

جامعة الأنبار

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المعلومات

قسم أنظمة شبكات الحاسوب

المرحلة الرابعة

**Operating System**

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## Overview

- A thread comprises a **thread ID**, a **program counter**, a **register set**, and a **stack**.
- It shares with other threads belonging to the same process its **code section**, **data section**, and other operating-system **resources**, such as open files and signals.
- A traditional (or *heavyweight*) **process** has a single thread of control.
- If a process has multiple threads of control, it can perform more than one task at a time.
- Figure 4.1 illustrates the difference between a traditional **single-threaded process** and a **multithreaded process**.
- Example: A word processor may have a thread for displaying graphics, another thread for responding to keystrokes from the user, and a third thread for performing spelling and grammar checking in the background.

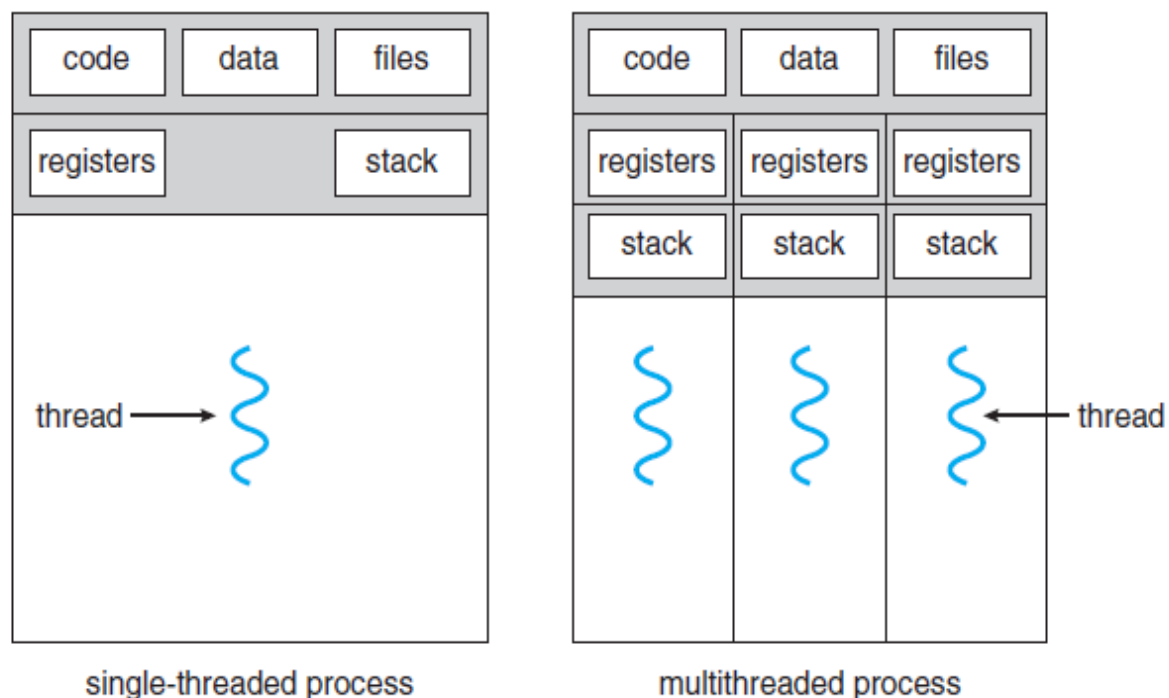


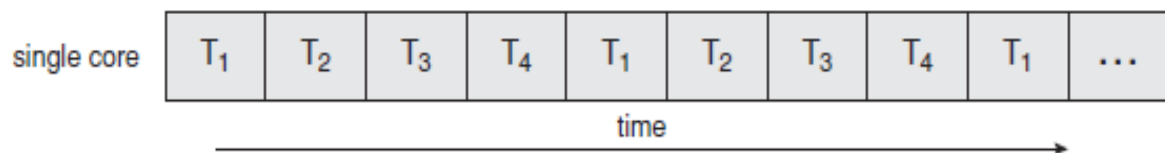
Figure 4.1 Single-threaded and multithreaded processes.

## Benefits

- **1- Responsiveness.** Multithreading an interactive application may allow a program to continue running even if part of it is blocked or is performing a lengthy operation.
- **2- Resource sharing.** The benefit of sharing code and data is that it allows an application to have several different threads of activity within the same address space.
- **3- Scalability.** in a multiprocessor architecture, threads may be running in parallel on different processing cores. A single-threaded process can run on only one processor, regardless how many are available.

## Multicore systems

- A recent trend in CPU design is to include multiple computing **cores** on a single chip. Such multiprocessor systems are termed **multicore**.
- They can be more efficient than multiple chips with single cores because **on-chip communication is faster than between-chip communication. In addition, one chip with multiple cores uses significantly less power than multiple single-core chips.**
- Multithreaded programming provides a mechanism for more efficient use of these multiple computing cores and improved concurrency.
- Consider an application with four threads.
- On a system with a single computing core, concurrency merely means that the execution of the threads will be interleaved over time because the processing core is capable of executing only one thread at a time.



- On a system with multiple cores, however, concurrency means that the threads can run in parallel, because the system can assign a separate thread to each core.

