

Exercise 3

Technology Basics II

Mobile Business I (WS 2024/25)

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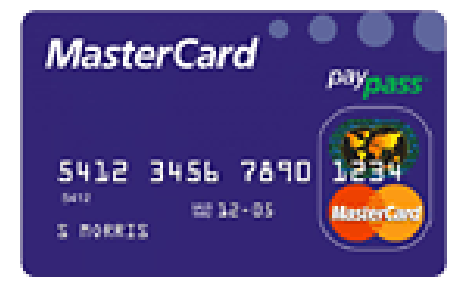
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- Exercise 1: L08 – Smartcards and Related Application Infrastructures
- Exercise 2: L09 – Mobile Devices
- Exercise 3: L10 – Concepts of Mobile OSs

a) What is a smartcard?

Smartcards – Examples



- 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:**
 - Phone cards of Deutsche Telekom
 - Smartcard applications for PC
 - Smartcards for mobile communication (SIMs)
 - eID functionality in your passport

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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.

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

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

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

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a) What is a process?



What is an operating system (OS)?

- An OS is a program that serves as a mediator between the user and the hardware.
- It enables the users to execute programs
- *Other properties:* Multi-user, multi-thread, high availability, real-time, ...

- **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.).

L10 – Concepts of Mobile OSs

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
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- 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.

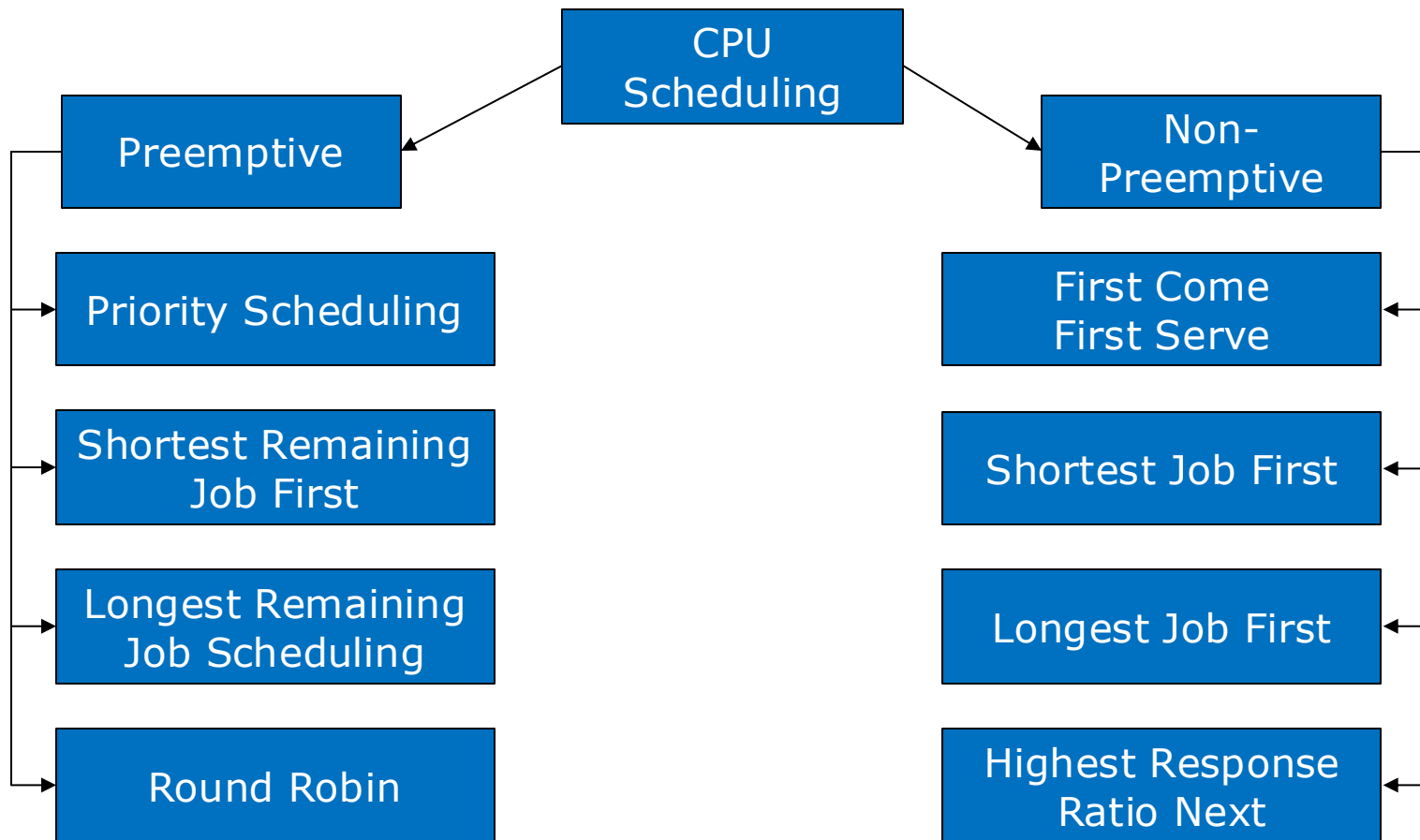
L10 – Concepts of Mobile OSs

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



First Come, First Serve (FCFS)

- Processes are executed by the CPU one after another in order of their occurrence.
- FIFO-principles (First In First Out)

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
- Similar 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 the process 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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