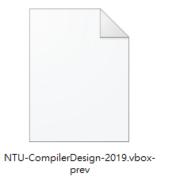
Open prepared VirtualBox image

- Install VirtualBox first
- Decompress NTU-CompilerDesign-2019.rar
 https://drive.google.com/open?id=1fEzdDWRkF686gbF-LXPh7SIwzF4ubCv_







*If the Internet is disable, please reconnect the Internet or reboot the OS.



Click it!

Prepared VM image! (RISC-V toolchain installed)

If internet is disable.

Please reboot or reconnect.

How to run our output.s

Tools

- RISC-V toolchain are all installed at /home/ntu/.local/riscv
- GNU C Compiler
 - riscv64-unknown-linux-gnu-gcc
- GNU objdump
 - riscv64-unknown-linux-gnu-objdump

compiler@compiler-VirtualBox:~/hw5_src\$ ls hello.c main.S others output.s

```
compiler@compiler-VirtualBox:~/hw5_src$ cat hello.c
int MAIN(){
    write("Hello");
    write("\n");
    return 0;
}
```

- Don't modify main.S.
- hello.c is the input file(what we want to compile).
- Run ./parser hello.c. The output.s is the output.

```
ntu@compiler:~/Compiler$ riscv64-unknown-linux-gnu-gcc -static -00 main.S
ntu@compiler:~/Compiler$ qemu-riscv64 a.out
Hello Compiler!
ntu@compiler:~/Compiler$
```

- Linking: riscv64-unknown-linux-gnu-gcc —static —O0 main.S
- a.out is the RV64G executable.

We run a.out through qemu-riscv64

You can also use run.sh

• We also provide a script: run.sh to do all these instructions.

Usage:

Put the run.sh and main.S in the same directory.

./run.sh [your parser] [the C-- file]

The output is a a.out executable.

Ex: ./run.sh ./parser ./patern/hello.c

How to debug?

Using GDB and QEMU

- We can run command: riscv64-unknown-linux-gnu-objdump -d
 a.out > tmp.s to dump assembly to tmp.s
- Run: qemu-riscv64 -g 1234 ./a.out
- create another terminal and type the following command
- riscv64-unknown-linux-gnu-gdb (enter gdb)
- set architecture riscv:rv64
- target remote localhost:1234

Some useful command for gdb

- b *address
- layout asm
- layout regs
- C
- nexti

Can get more information by typing help or google gdb.

```
000
File Edit View Search Terminal Help
ntu@compiler:~/Compiler$ qemu-riscv64 -g 1234 ./a.out
                                                                                      000
                                                            ra,8(sp)
                                                    ld
                1042e:
                            60a2
                                                    addi
               10430:
                            0141
                                                            sp,sp,16
                            f79ff06f
                                                            103aa <register_tm_clones>
               10432:
                                                            103aa <register_tm_clones>
               10436:
                            f75ff06f
                                                    j
            000000000001043a <_start_MAIN>:
               1043a:
                            1141
                                                    addi
                                                            sp,sp,-16
               1043c:
                            e406
                                                    sd
                                                            ra,8(sp)
               1043e:
                                                                                                      ntu@compiler: ~/Compiler
               10440:
               10442:
                            File Edit View Search Terminal Help
               10446:
            d_freeres+0x58> B+>
                                0x1043a addi
                                              sp,sp,-16
                1044a:
                                0x1043c sd
                                               ra,8(sp)
               1044e:
                                0x1043e sd
                                               s0,0(sp)
               10450:
                                0x10440 addi
                                              s0,sp,16
               10452:
                                0x10442 lui
                                               a5,0x58
               10454:
                                0x10446 addi
                                              a0,a5,1936
               10456:
                                0x1044a jal
                                               ra,0x1045a
               10458:
                                0x1044e li
                                               a5,0
                                0x10450 mv
                                               a0,a5
             000000000001045
                                0x10452 ld
                                               ra,8(sp)
                1045a:
                                0x10454 ld
                                               s0,0(sp)
                                0x10456 addi
                                              sp,sp,16
                                0x10458 ret
                            remote Remote target In:
                                                                                               PC: 0x1043a
                                                                                         L??
                            (gdb)
```