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The main purpose of an Operating System is to provide an environment in which we can execute programs. The main goals of the Operating System are: (i) To make the computer system convenient to use, (ii) To make the use of computer hardware in efficient way.

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There are three main types of RTOS based on their level of real-time responsiveness:

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The OS allows users to perform tasks like data input, processing operations, and output access. Examples of Operating systems include **Microsoft Windows,macOS, Linux, Unix**, etc. 14 May 2024

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Process control, file management system calls in OS, device management, information maintenance, and communication are main types of system calls in OS. Several crucial system calls used computer system include wait(), fork(), exec(), kill(), and exit(). 25 May

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Define system program and list the various type

System program types: · **Utility program**: It oversees, keeps up with, and regulates a variety of computer resources. · Device drivers: It is used to manage the ...

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There are mainly **six types** of system programs. These are classified as follows: ... Now, you will learn all these different types of system programs one by one.

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The interconnections between the various operating system components can be defined as the operating system structure. Th operating system is divided into various different structural types: structure, monolithic approach, layered approach, micro-kernels, exokernels, and virtual machines.

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The program under execution is called process. Process goes through different states throughout the life cycle which are called process states. **New, Ready, Running, Waiting or Block, Terminated or Completed, Suspend ready, and Suspend wait or blocked** are different states in which process might go during the life cycle. 12 May 2024

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Context switching refers to a technique/method used by the OS to switch processes from a given state to another one for the execution of its function using the CPUs present in the system.

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CPU scheduling has certain criteria that it uses to schedule processes in the most efficient manner:

- CPU utilization (maximize)
- Throughput (maximize)
- Turn Around Time (minimize)
- Waiting Time (minimize)
- Response Time (minimize)

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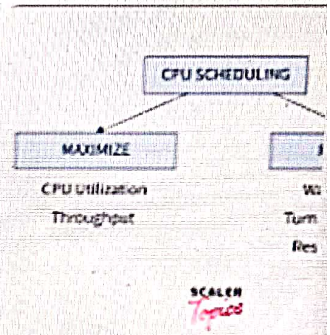

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A thread refers to a sequence of instructions that can be executec independently within a program. Threads **allow for concurrent execution and enable multitasking in a single application.**

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There are three main threading models: many-to-one maps many threads to one kernel thread; one-to-one maps each user threac own kernel thread; many-to-many maps user threads to kernel threads in a variable manner. 4 May 2021

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The need for synchronization originates when processes need to execute concurrently. The main purpose of synchronization is the sharing of resources without interference using mutual exclusion. other purpose is the coordination of the process interactions in an operating system.

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In preemptive scheduling, resources are allocated to a process for a specified time period. In non-preemptive scheduling, once resources are allocated to a process, the process maintains control until it completes or transitions to a waiting state. Interruptions can occur between processes in this scheduling. 31 Jul 2023

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Semaphores are **two-field data types, one of which is a non-negative type of integer S.V and the other is a set of processes in a queue S.L.** It is used to address critical section problems by using two atomic operations, wait and signal, to synchronize processes in this.

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After a process has made a request to access its critical section and before that request is approved, a limit on the number of times other processes are allowed to enter their critical sections must exist. Hence the correct answer is **Mutual Exclusion, Progress, and Bounded Waiting.** 3 Feb 2022

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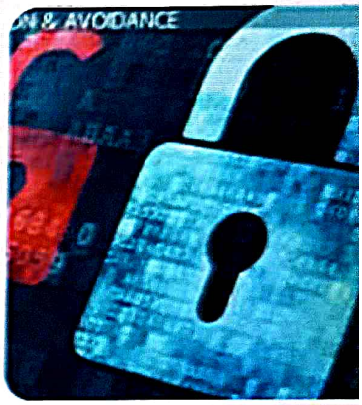

All trains are stopped, waiting for another to go, though none of them move. This is an example of deadlock because the resource, the train track, is held in a state of limbo as each train waits for another to move along so that they can continue.

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The four necessary conditions for a deadlock situation are **mutual exclusion, no preemption, hold and wait and circular set.** There are four methods of handling deadlocks - deadlock avoidance, deadlock prevention, deadline detection and recovery and deadlock ignorance. 9 Sept 2023

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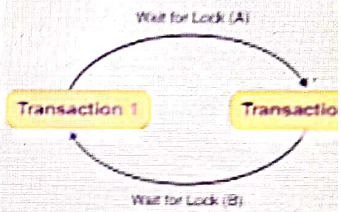
The following are the explanations:

- Deadlock Prevention. Deadlock happens whenever four conditions occur at the same time. ...
- Deadlock Detection. The resource scheduler can detect deadlock because it maintains track of all the resources allotted to different processes. ...
- Deadlock Avoidance. ...
- Ostrich Algorithm/Deadlock Ignorance.



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The main difference between a RAG and a wait-for graph is **the number of vertices each graph contains**. A RAG graph has two vertices: resource and process. A wait-for graph has one vertex: process. The wait-for graph is not making a circle, which means it'll not lead the system to a deadlock. 18 Mar 2024

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Swapping is a memory management scheme in which any process can be temporarily swapped from main memory to secondary memory so that the main memory can be made available for other processes.

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Compaction is a technique to collect all the free memory present in the form of fragments into one large chunk of free memory, which ca be used to run other processes. 25 Jun 2024

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Fragmentation refers to **an unwanted problem that occurs in the OS in which a process is unloaded and loaded from memory, and the free memory space gets fragmented**. The processes can not be assigned to the memory blocks because of their small size. Thus the memory blocks always stay unused.

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Virtual vs. phys

Virtual memory is a common technique used in a computer's operating system (OS). Virtual memory uses both hardware and software to enable a computer to compensate for physical memory shortages, temporarily transferring data from random access memory (RAM) to disk storage.

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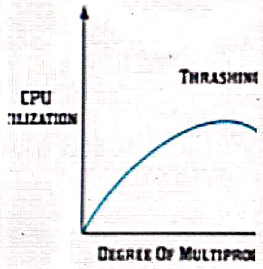

Thrashing in OS is a common phenomenon in computer systems. It occurs when the system spends more time swapping pages than actually performing useful tasks. It is caused by a high number of page faults, which happens when the system needs to retrieve a page from the disk because it is not present in memory. 27 Mar 2024

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Sure, let's address each of these questions systematically:

1. **Define a File and list the various operations over files:**

   - **File Definition:** A file is a collection of data or information that is stored on a computer system. It is identified by a filename and stored as a sequence of bytes. Files are managed by the operating system.
   - **Operations on Files:**
     - **Create:** To create a new file.
     - **Open:** To open an existing file for reading or writing.
     - **Close:** To close an opened file.
     - **Read:** To read data from a file.
     - **Write:** To write data to a file.
     - **Delete:** To delete a file from the file system.
     - **Rename:** To change the name of a file.
     - **Seek:** To move the file pointer to a specific position within the file.

2. **What are the different file access methoc**

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t as default

- **Seek:** To move the file pointer to a specific position within the file.

2. **What are the different file access methods:**

   - **Sequential Access:** Data is accessed in a linear sequence. Files are read or written sequentially, from the beginning to the end.
   - **Direct Access:** Also known as random access, allows the file to be read or written at any point without having to read through the entire file sequentially.
   - **Indexed Sequential Access:** Combines sequential and direct access methods. It uses an index to track the location of records in the file for quick access.

3. **List various file allocation methods:**

   - **Contiguous Allocation**
   - **Linked Allocation**
   - **Indexed Allocation**
   - **Multilevel Index Allocation**
   - **Combined or Hybrid Allocation**

4. **What is the need for file system mounting:**

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4. **What is the need for file system mounting:**

   - File system mounting is the process of making a file system available for access at a certain point in the operating system's directory tree (mount point).
   - It allows the operating system to access the contents of storage devices or partitions as part of the directory hierarchy.
   - Mounting is necessary to access files and directories stored on external devices such as USB drives, network shares, or other partitions.

5. **Define a Directory and list its operations:**

   - **Directory Definition:** A directory (or folder) is a container used to organize files hierarchically in a file system.
   - **Operations on Directories:**
     - **Create:** To create a new directory.
     - **Delete:** To delete an empty directory.
     - **List:** To list the contents (files and subdirectories) of a directory.
     - **Change:** To change the current working directory.
     - **Rename:** To rename a directory.

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...verse: To navigate through the directory structure.

6. **List different directory organization methods:**

   - **Single-level Directory**
   - **Two-level Directory**
   - **Hierarchical Directory**
   - **Tree-structured Directory**
   - **Acyclic Graph Directory**

7. **List various file attributes and types of files:**

   - **File Attributes:** Include metadata such as file name, size, type, location, permissions, creation time, modification time, and access time.
   - **Types of Files:** Regular files, directories, symbolic links, device files, FIFOs (named pipes), sockets, etc.

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8. **What are naming and grouping problems in directory organization:**

- **Naming Problems:** Ensuring unique names, handling case sensitivity, handling special characters, and managing naming conventions.
- **Grouping Problems:** Organizing files into appropriate directories or folders to maintain logical groupings, avoid overcrowding, and facilitate efficient access.

9. **How to ensure protection of files:**

- **File Permissions:** Assigning read, write, and execute permissions to users, groups, and others.
- **Access Control Lists (ACLs):** Fine-grained permissions for controlling access to files and directories.
- **Encryption:** Protecting files by encrypting their contents.
- **Backup:** Regularly backing up files to prevent data loss.

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- **Backup:** Regularly backing up files to prevent data loss.

10. **How do we achieve file sharing:**

    - **File Sharing Methods:**
        - **File Permissions:** Granting appropriate permissions to users and groups to access files.
        - **Network File Systems (NFS, SMB/CIFS):** Sharing files over a network so that multiple users can access them simultaneously.
        - **File Transfer Protocols (FTP, SCP, SFTP):** Transferring files between systems over a network.
        - **Cloud Storage Services:** Sharing files via cloud-based storage solutions with access controls.

These answers cover the fundamental aspects related to ●

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3.5 Log in

Let's address each question step by step:

1. **What is seek time and rotational latency:**

   - **Seek Time:** The time taken by the disk's read/write head to move to the specific track where the data is located. It involves physically positioning the head arm.
   - **Rotational Latency:** The additional time spent waiting for the disk to rotate so that the required sector is under the read/write head. It depends on the rotational speed of the disk (measured in revolutions per minute, RPM).

2. **List the various Disk scheduling algorithms:**

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2. List the various Disk scheduling algorithms:

- **FCFS (First-Come, First-Served):** Requests are served in the order they arrive.
- **SSTF (Shortest Seek Time First):** Services the request with the shortest seek time from the current head position.
- **SCAN (Elevator Algorithm):** The head moves in one direction servicing requests until the end, then reverses direction.
- **C-SCAN (Circular SCAN):** Like SCAN but the head moves only in one direction and upon reaching the end, jumps to the beginning.
- **LOOK:** Similar to SCAN but the head only goes as far as necessary in both directions.
- **C-LOOK:** Similar to C-SCAN but the head only goes as far as necessary in both directions.

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3. **What is swap-space management:**

   - **Swap Space:** Reserved disk space used by the operating system to hold inactive parts of programs and data when physical RAM (memory) is full.
   - **Swap-space Management:** The management of this disk space includes deciding when and which parts of memory to swap out to disk (swap-out) and when to bring them back into memory (swap-in), to optimize system performance.

4. **Define Protection and give the principles of protection:**

   - **Protection:** Protection refers to mechanisms for controlling access to resources and preventing unauthorized use or modification.
   - **Principles of Protection:**
     - **Least Privilege:** Users and processes should only have the minimum permissions necessary to perform their tasks.
     - **Fail-Safe Defaults:** Access should be denied by default unless explicitly allowed.
     - **Economy of Mechanism:** Keep the protection mechanisms as simple and small as possible to minimize vulnerabilities.
     - **Complete Mediation:** Access to resources should be checked every time access is requested.
     - **Open Design:** The design of protection mechanisms should not be kept secret; it should be open to scrutiny and review.

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5. **List the Goals of Protection:**
   - **Confidentiality:** Prevent unauthorized access to sensitive information.
   - **Integrity:** Ensure that data is accurate and unchanged by unauthorized parties.
   - **Availability:** Ensure that authorized users have access to the resources they need.
   - **Accountability:** Trace actions to specific individuals or processes.
   - **Auditability:** Allow monitoring and logging of access and actions.
6. **Give the merits and demerits of using Access matrix for system protection:**
   - Merits:
     - Provides a formal framework for specifying and enforcing access control policies.
     - Can represent complex access control relationships.
     - Supports dynamic changes in access rights.
   - **Demerits:**
     - Large matrix size can be impractical for large systems with many users and resources.
     - Sparse matrices can lead to inefficiencies in storage and access.
     - Managing and updating the matrix can be complex and error-prone.

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7. **List various categories of security violation:**
   - **Unauthorized Access:** Gaining access to resources without proper authorization.
   - **Data Breach:** Unauthorized access or exposure of sensitive information.
   - **Denial of Service (DoS):** Preventing legitimate users from accessing services or resources.
   - **Malware:** Introduction of malicious software that can compromise security.
   - **Social Engineering:** Manipulating individuals to divulge confidential information or perform actions that compromise security.
8. **List various security violation methods:**
   - **Phishing:** Deceptive emails or websites used to obtain sensitive information.
   - **Brute Force Attacks:** Trying all possible combinations to guess passwords or keys.
   - **SQL Injection:** Exploiting vulnerabilities in web applications to gain unauthorized access to databases.
   - **Man-in-the-Middle Attacks:** Intercepting and manipulating communication between parties.
   - **Insider Threats:** Malicious actions by authorized users with access to sensitive information.

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actions by authorized users with access to sensitive information.

9. **What are the different program threats:**

- **Viruses and Worms:** Self-replicating malicious software.
- **Trojan Horses:** Programs that appear legitimate but perform unauthorized actions.
- **Logic Bombs:** Code that executes a malicious action when certain conditions are met.
- **Backdoors:** Unauthorized access points left in software for later exploitation.
- **Spyware:** Software that gathers information about a user without their knowledge.

10. **What is the difference between protection and security:**

- **Protection:** Refers to mechanisms and policies implemented to control access to resources and prevent unauthorized use or modification.
- **Security:** Encompasses protection but also includes broader aspects such as threat detection, incident response, risk management, and overall system integrity and resilience.

These explanations cover the core concepts related to disk operations, protection mechanisms, and

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