



THE UNIVERSITY of EDINBURGH
informatics

Operating Systems (INFR10079) 2023/2024 Semester 2

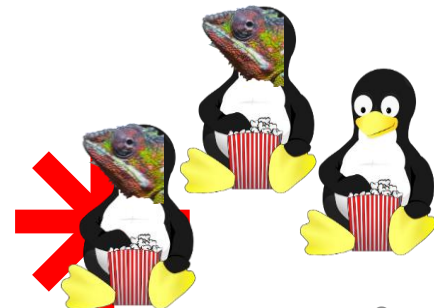
Course Overview

Antonio Barbalace (CO)
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- Education
 - BS Computer Engineering University of Padova, Italy
 - MS Computer Engineering University of Padova, Italy
 - PhD in Industrial Engineering University of Padova, Italy
- Experience
 - **Research Staff Member** National Research Council (CNR), Italy
 - **Visiting Researcher** Instituto Superior Técnico (IST) Lisboa, Portugal
 - **Postdoc** in Computer Engineering, Virginia Tech, VA
 - **Research Assistant Professor** in Computer Engineering, Virginia Tech, VA
 - **Principal Research Scientist and Manager** Huawei Research, Germany
 - **Assistant Professor** in Computer Science, Stevens Institute of Technology, NJ
 - **Senior Lecturer** in the School of Informatics, The University of Edinburgh, UK
- Key Research Areas
 - Hypervisor (Virtualization)
 - **Operating Systems**
 - Runtime, Compilers, Linkers



Luo Mai



- **Education**

- PhD in Computer Science, *Imperial College London*

- **Experience**

- **Lecturer in Data-Centric Systems**, *University of Edinburgh, 2020 - Now*
- **Postdoctoral Researcher**, *Imperial College London, 2018 – 2020*
- **Visiting Researcher**, *Microsoft Research, 2016 – 2018*

- **Research Interests**

- Distributed Systems
- Machine Learning
- Data Management

How to Get The Most Out of the Course

- Read ahead and use **Learn/Piazza** to ask questions
- **Attend and ask questions** during the live
 - **Lectures, Coursework Lectures**
 - **Review Sessions (Lectures)**
 - **Tutorials**
- Do the coursework well, schedule smartly!
- Exam questions are a mix of simple conceptual and challenging applied ones
- If you are struggling, **ask earlier rather than later**
- If you don't understand – **ask!**

Course Aims

- Understanding the *concepts* that underlie OS
- *Purpose, structure, and functions* of OS
- Illustration of *key OS aspects* by example

Course Outcomes

- **By the end of the lectures,** you should be able to
 - Describe, contrast, and compare differing structures for OSes
 - Understand and analyze theory and implementation of
 - processes, scheduling, physical and virtual memory, resource control (concurrency etc.), I/O and files
- **During the** practical exercise and associated self-study, you will
 - Become familiar (if not already) with the C languages, gcc compiler, and Makefiles
 - Understand the high-level structure of the OS kernel both in concept and source code
 - Acquire a detailed understanding of at least three aspects of the OS kernel

Course Material

- Introduction: overview of OS
- Basic OS structure and functions
- Process management, scheduling, concurrency
 - Processes and threads implementations
 - Scheduling: CPU utilization and task scheduling
 - Concurrency: mutual exclusion, synchronization, deadlock, starvation, etc.
- Memory management
 - Physical memory, early paging and segmentation techniques
 - Modern virtual memory concepts and techniques
 - Paging policies
- Storage Management
 - Low level I/O functions, high level I/O functions and filesystems
- Virtualization

Course Schedule (Tentative)

- Overview and Introduction
- OS Structure
- Device Drivers
- **Linux*****
- **Introduction to Coursework 0 (formative)**
- Processes and Threads (2x)
- Scheduling
- **Introduction to Coursework 1**
- Memory and Virtual Memory (3x)
- **Introduction to Coursework 2**
- **Review Session 1**
- Disks
- File Systems
- **Introduction to Coursework 3**
- Synchronization, Semaphore/Mutexes, Monitors (3x)
- Deadlock
- Virtualization
- **Review Session 2**

Administrative Details #1

- **Instructors**

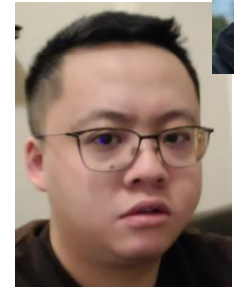
- Antonio Barbalace (CO)
 - IF-1.12
 - abarbala@inf.ed.ac.uk
- Luo Mai
 - IF-2.03
 - luo.mai@inf.ed.ac.uk

- **Tutors**

- Karim Manaouil (Monday)
 - IF-1.19
 - k.manaouil@ed.ac.uk
- Antonio Barbalace (Tuesday)
 - IF-1.12
 - abarbala@inf.ed.ac.uk
- Yuvraj Patel (Wednesday)
 - IF-1.18A
 - yuvraj.patel@ed.ac.uk

Administrative Details #2

- Teaching Assistants (TAs)
 - Alan Nair alan.nair@ed.ac.uk
 - Amir M Noohi amir.noohi@ed.ac.uk
 - Karim Manaouil k.manaouil@ed.ac.uk
 - Xiangyu Ren xiangyu.ren@ed.ac.uk
 - Tong Xing tong.xing@ed.ac.uk
- Communication
 - Instructors/TAs
 - Course mailing list: os-students@inf.ed.ac.uk
 - Q&A via Piazza
 - <https://piazza.com/ed.ac.uk/winter2023/infr1007920234sv1sem2/home>
 - Use the link on the Learn webpage



Administrative Details #3

- When and Where: (Semester 2)
 - Tuesday 9:00-9:50 @ **40GS_Lecture Theatre B**, 40 George Square
 - Thursdays 9:00-9:50 @ **50GS_Lecture Theatre G.03**, 50 George Square
- Course descriptor
 - <http://www.drps.ed.ac.uk/23-24/dpt/cxinfra10079.htm>
- Course webpage
 - On Learn
 - Schedule w/ lecture slides, assignments, TA contact info, past exam papers, examinable material, etc.

Administrative Details #4

- **Updated this year!**
- Tutorial Sessions
 - C programming basics (2 sessions) and **Linux***** practical (4 sessions)
 - 6 tutorials, on weeks 1, 2, 3, 5, 7, 9
 - Students divided in 5 groups
- When and Where: (Semester 2)
 - Group 01/optA1, Monday 13:10-14:00 @ **LLTC_3.2**, Karim Manaouil
 - Group 02/optA2, Monday 14:10-15:00 @ **LLTC_3.2**, Karim Manaouil
 - Group 04/optA3, Tuesday 12:10-13:00 @ **LLTC_5.3**, Antonio Barbalace
 - Group 05/optA4, Tuesday 13:10-14:00 @ **LLTC_3.3**, Antonio Barbalace
 - Group 03/optA5, Wednesday 12:10-13:00 @ **CMB_Seminar Room 1**, Yuvraj Patel

Review Sessions

- **2 Review Sessions**
 - Final exam like problems
- Currently, scheduled on (schedule may change)
 - Tuesday, 7th of March 2024
 - Thursday, 4th of April 2024
- During normal class hours
 - If you cannot attend, **do ask question online**

Assessment

- Exam: **50%** and Practical exercise: **50%**
- **4 practical Linux programming exercises** (Coursework)
 - **CW 0: (formative, not graded)**
 - Due: 12pm on Tue, 13th of February (0 out of 100)
 - **CW 1:**
 - Due 12pm on Tue, 5th of March (34 out of 100, or 17/50)
 - **CW 2:**
 - Due 12pm on Tue, 19th of March (34 out of 100, or 17/50)
 - **CW 3:**
 - Due 12pm on Tue, 2nd of April (32 out of 100, or 16/50)
 - Check *Learn* for more details
- **Exam**
 - Past exam papers: <http://www.exampapers.ed.ac.uk>

Textbooks

- **Main Textbook:** A. Silberschatz, P. Galvin and G. Gagne, "Operating System Concepts", 10th Edition, John Wiley, 2018
- Most of the other major OS texts are also suitable
 - For example: W. Stallings, "Operating Systems, Internals and Design Principles", 9th Edition, Pearson Education
- You are expected to read/know Silberschatz 10th edition
- Slides are a supplement not a replacement for the book
- If in doubt, read the book!
- **Notes**
 - We will **not cover** anything about Java
 - We will **mostly focus** on Linux/UNIX

Acknowledgments

Slides from many sources (ab)used in this course

Tom Spink, Mike O'Boyle, Myungjin Lee, Ed Lazowska,
Abraham Silberschatz allowed use of teaching slides for prev
versions of this course