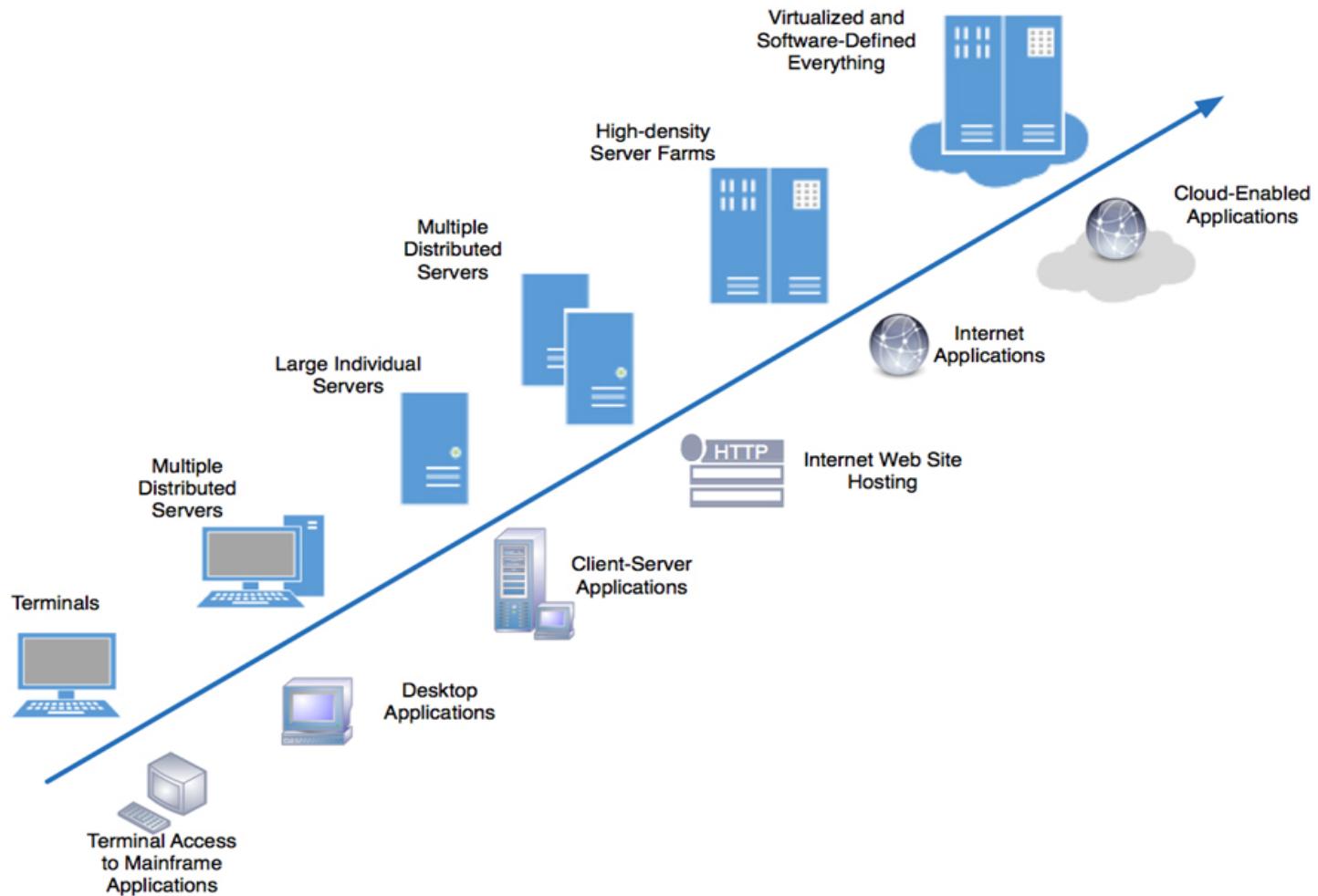
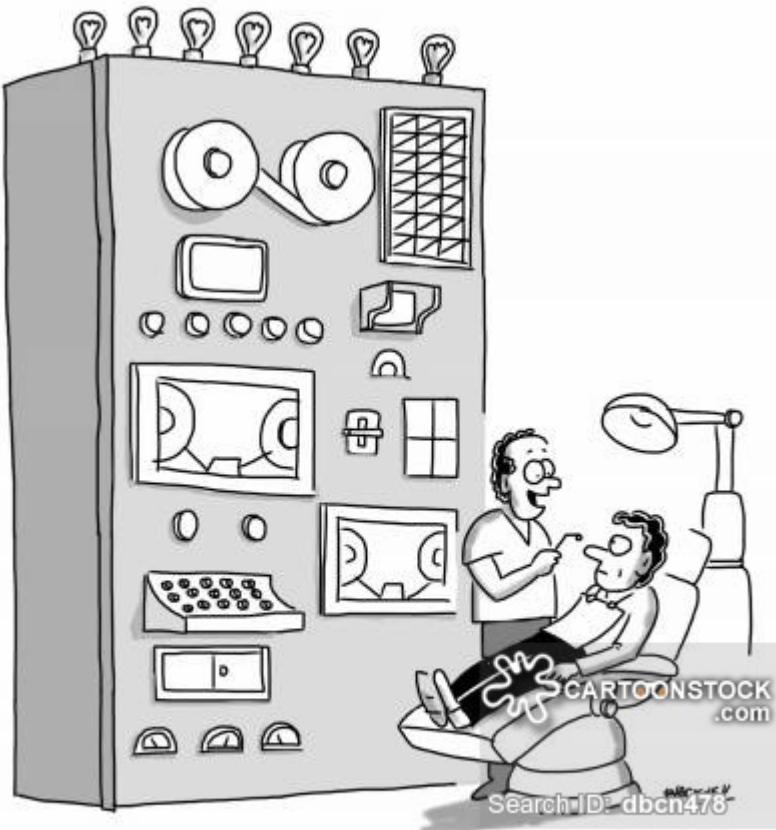


# Lecture-2 : Evolution of Cloud Computing

# Computing Paradigm Shift



# Mainframe Computing



*"YES, I BELIEVE I WAS ONE OF THE FIRST DENTISTS TO USE COMPUTERS!"*

- Jobs, Batches - Processing
- To carry out some mundane and routine jobs such as payroll, accounts, inventory thus sparing employees from tedious jobs.
- It was available in one location, and anyone who needs it must go to computer centre for availing it.



# Personal Computing

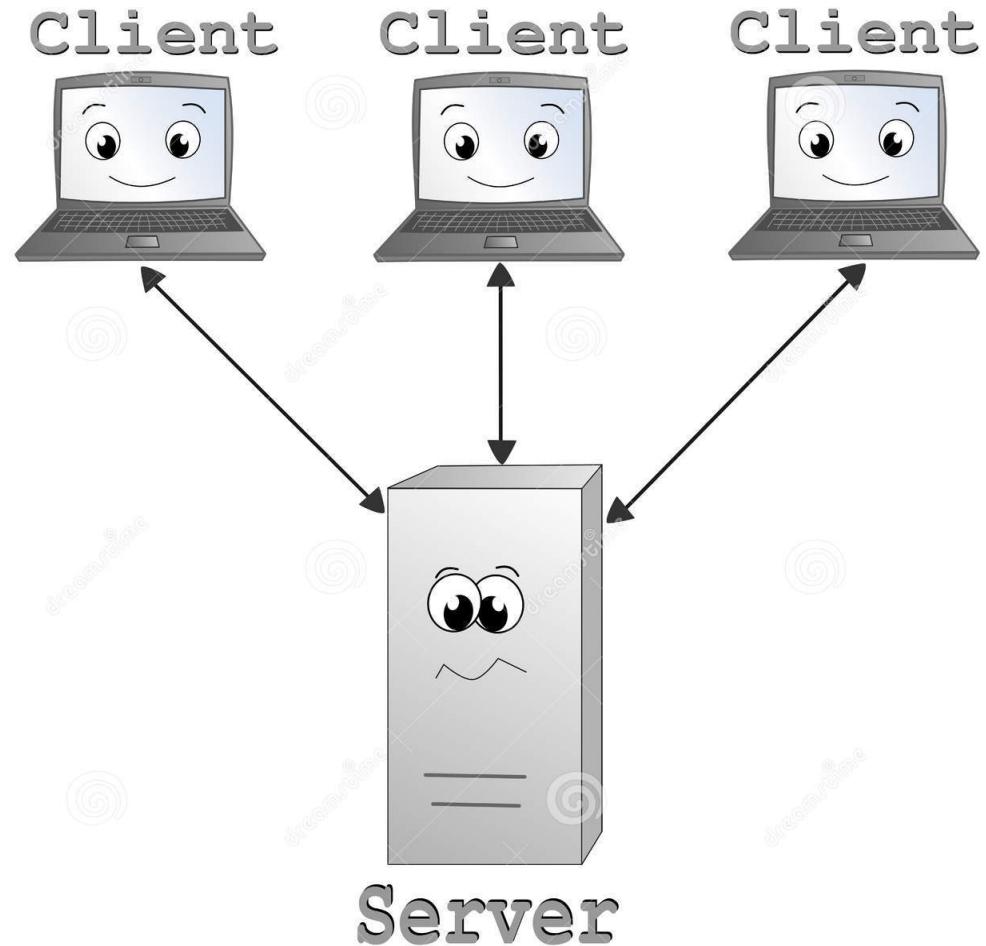


"Tech support says the problem is located somewhere between the keyboard and my chair."

- Desktop computing - personal computer small enough to fit conveniently in an individual workspace.
- Providing computers to each employee on their desktop or workspace.
- Decentralized computing.
- Less expensive, easy to upgrade and less accessories needed.
- Information sharing with other users is a tedious process.



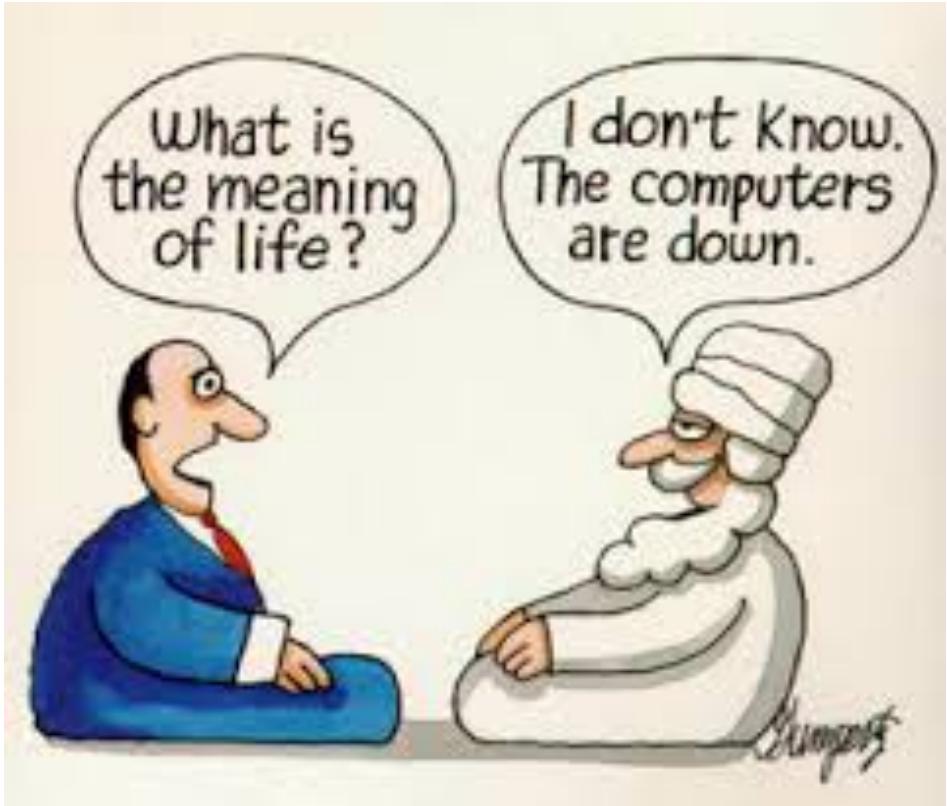
# Network Computing



- Networked computers - Local Area network (LAN) achieved this.
- In the networked computing model - a relatively powerful computer - **server** is loaded with all software needed
- Each user to provided with a connected - **terminal** to access and work



# Internet Computing



- Network computing such as LAN connected uses within an office or institutions.
- Internet computing - connect organizations located in **different geographical locations**.

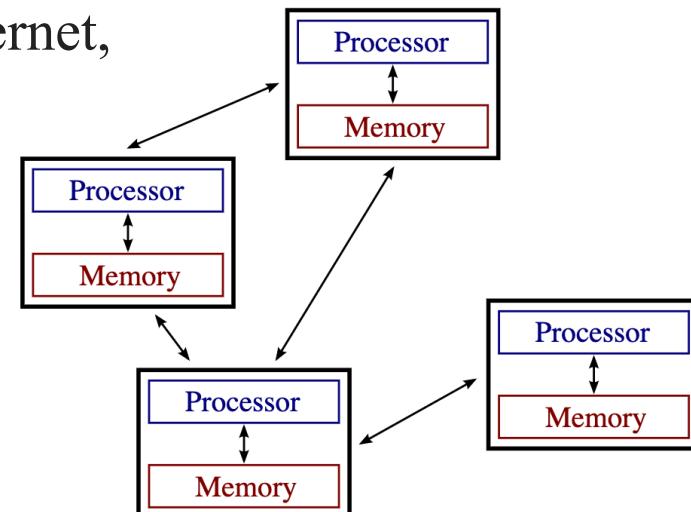


# Distributed computing

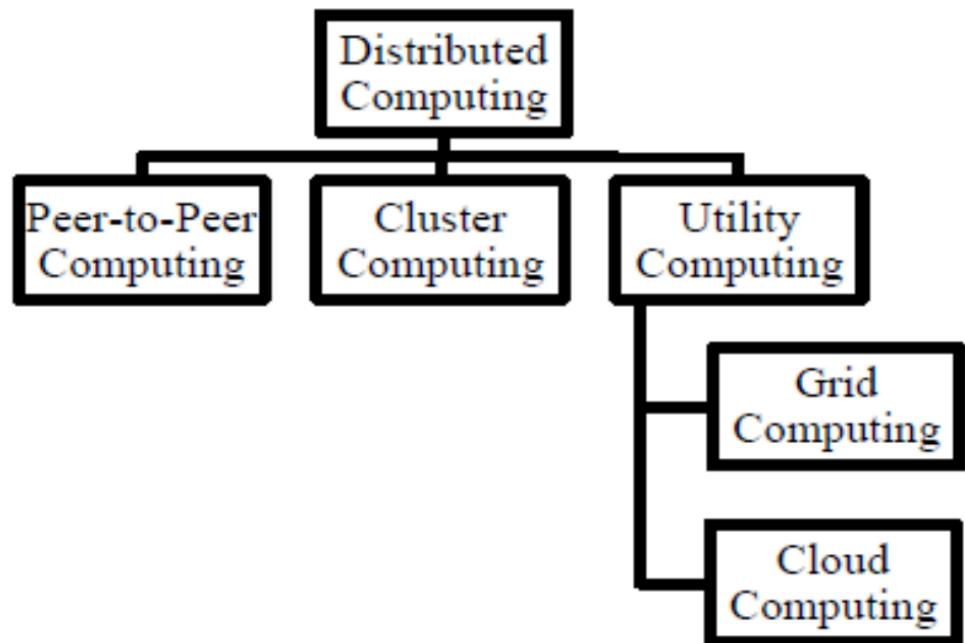
**Distributed computing** is a field of computer science that studies distributed systems

A *distributed system* is a system whose components are located on different **networked** computers, which communicate and coordinate their actions by **passing messages** to one another

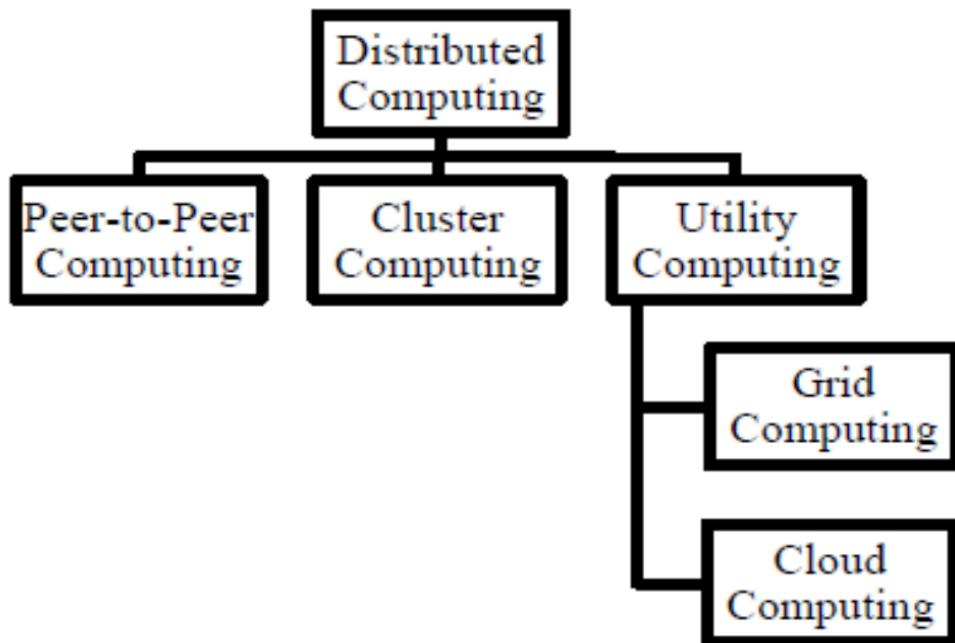
Applications of distributed computing : Intranets, Internet, WWW, email.



# Distributed computing models



# Distributed computing models



- In P2P system, every node acts as both a client and a server
- Nodes act autonomously
- No global view of the entire system



# Cluster Computing

- A computer cluster is a group of linked computers, working together closely thus in many respects forming a single computer.
- The components of a cluster are connected to each other through fast local area networks.
- Clusters are mainly used for load balancing and providing high availability.
- Requirements for computing increasing fast.
  - More data to process
  - More compute intensive algorithms available



# Cluster Computing

## Benefits

- High Availability
- Reducing cost
- Manageability

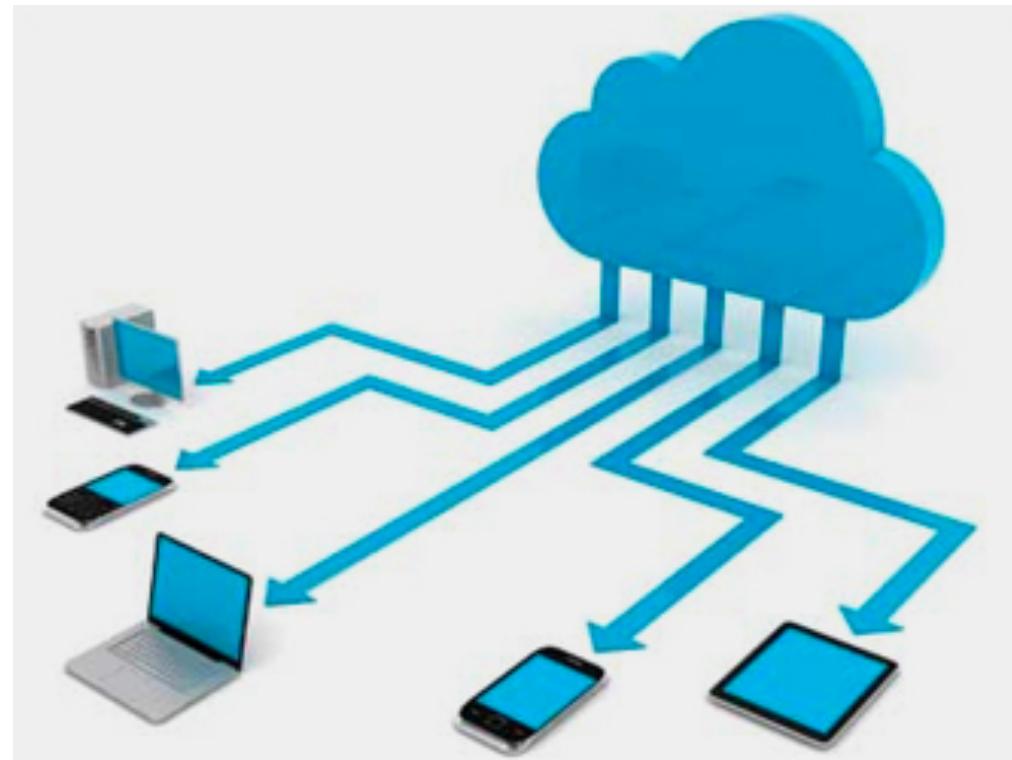
## Drawbacks

- Problem in Finding Fault
- The machines in a cluster are dedicated to work as a single unit
- The computers in the cluster are normally contained in a single location



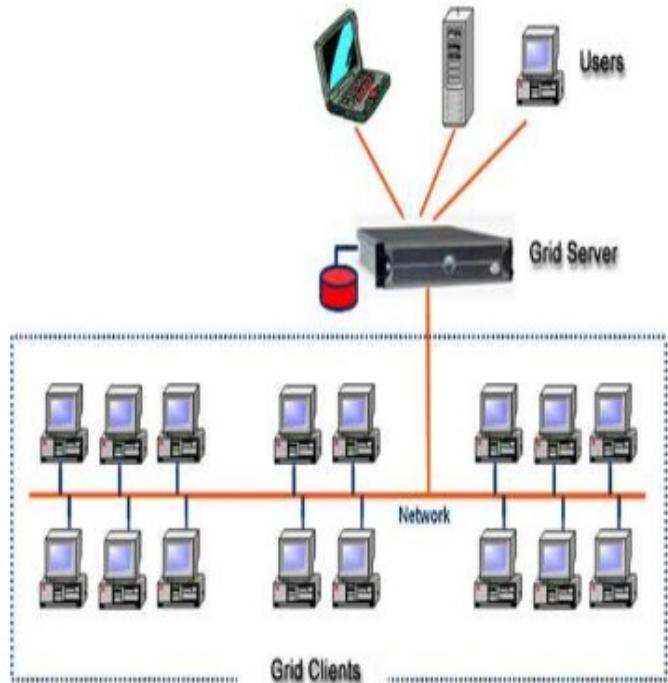
# Utility Computing

Utility computing 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.



# Grid Computing

## How Grid computing works ?



In general, a grid computing system requires:

- **At least one computer, usually a server, which handles all the administrative duties for the System**
- **A network of computers running special grid computing network software.**
- **A collection of computer software called middleware**

- Computing power available within an enterprise is not sufficient to carry out the computing task.
- Data required for the processing is generated at various geographical locations.
- GC requires the use of software that can divide and farm out pieces of a program as one large system image to several thousand computers.



# Grid Computing

## Benefits

- Enables applications to be easily scaled .
- Better utilization of resources .
- Parallelization of processing .

## Drawbacks

- Proprietary approach should be eliminated.
- There is a single point of failure if one unit on the grid degrades.
- Physical location of HW and SW are not known



# Grid Computing vs Cluster Computing

- Cluster is homogenous
  - The cluster computers all have the same hardware and OS.
  - The computers in the cluster are normally contained in a single location
- Grids are heterogeneous.
  - Run different operating systems and have different hardware.
- Grids are inherently distributed by its nature over a LAN, metropolitan or WAN.



# Cloud Computing - A vision to reality

Three decades ago, John Gage (Sun Microsystems) made the prophetic statement that:

*“The network is the computer.”*

Twenty-five years later, the advent of Cloud Computing has finally made this a reality.



<http://www.tmforum.org/CloudServicesBrokerage/10617/home.html>

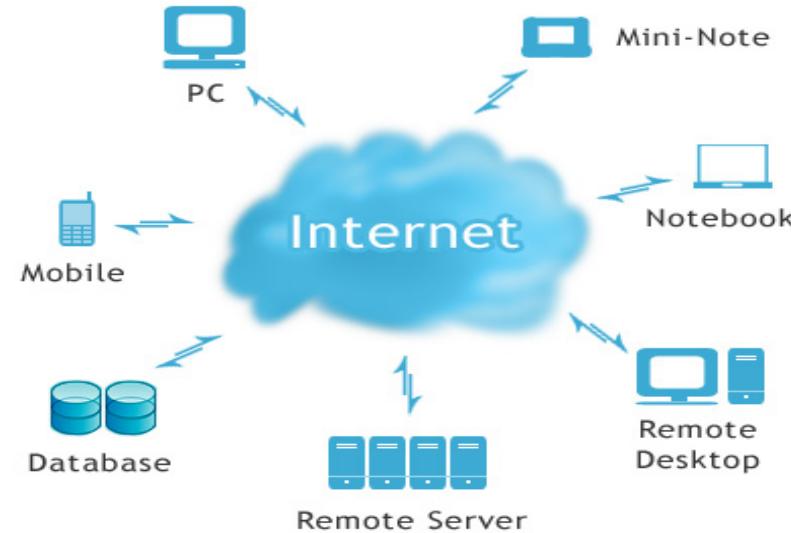
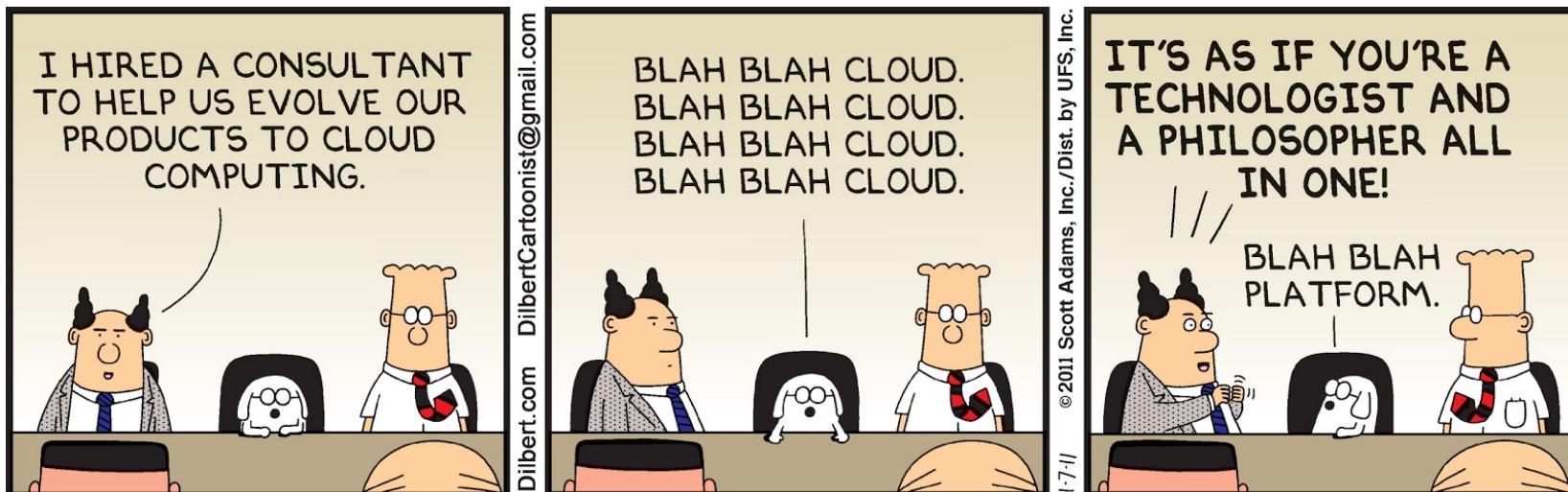
<http://cloudcomputingcompaniesnow.com>

<http://archive.opengroup.org/public/member/q400/gage.jpg>



# Definition of Cloud Computing

NIST defines Cloud Computing as<sup>1</sup>: “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.”



<http://cloudcomputingcompaniesnow.com/>



# Cloud Computing

- Cloud Computing refers to both the applications delivered as services over the Internet and the hardware and systems software in the data-centers that provide those services.



# Cloud Computing

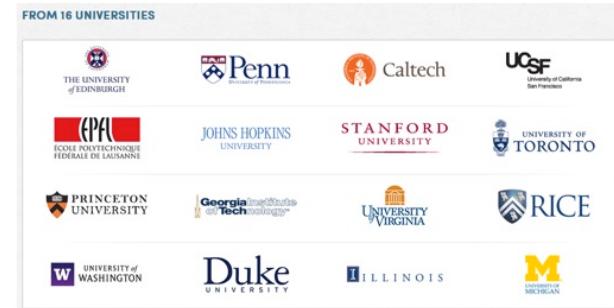
- Cloud Computing refers to both the applications delivered as services over the Internet and the hardware and systems software in the data-centers that provide those services.
- The datacenter - hardware and software is what we will call a Cloud.



# Some examples from your daily life....



# Coursera



# You Tube™



# Cloud Computing

## Benefits

- Disaster recovery
- Increased Scalability
- Faster Deployment
- Metered Service
- Highly Automated

## Drawbacks

- Constant Internet Connection
- High Speed Internet Required
- Data Stored is not secure



# Grid Vs Cluster Vs Cloud Computing

Properties	Cloud	Cluster	Grid
On-demand self-Service	Yes	No	No
Broad network access	Yes	Yes	Yes
Resource pooling	Yes	Yes	Yes
Rapid elasticity	Yes	No	No
Measured service	Yes	No	Yes

