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OPERATING SYSTEMS

By:
Anand Prakash Srivastava
B.Tech. (Information Technology)

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Ph.: 011-23260329, 45704411, 23244362, 23285501
E-mail: **info@neerajignoubooks.com**
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Sample Preview of the Solved Sample Question Papers

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QUESTION PAPER

(June – 2018)

(Solved)

OPERATING SYSTEMS

Time: 3 Hours **]** **[** ***Maximum Marks: 100***

[***Weightage: 75%***

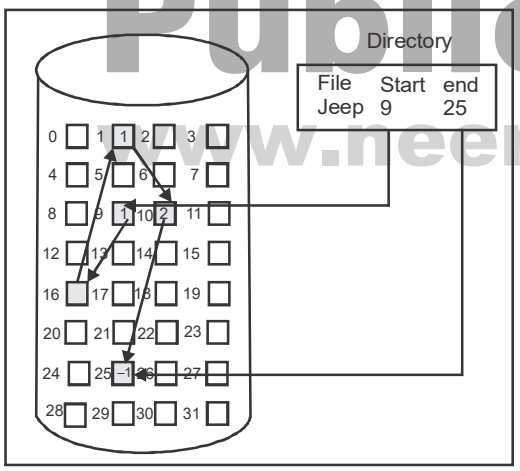
Note: *Question No.* ***1*** *is* ***compulsory****. Attempt* ***any three*** *questions from the rest.*

Q. 1. ***(a)*** **What is a Critical Section? Give a monitor solution to the Dining philosophers' problem and explain.**

Ans. Ref.: See Chapter-3, Page No. 35, Critical Sections : The Mutex Solution', and Page No. 41, 'Dining Philosophers Problem'.

(b) **Describe Linked and Indexed allocation for disk space allocation.**

Ans. Linked List Allocation: In this scheme, each file is a linked list of disk blocks which need not be contiguous. The disk blocks can be scattered anywhere on the disk.



The directory entry contains a pointer to the starting and the ending file block. Each block contains a pointer to the next block occupied by the file.

The file 'jeep' in following image shows how the blocks are randomly distributed. The last block (25) contains -1 indicating a null pointer and does not point to any other block.

Advantages:

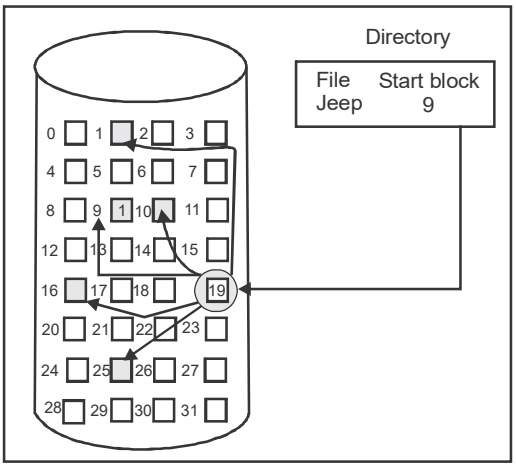
- This is very flexible in terms of file size. File size can be increased easily since the system does not have to look for a contiguous chunk of memory.
- This method does not suffer from external fragmentation. This makes it relatively better in terms of memory utilization.

Disadvantages:

- Because the file blocks are distributed randomly on the disk, a large number of seeks are needed to access every block individually. This makes linked allocation slower.
- It does not support random or direct access. We cannot directly access the blocks of a file. A block k of a file can be accessed by traversing k blocks sequentially (sequential access) from the starting block of the file via block pointers.
- Pointers required in the linked allocation incur some extra overhead.

Indexed Allocation

In this scheme, a special block known as the Index block contains the pointers to all the blocks occupied by a file. Each file has its own index block. The ith entry in the index block contains the disk address of the ith file block. The directory entry contains the address of the index block as shown in the image:



Advantages:

- This supports direct access to the blocks occupied by the file and therefore provides fast access to the file blocks.
- It overcomes the problem of external fragmentation.

Disadvantages:

- The pointer overhead for indexed allocation is greater than linked allocation.
- For very small files, say files that expand only 2-3 blocks, the indexed allocation would keep one entire block (index block) for the pointers which is inefficient in terms of memory utilization. However, in linked allocation we lose the space of only 1 pointer per block.

***(c)* Consider the page reference string:**

1, 2, 3, 4, 2, 5, 3, 4, 2, 6, 7, 8, 7, 9, 7, 8, 2, 5, 4 and 9

Calculate how many page faults would occur for LRU and FIFO page replacement algorithms, when the number of frames is 3. Assume all frames are initially empty.

Ans. LRU Page Replacement: One page fault the frame that was recently used in replaced.

Page Reference System

1	2	3	4	2	5	3	4	2	6	7	8	7	9	7	8	2	5	4	9
1	1	1	2	3	4	2	5	3	4	2	6	6	8	8	9	7	8	2	5
	2	2	3	4	2	5	3	4	2	6	7	8	7	9	7	8	2	5	4
		3	4	2	5	3	4	2	6	7	8	7	9	7	8	2	5	4	9
	*	*	*	*		*	*	*	*	*	*		*			*	*	*	*

Total 16 page faults in three frame memory

FIFO page Replacement: On a page fault, the frame that has been in memory the longest is replaced.

1	2	3	4	2	5	3	4	2	6	7	8	7	9	7	8	2	5	4	9
1	1	1	2	2	3	3	3	4	6	2	6	6	7	7	7	8	9	2	5
	2	2	3	3	4	4	4	5	2	6	7	7	8	8	8	9	2	5	4
		3	4	4	5	5	5	2	6	7	8	8	9	9	9	2	5	4	9
*	*	*	*		*			*	*	*	*		*			*	*	*	*

Total 14 page faults in 3 frame memory.

***(d)* What is RPC? Describe the steps involved in the execution of a RPC.**

Ans. Ref.: See Chapter-10, Page No. 134, 'Remote Procedure Calls' and 'How RPC Works?'.

Q. 2. *(a)* Define a process. Explain various states of a process. How does a process differ from a thread?

Ans. Ref.: See Chapter-2, Page No. 15, 'The Concept of Process' and Page No. 16, 'Proces State' and Page No. 125, Q. No. 1.

Sample Preview of The Chapter

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OPERATING SYSTEMS

INTRODUCTION TO OPERATING SYSTEMS AND PROCESS MANAGEMENT

Operating System: An Overview

1

INTRODUCTION

Working with Computers, an Operating System (OS) would be an unpleasant complication of details. Carrying out a seemingly simple procedure, like loading an application program from disk to primary memory, would require hours of work. Application programs themselves would be longer, more complicated and more expensive than they are now. Special versions of software would have to be written for virtually every model of machines. Luckily the availability of standard Operating System has prevented all of this and more.

CHAPTER AT A GLANCE

WHAT IS AN OPERATING SYSTEM?

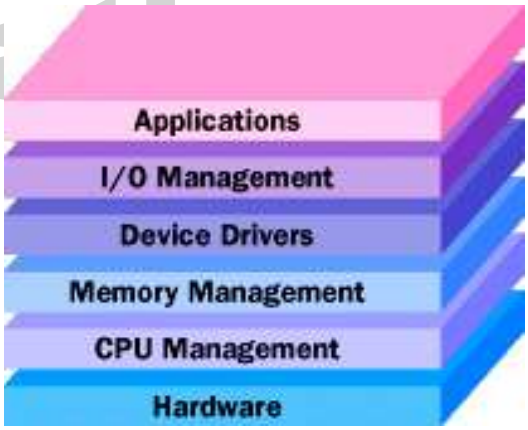
An Operating System run on computer hardware and serves as a platform for other software to run on the computer system.

An Operating System is a program (system software) which acts as an interface between user and computer hardware.

A Computer System can be logically divided into four components:

Computer Hardware, Operating System, Application Programs and Users.

An Operating System controls and coordinates the hardware components (CPU, Memory, I/O devices) among various application programs for different users.



The Operating System control every task your computer carries out and manages system resources.

Operating System has Two Main Objectives:

Convenience: An Operating System makes a computer more convenient to us.

Efficiency: An Operating System allows the computer resources to be used in an efficient manner.

Operating System is also called a **Resource Manager**. Operating System manages all computer **resources** and **allocates** them to a specific program and uses as it require completing its tasks.

The Operating System hides all the innermost details of the working of computer hardware components and provides a simple, usable and effective model of a computer. This type of image of a computer is called **virtual machine**.

The common operating systems are the windows family of operating systems (*viz*. Windows 95, 98, 2000.NT, VISTA), the UNIX family of operating systems (which includes UNIX, LINUX and many other derivatives) and the Macintosh Operating System.

GOALS OF AN OPERATING SYSTEM

Any Operating System should meet the following major goals:

(a) Optimize the use of computer resource so as to maximize its throughput.

(b) Create a user-friendly computing environment for accessing the computer resources.

(c) To hide details of hardware by creating abstraction.

(d) To allocate resources to processes (Manage resources).

(e) Provide a pleasant and effective user interface.

GENERATIONS OF OPERATING SYSTEMS

The history of computer development is often referred to in reference to the different generations of computing devices. Each generation of computer is characterized by a major technological development that fundamentally changed the way computers operate, resulting in increasingly smaller, cheaper, and more powerful and more efficient and reliable devices.

Read about each generation and the developments that led to the current devices that we use today.

0th Generation: (1642 – 1940s)

Notable characteristics and events included:

- Mechanical gears and electromechanical relays.
- In 1642 Blaise Pascal creates mechanical calculating machine using gears, hand powered, performs + and -.
- In 1834 Charles Babbage creates the Difference Engine which runs a single algorithm to compute tables of numbers. Output was punched copper plates. Never completed. Instead, began work on Analytical Engine, a programmable machine. Never completed. Was assisted by Ada Lovelace (first programmer) to write code for machine.
- In 1930's Konrad Zuse builds a series of automatic calculating machines (Z1) similar to Babbage's but using electromechanical relays. Destroyed in 1944 by allied bombing of Berlin.

1st Generation: (1940 – 1956: Vacuum Tubes)

- Vacuum tubes.
- Absolute machine language using wired plug boards.
- No programming languages or operating systems.
- Programmer signed up for a block of time and brought own plug boards.
- Serial processing.
- In 1930's, John Atanasoff at Iowa State College designs and builds special purpose computer using vacuum tubes. First electronic computer but still debated. First computer to use RAM.
- In 1946, John Mauchly and J.Presper Eckert design and build first general

purpose electronic computer, the ENIAC. 18,000 vacuum tubes, 1500 relays, and 30 tons. Hard-wired programs.

- In 1946, John Von Neumann writes paper on stored program concept.
- In 1951 Eckert and Mauchly complete the first commercially sold computer, the UNIVAC I. Used to predict the winner of presidential election 1952.
- IBM creates Model 650. Slow, but used punch cards.

2nd Generation: (1956 – 1964: Transistors)

- Transistor hardware, more reliable, sold commercially.
- Programmer would write program in FORTRAN, punch cards.
- Operator (or programmer) reads in program card deck + FORTRAN compiler card deck - Wasteful! So...
- Developed BUFFERING - input device reads multiple records, trying to "be ready" for CPU.
- FORTRAN introduced in 1957. COBOL introduced in 1960.
- DEC PDP-1 introduced in 1961. First mini, with 4K RAM, $120,000. 50 sold.
- IBM introduces model 1401and 7094 business computer in 1961 and1962.
- CDC introduces 6600 parallel processor number cruncher in 1964.

3rd Generation: (1964 – 1979: Integrated Circuits)

- IC technology
- IBM S/360 series of computers (family) created - one operating system ran on all models. OS was humongous! (Read Brooks - Mythical Man Month).
- Developed MULTIPROGRAMMING - CPU switches from one job to next very quickly when: I/O needed, job finishes (errs).
- Ken Thompson wrote UNICS/UNIX based upon concepts in MULTICS.
- Developed REAL-TIME OS - SABRE airline reservation system.
- Intel introduces 8080 microprocessor in 1974. General purpose 8-bit 64K RAM.
- Motorola introduces 6800 in 1974.
- Altair 8800 introduced in 1974.
- Bill Gates rewrites BASIC for microcomputer. First programming language on a micro. (1974)
- Gary Kildall creates CP/M in 1974.
- Steve Jobs and Steve Wozniak create Apple Computer (1974-1975).
- Apple II comes out in 1977.

4th Generation: (1979–Present: Microprocessors)

- Personal Computers, LSI technology, single-user OS.
- Developed NETWORK OS - loosely connected computers, each doing its own thing.
- Developed DISTRIBUTED OS - more tightly connected computers, working together on a large problem.
- SECURITY continued to improve, including access control, information flow control, and certification.
- SYSTEM STRUCTURE evolved into a layered or hierarchical design.
- VAX VMS, OS/2.
- UNIX, Linux (1992-93), MVS simplified, Windows NT.
- IBM introduces IBM PC with 64K, 8088 processor (1981).
- Apple introduces LISA 68000 based (1984).

- SUN introduces its own microprocessor based on RISC technology-the SPARC (Scalable Processor Architecture).
- Early 1990s - virtual reality, Digital's Alpha Architecture (1992) - 64-bit RISC.
- PowerPC (1993) - very powerful RISC processor.
- Apple Newton (1993) - first PDA, weighed 1 pound, 20 MHz Acorn RISC.
- Intel Pentium (1993) - CISC *can* run fast, 3.1 million transistors, 60 MHz.
- Apple's Power Mac (March 1994) - first mainstream RISC pc.
- World Wide Web.
- Windows 95 – first really successful Microsoft Windows product.
- Toy Story – First all digital movie.
- NetWare v. 4, then 6.
- Windows Server NT (followed by much better 2000, 2003, 2008).
- IPv6, Multi-core processors, Apple's iPhone, Cloud computing.

TYPES OF OPERATING SYSTEMS

Operating System can be CLASSIFIED INTO ONE OF MORE OF THE FOLLOWING CATEGORIES: **Batch OS, Multiprogramming OS, Network OS and Distributed OS.**

Batch Processing Operating System:

During batch processing environment, it requires grouping of similar jobs, which consist of programs, data and system commands. This type of processing is suitable is programs with large computation time with no need of user interaction or involvement. For example, payroll, forecasting, statistical analysis and large scientific number crunching programs. Users need not wait while the job is being processed. They can submit their programs to operators and collect them later. The disadvantages of batch operating systems are non-interactive environment and Off-line debugging.

Time Sharing

Time-sharing is a way of allowing several people to run program on different terminals, but on the same computer system, at the same time. This feature is only found is large Operating System. Time-sharing is a form of multi-programmed OS that operates in an interactive mode with a quick response time. The user types a request to the computer through a keyboard. The computer processes it and a response, if any is displayed on the user's terminal. A time sharing system allows many users to simultaneously share the computer resources.

Real Time Operating System (RTOS)

A real-time OS responds to the input instantly. They are used in special embedded applications. It is used in environments where a large number of events, most external to computer systems, must be accepted and processed in a short time or within certain deadlines. For example, flight control, real-time simulations, military applications, etc. General-purpose operating systems, such as DOS and UNIX, are not real-time. A primary objective of real-time system is to provide quick response times.

Multiprogramming Operating System:

Multiprogramming is the concurrent execution of two or more processes. Multiprogramming operating systems are fairly sophisticated compared to batch operating systems. Multiprogramming has a significant potential for improving system throughput and resource utilization with very minor differences. Different forms of multiprogramming operating systems are multitasking, multiprocessing and multi-user operating systems.

Multiprocessing Operating System

A multiprocessing system is a computer that has more than one processor. A multiprocessing