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System Software CAT-204

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Syllabus

UNIT-I

Introduction to System Software: Machine Structure, evolution of operating system, machine language.

Assembler: Elements of Assembly Language Programming, General design procedure, design of a Two Pass Assemblers, A Single Pass Assemblers Design.

Table Processing: Searching & Sorting.

Syllabus

UNIT-II

Macro and Macro Processors: Macro instructions, Features of a macro Facility: macro Instruction arguments, Conditional macro expansion, Macro calls within macros, Macro instruction defining macros, Advanced Macro Facilities, Implementation of simple macro processor, Two-pass algorithm, Implementation of macro calls within macros, Implementation within an assembler.

Linkers – Translated linked and load time addresses, relocation and linking concepts, Design of a linker, self relocating programs.

Syllabus

UNIT-III

Loaders: Loader scheme, absolute loaders, Subroutine linkages, Relocating loaders, Direct linking loaders, binders, linking loaders, overlays, Dynamic Binders, Design of an Absolute Loader, Design of a Direct-Linking Loader. Compilers: Phases of Compiler Construction, Symbol Table, Top-down and bottom-up Parsing, Operator-Precedence Parsing, LR Parsers, Code Generation and Code Optimization, Memory management, Design & other issues.



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Evolution of Operating Systems



- What is an Operating System?
- Mainframe Systems
- Desktop Systems
- Multiprocessor Systems
- Distributed Systems
- Clustered System
- Real -Time Systems
- Handheld Systems
- Operating System Services
- Operating System Calls
- System programs

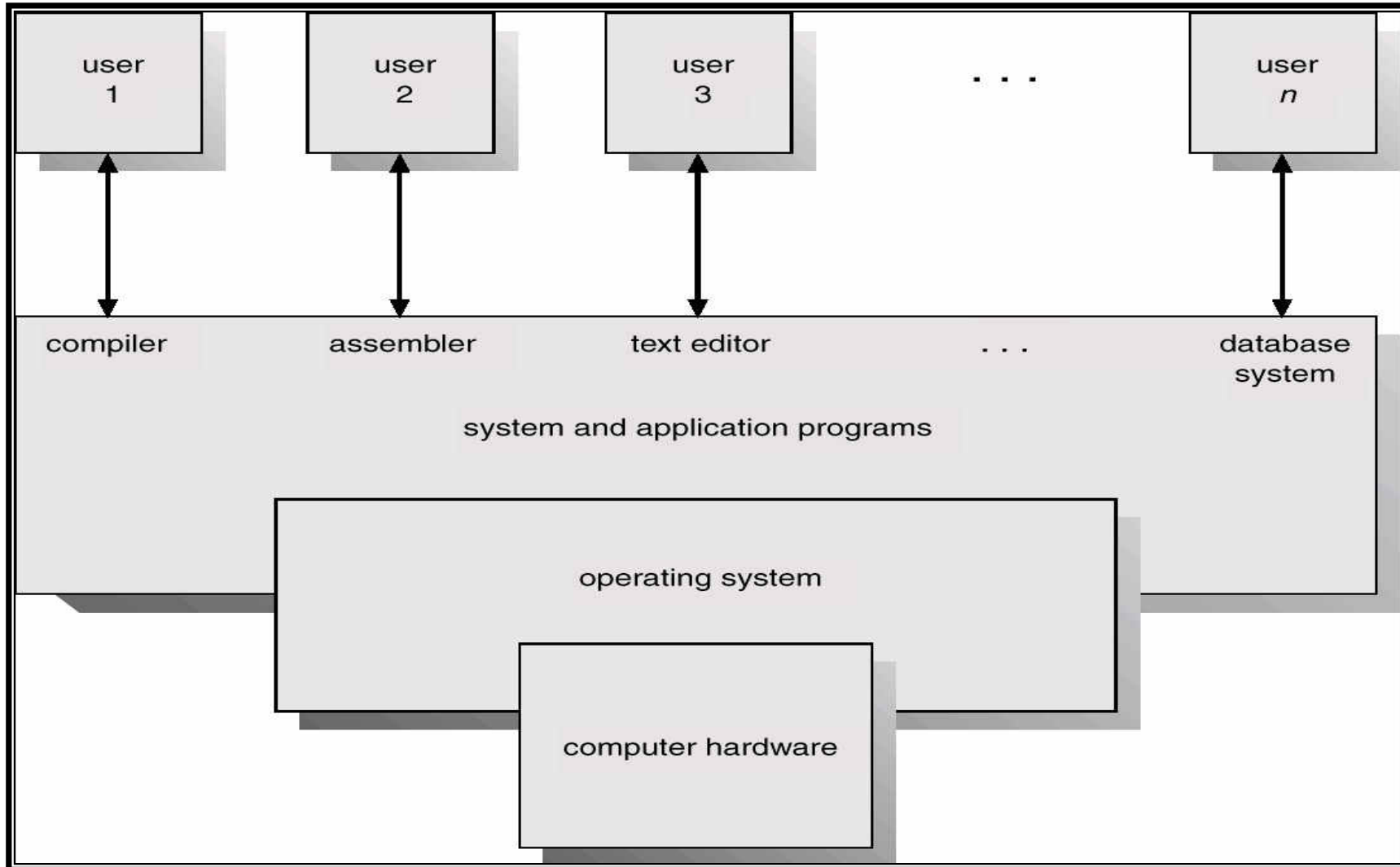
Meaning

- A program that acts as an intermediary between a user of a computer and the computer hardware.
- Operating system goals:
 - Execute user programs and make solving user problems easier.
 - Make the computer system convenient to use.
- To Manage & make use of the computer hardware in an efficient manner.

Computer System Components

1. **Hardware** – provides basic computing resources (CPU, memory, I/O devices).
2. **Operating system** – controls and coordinates the use of the hardware among the various application programs for the various users.
3. **Applications programs** – define the ways in which the system resources are used to solve the computing problems of the users (compilers, database systems, video games, business programs).
4. **Users**- people, machines, other computers.

Abstract View of Computer System Components



Operating System Definitions

- Resource allocator – manages and allocates resources.
- Control program – controls the execution of user programs and operations of I/O devices .
- Kernel – the one program running at all times (all else being application programs).

The Types of Operating Systems

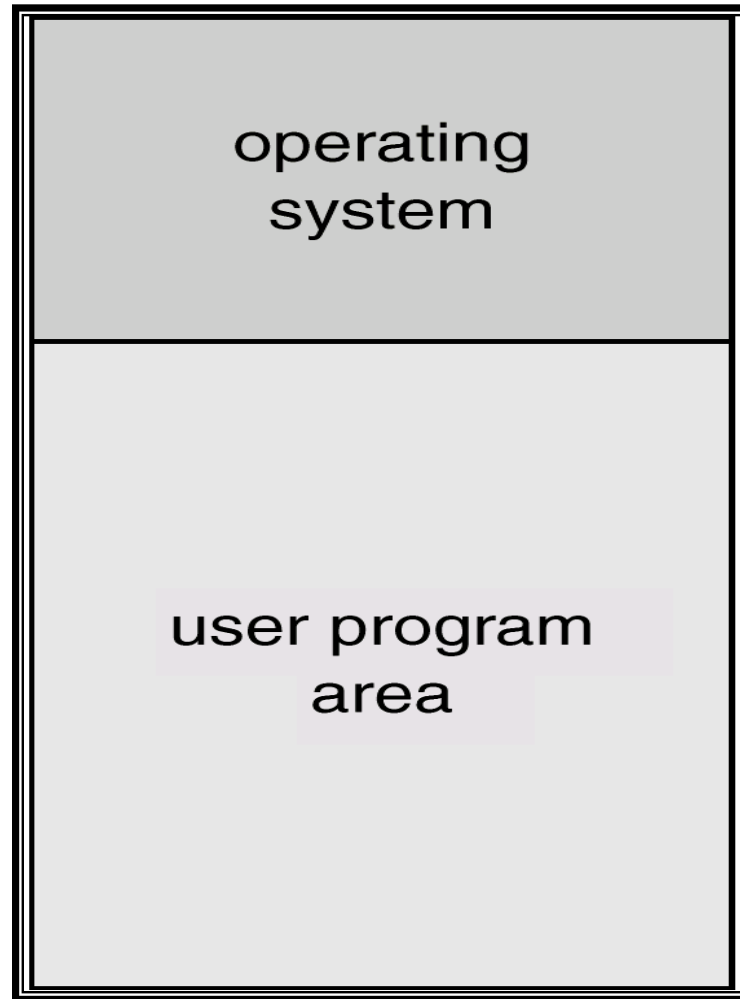
1. Mainframe Systems

- Reduce setup time by batching similar jobs
- Automatic job sequencing – automatically transfers control from one job to another. First rudimentary operating system.
- Resident monitor
 - initial control in monitor
 - control transfers to job
 - when job completes control transfers back to monitor

1.1 Simple Batch Systems

- To speed up the processing ,the jobs with similar needs are **batched** together and are run through the computer as group.
- The CPU is sometimes idle as its processing speed is far more than the I/O devices.

Memory Layout for a Simple Batch System

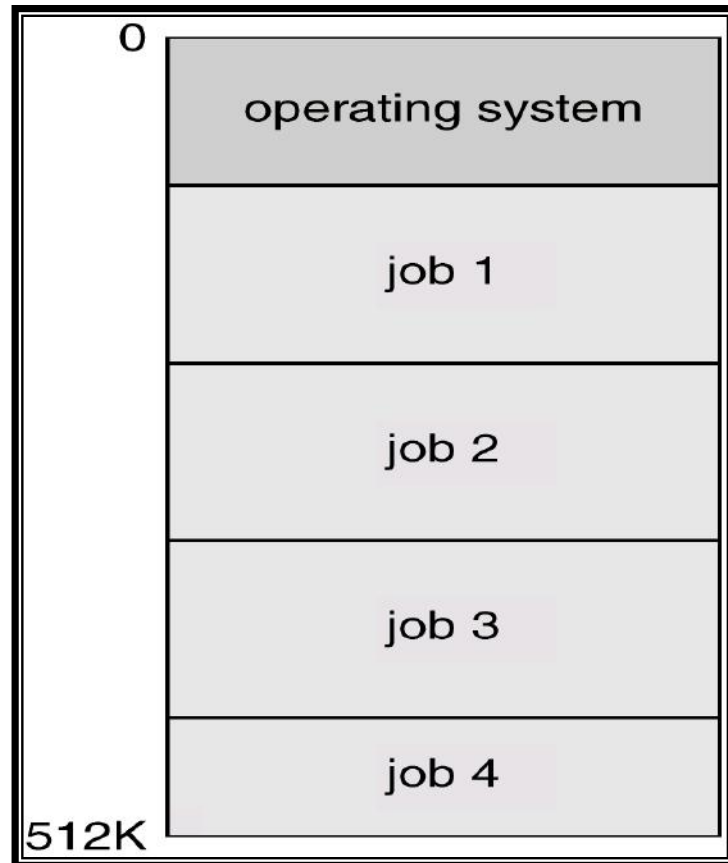


1.2 Multiprogrammed Batch systems

- These systems are based on the concept of multiprogramming where several jobs are kept in memory in order to keep the CPU busy with a sequence of jobs.
- The set of jobs kept in memory are only a subset of the huge set of jobs kept in job pool.
- Job scheduling & CPU scheduling are the two major concepts being used in these systems.

Multiprogrammed Batch Systems

Several jobs are kept in main memory at the same time, and the CPU is multiplexed among them.



OS Features Needed for Multiprogramming

- I/O routine supplied by the system.
- Memory management – the system must allocate the memory to several jobs.
- CPU scheduling – the system must choose among several jobs ready to run.
- Allocation of devices.

2.Time-Sharing Systems

- **The CPU is multiplexed among several jobs that are kept in memory and on disk (the CPU is allocated to a job only if the job is in memory).**
- **A job swapped in and out of memory to the disk.**
- **On-line communication between the user and the system is provided; when the operating system finishes the execution of one command, it seeks the next “control statement” from the user’s keyboard.**
- **On-line system must be available for users to access data and code.**

3. Desktop Systems

- ***Personal computers*** – computer system dedicated to a single user.
- **I/O devices** – keyboards, mice, display screens, small printers.
- **User convenience and responsiveness.**
- **Can adopt technology developed for larger operating system' often individuals have sole use of computer and do not need advanced CPU utilization of protection features.**
- **May run several different types of operating systems (Windows, MacOS, UNIX, Linux)**

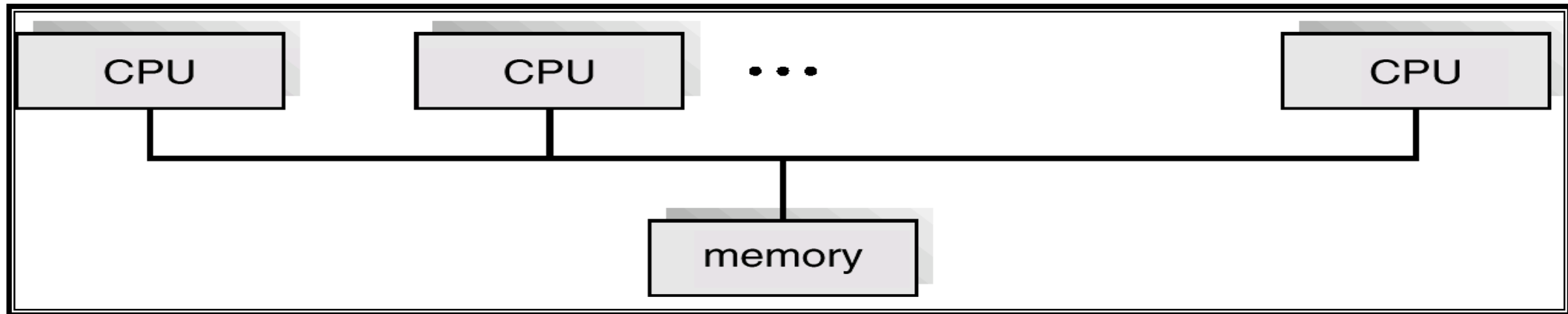
4. Parallel Systems

- Multiprocessor systems with more than one CPU in close communication.
- *Tightly coupled system* – processors share memory and a clock; communication usually takes place through the shared memory.
- Advantages of parallel system:
 - Increased *throughput*
 - Economical
 - Increased reliability

4. Parallel Systems (Cont.)

- *Symmetric multiprocessing (SMP)*
 - Each processor runs an identical copy of the operating system.
 - Many processes can run at once without performance deterioration.
 - Most modern operating systems support SMP
- *Asymmetric multiprocessing*
 - Each processor is assigned a specific task; master processor schedules and allocates work to slave processors.
 - More common in extremely large systems

Symmetric Multiprocessing Architecture



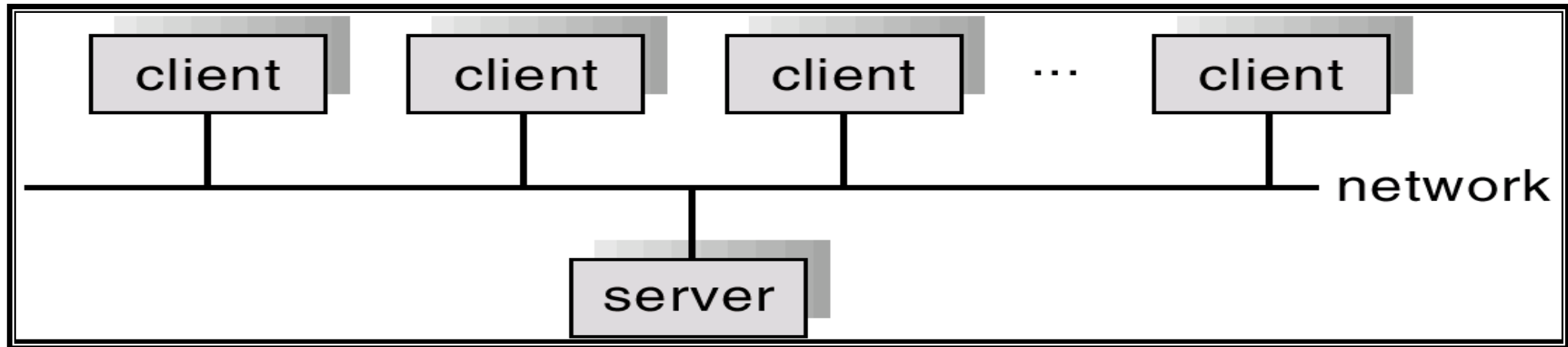
5. Distributed Systems

- **Distribute the computation among several physical processors.**
- ***Loosely coupled system* – each processor has its own local memory; processors communicate with one another through various communications lines, such as high-speed buses or telephone lines.**
- **Advantages of distributed systems.**
 - **Resources Sharing**
 - **Computation speed up – load sharing**
 - **Reliability**
 - **Communications**

5. Distributed Systems (cont)

- Requires networking infrastructure.
- Local area networks (LAN) or Wide area networks (WAN)
- May be either client-server or peer-to-peer systems.

5.1 Client-Server systems



6. Clustered Systems

- Clustering allows two or more systems to share storage.
- Provides high reliability.
- *Asymmetric clustering*: one server runs the application while other servers standby.
- *Symmetric clustering*: all N hosts are running the application.

7. Real-Time Systems

- Often used as a control device in a dedicated application such as controlling scientific experiments, medical imaging systems, industrial control systems, and some display systems.
- Well-defined fixed-time constraints.
- Real-Time systems may be either *hard* or *soft* real-time.

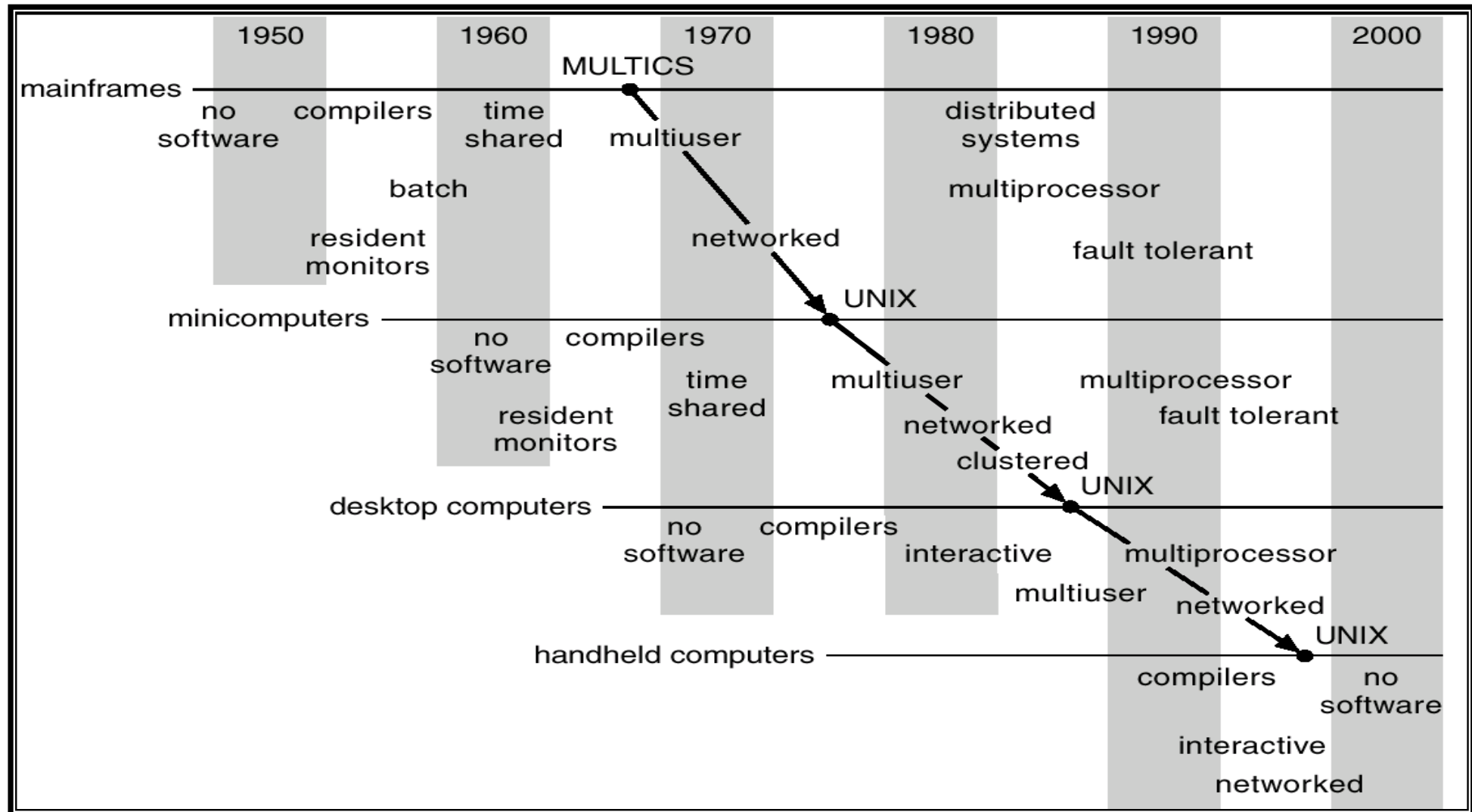
7. Real-Time Systems (Cont.)

- Hard real-time:
 - Secondary storage limited or absent, data stored in short term memory, or read-only memory (ROM)
 - Conflicts with time-sharing systems, not supported by general-purpose operating systems.
- Soft real-time
 - Limited utility in industrial control of robotics
 - Useful in applications (multimedia, virtual reality) requiring advanced operating-system features.

8. Handheld Systems

- Personal Digital Assistants (PDAs)
- Cellular telephones
- Issues:
 - Limited memory
 - Slow processors
 - Small display screens.

Migration of Operating-System Concepts and Features



Operating System Services/Functions

- **Program execution** – system capability to load a program into memory and to run it.
- **I/O operations** – since user programs cannot execute I/O operations directly, the operating system must provide some means to perform I/O.
- **File-system manipulation** – program capability to read, write, create, and delete files.
- **Communications** – exchange of information between processes executing either on the same computer or on different systems tied together by a network. Implemented via *shared memory* or *message passing*.
- **Error detection** – ensure correct computing by detecting errors in the CPU and memory hardware, in I/O devices, or in user programs.

Additional Operating System Functions

Additional functions exist not for helping the user, but rather for ensuring efficient system operations.

- **Resource allocation** – allocating resources to multiple users or multiple jobs running at the same time.
- **Accounting** – keep track of and record which users use how much and what kinds of computer resources for account billing or for accumulating usage statistics.
- **Protection** – ensuring that all access to system resources is controlled.

System Calls

- System calls provide the interface between a running program and the operating system.
 - Generally available as assembly-language instructions.
 - Languages defined to replace assembly language for systems programming allow system calls to be made directly (e.g., C, C++)
- Three general methods are used to pass parameters between a running program and the operating system.
 - Pass parameters in *registers*.
 - Store the parameters in a table in memory, and the table address is passed as a parameter in a register.
 - *Push* (store) the parameters onto the *stack* by the program, and *pop* off the stack by operating system.

Types of System Calls

- Process control
 - end, abort
 - load ,execute
 - create, terminate
 - get /set process attributes
 - Allocate the free memory
- File management
 - Create, delete file
 - Open, close
 - Read, write
 - get/set file attribute

Types of System Calls

- **Device management**
 - request, release device
 - get/set device attribute
- **Information maintenance**
 - Get/set time or date
 - Get/set system data
 - Get/set process, file, device attributes
- **Communications**
 - Create ,delete communication connection
 - Send, receive messages

System Programs

- System programs provide a convenient environment for program development and execution. They can be divided into:
 - File manipulation
 - Status information
 - File modification
 - Programming language support
 - Program loading and execution
 - Communications
 - Application programs

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Queries???



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Thank You