

# CO541 Distributed Operating System

TH: 03 hrs

PR: 2 hrs

Max Marks: 100 TH + 50 PR

Credits 03+01

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ISA Tool (Marks : 10)

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

# What is Distributed Operating System?

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

- ▶ Tightly Coupled System
- ▶ Loosely Coupled System

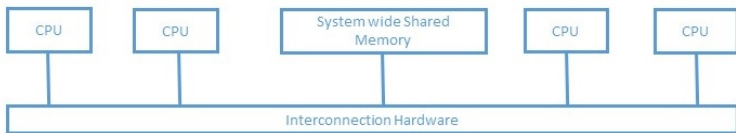


Figure: Tightly Coupled System

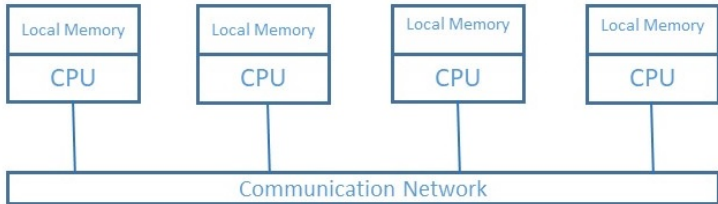


Figure: Loosely Coupled System

# Evolution of DCS

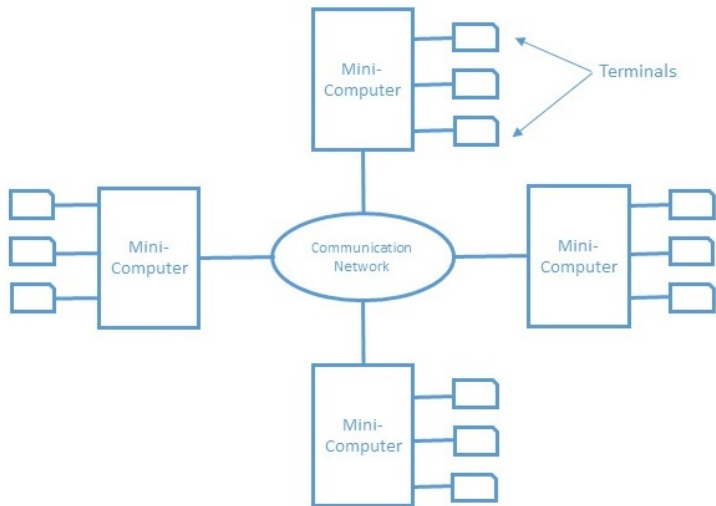
## Content of Evolution

# Distributed Computing System Models

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

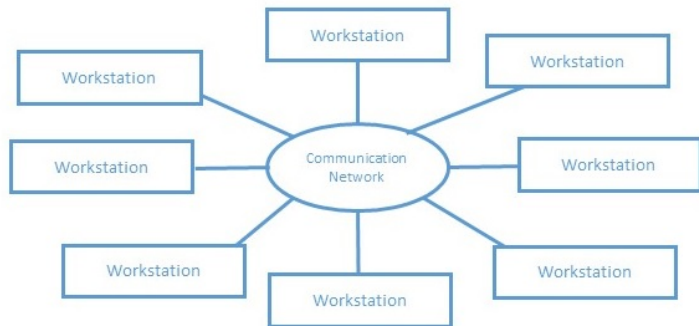
- ▶ Minicomputer Model
- ▶ Workstation Model
- ▶ Workstation-Server Model
- ▶ Processor-Pool Model
- ▶ Hybrid Model

# Minicomputer Model



**Figure:** A Distributed Computing System based on the Minicomputer Model

# Workstation Model

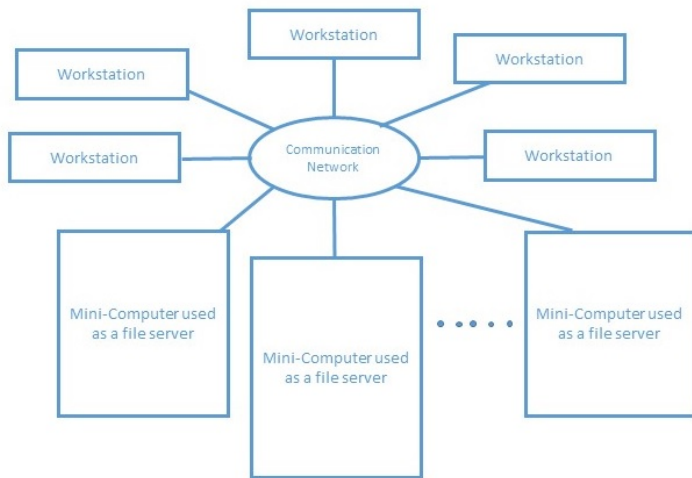


**Figure:** A Distributed Computing System based on the Workstation Model

Issues:

- ▶ How does the system find an idle workstation?
- ▶ How is a process transferred from one workstation to another to get it executed?

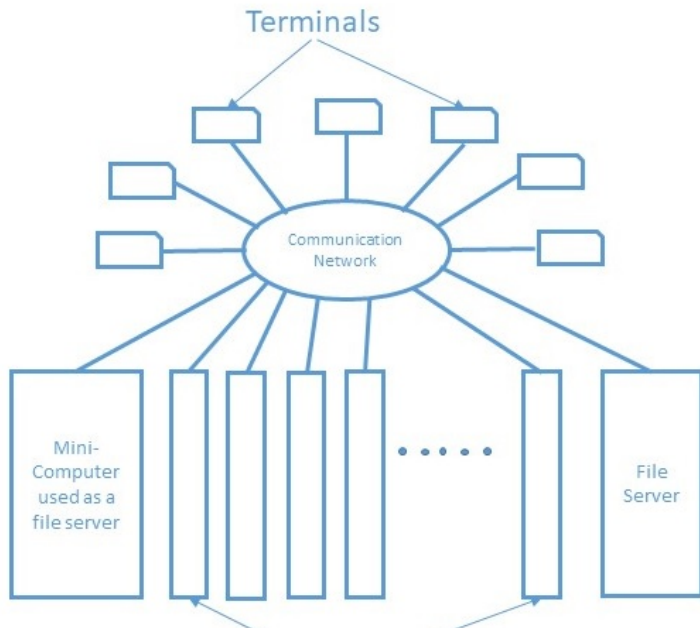
# Workstation-Server Model



**Figure:** A Distributed Computing System based on the Workstation-Server Model



# 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

## 2. Reliability

2.1 Fault Avoidance

2.2 Fault Tolerance

2.3 Fault Detection and Recovery

# Issues In Designing a Distributed Operating System III

## 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

## 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 V

## 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