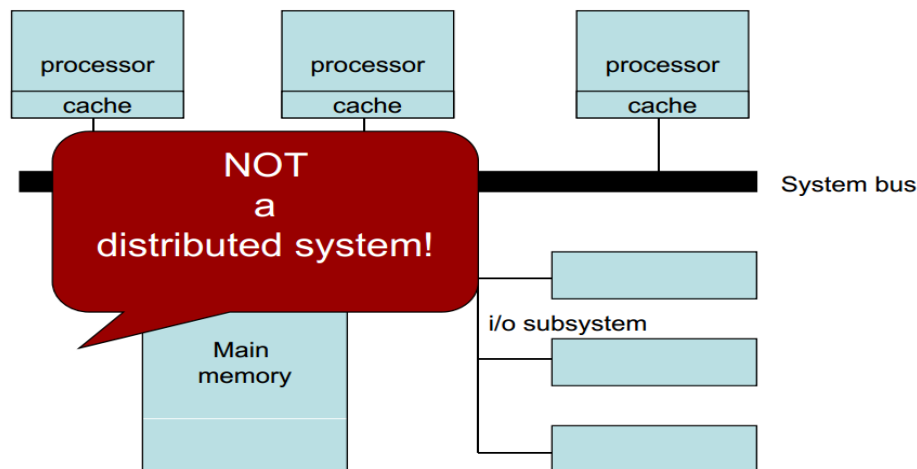


WEEK # 1 - INTRODUCTION TO DISTRIBUTED SYSTEMS

What is a distributed System?

- We define a distributed system as one in which hardware or software components located at networked computers communicate and coordinate their actions only by passing messages.
- Computers that are connected by a network may be spatially separated by any distance. They may be on separate continents, in the same building or in the same room.
- **Examples:** Internet, intranet and mobile computing systems computing systems.

Shared Memory Multi Shared Memory Multi-Processor



Significant Consequences of Distributed System

Our definition of distributed systems has the following significant consequences:

- **Concurrency**
 - Different Computers on a network. Each computer can be doing work at the same time.
 - What happens if two computers want to access a resource at the same time?
 - Network delays are not constant make synchronization difficult.
 - Users work independently & share resources
- **No Global Clock**
 - Coordination is done by message exchange
 - There are limits to the accuracy with which components in a network can synchronize their clocks.

- **Independent Failures**

- Failure of a computer, or the unexpected termination of a program somewhere in the system (a crash), is not immediately made known to the other components with which it communicates.
- Each component of the system can fail independently, leaving the others still running.

Advantages of Distributed System?

Functional distribution

- Computers have different functional (eg. File server, print,) capabilities yet may need to share resources

Inherent distribution in application domain

- physically or across administrative domains physically or across administrative domains
- cash register and inventory systems for supermarket chains
- computer supported collaborative work

Better performance Better performance

- Load balancing
- Replication of processing power Replication of processing power

Computer supported cooperative networking

Users that are geographically separated can now work and play together. Examples of this are electronic whiteboards, distributed document systems, audio/video teleconferencing, email, file transfer, and games such as Doom, Quake, Age of Empires, and Starcraft, and scores of others.

Increased reliability

If a small percentage of machines break, the rest of the system remains intact and can do useful work. Incremental growth. A company may buy a computer. Eventually the workload is too great for the machine. The only option is to replace the computer with a faster one. Networking allows you to add on to an existing infrastructure.

Remote services

Users may need to access information held by others at their systems. Examples of this include web browsing, remote file access, and programs such as Napster and Gnutella to access MP3 music.

Mobility

Users move around with their laptop computers, Palm Pilots, and WAP phones. It is not feasible for them to carry all the information they need with them.

WEEK # 1 - EXAMPLES OF DISTRIBUTED SYSTEMS

DAY # 2

Selected application domains and associated networked applications:

Finance And Commerce:

The growth of ecommerce as exemplified by companies such as Amazon and eBay, and underlying payments technologies such as PayPal; the associated emergence of online banking and trading and also complex information dissemination systems for financial markets.

The Information Society

The growth of the World Wide Web as a repository of information and knowledge; the development of web search engines such as Google and Yahoo to search this vast repository; the emergence of digital libraries and the large-scale digitization of legacy information sources such as books (for example, Google Books); the increasing significance of user-generated content through sites such as YouTube, Wikipedia and Flickr; the emergence of social networking through services such as Facebook and MySpace.

Creative Industries And Entertainment

The emergence of online gaming as a novel and highly interactive form of entertainment; the availability of music and film in the home through networked media centres and more widely in the Internet via downloadable or streaming content; the role of user-generated content (as mentioned above) as a new form of creativity, for example via services such as YouTube; the creation of new forms of art and entertainment enabled by emergent (including networked) technologies.

Transport And Logistics

The use of location technologies such as GPS in route finding systems and more general traffic management systems; the modern car itself as an example of a complex distributed system (also applies to other forms of transport such as aircraft); the development of web-based map services such as MapQuest, Google Maps and Google Earth.

Education

The emergence of e-learning through for example web-based tools such as virtual learning environments; associated support for distance learning; support for collaborative or community-based learning.

Financial Trading

As a final example, we look at distributed systems support for financial trading markets. The financial industry has long been at the cutting edge of distributed systems technology with its need, in particular, for real-time access to a wide range of information sources (for example, current share prices and trends, economic and political developments). The industry employs automated monitoring and trading applications.

Massively Multiplayer Online Games (MMOGs)

Massively multiplayer online games offer an immersive experience whereby very large numbers of users interact through the Internet with a persistent virtual world. Leading examples of such games include Sony's Ever Quest II and EVE Online from the Finnish company CCP Games.