Multithreading

Objectives

At the end of this module, you will be able to:

- Understand what is a Thread

Agenda

1 Introduction to Multithreading

2 Multitasking

Introduction to Multithreading

Sensitivity: Internal & Restricted

Need for Multithreading

Have you faced the following situations:

Your browser cannot skip to the next web page because it is downloading a file?

You cannot enter text into your current document until your word processor completes the task of saving the document to disk

What is Multitasking?

- Multitasking is synonymous with process-based multitasking, whereas multithreading is synonymous with thread-based multitasking

- All modern operating systems support multitasking

- A process is an executing instance of a program

- Process-based multitasking is the feature by which the operating system runs two or more programs concurrently

Example

- You might have come across people doing multiple things at the same time: A person talking on the phone while having lunch or watching TV
- In a computer, you can run multiple programs at the same time. Like you can play a song using Media Player while typing a Word document

What is Multithreading?

- In multithreading, the thread is the smallest unit of code that can be dispatched by the thread scheduler

- A single program can perform two tasks using two threads

- Only one thread will be executing at any given point of time given a single-processor architecture

Examples

- Computer games are best examples of multithreading
- You might have seen that in most of the ‘race’ games, other cars or bikes will be competing with your car/bike. These are nothing but threads.

Examples

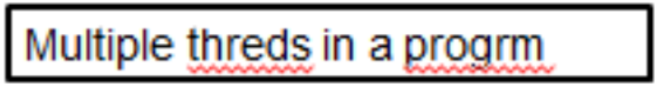
- Imagine that you need to paint your house. You can employ one painter who will take 10 days to complete the work or you can employ 10 painters who will finish the work in one day.
- In this case the 10 painters will be painting at the same time. That is 10 threads will be executing at the same time.

One thread

Multiple threads

Examples

- When you start typing in a MS Word document, you can see that the incorrectly spelled words are underlined with a red wavy line. Like:



Multiple threds in a progrm

- This is done by spell check feature of MS Word. The spell check is running in parallel while we type in a Word document. This is handled by a separate thread.

Multitasking Vs. Multithreading

Compared to multithreading, multitasking is characterized by the following:

- Each process requires its own separate address space
- Context switching from one process to another is a CPU-intensive task needing more time
- Inter-process communication between processes is again expensive as the communication mechanism has to span separate address spaces

These are the reasons why processes are referred to as heavyweight tasks

- Threads cost less in terms of processor overhead because of the following reasons:
  - Multiple threads in a program share the same address space and they are part of the same process
  - Switching from one thread to another is less CPU-intensive
  - Inter-thread communication, on the other hand, is less expensive as threads in a program communicate within the same address space

- Threads are therefore called lightweight processes

Uses of Multithreading

- A multithreaded application performs two or more activities concurrently
- It is accomplished by having each activity performed by a separate thread
- Threads are the lightest tasks within a program, and they share memory space and resources with each other

Single-Threaded Systems

- Single-threaded systems use an approach called an event loop with polling

- In this model:
  - A single thread of control runs in an infinite loop
  - Polling a single event queue to decide which instruction to execute next
  - Until this instruction returns, nothing else can happen in the system
  - This results in wastage of precious CPU cycles

Summary

- In this module, you were able to:
  - What is a multithreading
  - What is Multitasking?
  - Uses of Multithreading

Thank You

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