Advanced Networking
Course Introduction

Antonio Carzaniga

Faculty of Informatics
Università della Svizzera italiana

February 21, 2022
General course information

Program

Preliminary schedule

A preview of Advanced Networking
On-line course information

- on iCorsi
- and on my web page: https://www.inf.usi.ch/carzaniga/edu/adv-ntw/
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Announcements (you are responsible for reading them!)

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Office hours

- Antonio Carzaniga: by appointment
- Ali Fattaholmanan: by appointment
Computer Networking
A Top-Down Approach

James F. Kurose
Keith W. Ross

Addison-Wesley
Computer Networking
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Keith W. Ross

Addison-Wesley
Mathematical Foundations of Computer Networking

Srinivasan Keshav

Addison-Wesley Professional
Evaluation

+ 70\%\ homework assignments and projects
+ 30\%\ paper presentations
± 10\%\ instructor's discretionary evaluation
▶ participation
▶ extra credits
▶ trajectory
...
Evaluation

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- 30% paper presentations
- ±10% instructor’s discretionary evaluation
  - participation
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- Using someone else’s material may be appropriate
  - e.g., software libraries
  - always clearly identify the external material, and acknowledge its source; failing to do so means committing plagiarism.
  - the work will be evaluated based on its added value
- Committing plagiarism on an assignment or an exam will result in failing that assignment or that exam.

- Penalties may be escalated in accordance with the regulations of the Faculty of Informatics.
Deadlines are firm. Exceptions may be granted at the instructors' discretion only for documented medical conditions or other documented emergencies. Each late day will reduce the assignment's grade by one third of the total value of that assignment. Corollary: the grade of an assignment turned in more than two days late is 0.
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What this course is about

(What and How)
How Are We Going To Learn?

1. I give you a problem, which we discuss together
2. You solve it on your own without any directions
3. We discuss your solutions
4. I present my solution
5. We generalize and study the theory

The Feynman ⋆ technique (sort-of)

▶ The best way to learn a concept is to teach it!
▶ Seminars on topics of your choice, possibly including the topics of the course
▶ We all discuss, but the point is that you are the teacher!

⋆ Richard Feynman, theoretical physicist, great teacher, genius, amazing human being!
Problem solving

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Recap on Basic Networking Concepts: Network architecture, application protocols, TCP, datagram network service, router architecture, forwarding, routing, and in particular link-state routing.

Sampling from the nodes in a network

Graph model; Monte-Carlo simulation; analytic solutions; design and optimization

Traffic engineering

Flow problems; linear programming; whole-flow optimization; integer linear programming; randomized routing schemes.

Network modeling and simulation

Packet-level modeling and simulation.
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Network as a queuing system
- Basics of queueing models; basic results in queuing theory; Little's theorem and applications; Poisson processes; analysis of an M/M/1 queue and applications; statistical multiplexing

Network and Communication Security
- Basics of communication security; modern cryptography and provable security; basics of symmetric cryptography; basics of public-key cryptography; concrete protocols and systems: IPSec

Advanced Architectures and Protocols
- The modern Web: HTTP/2; the future Web: HTTP/3? Data-center networking: architectures and protocols; DCTCP; Timely

Programmable Networks
A network as a queuing system

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