
Indlejret Software Udvikling Dispositioner

AARHUS SCHOOL OF ENGINEERING



EKSAMENSNOTER

Indholdsfortegnelse

1 Programs in relation to the OS and the kernel 1

1.1 Sub topics 1

1.2 Curriculum 1

1.3 Exercises 1

2 Synchronization and protection 2

2.1 Sub topics 2

2.2 Curriculum 2

2.3 Exercises 2

3 Thread communication 3

3.1 Sub topic 3

3.2 Curriculum 3

3.3 Exercises 3

4 OS API 4

4.1 Sub topics 4

4.2 Curriculum 4

4.3 Exercises 4

5 Message Distribution System (MDS) 5

5.1 Sub topics 5

5.2 Curriculum 5

5.3 Exercises 5

6 Resource handling 6

6.1 Sub topics 6

6.2 Curriculum 6

6.3 Exercises 6

List of Figures

List of Tables

1 Programs in relation to the OS and the kernel

1.1 Sub topics

- Processes and threads.
- Threading model.
- Process anatomy.
- Virtual memory.
- Threads being executed on CPU, the associated scheduler and cache.

1.2 Curriculum

- Slides "Intro to OS's".
- Slides "Parallel programs, processes and threads".
- OLA: "Anatomy of a program in memory", Gustavo Duarte.
- OLA: "The free lunch is over".
- OLA: "Virtual memory", pages 131-141.
- OLA: " Introduction to operating systems".
- OLA: "Multithreading".
- Kerrisk: Ch. 3-3.4 - System programming concepts.
- Kerrisk: Ch. 29 - Threads: Introduction.

1.3 Exercises

- Posix Threads.

2 Synchronization and protection

2.1 Sub topics

- Data integrity - Concurrency challenge.
- Mutex and Semaphore.
- Mutex and Conditionals.
- Producer / Consumer problem.
- Dining philosophers.
- Dead locks.

2.2 Curriculum

- Slides: "Thread Synchronization I and II".
- Kerrisk: Chapter 30: Thread Synchronization.
- Kerrisk: Chapter 31: Thread Safety and Per-Thread Storage (Speed read)".
- Kerrisk: Chapter 32: Thread Safety and Per-Thread Storage (Speed read)".
- Kerrisk: Chapter 53: Posix Semaphores (Named not in focus for this exercise)".
- OLA: "pthread-Tutorial" - chapters 4-6.
- OLA: "Producer/Consumer problem".
- OLA: "Dining Philosophers problem".

2.3 Exercises

- Posix Threads
- Thread Synchronization I & II

3 Thread communication

3.1 Sub topic

- The challenges performing intra-process communication.
- Message queue.
 - The premises for designing it.
 - Various design solutions - Which one chosen and why.
 - Its design and implementation.
- Impact on design/implementation between before and after the Message Queue.
- Event Driven Programming.
 - Basic idea.
 - Reactiveness.
 - Design - e.g. from sequence diagrams to code (or vice versa).

3.2 Curriculum

- Slides: "Inter-Thread Communication".
- OLA: "Event Driven Programming: Introduction, Tutorial, History - Pages 1-19 & 30-51".
- OLA: "Programming with Threads - chapters 4 & 6".

3.3 Exercises

- Thread Communication

4 OS API

4.1 Sub topics

- The design philosophy - Why OO and OS Api?
- Elaborate on the challenge of building it and its current design:
 - The PIMPL / Cheshire Cat idiom - The how and why.
 - CPU / OS Architecture.
- Effect on design/implementation:
 - MQs (Message queues) used with pthreads contra MQ used in OO OS Api.
 - RAII in use.
 - Using Threads before and now.
- UML Diagrams to implementation (class and sequence) - How?

4.2 Curriculum

- Slides: OS Api”.
- OLA: OSAL SERNA SAC10”.
- OLA: Specification of an OS Api”.
- Kerrisk: Chapter 35: Process Priorities and Scheduling”.

4.3 Exercises

- OS API.

5 Message Distribution System (MDS)

5.1 Sub topics

- Messaging distribution system - Why & how?
- The PostOffice design - Why and how?
- Decoupling achieved.
- Design considerations & implementation.
- Patterns per design and in relation to the MDS and PostOffice design:
 - GoF Singleton Pattern
 - GoF Observer Pattern
 - GoF Mediator Pattern

5.2 Curriculum

- Slides: "A message system".
- OLA: "GoF Singleton pattern".
- OLA: "GoF Observer pattern".
- OLA: "GoF Mediator pattern".

5.3 Exercises

- The Message Distribution System

6 Resource handling

6.1 Sub topics

- RAII - What and why?
- Copy construction and the assignment operator.
- What is the concept behind a Counted SmartPointer?
- What is *boost :: shared_ptr* <> and how do you use it?

6.2 Curriculum

- Slides: "Resource Handling".
- OLA: "RAII - Resource Acquisition Is Initialiation".
- OLA: "SmartPointer".
- OLA: "Counted Body".
- OLA: "*boost :: shared_ptr*".
- OLA: "Rule of 3".

6.3 Exercises

- Resource Handling.