CCS335–CLOUD COMPUTING

UNIT- I CLOUD ARCHITECTURE MODELS AND INFRASTRUCTURE

Cloud Architecture: System Models for Distributed and Cloud Computing – NIST Cloud Computing Reference Architecture–Cloud deployment models–Cloud service models; Cloud Infrastructure: Architectural Design of Compute and Storage Clouds – Design Challenges.

Cloud Architecture: System Models for Distributed and Cloud Computing

Cloud refers to a Network or Internet. Cloud is something, which is present at remote location. Cloud can provide services over network, that is, on public networks or on private networks, that is, Wide Area Networks (WANs), Local Area Networks (LANs), or Virtual Private Networks (VPNs). Applications such as e-mail, web conferencing, customer relationship management (CRM), all runs in cloud.

Figure1.1ExamplesofCloudComputing

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

1. SYSTEM MODELS FOR DISTRIBUTED AND CLOUD COMPUTING

• Distributed and cloud computing systems are
  - Built over a large number of autonomous computer nodes.
  - Inter connected by SANs, LANs, or WANs in a hierarchical manner.
  - A storage area network (SAN) is a dedicated high-speed network or sub network that inter connects and presents shared pools of storage devices to multiple servers.
  - LAN switches-connect hundreds of machines as a working cluster.
  - WAN-connect many local clusters to form a very large cluster of clusters.

Classification of Distributed Computing

- Clusters of Cooperative Computers
- Peer-to-Peer Networks
- Grid Computing
- Cloud Computing over the Internet

Clusters of Cooperative Computers

Clustering means that multiple servers are grouped together to achieve the same service.
A computing cluster consists of inter connected stand-alone computers which work cooperatively as a single integrated computing resource.
In the past, clustered computer systems have demonstrated impressive results in handling heavy workloads with large data sets.

Cluster Architecture

The architecture of a typical server cluster built around a low-latency, high bandwidth interconnection network. This network can be as simple as a SAN (e.g., Myrinet) or a LAN (e.g., Ethernet).

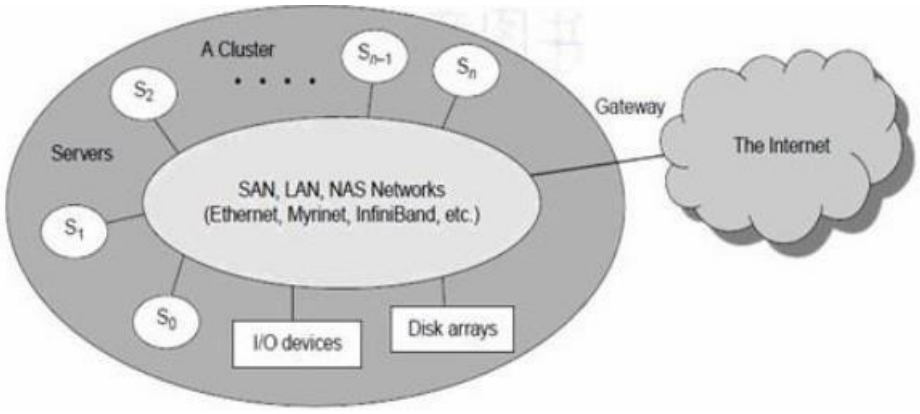


Figure1ClustersofServers

• To build a larger cluster with more nodes, the interconnection network can be built with multiple levels of Gigabit Ethernet, or Infini Band switches.
• Through hierarchical construction using a SAN, LAN, or WAN, one can build scalable clusters with an increasing number of nodes. The cluster is connected to the Internet via a virtual private network (VPN) gateway.

• The gateway IP address locates the cluster. The system image of a computer is decided by the way the OS manages the shared cluster resources.

Most clusters have loosely coupled node computers. All resources of a server node are managed by their own OS. Thus, most clusters have multiple system images as a result of having many autonomous nodes under different OS control.

Single-System Image(SSI)

- Ideal cluster should merge multiple system images into a single- system image (SSI).
- Cluster designers desire a cluster operating system or some middleware to support SSI at various levels, including the sharing of CPUs, memory, and I/O across all cluster nodes.
- An SSI is an illusion created by software or hardware that presents a collection of resources as one integrated, powerful resource.
- SSI makes the cluster appear like a single machine to the user. A cluster with multiple system images is nothing but a collection of independent computers.

Advantages of Cluster Computing

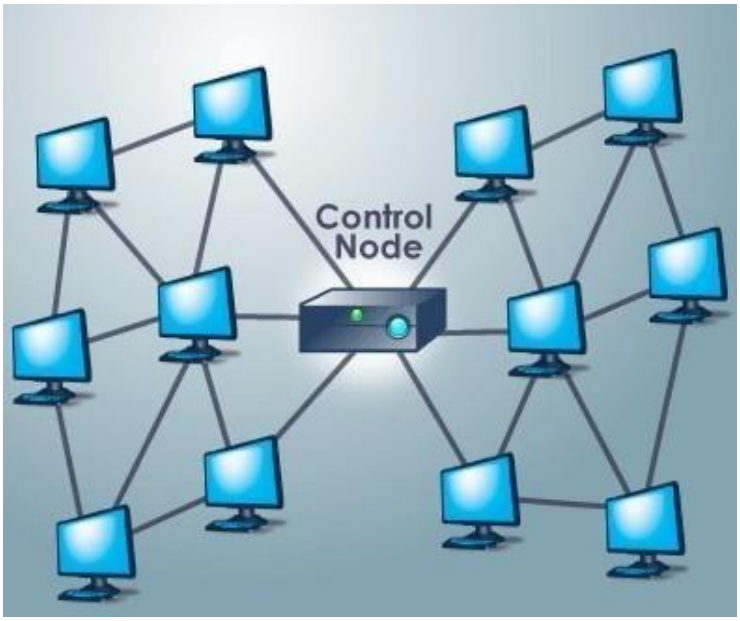
1. High Performance
2. Easy to manage
3. Scalable
4. Expandability
5. Availability
6. Flexibility
7. Cost-effectiveness
8. Distributed applications

Disadvantages of Cluster Computing

1. High cost.
2. The problem is finding the fault.
3. More space is needed.
4. The increased infrastructure is needed.
5. In distributed systems, it is challenging to provide adequate security because both the nodes and the connections must be protected.

Grid Computing

- Grid Computing is a subset of distributed computing.
- In grid computing, the sub group consists of distributed systems, which are often set up as a network of computer systems, each system can belong to a different administrative domain and can differ greatly in terms of hardware, software, and implementation network technology.



- The different department has different computer with different OS to make the control node present which helps different computer with different OS to communicate with each other and transfer messages to work.

Grid Computing Infrastructures

- An infrastructure that couples computers, software / middleware, special instruments, and people and sensors together.
- Constructed across LAN, WAN, or Internet backbone networks at a regional, national, or global scale.
- Mainly uses workstations, servers, clusters, and super computers.
- Personal computers, laptops, and PDAs can be used as access devices to a grid system.
- Industrial grid platform development by IBM, Microsoft, Sun, HP, Dell,Cisco

Advantages of Grid Computing

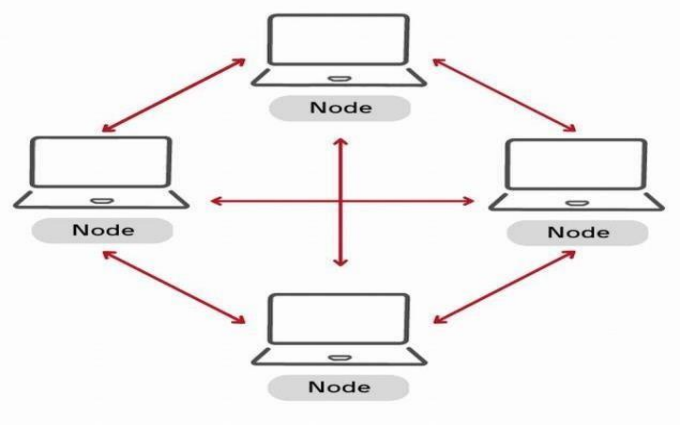
1. Can solve bigger and more complex problems in a shorter time frame. Easier collaboration with other organizations and better use of existing equipment.
2. Existing hardware issued to the fullest.
3. Collaboration with organizations made easier

Disadvantages of Grid Computing

1. You may need a fast connection between computer resources.
2. Licensing on many servers can be prohibitive for some applications.

Peer To Peer Network (P2P)

- Peer to Peer network is group of computers each of which acts as a node for sharing files within the group.
- It allows people to share the files with each other without the need of centralized server.



- The P2P architecture offers a distributed model of networked systems.
- A P2P network is client-oriented instead of server-oriented.
- P2P systems are introduced at the
  - Physical network
  - Overlay networks at the logical levels

Physical Network:

- The participating peers form the physical network at any time.
- Unlike the cluster or grid, a P2P network does not use a dedicated inter connection network.
- The physical network is simply an adhoc network formed at various Internet domains randomly using the TCP/IP and NAI protocols

Overlay Network

- Based on communication or file-sharing needs, the peer IDs form an overlay network at the logical level.
- This overlay is a virtual network formed by mapping each physical machine with its ID, logically, through a virtual mapping.
- When a new peer joins the system, its peer ID is added as a node in the overlay network and is removed from the overlay network automatically when it leaves.
- Therefore, it is the P2Poverlay network that characterizes the logical connectivity among the peers.
- Two types of overlay networks:
  - Unstructured and structured

Cloud Computing over the Internet

• A cloud is a pool of virtualized computer resources.

• A cloud can host a variety of different workloads, including batch-style backend jobs and interactive and user-facing applications.

• A cloud allows workloads to be deployed and scaled out quickly through rapid provisioning of virtual or physical machines.

• The cloud supports redundant, self-recovering, highly scalable programming models that allow workloads to recover from many unavoidable hardware/software failures.

• Finally, the cloud system should be able to monitor resource use in real time to enable rebalancing of allocations when needed.

a. Internet Clouds

• Cloud computing applies a virtualized platform with elastic resources on demand by provisioning hardware, software, and data sets dynamically. The idea is to move desktop computing to a service-oriented platform using server clusters and huge databases at data centres.

• Cloud computing leverages its low cost and simplicity to benefit both users and providers.

• Machine virtualization has enabled such cost-effectiveness. Cloud computing intends to satisfy many user applications simultaneously.

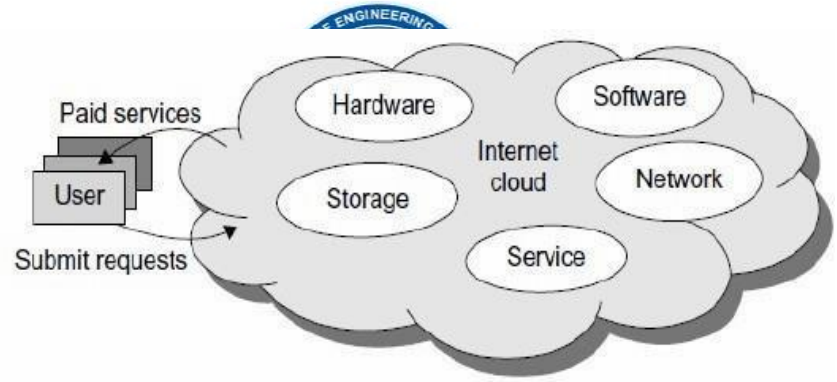


Figure: Internet Cloud

b. The Cloud Landscape

- The cloud eco system must be designed to be secure, trust worthy, and dependable.
- Some computer users think of the cloud as a centralized resource pool.
- Others consider the cloud to be a server cluster which practices distributed computing over all the servers.
- Traditionally, a distributed computing system tends to be owned and operated by an autonomous administrative domain (e.g., are search laboratory or company) for on-premises computing needs.
- Cloud computing as an on-demand computing paradigm resolves or relieves us from these problems.