

Concurrency is **NOT** Parallelism

by Vonnie Wu

Overview

- **Definitions**
- Distinction between both concepts
- Process vs. Thread vs. Coroutine
- Litmus Test

Phone Upgrade?

Both Phones Can:

- Receive texts while calling.
- Can play music while texting.
- Can use apps and still receive calls.
- Both can multitask to a certain extent.
- Can we say that both phones are running processes in parallel?



Definitions

- There is an inherent, yet subtle, difference between concurrency and parallelism.
- **Concurrency** is the act of running and managing multiple computations at the same time.
- **Parallelism** is the act of running multiple computations **simultaneously**.

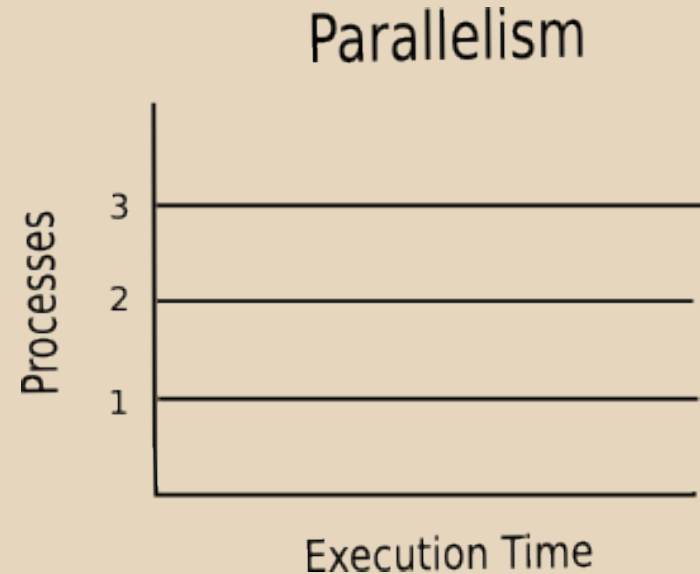
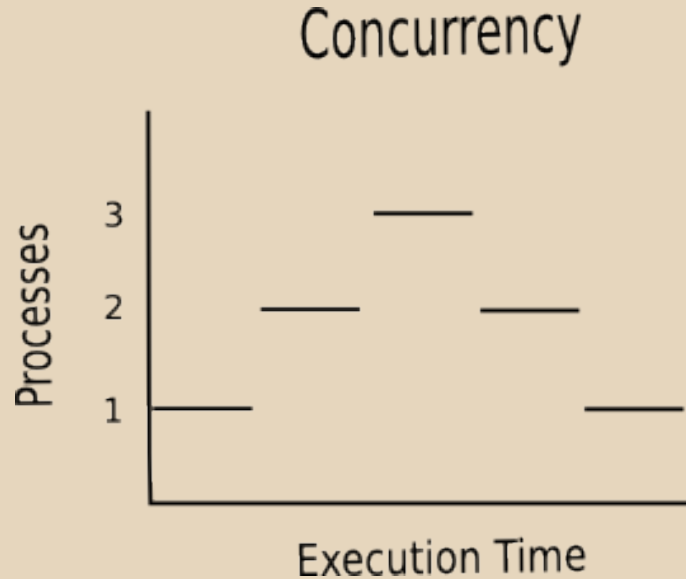
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Bottom Line

Not all Concurrency is Parallelism, but all Parallelism is Concurrency.

Difference in execution



*Assuming single processor for concurrent system and multiple processors for parallel system.

Question?

So if it's this simple, why do people get confused?



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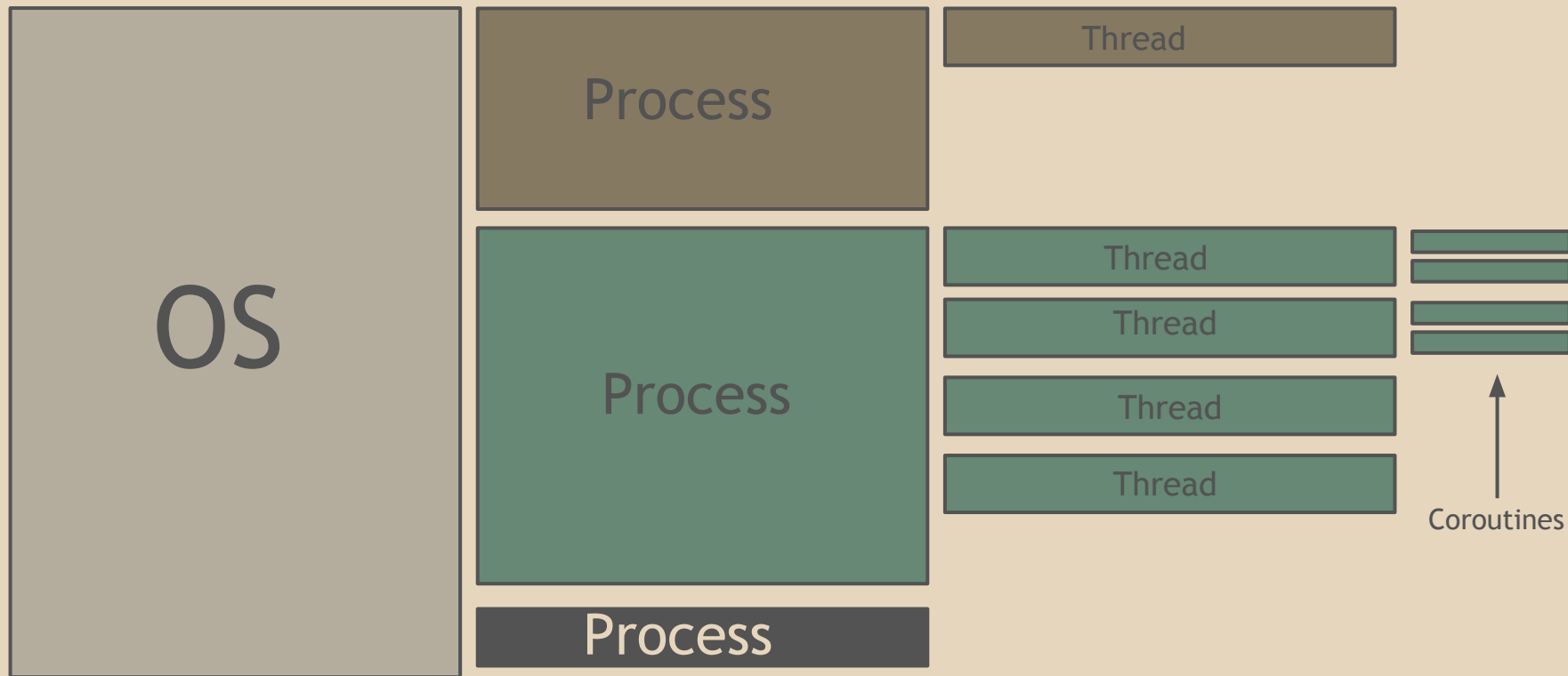
Process vs. Thread vs. Coroutine

Process: can be thought of as a program running in your OS

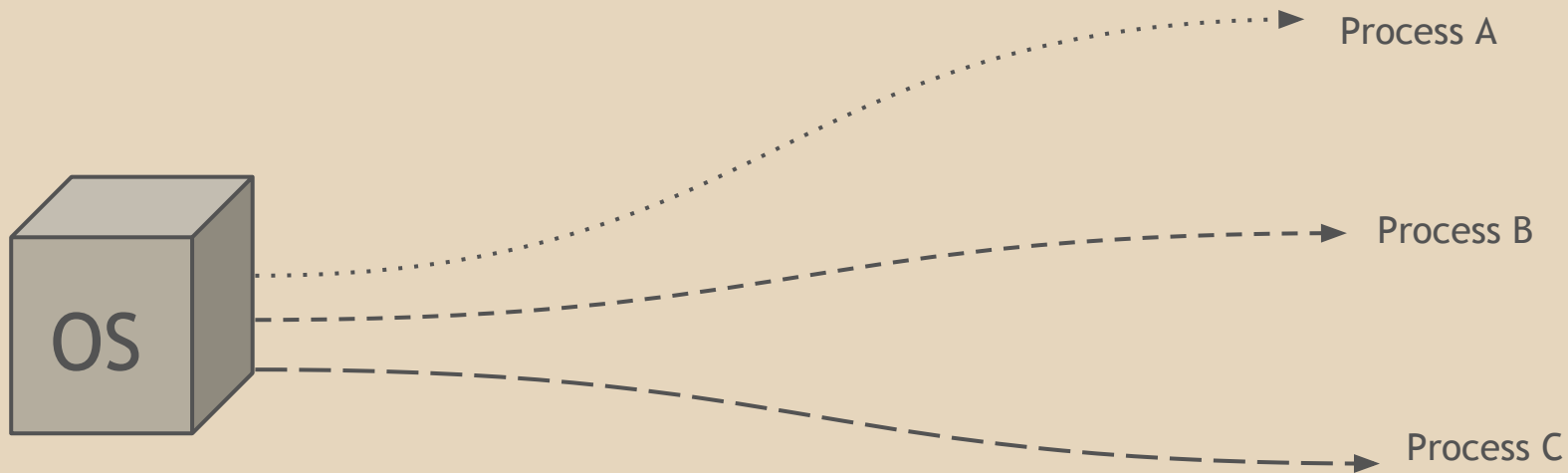
Thread: can be thought of as a small sub-process that belongs to a process.

Coroutine: can be thought of as a small thread, that gets multiplexed onto a thread.

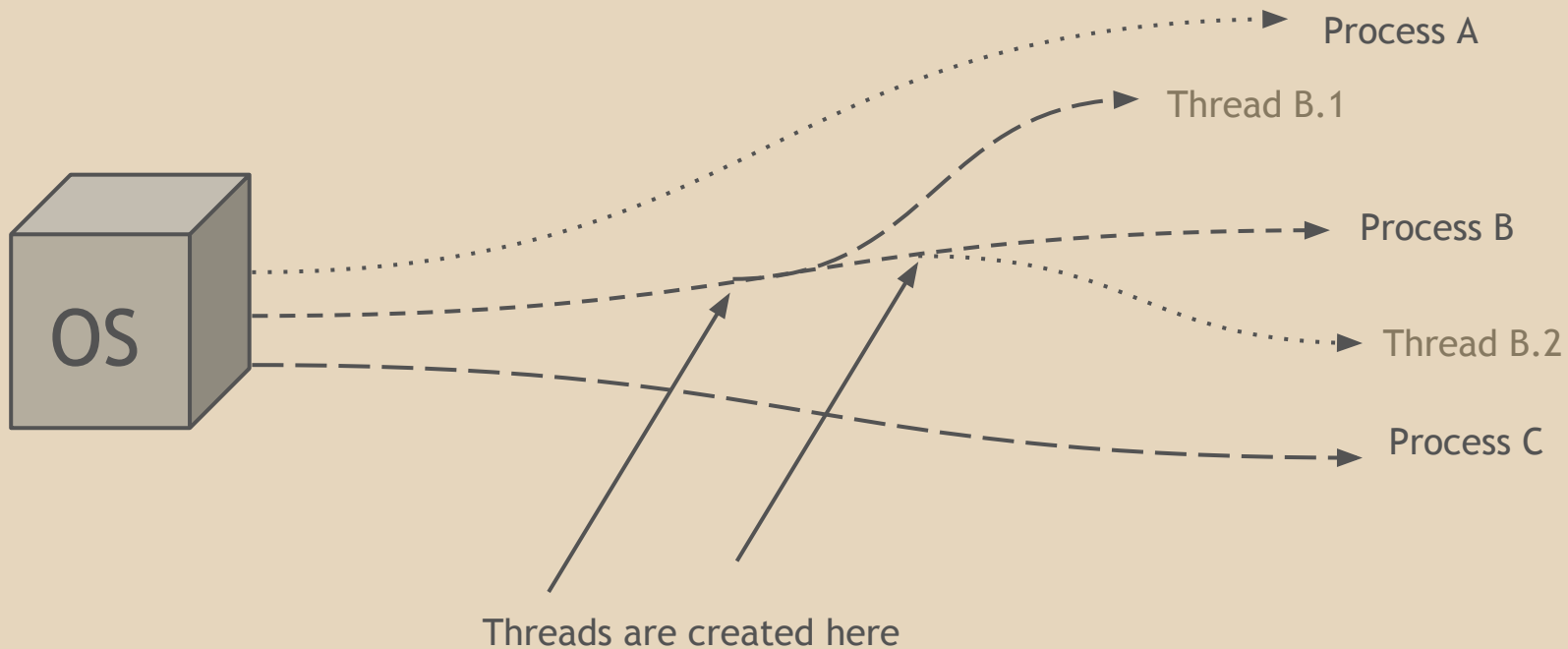
Process vs. Thread vs. Coroutine



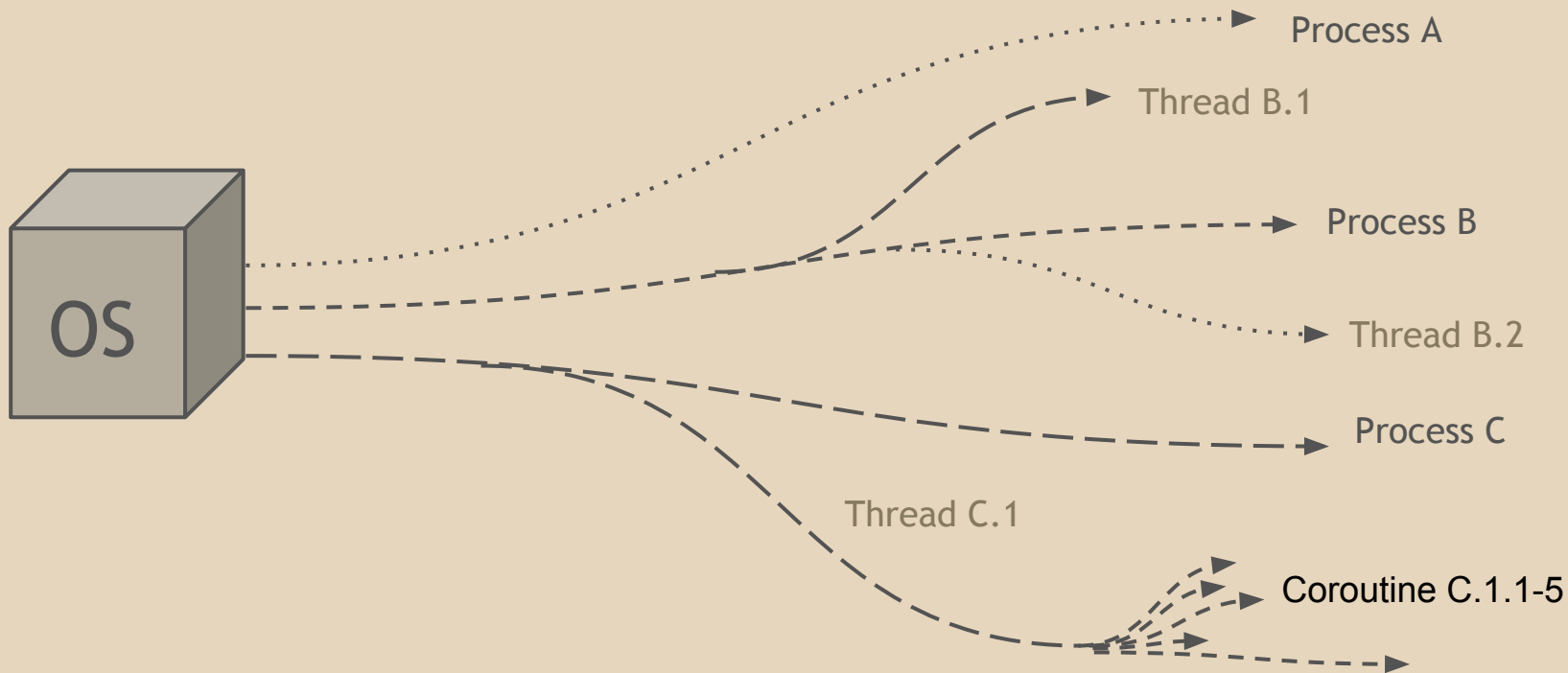
Process



Thread



Coroutine



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Litmus Test

So how can we tell if our programs run concurrently or in parallel?*

*Assuming that threads or coroutines are used in the program.

Litmus Test: Single Processor

If we have a single processor, ALL of our programs will run concurrently.

Litmus Test: Multiple Processors

If we have multiple processors, our programs **may** run in parallel.

Back to my example

Both Phones Can:

- Can we say that both phones are running processes in parallel?
- NO. My old Pantech phone had only a single processor so its processes ran **concurrently**.
- My new Nokia phone has 4 processors, its processes may run in **parallel**.



Any questions?

Thank you for your time!