The Life Cycle of a Thread

Threads are the basic units of CPU utilization. They allow for parallel execution within a process. In this presentation, we will explore how threads work and their life cycle.

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Thread States and Transitions

A thread can exist in one of several states. Understanding these states and their transitions is essential to effective concurrent programming. States include, ready, running, blocked, sleeping, and dead.

Ready

The thread is ready to run and is waiting to be scheduled on a CPU.

Running

Instructions are being executed on the CPU.

Blocked

The thread is blocked waiting for a resource or until a certain condition is met.

Sleeping

The thread is in a sleep state and waiting for a fixed amount of time.

Dead

The thread has finished executing and has been terminated.

Thread Synchronization and Communication

Threads can communicate and synchronize using several techniques. These include locks, semaphores, monitors, messages, and signals. Synchronization avoids race conditions and data inconsistency.
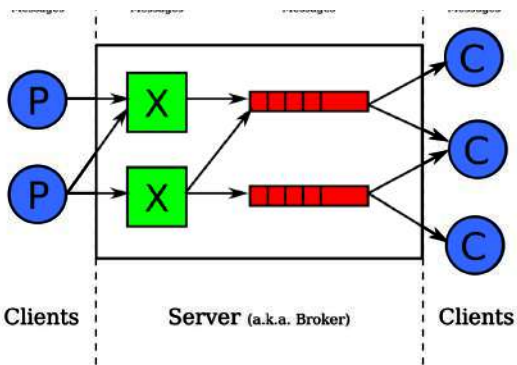

Locks and Semaphores

Ensure mutual exclusion and prevent race conditions.

Monitors

Allow threads to take turns in a critical section that must be executed atomically.

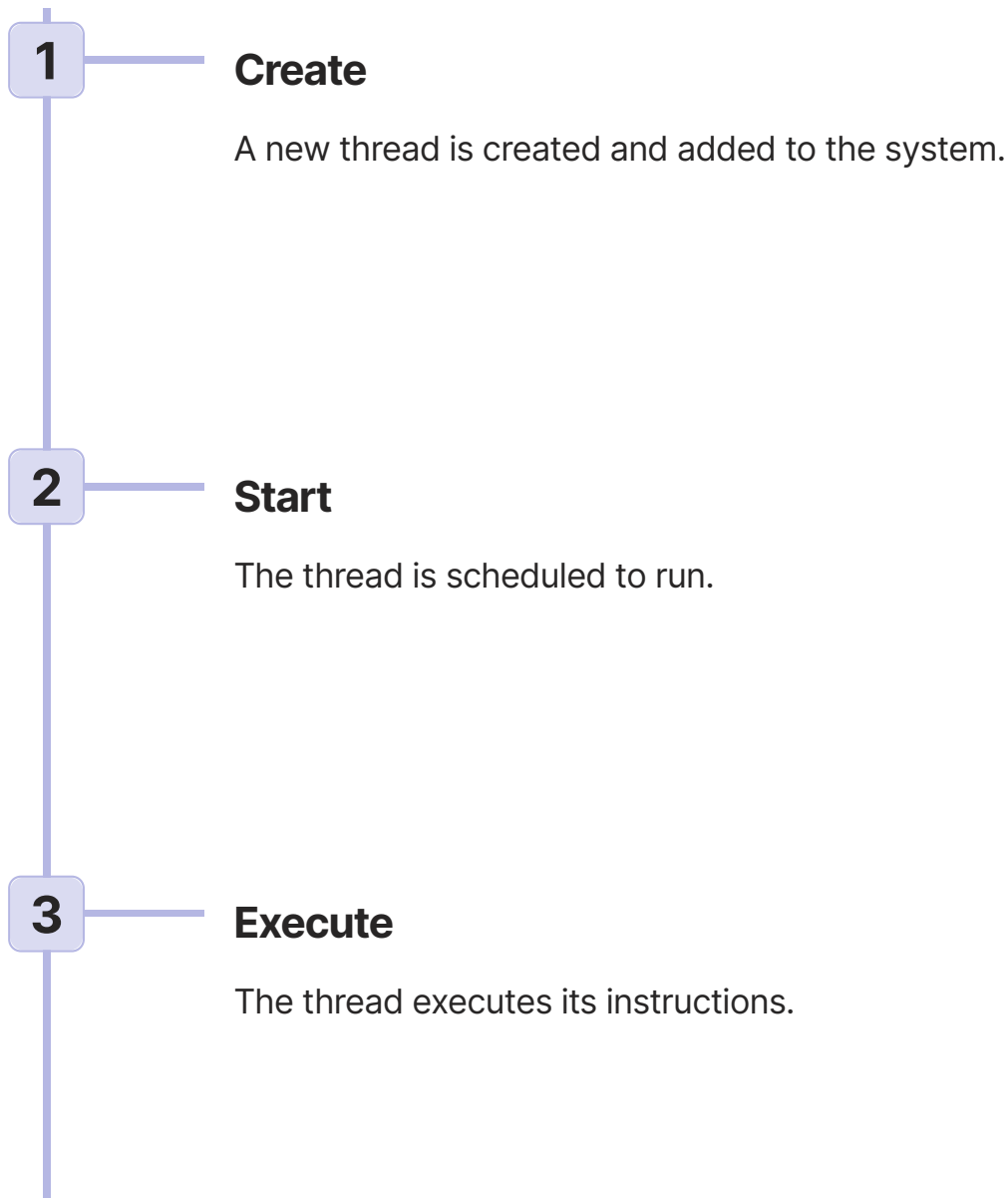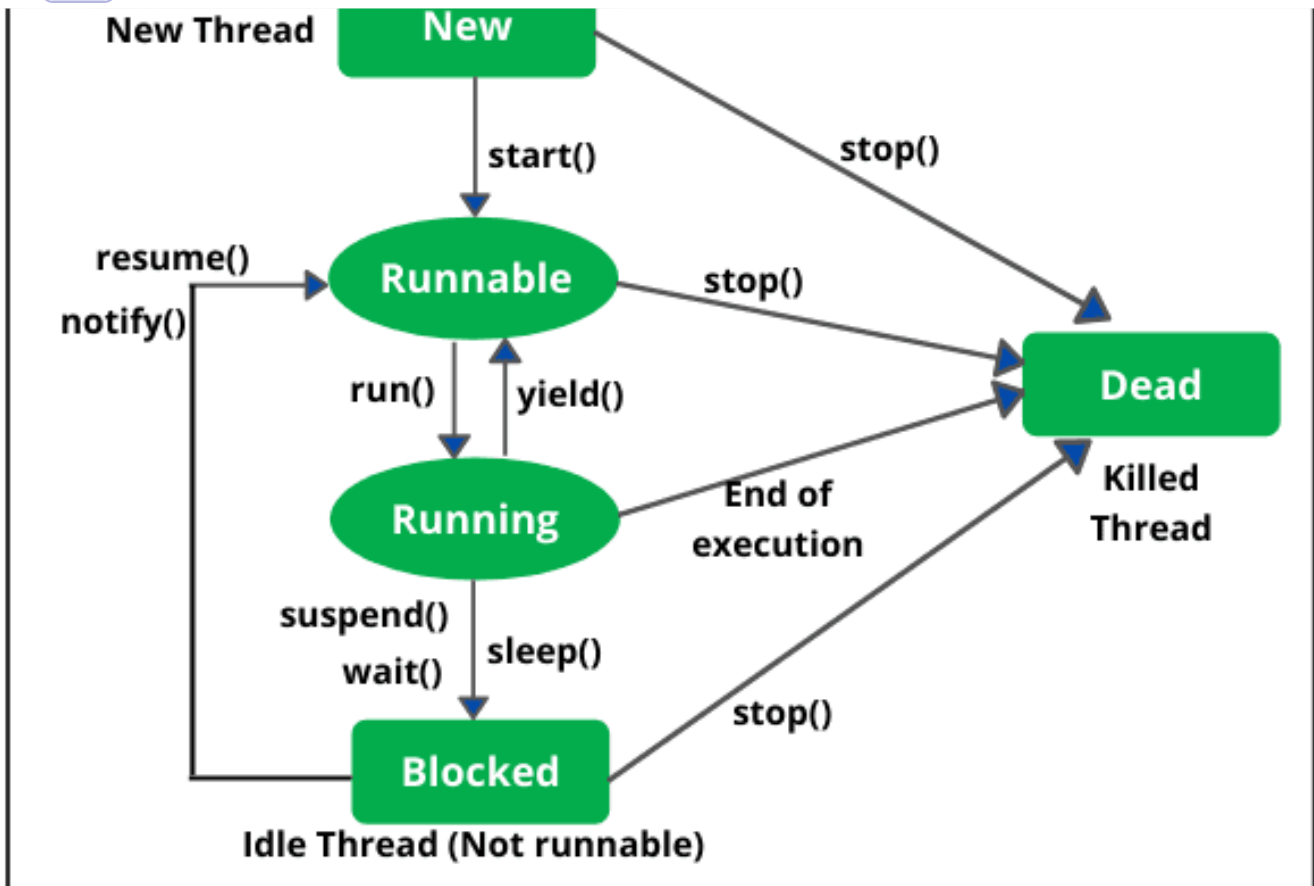Clients   Server (a.k.a. Broker)   Clients

Message Queues

Allows for inter-process communication and transfer of data.

Thread Creation and Termination

Threads are created and terminated in several ways. The most common way is through the use of an API. Threads can be programmed to terminate when they have completed their task, or they can wait until they were explicitly instructed to terminate.

1 — **Create**

A new thread is created and added to the system.

2 — **Start**

The thread is scheduled to run.

3 — **Execute**

The thread executes its instructions.

4 — **Finish**

Thread Life Cycle Diagram

A visual representation of the thread life cycle helps developers understand better how thread states and transitions work.

Real-Life Examples of Threads

Threads are ubiquitous in modern computing. They're used in many common applications, from web browsers to video games. They allow for parallel processing and a better user experience.

Web Browsers

Threads let the browser load multiple pages at the same time.

Video Games

Threads allow the user to play their game while the computer generates enemy AI.

Medical Devices

Threads control medical devices, such as insulin infusion pumps, to ensure precision.

Conclusion and Q&A Session

Threads are an essential part of modern computing. Understanding their life cycle and how they can be used to enhance parallel processing is essential. Now, let's answer any questions you may have.

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