NETWORK TRAFFIC ENGINEERING

1. KEY INDICATORS

CFU/ECTS: 6
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2. OBJECTIVE OF THE COURSE

This class aims at providing students with basic tools for analysis and dimensioning of networked systems and protocols.
Specific aims are the ability of identifying, solving and exploiting network traffic models and networked information processing system models, both using analytic, simulation and experimental approaches. Further, some hints are given to the application of these models to the design of tlc networks.

3. ACQUIRED ABILITIES

Basic (undergraduate level) knowledge of communication systems, probability and stochastic processes, network architectures and protocols, TCP/IP networking

4. PROGRAM

The classes are organized into two main parts. About 2/3 of time is devoted to face-to-face lessons; the ramining 1/3 is devoted to lab with use of ns2 e Wireshark.
Introduction. Role and context of tlc networks performance evaluation. Key performance indicators and traffic engineering issues. An example of traffic engineering: the delay equalization. problem.
Tools for traffic engineering. Service systems. LittleÕs law. Queuing and traffic theory: M/M queuing systems, M/G/1 queue, Jackson and Gordon-Newell networks of queues. Priority queuing: conservation law, scheduling examples (HOL, SJF). Bounds and approximations for the analysis of queueing systems: fluid approximation. Discrete event simulation. Tlc networks and protocols simulation for performance evaluation: practice with ns2 software package. Traffic measurements: practice with Wireshark software package.
Networks analysis and dimensioning. Kleinrock model of a packet network. Network optimization problems. Optimal capacity assignment. Reactive control of network congestion. Models and performance evaluation of TCP. Fluid models of TCP/IP networks. Network design as an utility optimization problem (NUM). Primal and dual problem statement. Distributed optimal controller: global stability proof. Hints on analysis and dimensioning of circuit switched networks.

5. REFERENCES

Leonard Kleinrock, Queueing systems, 2 Voll., Wiley, 1975-1976;
Srinivas Shakkottai and R. Srikant, Network Optimization and Control, 2007;
R. Srikant, The Mathematics of Internet Congestion Control, Birkhauser, December 2003;
Handouts distributed in class.

6. COURSES WEBSITE

http://net.infocom.uniroma1.it/corsi/ing_traffico/