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«Київський політехнічний інститут імені Ігоря Сікорського»
Факультет інформатики та обчислювальної техніки
Кафедра обчислювальної техніки

Архітектура комп'ютера - 3

Лабораторна робота №1

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Результаты выполнения лабораторной работы:

The image displays a Linux environment where a QEMU virtual machine is being configured for an STM32F4-Discovery board. The top part shows a file manager window with the following files: `firmware.bin`, `firmware.elf`, `lsicript.ld`, `Makefile`, and `start.o`. The bottom part shows a terminal window with the command `qemu-system-gnuefipflash --verbose --board STM32F4-Discovery --mcu STM32F407VG -d unimp,guest_errors --image firmware.bin --semhosting-config enable=on,target=native -s -S` and its output, which includes details about the QEMU version, board name, device file, and memory layout. A separate window shows a photograph of the physical STM32F4-Discovery board, which is a green PCB with various components, including a USB port, a push button, and a microcontroller chip.

2_semestr 1_Lab

Недавние
Избранные
Домашняя папка
Рабочий стол
Видео
Документы
Загрузки
Изображения
Музыка
Корзина
Другие места

firmware.bin
firmware.elf
lsicript.ld
Makefile
start.o
start.S

```
misha_hrystuk@not-my-computer: ~/2_semestr/1_Lab
misha_hrystuk@not-my-computer:~/2_semestr/1_Lab$ qemu-system-gnuefipflash --verbose --board STM32F4-Discovery --mcu STM32F407VG -d unimp,guest_errors --image firmware.bin --semhosting-config enable=on,target=native -s -S
xPack 64-bit QEMU v2.8.0-12 (qemu-system-gnuefipflash).
Board: 'STM32F4-Discovery' (ST Discovery kit for STM32F407/417 lines).
Board picture: '/home/misha_hrystuk/opt/xPacks/qemu-arm/2.8.0-12/share/qemu/grap
hics/STM32F4-Discovery.jpg'.
Device file: '/home/misha_hrystuk/opt/xPacks/qemu-arm/2.8.0-12/share/qemu/grap
hics/STM32F40x-qemu.json'.
Device: 'STM32F407VG' (Cortex-M4 r0p0, MPU, ITM, 4 NVIC pri
sh: 1024 kB, RAM: 128 kB.
Image: 'firmware.bin'.
Command line: (none).
Load 20 bytes at 0x08000000-0x08000013.
Cortex-M4 r0p0 core initialised.
'/machine/mcu/stm32/RCC', address: 0x40023800, size: 0x0400
'/machine/mcu/stm32/FLASH', address: 0x40023C00, size: 0x0400
'/machine/mcu/stm32/PWR', address: 0x40007000, size: 0x0400
'/machine/mcu/stm32/SYSCFG', address: 0x40013800, size: 0x0400
'/machine/mcu/stm32/EXTI', address: 0x40013C00, size: 0x0400
'/machine/mcu/stm32/GPIOA', address: 0x40020000, size: 0x0400
'/machine/mcu/stm32/GPIOB', address: 0x40020400, size: 0x0400
'/machine/mcu/stm32/GPIOC', address: 0x40020800, size: 0x0400
```

2_semestr 1_Lab

firmware.bin
firmware.elf
lsicript.ld
Makefile
start.o

ST Discovery kit for STM32F407/417 lines

STM32F4-Discovery

```
misha_hrysiuk@not-my-computer: ~/2_sememstr/1_Lab
misha_hrysiuk@not-my-computer:~/2_sememstr/1_Lab$ gdb-multiarch f
GNU gdb (Ubuntu 9.2-0ubuntu1-20.04) 9.2
Copyright (C) 2020 Free Software Foundation, Inc.
License GPLv3+: GNU GPL version 3 or later <http://gnu.org/licenses/gpl.html>.
This is free software: you are free to change and redistribute it.
There is NO WARRANTY, to the extent permitted by law.
Type "show copying" and "show warranty" for details.
This GDB was configured as "x86_64-linux-gnu".
Type "show configuration" for configuration details.
For bug reporting instructions, please see:
<http://www.gnu.org/software/gdb/bugs/>.
Find the GDB manual and other documentation resources online at:
<http://www.gnu.org/software/gdb/documentation/>.

For help, type "help".
Type "apropos word" to search for commands related to "word"...
Reading symbols from firmware.elf...
(gdb) target extended-remote:1234
Undefined target command: "extended-remote:1234". Try "help target".
(gdb) target extended-remote:1234
Remote debugging using 1234
__hard_reset__ () at start.S:18
18      ldr r0, =__stack_start
(gdb) step
19      mov sp, r0
(gdb) step
__hard_reset__ () at start.S:20
20      b __hard_reset__
(gdb) step
__hard_reset__ () at start.S:18
18      ldr r0, =__stack_start
(gdb)

'/machine/mcu/stm32/GPIOE', address: 0x40021000, size: 0x0400
'/machine/mcu/stm32/GPIOF', address: 0x40021400, size: 0x0400
'/machine/mcu/stm32/GPIOD', address: 0x40021800, size: 0x0400
'/machine/mcu/stm32/GPIOD', address: 0x40021C00, size: 0x0400
'/machine/mcu/stm32/GPIOD', address: 0x40022000, size: 0x0400
'/machine/mcu/stm32/USART1', address: 0x40011000, size: 0x0400
'/machine/mcu/stm32/USART2', address: 0x40004400, size: 0x0400
'/machine/mcu/stm32/USART3', address: 0x40004800, size: 0x0400
'/machine/mcu/stm32/USART6', address: 0x40011400, size: 0x0400
'/peripheral/led:green' 8*10 @ (258,218) active high '/machine/mcu/stm32/GPIOD'
'/peripheral/led:orange' 8*10 @ (287,246) active high '/machine/mcu/stm32/GPIOD'
'/peripheral/led:red' 8*10 @ (258,274) active high '/machine/mcu/stm32/GPIOD'
'/peripheral/led:blue' 8*10 @ (230,246) active high '/machine/mcu/stm32/GPIOD'
'/peripheral/button:reset' 40*40 @ (262,324)
'/peripheral/button:user' 40*40 @ (262,164) active high '/machine/mcu/stm32/GPIOD'
GDB Server listening on: 'tcp::1234'...
Cortex-M4 r0p0 core reset.
... connection accepted from 127.0.0.1.
```

```
misha_hrysiuk@not-my-computer: ~/2_sememstr/1_Lab
misha_hrysiuk@not-my-computer:~/2_sememstr/1_Lab$ make
arm-none-eabi-gcc -x assembler-with-cpp -c -O0 -g3 -mcpu=cortex-m4 -Wall start.o
arm-none-eabi-gcc start.o -mcpu=cortex-m4 -Wall --specs=nosys.specs -nostdlib -lgcc -T./lscript.ld -o firmware.elf
arm-none-eabi-objcopy -O binary -F elf32-littlearm firmware.elf firmware.bin
misha_hrysiuk@not-my-computer:~/2_sememstr/1_Lab$ make qemu
qemu-system-gnuarmclipline --verbose --verbose --board STM32F4-Discovery --mcpu STM32F407VG -d unimp,guest_errors --image firmware.bin --semihosting-config enable=on,target=native -gdb tcp::1234 -S

xPack 64-bit QEMU v2.8.0-12 (qemu-system-gnuarmclipline).
Board: 'STM32F4-Discovery' (ST Discovery kit for STM32F407/407R)
Board picture: '/home/misha_hrysiuk/opt/xPacks/qemu-arm/2.8.0-12/pictures/STM32F4-Discovery.jpg'.
Device file: '/home/misha_hrysiuk/opt/xPacks/qemu-arm/2.8.0-12/s/STM32F40x-qemu.json'.
Device: 'STM32F407VG' (Cortex-M4 r0p0, MPU, ITM, 4 NVIC priority groups)
sh: 1024 kB, RAM: 128 kB.
Image: 'firmware.bin'.
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Cortex-M4 r0p0 core initialised.
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'/machine/mcu/stm32/USART1', address: 0x40011000, size: 0x0400
'/machine/mcu/stm32/USART2', address: 0x40004400, size: 0x0400
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'/peripheral/led:blue' 8*10 @ (230,246) active high '/machine/mcu/stm32/GPIOD'
'/peripheral/button:reset' 40*40 @ (262,324)
'/peripheral/button:user' 40*40 @ (262,164) active high '/machine/mcu/stm32/GPIOD'
GDB Server listening on: 'tcp::1234'...
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