Assignment 1

19UCS122

Q1. Define OS and list the basic services provided by OS.

-> An operating system is a program that manages a computer's hardware. It also provides a basis for application programs and acts as an intermediary between the computer user and the computer hardware.

Users <-> Application <-> Programs <-> OS <-> Hardware

Operating-System Services:-

1. An operating system provides an environment for the execution of programs.
2. It provides certain services to programs and the users of those programs.
3. The specific services provided, of course, differ from one operating system to another.
4. These operating system services are provided for the convenience of the programmer, to make

1. User interface:--

Almost all operating systems have a user interface
(UI). command-line interface, batch interface, and graphical user interface (GUI).

2. Program execution:--

The system must be able to load a program into memory and to run that program

3. IO operations:--

A running program may require IO, which may involve a file or an IO device

4. File-system manipulation:--

The file system is of particular interest.
Obviously, programs need to read and write files and directories. They also need to create and delete them by name, search for a given file, and list file information.

5. Error detection:--

The operating system needs to be detecting and correcting errors constantly.

1 Errors may occur in the CPU and memory hardware (such as a memory error or a power failure).

2. In I/O devices (such as a parity error on disk, a connection failure on a network, or lack of paper in the printer).

3. In the user program (such as an arithmetic overflow, an attempt to access an illegal memory location, or a too-great use of CPU time)

6. Resource allocation:--

When there are multiple users or multiple jobs
running at the same time, resources must be allocated to each of them.

7. Accounting:--

We want to keep track of which users use

how much and what kinds of computer resources. This record-keeping may be used for accounting

8. Protection and security:--

The owners of information stored in a multiuser or networked computer system may want to control the use of that information.

Q2. Differentiate between single processor system and multiprocessor system.

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Single-Processor operating Systems:-

1. They perform only one process at a given time.
2. And it carries out the next process in the queue only after the current process is completed.
3. OS monitors the status and also sends them the next executable instruction.

Multiprocessor Operating Systems:-

1. This refers to the use of two or more central processing units within a single computer system.
2. These multiple CPUs share the computer bus, memory, and other peripheral devices.
3. These types of systems are used when very high speed is required to process a large volume of data

Q 3. Explain symmetric and asymmetric multiprocessor systems with a neat diagram.

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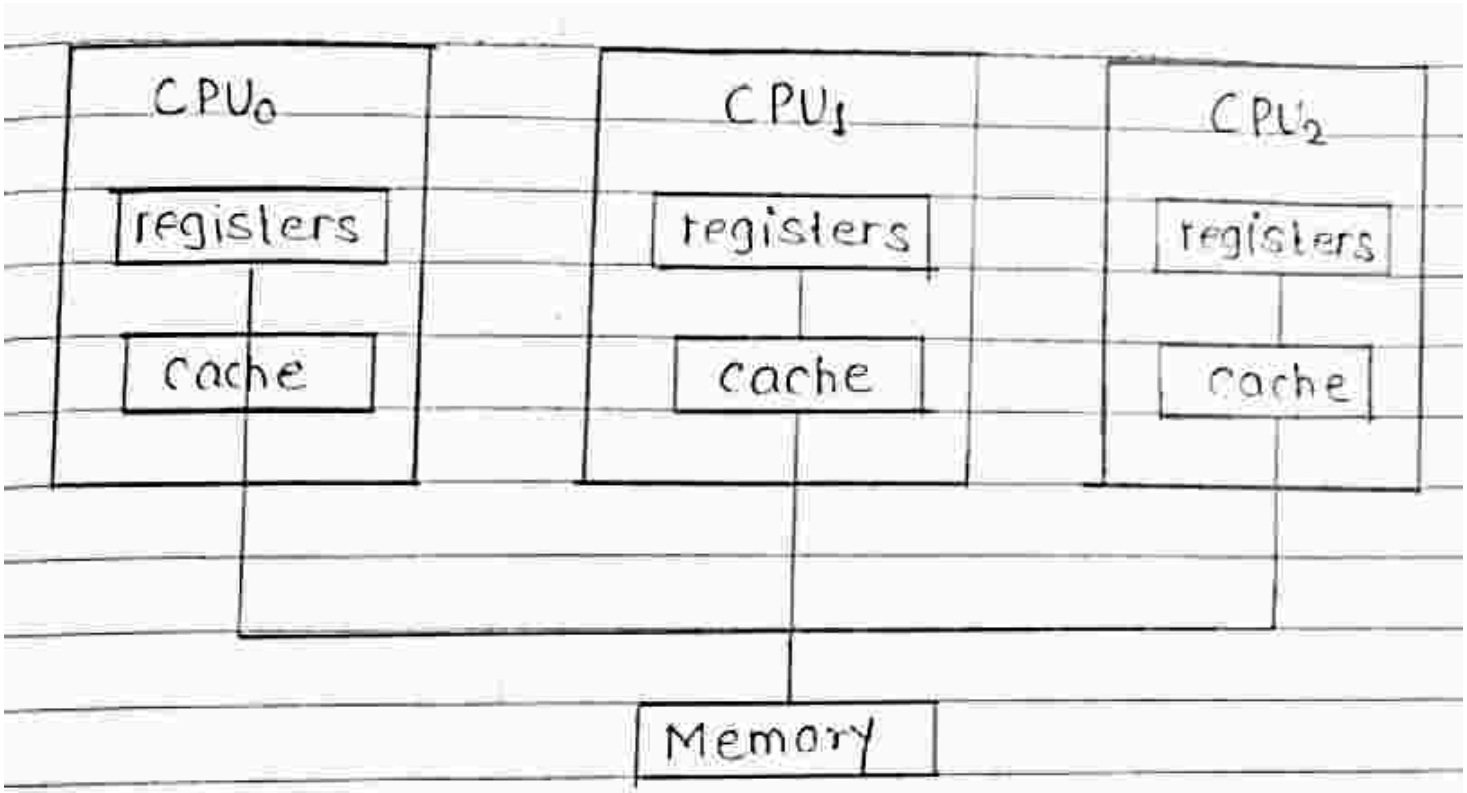
The multiple-processor systems in use today are of two types:-

Asymmetric multiprocessing:-

In which each processor is assigned a specific task

1. A boss processor controls the system; the



Symmetric multiprocessing architecture.

other processors either look to the boss for instruction or have predefined tasks

2. This scheme defines a boss-worker relationship.

3. The boss processor schedules and allocates work to the worker processors.

Symmetric multiprocessing:-

In which each processor performs all tasks within the operating system.

1. SMP means that all processors are peers; no boss-worker relationship exists between processors.

2. Notice that each processor has its own set of registers, as well as a private or local cache

3. However, all processors share physical memory

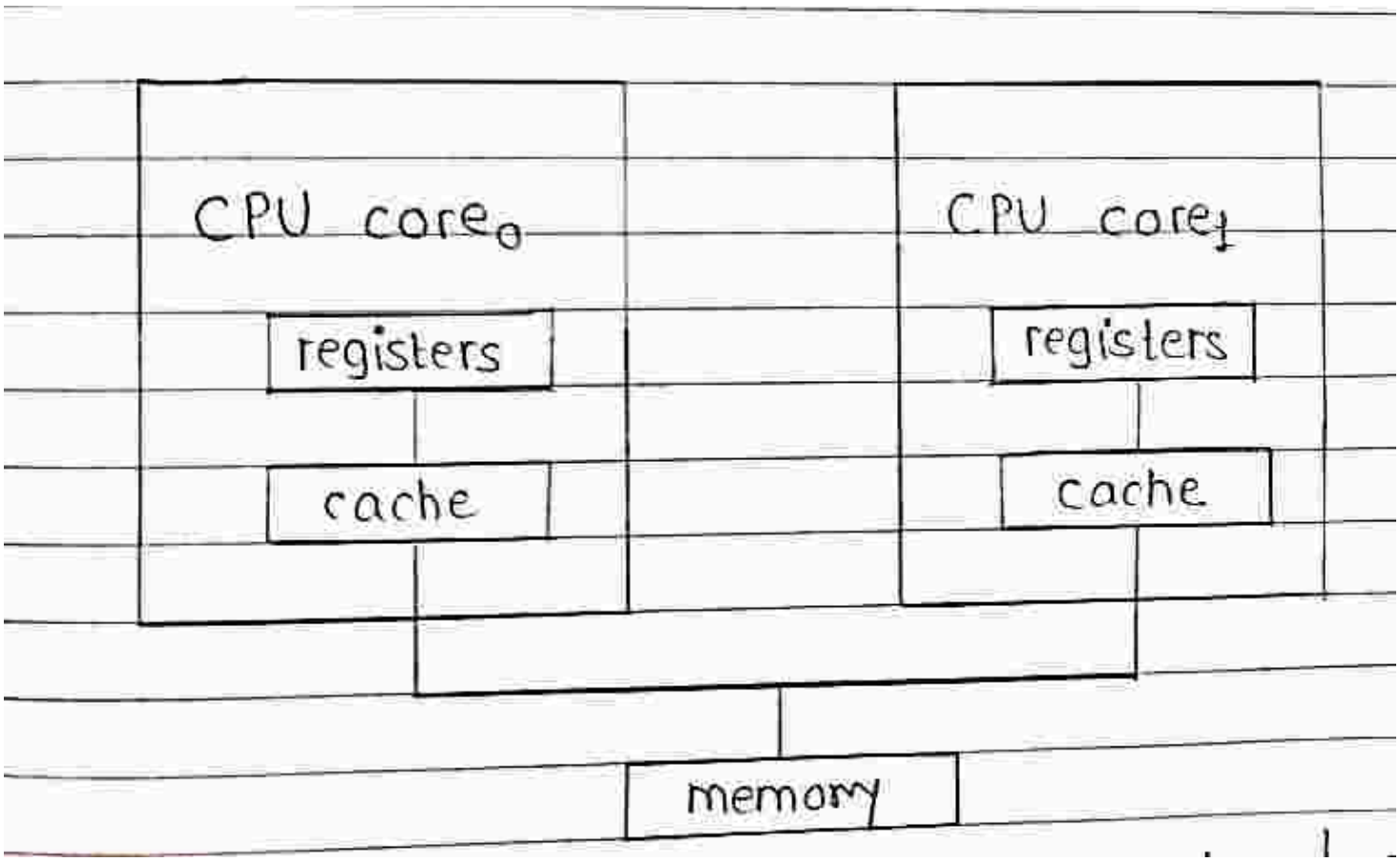
Q4. -> Explain multiprocessor OS & their types in detail

A multi-core processor is a single computing component with two or more independent processing units called cores, which read and execute program instructions

They can be more efficient than multiple chips with single cores because on-chip communication is faster than between-chip communication.

Clustered Systems:-

1. Another type of multiprocessor system is a clustered system, which gathers together multiple CPUs.
2. Clustered systems differ from multiprocessor systems in that they are composed of two or more individual systems or nodes joined together.
3. Such systems are considered loosely coupled.
4. Each node may be a single processor system or a multi-core system.


CPU core0
registers
cache
CPU core1
registers
cache
memory

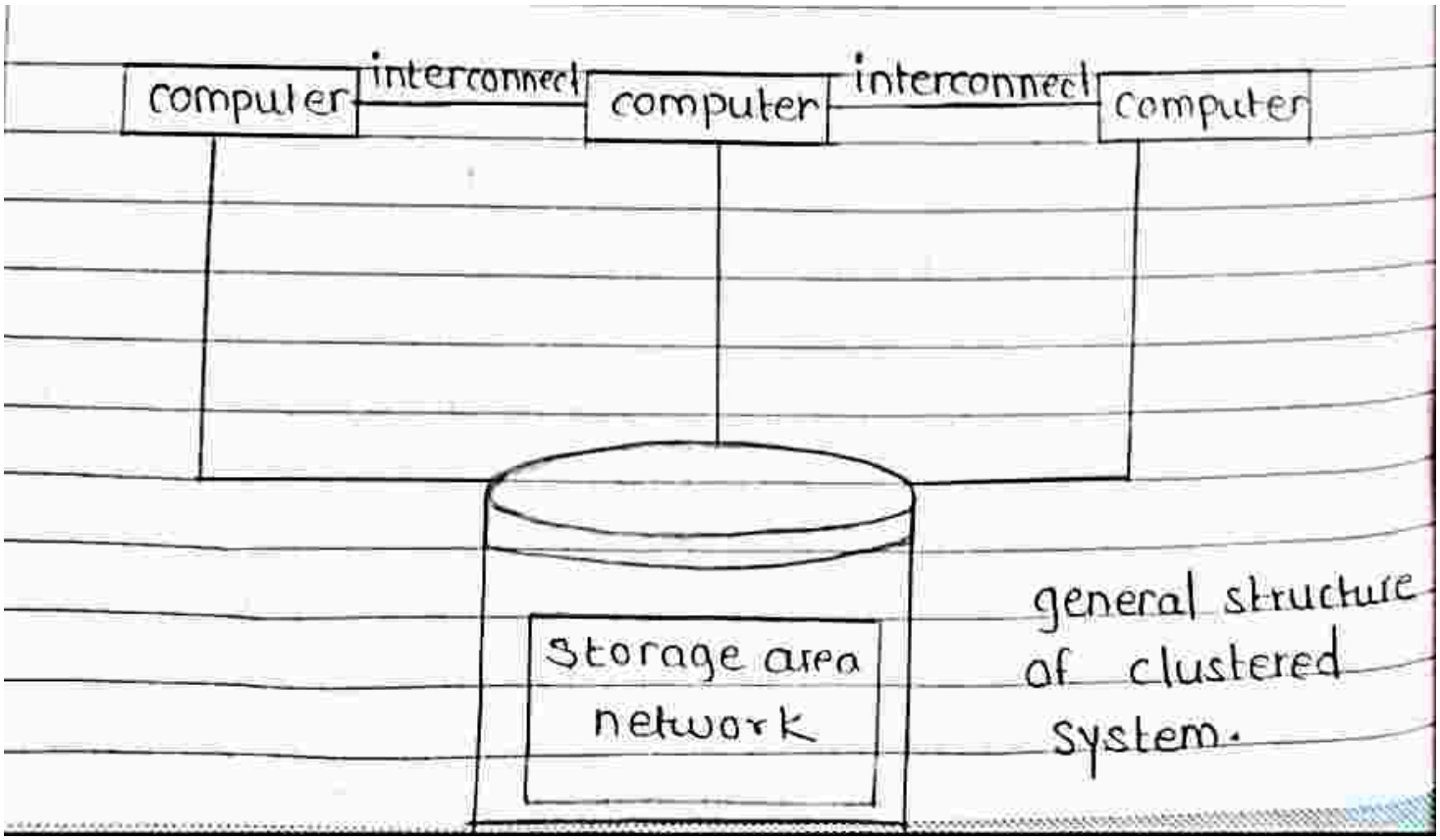
4. Clustering is usually used to provide high-availability service that is, service will continue even if one or more systems in the cluster fail.

Clustering can be structured asymmetrically or symmetrically

In asymmetric clustering, one machine is in hot-standby mode while the other is running the applications.

The hot-standby host machine does nothing but monitors the active server.
If that server fails, the hot-standby host becomes the active server

In symmetric clustering, two or more hosts are running applications and are monitoring each other. This structure is obviously more efficient, as it uses all of the available hardware



general structure of clustered system.

Q5. Define the following types of systems with their properties.

a. Time-sharing System

b. Distributed System

c. Real-time System

-> d. Parallel System

a. Timesharing System :

It is a logical extension of multiprogramming in which the CPU switches jobs so frequently that users can interact with each job while it is running, creating interactive computing

1. Response time should be < 1 second

2. Each user has at least one program executing in memory Process

3. If several jobs are ready to run at the same time, the system uses CPU scheduling

4. If processes don't fit in memory, swapping moves them in and out to run

5. Virtual memory allows the execution of processes that are not completely in memory
6. It enables users to run programs that are larger than actual physical memory.
7. A time-sharing system must also provide a file system that resides on a collection of disks; hence, disk management must be provided.
8. Also, the time-sharing system must provide mechanisms for job synchronization and communication, ensure that jobs do not get stuck in a deadlock, forever waiting for one another.

b. Distributed System :

A distributed system is a collection of physically separate, possibly heterogeneous, computer systems that are networked to provide users with access to the various resources that the system maintains

Access to a shared resource increases

computation speed, functionality, data availability, and reliability

3. Generally, systems contain a mix of the two modes – for example, FTP and NFS.

4. Distributed systems depend on networking for their functionality.

Q6. Write a note on :

a. Computing Environments

b. System calls

C. OS Structure

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a. Computing Environments :

It's important to study how operating systems are used in a variety of computing environments.

There are total 7 Types :

1. Traditional Computing

2. Mobile Computing

3. Distributed Systems

4. Client -Server Computing

5. Peer-to-Peer Computing
6. Virtualization
7. Cloud Computing

1. Traditional Computing:

Today, traditional time-sharing systems are uncommon which used timer and scheduling algorithms to cycle processes rapidly through the CPU, giving each user a share of the resources.

The current trend is toward providing more ways to access these computing environments.

User processes, and system processes that provide services to the user, are managed so that each frequently gets a slice of computer time

Web technologies and increasing WAN bandwidth are stretching the boundaries of traditional computing.

Companies establish portals, which provide web access to their internal servers

2. Mobile Computing:

Refers to computing on handheld smartphones and tablet computers. These devices share the distinguishing physical features of being portable and lightweight.

In fact, we might argue that the features of a contemporary mobile device allow it to provide functionality that is either unavailable or impractical on a desktop or laptop computer.

In several computer games that employ accelerometers, players interface with the system not by using a mouse or a keyboard but rather by tilting, rotating, and shaking the mobile device!

Perhaps more practical use of these features is found in augmented-reality applications, which overlay information on a display of the current environment

The memory capacity and processing speed of mobile devices, however, are more limited than those of PCs.

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4. Client -Server Computing:

Terminals connected to centralized systems are now being supplanted by PCs and mobile devices.

many of today's systems act as server systems to satisfy requests generated by client systems. This form of the specialized distributed

the system is called a client-server system.

It has the general structure as shown in fig

5. Peer-to-Peer Computing:

In a client-server system, the server is a bottleneck; but in a peer-to-peer system, services can be provided by several nodes distributed throughout the network

In the peer-to-peer (P2P) system model, clients and servers are not distinguished from one another.

Instead, all nodes within the system are considered peers, and each may act as either a client or a server, depending on whether it is requesting or providing a service

6. Virtualization:

Allows operating systems to run as applications within other operating systems using Emulation.

Here, every machine-level instruction that runs natively on the source system must be translated to the equivalent function on the target system, frequently resulting in several target instructions.

7. Cloud Computing:

Computing that delivers computing, storage, and even applications as a service across a network.

In some ways, it's a logical extension of virtualization, because it uses virtualization as a base for its functionality

b. System calls :

In computing, a system call is a programmatic way in which a computer program requests a service from the kernel of the operating system it is executed

A system call is a way for programs to interact with the operating system

System call provides the services of the operating system to the user programs via Application Program Interface (API)

Possible error conditions for each operation can require additional system calls.

When the program tries to open the input file, for example, it may find that there is no file of that name or that the file is protected against access

In these cases, the program should print a message on the console (another sequence of system calls.

Simple programs may make heavy use of the operating system. Frequently, systems execute thousands of system calls per second.

Typically, application developers design programs according to an application programming interface (API).

API is a set of functions and procedures that allow the creation of applications

System calls can be grouped roughly into six major categories:

Process control

File manipulation

Device manipulation

Information maintenance

communications

protection.

C. OS Structure :

1. Layered Approach

With proper hardware support, operating systems can be broken into pieces that are smaller and more appropriate than those allowed by the original MS-DOS and UNIX systems.

Layering provides a distinct advantage in an operating system. All the layers can be defined separately and interact with each other as required.

Also, it is easier to create, maintain and update the system if it is done in the form of layers.

Change in one layer specification does not affect the rest of the layers.

Each of the layers in the operating system can only interact with the layers that are above and below it

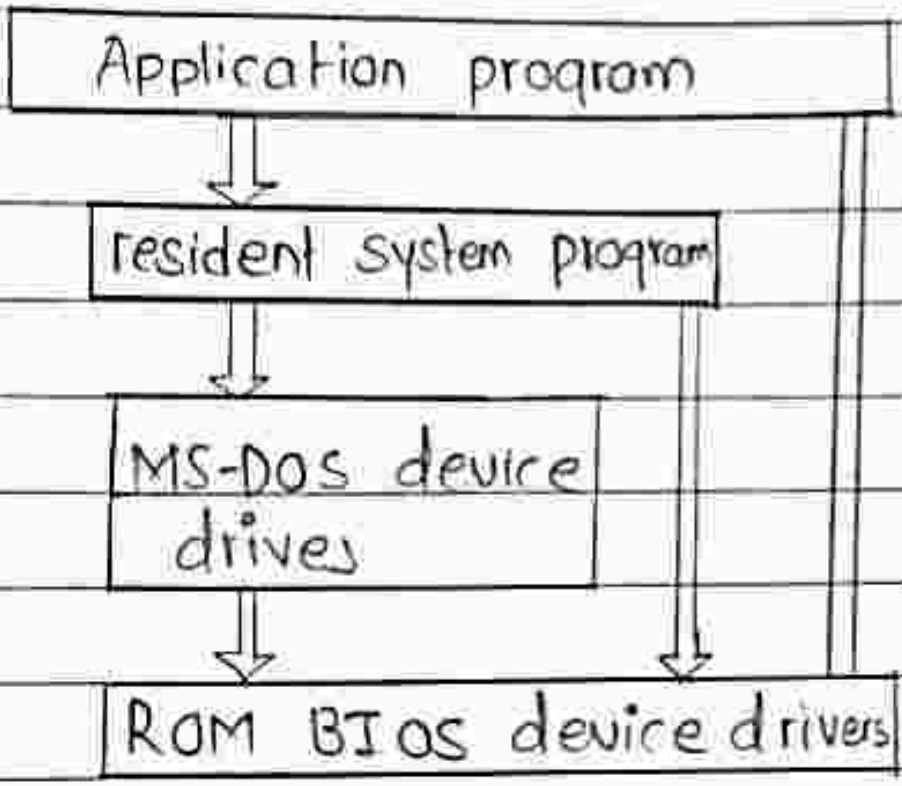
The lowest layer handles the hardware and the uppermost layer deals with the user applications.

A typical operating-system layer— say, layer M — consists of data structures and a set of routines that can be invoked by higher-level layers.

Layer M, in turn, can invoke operations on lower-level layers

2. Microkernels :

In UNIX expanded OS, the kernel became large and difficult to manage.



MS-DOS layer structure

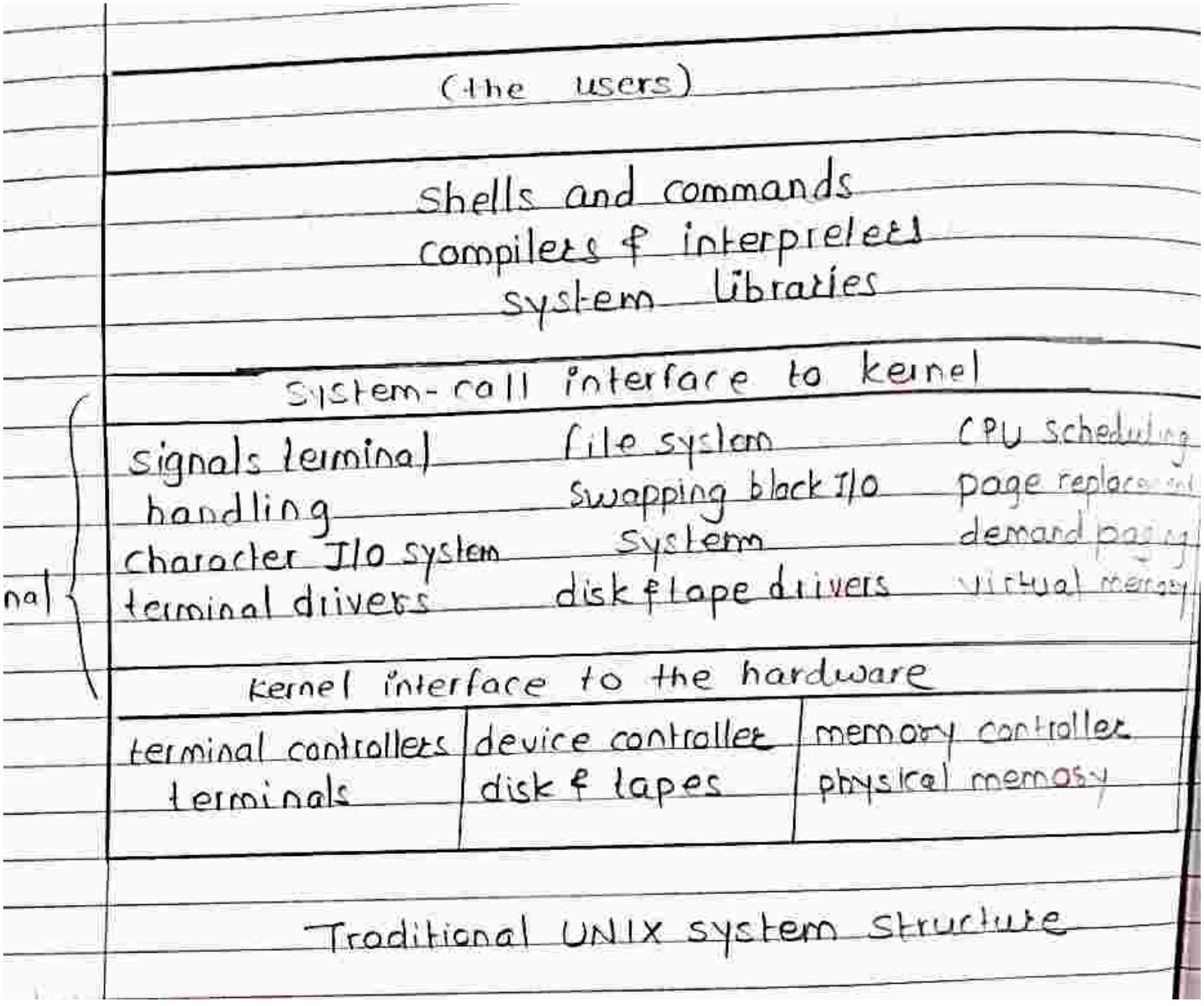
This method structures the operating system by removing all nonessential components from the kernel and implementing them as a system and user-level programs.

The result is a smaller kernel.

Typically, however, microkernels provide minimal process and memory management, in addition to a communication facility

The main function of the microkernel is to provide communication between the client program and the various services that are also running in userspace.

Communication is provided through message passing.



Traditional UNIX system structure