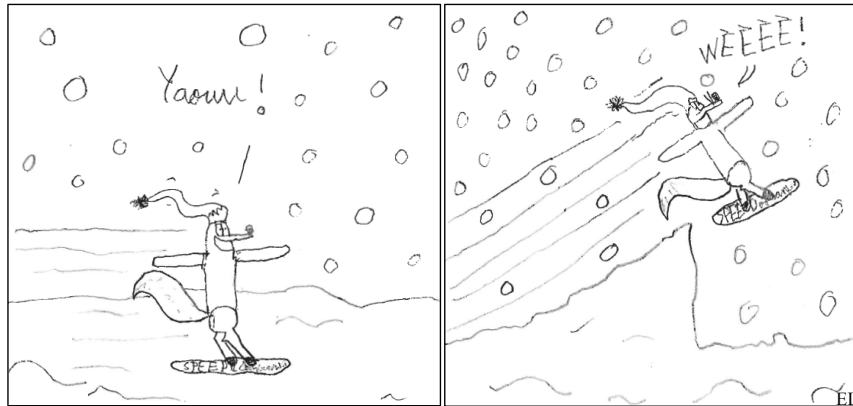




# TCP/IP Networking

Jean-Yves Le Boudec  
Patrick Thiran  
Fall 2009

*Understand what's behind surfing the net*



## \*Your team

■ Lecturer: J.-Y. Le Boudec / P. Thiran

■ TAs:

- ▶ George Theodorakopoulos (webmaster)
- ▶ Denisa Ghita
- ▶ Nikodin Ristanovic

## \* Organization

### ■ 2 time slots:

- ▶ 12:15 – 14:00 lecture slot
- ▶ 14:15 – 16:00 exercises or lab (except first week)

### ■ Lectures

- ▶ 2 hours every week
- ▶ Exceptionally this week : lecture 12:15 to 16:00

### ■ Exercises – see [web site](#) for details

- ▶ 4 labs (internet engineering workshops)
- ▶ 4 paper and pencil exercise session in class – not graded

### ■ Office hours – see web site

- ▶ Prof's office hours for questions relative to lecture
- ▶ TA's office hours for questions relative to labs

## \* Exams and theory tests

- The course is organized in 2 parts
- One mid term exam (12:15, Nov 12) during lecture time slot
  - ▶ See [web site](#) for details
  - ▶ 1h30 mn, written, no documents allowed

- One final exam in the regular exam session
  - ▶ 2 problems, each corresponding to a part of the course
  - ▶ No documents allowed

- Final theory grade  $T$ 
$$T = \frac{\max(M_1, F_1) + F_2}{2}$$
  - ▶ M1: mid term grade (on part 1 of lecture)
  - ▶ F1, F2: grades at final

- All tests/exams are written, closed book, no electronic equipment
  - ▶ The “exam booklet” with ca. 12 pages of useful information is allowed
  - ▶ Don’t bring yours, we’ll give you a printed version

## \* Labs

- Mandatory
- In special room (“internet engineering workshop”)
  - ▶ Starts next week
  - ▶ Every lab lasts 1 to 3 weeks, see web site
  - ▶ Organisation of time slots : see later, presentation by TAs
- Lab is graded
  - ▶ See web site for more details

## \* Paper and Pencil Exercises

- In class, not graded
- Preparation of exam or lab session
- Based on exercise booklet or last year's exam
  
- Organization
  - ▶ we will post which exercises you should do before theory test exam
  - ▶ We will distribute solutions to exercises before test

## \* Grading

### ■ Grading

- ▶ T = theory grade
  - ▶ As explained earlier

- ▶ L = average of labs

$$L = \frac{L_1 + 2L_2 + 3L_3 + 2L_4}{8}$$

- ▶ Final grade

$$G = 0.7T + 0.3L$$

## \* Organization

- We use Moodle as front end
  
- Main site is  
<http://ica1www.epfl.ch/cn2/0910>
  
- Communication
  - ▶ Use the forum on Moodle



## \* The Spirit of This Course

- Viewpoint 1: « I want this course to teach me all the details of all networking protocols »
  - ▶ ex: how to setup my NAT on my ADSL modem
- Viewpoint 2: « TCP/IP is a mountain of details, I will learn when and if the need arises »
  - ▶ thus I do not need this course

viewpoint 1 is correct if you have infinite time during your education years

viewpoint 2 is correct if you have infinite time on the job when you have a problem to solve

both viewpoints are *not fun*

## \* Learn by both Examples and Concepts

### ■ Computer networking is $\approx$ 45 years of design experience

- ▶ First paper on packet switching: 1961 (Kleinrock)
- ▶ First router built (connection oriented): 1969 (ARPAnet)
- ▶ TCP/IP is not a random collection of protocols, it is based on a few ideas

in this course we will learn the *concepts*

### ■ “The devil’s in the detail”

- ▶ it is easy to misunderstand concepts if you do not have practical experience: ex: difference between a router and a bridge ?

in this course we will gain *practical experience* by carefully selected practicals

### ■ This is more fun

## \* 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 ?

- This is important if you plan to become a technical leader or manager !



## \* After this Course

- You will know enough concepts and have enough practical experience to
  - ▶ undertake a project that uses TCP/IP
  - ▶ look credible at a technical meeting (ex: IETF meeting)
  - ▶ quickly learn by yourself the details you need to know, when you need to know them

## \* Contents

### Part 1:

#### The TCP/IP architecture

[archi.ppt](#)

[mac.ppt](#)

[ip.ppt](#)

[tcp.ppt](#)

[appli.ppt](#)

[Lab L1 "Tools for everybody"](#)

[Lab L2 "Problems with Networks"](#)

#### Routing

[dv.ppt](#)

[bgp.ppt](#)

[Mid-Term exam](#)

### Part 2:

#### Routing

[Lab L3 "Dynamic Routing"](#)

[ls.ppt](#)

#### Congestion control

[cc.pdf](#)

[Lab L4 "TCP for hackers"](#)

#### Advanced Topics

[ipv6.ppt](#)

[bridging.ppt](#)

[mpls.ppt](#)

## \* Sources of Information

### ■ The **best sources** of information are the **original IETF RFCs**.

- ▶ [www.ietf.org](http://www.ietf.org) : all working groups have overview documents.
- ▶ usually well written, explain both “what” and “how”

### ■ If you want a book, buy these two

- ▶ R. Stevens, “TCP/IP Illustrated”, volumes 1 and 3, Addison Wesley 1994  
*best reference for understanding in detail*
- ▶ Kurose and Ross, “Computer Networking”, Addison Wesley *High level and global*

### ■ Other Resources

- ▶ Bertsekas and Gallager, “Data Networks”, 1992 *classical reference for the mathematics of routing*
- ▶ Cisco’s white papers
- ▶ explain the “how”, not always the “what” and “why”

## \* Courseware (Lecture Notes)

### ■ Slides

- ▶ Slides (+ writeup for module “congestion control”) are self-contained and can be read standalone
- ▶ While reading the slides, try and answer the inline questions

Q. Where is the answer to an inline question ?

[solution](#)

- ▶ If you have questions, please try for a reasonable amount of time to find the solution on the net or in the textbooks I recommend. If this does not work, use the forum of this course.

- Slides marked with \* need not be known in detail at the exam.
- For the module “Congestion Control” a detailed writeup is also given in addition to the slides. The program of the exam is the content of the slides not marked with a \*

Feedback is welcome – please use the forum or send me your comments at the end of the lecture ... now enjoy !



# Solutions

## \* Courseware (Lecture Notes)

### ■ Slides

- ▶ Slides (+ writeup for module “congestion control”) are self-contained and can be read standalone
- ▶ While reading the slides, try and answer the inline questions

**Q.** Where is the answer to an inline question ?

**A.** At the end of the module.

- ▶ If you have questions, please try for a reasonable amount of time to find the solution on the net or in the textbooks I recommend. [back](#) If this does not work, use the forum of this course.

### ■ Writeup

- ▶ For module “congestion control”. This is a fully written, self-contained tutorial.