



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

Self-study:

- ▶ Process Management
- ▶ Distributed File System

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What is Distributed Computing System?

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

- ▶ Tightly Coupled System
- ▶ Loosely Coupled System

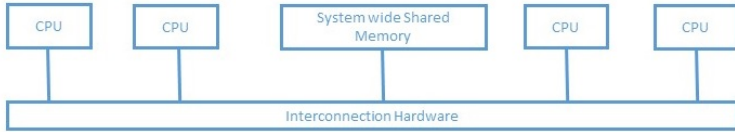


Figure: Tightly Coupled System

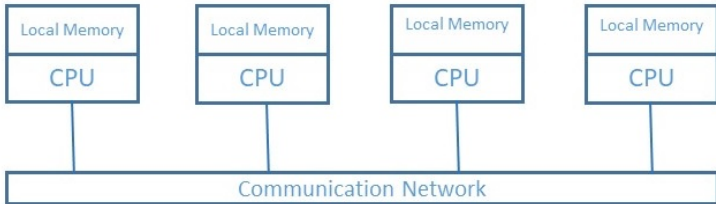


Figure: Loosely Coupled System

Evolution of DCS



- ▶ Large Size Computer
- ▶ Batching
- ▶ Job Sequencing
- ▶ Multiprogramming
- ▶ Time Sharing
- ▶ Mini Computers and so on



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

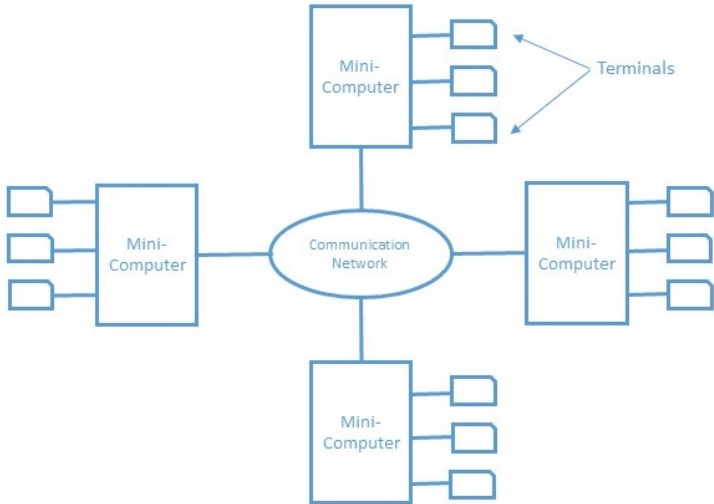


Figure: A DCS based on the Minicomputer Model

Workstation Model

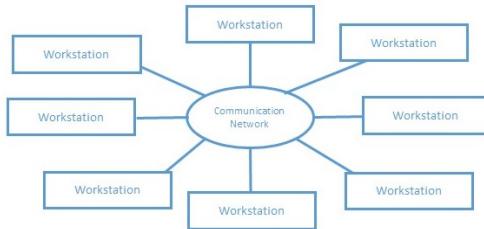


Figure: A DCS based on the Workstation Model

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

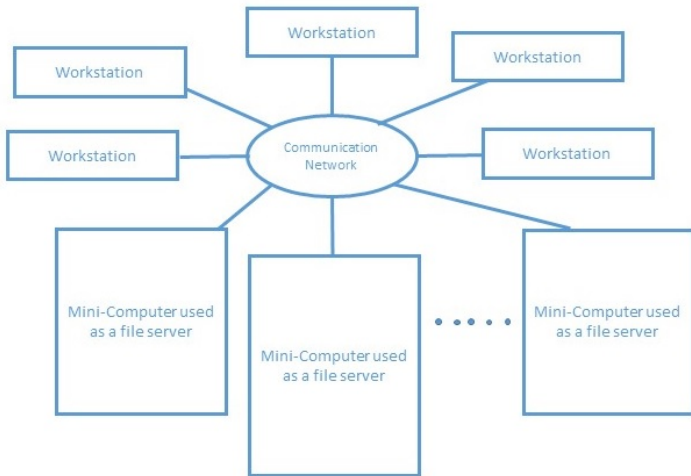


Figure: A DCS based on the Workstation-Server Model

Processor-Pool Model

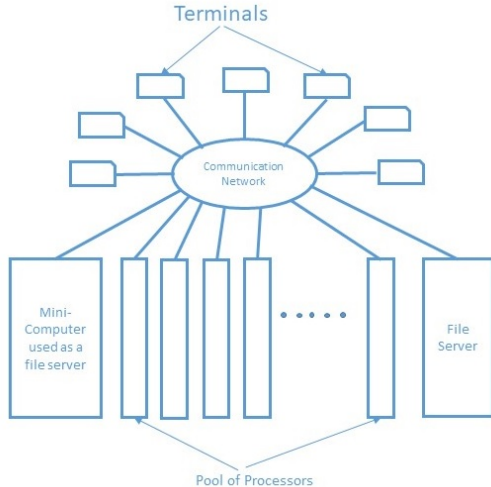


Figure: A DCS based on the Processor-Pool Model

Hybrid Model



Hybrid Model = Workstation-Server + Processor-Pool

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 computer system resources and provides interface to its user.

Therefore, primary tasks of OS are;

- ▶ To present users with a virtual machine that is easier to program.
- ▶ To manage the various resources of the system.

The Operating Systems commonly used for DCS can be classified on

- ▶ Network Operating System
- ▶ Distributed Operating System

▶ Features used to differentiate NOS and DOS are:

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



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



► Monolithic Kernel

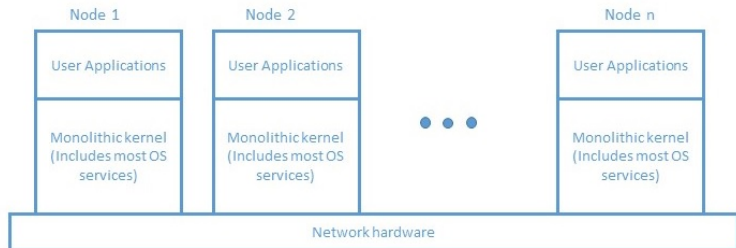


Figure: Monolithic Kernel Model

Issues In Designing a Distributed Operating System V



► Micro Kernel Model

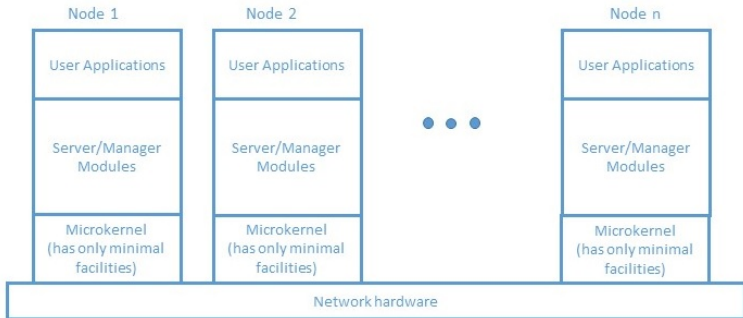


Figure: Monolithic Kernel Model



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



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

Enforcement of security needs following requirements

- ▶ It should be possible for the sender to know that the message was received by the intended receiver
- ▶ It should be possible for receiver to know that the message was sent by the genuine sender
- ▶ It should be possible for both sender and receiver the message were not changed while it was in transfer.