CO451 Distributed Operating System

TH: 03 hrs   PR: 2 hrs
Max Marks: 100 TH + 50 PR   Credits 03+01

ISA Tool (Marks : 10)

1. Attendance
2. Class Notebook
3. Surprise Test
4. MiniProject/Case Study

What is Distributed Computing System?

Computer Architectures consisting of interconnected, multiple processors are of basically two types

- ▶ Tightly Coupled System
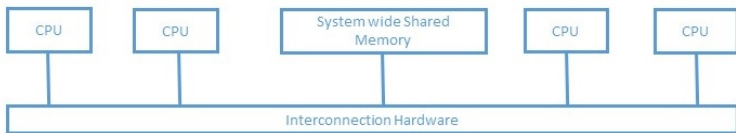- ▶ Loosely Coupled System
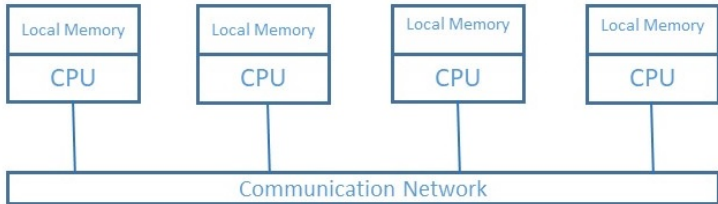
Figure: Tightly Coupled System

Figure: Loosely Coupled System

Evolution of DCS

Content of Evolution

Distributed Computing System Models

Various models are used for building distributed computing systems. These models can be broadly classified into five categories:

- ▶ Minicomputer Model
- ▶ Workstation Model
- ▶ Workstation-Server Model
- ▶ Processor-Pool Model
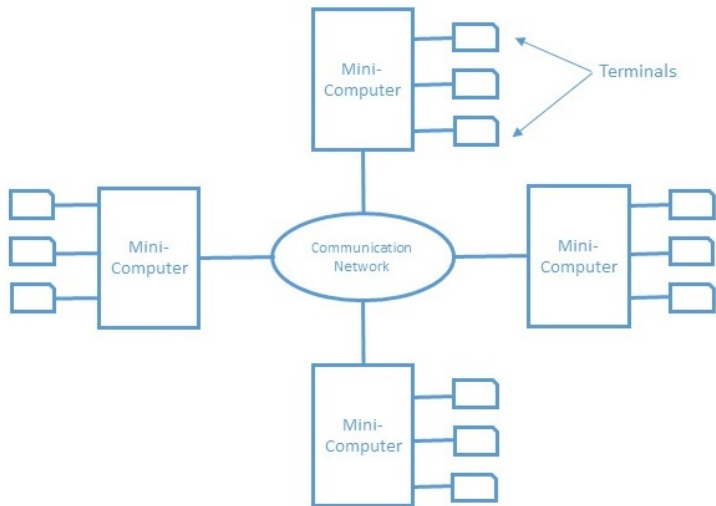- ▶ Hybrid Model

Minicomputer Model

Figure: A DCS based on the Minicomputer Model
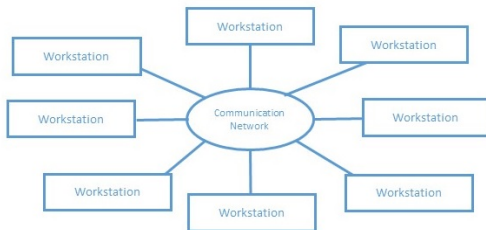
Workstation Model

Figure: A DCS based on the Workstation Model

Issues:

- ▶ How does the system find an idle workstation?
- ▶ How is a process transferred from one workstation to another to get it executed?
- ▶ What happens to a remote process if a user logs onto a workstation that was idle until now and being used to execute a process of another workstation?
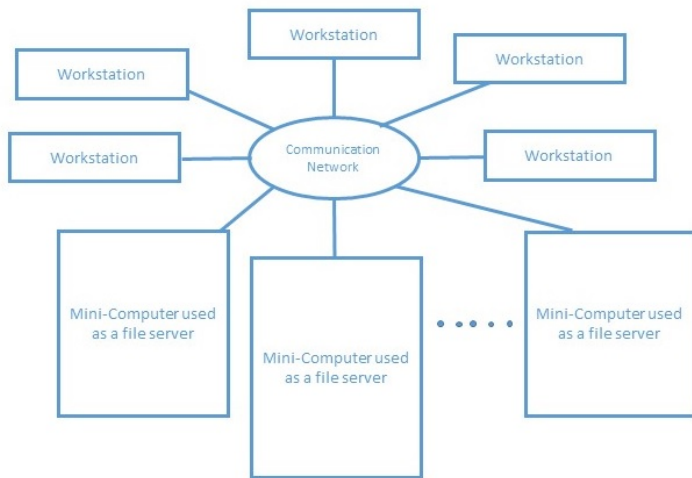
Workstation-Server Model

Figure: A DCS based on the Workstation-Server Model
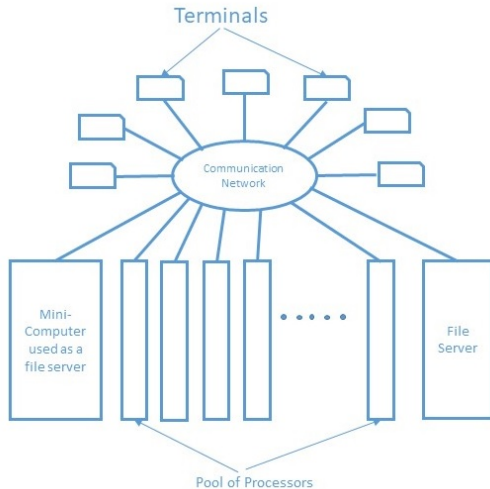
Processor-Pool Model

Figure: A DCS based on the Processor-Pool Model

Hybrid Model

Why are Distributed Systems Gaining Popularity?

Distributed Systems Gaining Popularity because...

- ▶ Inherently Distributed Applications
- ▶ Information Sharing among Distributed Users
- ▶ Resource Sharing
- ▶ better Price Performance Ratio
- ▶ Shorter Response Time and Higher Throughput
- ▶ Higher Reliability
- ▶ Extensibility and Incremental Growth
- ▶ Better Flexibility in Meeting User's Needs

What is Distributed Operating Systems?

- ▶ What is Operating System?
  A program that controls the resources of a computer system and provides its user with an interface or a virtual machine that is more convenient to use than the bare machine. Therefor, primary tasks of OS are;
  - ▶ To present users with a virtual machine that is easier to program than the underlying hardware.
  - ▶ To manage the various resources of the system.

- ▶ Features:
  1. System Image
  2. Autonomy
  3. Fault Tolerance Capability

Issues In Designing a Distributed Operating System

1. Transparency
2. Reliability
3. Flexibility
4. Performance
5. Scalability
6. Heterogeneity
7. Security
8. Emulation of Existing System

Issues In Designing a Distributed Operating System I

1. Transparency
   1.1 Access Transparency
   1.2 Location Transparency
   1.3 Replication Transparency
   1.4 Failure Transparency
   1.5 Migration Transparency
   1.6 Concurrency Transparency
   1.7 Performance Transparency
   1.8 Scaling Transparency

Issues In Designing a Distributed Operating System II

3. Flexibility
   3.1 Ease of Modification
   3.2 Ease of Enhancement

The most important design factors that affects the flexibility of a distributed operating system is the model used for designing its kernel. Two commonly used models for kernel design in distributed operating system are;

- Monolithic Kernel Model
- Microkernel Model

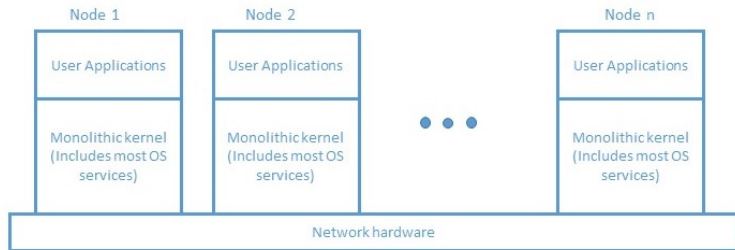# Issues In Designing a Distributed Operating System IV

▶ Monolithic Kernel

Figure: Monolithic Kernel Model

- Micro Kernel Model

Figure: Monolithic Kernel Model

4. Performance
   Some design principles considered useful for better
   performance as follows

   - Batch if Possible
   - Cache whenever Possible
   - Minimize copying of Data
   - Minimize Network Traffic

Issues In Designing a Distributed Operating System VII

5. Scalability

   Some guiding principles for designing Scalable Distributed
   Operating Systems are as follows
   - Avoid Centralized Entities
   - Avoid Centralized Algorithms
   - Perform Most Operations on Client Workstations

6. Heterogeneity
7. Security