

Extreme Multiprogramming

Lecture plan

Introduction to multiprogramming

- Purpose
- Multiprocessing
- Multithreading
- Concurrency
- Parallelism
- Deadlocks
- Live-locks
- Race-conditions
- Fairness
- Scheduling

Thread Programming

- Kernel level threads
- User level threads
- Mixed threads
- POSIX threads
- Java Threads
- Python Threads

CSP

- Basic notation
- Formal verification
- Modular design

Programming CSP

- JCSP
- CTJ
- CCSP
- C++CSP
- Occam
- RMoX
- Transterpreter

Parallel Architectures

- Shared bus
- MESI
- Directory Memory
- Distributed memory
- False Sharing
- SMP on a Chip
- Majc
- CELL
- Xenon
- Niagara – special guest lecture on this one

Scheduling

- Scheduling for
 - Utilization
 - Priority
 - Locality

Multiprogramming for Robotics

- CSP as an method for event programming
- This will (hopefully) be a guest lecture

Multiprogramming for Gaming

- Thinking in concurrency
- Time co-ordination
- Re-use

Formal verification

- There are tools that can formally verify systems based on communication sequential processes
- This will be a guest-lecture

Exercises/Exam

- You will work on a project during the course – this will also be your exam project
- There will be no classic exercises
- The project must contain
 - Considerations on the concurrency available in the system
 - Design
 - Implementation
 - Findings

Exercises/Exam

- Implementation can be in any language you'd like
- However there are languages that suit the model well
 - C++ - using CSP C++
 - Java – using JCSP or CTJ
 - Occam – the father of CSP languages

Exercises/Exam

- You decide on the kind of project you want
 - But it need to be concurrent in nature...:D
- Groups are allowed (but don't tell the minister ;))

Exercises/Exam

- Project examples
- Action game – 2D and event based is nice and easy:
 - Worm, ping-pong and similar oldies
 - **KEEP YOUR AMBITION LEVEL LOW!**
- Robotics
 - Library for handling sensor input from a robot
 - Plan to use a simulated environment

Exercises/Exam

- Automata modeling
 - Conways life
 - WATOR
- Networking
 - Webserver, IP-phone central, etc