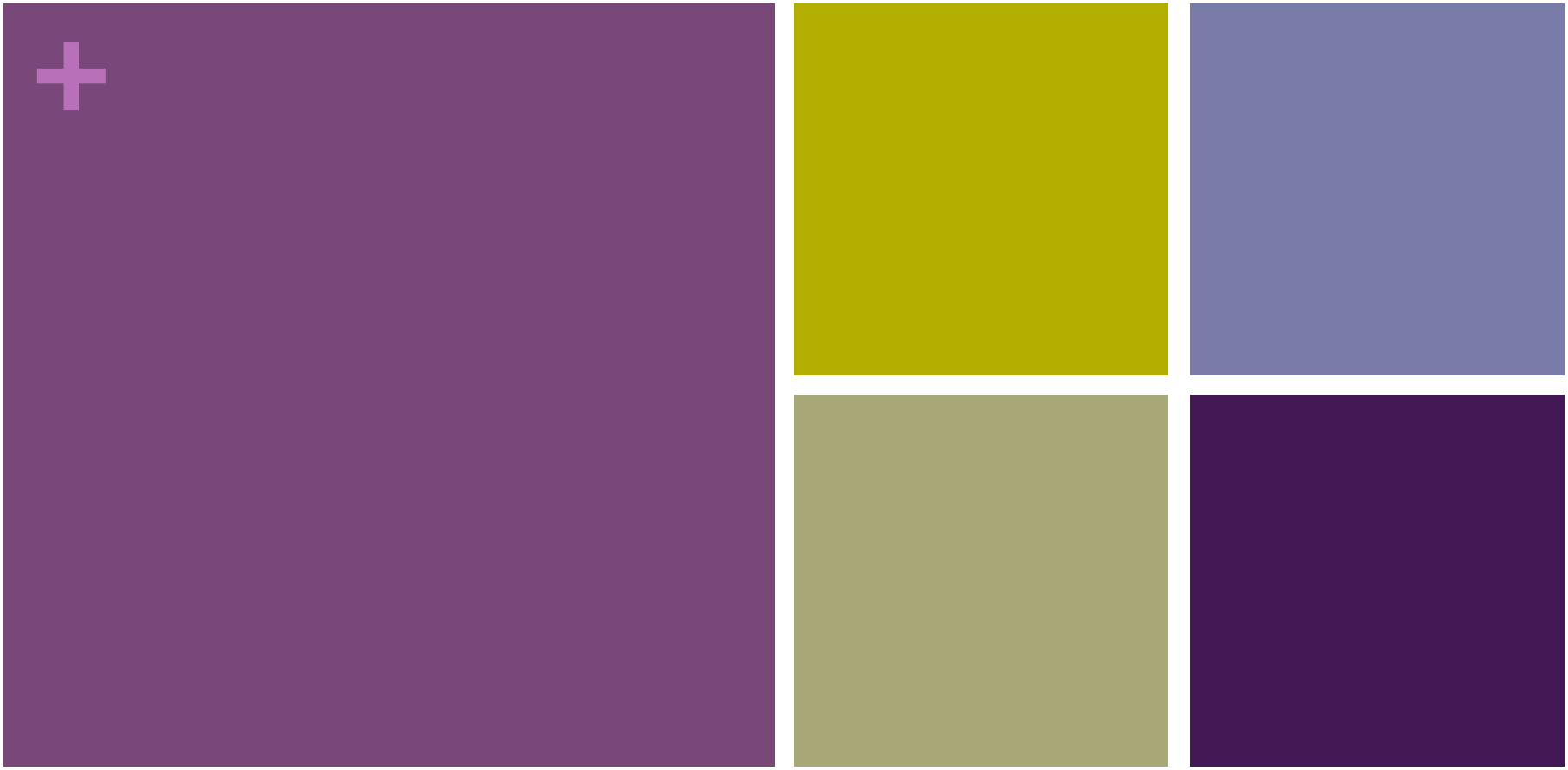
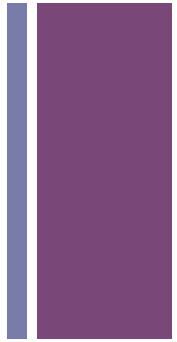


Section 3

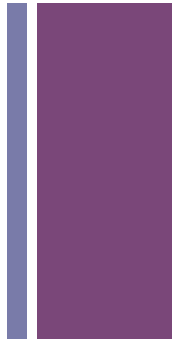
Threading and Locking

Definitions



What is a thread?

Definitions



What is a thread?

A single flow of control with a process

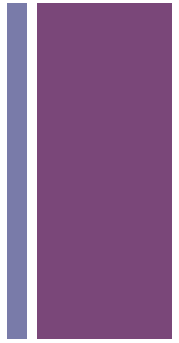
Definitions

What is a thread?

A single flow of control with a process

Why use threads?

Definitions



What is a thread?

A single flow of control with a process

Why use threads?

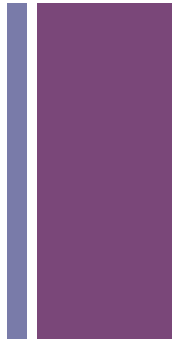
Exploit latency, concurrency

Event-driven software

Dangers

What could go wrong?

Dangers



What could go wrong?

Race Conditions

Dangers

What could go wrong?

Race Conditions

How do we fix this?

Dangers

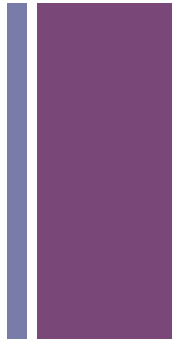
What could go wrong?

Race Conditions

How do we fix this?

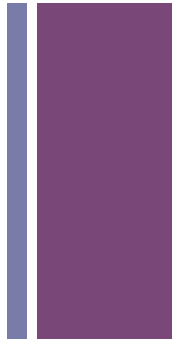
Locking

Definitions



What is a lock?

Definitions

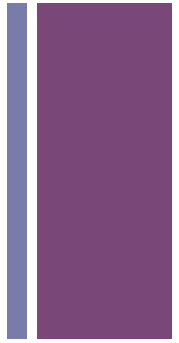


What is a lock?

Serializes access to some critical region of code or data

Used to enforce mutual exclusion concurrency control

Definitions



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Locks need help from hardware

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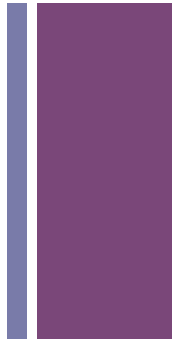


What is a lock?

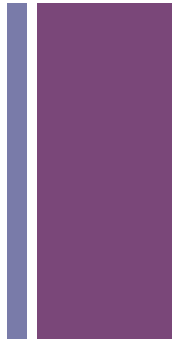
- Serializes access to some critical region of code or data
- Used to enforce mutual exclusion concurrency control
- Locks need help from hardware

Different kinds of locks

Dangers

What could go wrong?

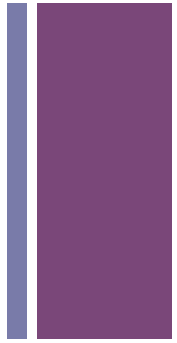
Dangers



What could go wrong?

Impacts Performance

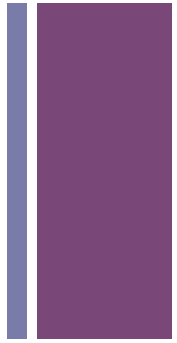
Dangers



What could go wrong?

- Impacts Performance
- Hard to debug

Dangers



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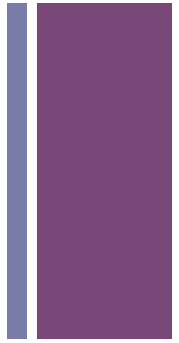
Dangers



What could go wrong?

- Impacts Performance
- Hard to debug
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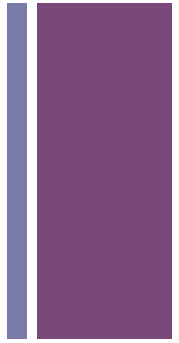
How do we fix this?

Dangers



What could go wrong?

- Impacts Performance
- Hard to debug
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How do we fix this?

- Punt (if collisions aren't our problem)

Dangers

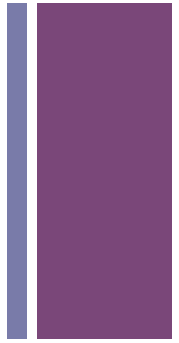
What could go wrong?

- Impacts Performance
- Hard to debug
- Deadlocks

How do we fix this?

- Punt (if collisions aren't our problem)
- Resource hierarchy/Conductor/Chandy-Misra

Using Threads



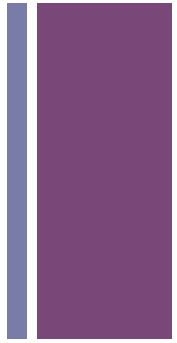
Creation

Termination

Detachment and Joining

Self and Equal

Using Threads



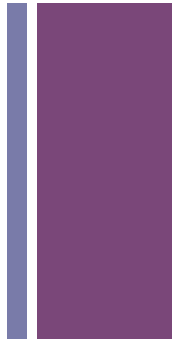
Thread (class)

Runnable (interface)

ForkJoin

ThreadPools/Executor Services

Project 0 Review



Project 1 Suggestions

John's Suggestion

One thread for listening (waiting for server probes)

One thread for keyboard input that handles server communication initiated by keyboard input

One thread for periodic re-registration

Project 1 Reminders

John's Suggestion

- One thread for listening (waiting for server probes)
- One thread for keyboard input that handles server communication initiated by keyboard input
- One thread for periodic re-registration

Remember

- Terminate cleanly
- You need to re-register
- Modularity

Questions?

Java:

http://docs.oracle.com/javase/tutorial/essential/concurrency/index.html

http://docs.oracle.com/cd/E13150_01/jrockit_jvm/jrockit/geninfo/diagnos/thread_basics.html

C/Unix:

http://www.mit.edu/people/proven/IAP_2000/index.html

http://www.yolinux.com/TUTORIALS/LinuxTutorialPosixThreads.html