Unit-2
Introduction to cloud computing

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Cloud-Computing

Cloud:- Cloud refers to servers that are accessed over the internet located remotely.

Computing:- Any activity that users computers to manage process and communicate information.

Cloud computing

It is the on demand availability of computer system resources and computing power without direct active management by the user.

Cloud computing in nutshell

- Technologies such as cluster, grid, and now, cloud computing, have all aimed at allowing access to large amounts of computing power in a fully virtualized manner.
- Consumers pay providers based on usage (“pay-as-you-go”), similar to the way in which we currently obtain services from traditional public utility services such as water, electricity, gas, and telephony.

- Cloud computing has been coined as an umbrella term to describe a category of sophisticated on-demand computing services initially offered by commercial providers, such as Amazon, Google, and Microsoft.
- It denotes a model on which a computing infrastructure is viewed as a “cloud,” from which businesses and individuals access applications from anywhere in the world on demand
- The main principle behind this model is offering computing, storage, and software “as a service.”

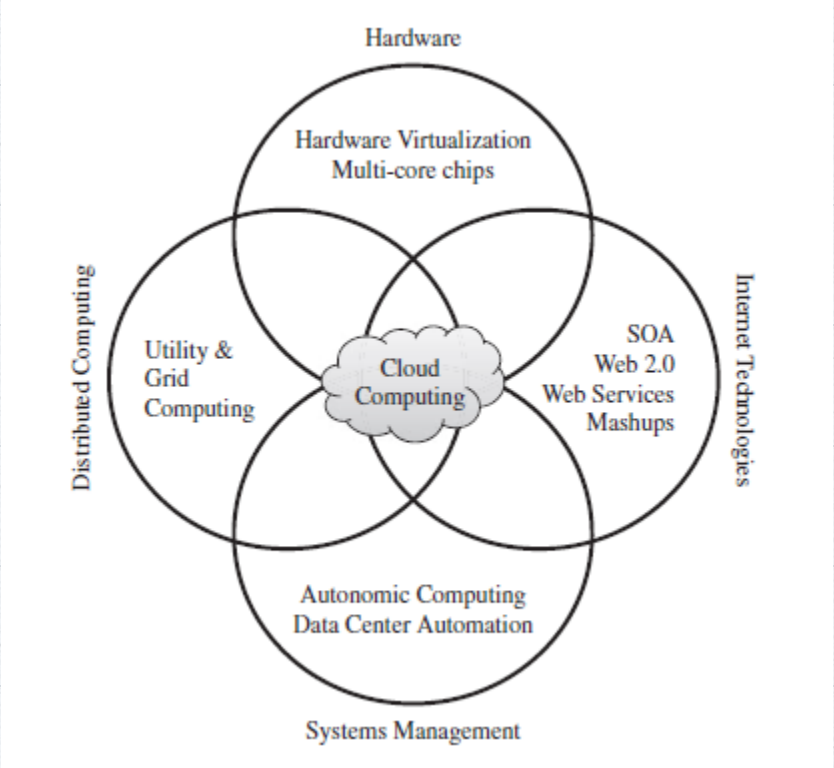
Cloud computing is the result of many years of evolution dating back to the first computers. It is the natural progression from the centralized mainframe era, to the distributed client-server era enabled by the birth of personal computers, to the Internet era where the enterprise was able to connect to the rest of the world through a network of computers that spanned the globe.

In October 2010, a photo-sharing application called Instagram was launched, and 25,000 people registered on that first day.
Three months later, Instagram had 1 million users, and shortly after hit 10 million. At that time, the company only offered an iOS version of its mobile application, so it was only capturing iPhone users.

Would it have been possible that a normal traditional server would have supported that kind of traffic?

ROOTS OF CLOUD COMPUTING

- We can track the roots of clouds computing by observing the advancement of several technologies, especially in hardware (virtualization, multi-core chips), Internet technologies (Web services, service-oriented architectures, Web 2.0), distributed computing (clusters, grids), and systems management (autonomic computing, data center automation).


Hardware
Hardware Virtualization
Multi-core chips
Distributed Computing
Utility &
Grid
Computing
Cloud
Computing
SOA
Web 2.0
Web Services
Mashups
Internet Technologies
Autonomic Computing
Data Center Automation
Systems Management

- This model brings benefits to both consumers and providers of IT services. Consumers can attain reduction on IT-related costs by choosing to obtain cheaper services from external providers as opposed to heavily investing on IT infrastructure and personnel hiring. The “on-demand” component of this model allows consumers to adapt their IT usage to rapidly increasing or unpredictable computing needs.

- Web services can glue together applications running on different messaging product platforms, enabling information from one application to be made available to others, and enabling internal applications to be made available over the Internet.
- The purpose of a SOA is to address requirements of loosely coupled, standards-based, and protocol-independent distributed computing.

- In a SOA, software resources are packaged as “services,” which are well-defined, self-contained modules that provide standard business functionality and are independent of the state or context of other services. Services are described in a standard definition language and have a published interface.

Types of cloud

Service Class	Main Access & Management Tool	Service content
 SaaS	Web Browser	**Cloud Applications** Social networks, Office suites, CRM, Video processing
 PaaS	Cloud Development Environment	**Cloud Platform** Programming languages, Frameworks, Mashups editors, Structured data
 IaaS	Virtual Infrastructure Manager	**Cloud Infrastructure** Compute Servers, Data Storage, Firewall, Load Balancer

- Cloud computing services are divided into three classes, according to the abstraction level of the capability provided and the service model of providers, namely:

(1) Infrastructure as a Service

(2) Platform as a Service

(3) Software as a Service

Infrastructure-as-a-service

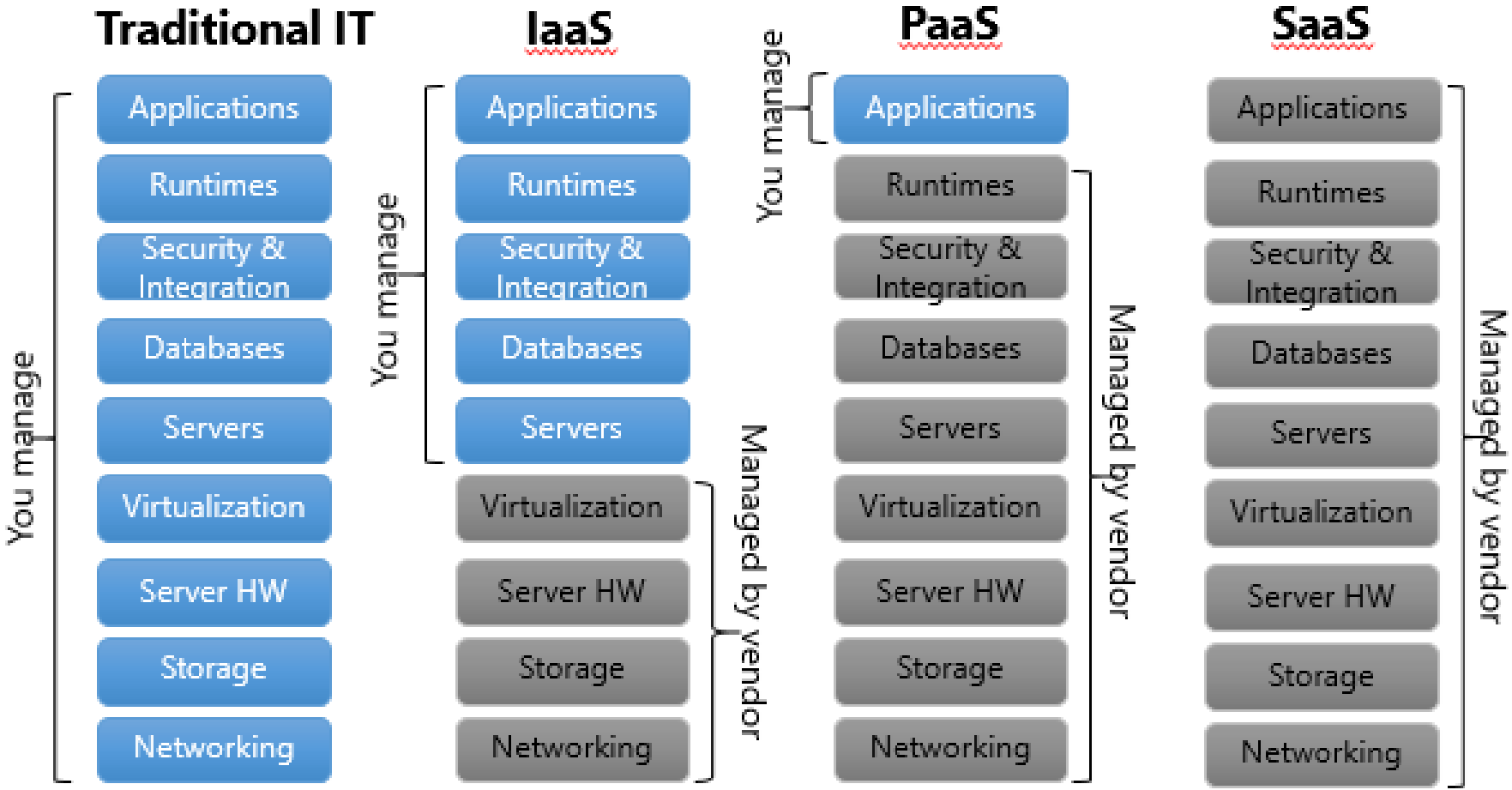
- *Infrastructure as a Service (IaaS) is the delivery of computer hardware (servers,* networking technology, storage, and data center space) as a service. It may also include the delivery of operating systems and virtualization technology to manage the resources.
- Dynamic scaling as applied to infrastructure means that the infrastructure can be automatically scaled up or down, based on the requirements of the application.

Platform-as-a-service

- With *Platform as a Service (PaaS), the provider delivers more than infrastructure.* It delivers what you might call a *solution stack — an integrated set of software* that provides everything a developer needs to build an application — for both software development and runtime.
- PaaS can be viewed as an evolution of Web hosting. In recent years, Webhosting companies have provided fairly complete software stacks for developing Websites.

Software-as-a-service

- One of the first implementations of cloud services was *Software as a Service (SaaS) — business applications that are hosted by the provider and delivered* as a service.
- At the top of the stack is SaaS. SaaS is a complete application delivered as a service to the service consumer. The service consumer has only to configure some application-specific parameters and manage users.


Traditional IT
You manage
Applications
Runtimes
Security & Integration
Databases
Servers
Virtualization
Server HW
Storage
Networking
IaaS
You manage
Applications
Runtimes
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Features of cloud

- Certain features of a cloud are essential to enable services that truly represent the cloud computing model and satisfy expectations of consumers, and cloud offerings must be

(i) self-service

(ii) per-usage metered and billed

(iii) elastic

(iv) customizable.

CLOUD INFRASTRUCTURE MANAGEMENT

- A key challenge IaaS providers face when building a cloud infrastructure is managing physical and virtual resources, namely servers, storage, and networks
- The orchestration of resources must be performed in a way to rapidly and dynamically provision resources to applications
- The software toolkit responsible for this orchestration is called a virtual infrastructure manager.

Features of infrastructure manager

- **Virtualization Support-**The multi-tenancy aspect of clouds requires multiple customers with disparate requirements to be served by a single hardware infrastructure. Virtualized resources (CPUs, memory, etc.) can be sized and resized with certain flexibility.
- **Self-Service, On-Demand Resource Provisioning-**Self-service access to resources has been perceived as one the most attractive features of clouds.

- **Storage Virtualization-** Virtualizing storage means abstracting logical storage from physical storage. By consolidating all available storage devices in a data center
- **Dynamic Resource Allocation-** Increased awareness of energy consumption in data centers has encouraged the practice of dynamic consolidating VMs in a fewer number of servers.
- **High Availability and Data Recovery-** The high availability (HA) feature of UI managers aims at minimizing application downtime and preventing business disruption.

Characteristics of cloud

- **On-demand self-services:**
  The Cloud computing services does not require any human administrators, user themselves are able to provision, monitor and manage computing resources as needed.
- **Broad network access:**
  The Computing services are generally provided over standard networks and heterogeneous devices.

- **Rapid elasticity:**

  The Computing services should have IT resources that are able to scale out and in quickly and on as needed basis. Whenever the user require services it is provided to him and it is scale out as soon as its requirement gets over.

- **Resource pooling:**

  The IT resource (e.g., networks, servers, storage, applications, and services) present are shared across multiple applications and occupant in an uncommitted manner.

- **Measured service:**

  The resource utilization is tracked for each application and occupant, it will provide both the user and the resource provider with an account of what has been used. This is done for various reasons like monitoring billing and effective use of resource.

Types of Cloud Deployment

Public Cloud

Typically have massive amounts of available space, which translates into easy scalability. Recommended for software development and collaborative projects.

Private Cloud

Usually reside behind a firewall and are utilized by a single organization. Recommended for businesses with very tight regulatory requirements

Hybrid Cloud

Combine public clouds with private clouds to allow the two platforms to interact seamlessly. Recommended for businesses balancing big data analytics with strict data privacy regulations.

Community Cloud

A collaborative, multi-tenant platform used by several distinct organizations to share the same applications. Users are typically operating within the same industry or field.

	Type	Properties
1.	Private cloud	• Outsource or own • Lease or buy • Separate or virtual data center
2.	Community cloud	• Private cloud for a set of users with specific demands • Several stakeholders
3.	Public cloud	• Mega scaleable infrastructure • Available for all
4.	Hybrid cloud	• Combination of two clouds • Usually private for sensitive data and strategic applications

What does Cloud computing achieve?

Traditional IT

- Limited to local disk, may be less consumed.
- Hard to retain data consistency.
- Computing power is not movable.
- Small devices can only perform basic work.

Cloud Computing

- Dynamically allocated on demand.
- Data consistency continued by cloud.
- Can be accessed via small smart devices.
- Small smart devices can also be managed through the cloud.

Cloud Architecture

- Cloud computing architecture is a general high level view to visualize the structure of the system various cloud resources, middleware, software components, services and relationships among them.
- Users can use various services according to their choice and usage; service providers provide those services with the help of various virtualization techniques.

Challenges with Cloud Computing

- ✗ 1. Security
- ✗ 2. integration of services
- ✗ 3. High network response time
- ✗ 4. The problem of metering

Performance and Optimization

- For a cloud to provide great computing power, application performance must be guaranteed
- Methods for achieving performance and Optimization:

1. Parallel processing
2. Load balancing
3. Job scheduler