

Computer Networks

Exercise Session 05

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General Schedule

All exercises will follow this general schedule

- Identify potential understanding problems
 - Ask your questions
 - Recap of the lecture
- Address the understanding problems
 - Answer your questions
 - Repeat certain topics
- Walk through the exercises/solutions → Some hints and guidance
 - Work time or presentation of results

Framing

You have seen . . .

- the main services of the Data Link Layer
- what link layer **frames** are and how they can be **marked**
- the specific design of **IEEE 802.3 (Ethernet)** and **IEEE 802.11 (WLAN)** frames

Addresses

You have seen . . .

- which network components typically can be **addressed** on the Data Link Layer
- the **representation** of **MAC addresses**
- how MAC addresses are composed (→ **EUI-64** and **OUI**)

Switching

You have seen . . .

- what functionality is provided by **Bridges** and **Switches**
- how these devices **learn** about the topology
- which **forwarding** strategies exist
- that **loops** on the Data Link Layer can cause serious problems
- how loops can be avoided by creating a logical hierarchy with the **Spanning Tree Protocol**

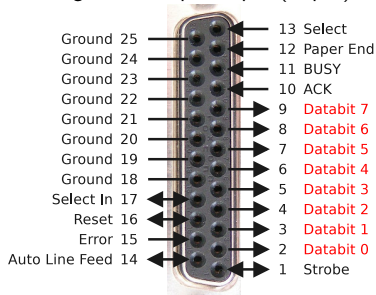
Any other questions left?



Exercise 1: Guided Transmission Media

- Communication between computers is possible via **parallel** and **serial** data transmission
- With **parallel data transmission**, in addition to the control lines, **multiple** data lines exist
- Example: Parallel port which was the standard interface to connect printers until it was replaced by USB
 - Via this interface, an entire byte of data can be transferred per time unit
- Benefit: Higher throughput
- Drawback: Lots of lines are necessary
 - This is cost-intensive for long distances
- Usage: Local bus systems

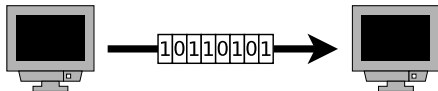
The image shows the parallel port (25 pins)



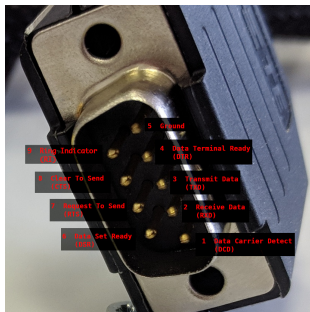
(e.g. ATA, SCSI, ISA, PCI, Front Side Bus, IEEE-1284 "printer port")

Serial Data Transmission

- When **serial data transmission** is used, the bits are transmitted one after another via the bus
 - Transferring a byte takes 8 times longer compared to parallel data transmission (when using 8 data lines)
- Benefit: Can be used for long range distances, because only few wires are required
- Drawback: Less throughput
- Usage: Local bus systems and **computer networks**



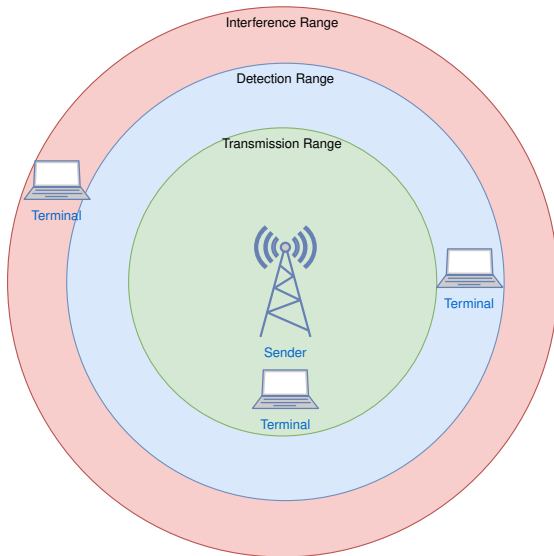
The image shows the serial port RS-232 (DB-9 = 9 pins)



Some serial network technologies

Ethernet, USB, CAN, FireWire, Fibre Channel (for SAN), InfiniBand

Exercise 2: Unguided Transmission Media



Exercise 2: Unguided Transmission Media

■ Wireless propagation phenomenons:

Absorption Different material absorb the energy of the radio wave

Material	Absorption
Human body	3 – 5 dB
Plain-Glass Window	3 – 8 dB
Wooden door	4 – 7 dB
Steel door	20 – 30 dB
Concrete Wall	20 – 30 dB

Reflection Waves being reflected from surfaces
→ **multi-path fading**

Diffraction Radio waves are bent and spread when they encounter obstructing objects

Scattering Rough surfaces, dust, humidity, rain etc. cause scattered reflections

Exercise 3: Technologies

- An **Ethernet repeater** or hub will **amplify** the received signal
- It has one port per connection
- A **WLAN repeater** (or extender or booster) often has only **one antenna**
- Hence, the throughput is reduced by 50 %
- In order to extend the range of WLAN typically multiple access points are used

Exercise 5: Bridges and Switches



- Repeater, Switch, Router?
- On which layer?

Link Layer Protocols

- HDLC (High-Level Data Link Control)
 - Standardized by ISO
 - Emerged from *Synchronous Data Link Control (SDLC)*
- SLIP (Serial Line Internet Protocol)
 - Specified by the IETF
 - Developed to transport IP over serial lines
- PPP
 - Successor of SLIP
 - Commonly used by ISPs (as *Point-to-Point Protocol over Ethernet (PPPoE)* and *Point-to-Point Protocol over ATM (PPPoA)*)
- ATM
 - Standardized by ITU and ANSI
 - Uses small, fixed-sized cells for to eliminate jitter for voice communication