UNIVERSITÀ DI PISA

# PACKET SWITCHING AND PROCESSING ARCHITECTURES

## GREGORIO PROCISSI

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| Anno accademico | 2019/20 |
| CdS | COMPUTER SCIENCE AND NETWORKING |
| Codice | 145II |
| CFU | 6 |

| Moduli | Settore/i | Tipo | Ore | Docente/i |
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| PACKET SWITCHING AND PROCESSING ARCHITECTURES | ING-INF/03 | LEZIONI | 48 | GREGORIO PROCISSI |

### Learning outcomes

*Knowledge*
The student who successfully completes the course will be able to demonstrate a solid knowledge of circuit and packet switching mechanisms, and of fast and efficient processing techniques for high-speed monitoring and measurements. In particular, she or he will acquire skills on the different switching architectures and the associated performance. In addition, she or he will be aware of fast techniques based on both deterministic and probabilistic data structures for real time processing of Internet packets directly in place and at the wire speed. Finally, the student who successfully completes the course will acquire the knowledge on Openflow, a very popular platform for software defined networking, and she/he will be able to provide her/his own experimental switching solution to specific switching and processing problems.

*Assessment criteria of knowledge*
During the exam, the student will be assessed on her/his ability in discussing the main course content with competence, critical awareness and property of expression.
Methods:

- Final oral exam

Further information:
The exam consists of an oral colloquium on the main topics of the course. In addition, the colloquium typically includes the discussion of a simple project that will be assigned during class time.

*Skills*
By the end of the course, Students will be able to design and implement their own solutions to practical packet switching and processing problems. This will include:
- the ability to take advantage of structures and algorithms for fast packet processing;
- the ability to adopt suitable switching and processing architectures.

*Assessment criteria of skills*
The assessment of the skills is obtained through questionnaires proposed during the course, and through the realization of a project.

*Behaviors*
The course aims to bring the student closer to the topic of complexity. Indeed, the course aims to the comprehension of functions that were born "by invention" and are integrated with ever-increasing complexity with other functionalities present in the network.

*Assessment criteria of behaviors*
The verification of the "modification" of the student's attitudes towards complexity is obtained by qualitative observation (questions, interviews).

### Prerequisites
Basic probability and queueing systems
C/C++ programming

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## Teaching methods

Delivery: face to face
Learning activities:

- attending lectures
- participation in discussions
- individual study

Attendance: Advised
Teaching methods:

- Lectures
- project work

## Syllabus

The course presents the main network switching architectures, with particular focus on packet switching architectures. After a brief introduction to the notions of circuit and packet switching, the course addresses the main schemes of packet switching together with their performance and possible issues. Then, the course deals with packet lookup and classification by presenting main algorithms currently in use. The course also presents the OpenFlow platform to run "software defined" experimental switching solutions. Finally, the course addresses the topic of traffic measurements and monitoring by introducing the main deterministic and probabilistic techniques to improve performance on high-speed links. More in detail, the course covers:

- Basics on switching paradigms (circuit/packet switching)
- Switching fabrics
- Packet switching architectures
- Packet Lookup and Classification
- Efficient data structures for packet processing

- Traffic Measurements and Monitoring

## Bibliography

Lecture notes on the class content will be available to the students enrolled in the course. However, a recommended reading includes the book:
[1] George Varghese, "Network Algorithmics", Morgan-Kaufmann, 2005
Also, students will be addressed to the book:
[2] Michael Mitzenmacher, Eli Upfal, Probability and Computing - Randomized Algorithms and Probabilistic Analysis, Canbridge University Press, 2005
Further bibliography will be indicated during the course.

## Non-attending students info

Lecture notes are freely available for all students. The exam program does not change.

## Assessment methods

The exam consists of an oral exam and the implementation of a small project.
The oral test consists of an interview between the student and the teacher and deals with the topics of the course. The candidate will be typically asked to derive some of the main results presented in the course. In addition, the interview may include the solution to written exercises.
The project typically requires the implementation of a small system for traffic processing/monitoring.

*Updated: 09/12/2019 10:23*