TCP/IP Networking

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2018

Understanding what’s behind TCP/IP
Your Team

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Teaching Assistants

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Whom is this course for?

Master students in electricity, communication systems and computer science, all branches of engineering

Requirements

Experience with using one programming language
No prior knowledge of TCP/IP is required
We will practice with computers in a virtual environment – expect to spend time on your computer
The RAKE philosophy

Viewpoint 1: «I want this course to teach me all the details of all networking protocols »

Viewpoint 2: «TCP/IP is a mountain of details, I will learn when and if the need arises »

We will use the RAKE philosophy
- Depth by a few carefully selected labs
- Breadth by systematic concepts
What, Why, How

I will try and teach you to always ask first

*Why* was this stuff invented, what problem is it solving?

*What* is it doing?

before asking:

*How* does it do its job?

The why and what are short.
The how is long but can often be guessed once you understand the why and what.

Wikipedia is good at how, often less good at what and why.
Organization of the course

Lecture
Every week
12:15-14:00
CM 2

Test (quiz) on
weeks 2,4,6,8,10,12,14
11:15-11:30 INF 1

Final exam
Winter exam
session

Lab
Every week
Friday
11:15-13:00 INF1
or
(extra session)
Tuesday
16:00-18:00 INF019


On Moodle

Enrolment automatic after course registration
slides, lab and research exercise
Labs

A total of 7 labs (lab 0 to lab 6)
Labs are mandatory and graded
Main slot for labs is on Fridays from 11:15 to 13:00
Extra lab slot on Tuesdays 16h-18h in INF019 – Internet Engineering Workshop

Bring your own PC
You work in groups of 2

One written report per group

Fill in the answers directly in the assignment PDF file
(Use Adobe Reader XI, not all PDF readers support saving forms)
Upload it on Moodle

Deadline for uploading the lab report:

Given on Moodle, but typically is the week after the last session of the lab, at 23:55, Wednesday the day before the lecture on Thursday.
Network Emulation

We will mostly use **Mininet** to emulate the communication network in a single computer

We will give you a virtual machine with Mininet installed

  Single virtual machine for all labs.

  Python-based scripting

To play a bit with real (small) network, we let you manipulate a small network we setup for you in INF 019 in Lab 2

Some labs require a public IPv6 address for your computer

  If you don’t have one at home, you can use the **lca2-tcpiplabs** WiFi AP (in or around INF 019) that provides **both IPv4 and IPv6 addresses** via DHCP(6)
You will need access to INF 019  
Lab2 will require access to do some network manipulation
You can access any time of the day and of the week (exception: maintenance periods)

What you need to do:
Go to Moodle and fill in the “Lab Rules Agreement”

You should do it before next Thursday (September 27).
We will then give you access to INF 019.

In particular:
Keep all lab material in good state and put them back after using
Watch out for mysterious activities when you are in the lab (you are responsible for lab activities during the time you are in the lab)
Respect the EPFL network rules
Labs 0 and 1

Lab 0 – introductory (Half-lab)

Network tools on your PC
IPv4 / IPv6

Recommendation: Finish it ASAP to leave more time for lab 1

**Deadline:** Wed, September 26, 23h55 (in one week!)

Lab 1 – virtual environment – important for next labs!

The main objective: getting used to VirtualBox & Mininet
Other objectives: static network address configuration, iptables
Do it as soon as possible, things can go wrong…

Students, with no or little background in computer networks, may need to work harder to get up to the speed with others

Provision of extra slot on Tuesdays
No need to do the **optional** research exercise question in Lab 0
Organizational stuff

TAs are here to help – ask questions!
   Also, Google, stackoverflow, etc. are your friend

There is a different TA in charge of each lab
   ... and of grading it!

Give **brief but complete** answers in the report
   They should convince the grader that you really understand, without being too boring

No cheating
   There have been cases in the past – just don’t do it, it’s embarrassing!
   Labs are not very difficult, they just require some time
Slack channels

This year we are using SLACK to communicate

We will create 1 slack channel per lab + 1 channel for the questions about the course

You will receive invitation on your EPFL email address

Write your question about the lab in the corresponding channel

You can also answer the questions of other students (start a thread)

Please, check if someone already asked question that you have

Add reaction on answer if it was useful for you (“Thumb up”)

On every lab slack channel, we will count reactions for answers, the 2 most active and helpful students will get bonus for this lab +0.25
Enjoy!
Tests

7 Tests (short quizzes)

INF1 on Fridays of even weeks 11:15-11:30 sharp

Program of test is: everything up to and including the lecture of the day before the test

Best 5 tests used for grading

No replacement if sick or other excuse

All tests are written, closed book, no electronic equipment
only one pen/pencil allowed on table
Please go to speakup.info or start speakup app
Join room number written on board and say in which case you are

A. Computer Science
B. Communication Systems
C. Data Science
D. Electrical Engineering, Smart Grid
E. Electrical Engineering, other orientation
F. Mechanical Engineering
G. Maths
H. Other Section
Please use speakup **ethically**
– don’t abuse anonymity
Final Exam

One final exam in exam session
See last year’s exams on moodle
All tests/exams are written, closed book, no electronic equipment
The “exam booklet” is allowed
Grading

**Theory Grade** \( T = \max(0.4 \ C + 0.6F, F) \)

where \( C \) = test grade (average of best 5 tests)

\( F \) = final exam

**Lab grade**

\( L_i = \min(6, \text{ raw lab grade } + \text{ social influence bonus (0.25)}) \)

\( L_{avg} = \frac{0.5L_0 + L_1 + \cdots + L_6}{6.5} \) (lab0 counts as ½ lab)

\( RE_{avg} = \frac{RE_0 + RE_1 + RE_3 + RE_4 + RE_5 + RE_6}{12} \)

where \( RE_i \in [0,1] \) is the bonus at lab \( i \) (max bonus = 0.5 on scale 1-6)

\[ L = \min(6, L_{avg} + RE_{avg}) \]

**Final grade** \( G_1 = \) harmonic mean of \( T \) and \( L \) (where \( T \) and \( L \) are in scale 1-6, not rounded)

Final grade \( G = \text{round}(G_1) \) where round is to the nearest quarter-integer.

All grades except \( G \) are non-rounded.
Roadmap

Module 1
Network Layer Basics
Labs 0 and 1

Module 2
Network Layer, (advanced) MAC layer
Lab 2

Module 3
Transport layer Socket programming
Lab 3

Module 4
Single Domain Routing, SDN
Lab 4

Module 5
Traffic Control
Lab 5

Module 6
Internet Routing
Lab 6

Module 7
Appli, QUIC, 6-4, Distance Vector