

# 3rd Semester Exam Information

## Network

Datamatiker - Computer Science

Spring 2013



## Contents

<b>1</b>	<b>Module 3 in general</b>	<b>2</b>
1.1	Aim . . . . .	2
1.2	Objectives . . . . .	2
1.3	Sub-objectives . . . . .	2
<b>2</b>	<b>Learning objectives</b>	<b>3</b>
2.1	Week 1 . . . . .	3
2.2	Week 2 . . . . .	4
2.3	Week 3 . . . . .	5
2.4	Week 4 . . . . .	6
2.5	Network Sockets . . . . .	7
2.6	Security . . . . .	8
<b>3</b>	<b>Schedule</b>	<b>9</b>
3.1	Tuesday June 4 <sup>th</sup> 2013 . . . . .	9

# 1 Module 3 in general (30 ECTS)

The main theme for 3rd semester is distribution in software development. Development of distributed systems, and distribution of development with a global perspective. *In parallel, network technology has been treated with focus on the TCP/IP model, but network is tested separately.*

## 1.1 Aim

The aim of this module is that the student must master principles of distributed systems. In addition, the student must develop distributed applications.

## 1.2 Objectives

- can carry out project work in an organisational context co-operating with developmental groups.
- can implement a distributed system by using an object-oriented method.
- understands the principles of a given distributed technology.
- can use experiments to explore advanced technologies.
- understands basic concepts within distributed programming.

## 1.3 Sub-objectives

*Based on a specifically applied communication mode, the student must understand the general principles of networks, including service and protocol concepts. In addition, the student must be able to estimate the advantages and disadvantages of various types of LAN and WAN and relate them to the needs of a specific user organization.*

The student should understand the central principles behind distributed systems with a central service.

The student must be able to understand different ways of handling the communication between client and server. Furthermore, the student must understand the principles of both client and server programming.

The student must be introduced to the method of implementing a distributed application, previously presented in the 1st and 2nd modules. Based on a specified project, the student must be able to design relevant models (including source codes) in order to make the distributed application operational. The student must be able to apply patterns that are relevant to distributed systems.

The student must understand client side programming in a web application. Also the student must be able to develop web applications.

## 2 Learning objectives

### 2.1 Week 1

#### Main topics

- TCP/IP and the OSI model
- Network analysis/sniffing
- Application Layer Protocols
- DNS
- HTTP

#### You should be able to

- Explain what a network protocol suite is.
- Describe the layers of the TCP/IP protocol system and the purpose of each layer.
- Explain about the OSI model and how the OSI layers relate to TCP/IP layers.
- Describe the purpose of network sniffing/analysis tools, and use nslookup, ipconfig (ifconfig), ping, traceroute (tracert) and Wireshark for simple analysis scenarios.
- Give examples of popular Application Layer Protocols.
- Explain and demonstrate details about the HTTP protocol using Wireshark and/or Google developer tools.
- Describe the overall details of the DNS system, and demonstrate the protocol details using relevant tools.

#### Materials

- [http://en.wikipedia.org/wiki/Internet\\_protocol\\_suite](http://en.wikipedia.org/wiki/Internet_protocol_suite)
- [http://en.wikipedia.org/wiki/Domain\\_Name\\_System](http://en.wikipedia.org/wiki/Domain_Name_System)
- [http://en.wikipedia.org/wiki/Hypertext\\_Transfer\\_Protocol](http://en.wikipedia.org/wiki/Hypertext_Transfer_Protocol)
- Slides on Fronter

## 2.2 Week 2

### Main topics

- TCP/IP (transport layer)
- TCP and UDP

### You should be able to

- Explain the TCP/IP transport layer.
- Explain the differences between a connection oriented protocol and a connectionless protocol.
- Explain about the User Datagram Protocol (UDP) → properties and use cases.
- Explain the concept of ports and sockets.
- Explain about TCP and UDP, the differences between the two protocols and give use cases for both.
- For UDP explain the UDP header.
- For TCP explain about:
  - TCP headers.
  - Three Way Handshake.
  - The purpose of Sequence and Acknowledgment numbers.
  - Flow Control, Error Control and Congestion Control.
- Use relevant tools to monitor TCP/IP traffic and explain scenarios/topics like “three way handshake”, flow/congestion control, etc. from real life monitored data.

### Materials

- [http://en.wikipedia.org/wiki/Internet\\_protocol\\_suite](http://en.wikipedia.org/wiki/Internet_protocol_suite)
- [http://en.wikipedia.org/wiki/Transmission\\_Control\\_Protocol](http://en.wikipedia.org/wiki/Transmission_Control_Protocol)
- [http://en.wikipedia.org/wiki/User\\_Datagram\\_Protocol](http://en.wikipedia.org/wiki/User_Datagram_Protocol)
- Slides on Fronter

## 2.3 Week 3

### Main topics

- The IP-layer and IP addresses

### You should be able to

- Explain the responsibility of the IP layer.
- Explain about IPv4-addressing including:
  - Classful Addressing.
  - Classless Addressing.
  - Subnets.
  - IPv6 addresses.
- Explain the fields in the IPv4-header.
- Explain the topic IP-fragmentation.
- Explain about routing and routers and routing tables.
- Explain briefly the functionality/protocols DHCP and ICMP.
- Use relevant tools like traceroute and Wireshark to monitor IP, ICMP and IP header datagrams, and investigate terms like fragmentation from real life monitored data.

### Materials

- [http://en.wikipedia.org/wiki/Internet\\_layer](http://en.wikipedia.org/wiki/Internet_layer)
- [http://en.wikipedia.org/wiki/IPv4\\_Header](http://en.wikipedia.org/wiki/IPv4_Header)
- [http://en.wikipedia.org/wiki/Internet\\_protocol\\_suite](http://en.wikipedia.org/wiki/Internet_protocol_suite)
- Slides on Fronter

## 2.4 Week 4

### Main topics

- TCP/IP's Network Layer (the Link and physical layer)
- Network devices
- ARP and RARP

### You should be able to

- Explain about the TCP/IP's Network Layer (the Link and physical layer).
- Explain about Ethernet, types, and the fundamentals of CSMA/CD.
- Explain about the Ethernet Frame.
- Explain about IEEE 802.11 and how the Media Access Protocol differs from wired Ethernet.
- Explain about network devices like, Repeaters, Hubs, Bridges, Routers and Switches.
- Explain about ARP and RARP and the Arp Packet.
- Use relevant tools to monitor and explain Ethernet, ARP and RARP packets.

### Materials

- [http://en.wikipedia.org/wiki/Internet\\_protocol\\_suite](http://en.wikipedia.org/wiki/Internet_protocol_suite)
- [http://en.wikipedia.org/wiki/Address\\_Resolution\\_Protocol](http://en.wikipedia.org/wiki/Address_Resolution_Protocol)
- Slides on Fronter

## 2.5 Network Sockets

### Main topics

- Socket Programming
- Network protocols

### You should be able to

- Implement Network Clients using the protocols TCP and UDP.
- Implement Servers using TCP or UDP.
- Implement thread safe multithreaded servers.
- Implement a simple user defined application layer protocol.
- Monitor live traffic between client and servers using Wireshark.

### Materials

- <http://docs.oracle.com/javase/tutorial/networking/index.html>
- Slides on Fronter

## 2.6 Security

### Main topics

- Confidentiality, Integrity, Authentication and Nonrepudiation
- Conventional and Public Cryptography systems
- TLS

### You should be able to

- Explain requirements terms like: Confidentiality, Integrity, Authentication and Nonrepudiation.
- Explain the strategy behind Conventional and Public Cryptography systems.
- Explain about digital signatures.
- Use a system like PGP, to encrypt, decrypt, sign and verify documents.
- Explain about Digital Certificates.
- Implement a simple secure server solution with Glashfish.
- Explain about TLS and explain the initial handshake in a TLS connection

### Materials

- <http://www.pgpi.org/doc/guide/6.5/en/intro/>
- [http://publib.boulder.ibm.com/infocenter/wmqv7/v7r1/...  
...index.jsp?topic=%2Fcom.ibm.mq.doc%2Fsy10670\\_.htm](http://publib.boulder.ibm.com/infocenter/wmqv7/v7r1/...index.jsp?topic=%2Fcom.ibm.mq.doc%2Fsy10670_.htm)
- Slides on Fronter



### 3 Schedule

The exam is held Tuesday June 4<sup>th</sup> 2013.

**Preparation** in room 214

**Examination** in room 213

**Examinator** Lars Mortensen

**Censor** Torben Østrup

Except for the first student, all students must show up at least 30 minutes before the listed preparation time.

#### 3.1 Tuesday June 4<sup>th</sup> 2013

Prep.	Start	End	Name
09:00	09:15	09:30	Kasper Borch Karstensen
09:15	09:30	09:45	Tore Røhsle Luntang Christensen
09:30	09:45	10:00	Lasse Emil Ejvin Mejsner
09:45	10:00	10:15	Casper Berg Ylønen
10:00	10:15	10:30	Lars Henrik Thomsen
10:15	10:30	10:45	Ronnie Kopps Skou
10:30	10:45	11:00	Andreas Nugaard Holm
10:45	11:00	11:15	Nicklas Hundstrup Hemmingsen
11:00	11:15	11:30	Søren Wittchen Holm
11:15	11:30	11:45	Kenneth Thomsen
11:30	11:45	12:00	Mathias Valling
11:45	12:00	12:15	Patrick Grønbæch Christensen
<i>lunch</i>			
12:45	13:00	13:15	Benjamin Ibdal
13:00	13:15	13:30	Mathias Jahn-Nielsen
13:15	13:30	13:45	Mek Brandt Jensen
13:30	13:45	14:00	Mads Heckmann
13:45	14:00	14:15	Alexander Gørtz Engelhardt
14:00	14:15	14:30	Pernille Borg Jensen