

Concurrent Programming

1: Introduction

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Concurrent systems

- Systems where multiple executions take place at the same time.
- Executions may interact with each other.
- Think:
 - Some applications may collaborate together.
 - A single application using multiple CPUs at the same time.

Why concurrency?

- Two main motivations.
- Speed:
 - CPUs are not getting much faster every year...
 - ...but they are getting more cores!
- Networks:
 - Computers are not getting much faster every year...
 - ...but our networks are getting bigger!

Concurrency is hard!

- Programming is difficult enough already.
- It gets harder when you think about *multiple* executions.
- So we need to equip ourselves with good *tools* and *methods*. :-)

I deal with it every day

- I maintain the Jolie programming language (jolie-lang.org)
- It's a language meant for concurrency.
- Open source: I review the patches.

Topic

- Techniques for designing and programming concurrent systems.
- Focus is on:
 - The key concepts behind concurrency.

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Course Structure

- This course uses (a variant of) Flipped Classroom!
- You read the book and do exercises during the exercise classes.
- You then come to the frontal lectures with me:
 - I'll expect you to have read the book chapters I assigned.
 - Live coding and more practical insight.
 - Reflection (e.g., quizzes).

Course Material

- Slides.
- **The Book:** Java Concurrency in Practice. *Brian Goetz et al.*
Addison-Wesley.
- The book has a website: <http://jcip.net/>
- More resources during the lectures.

What we will strive to learn

- Define concurrency.
- Design and implement concurrent programs.
- Reason about the efficiency of a concurrent program.
- Reason about the **correctness** of a concurrent program.

The General Objective

- Understand how we can exploit having a lot of cores in our CPUs and a lot of devices connected together.

Evaluation

- Final project with report:
 - You will all solve the same problem.
 - External censor, 7-point scale.
 - The problem will be given later during the course.
 - The structure of the report will also be given.

Communication during the lectures

- Don't leave me alone, I'll bore myself.
- So there will be some quizzes.
- Also, I need to get feedback from you.
- The Humming feedback system!