CO451 Distributed Operating System

TH: 03 hrs
Max Marks: 100 TH + 50 PR

PR: 2 hrs
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

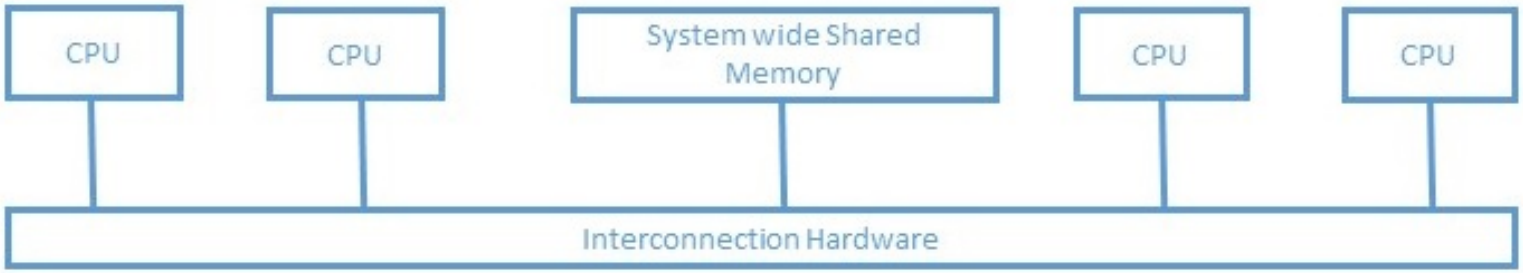

Figure: Tightly Coupled System

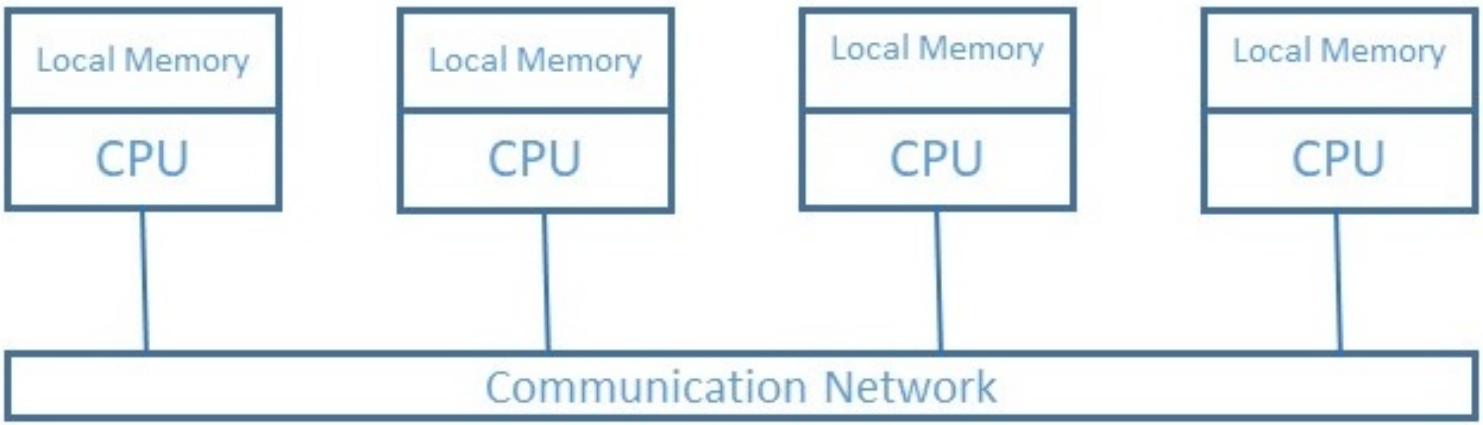

Figure: Loosely Coupled System

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

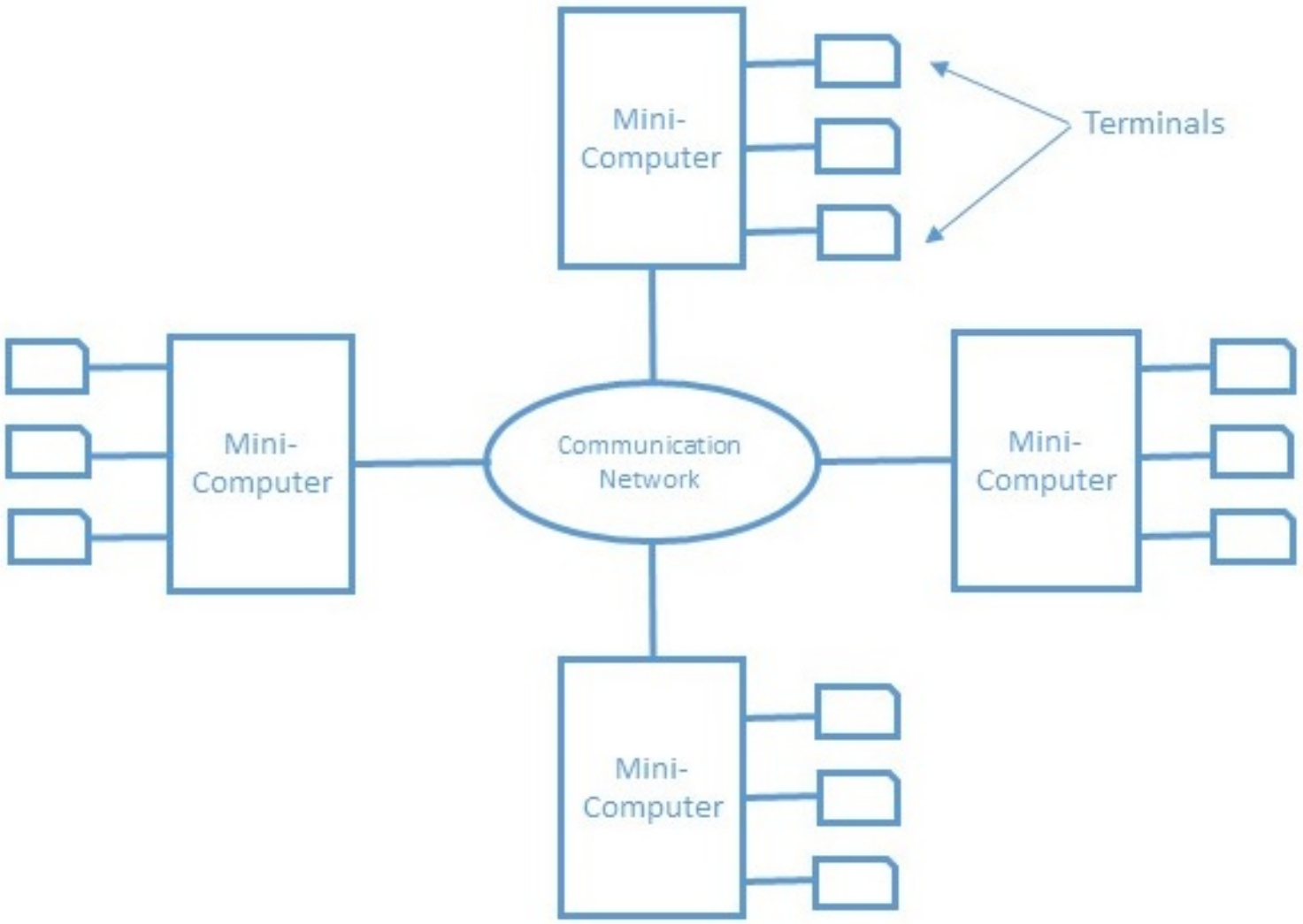

Figure: A DCS based on the Minicomputer Model

Workstation Model

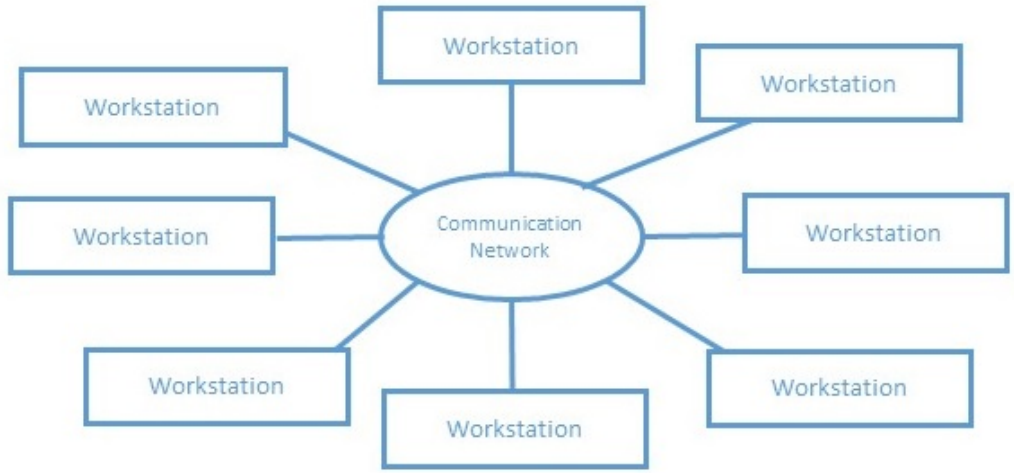

Figure: A DCS based on the Workstation Model

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

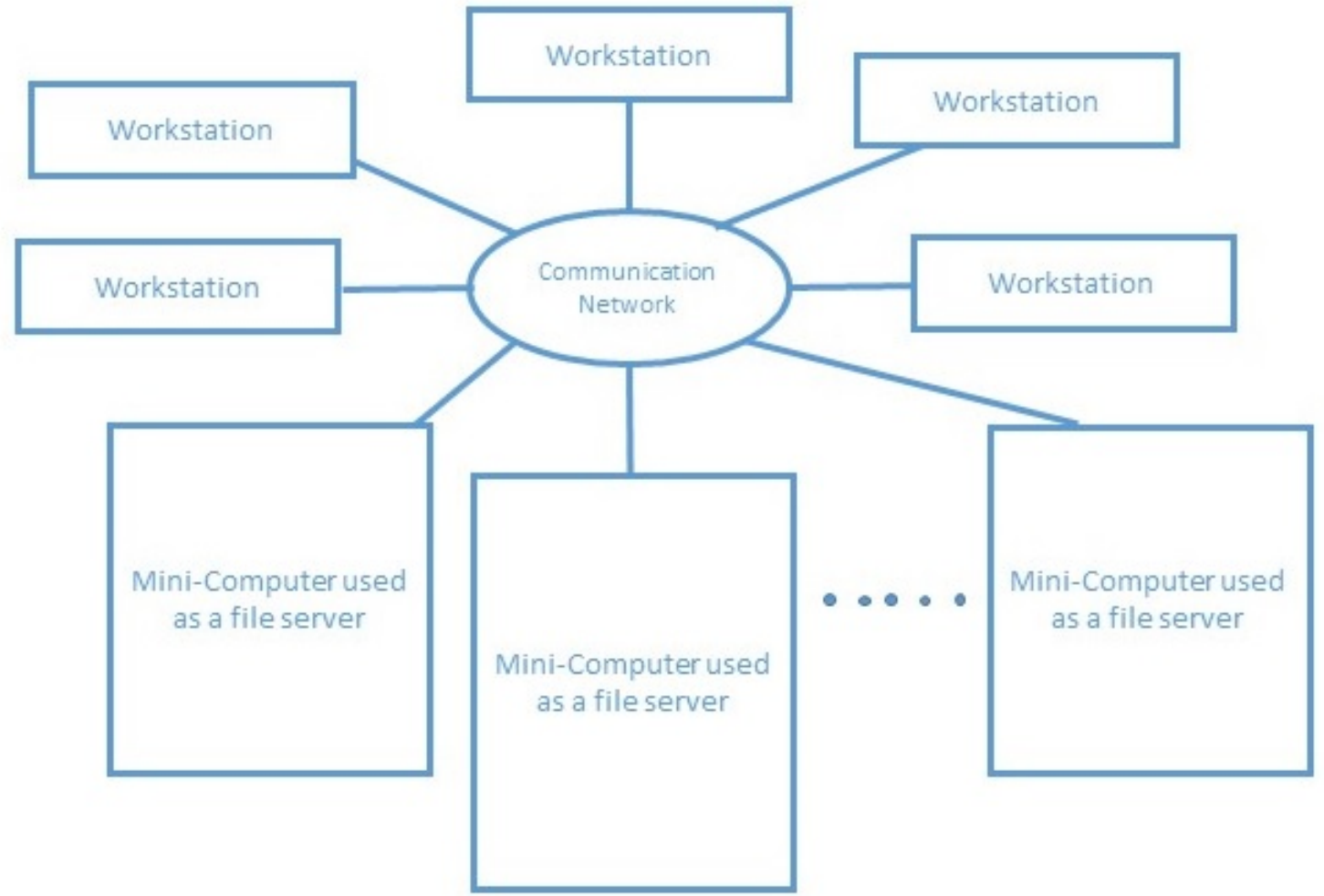

Figure: A DCS based on the Workstation-Server Model

Processor-Pool Model

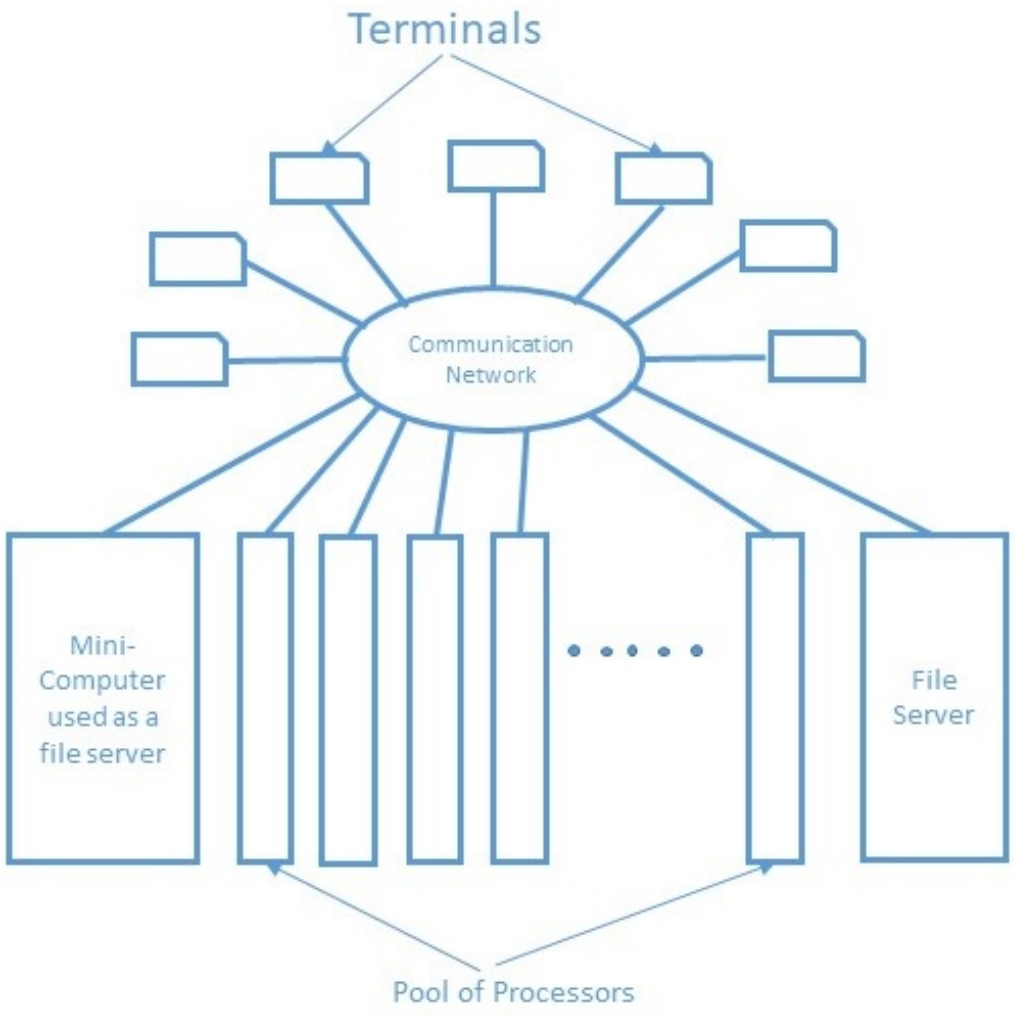

Figure: A DCS based on the Processor-Pool Model

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.
  Therefor, 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

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

- Monolithic Kernel

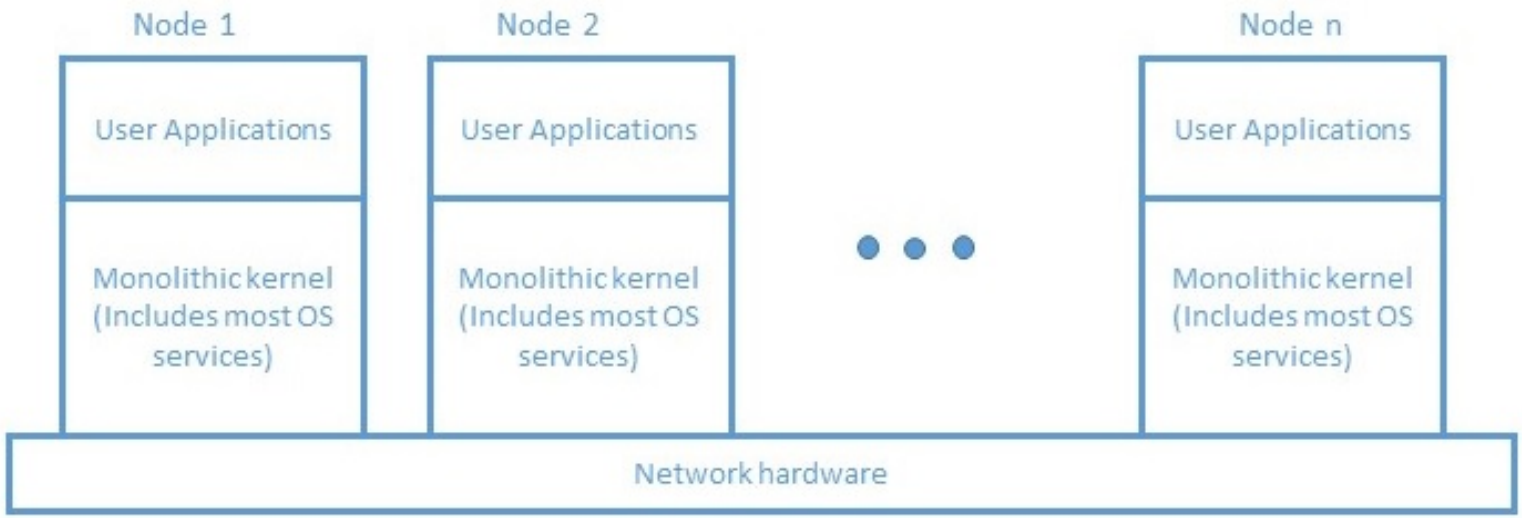

Figure: Monolithic Kernel Model

Issues In Designing a Distributed Operating System V

- Micro Kernel Model

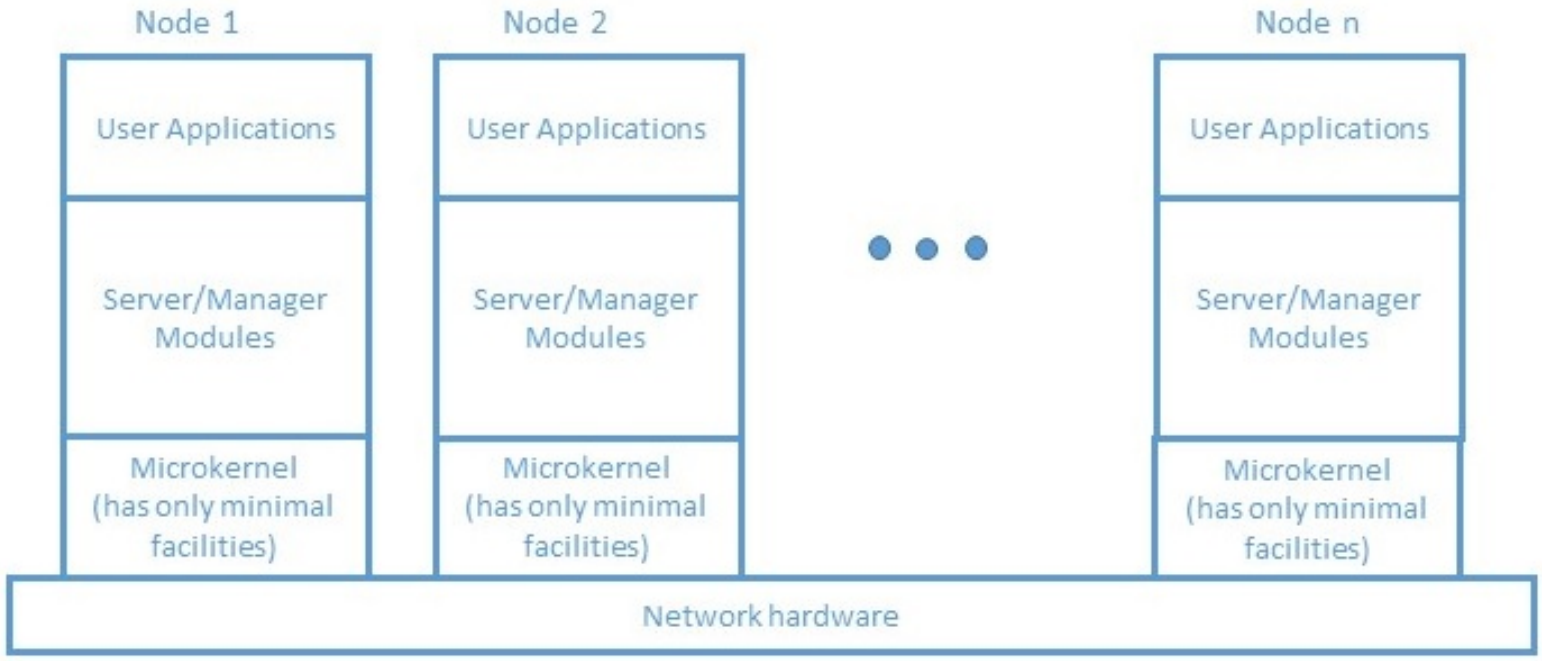

Figure: Monolithic Kernel Model

Issues In Designing a Distributed Operating System VI

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
   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.