

Homework 1

Advanced Embedded Software Development

Nachiket Kelkar

24th Jan 2019

LAB Policy Agreement

To: nake6459@colorado.edu

Google Forms

Thanks for filling out [ECEE Classroom Lab Policy Agreement](#)
Here's what we got from you:
[EDIT RESPONSE](#)

ECEE Classroom Lab Policy Agreement

You will be emailed a copy of your responses. Please make sure to read and understand everything you agree to. If you violate any of the terms here, your lab access may be revoked. For any questions, email ecehelp@colorado.edu.

Your email address (nake6459@colorado.edu) was recorded when you submitted this form.

Question 7:

Compiled application

```
nachiket@nachiket-VirtualBox:~/AESD/HW1/MELP/Chapter02/library/hello-arm$ ./hello-arm-static
Hello from ARM
add_ints
4 + 5 = 9
multiply_ints
4 * 5 = 20
nachiket@nachiket-VirtualBox:~/AESD/HW1/MELP/Chapter02/library/hello-arm$ ./hello-arm-shared
./hello-arm-shared: error while loading shared libraries: libtest.so: cannot open shared object file: No such file or directory
nachiket@nachiket-VirtualBox:~/AESD/HW1/MELP/Chapter02/library/hello-arm$ LD_LIBRARY_PATH=./shared ./hello-arm-shared
Hello from ARM
add_ints
4 + 5 = 9
multiply_ints
4 * 5 = 20
```

Difference between static and shared file size

```
nachiket@nachiket-VirtualBox:~/AESD/HW1/MELP/Chapter02/library/hello-arm$ ls -l hello-arm-s*
-rwxr-xr-x 1 nachiket nachiket 8416 Jan 24 19:01 hello-arm-shared
-rwxr-xr-x 1 nachiket nachiket 847680 Jan 24 19:01 hello-arm-static
```

Shared library use of executable

```
nachiket@nachiket-VirtualBox:~/AESD/HW1/MELP/Chapter02/library/hello-arm$ readelf -a hello-arm-shared | grep "Shared library"
0x00000000 (NEEDED)      Shared library: [libtest.so]
0x00000000 (NEEDED)      Shared library: [libc.so.6]
nachiket@nachiket-VirtualBox:~/AESD/HW1/MELP/Chapter02/library/hello-arm$ readelf -a hello-arm-shared | grep "program interpreter"
[Requesting program interpreter: /lib64/ld-linux-x86-64.so.2]
nachiket@nachiket-VirtualBox:~/AESD/HW1/MELP/Chapter02/library/hello-arm$
```

Question 8

ARM

Version and configuration

```
nachiket@nachiket-VirtualBox:~/AESD/Projects/crosstool-ng$ ./ct-ng show-arm-cortex_a8-linux-gnueabi
[L..] arm-cortex_a8-linux-gnueabi
Languages      : C,C++
OS             : linux-4.19.1
Binutils       : binutils-2.31.1
Compiler       : gcc-8.2.0
C library      : glibc-2.28
Debug tools    : duma-2.5.15 gdb-8.2 ltrace-0.7.3 strace-4.24
Companion libs : expat-2.2.6 gettext-0.19.8.1 gmp-6.1.2 isl-0.20 libelf-0.8.13 libconv-1.15 mpc-1.1.0 mpfr-4.0.1 ncurses-6.1
Companion tools: autoconf-2.69 automake-1.16.1
```

Sysroot directory

```
nachiket@nachiket-VirtualBox:~/AESD/Projects/crosstool-ng$ arm-cortex_a8-linux-gnueabi-hf-gcc -print-sysroot
/home/nachiket/x-tools/arm-cortex_a8-linux-gnueabi-hf/arm-cortex_a8-linux-gnueabi-hf/sysroot
```

Shared library use and program interpreter

```
nachiket@nachiket-VirtualBox:~/AESD/HW1/ARM/MELP/Chapter02/library/hello-arm$ readelf -a hello-arm-shared | grep "Shared library"
0x00000001 (NEEDED)      Shared library: [libtest.so]
0x00000001 (NEEDED)      Shared library: [libc.so.6]
nachiket@nachiket-VirtualBox:~/AESD/HW1/ARM/MELP/Chapter02/library/hello-arm$ readelf -a hello-arm-shared | grep "program interpreter"
[Requesting program interpreter: /lib/ld-linux-armhf.so.3]
nachiket@nachiket-VirtualBox:~/AESD/HW1/ARM/MELP/Chapter02/library/hello-arm$ file hello-arm-shared
hello-arm-shared: ELF 32-bit LSB executable, ARM, EABI5 version 1 (SYSV), dynamically linked, interpreter /lib/ld-linux-armhf.so.3, for GNU/Linux 4.19.1, with debug_t
info, not stripped
```

Size of executable

```
nachiket@nachiket-VirtualBox:~/AESD/HW1/ARM/MELP/Chapter02/library/hello-arm$ ls -l hello-arm-s*
-rwxr-xr-x 1 nachiket nachiket 12076 Jan 24 20:06 hello-arm-shared
-rwxr-xr-x 1 nachiket nachiket 4145192 Jan 24 20:06 hello-arm-static
```

QEMU Emulator

Version and configuration

```
nachiket@nachiket-VirtualBox:~/AESD/Projects/croostool-ng$ ./ct-ng show-arm-unknown-linux-gnueabi
[...]
```

Languages	: C,C++
OS	: linux-4.19.1
Binutils	: binutils-2.31.1
Compiler	: gcc-8.2.0
C library	: glibc-2.28
Debug tools	: duma-2.5.15 gdb-8.2 ltrace-0.7.3 strace-4.24
Companion libs	: expat-2.2.6 gettext-0.19.8.1 gmp-6.1.2 isl-0.20 libelf-0.8.13 libiconv-1.15 mpc-1.1.0 mpfr-4.0.1 ncurses-6.1
Companion tools	: autoconf-2.69 automake-1.16.1

Sysroot directory

```
nachiket@nachiket-VirtualBox:~/AESD/Projects/croostool-ng$ arm-unknown-linux-gnueabi-gcc -print-sysroot
/home/nachiket/x-tools/arm-unknown-linux-gnueabi/arm-unknown-linux-gnueabi/sysroot
```

Shared library and program interpreter

```
nachiket@nachiket-VirtualBox:~/AESD/HW1/QEMU/MELP/Chapter02/library/hello-arm$ readelf -a hello-arm-shared | grep "Shared library"
0x00000001 (NEEDED)             Shared library: [libtest.so]
0x00000001 (NEEDED)             Shared library: [libc.so.6]
nachiket@nachiket-VirtualBox:~/AESD/HW1/QEMU/MELP/Chapter02/library/hello-arm$ readelf -a hello-arm-shared | grep "program interpreter"
[Requesting program interpreter: /lib/ld-linux.so.3]
nachiket@nachiket-VirtualBox:~/AESD/HW1/QEMU/MELP/Chapter02/library/hello-arm$ file hello-arm-shared
hello-arm-shared: ELF 32-bit LSB executable, ARM, EABI5 version 1 (SYSV), dynamically linked, interpreter /lib/ld-linux.so.3, for GNU/Linux 4.19.1, with debug_info, not stripped
```

Size of executable

```
nachiket@nachiket-VirtualBox:~/AESD/HW1/QEMU/MELP/Chapter02/library/hello-arm$ ls -l hello-arm-s*
-rwxr-xr-x 1 nachiket nachiket 12020 Jan 24 20:19 hello-arm-shared
-rwxr-xr-x 1 nachiket nachiket 4258220 Jan 24 20:19 hello-arm-static
```