Peer-to-Peer Systems and Applications

Lecture Organization

TECHNISCHE UNIVERSITÄT DARMSTADT

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http://www.ps.tu-darmstadt.de/teaching/p2p

*Original slides for this lecture provided by Burkhard Stiller, David Hausheer (University of Zurich, Department of Informatics, Communication Systems Group CSG, Switzerland)

1. Motivation

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- What is “Peer-to-Peer”?
  - Depends on who you ask!
- P2P in the media
  - Illegal file sharing, copyright infringement
- P2P in academia
  - A paradigm for communication in the Internet
- Is it new?
  - The Internet in the late 60s (ARPANET) was designed as a Peer-to-Peer system without any centralized control
  - Only the emergence of the Domain Name System (DNS) and the World Wide Web (WWW) changed the Internet into a Client/Server system with centralized control

1. Motivation: P2P Traffic

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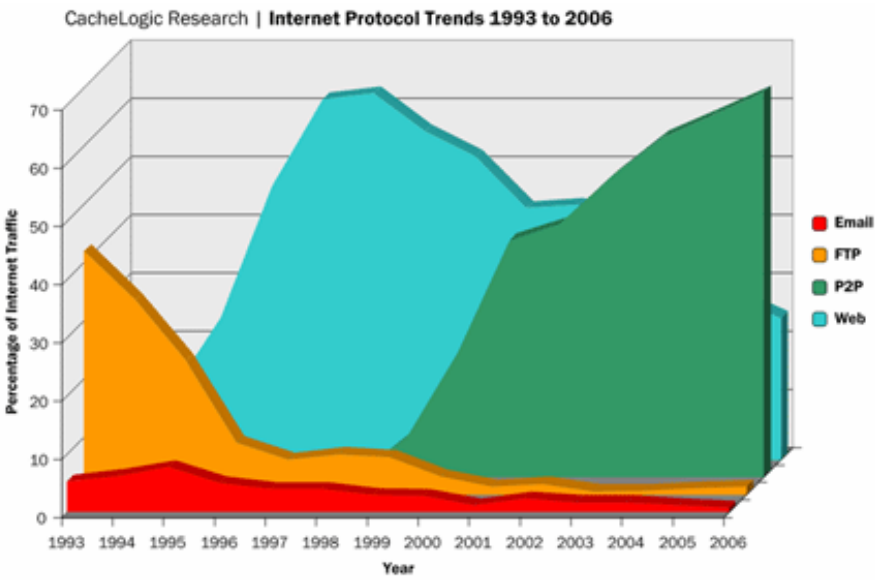
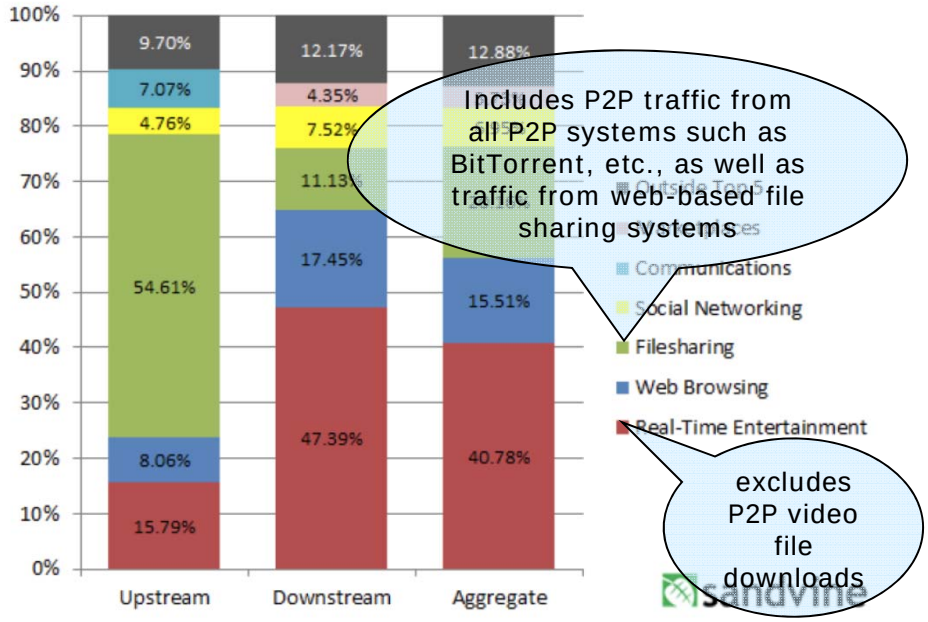
- IP Traffic 1993 - 2006



=> 70% of Internet traffic was due to P2P applications!

Source: CacheLogic Research

- IP Traffic Composition 2013



=> P2P filesharing traffic declined, but still accounts for the majority of upstream traffic

Source: Sandvine Global Internet Phenomena Report, 2H 2013, Peak Period Aggregate Traffic Composition - Europe, Fixed Access

2. Goals

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- Provide a in-depth view into advanced Peer-to-Peer methods and concepts
  - Fully decentralized communication paradigm
    - Alternative to client/server paradigm
  - Benefits and drawbacks
    - Scalability, security, efficiency, fault-tolerance, manageability
  - Selected concepts and approaches
    - Structured versus unstructured P2P systems, Distributed Hash Tables, P2P search, Hybrid P2P systems
  - Applications and related systems
    - Mobile P2P systems, P2P storage, P2P video streaming
  - Economic aspects
    - P2P Incentives, Accounting, P2P Currencies, Energy-efficiency of P2P

3. Lecture Overview (Tentative)

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Apr 13 (DH)	Lecture 1:	Introduction to P2P Systems
Apr 20 (DH)	Lecture 2:	Distributed Hash Tables (1)
Apr 27 (DH)	Lecture 3:	Distributed Hash Tables (2)
May 04 (NN)	Lecture 4:	P2P Video Streaming
May 11 (DH)	Lecture 5:	Hybrid Approaches and Testbeds
May 18 (DH)	Lecture 6:	Selected P2P Concepts
May 25		Pentecost Monday
June 01 (NN)	Lecture 7:	P2P Economics (1): P2P Incentives
June 08 (DH)	Lecture 8:	P2P Economics (2): BitTorrent and BitCoin
June 15 (DH)	Lecture 9:	Mobile P2P (1)
June 22 (NN)	Lecture 10:	Mobile P2P (2)
June 29 (DH)	Lecture 11:	P2P Accounting
July 06 (DH)	Lecture 12:	Current Topics and Outlook
July 13 (DH)	Lecture 13:	Backup

4. Teaching Aids

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- Basics and background information available within:
  - R. Steinmetz, K. Wehrle (Eds.): *Peer-to-Peer Systems and Applications;* Springer Publisher, Berlin-Heidelberg, Germany, Lecture Notes in Computer Science LNCS, Vol. 3485, 2005.
  - Selected chapters and additional material as indicated
  - Available online within TUD: http://dx.doi.org/10.1007/11530657

  Furthermore, detailed studies of important aspects in
  - Journal, conference, or workshop papers.
  - Web sites and white papers.
  - Code examples.

5. Exercise Overview (Tentative)

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Apr 14	No Exercise – Introduction to CN Lab
Apr 21	Lab Work Introduction / Lab Work 1 Hand-out
Apr 28	Lab Work 1 Discussion / Lab Work 2 Hand-out
May 05	Lab Work 2 Discussion / Lab Work 3 Hand-out
May 12	Exercise Introduction / Exercise 1 Hand-out
May 19	Lab Work 3 Discussion / Lab Work Backup
May 26	Exercise 1 Discussion / Exercise 2 Hand-out
June 02	Exercise 2 Discussion / Exercise 3 Hand-out
June 09	Exercise 3 Discussion / Exercise 4 Hand-out
June 16	Exercise 4 Discussion / Exercise 5 Hand-out
June 23	Exercise 5 Discussion / Exercise 6 Hand-out
June 30	Exercise 6 Discussion / Exercise 7 Hand-out
July 07	Exercise 7 Discussion / Exercise Backup
July 14	Consultation hour for the exam

Tentative, more infos on 21.04.2015

6. Organizational Issues – Lectures

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- Lectures: Monday
  - Time: 11:40 - 13:20 hours
  - Location: S3|11 Room 0012

- In case of questions, concerns, help, or ideas concerning the lecture please contact:
  - David Hausheer
    - By e-mail hausheer@ps.tu-darmstadt.de
  - Matthias Wichtlhuber, Leonhard Nobach (Coordinators) Christian Koch, Fabian Kaup, Jeremias Blendin
    - By e-mail [mwichtlh|lnobach|ckoch|fkaup|jblendin]@ps.tu-darmstadt.de

7. Organizational Issues – Exercises

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- Exercises / Lab Work: Tuesday
  - Time: 16:15 - 17:55 hours
  - Location: S1|01 Room A5
- Introduction: **21.04. 16:15 (S101/A5)**
- Support:
  - Matthias Wichtlhuber, Leonhard Nobach (Coordinators)
    Christian Koch, Fabian Kaup, Jeremias Blendin
    - By e-mail [mwichtlh|lnobach|ckoch|fkaup|jblendin]@ps.tu-darmstadt.de
    - Room: S3|19 [7/8] (**only upon appointment!**)

8. Teaching Resources

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- All resources will be available on the Moodle platform
  - Lecture slides as PDF, on regular basis before the lecture date
  - Exercise assignments (typically two weeks before the exercise date) and solutions (directly after the exercise date)

- Location
  - https://moodle.tu-darmstadt.de/
    - Course: Peer-to-Peer Systems 18-hh-2010-vl SoSe 2015
    - Direct link: https://moodle.tu-darmstadt.de/course/view.php?id=4764

- You will be registered to the Moodle course automatically, after signing up in TUcAN.

9. Registration in TUCaN

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- ETiT/CS students
  - Register for (1) the module, (2) the lecture, and (3) the exercises
  - Register for module:
    «Peer-to-Peer Systems and Applications» (18-hh-2010)
  - Register for lecture: 18-hh-2010-vl
  - Register for exercises: 18-hh-2010-ue
- Since SS2015 module 18-hh-2010 is offered for CS students
  - Replaces former module 18-hh-3010 «Peer-to-Peer II - Methods»

9. Registration in TUCaN

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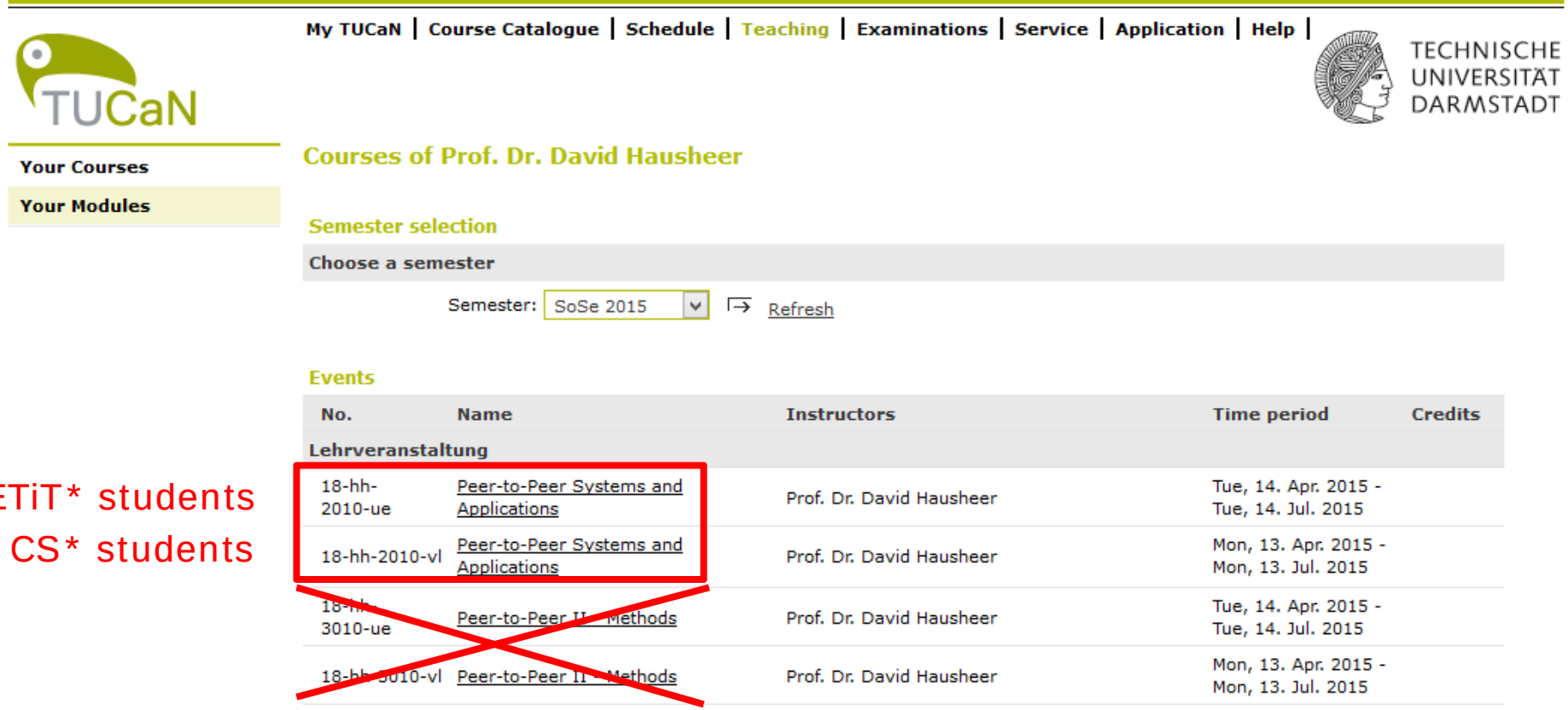

ETiT* students
CS* students

* And related study programs (Wi-CS, Wi-ETiT, iST, etc.)

10. Exam

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- The written exam will take place on **<tbd>**
- 90 minutes exam
- Exam material: lecture and exercise slides
  - Further reading helps to understand the material better
- Max. 90 points
  - General P2P knowledge questions
  - Understanding and application of basic P2P concepts
    - E.g. completion of signaling scheme for a specific use case
  - Understanding of differences between alternatives
  - Calculations based on specific use case examples
  - Etc.
- *In case of few registrations, an oral exam will be held.*

11. Summary

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- Register in TUCaN
  - Module, Lecture, and Exercises
    - ETiT/CS students: «P2P Systems and Applications» (18-hh-2010)
- Check out the Moodle
  - https://moodle.tu-darmstadt.de/course/view.php?id=4764
- Check out the course website for all infos
  - Scan the QR code with your smartphone
  - Direct link: http://tinyurl.com/p2psystems
  - or http://www.ps.tu-darmstadt.de/teaching/p2p/

Seminar
Software Defined Networking

Introduction on 13.04.15
16:15h S3|11 Room 006

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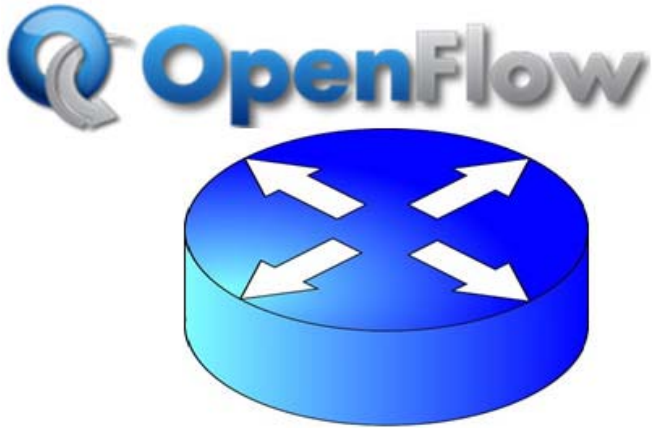
- Lecturer
  - Prof. Dr. David Hausheer



- Competencies
  - Literature search, classification, evaluation, and comparison
  - Writing (10-12 pages) and presentation (30min) of a literature study
- Prerequisites
  - Knowledge of Communication Networks I and II is recommended
  - Students of M.Sc. ETiT, B. Sc./M. Sc. CS

- Topics, not limited to:
  - SDN Architecture
  - SDN Interfaces (North/South-bound vs. East/West-bound interface)
  - SDN Applications
  - Network Virtualization and Slicing
  - Network Function Virtualization (NFV) and Network Service Chaining
  - SDN Security
  - Network Operating Systems and Languages
  - OpenFlow Controller (e.g. NOX, Beacon)
  - Hardware vs. Software Switches
  - Software Defined Networking in Wireless Networks (e.g. OpenWRT)

Interested?
Scan the QR code with your smartphone or visit the course page:
http://tinyurl.com/seminar-sdn

CN Lab – Advanced Topics in Communication Networks

Introduction on 14.04.15
16:15h S1|01 Room A5

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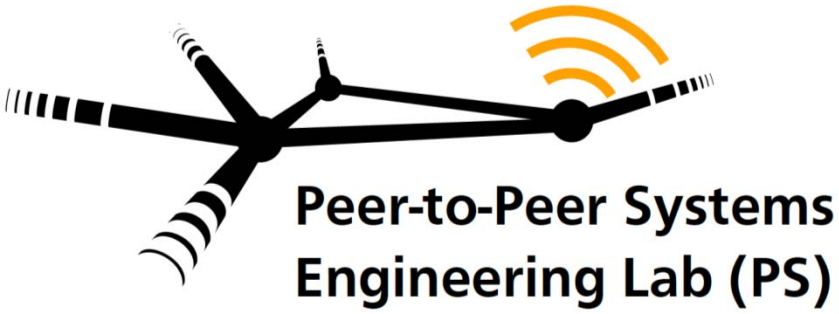
- Lecturer
  - Prof. Dr. David Hausheer



- Organization
  - Single/group work, 2-6 hours/week, 3-9 CP
  - Offered in parallel as four modules: 18-hh-2030-pr, 18-hh-2040-pj, 18-hh-3020-pr, 18-hh-3030-pr

- Prerequisites
  - Solid programming experience; Interest to develop challenging network applications
  - Students of M.Sc. ETiT, B. Sc./M. Sc. CS

- Contents, not limited to:
  - Peer-to-peer and overlay networks
  - Mobile P2P networks, P2P video streaming
  - Network functions virtualization
  - Software-defined networking
  - Energy-efficient networking
  - Network simulation
  - Economic aspects
- Competencies
  - Design & development of communication networks & applications
  - Application of object-oriented programming techniques

Interested?
Scan the QR code with your smartphone or visit the course page:
http://tinyurl.com/ps-cnlab

Theses

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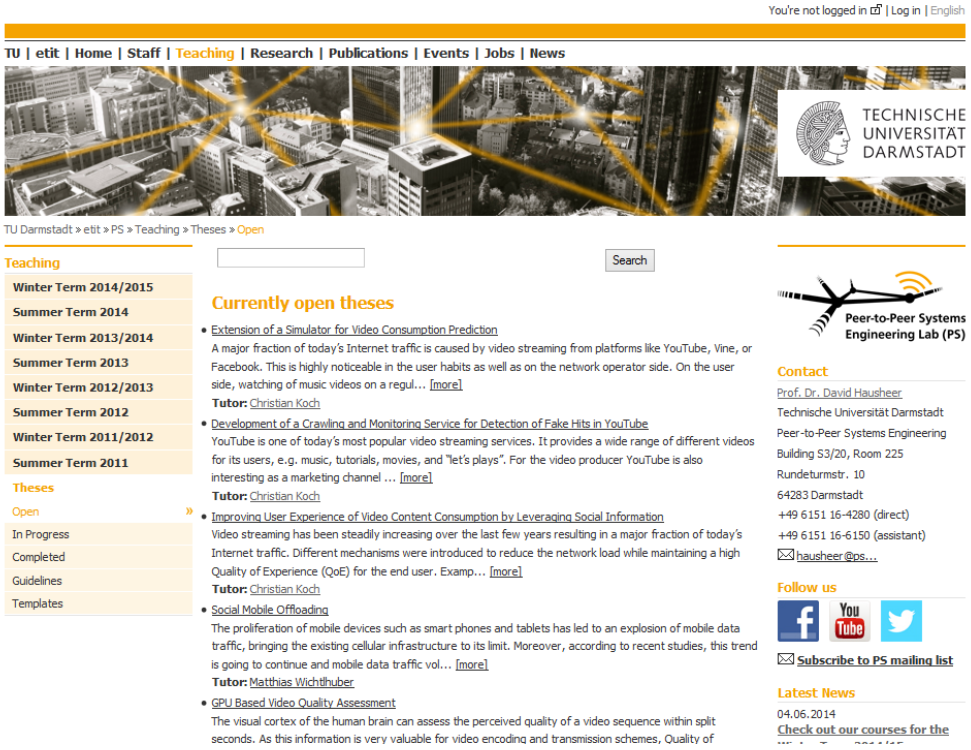
- Open Theses
  - http://www.ps.tu-darmstadt.de/ => Teaching => Theses



Quality-of-Service in Telecommunication Networks (V2 + Ü0)

Introduction on 13.04.15
09:50h S3|20 Room 005

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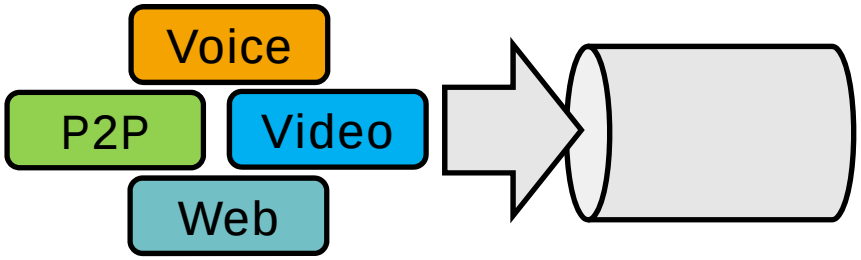
- Lecturer:
  - PD Dr. Gerhard Hasslinger (Deutsche Telekom AG)



- Organization
  - 2 + 0 hours per week, 3.0 credit points
  - Lecture: Mondays, 09:50 – 11:30, S320/5

- Prerequisites
  - Knowledge of Communication Networks I and II is recommended
  - Students of M.Sc. ETiT, B.Sc./M.Sc. CS (and related study programs)

- Contents, not limited to:
  - Architecture, services and protocols for Broadband Access and Core Networks
    - BGP, OSPF, MPLS
    - Overlay Networks for Content Delivery (CDN & Caching, P2P)
  - Quality-of-Service (QoS) Architectures
    - IntServ, DiffServ, IP Traffic Mgnt.

- Competences
  - Insights into the state of the art in managing Internet Service Provider networks

Interested?
Scan the QR code with your smarthone or visit the course page:
http://tinyurl.com/qos-telco