



2EL6030 – Operating systems

Instructors: Frederic Tronel
Department: CAMPUS DE RENNES
Language of instruction: FRANCAIS
Campus: CAMPUS DE RENNES
Workload (HEE): 60
On-site hours (HPE): 35,00
Elective Category : Fundamental Sciences
Advanced level : Yes

Description

This teaching is part of the infosec course. The objective of this course is to give all knowledges required to realise a real kernel that is able to manage the process memory, the interruptions (and consequently the system calls), and is able to perform basic inputs-outputs.

Quarter number

SG8

Prerequisites (in terms of CS courses)

The prerequisites for this lecture are the following ones:

- Fluency in C language (e.g. by following the compilation course).
- Knowledge of RISC-V assembly language (e.g. by following the computer architecture course) would be a plus.

Syllabus

The course is organised as follows:

I Lesson 1:

- Operating system history

II Lesson 2 :

- Operating system startup
- Control registers
- Priviledge levels
- Interrupt management
- System calls

III Lesson 3 :

- Process scheduling
- Scheduling algorithms
- Context switching

IV Lesson 4 :

- Synchronization primitives in kernel and user spaces



- Concurrency problems
- Pseudo-concurrency and real concurrency

V Lesson 5 :

- Virtual memory management
- Segmentation vs pagination
- Memory protection
- Binary loading
- Memory allocation algorithms

Class components (lecture, labs, etc.)

Lectures: 15h

Labs: 18h

Grading

Final exam: oral exam

Mandatory evaluations: Reports for two labs, including the code produced to answer the questions, and the number of functional tests passed by the code.

$$NF=0.5 \text{ CF} + 0.5 \text{ EO}$$

Skill C2.1 is validated at milestone 2 by the validation of this course.

Skill C6.2 is validated at milestone 2 after having validated the practical exercises (having the average on the 2 practical exercises)

Skill C7.1 is validated at milestone 2 on the performance during the oral presentation.

Course support, bibliography

- Andrew Tanenbaum, " Systèmes d'exploitation ", 3eme Edition, Pearson.
- Russinovich, Mark, Solomon, David, Ionescu, Alex, "Windows Internals", 6eme edition, Microsoft Press.
- Daniel Bovet, Marco Cesati, "Understanding the Linux Kernel", 2nd Edition, O'Reilly.
- Love, Robert , "Linux Kernel Development: A thorough guide to the design and implementation of the Linux kernel (Developer's Library) ", Addison-Wesley.

Resources

Teachers: Frédéric Tronel and Pierre Wilke

Hardware: PC equipped with a Linux operating system.

Software: GCC cross-compilation chain for RISC-V, qemu-riscv64 and docker (we provide an installation guide for these tools during the first lecture).



Learning outcomes covered on the course

Understand the concepts involved in the design of an operating system.
Understand the impact of services offered by an operating system on the performance and security of applications.

Description of the skills acquired at the end of the course

C2.1
C6.2
C7.1