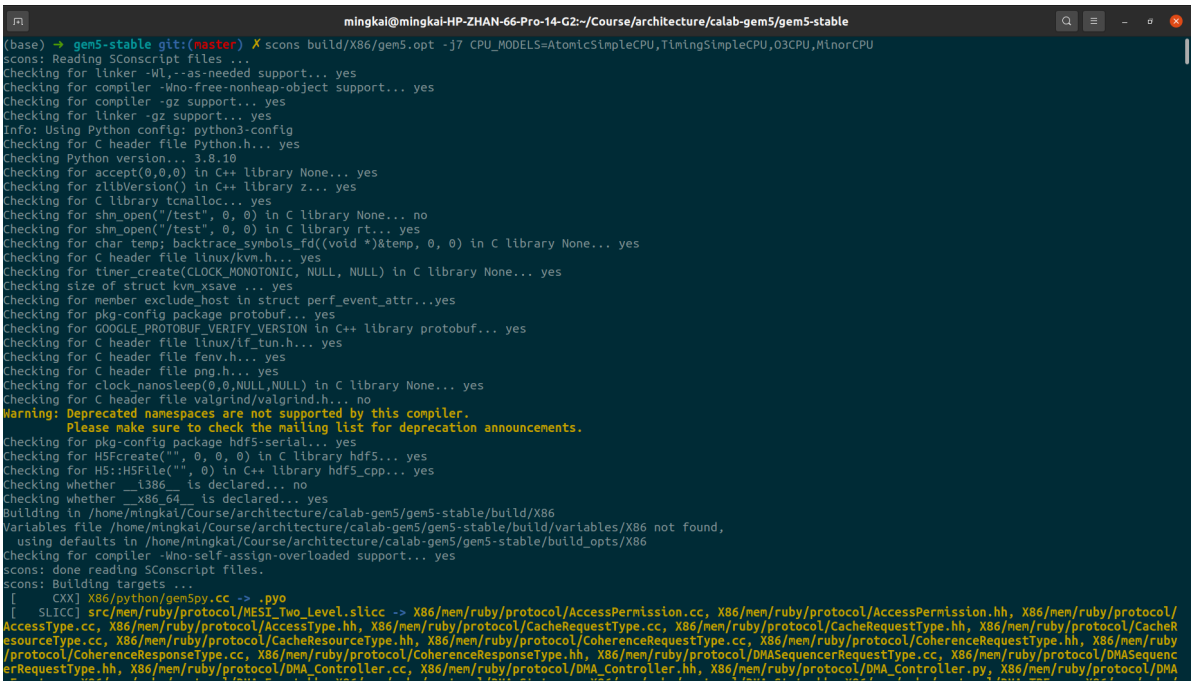
实验1 学习使用gem5模拟器

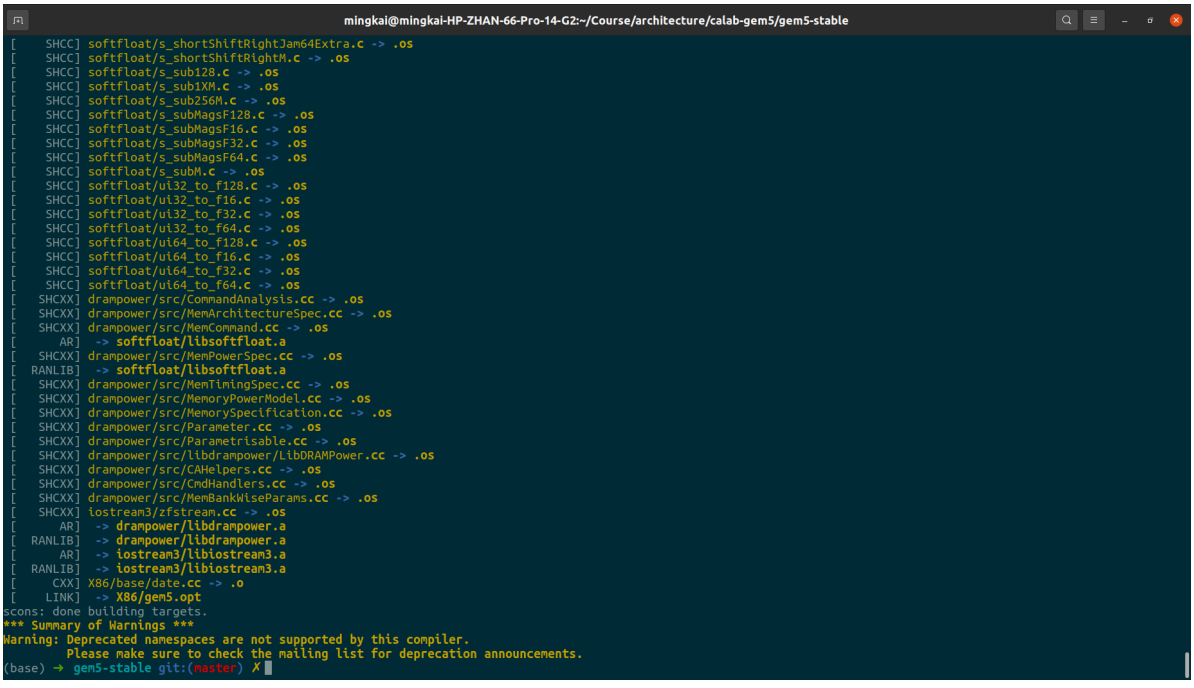
1 编译gem5模拟器

运行下列指令，配置环境后对gem5模拟器进行编译：

```
sudo apt install build-essential git m4 scons zlib1g zlib1g-dev libprotobuf-dev
protobuf-compiler libprotoc-dev libgoogle-perftools-dev python-dev python
sudo apt install libhdf5-dev
sudo apt install libpng-dev
scons build/X86/gem5.opt -j7
CPU_MODELS=AtomicSimpleCPU,TimingSimpleCPU,O3CPU,MinorCPU
```

编译后terminal显示结果如下，编译后得到的可执行文件可以在`build`文件夹下找到：

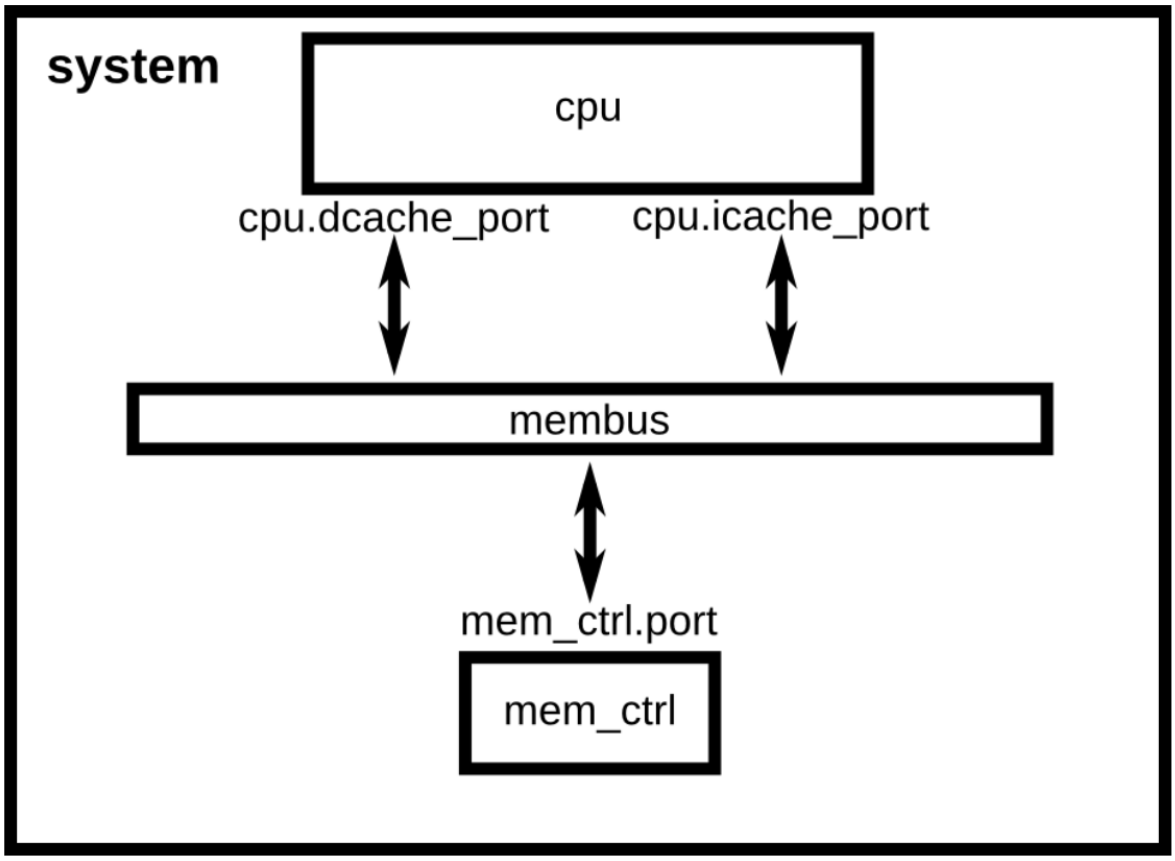




2 运行`simple.py`

```
(base) ➜ gem5-stable git:(master) ✗ build/X86/gem5.opt configs/tutorial/part1/simple.py
gem5 Simulator System.  http://gem5.org
gem5 is copyrighted software; use the --copyright option for details.

gem5 version 21.2.1.0
gem5 compiled Mar 16 2022 21:30:22
gem5 started Mar 17 2022 20:44:55
gem5 executing on mingkai-HP-ZHAN-66-Pro-14-G2, pid 5815
command line: build/X86/gem5.opt configs/tutorial/part1/simple.py

Global frequency set at 1000000000000 ticks per second
warn: No dot file generated. Please install pydot to generate the dot file and pdf.
build/X86/mem/mem_interface.cc:791: warn: DRAM device capacity (8192 Mbytes) does not match the address range assigned (512 Mbytes)
0: system.remote_gdb: listening for remote gdb on port 7000
Beginning simulation!
build/X86/sim/simulate.cc:194: info: Entering event queue @ 0.  Starting simulation...
Hello world!
Exiting @ tick 508536000 because exiting with last active thread context
(base) ➜ gem5-stable git:(master) ✗
```

`simple.py`描述了如下的体系结构：

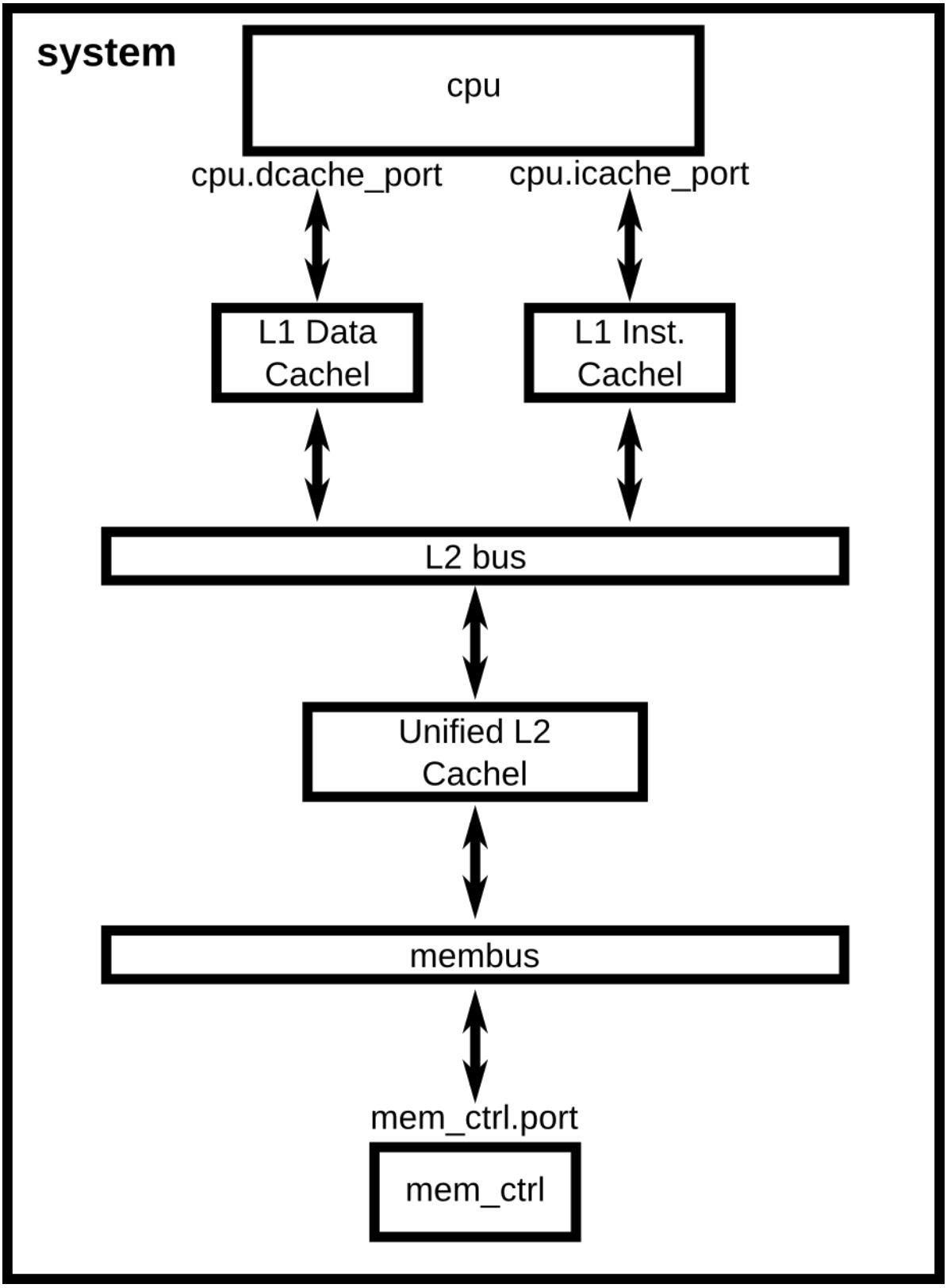


由于所有的class都是系统预设的，所以可以直接将这些预设class实例化。需要注意的是，在port之间的连接时，需要遵循request port到response port的连接准则。具体来说，request port作为`=`的左值，response port作为`=`的右值，如此进行port之间的连接。另外一点需要注意的是，在设置path时（包括binary的path和调用包的path），需要根据当前python程序的实际位置进行相对位置的设置。

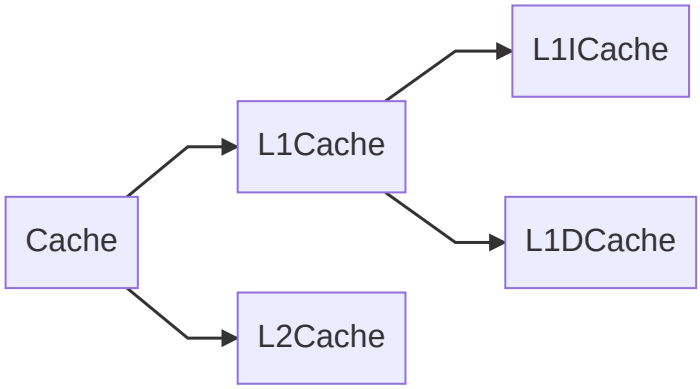
3 运行`two_level.py`

```
(base) ➜ gem5-stable git:(master) ✗ build/X86/gem5.opt configs/tutorial/part1/two_level.py --l2_size='1MB' --l1d_size='128kB'
gem5 Simulator System.  http://gem5.org
gem5 is copyrighted software; use the --copyright option for details.

gem5 version 21.2.1.0
gem5 compiled Mar 16 2022 21:30:22
gem5 started Mar 17 2022 20:47:48
gem5 executing on mingkai-HP-ZHAN-66-Pro-14-G2, pid 6105
command line: build/X86/gem5.opt configs/tutorial/part1/two_level.py --l2_size=1MB --l1d_size=128kB

Global frequency set at 1000000000000 ticks per second
warn: No dot file generated. Please install pydot to generate the dot file and pdf.
build/X86/mem/mem_interface.cc:791: warn: DRAM device capacity (8192 Mbytes) does not match the address range assigned (512 Mbytes)
0: system.remote_gdb: listening for remote gdb on port 7000
Beginning simulation!
build/X86/sim/simulate.cc:194: info: Entering event queue @ 0.  Starting simulation...
Hello world!
Exiting @ tick 58125000 because exiting with last active thread context
(base) ➜ gem5-stable git:(master) ✗
```

`two_level.py`描述了如下的体系结构：



由于L1的Data Cache、Instruction Cache和L2 Cache都是自定义的，这些class需要在`cache.py`中进行定义。它们之间的继承关系如下所示：



在对这些class进行妥善定义后，对各个部件进行实例化。和`simple.py`类似，按照request port到response port的连接方式即可在`two_level.py`中对该体系结构进行描述。需要注意的是，任意两个部件之间需要有bus的参与，它们往往在系统中以预设的class存在。