



Norwegian University of
Science and Technology

System and Runtime Software Interaction with Modern Hardware

Fordypningsemne / theory module TDT09

Meeting November 2nd, 2021

Høst 2021

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Motivation

- The idea:
 - Understand the *evolution* of the Unix system over the last decades
- This evolution led to current OS *features* that can be investigated as well as possible future features
 - Each of these features is illustrated by a relevant paper introducing the new idea/feature.
- Your task:
 - understand the ideas behind the respective paper for one of the given topics
 - develop an idea of how the implementation of the respective feature into a relatively simple Unix-like system (xv6) could take place
 - figure out which changes to the system the implementation of the feature requires

The Basis

- the [xv6 educational OS from MIT](#).
- xv6 exists in a number of versions – feel free to choose one:
 - [An older version for x86 PCs](#)
 - [Documentation about xv6 for x86](#)
 - [The currently supported version for RISC-V](#)
 - [Documentation about xv6 for RISC-V](#)
 - [An unofficial port to the Raspberry Pi 1/Zero \(ARM32\)](#)
 - [An unofficial port to the Raspberry Pi 2 \(ARM32\)](#)
- Running xv6:
 - x86 and RISC-V: [qemu](#) emulator (configurations `qemu-system-i386` and `qemu-system-riscv64`)
 - x86 and ARM32 also on real hardware: PC and Raspi 1/2
 - RISC-V on real hardware: Allwinner Nezha D1 board

Deliverables

1. A **paper** (about 10-15 pages) as PDF file
 - describing the feature from your topic and the results of your investigation of a possible implementation in xv6
 - ideally including a description of your implementation approach
2. A **presentation video** (about 15-20 minutes)
 - including your presentation slides as a PDF file

Presentation

- I would love to have a **live session** with your presentations
 - ...and demonstrations in case you want to show code
 - and we could order pizza :-)
- Problems:
 - 29.11.-3.12. NIKT conference/workshop/PhD defense
 - 5.12.-11.12. RISC-V Summit in San Francisco...
- Would it be possible to have a meeting in the week of December 13th?
 - This would probably be a whole day, so we would need to find a room
 - ...and watch the Corona situation as usual...

Topic distribution

- As expected, some topics were more popular than others
 - I hope everyone's still happy with the assigned topic
 - If not, let me know and we'll try to find an alternative

1. **New approaches to system calls**

Tor Andre Haugdahl

2. **Tickless scheduling**

Jenny Manne

3. **Single address-space OS**

Sveinung Øverland

4. **Capabilities**

Petter Bjørseth

5. **Redundant multithreading**

Hans Erik Frøyland

6. **Memory error handling**

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7. **Lazy Process Switching**

Markus Rekdal

8. **Slim Binaries**

Håvard Ramberg

9. **Log-structured File Systems**

Iver Håkonsen

10. **Tracing**

Jonathan Andrew Scott Nilsen

11. **Checkpointing and Migration**

Philip Gausaker

12. **Processes as Files**

Anders Hallem Iversen

13. **Virtualization**

Ole Sivert Aarhaug

14. **Kernel Optimization/Synthesis**

Petter Berven

References

1. Writing papers:

Roy Levin and David D. Redell: "How (and How Not) to Write a Good Systems Paper"
https://www.usenix.org/legacy/publications/library/proceedings/dsl97/good_paper.html

2. Preparing presentations:

Andreas Zeller: "How to give a good research talk" (see also his Twitter account @AndreasZeller)
<https://www.st.cs.uni-saarland.de/edu/specmine11/slides-good-talk-howto.pdf>

3. The state of OS research:

Rob Pike's talk "System software research is irrelevant":
<http://herpolhode.com/rob/utah2000.pdf>

Timothy Roscoe's Usenix ATC/OSDI2021 keynote "It's Time for Operating Systems to Rediscover Hardware":

<https://www.youtube.com/watch?v=36myc8wQhLo>

4. xv6 for RISC-V (+ qemu/compiler setup):

Web: <https://pdos.csail.mit.edu/6.828/2021/xv6.html>

Book: <https://github.com/mit-pdos/xv6-riscv-book>

Code: <https://github.com/mit-pdos/xv6-riscv>

5. RISC-V documentation – the RISC-V reader: <https://github.com/Lingrui98/RISC-V-book>

6. Nezha D1 technical information: https://linux-sunxi.org/Allwinner_Nezha