# Exercise 1

Yachao Shao, M.Sc.

yshao@gwdg.de

# Notes
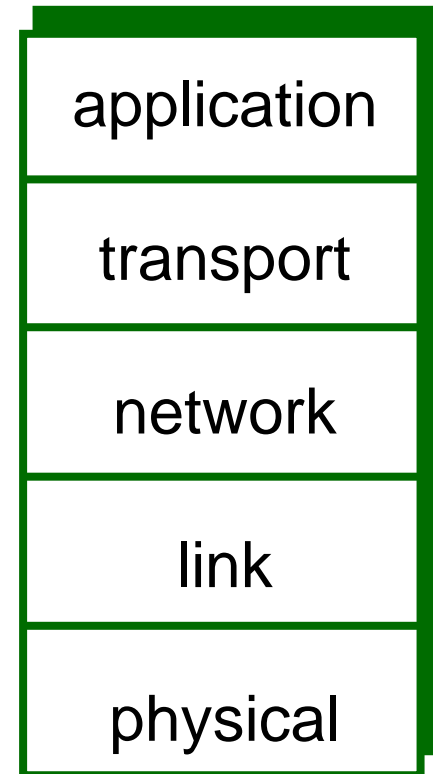
o Introducing myself.

o Doing Exercises by yourself!

o Do you want the full score?

o Have Questions?

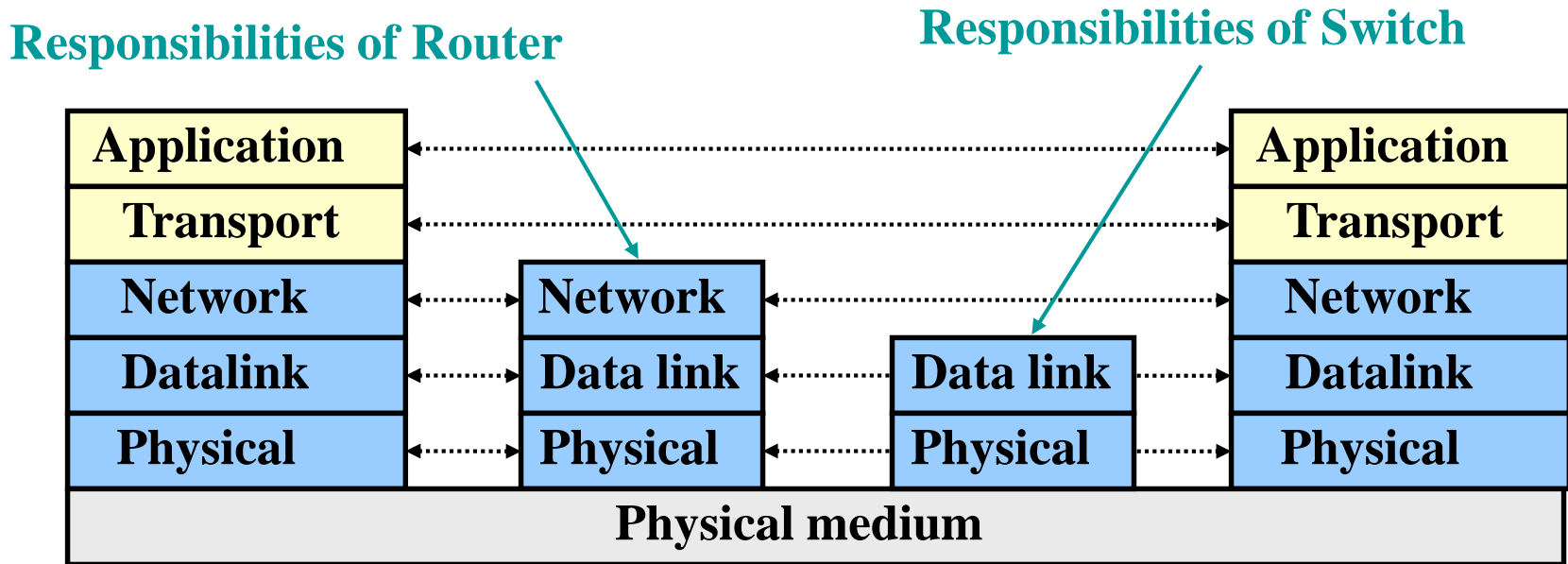o Not enough questions?

o Practical Networking Course

# Q1

○ In the Internet, what are the five layers, from top to bottom, in the Internet protocol stack? Till which layer does a switch process? Please make sure you understand the concept of layering and also think about advantages and disadvantages of layering.

# 1. The five layers

o A switch processes up to layer 2. It uses the physical and the link layer.

o Advantages: Isolation, transparent to changes in other layers

o Disadvantages: Isolation ;), cannot optimize across layers

| application |
| --- |
| transport |
| network |
| link |
| physical |

# 1. The five layers



**Responsibilities of Router**

**Responsibilities of Switch**

| Application | | | | Application |
| Transport | | | | Transport |
| Network | Network | | | Network |
| Datalink | Data link | Data link | | Datalink |
| Physical | Physical | Physical | | Physical |

**Physical medium**

# Q2

o The ISO/OSI reference model adds two layers. What is the purpose of the session layer? Does the current Internet implements a session layer?

# 2. ISO/OSI

o Session layer is responsible for synchronization and recovery of data exchange.

  o Today's Internet does not typically implement Session layer and nodes are identified by IP addresses. If connection breaks or IP changes, session typically fails.

o Presentation layer takes care of data interpretation, e.g. compression, en- and decryption etc.

# Q3

○ What is the difference between the client/server model and the peer-to-peer model?

# 3. Client/Server and P2P

o Client/Server: Client requests, server delivers (typically always-on!).

   o Examples: Web browser and server, email client and server

o Peer-to-Peer model: Everybody serves as client and server. Typical setup of file sharing systems, but also used in Skype. No always-on etc.

   o (Often P2P operates between end hosts and is not or only lightly infrastructure supported.)

# Q4

o Circuit switching versus packet switching: Assume all traffic sources to be bursty: what switching technology is preferable? What are the advantages of the other technique?

# 4. Circuit vs. Packet switching

o If sources are bursty they do use the bandwidth only for short timeslots. The burst-process is random.

   o Randomness: Hard to deal with in circuit switching but easy to do with packet switching.

   o Circuit switching has lots of wasted bandwidth with bursty sources, packet switching scales better.

o Even if the sources are bursty, QoS reason can make it indispensable to use circuit switching

# **Q5**

○ In what switching technology is Frequency or Time Division Multiplexing used?

# 5. FDMA and TDMA

o Only in shared media, Multiple Access protocols to guarantee resource allocation via channel partitioning

o Divides a shared channel in fixed timeslots or frequency slots.

FDMA and TDMA are used in circuit switching.

# Q6

○ What is "statistical multiplexing"?

# 6. Statistical multiplexing

o Occurs in packet switching

o Statistical multiplexing: Sequence of sending packets does not have a fixed pattern

  o No definite prediction possible

  o This has implications for router queues etc.

# Q7

○ What are the four sources of packet delay? How does loss occur?

# 7. 4 Sources of packet delay

○ Nodal processing: Error checks and link determination

○ Queuing: Congestion at router? Time wait at output link (e.g. when shared channel is busy)

○ Transmission delay: Writing data to the link

○ Propagation delay: Typically the speed of light and level 1 processing.

# 7. Loss

o If router queues are full, new packets are just dropped

o Physical influences: Interruption in communication, especially in wireless communications