plays a specific role in delivering function cloud based application.

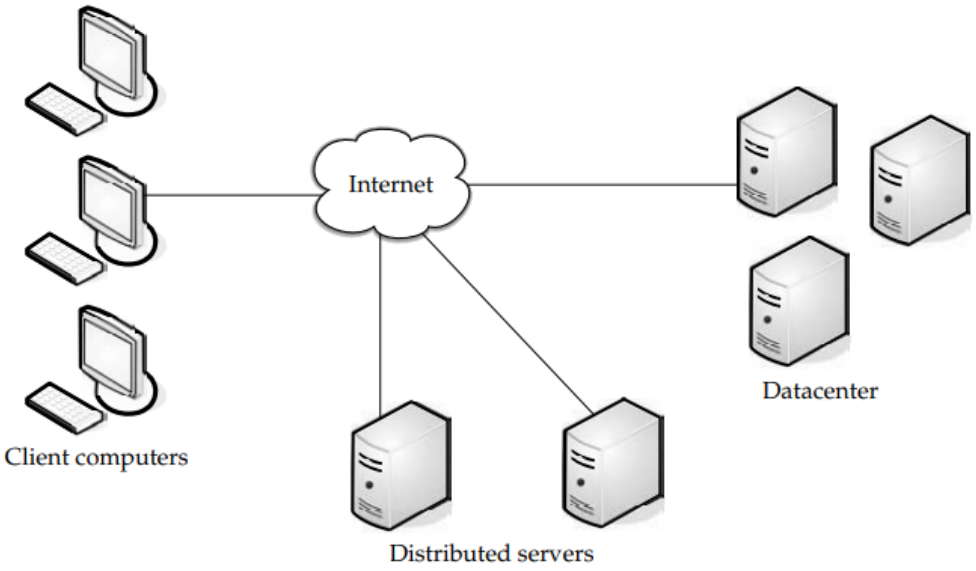


FIGURE 1-3 Three components make up a cloud computing solution.

Clients

- Clients are, in a cloud computing architecture, the exact same things that they are in a plain, old, everyday local area network (LAN).
- They are, typically, the computers that just sit on your desk. But they might also be laptops, tablet computers, mobile phones, or PDAs—all big drivers for cloud computing because of their mobility. Anyway, clients are the devices that the end users interact with to manage their information on the cloud.
- Clients generally fall into three categories:
  - **Mobile** Mobile devices include PDAs or smartphones, like a Blackberry, Windows Mobile Smartphone, or an iPhone.
  - **Thin** Clients are computers that do not have internal hard drives, but rather let the server do all the work, but then display the information. For example: Yahoo Messenger, Office 365, Microsoft Outlook
  - **Thick** This type of client is a regular computer, using a web browser like Firefox or Internet Explorer to connect to the cloud.

Datacenter

- The datacenter is the collection of servers where the application to which you subscribe is housed.
- It could be a large room in the basement of your building or a room full of servers on the other side of the world that you access via the Internet.
- A growing trend in the IT world is virtualizing servers. That is, software can be installed allowing multiple instances of virtual servers to be used. In this way, you can have half a dozen virtual servers running on one physical server.

Distributed Servers

- Often, servers are in geographically disparate locations. But to the cloud subscriber, these servers act as if they're right next to each other. This gives the service provider more flexibility in options and security.
- For instance, Amazon has their cloud solution in servers all over the world. If something were to happen at one site, causing a failure, the service would still be accessed through another site.
- Also, if the cloud needs more hardware, they need not throw more servers in the safe room—they can add them at another site and simply make it part of the cloud.

Essential Characteristics of Cloud Computing

- **On-demand self-service:** A consumer can unilaterally provision computing capabilities, such as server time and network storage, as needed automatically without requiring human interaction with each service provider.
- **Broad network access:** Capabilities are available over the network and accessed through standard mechanisms that promote use by heterogeneous thin or thick client platforms (e.g., mobile phones, tablets, laptops, and workstations).
- **Resource pooling**: The provider's computing resources are pooled to serve multiple consumers using a multi-tenant model, with different physical and virtual resources dynamically assigned and reassigned according to consumer demand. There is a sense of location

independence in that the customer generally has no control or knowledge over the exact location of the provided resources but may be able to specify location at a higher level of abstraction (e.g., country, state, or datacenter). Examples of resources include storage, processing, memory, and network bandwidth.

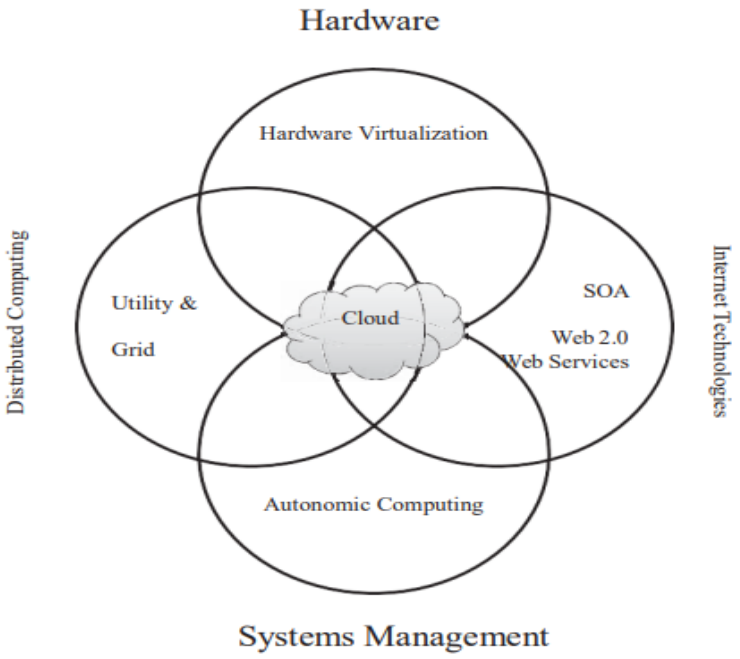
- **Rapid elasticity**: Capabilities can be elastically provisioned and released, in some cases automatically, to scale rapidly outward and inward commensurate with demand. To the consumer, the capabilities available for provisioning often appear to be unlimited and can be appropriated in any quantity at any time.
- **Measured service:**. Cloud systems automatically control and optimise resource use by leveraging a metering capability at some level of abstraction appropriate to the type of service (e.g., storage, processing, bandwidth, and active user accounts). Resource usage can be monitored, controlled, and reported, providing transparency for both the provider and consumer of the utilised service.

Roots of Cloud Computing

The roots of cloud computing are sub-divided into four types. They are,

- Internet Technologies
- Hardware
- System Management
- Distributed Computing

FIGURE 1.1. Convergence of various advances leading to the advent of cloud computing.

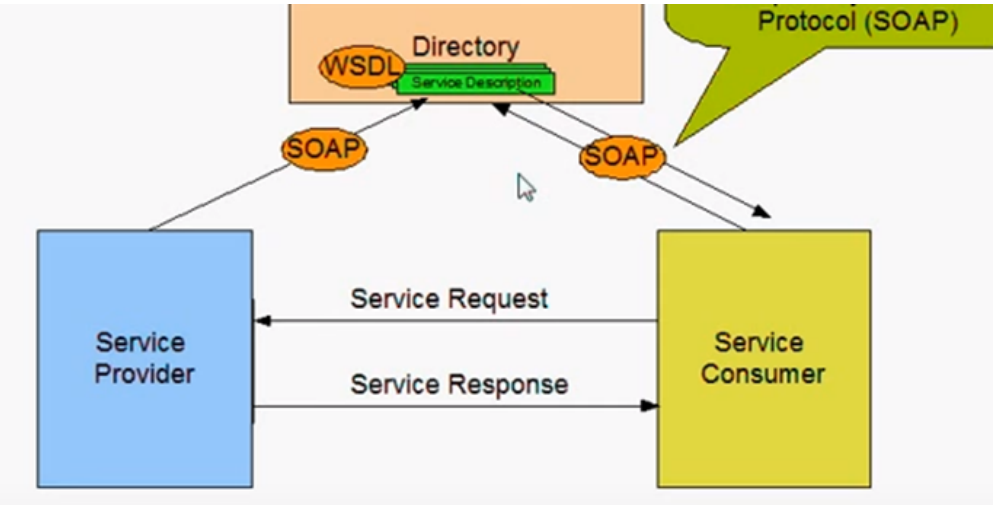


Internet Technologies

- The first root is Internet Technologies which contains service-oriented architecture (SOA), web 2.0, and web services.
- **Web services**

1. Web service is an application typically delivered over HTTP(Hyper Text Transport Protocol).
- It is a client server application or application component for communication.
- method of communication between two devices over network.

2. A web service is thus a distributed application whose components can be deployed and executed on different devices.
3. For instance, a stock-picking web service might consist of several code components, each hosted on a separate server, and the web service might be consumed on PCs, handhelds, and other devices.
4. UDDI(Universal Description, Discovery, and Integration) is an XML-based standard for describing, publishing, and finding web services.
5. XML is the data format used to contain the data and provide metadata around it, SOAP is used to transfer the data, WSDL is used for describing the **services** available and UDDI lists what **services** are available.



6. A **web service** is a method of communication between two electronic devices over a network.
7. Ex: Booking a flight : user will search all flight between mumbai to delhi ,Make My Trip communicate with these airways, how Is it possible for Make my trip to retrieve all the data of flights as no airways will allow to access the database of each airways. All airlines have exposed their web services through an API and this website Make my trip uses those web services to communicate between the airline(same eg for soa)
8. It is provided for business handling, event logging, and authentication services which are saving lots of paperwork and time.**Web Services** like XML and HTTP are providing web delivery services by using common mechanisms. It is a universal concept of web service all over the world.**WEB 2.0** Services are

more convenient for the users, as they do not have to learn more about coding and concepts to work with it.

1. **Service-oriented Architecture or SOA**
2. Service Oriented Architecture, is an architectural concept which focuses on having different services communicating with each other to carry out a bigger job.
3. As an example, consider how an enterprise might use a set of existing applications to create a new, composite supply-chain application. While the existing applications are heterogeneous and distributed across various systems, their functionality is exposed and accessed using standard interfaces.

Hardware

- Cloud computing services are usually backed by large scale data centers composed of thousands of computers. Such data centres are built to serve many users and host many disparate applications. For this purpose, hardware virtualization can be considered as a perfect fit to overcome most operational issues of data centre building and maintenance.
- Hardware virtualization allows running multiple operating systems and software stacks on a single physical platform.
- It provides an environment that is logically separated from the underlying hardware.

- Host Machine:on which the virtual machine is going to create
- Guest machine:is referred as virtual machine

- As depicted in Figure 1.2, a software 18 layer, the virtual machine monitor (VMM), also called a hypervisor, mediates access to the physical hardware presenting to each guest operating system a virtual machine (VM), which is a set of virtual platform interfaces .
- A number of VMM platforms exist that are the basis of many utility or cloud computing environments. The most notable ones, VMWare, Xen, and KVM.

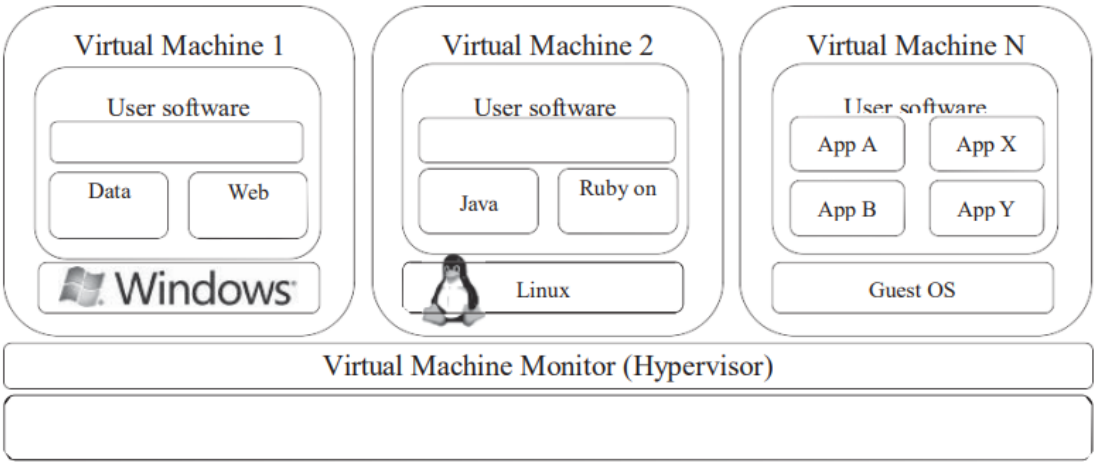


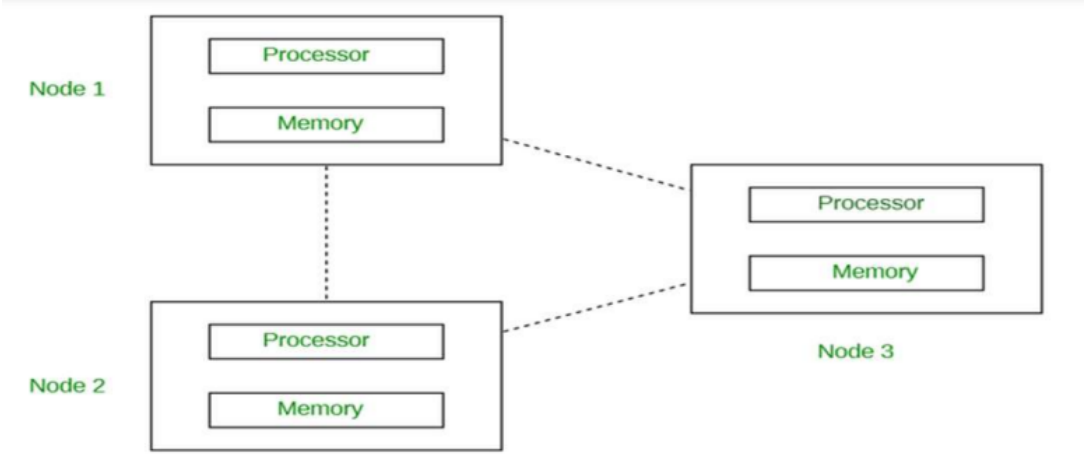
FIGURE 1.2. A hardware virtualized server hosting three virtual machines, each one running distinct operating system and user level software stack.

System Management

- The increasing complexity of computing systems has motivated research on autonomic computing, which seeks to improve systems by decreasing human involvement in their operation. In other words, systems should manage themselves, with out high-level guidance from humans.
- Autonomic, or self-managing, systems rely on monitoring probes and gauges (sensors), on an adaptation engine (autonomic manager) for computing optimizations based on monitoring data, and on effectors to carry out changes on the system.
- IBM‘s Autonomic Computing Initiative has contributed to define the four properties of autonomic systems: self-configuration, self- optimization, self-healing, and self-protection.

Distributed Computing

- Distributed computing is defined as a type of computing where multiple computer systems work on a single problem.
- Here all the computer systems are linked together, and the problem is divided into sub-problems where each part is solved by different computer systems.
- The goal of distributed computing is to increase the performance and efficiency of the system and ensure fault tolerance.
- In the below diagram, each processor has its own local memory, and all the processors communicate with each other over a network.



- Distributed Cloud Computing generalises the cloud computing model to position, process, and serve data and applications from geographically distributed sites to meet requirements for performance, redundancy and regulations.