Computer Architecture Exercises

Introduction to Serie 4

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Organisation

Today
- Introduction to Serie 4
- ARM Assembly

April 24
- Pool session

May 1
- Hand in Serie 4
- Start Serie 5

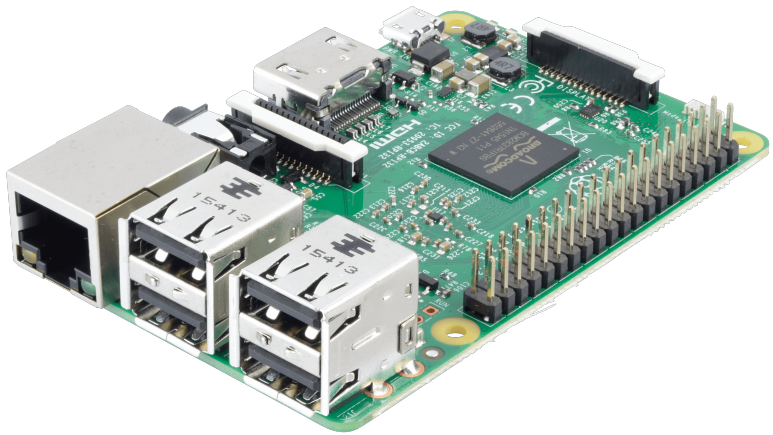
Serie 4

- Groups are final from today (see ILIAS)
- Submit both theoretical- and programming part as team
- **Special rule** for programming part
  - There are three versions of the exercise
  - As a group, solve all versions together
  - Each member is responsible for one version
  - See details in exercise sheet
- **Start early!**

Serie 4

First steps

- Follow instructions in *Raspberry Pi Introduction* document (see PDF on ILIAS)
- Use your own peripherals or ExWi computer pool
- Missing parts? Defective components? Please contact us immediately!



ARM Assembly

- Programming exercises with ARM (Advanced RISC Machine)
- Similar to MIPS, different syntax
- Study and test our blinking LED demo program `blink.s`
- We provide a code skeleton for Serie 4

Example: Blinking LED – Part 1

```
.global main
.func main

main:
        // This will setup the wiringPi library.
        // In case something goes wrong,
        // we exit the program.
        BL      wiringPiSetupGpio
        CMP     R0, #-1
        BEQ     exit

configurePin:
        // Here we configure the pin. We use the
        // pin number 21 as defined at the bottom of
        // this file and set the pin to output mode.
        LDR     R0, .LED_PIN
        LDR     R1, .OUTPUT
        BL      pinMode
```

Example: Blinking LED – Part 2

```
blinkLoop:
        // Loop for blinking the LED
        // Turn the LED on
        LDR     R0, .LED_PIN
        LDR     R1, .HIGH
        BL      digitalWrite
        // Wait 500 milliseconds
        MOV     R0, #500
        BL      delay
        // Turn the LED off
        LDR     R0, .LED_PIN
        LDR     R1, .LOW
        BL      digitalWrite
        // Wait 500 milliseconds
        MOV     R0, #500
        BL      delay
        // Repeat
        B       blinkLoop
```

Example: Blinking LED – Part 3

```
exit:
        MOV     R7, #1
        SWI     0


// We use GPIO pin 21 (BCM-style) to connect the LED.
.LED_PIN:               .word   21

// Constants for high- and low signals on the pins
.HIGH:                  .word   1
.LOW:                   .word   0

// The mode of the pin can be set to input or output.
.OUTPUT:                .word   1
.INPUT:                 .word   0
```