An Introduction to Concurrent Programming

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Overview

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- Response time

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- Parallelize IO operations

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- How does the OS schedule tasks?
- “Concurrent” v.s. “Parallel”

Process-level concurrency

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- Pros and cons

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  - MPI implementations

Multithreading

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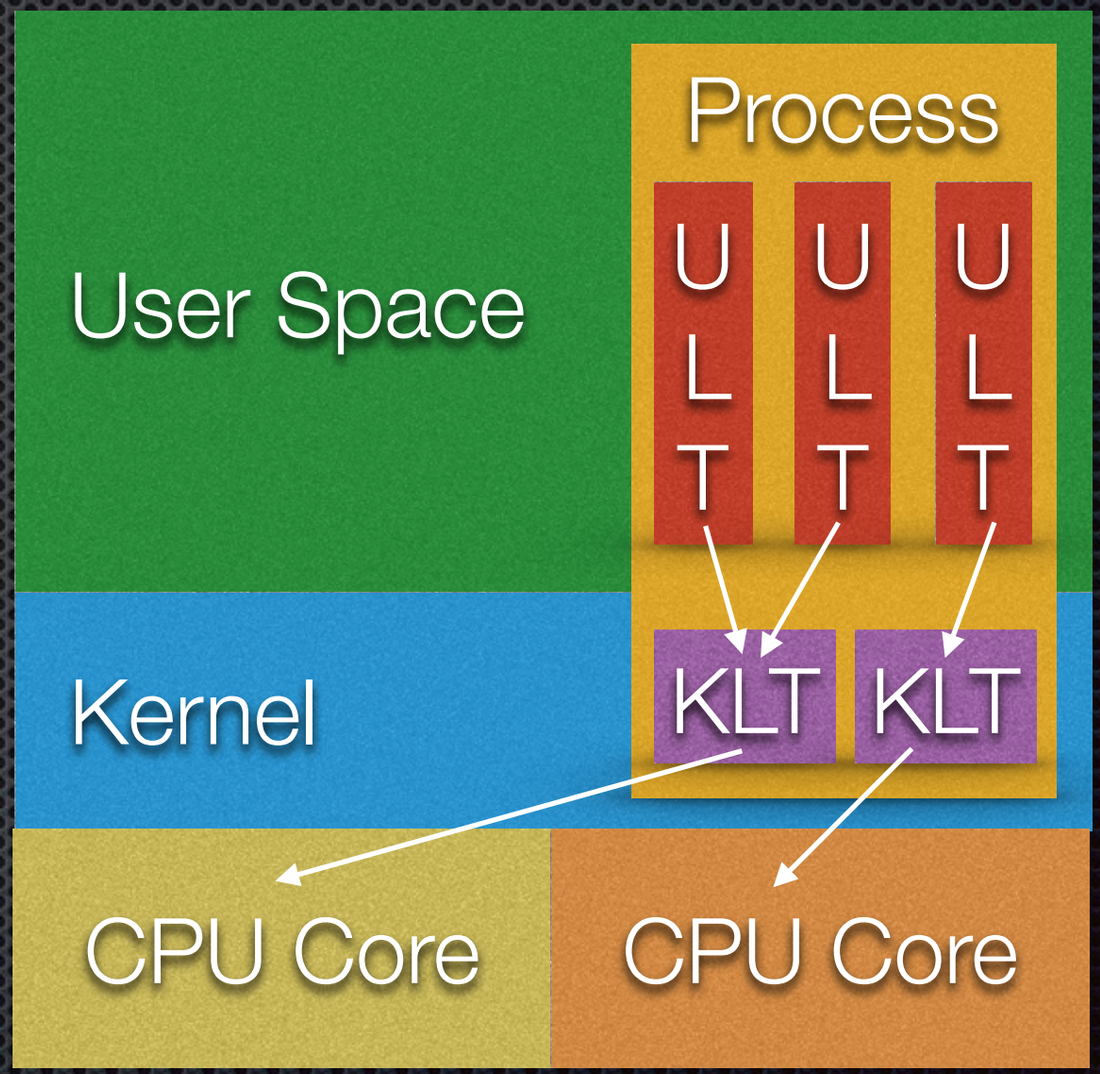
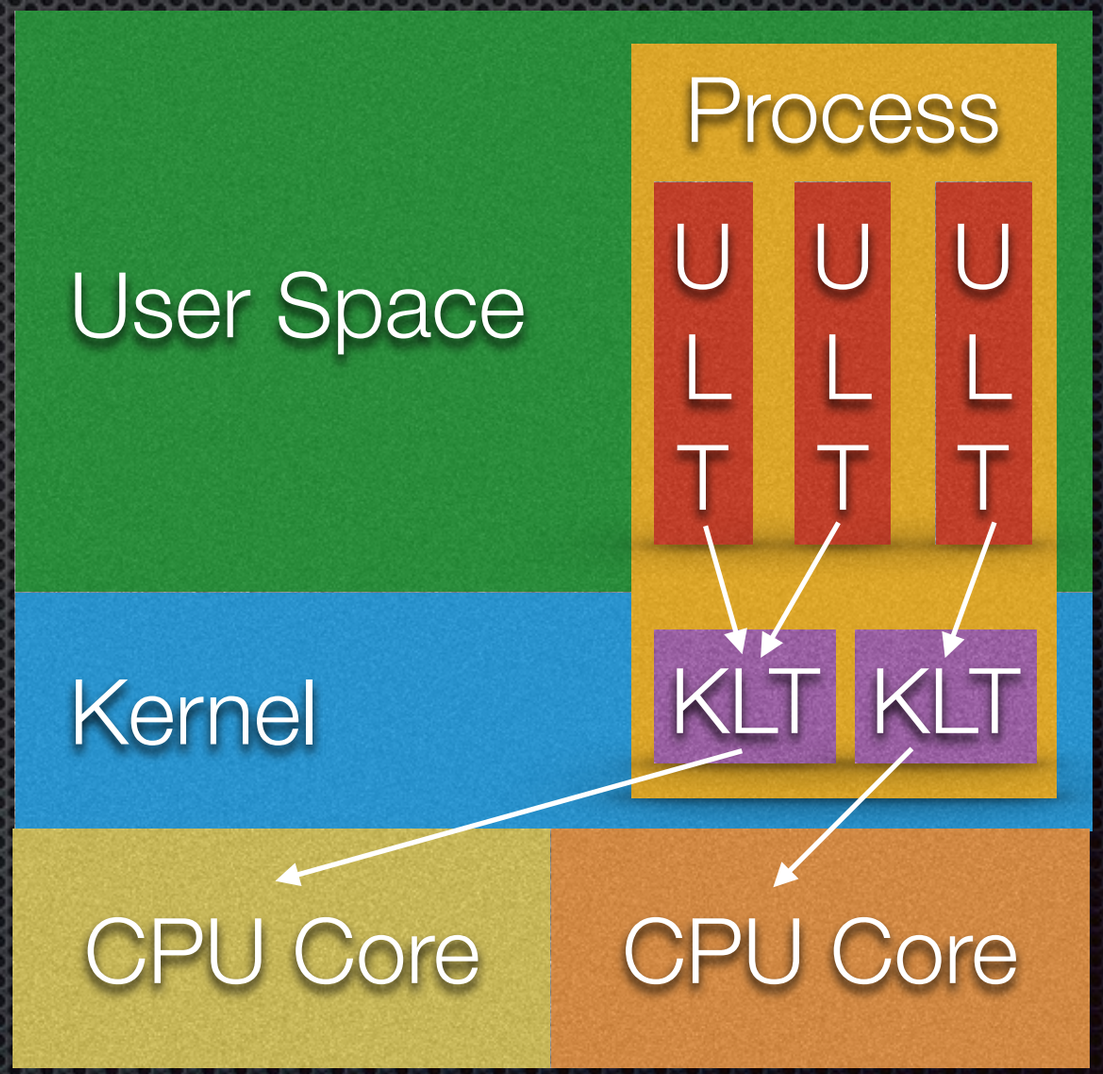
- Process v.s. thread



Multithreading

- Process v.s. thread
- KLT v.s. ULT



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  - Simple wrappers for kernels' threading facilities (e.g. Python's `threading` package)

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    - Implementations
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      - Python's generator and `greenlet` for Python
      - Ruby's `fiber`

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- High level threading libraries/standards

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  - OpenMP
  - Intel Threading Building Blocks
  - Apple Grand Central Dispatch

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    - Multiversion Concurrency Control (MVCC)

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  - Message passing

Summary

	Weight	Scheduling Policy	Utilize Multicores	Thread Safety	Other Features
Process	Most Heavy	Cooperative & preemptive	Yes	Less important	Dispatch across networks
KLT	Heavy	Cooperative & preemptive	Yes	Important	
ULT (Coroutine)	Light	Cooperative	No	Less important	Must be mapped onto KLT
Hybrid	Light	-	Yes	-	Separate logic and runtime
High level threads	-	-	Yes	Less important	Task-based

Q&A

Thanks!