Computer Networks

EDA387/DIT660

Introduction

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Aim

- Computer networks cover a range of sub-specialties including: self-stabilizing algorithms for computer networks, programming using the BSD socket API, and communication concepts and protocols.
  - Mastery of computer network involves both theory and practice in the design, implementation and use of network protocols and services.

Aim

- Design and analyze self-stabilizing algorithms for network protocols, to have experience in socket programming and to gain knowledge in existing communication networks including supporting systems and protocols fundamental tasks.
  - Provide in-depth knowledge of designing and analyzing fault-tolerant network-oriented algorithms and to gain knowledge in existing communication networks, such as the Internet technology with example of core supporting hardware, communication protocols, fundamental services and methods in communicating data.

Prerequisites

- You should have a Bachelor's degree or equivalent.
- You should have taken at least one course in computer programming.
- 7.5hp or equivalent in one of the five areas:
  - Computer communication (DIT420/EDA343), Operating Systems, Algorithms and/or Data Structures, Programming (C or C++) and Mathematics (Discrete Mathematics).

Expected Outcome

Knowledge and understanding

- Internet technology and the domain name systems.
- Technical knowhow about IPv6.
- Core protocols, global routing, services as well as their limitations of networks, such as the Internet.
- Contemporary networking problems, such as TCP connections, contention, performance & flow control.

Expected Outcome

Skills and abilities

- define systematically and analyze a computer network in terms of communication graphs and as a distributed system.
- analyze the effect of failures, such as transient faults, message omission and topology changes, on the system and how can such failures propagate and effect computer networks.

Expected Outcome

Skills and abilities

- develop small scale network applications using fundamental networking techniques.
- written communication skills: write up of lab reports and the demonstration of protocol correctness.
- show correctness of protocols as well as clearly describe the network algorithms that you design yourself.

Expected Outcome

Judgment and approach

- the ability to describe, design and analyze existing and new algorithms for network protocols with a very strong emphasis on self-stabilizing algorithms for computer networks.

Content

- hands-on experimentation and analysis as they reinforce student understanding of concepts and their application to real-world problems
- Labs:

1. Labs on socket API (mandatory w. exceptions)
2. Labs on algorithms for computer networks (mandatory)
3. Labs on advanced internet technologies (mandatory w. exceptions)
4. Labs on self-stabilizing SDN (mandatory w. exceptions)

Lecture Outline

15 lectures + 4 service meetings (plus two backups)

- Review of Internet Technologies (3.5)
- Advanced Internet Technologies (1)
- Algorithms for computer networks (10.5 x EMS)
- Other activities: 2 review classes as well as introduction and summary meetings

Schedule

- See TimeEdit and Canvas

Examination

- To pass the course you need to pass a written exam at the end of the course and approved all mandatory labs and home assignments, see Canvas for details.
- Written exams:
  - There will be three written exam possibilities:
  - 31 Oct 2019 am, 08 Jan 2020 pm, 27 Aug 2020 pm
  - The knowledge base which will be tested at the exam consists of the course books, the papers given above, the labs (and their related literature), lecture preparation materials, class presentation materials, and API programming knowledge.

Literature

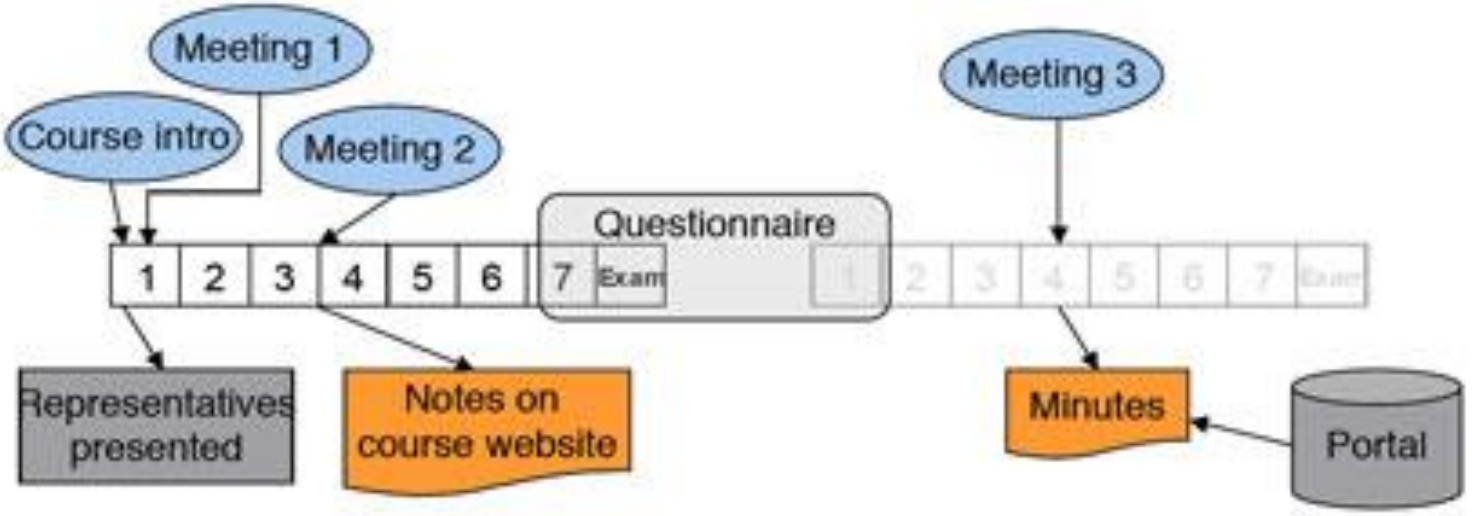
- Shlomi Dolev, *Self-Stabilization*, 1st edition, The MIT Press, ISBN-10:0-26-204178-2. We use this book in the methods in computer networks part. Here you can find some additional materiel. This book is going in at least ten lectures and several home assignments.

Literature

- W. Richard Stevens, Bill Fenner, Andrew M. Rudoff, *Unix Network Programming*, *Volume 1: The Sockets Networking API*, 3rd edition, Addison-Wesley Professional, ISBN-10: 0-13-141155-1. We use this book in the networking API part --- not mandatory.

Course Evaluation

- The course evaluation is following the standard Chalmers procedure



- Students that wish to become evaluators are invited to contact the course responsible.

Tips from the Past

- Self-study the review course and watch the videos
- Prepare before and after each lecture
  - Read the assigned chapters before and answer the questions
  - Review each lecture by the end of its week
  - Read the slides, the assigned chapters and answer the questions
- Do not procrastinate your lab duties
  - Find a lab partner that doesn’t procrastinate
- Visit our Canvas page every other day.

What you need to do next?

- Login to Canvas and check the site.
  - If you have problems logining to Canvas, please send contact the student center now.
  - If you cannot see the course page, please email me elad@chalmers.se
- Start working on the review courses:
  - Stanford's course Networking - SELF PACED Introduction to Computer Networking.
  - Computer Networking by Georgia Tech.

Please watch:

1. History of the Internet http://vimeo.com/2696386
2. Conditions leading to start of internet
   http://www.youtube.com/watch?v=8KQ1TFZcTpM
3. Inside the Internet
   http://www.youtube.com/watch?v=ZZQXnCi6H9Y

You can also watch:

4. How a packet moves through network
   http://www.youtube.com/watch?v=O7CuFlM4V54
5. 40 years of the internet
   http://www.youtube.com/watch?v=eZSPWDMn730
6. The Internet in 1969
   http://www.youtube.com/watch?v=Y0pPfyYtiBc

QUESTIONS?