

Amrita Vishwa Vidyapeetham

Amritapuri Campus





WELCOME ALL

19CSE445 - CLOUD COMPUTING

WEEK1



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I don't need a hard disk in my computer if I can get to the server faster....”

- Steve Jobs, Co-founder, CEO and Chairman, Apple Inc.



Discussion

*What the CLOUD is
and*

*Why it is a Technological and Business
"Game changer"*



Cloud Computing

- ❖ *What is CLOUD ?*
- ❖ *What is COMPUTING ?*
- ❖ *Examples*



Cont'd

- ❖ *Widely distributed*
- ❖ *Network based*
- ❖ *Storage*

- ❖ *Using someone else's server to host, or to process, or to store data*

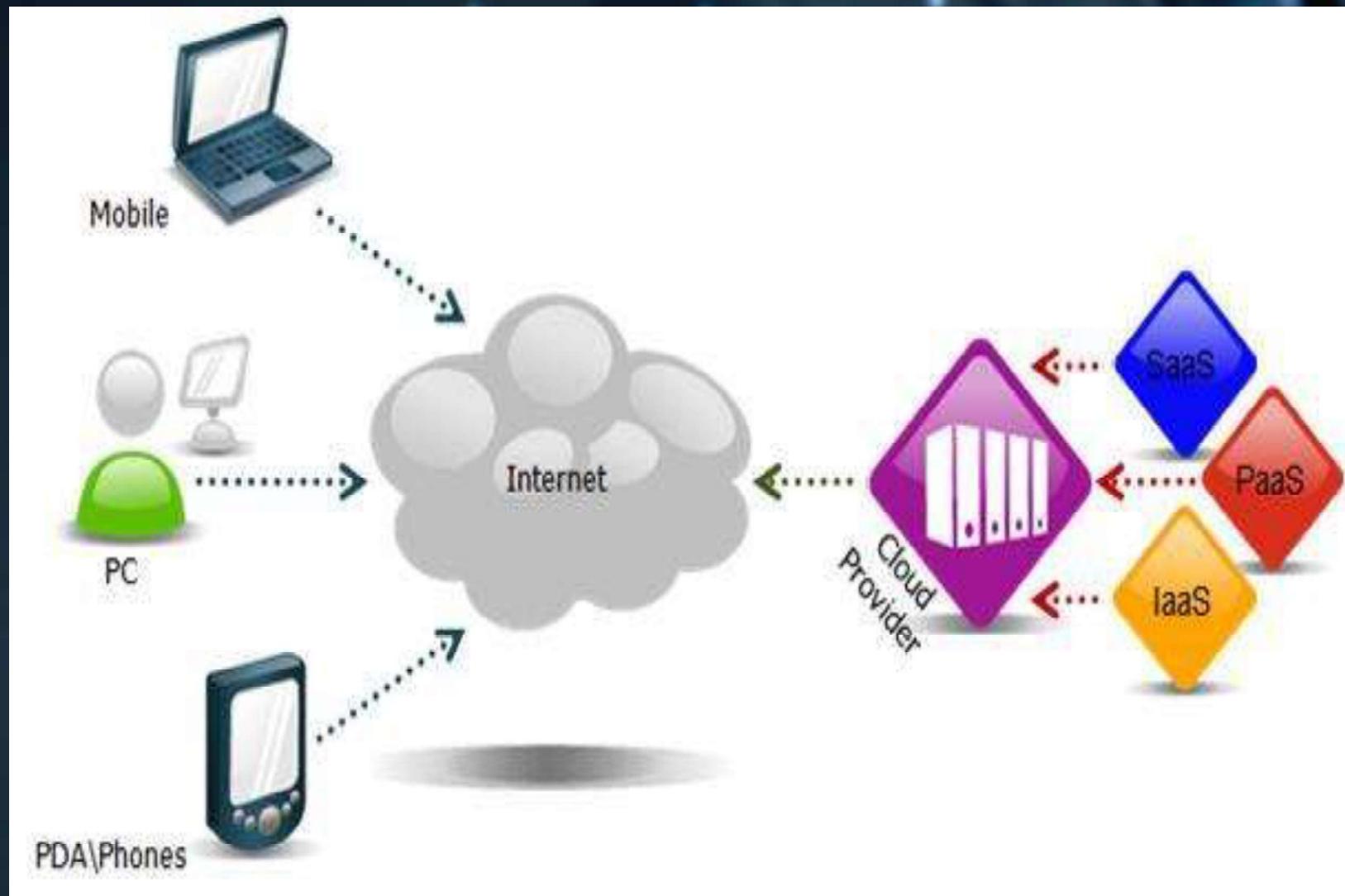


❖ ***Definitions***

- ❖ *It is the use of remote servers on the Internet to STORE,MANAGE, and PROCESS data rather than Local Servers.*
- ❖ *Services such as servers are delivered to an organization computers and devices through the Internet*
- ❖ *Cloud is something which is present in Remote location*
- ❖ *It provides us the means by which we can access the applications as utilities over the Internet.*
- ❖ *etc.*



Basic Model :



Service Providers

- Amazon Web Services (AWS)
- Microsoft Azure.
- Google Cloud.
- Alibaba Cloud.
- IBM Cloud.
- Oracle.
- Salesforce.
- SAP
- Rackspace Cloud
- VMWare



How Cloud Computing Works?



- Provides permission to the user to upload and download the information which stores.
- ❖ Advantage :
- ❖ We can access the data from anywhere.
 - ❖ A user will get the initial amount of storage at a very low price.

- Divided into two systems - Front-end and the other is Back-end.
- Interconnection - with the help of an **Internet connection**.
- Front end - computer user or client. (the application, which is used to access the cloud system).
- Backend of the cloud - is the system (various computers, hardware, servers, and data storage systems that make the cloud).
- All these features and functions managed by the **Central Server**.

Characteristics

- ✓ On-demand self service
- ✓ Broad network Access
- ✓ Rapid Elasticity
- ✓ Measured Service
- ✓ Time Saver
- ✓ Flexible options



**Let's EXPLORE more
in the next class.....**



WELCOME ALL

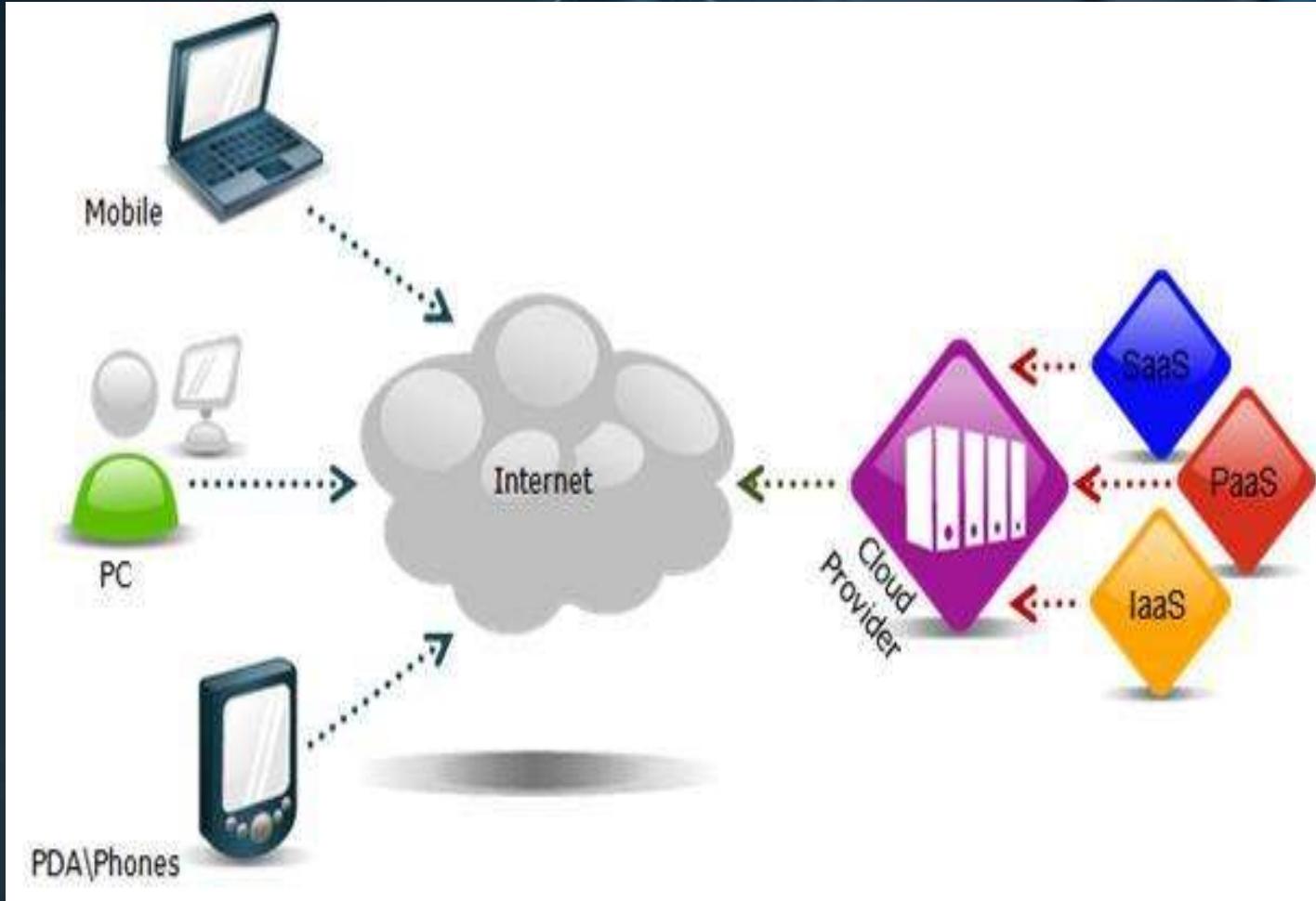
19CSE445 - CLOUD COMPUTING

WEEK2



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Basic MODEL



Advantages



01

Economical

02

Reliability

03

Manageability

04

**Data
Centralization**

05

Proper Security

Disadvantages.....



-
- A hand is pointing at a digital interface displaying seven reasons for connectivity issues, each enclosed in a hexagonal callout box. The reasons are numbered 01 through 07.
- 01 Internet Connectivity
 - 02 Lower Bandwidth
 - 03 Affect of Speed
 - 04 Security Issues
 - 05 Agreements
 - 06 Lacks of Support
 - 07 Variation is Cost

Defining Cloud Computing in Different Perspectives.....

❖ Customer (User/You) Oriented

- Any time
- Any place
- Any device
- Any service



❖ Business Oriented

- Universal access
- Scalable services
- Pay-as-you-go

Example : Gmail

Definition Cont'd.....

It is the delivery of **on-demand** computing service over the internet on a **pay-as-you-go-basis**.



WHY CLOUD COMPUTING?

You	Cloud
▪ Need huge space for services	?
▪ No automatically update	?
▪ Need team for H/W or S/W	?
▪ Lack of Flexibility	?
▪ Data can't be accessed remotely	?
▪ Longer Implementation time	?
▪ No Security	?

CLOUD – The Basic Concept :

There are certain services and models behind the scene making the cloud computing feasible and accessible to **End Users.**



Working Models :

- 1. Service Models**
- 2. Deployment Models**

I. CLOUD SERVICE MODELS :

- ✓ What Cloud can provide.....?
- ✓ Reference models on which Cloud computing is based



1. SaaS – Software as a Service :

Eg: Google Workspace, Gmail, Office 365, Dropbox, Salesforce, Cisco WebEx, Concur, GoToMeeting

2. PaaS – Platform as a Service :

Eg: AWS Elastic Beanstalk, Windows Azure, Heroku, Force.com, Google App Engine, Apache Stratos, OpenShift



3. IaaS – Infrastructure as a Service :

Eg: DigitalOcean, Linode, Rackspace, Amazon Web Services (AWS), VMware, Cisco Metapod, Microsoft Azure, Google Compute Engine (GCE)

1. SaaS – Software as a Service :

- ❖ **On-Demand**
- ❖ **End users/client**
- ❖ **No need to install on PC**
- ❖ **Servers /Resources are managed by Vendors**
- ❖ **No need to go and check backend**
- ❖ **Only utilization**
- ❖ **Platform independence**

Example : Online food ordering

2. PaaS – Platform as a Service :

- Runtime Environment
- Offers develop and deployment tools
- Developers use it.
- No need to purchase h/w or s/w.

(* High speed Internet)



3. IaaS – Infrastructure as a Service :

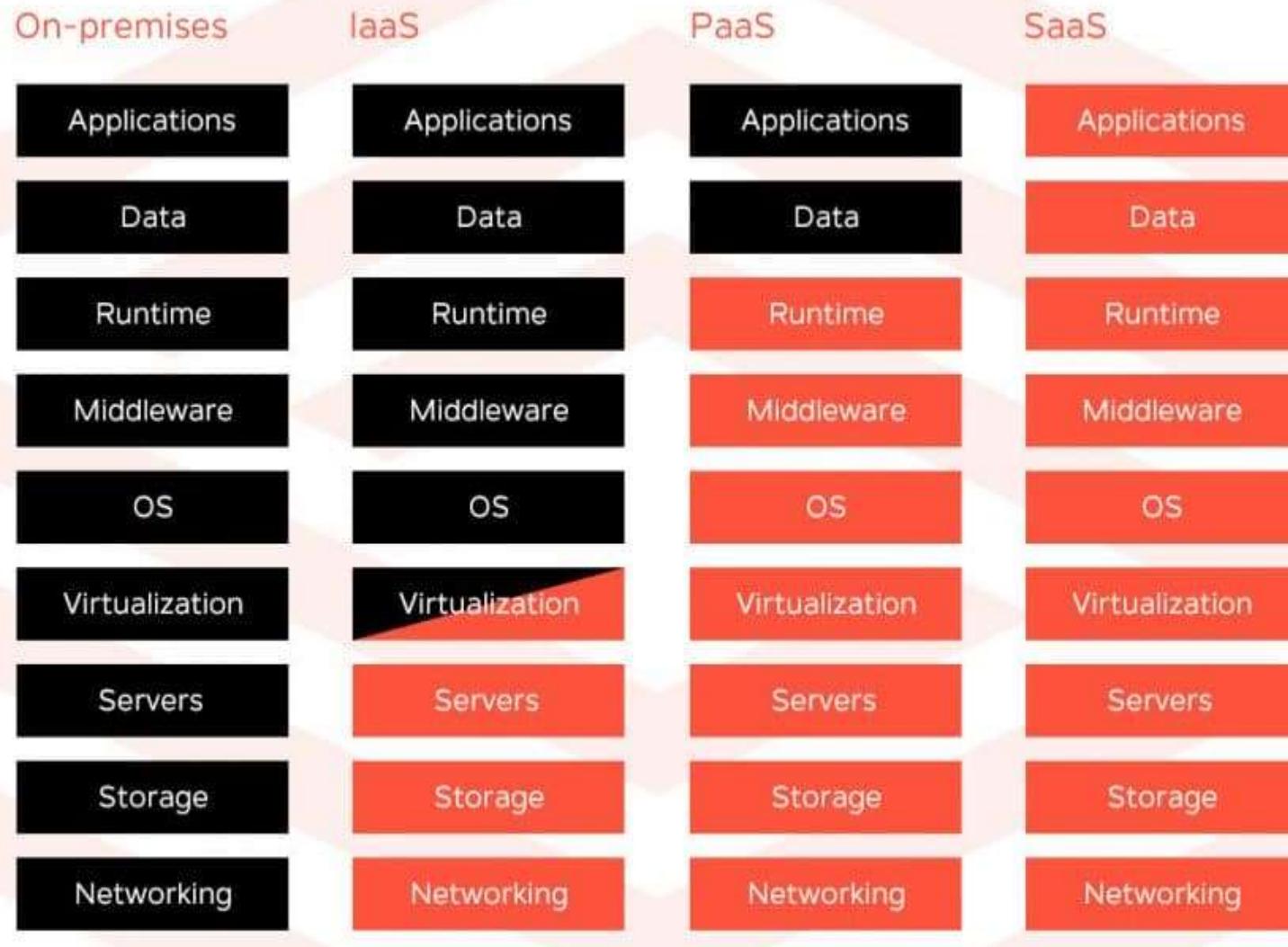
- ❖ Operating System
 - ❖ Virtual machine and storage
 - ❖ IP Address
 - ❖ Provides Infrastructure
 - ❖ Enhanced Scalability
 - ❖ Flexible
 - ❖ Network Architects and IT Administrators
- Example : AWS Login – Compute – EC2



XaaS: Everything as a Service



Summary



■ Managed by your team
■ Managed by a provider

Summary (Cont'd)

SaaS Enablement

Marketplace
Custom Packaging
Premium CDN & DNS
Built-In Billing



PaaS Management

App Deployment
Auto-Scaling & Clustering
CI/CD Automation
Container Orchestration



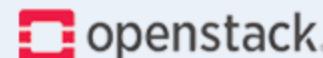
kubernetes



docker

IaaS Optimization

Containers
Virtual Machines
Network
Storage



II. Deployment Model

- Defines the type of access to Cloud
- Types :
 1. Public
 2. Private
 3. Hybrid
 4. Community



1. Public Cloud

- It allows systems and services to be easily accessible to the general public.
- Eg: Google, Amazon, and Microsoft



Benefits :

- 1. Cost Effective :** Share - same resources to large number of customers.
- 2. Reliability :** Whenever one system getting any issue; easily managed (large number of resources from different locations)
- 3. Flexibility :** Can integrate with other models
- 4. Location Independence**
- 5. Utility Style costing – Pay-as-you-go**
- 6. Scalability**

2. Private Cloud

- It allows systems and services to be easily accessible within an organisation .
- Managed internally by the organisation or by trusted third party (Pay-as-you-go).
- Maintained privately

Eg: Jewels storage



Benefits

- High security and Privacy.
- More control .

Disadvantages

- Restricted area of operations (Cant be deployed globally).
- Limited Scalability
- Price

3. Hybrid Cloud

- Mixture
- Critical activities : Private and Non-Critical : Public.

Benefits

- Scalability
- Flexibility
- Cost Efficiency
- Security

Disadvantages

- Network issues, Infrastructure dependency



4. Community Cloud

- Community : Group of People
- System and Services to be accessible by a group of organisation.

Benefits

- Cost Effective
- Share - among several organisation
- Security (less than Private and more than Public)

Disadvantages

- Network issues



Let's Explore More in the Next Class











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Welcome All

CLOUD COMPUTING

Week - 3



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❖ Working Models

- Service Models.
- Deployment Models



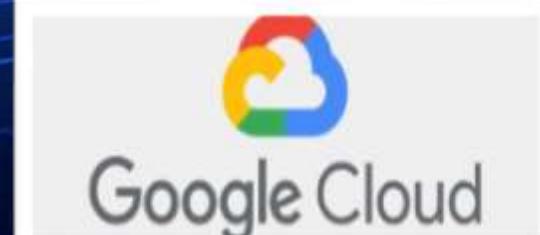
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1. Public Cloud

- It allows systems and services to be easily accessible to the general public.
- Eg: Alibaba Cloud, Amazon Web Services (AWS), Google Cloud, IBM Cloud, and Microsoft Azure.



Benefits :

- 1. Cost Effective :** Share - same resources to large number of customers
- 2. Reliability :** Whenever one system getting any issue; easily managed (large number of resources from different locations)
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Benefits

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Disadvantages

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- Limited Scalability
- Price



VS



Publicly Shared
Virtualized Resources



Privately Shared
Virtualized Resources

Supports Multiple
Customers



Cluster of Dedicated
Customers

Supports Internet
Connectivity



Connectivity Over Internet,
Fiber, and Private Network

Suited for Less
Confidential Information



Suited for Secured
Confidential Information and
Core Systems

3. Hybrid Cloud

- Mixture
- Critical activities : Private, Non-Critical : Public.

Benefits

- Scalability
- Flexibility
- Cost Efficiency
- Security

Disadvantages

- Network issues, Infrastructure dependency



Public/Internet Clouds

*Third-party, multitenant cloud infrastructure and services

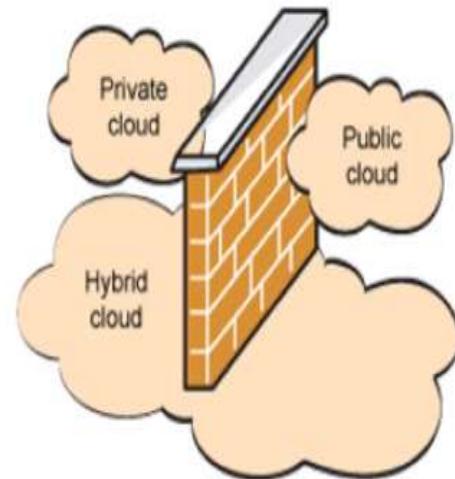
*Available on a subscription basis to all

Private/Enterprise Clouds

*A public cloud model within a company's own datacenter/infrastructure for internal and/or partners' use

Hybrid/Inter Clouds

* Mixed use of private and public clouds; leasing public cloud services when private cloud capacity is insufficient



4. Community Cloud

- Community : Group of People
- System and Services to be accessible by a group of organisation.

Benefits

- Cost Effective
- Share - among several organisation
- Security (less than Private and more than Public)

Disadvantages

- Network issues



APPLICATIONS

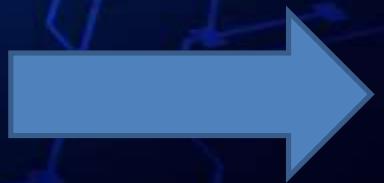
Cloud Computing is applied in almost all the fields like :

- ✓ **Business** - Google apps for business (Google Doc), Quick books (online accounting solutions, etc.)
- ✓ **Data Storage and Backup Service** – Box.com (drag & drop), Mozy (backup), etc.
- ✓ **Management** - Toggl (tracks time period), Evernote (create, organise, and store different pieces of data), etc.
- ✓ **Art** – Moo (designs printing cards, post cards, etc.)
- ✓ **Entertainment** – Audio box (Streaming)
- ✓ **Social Applications** – Facebook, Twitter, etc.

Summary



SECURITY ISSUES AND CHALLENGES



SECURITY ISSUES/ CONCERNS

- Third Party (no 100% security)
- Cyber Attacks
- Insider attacks
- Govt. – Intrusions – supervision of data
- Legal Liability
- Lack of support
- Lack of Standards

Challenges

❖ Cloud computing is an emerging technology and has many challenges in various aspects of “Information Handling”.

- ✓ Security and Privacy – Secure applications, encrypted files, Data loss software, etc.
- ✓ Interoperability
- ✓ Portability – From one Cloud to another and should operate correctly.
- ✓ Service Quality – Service level agreements, assurance.
- ✓ Computing Performance
- ✓ Reliability and Availability



Summary

Availability and
Reliability

Performance

Security and Privacy

Interoperability

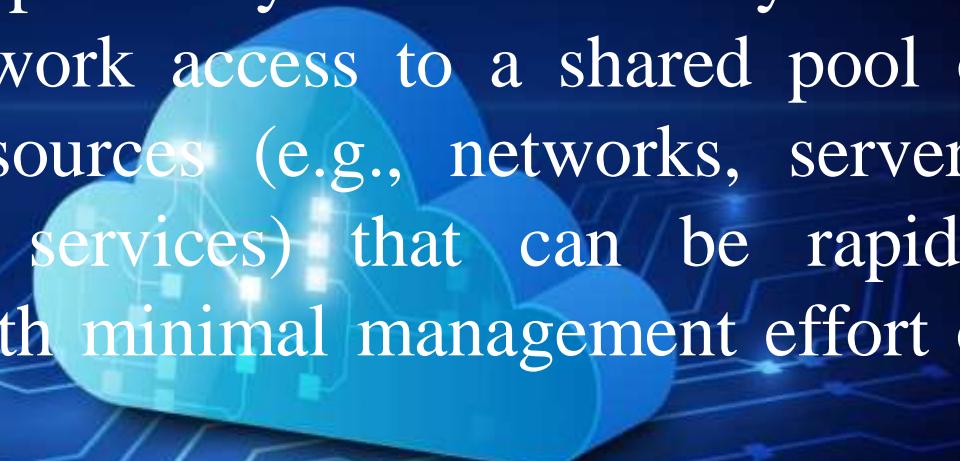
Portability



NIST Definition :

The U.S. National Institute of Standards and Technology (NIST) :

Cloud computing is a model for enabling ubiquitous (computing is made to appear anytime and everywhere), 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.



Let's Explore More in the Next Class



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AMRITA
VISHWA VIDYAPEETHAM

DEEMED TO BE UNIVERSITY





Welcome All

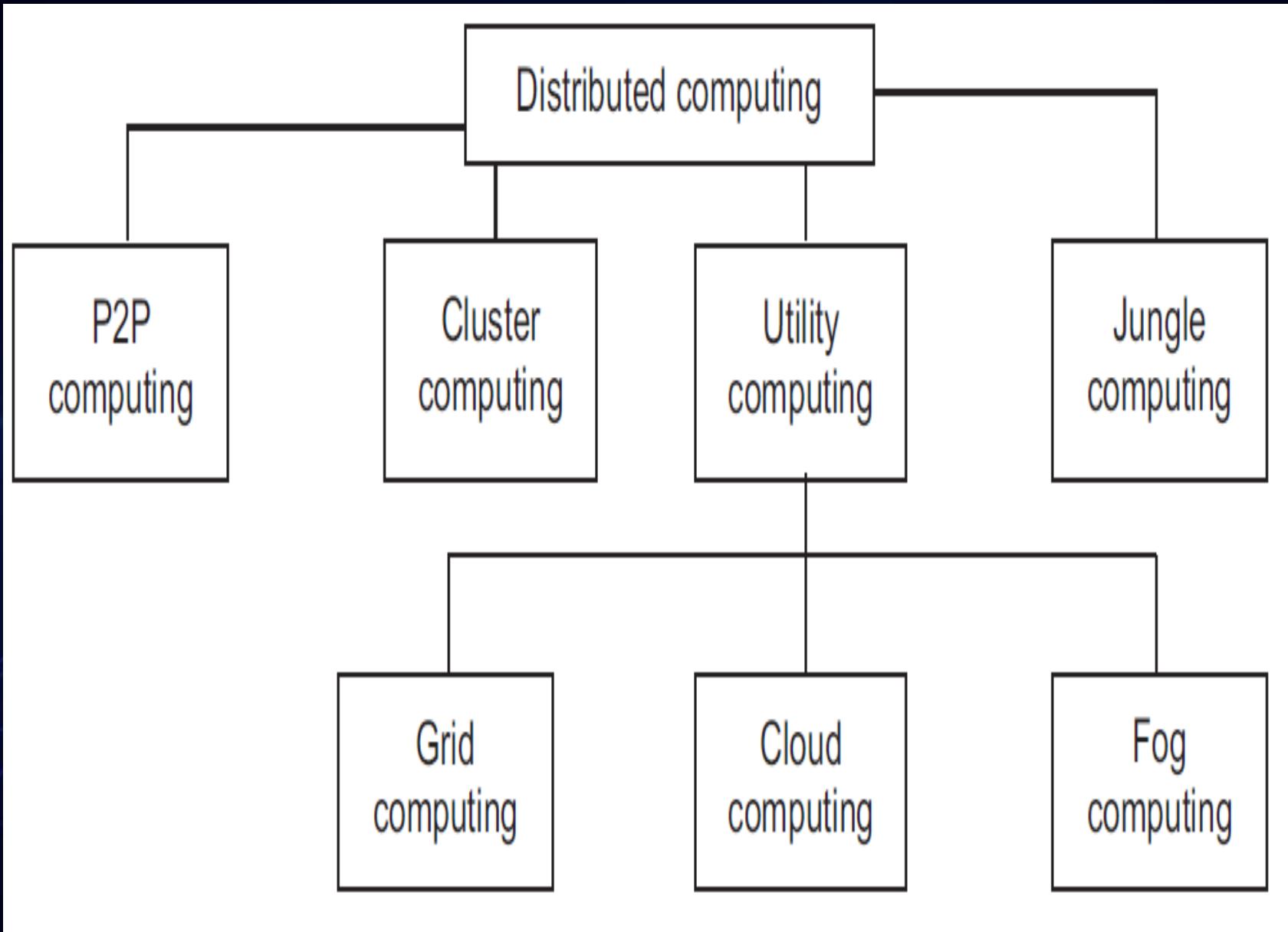
CLOUD COMPUTING

Week - 4



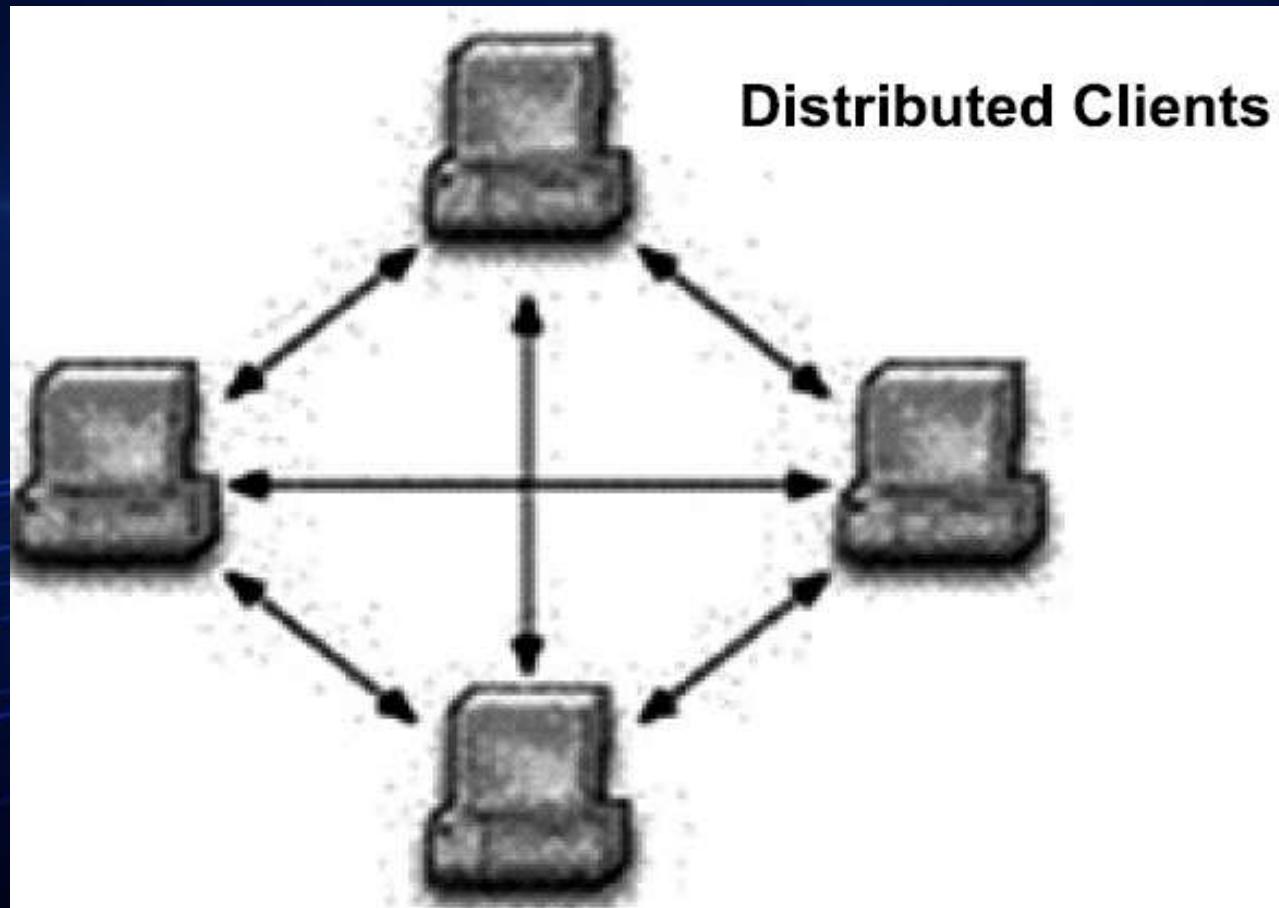
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❖ Taxonomy of Distributed Computing (Cont'd.)



1. Peer-to-Peer

- All are connected
- No central Computer
- Equal status



- A peer is a computer that behaves as a **client** in the client/server model. It also contains an additional layer of software that allows it to perform **server functions**.
- The peer computer can respond to **requests from other peers** by communicating a message over the network.
- P2P computing refers to a class of systems and applications that employ **distributed resources** to perform a critical function in a **decentralized manner**.

Advantages

- **Less Costly as there is no server**
- **If one computer in the network stops working, all other computers in the network are not affected and they will continue to work as same as before.**
- **Installation is quite easy.**



Disadvantages

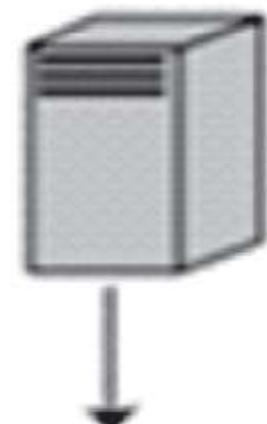
- Back up measures need to be taken separately.
- Security measures need to be taken separately
- Scalability is a problem as connecting each computer to every other computer is a headache on a very large network.



2. Cluster Computing

- Cluster – small group
- Group of computer or node or data points connected closely via a dedicated link and it appears as a single system.
- It consists of a collection of interconnected standalone computers cooperatively working together as a single integrated computing resource to take advantage of the parallel processing power of those standalone computers.

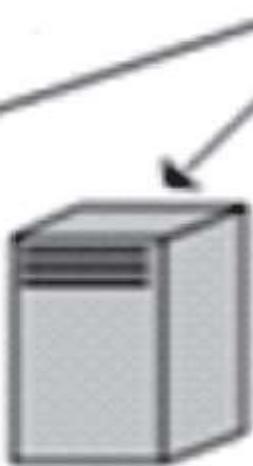
Front-end Node



Switch



Node 1



Node 2



Node 3



Node 4

.....

Why Cluster Computing?

- ✓ Performing a complex task where more resources needed.
- ✓ Processing Speed.
- ✓ Load Balancing

Characteristics

- ❖ Homogeneous in nature
- ❖ All nodes are located in single location



Advantages :

- ❖ Manageability,
- ❖ Single system image
- ❖ High availability.
- ❖ Software is automatically installed and configured, and the nodes of the cluster can be added and managed easily.
- ❖ It is an open system that is very easy to deploy and cost-effective to acquire and manage.



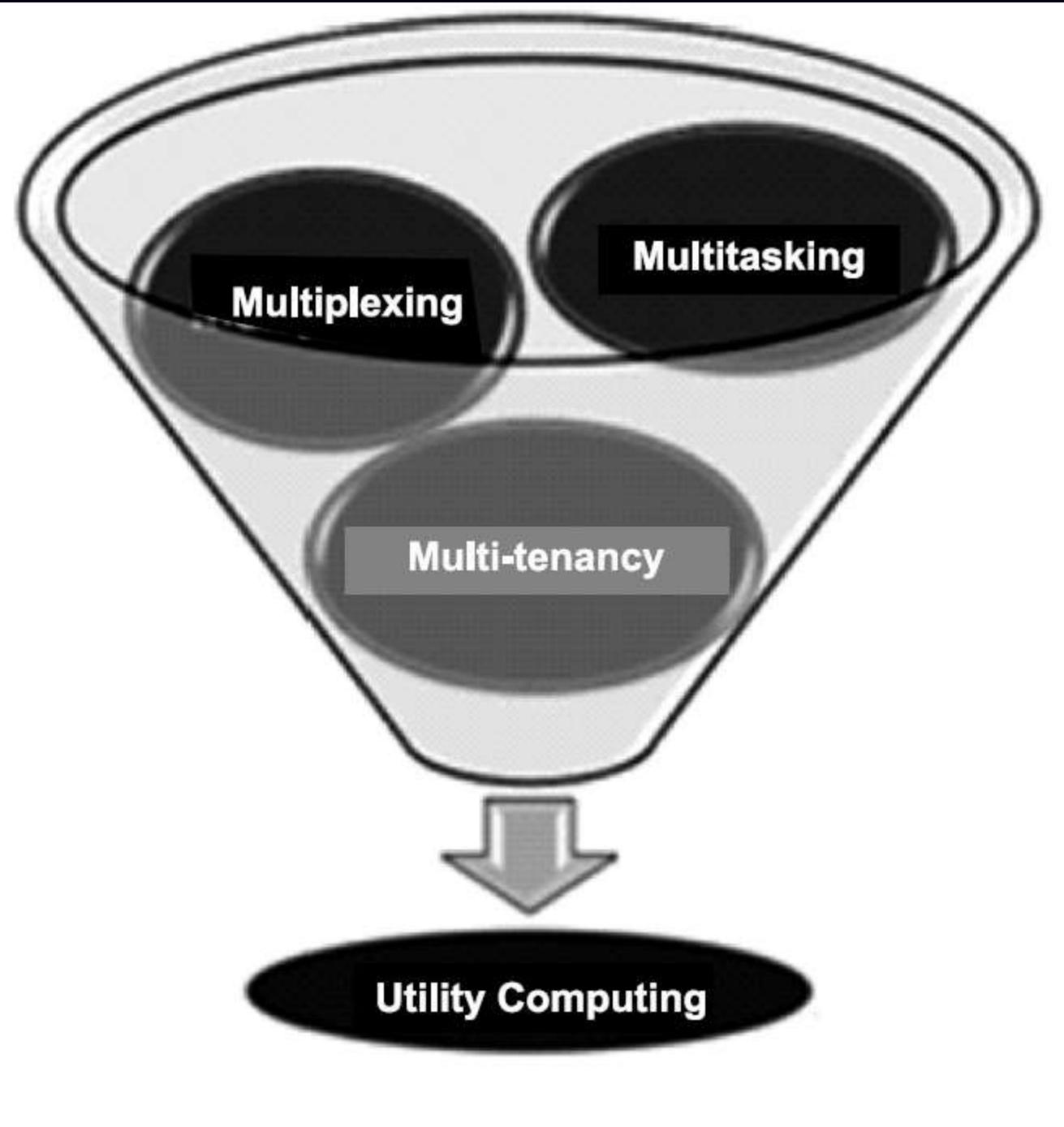
Disadvantages:

- ❖ It is hard to manage cluster computing without experience.
- ❖ When the size of the cluster is large, it is difficult to find out if something fails.
- ❖ Its programming environment is hard to be improved when software on some node is different from the other.

3. Utility Computing

- It is a service provisioning model in which a service provider makes computing resources and infrastructure management available to the customer as per the need, and charges them for specific usage rather than a fixed rate.
- It has an advantage of low cost with no initial cost to afford the computer resources.





- The customers need not to buy all the hardware, software and licenses to do business.
- The customer relies on another party to provide these services.
- Utility computing is one of the most popular IT service models primarily because of the flexibility and economy it provides.

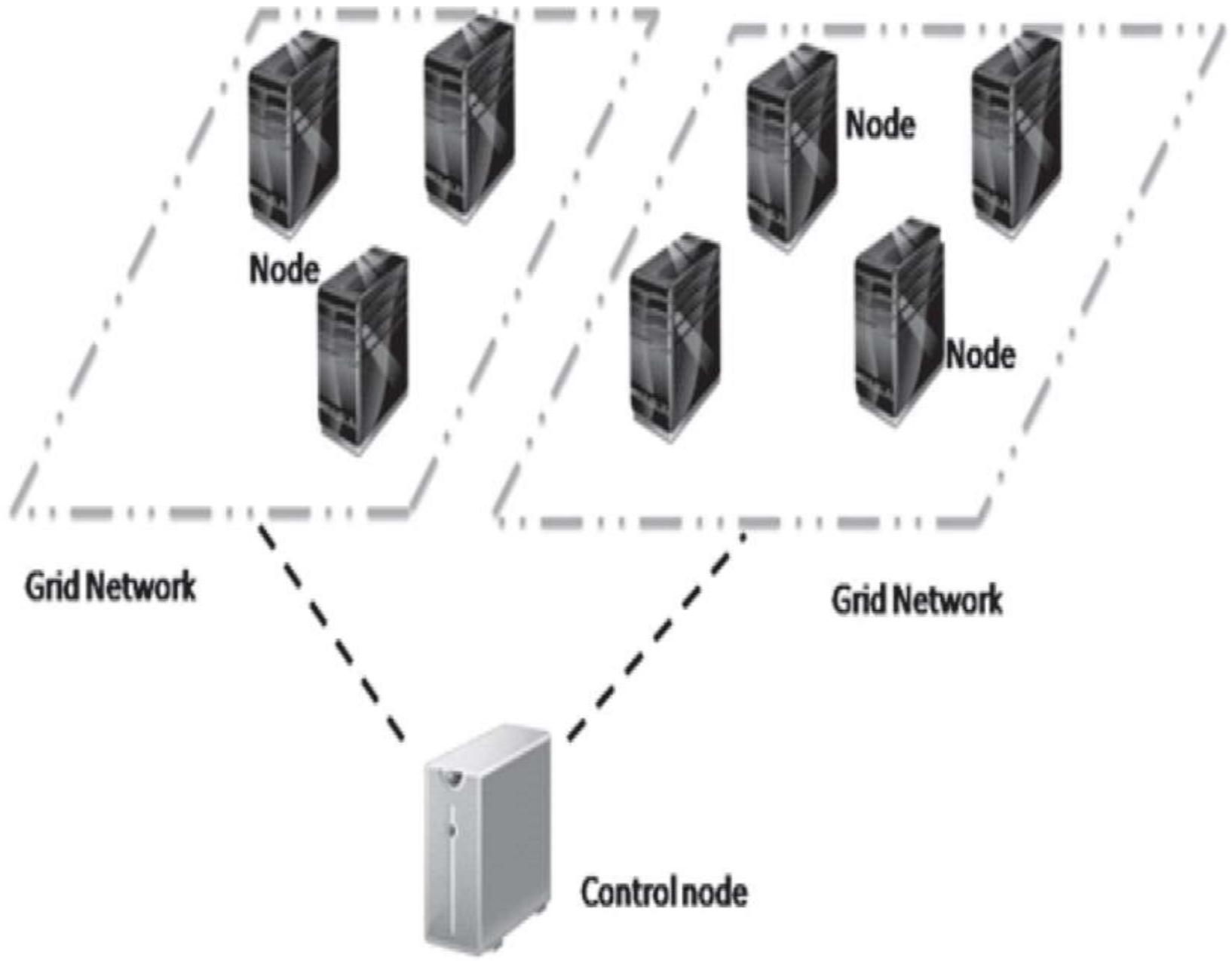


I. Grid Computing

- ❖ Basic level, grid computing is a computer network in which each computer's resources are shared with every other computer in the system.
- ❖ It is basically a way to execute jobs across a distributed set of processors.
- ❖ It offers sharing of resources over geographically distributed locations.
- ❖ Processing power, memory, and data storage are all community resources.

Grid Computing (Cont'd)

- ❖ It divides a large program into sub-programs and assigns each sub-program to an individual processor.
- ❖ Each processor now processes the sub-program and returns the end result.
- ❖ Even if one processor fails, the result will not get affected because the task will be reassigned to another processor.
- ❖ A variety of resources may be shared, including computers, storage devices, network, data, software, sensors, or scientific instruments.



Classification

1. Computational Grids :—

Grids that primarily focus on intensive and complex computations.

2. Data Grids :—

Grids for management and control of sharing of vast amounts of data.



Advantages

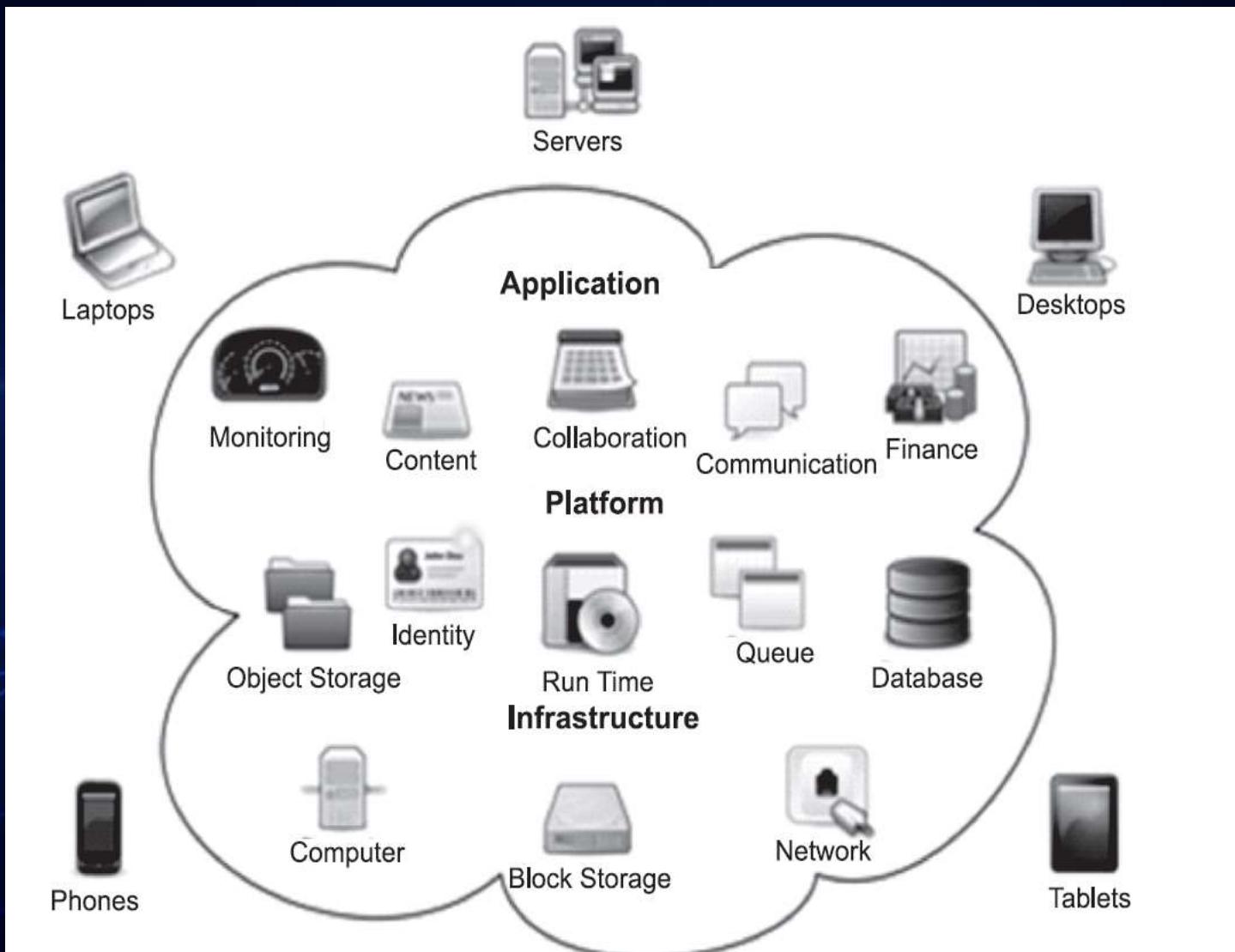
- The enterprises don't need to buy large servers for applications that can be split up and farmed out to smaller commodity type servers.
- It's more efficient in the use of resources.
- The environments are much more modular, and policies in the grid can be managed by the grid software.

Disadvantages

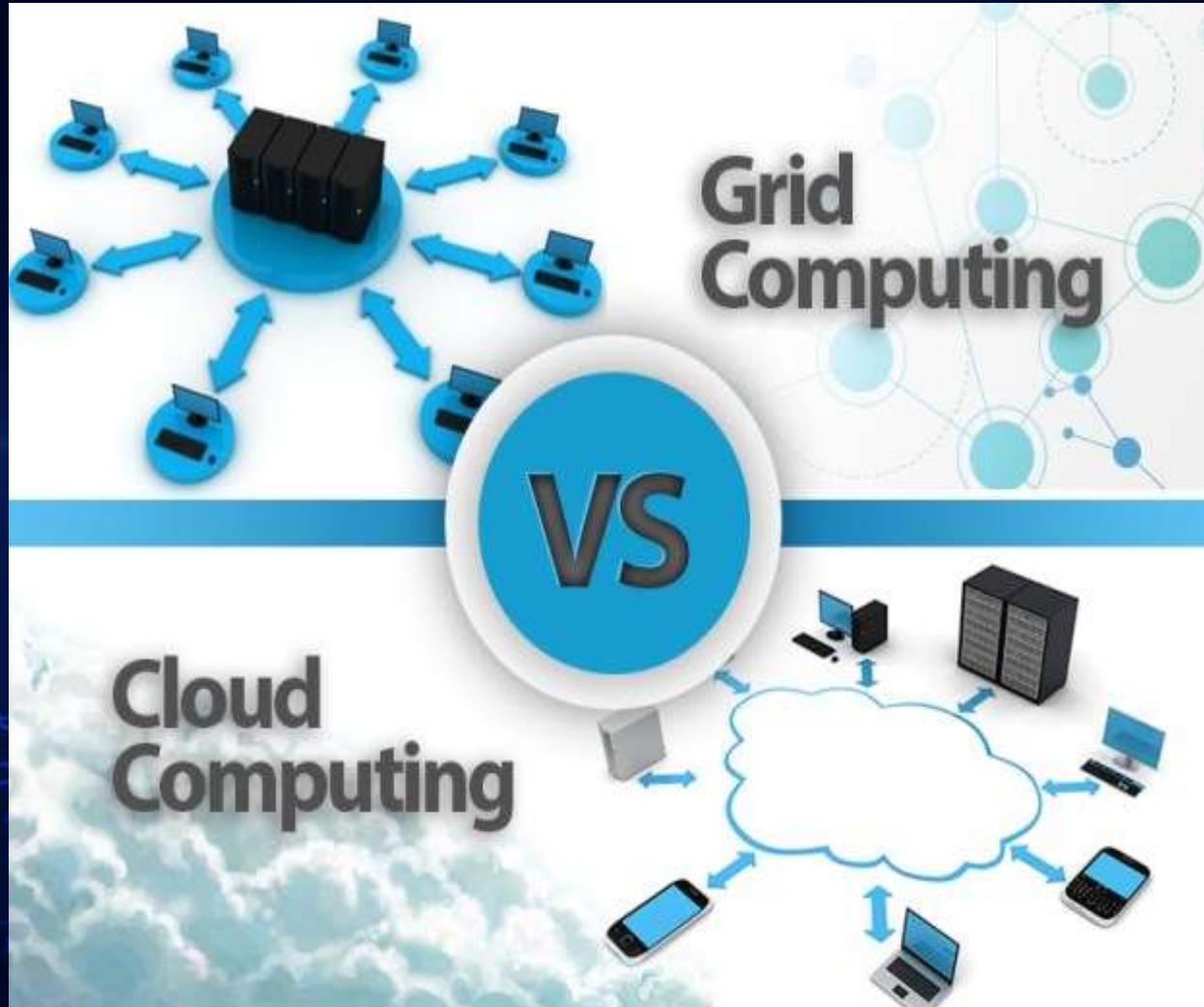
1. Requires Fast Interconnect
2. Some Applications Require Customization
3. Licensing



II. Cloud Computing

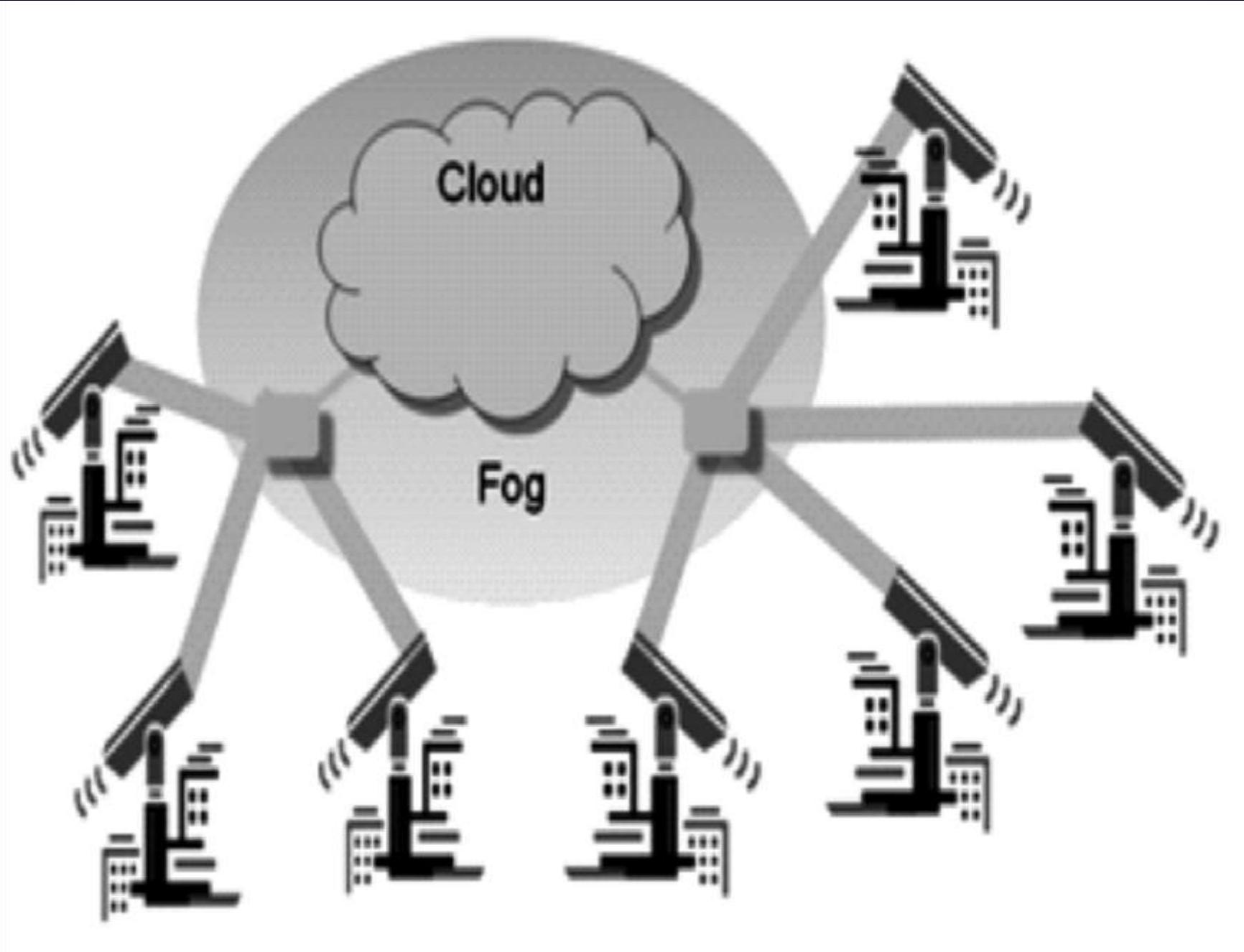


GC Vs CC



III. Fog Computing

- Fog computing or fogging is a distributed computing infrastructure in which some application services are handled on a smart device, and some are handled in a remote data centre — on the cloud.
- The main objectives of fogging :
 - To improve computing efficiency
 - Reduce the amount of data that needs to be transferred to the cloud for storage, processing, and analysis.

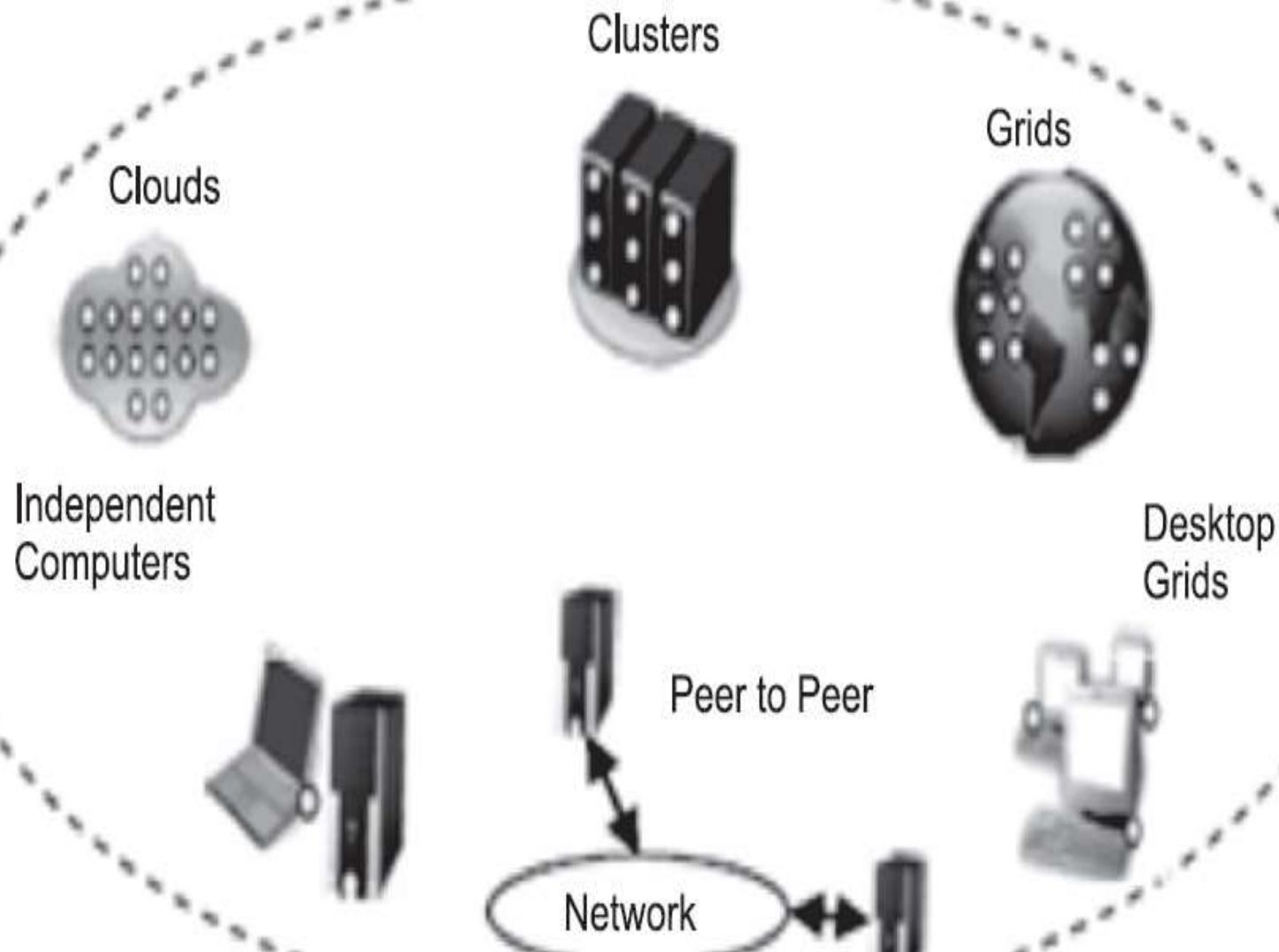


Fog Computing (Cont'd)

- ❖ The major processing takes place in a data hub on a smart mobile device or on a network in a router or other gateway device.
- ❖ It is inefficient to transfer all the data to the cloud for processing and analysis, as it requires a great deal of bandwidth and all the communication between the sensors and the cloud can reduce efficiency.

4. Jungle Computing

- ✓ It is a combination of heterogeneous, hierarchical and distributed computing resources.
- ✓ Domain experts concurrently use multiple clusters, grids, clouds, desktop grids, independent computers and more in many realistic scientific research areas.
- ✓ It refers to the use of diverse, distributed and highly non-uniform high-performance computer systems to achieve maximum performance.
- ✓ Why the term - Jungle Computing ?



Comparison

Feature	Utility computing	Cluster computing	Grid computing	Cloud computing
Virtualization	Some form of virtualization	Half	Half	Essential
Scalability	Yes	No	Half: Nodes & Sites	Yes
Standardization and interoperability	Standardization of backup policies	Virtual interface architecture based	Open grid forum standards	Web services
User management	Centralized	Centralized	Decentralized	Centralized or by third party
Size	100s	100s	1000s	100s to 1000s
Pricing	Utility pricing	Limited	Dominated by public good or privately assigned	Utility pricing discounted for larger customers
Resource management	Distributed	Centralized	Distributed	Centralized or distributed
Capability	Based on service provisioning	Stable and guarantee	Varies but high	On demand

Control	Centralized	Centralized	Decentralized	Centralized
Ownership	Single	Single	Multiple	Single
Privacy	Service level	Medium level	Medium level	High level
Transparency	Yes	Yes	No, low	Yes, high but optional
Applications	Business model	Science, business and data centres	Collaborative, scientific and HPC	Web application and content delivery
Examples	Google, Amazon 2008	ARCnet, VAXcluster	GIMPS, SET1	Amazon EC2

PRINCIPLES OF PARALLEL AND DISTRIBUTED COMPUTING



PARALLEL COMPUTING

- ❖ It is a form of computation on which many calculations can be done Simultaneously
- ❖ Multiple CPU's will be there
- ❖ Problem divided into discrete parts and that can be executed concurrently.



WHY PARALLEL COMPUTING ?

- ❖ Save Time
- ❖ Save money
- ❖ Solves larger problem
- ❖ Provides concurrency
- ❖ Uses non-local resources



Elements . . . ?



Let's Explore More in the Next Class



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**WELCOME ALL
CLOUD COMPUTING**



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VISION OF CLOUD COMPUTING





GOALS

OVERVIEW



- In Simplest terms, Cloud Computing means storing and accessing the data and programs on remote servers that are hosted on **Internet** instead of computer's hard drive or local server.
- Cloud computing is also referred as Internet Based Computing.

The Vision of Cloud Computing :

1. Cloud Computing provides the facility to provision virtual hardware, runtime environment and services to a person having money.
2. These all things can be used as long as they are needed by the user.
3. The whole collection of computing system is transformed into collection of utilities, which can be provisioned and composed together to deploy systems in hours rather than days, with no maintenance cost.
4. The long term vision of a cloud computing is that IT services are traded as utilities in an open market without technological and legal barriers.

5. In the future, we can imagine that it will be possible to find the solution that matches with our requirements by simply entering our request in a global digital market that trades with cloud computing services.

6. The existence of such market will enable the automation of discovery process and its integration into its existing software systems.

7. Due to the existence of a global platform for trading cloud services will also help service providers to potentially increase their revenue.

8. A cloud provider can also become a consumer of a competition service in order to fulfill its promises to customers.

9. In the near future, we can imagine a solution that suits our needs by simply applying our application to the global digital market for cloud computing services.

10. The presence of this market will enable the acquisition process to automatically integrate with its integration into its existing software applications. The availability of a global cloud trading platform will also help service providers to increase their revenue.

11. A cloud provider can also be a buyer of a competitive service to fulfill its promises to customers.



Thanks

