

Francqui KULeuven 2005-2006
“Broadband Communication”
by Piet Demeester

1. General information on examination:

Material for the examination:

All the lectures:

- Inaugural lecture
- Internet support for multimedia flows
- Access Networks
- Optical Networks
- Mobile Networks
- Grid Computing
- Reliability of Communication Networks

Publications

Internet support for multimedia flows:

- The Session Initiation Protocol: Internet-Centric Signaling (Schulzrinne, Rosenberg)
- On the building blocks of quality of service in heterogeneous IP networks (Soldatos, Vayias, Karmentzas)

Access Networks:

- Media Access Control for Ethernet Passive Optical Networks: An Overview (Zheng, Mauftah)

Mobile Networks:

- IP Micro-Mobility Protocols (Reinbold, Bonaventure)

Grid Computing:

- A Gentle Introduction to Grid Computing and Technologies (Buya, Venugopal)

Reliability of Communication Networks

- Benefits of GMPLS for Multilayer Recovery (Puype et.al.)

Examination:

Closed book exam: 70% from list of questions (see below), 30% not from list

Open book (slides, notes, publications allowed): e.g. questions that link different subjects together or small exercises

Evaluation: roughly 70% closed book, 30% open book

Duration: 3 hours

Illustrate your answers with clear figures (when appropriate)

2. List of Questions^{1 2}:

Internet support for multimedia flows

1. Explain the principle of and relation between a user plane and a control plane in classical telephony.
2. Describe 3 cases where VoIP is used.
3. What is SDP.
4. Explain the general principle of SIP and give the basic building blocks.
5. An example of a SIP message is given during the exam: explain.
6. Give 2 specific problems when the Internet is used for voice. What are (partial) solutions to these problems.
7. How does RTP resolve timing problems encountered when transporting voice or video over internet.
8. Explain the principle of a QoS aware IP router.
9. Explain classification, shaping, policing, queueing, scheduling, buffer management as used in a QoS aware IP router.
10. Explain the principle of 2 techniques used to support flow differentiation in IP networks.
11. Explain the operation of MPLS.
12. *Explain the principle of VOQ (Virtual Output Queue) and why is it used.*

Access Networks

1. Explain the evolution of a classical telephone access network towards a triple play enabled access network.
2. Explain the ADSL architecture (figure from ITU-T rec G.992.1 will be given).
3. Explain the principle of DMT and QAM.
4. Explain the basic principles of : CRC, scrambling, FEC.
5. Explain in detail FEC (coding and decoding).
6. Explain the evolution of a classical coax access network (CATV) towards a triple play enabled access network.
7. *Explain the basic principle of MPCP in E-PON. Give 3 polling policies.*
8. *Explain DBA in E-PON.*

Optical Networks³

1. Explain the difference between logical and physical topology. Give an example.
2. Explain the principle of WDM and OTDM.
3. Explain the principle of dispersion, attenuation, 3R regeneration, space switching, wavelength switching, optical memory.
4. Give the basic structure of an OXC and OADM.
5. Explain the difference between an optical network with or without wavelength conversion.

¹ The whole question or a part of a question may be asked

² Some questions are related to the publications that are listed above (they are indicated in *italic*).

³ Optical Packet Switching is not part of the examination subject matter

6. Explain the principles of control planes in optical networks: static versus dynamic, dynamic overlay versus dynamic peer.

Mobile Networks

1. Explain: FDMA, TDMA, SDMA and CDMA.
2. Explain: TDD, FDD.
3. Explain: hidden terminal problem, exposed terminal problem.
4. Explain RTS/CTS principle.
5. Explain FHSS and DSSS.
6. Describe the basic architecture of a GSM network.
7. Explain roaming in GSM.
8. Explain the evolution towards 3G (briefly explain the different technologies/enhancements).
9. Explain the principle of DFWMAC-DCF using CSMA/CA using an example.
10. Explain the principle of Mobile IP.
11. Make a comparison between GSM and Mobile IP.
12. *Explain the figure 5 from the paper “IP Micro-Mobility Protocols (Reinbold, Bonaventure)”*. The figure will be given.
13. *Explain the principle of Hierarchical Mobile IP and Fast Handoff*

Grid Computing

1. Explain the evolution towards grid computing from 2 different perspectives.
2. Give 4 types of grids and explain the principles.
3. Describe the building blocks of a grid architecture.
4. What is grid middleware.
5. Explain grid scheduling.
6. What is application gridification. Give two examples.
7. What is network aware grid scheduling. When is it important.

Reliability of Communication Networks

1. Explain defect, repair, fault, failure.
2. Explain: protection and restoration, dedicated and shared protection, recovery scope.
3. How does the classical TCP/IP protocol stack cope with network element failures?
4. Explain the principle of facility backup in MPLS.
5. Explain 1+1, 1:1, 1:1 with preemption and OMS-SPRing (in optical networks)
6. Explain single layer recovery in the IP/MPLS over OTN case.
7. What are secondary failures and what is the impact on single layer recovery.
8. Explain the problem of uncoordinated multi-layer recovery. Give a solution.
9. Explain Static versus Dynamic multilayer recovery.