Computer Networks

Summary

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February 10, 2023

Agenda

- Exam
- Overview

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Organizational

- The exam will take place at 4-111/112 on February 13, 2023 at 14:00 CET
- You will be allowed to bring a single-sided cheat sheet and a calculator
- Note the exam regulations, in particular . . .
  - You have to be registered for exam via HIS.
  - You can authenticate yourself with an photo ID and your student identity card.
  - In case of delay no additional time will be granted.

Content

- All necessary formulas, concrete numbers, and some conversion tables will be given in the exam (see mock exam)
- The exam will consist of similar tasks as in the exercise sheets and look similar to the mock exam

Reminder

- What is necessary to pass the exam?
- You should be able to ...
  - explain main concepts and ideas with your own words,
  - select a suitable solution for a given problem,
  - analyze a given solution and detect (potential) problems, and
  - explain your answers.

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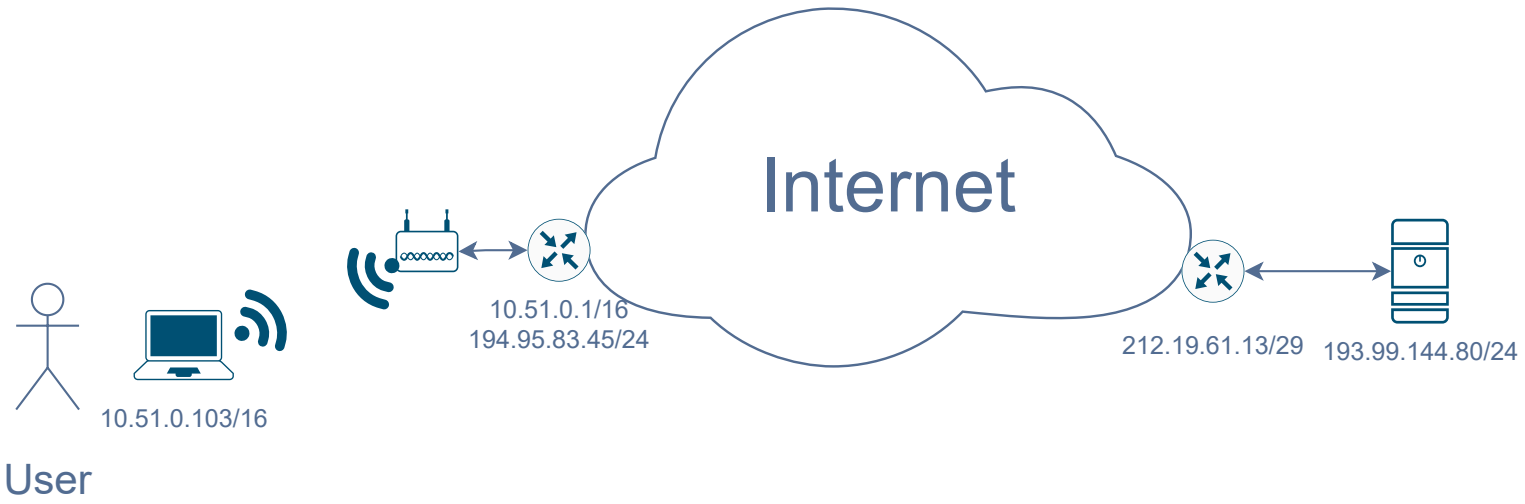

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- What's the deal with a *lag* in online gaming?
- Who can read my mails?
- How can we transmit data through the air (aka wireless networking)?

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→ Use of radio waves as unguided transmission media and coordinate the access via CSMA/CA

Objective

Now you should . . .

- understand what the term *"online"* means,
- be able to explain what the *Internet* is,
- know how computers communicate,
- know what protocols are,
- be familiar with the layers of a network stack,
- understand how the data finds its way, and
- be conscious of security and privacy concerns of computer networks.

Key Terms (1/5)

- Host, Client, Server, Peer
- Network service
- Network protocol
- Transmission medium
- PAN/BAN, LAN, MAN, WAN
- Synchronous vs. asynchronous communication
- Unicast, broadcast, multicast, anycast
- Connection-oriented vs. connectionless
- Simplex, half-duplex, full-duplex
- Topology
- Bandwidth, Throughput, Goodput, and Latency/Delay
- Reference models and layers

Key Terms (2/6)

- Analog and digital signals
- Quantization and Sampling
- Frequency, period, amplitude, phase
- Bandwidth, symbol rate, and date rate
- Line encoding, baseline wander, clock recovery, and modulation
- Coaxial cables, twisted pair, and fiber optic cables

Key Terms (3/6)

- Ethernet (IEEE 802.3), Token Ring (IEEE 802.5), WLAN (IEEE 802.11), and Bluetooth
- Frames, byte/bit stuffing
- Physical network addresses AKA MAC addresses
- Bridges, switches, forwarding, and Spanning Tree Protocol
- ALOHA, CSMA (CD and CA), MACA, TDMA, FDMA, CDMA
- Error control, error detection, error correction
- Hamming distance, parity check, CRC
- ARP and NDP

Key Terms (4/6)

- IPv4 and IPv6, packet header
- IP addresses, ranges, classes, network ID, subnet ID, host ID
- Private or unique local addresses, link-local addresses, and NAT
- IP fragmentation, MTU
- ICMP, ping, and traceroute
- Address autoconfiguration, DHCP, SLAAC
- Internetworking, router, forwarding, and routing
- Autonomous systems, Inter and intra domain routing
- Routing algorithms and metrics
- Distance vector routing and link state routing
- Bellman-Ford and Dijkstra algorithm, RIP, OSPF, IS-IS, and BGP
- Count-to-infinity and split horizon

Key Terms (5/6)

- End-to-end transport, multiplexing, and (well-known) ports
- Reliability, ordering, flow control, and congestion control
- TCP, UDP, and QUIC
- Sockets
- TCP sequence numbers and acknowledgement numbers
- Three-way handshake, data transmission, and connection termination
- AIMD, Slow start, congestion avoidance, sliding window, silly window syndrome, (duplicate) ACKs, fast retransmit, and fast recvovery
- SYN flood DOS attack
- Head of line blocking

Key Terms (6/6)

- DNS, domain, resource record, zone, label, TTL, FQDN
- Telnet, and SSH
- HTTP, HTTP methods and status codes
- SMTP, IMAP, POP, MUA, MTA, Spam