Grid and Cloud Computing

Unit – I - INTRODUCTION

Scalable Computing over the Internet

UNIT I
INTRODUCTION

- Evolution of Distributed computing
  - Scalable computing over the Internet
  - Technologies for network based systems
  - Clusters of Cooperative Computers
  - Grid Computing Infrastructures
  - Cloud Computing
  - Service Oriented Architecture (SOA)
- Introduction to Grid Architecture and Standards
- Elements of Grid
- Overview of Grid Architecture.

What is Scalability?

- It is the ability of a computer application or product (hardware or software) to continue to function well when it is changed in size or volume in order to meet a user need.

- Typically, the rescaling is to a larger size or volume.

Scalable Computing Over the Internet

- The evolutionary changes in machine architecture, operating system platform, network connectivity, and application workload
- Billions of people use the Internet every day
- Supercomputer sites and large data centers must provide high-performance computing services to huge numbers of Internet users concurrently
- Upgrade data centers using fast servers, storage systems, and high bandwidth networks.
- The purpose is to advance network-based computing and web services with the emerging new technologies
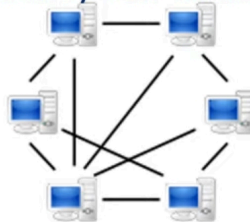
Computer Clusters

- Clusters are a set of loosely or tightly connected computers that work together so that, they can be viewed as a single system.

- Unlike grid computers, computer clusters have each node set to perform the same task, controlled and scheduled.
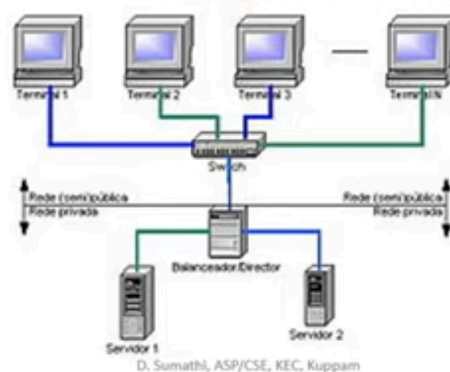
Peer-to-Peer Networks

- **P2P network**, the "**peers**" are computer systems which are connected to each other via the Internet.

- Files can be shared directly between systems on the **network** without the need of a central server.

- Each computer on a **P2P network** becomes a file server as well as a client.

- Otherwise, a group of computer systems and other computing hardware devices that are linked together and communicate by message passing, so that they can share resources to do individual tasks.

Evolutionary trend toward parallel, distributed, and cloud computing with clusters, MPPs, P2P networks, grids, clouds, web services, and the Internet of Things.
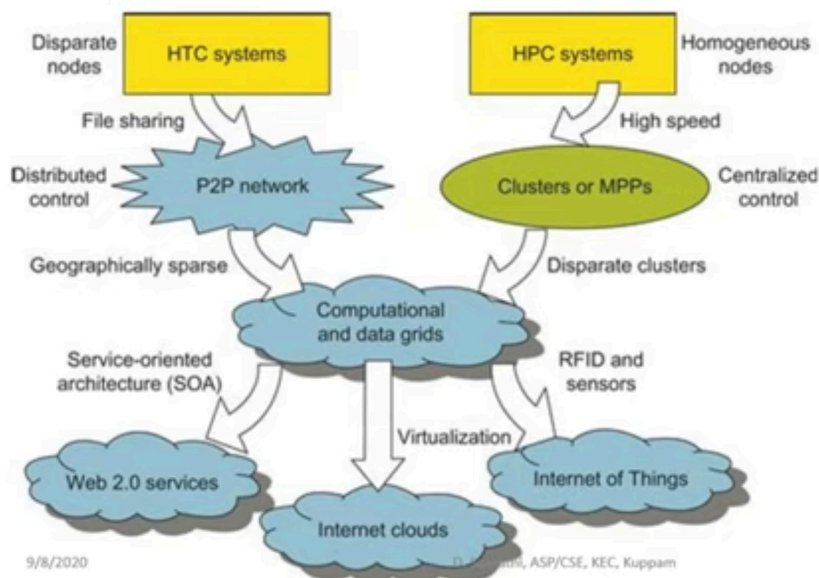

Figure :
The Evolution of
HTC and HPC Systems

The Evolution of HTC and HPC Systems

- On the HPC side, supercomputers (*massively parallel processors* or *MPPs*) are gradually replaced by clusters of cooperative computers out of a desire to share computing resources.
- The cluster is often a collection of homogeneous compute nodes that are physically connected in close range to one another.
- On the HTC side, *peer-to-peer (P2P)* networks are formed for distributed file sharing and content delivery applications.
- A P2P system is built over many client machines.
- Peer machines are globally distributed in nature.
- P2P, cloud computing, and web service platforms are more focused on HTC applications than on HPC applications.
- Clustering and P2P technologies lead to the development of computational grids or data grids.

High-performance computing

- HPC systems emphasize the raw speed performance.
- The speed of HPC systems has increased from Gflops in the early 1990s to now Pflops in 2010.
- This improvement needed to solve the problems of complex scientific, engineering, mathematical and manufacturing communities.
- For example, the Top 500 most powerful computer systems in the world are measured by floating-point speed
- the number of supercomputer users is limited to less than 10% of all computer users.

Internet Clouds

- A model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., servers, storage, networks, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction.

  - – NIST

The Internet of Things and Cyber-Physical Systems

- Internet of Things
    - The networked interconnection of **everyday objects, tools, devices, or computers**.
    - One can view the IoT as a **wireless network of sensors** that interconnect all things in our daily life.
    - These things can be **large or small** and they vary with respect to time and place.
    - The idea is **to tag every object using RFID** or a related sensor or electronic technology such as **GPS**.

- IoT era, all objects and devices are instrumented, interconnected, and interacted with each other intelligently
- Three communication patterns co-exist
  - H2H (human-to-human),
  - H2T (human-to-thing), and
  - T2T (thing-to-thing) – any machine, PCs, Phones
- IoT emphasizes various networking connections among physical objects
- **Communicate to anything, anywhere, anytime**

- Cyber-Physical Systems - CPS
  - interaction between computational processes and the physical world.
  - "cyber" (heterogeneous, asynchronous) with "physical" (concurrent and information-dense) objects
  - CPS emphasizes exploration of *virtual reality (VR)* applications in the physical world