Introduction to Cloud Computing

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Service Oriented Computing

- Service – oriented computing organizes distributed systems in terms of services, which represent the major abstraction for building systems
- Service orientation expresses applications and software systems as an aggregation of services that are coordinated within a service oriented architecture (SOA)
- Even though there is no designed technology for the development of service-oriented software systems, web services are the de facto approach for developing SOA
- Web services, the fundamental component enabling Cloud computing systems, leverage the Internet as the main interaction channel between users and the system

Service-Oriented Architecture (SOA)

- SOA is an architectural style supporting service orientation. It organizes a software system into a collection of interacting services.
- SOA encompasses a set of design principles that structure system development and provide means for integrating components into a coherent and decentralized system.
- SOA based computing packages functionalities into a set of interoperable services, which can be integrated into different software systems belonging to separate business domains.
- There are two major roles within SOA:
  - Service Provider
  - Service Consumer

Web Services

- Web Services are the prominent technology for implementing SOA systems and applications
- They leverage Internet technologies and standards for building distributed systems
- Several aspects make Web Services the technology of choice for SOA
- First, they allow for interoperability across different platforms and programming languages
- Second, they are based on well-known and vendor-independent standards such as HTTP, SOAP, and WSDL
- Third, they provide an intuitive and simple way to connect heterogeneous software systems, enabling quick composition of services in distributed environment

What is Cluster Computing?

- A cluster is a type of parallel or distributed computer system, which consists of a collection of inter-connected stand-alone computers working together as a single integrated computing resource
- Key components of a cluster include multiple standalone computers (PCs, workstations), operating systems, high performance interconnects, middleware, parallel programming environments, and applications
- Clusters are usually deployed to improve speed and/ or reliability over that provided by a single computer, while typically being much more cost effective than single computer the of comparable speed or reliability

Key Operational Benefits of Clustering

- **System availability:** offer inherent high system availability due to the redundancy of hardware, operating systems, and applications
- **Hardware fault tolerance:** redundancy for most system components (eg. Disk-RAID), including both hardware and software
- **OS and application reliability:** run multiple copies of the OS and applications, and through this redundancy
- **Scalability:** adding servers to the cluster or by adding more clusters to the network as the need arises
- **High performance:** running cluster enabled programs

Grid Computing

- A form of networking, unlike conventional networks that focus on communication among devices, grid computing harnesses unused processing cycles of all computers in a network for solving problems too intensive for any stand-alone machine
- Grid computing enables the virtualization of distributed computing and data resources such as processing, network bandwidth and storage capacity to create a single system image, granting users and applications seamless access to vast IT capabilities. Just as an Internet user views a unified instance of content via the Web, a grid user essentially sees a single, large virtual computer
- Grid Computing is a computing infrastructure that provides dependable, consistent, pervasive and inexpensive access to computational capabilities

Grid Computing

- **Share more than information:** Data , computing power, applications in dynamic environment, multi-institutional, virtual organizations
- **Efficient use of resources at many institutes:** People from many institutions working to solve a common problem (virtual organization).
- Join local communities.

Type of Grids

- **Computational Grid:** These grids provide secure access to huge pool of shared processing power suitable for high throughput applications and computation intensive computing.
- **Data Grid:** Data grids provide an infrastructure to support data storage, data discovery, data handling, data publication, and data manipulation of large volumes of data actually stored in various heterogeneous databases and file systems.
- **Collaboration Grid:** With the advent of Internet, there has been an increased demand for better collaboration. Such advanced collaboration is possible using the grid. For instance, persons from different companies in a virtual enterprise can work on different components of a CAD project without even disclosing their proprietary technologies.

Type of Grids

- **Network Grid:** A network grid provides fault-tolerant and high-performance communication services. Each grid node works as a data router between two communication points, providing data-caching and other facilities to speed up the communications between such points.
- **Utility Grid:** This is the ultimate form of the grid, in which not only data and computation cycles are shared but software or just about any resource is shared. The main services provided through utility grids are software and special equipment. For instance, the applications can be run on one machine and all the users can send their data to be processed to that machine and receive the result back.

Grid Components