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DEADLOCK IN OS

Introduction of Deadlock in Operating System

A deadlock is a situation where a set of processes is blocked because each process is holding a resource and waiting for another resource aquired by some other process.

What is Deadlock ?

A situation in computing where two or more processes are unable to proceed bcz each is waiting for the other to release resources. Key concepts includes, mutual exclusion, resource holding, circular wait, and no preemption.

How does Deadlock occur in the OS ?

That situations of deadlock is occures when some processes hold some resources

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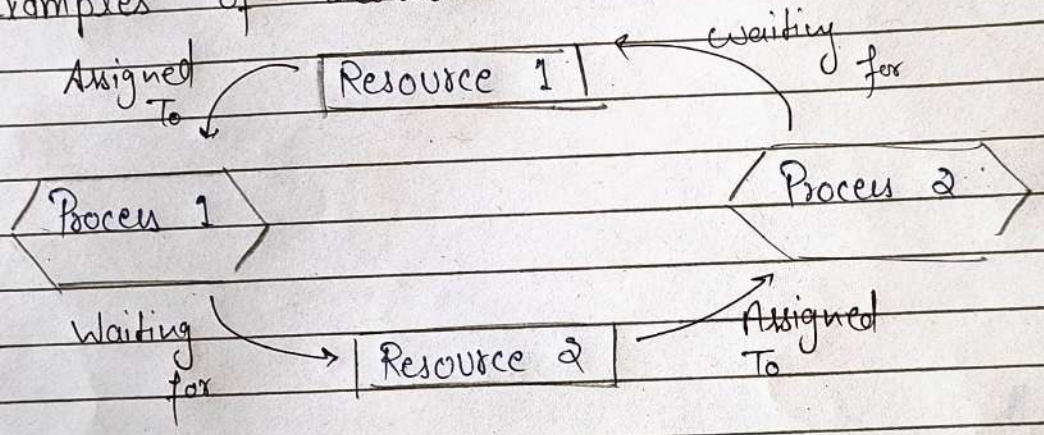
and wait for resources held by other(s). For example, in the below diagram, Process 1 is holding resource 1 and waiting for resource 2 which is aquired by Process 2, and Process 2 is waiting for resource 1.

Examples of Deadlock



Explaination : Processes : P_1 and P_2
Resources : R_1 and R_2
let us say R_1 is allocated to P_1. P_1 is requesting for R_2 but R_2 is held by P_2. Now P_2 is requesting for R_1, So we can say that it is kind of deadlock or it is a deadlock situation.

Necessary Conditions for deadlock

A deadlock situation can be aries if the following 4 Conditions hold simultaneously -

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1. Mutual Exclusion : It mean Resources is non-sharable. At a time only one Process can use the resource if another process requests to use resource, the requesting resource must be delayed until the resource has been released

2. Hold and wait : A Process must be holding at least one resource and waiting to aquire additional resource that are currently being held by other processes.

3. No Premption : Once a process is holding a resource, then that resource cannot be taken away from the process until the process voluntarily release it

4. Circular Wait : A set of processes ($P_1, P_2 \dots P_n$) of waiting processes must exist such that P_1 is waiting for resource that is held by P_2, P_2 is waiting for res. that is held by $P_3 \dots P_n$ is waiting for res. that is held by P_1.

Deadlock detection

The process of finding out whether any process are stuck in loop or

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not. There are serval algorithms like

- Resource Allocation Graph
- Banke's Algorithm

Methods for Handling Deadlock

There are 3 ways of handling deadlocks :

1. Deadlock prevention or avoidance : Deadlock can be prevented by preventing at least one of the four required conditions. Either try to remove all four conditions or one of the four conditions.

2. Deadlock detection and recovery : It consist of two phases:
   - In the first phase, we examine the state of the process and check whether there is a deadlock or not in the system.
   - if found deadlock in the first phase then we apply the algo for recovery of the deadlock

3. Ignore the problem all together : if a deadlock is very rare,

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then let it happens and reboot the system. This is the approch that both windows and UNIX take. we use the ostrich algorithm for deadlock ignorance. In deadlock, ignorance performance is better than the above two methods but the Correctness of data is not there.

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MEMORY MANAGEMENT

Before we start Memory management, let us know what is main memory,

- Main Memory : Main memory is the place where programs and informations are kept when the processor is effectively utilizeing them. Main memory is also known as RAM (Random Access Memory)

- Memory Management : In a multiprogramming computer, the OS resides in a part of memory, and the rest is used by multiple processes. The task of subdividing the memory among different processes is called Memory Management. The main of memory management is to achieve efficient utilization of memory.

- Why memory management is Required ?

  - To allocate and deallocate memory

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before and after process execution
- To keep track of used memory space by process.
- To minimize fragmentation issues.
- To proper utilization of main memory
- To maintain data integrity while executing of process.

Logical and Physical Address Space

- Logical Address space : An address generated by the CPU is known as a "Logical Address". It is also known as a Virtual Address. Logical address space can be defined as the size of the process. A logical address can be changed.

- Physical Address space : An address seen by the memory unit is commonly known as a "Physical Address". A Physical Address is also known as a Real Address. The set of all Physical addresses corresponding to these logical addresses is known as Physical address space

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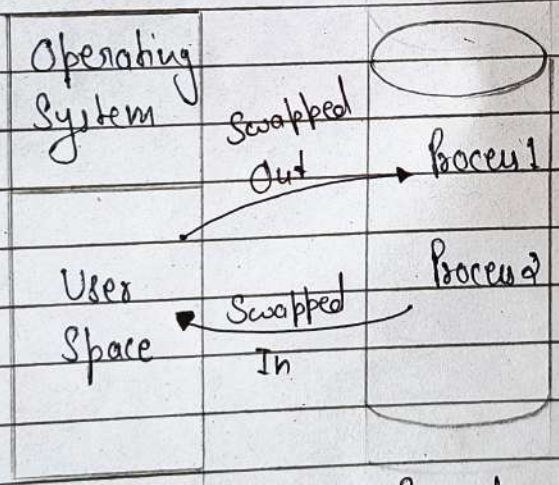
A Swapping

When a process is executed it must have resided in memory. Swapping is a process of swapping a process temporarily into a secondary memory from the main memory, which is fast compared to secondary memory. The main part of Swapping is transferred time and the total time is directly proportional to the amount of memory swapped.



A Memory Allocations

To gain proper memory utilization, memory allocation must be allowed allocated efficient manner. One of the simple methods for allocating memory is to divide into several fixed-size partitions

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and another method is Multiple partitions.

- Multiple Partitions Allocations :

In this method, A process is selected from the input queue and loaded into the free partition. When the process terminates, the partition becomes available for other processes.

- Fixed Partitions Allocation :

In this method, the OS maintains a table that indicates which parts of memory are available and which are not. When the process arrives and needs memory, we search for a hole that is large enough to store this process.

While allocating a memory sometimes Dynamic storage allocation problems occures, which concerns how to satisfy a request of size n from a list of free holes. There are some solution to this problem :

i) First fit : In this the first available free hole fulfil the requirement of the process allocated.

ii) Best fit : In the Best fit, allocate the

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smallest hole that is big enough to process requirements

3. Worst fit : In the worst fit, allocate the largest available hole to process.

* Fragmentation : Fragmentation is defined as when the process is loaded and removed after execution from memory, it creates a small free hole. To achieve a degree of multiprograming, we must reduce the waste of memory or fragmentation problems. In the OS two types of fragmentations :

i) Internal fragmentations : This occures when the memory blocks are allocated to the process more than their requested size

ii) External fragmentation : In this, we have a free memory block, but we can not assign it to a process bcz blocks are not Contiguous.

* Paging : Paging is a memory management scheme that eliminates the need for a contiguous allocation of physical memory.

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