

# CSE4509 Operating Systems

## Thread

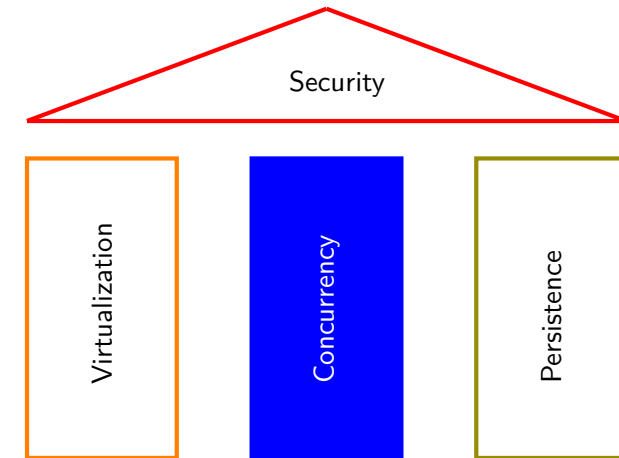
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Original slides by Mathias Payer and Sanidhya Kashyap [EPFL]

## Concurrency



## Lecture Topics

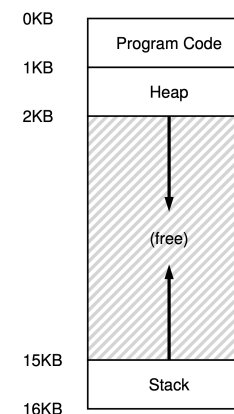
- Thread abstraction
- Multi-threading challenges
- Key concurrency terms and definitions

This slide deck covers chapters 26 and 27 in OSTEP.

[Credits: Portions of the content are adapted from slides based on the OSTEP book by Prof. Youjip Won (Hanyang University) and Prof. Mythili Vutukuru (IIT Bombay), with thanks.]

## Threads: Executions context

- Threads are independent execution context
  - similar to processes
  - EXCEPT they share the same address space

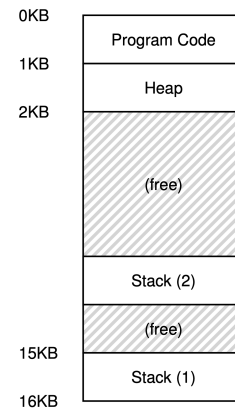


- We only had one thread in a process so far
  - single-threaded program
  - one Program Counter (PC)
  - one Stack Pointer (SP)

## Multi-threaded Process

- **What happens if we want multiple threads in parallel?**

- they must share the address space
- they must maintain separate execution stream
- **is that possible with a shared stack or PC?**
- each thread has separate stack
  - leading to independent function calls
- each thread has separate PC
  - able to execute different parts of the program
- code and heap segments are still shared



- **Communication between processes vs threads**

- Processes need complicated Inter-Process Communication (IPC)
- Extra memory footprint for IPC
- Threads can do it by simply using global variables (shared)

## To be continued