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CPE 434-01

4/1/2021

Lab 12

Introduction

Compiler – used to translate a program from a high-level language to an assembly language. It checks for syntax errors.

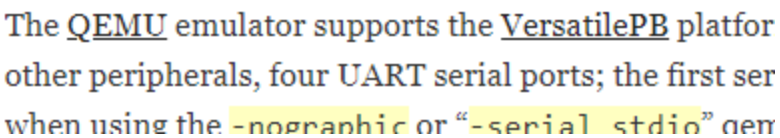
Assembler – Translates assembly language into relocatable machine code. This is stored in an object file.

Linker – Takes all the object files and combines them to for an executable. It does this by combining all of the object files that are needed.

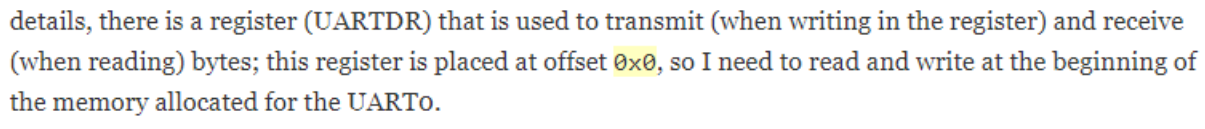
Assignment

2.

It supports 4 UART serial ports.



UARTDR is used to transmit and receive.



3.

```
volatile unsigned int * const UART0DR = (unsigned int *)0x101f1000;

void print_uart0(const char *s) {
 while(*s != '\0') { /* Loop until end of string */
 *UART0DR = (unsigned int)(*s); /* Transmit char */
 s++; /* Next char */
 }
}

void c_entry() {
 print_uart0("Hello world!\n");
}
```

```
odroid@odroid:~/lab12$ ^C
odroid@odroid:~/lab12$  arm-none-eabi-gcc -c -mcpu=arm926ej-s -g test.c -o test.o
odroid@odroid:~/lab12$
```

4.

```
odroid@odroid:~/lab12$ arm-none-eabi-as -mcpu=arm926ej-s -g startup.s -o startup.o
odroid@odroid:~/lab12$
```

5.

```
odroid@odroid:~/lab12$ arm-none-eabi-ld -T test.ld test.o startup.o -o test.elf
odroid@odroid:~/lab12$
```

6.

```
odroid@odroid:~/lab12$ arm-none-eabi-objcopy -O binary test.elf test.bin
odroid@odroid:~/lab12$
```

7.

```
Package qemu-kvm-extras is not available, but is referred to by another package.
This may mean that the package is missing, has been obsoleted, or
is only available from another source

E: Package 'qemu-kvm-extras' has no installation candidate
odroid@odroid:~/lab12$ qemu-system-arm -M versatilepb -m 128M -nographic -kernel test.bin
pulseaudio: set_sink_input_volume() failed
pulseaudio: Reason: Invalid argument
pulseaudio: set_sink_input_mute() failed
pulseaudio: Reason: Invalid argument
Hello world!
```

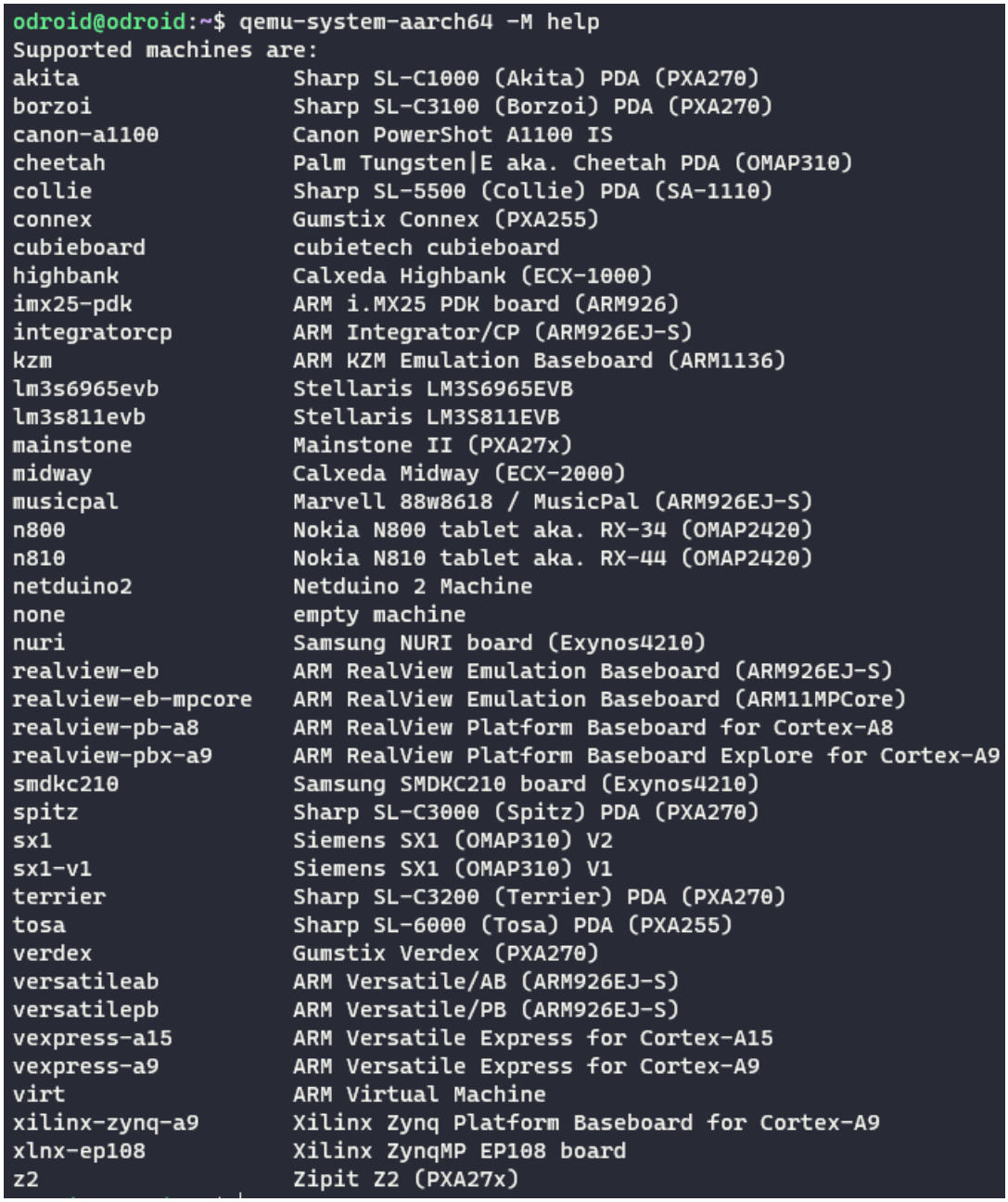
8.

The first step is to run arm-none-eabi-gcc -c -mcpu=arm926ej-s -g test.c -o test.o. This generates an object file of test.c. The next step is to run the same command but with startup.s. This checks for errors and assembles the files into object code.

The linker takes the code that I have written and combines it all together. This includes precompiled library code. The final command creates another executable of a different format.

8.2

```
Last login: Mon Apr  5 15:52:31 2021 from 172.22.0.6
odroid@odroid:~$ qemu-system-arm -M help
Supported machines are:
akita                Sharp SL-C1000 (Akita) PDA (PXA270)
borzoi               Sharp SL-C3100 (Borzoi) PDA (PXA270)
canon-a1100          Canon PowerShot A1100 IS
cheetah              Palm Tungsten|E aka. Cheetah PDA (OMAP310)
collie               Sharp SL-5500 (Collie) PDA (SA-1110)
connex               Gumstix Connex (PXA255)
cubieboard           cubietech cubieboard
highbank             Calxeda Highbank (ECX-1000)
imx25-pdk            ARM i.MX25 PDK board (ARM926)
integratorcp         ARM Integrator/CP (ARM926EJ-S)
kzm                  ARM KZM Emulation Baseboard (ARM1136)
lm3s6965evb          Stellaris LM3S6965EVB
lm3s811evb           Stellaris LM3S811EVB
mainstone            Mainstone II (PXA27x)
midway               Calxeda Midway (ECX-2000)
musicpal             Marvell 88w8618 / MusicPal (ARM926EJ-S)
n800                 Nokia N800 tablet aka. RX-34 (OMAP2420)
n810                 Nokia N810 tablet aka. RX-44 (OMAP2420)
netduino2            Netduino 2 Machine
none                 empty machine
nuri                 Samsung NURI board (Exynos4210)
realview-eb          ARM RealView Emulation Baseboard (ARM926EJ-S)
realview-eb-mpcore   ARM RealView Emulation Baseboard (ARM11MPCore)
realview-pb-a8       ARM RealView Platform Baseboard for Cortex-A8
realview-pbx-a9      ARM RealView Platform Baseboard Explore for Cortex-A9
smdkc210             Samsung SMDKC210 board (Exynos4210)
spitz                Sharp SL-C3000 (Spitz) PDA (PXA270)
sx1                  Siemens SX1 (OMAP310) V2
sx1-v1               Siemens SX1 (OMAP310) V1
terrier              Sharp SL-C3200 (Terrier) PDA (PXA270)
tosa                 Sharp SL-6000 (Tosa) PDA (PXA255)
verdex               Gumstix Verdex (PXA270)
versatileab          ARM Versatile/AB (ARM926EJ-S)
versatilepb          ARM Versatile/PB (ARM926EJ-S)
vexpress-a15         ARM Versatile Express for Cortex-A15
vexpress-a9          ARM Versatile Express for Cortex-A9
virt                 ARM Virtual Machine
xilinx-zynq-a9       Xilinx Zynq Platform Baseboard for Cortex-A9
z2                   Zipit Z2 (PXA27x)
```



9.

Emulation requires a software bridge. VMs can access hardware directly. Because of this, emulators are faster. VMs are more completed to implement than an emulator is.

10.

Yes. Guest machines can run hypervisors, but they cannot perform full virtualization because they do not have full access to the system’s hardware.