

Department of Computer Engineering
B.E II Year
CO24009:Computer Architecture
LAB-1

Experiment : GEM5 Simulation And Cache Optimization

- Link of the video lecture
<https://www.youtube.com/watch?v=hMj-GB8BTd4>
- Link of the Document
<http://www.m5sim.org/Download>

```
priyanka@Priyanka-cloud: ~/gem5
priyanka@Priyanka-cloud:~$ git clone https://gem5.googlesource.com/public/gem5
fatal: destination path 'gem5' already exists and is not an empty directory.
priyanka@Priyanka-cloud:~$ cd gem5/
priyanka@Priyanka-cloud:~/gem5$ git pull
remote: Counting objects: 1856, done
remote: Finding sources: 100% (2694/2694)
remote: Total 2694 (delta 1888), reused 2675 (delta 1888)
Receiving objects: 100% (2694/2694), 2.21 MiB | 1.10 MiB/s, done.
Resolving deltas: 100% (1888/1888), completed with 490 local objects.
From https://gem5.googlesource.com/public/gem5
   c97af48..86e0cdf  develop    -> origin/develop
   fa70478..090fa08  stable     -> origin/stable
   * [new tag]       v20.1.0.0  -> v20.1.0.0
Already up-to-date.
priyanka@Priyanka-cloud:~/gem5$ sudo apt install build-essential git m4 scons zlibg zlibg-dev \
> libprotobuf-dev protobuf-compiler libprotoc-dev libgoogle-perftools-dev \
> python-dev python-six python libboost-all-dev pkg-config
[sudo] password for priyanka:
Reading package lists... Done
Building dependency tree
Reading state information... Done
build-essential is already the newest version (12.1ubuntu2).
libprotobuf-dev is already the newest version (2.6.1-1.3).
libprotoc-dev is already the newest version (2.6.1-1.3).
m4 is already the newest version (1.4.17-5).
m4 set to manually installed.
pkg-config is already the newest version (0.29.1-0ubuntu1).
python-six is already the newest version (1.10.0-3).
python-six set to manually installed.
git is already the newest version (1:2.7.4-0ubuntu1.9).
python is already the newest version (2.7.12-1-16.04).
python-dev is already the newest version (2.7.12-1-16.04).
zlibg is already the newest version (1:1.2.8.dfsg-2ubuntu4.3).
zlibg-dev is already the newest version (1:1.2.8.dfsg-2ubuntu4.3).
The following additional packages will be installed:
  icu-devtools libboost-atomic-dev libboost-atomic1.58-dev
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  libboost-chrono1.58.0 libboost-context-dev libboost-context1.58-dev
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  libboost-coroutine1.58.0 libboost-date-time-dev libboost-date-time1.58-dev
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  libboost-filesystem-dev libboost-filesystem1.58-dev libboost-graph-dev
  libboost-graph-parallel-dev libboost-graph-parallel1.58-dev
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  libboost-iostreams-dev libboost-iostreams1.58-dev libboost-locale-dev
  libboost-locale1.58-dev libboost-locale1.58.0 libboost-log-dev
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  libboost-mpi1.58.0 libboost-program-options-dev
  libboost-program-options1.58-dev libboost-program-options1.58.0
  libboost-python-dev libboost-python1.58-dev libboost-python1.58.0
  libboost-random-dev libboost-random1.58-dev libboost-random1.58.0
  libboost-regex-dev libboost-regex1.58-dev libboost-serialization-dev
  libboost-serialization1.58-dev libboost-serialization1.58.0
  libboost-signals-dev libboost-signals1.58-dev libboost-signals1.58.0
  libboost-system-dev libboost-system1.58-dev libboost-test-dev
  libboost-test1.58-dev libboost-test1.58.0 libboost-thread-dev
  libboost-thread1.58-dev libboost-timer-dev libboost-timer1.58-dev
  libboost-timer1.58.0 libboost-tools-dev libboost-wave-dev
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[sudo] password for priyanka:
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Reading package lists... Done
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libboost-dev libboost-exception-dev libboost-exception1.58-dev
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libboost-filesystem-dev libboost-filesystem1.58-dev libboost-graph-dev
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libboost-mpi1.58.0 libboost-program-options-dev
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priyanka@Priyanka-cloud: ~/gem5

```
priyanka@Priyanka-cloud:~/gem5$ scons build/X86/gen5.opt -j 4
scons: Reading Sconscript files ...
```

You're missing the gem5 style or commit message hook. These hooks help to ensure that your code follows gem5's style rules on git commit. This script will now install the hook in your .git/hooks/ directory. Press enter to continue, or ctrl-c to abort:

Warning: Your compiler doesn't support incremental linking and lto at the same time, so lto is being disabled. To force lto on anyway, use the -force-lto option. That will disable partial linking.

Info: Using Python config: python2.7-config

Checking for C header file Python.h... yes

Checking for C library python2.7... yes

Checking for C library pthread... yes

Checking for C library dl... yes

Checking for C library util... yes

Checking for C library m... yes

Checking for accept(0,0,0) in C++ library None... yes

Checking for zlibVersion() in C++ library z... yes

Checking for GOOGLE_PROTOBUF_VERIFY_VERSION in C++ library protobuf... yes

Checking for C header file valgrind/valgrind.h... no

Checking for clock_nanosleep(0,0,NULL,NULL) in C library None... yes

Checking for timer_create(CLOCK_MONOTONIC, NULL, NULL) in C library None... no

Checking for timer_create(CLOCK_MONOTONIC, NULL, NULL) in C library rt... yes

Checking for C library tcmalloc... yes

Checking for char temp; backtrace_symbols_fd((void*)&temp, 0, 0) in C library None... yes

Checking for C header file fenv.h... yes

Checking for C header file png.h... no

Warning: Header file <png.h> not found.

This host has no libpng library.

Disabling support for PNG framebuffers.

Checking for C header file linux/kvm.h... yes

Checking for C header file linux/lf_tun.h... yes

Checking size of struct kvm_xsave ... yes

Checking for member exclude_host in struct perf_event_attr...yes

Package hdf5-serial was not found in the pkg-config search path.

Perhaps you should add the directory containing 'hdf5-serial.pc'

to the PKG_CONFIG_PATH environment variable

No package 'hdf5-serial' found

Checking for hdf5-serial using pkg-config... no

Package hdf5 was not found in the pkg-config search path.

Perhaps you should add the directory containing 'hdf5.pc'

to the PKG_CONFIG_PATH environment variable

No package 'hdf5' found

Checking for hdf5 using pkg-config... no

Checking for H5Fcreate("", 0, 0, 0) in C library hdf5... no

Warning: Couldn't find any HDF5 C++ libraries. Disabling

HDF5 support.

Checking whether __i386__ is declared... no

Checking whether __x86_64__ is declared... yes

Building in /home/priyanka/gem5/build/X86

Variables file /home/priyanka/gem5/build/variables/X86 not found,

using defaults in /home/priyanka/gem5/build.opts/X86

warn: CheckedInt already exists in allParams. This may be caused by the Python 2.7 compatibility layer.

warn: Enum already exists in allParams. This may be caused by the Python 2.7 compatibility layer.

warn: ScopedEnum already exists in allParams. This may be caused by the Python 2.7 compatibility layer.

scons: done reading Sconscript files.

scons: Building targets ...

[CXX] X86/sim/main.cc -> .o

[TRACING] -> X86/debug/CommMonitor.hh

[SO PARAM] CommMonitor -> X86/params/CommMonitor.hh

[SO PARAM] SimObject -> X86/params/SimObject.hh

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priyanka@Priyanka-cloud: ~/gem5
Switching
-S, --simpoint          Use workload simpoints as an instruction offset for
                        --checkpoint-restore or --take-checkpoint.
--at-instruction         Treat value of --checkpoint-restore or --take-
                        checkpoint as a          number of
                        instructions.
--spec-input=SPEC_INPUT  Input set size for SPEC CPU2000 benchmarks.
--arm-iset=ARM_ISET      ARM instruction set.
-c CMD, --cmd=CMD        The binary to run in syscall emulation mode.
-o OPTIONS, --options=OPTIONS
                        The options to pass to the binary, use " "
                        around the entire string
-e ENV, --env=ENV        Initialize workload environment from text file.
-i INPUT, --input=INPUT  Read stdin from a file.
                        Redirect stdout to a file.
--output=OUTPUT          Redirect stderr to a file.
--errout=ERRROUT        The chroot option allows a user to alter the search
                        path for processes running in SE mode. Normally, the
                        search path would begin at the root of the filesystem
                        (i.e. /). With chroot, a user can force the process to
                        begin looking at some other location (i.e.
                        /home/user/rand.dir). The intended use is to trick
                        sophisticated software which queries the __HOST__
                        filesystem for information or functionality. Instead
                        of finding files on the __HOST__ filesystem, the
                        process will find the user's replacement files.
--interp-dir=INTERP_DIR The interp-dir option is used for setting the
                        interpreter's path. This will allow to load the guest
                        dynamic linker/loader itself from the elf binary. The
                        option points to the parent folder of the guest /lib
                        in the host fs
--redirects=REDIRECTS    A collection of one or more redirect paths to be used
                        in syscall emulation. Usage: gem5.opt [...] --redirects
                        /dir1=/path/to/host/dir1 --redirects
                        /dir2=/path/to/host/dir2
--wait-gdb=WAIT_GDB     Wait for remote GDB to connect.
priyanka@Priyanka-cloud:~/gem5$ ./build/X86/gem5.opt configs/example/se.py -c tests/test-progs/hello/bin/x86/linux/hello
warn: checkedInt already exists in allParams. This may be caused by the Python 2.7 compatibility layer.
warn: Enum already exists in allParams. This may be caused by the Python 2.7 compatibility layer.
warn: ScopedEnum already exists in allParams. This may be caused by the Python 2.7 compatibility layer.
gem5 Simulator System. http://gem5.org
gem5 is copyrighted software; use the --copyright option for details.
gem5 version 20.0.0.3
gem5 compiled Oct 12 2020 23:29:51
gem5 started Oct 13 2020 00:04:19
gem5 executing on Priyanka-cloud, pid 17337
command line: ./build/X86/gem5.opt configs/example/se.py -c tests/test-progs/hello/bin/x86/linux/hello
Global frequency set at 1000000000000 ticks per second
warn: No dot file generated. Please install pydot to generate the dot file and pdf.
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
**** REAL SIMULATION ****
info: Entering event queue @ 0. Starting simulation...
Hello world!
Exiting @ tick 5943000 because exiting with last active thread context
priyanka@Priyanka-cloud:~/gem5$
```

Cache Optimization

- Link of the video
<https://www.youtube.com/watch?v=-riAWSuNwvU>