

Exercise 3

Technology Basics II

Mobile Business I (WS 2025/26)

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**QA Session:
10.02.2026 (14:00-16:00)**

Please send us (mob1@m-chair.de) your questions in this
period:

27.01.2025 (08:00) - 03.02.2023 (23:00)

- Exercise 1: L08 – Smartcards and Related Application Infrastructures
- Exercise 2: L09 – Mobile Devices
- Exercise 3: L10 – Concepts of Mobile OSs

a) What is a smartcard?



- Small computers with **memory, operating system, software, processor, I/O and access control**
- **Chip protected against manipulation**
- After being **initialised** with **keys** and other data, smartcards are distributed to their users

b) What are smartcards being used for?

- Used when **security** of data (e.g. for keys, signatures, physical access control, payment) is needed **in insecure environments**

- Examples:
 - Smartcard applications for PC (AusweisApp)
 - SIM Cards (Calling, Data)
 - Payment (Credit card, NFC)
 - Room access
 - Health insurance

- Exercise 1: L08 – Smartcards and Related Application Infrastructures
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a) What are Personal Area Networks (PANs)?

- ***Purpose:*** Connection of devices in short range of an individual, for example mobile device and printer. Typically wireless, can also be wired.

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- **Replaces cable-connections:**
 - Infrared Communications
 - Bluetooth
 - Near Field Communication (NFC)

Bonus: Can you think of newer PAN protocols or standards?

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Zigbee:

- IEEE 802.15.4-based communication protocols to create PANs for smart home devices.
- Intended to be simpler, cheaper than Bluetooth
- Creates a mesh network of devices, needs a Zigbee coordinator (ZC) as a central node as trust centre and repository for security keys
- Used for powered wireless light bulbs, smart thermostats
- Operates on the lower OSI layers (1-3), i.e. in contrast to other, more recent, „standards“ such as Matter.



- b) How has the evolution of mobile devices been when it comes to device capabilities?

▪ Development of device capabilities



- **Short Message Service (SMS)**
- **General telephony capabilities**

▪ Development of device capabilities



- **Data Services (Internet connectivity, 2G)**
- **Short Message Service (SMS)**
- **General telephony capabilities**

▪ Development of device capabilities



- **Sensors (microphone, camera, GPS, ...)**
- **Data Services (Internet connectivity, 2G)**
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▪ Development of device capabilities



- **Possibility to execute 3rd party software**
- **Sensors (microphone, camera, GPS, ...)**
- **Data Services (Internet connectivity, 2G)**
- **Short Message Service (SMS)**
- **General telephony capabilities**

■ Development of device capabilities



- **Near-field communication (NFC) module**
- **Interactive Voice Response (IVR)**
- **Multimedia applications (MP4, radio, video, TV, etc.)**
- **Possibility to execute 3rd party software**
- **Sensors (microphone, camera, GPS, ...)**
- **Data Services (Internet connectivity, 2G)**
- **Short Message Service (SMS)**
- **General telephony capabilities**

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- It enables the users to execute programs
- *Other properties:* Multi-user, multi-thread, high availability, real-time, ...

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- ***Primary goal of an OS:*** Easy usage of the actual hardware
- ***Secondary goal of an OS:*** Efficient usage of the hardware

- Several programs (processes) can run simultaneously & concurrently on an OS:
 - *How are processes managed in a system with regard to processing time, memory, etc?*
 - *Which process is allowed to access resources when?*
 - *How are resources (I/O) shared among processes?*
 - *How do processes exchange data among each other?*

- A process is a program “in operation”.
- A process uses resources, such as CPU time, and memory.
- The resources of a process are allocated while it is created or when it is running.
- The operating system has to manage the process (creation, resource distribution, etc.).

b) Describe the advantages of multi-programming.

■ **Advantages:**

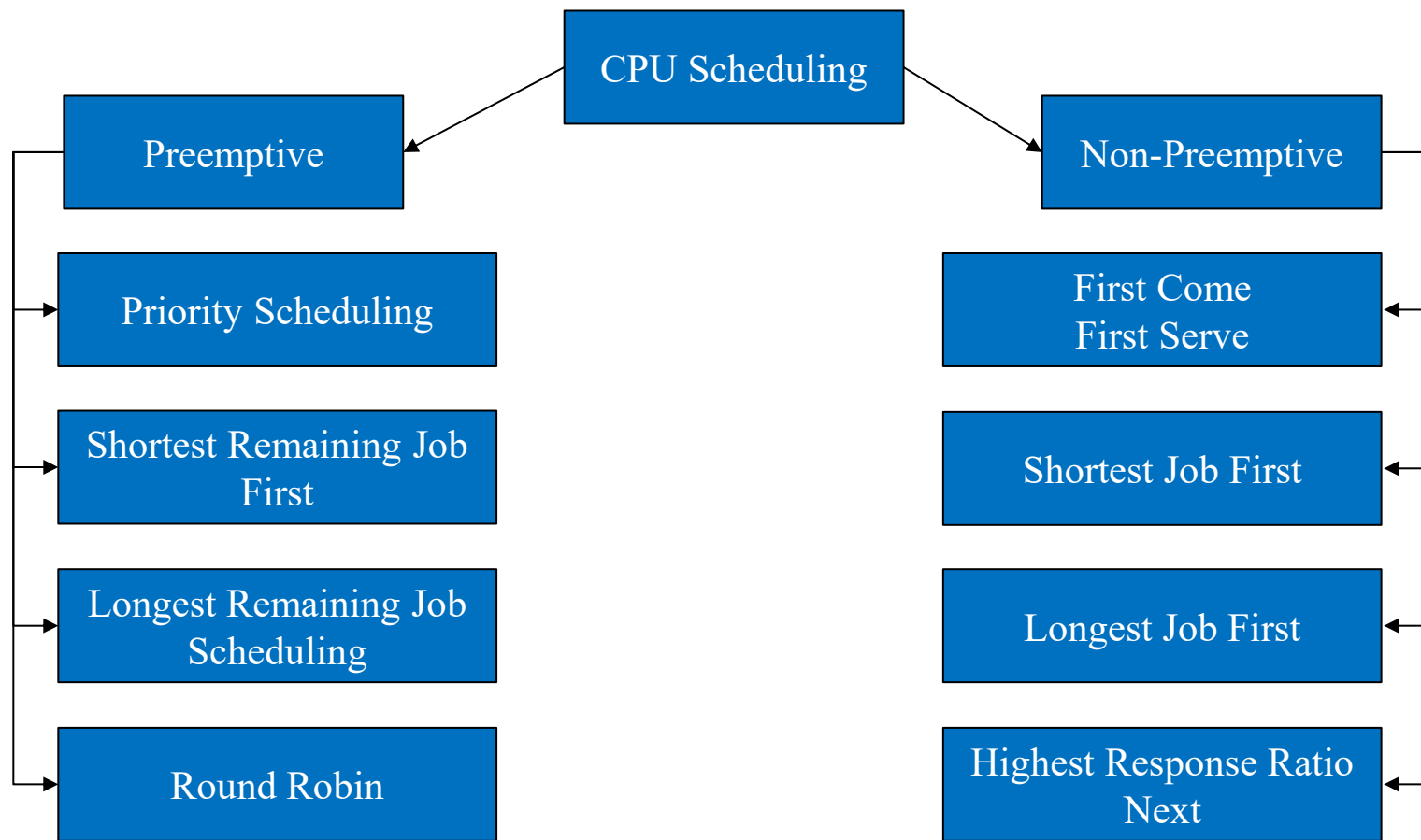
- Maximisation of the CPU usage
 - Enabling users to operate several programs simultaneously
 - Enabling several users to work on the same machine simultaneously
-
- On a CPU only one process is running at a time.
 - The process switching must be fast, to enable the user to interact with all running programs.
 - Queues are used to handle this task.

c) Describe the following scheduling algorithms:

- First Come, First Serve
- Shortest Job First
- Priority Scheduling
- Round Robin Scheduling

L10 – Concepts of Mobile OSs

Scheduling Approaches:



- FIFO-principles (First In First Out): Processes are executed by the CPU one after another in order of their occurrence.
- Pros/Cons:
 - Simple, easy to implement.
 - The throughput is not optimal.
 - Average response time is very high
 - No optimal utilisation of the CPU (Convoy-Effect)
 - Not appropriate for Time-Sharing-Systems

- The processes are executed in order of their execution time.
- Processes that can be finished fast are executed first.
- Pros/Cons:
 - Optimal with regard to the average latency time
 - Not fair. Complex processes can “starve to death”.
 - Difficult to predict the length of upcoming CPU requests

- Processes get an assigned priority number.
- Process execution in the order of the assigned priority.
- Deadlocks or “starvation” of processes with low priority numbers is possible.

➔ Aging: Gradually raising the priority of a process

- Especially used for Time-Sharing-Systems and one of the simplest scheduling algorithms
- Similarly to FCFS, assigning time slices of a time interval to a process being held in the scheduling queue.
- After the time slice of a process is expired, the CPU is revoked from the process, and it is placed at the end of the scheduling queue.

- This set of slides is based upon the following lectures:
 - *Lecture 8:* Smartcards and Related Application Infrastructures
 - *Lecture 9:* Mobile Devices
 - *Lecture 10:* Concepts of Mobile OSs

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