Introduction to SimpleScalar

CMPEN 431

Sim-Outorder

- Most complicated and detailed simulator
- Supports out-of-order issue and execution
- Provides reports
  - branch prediction
  - cache
  - external memory
  - various configuration

Specifying Sim-outorder

- **Running a program**

  sim-outorder [sim opts] program [program opts]

- **e.g.**

  $SIMPLESIM/simplesim-3.0/sim-outorder
  -config cfg_file bzip2_base.i386-m32-gcc42-nn
  dryer.jpg

Benchmark

- SPEC 2006
  - Six benchmarks (4 integer, 2 floating point)

    bzip2(INT)

    equake(FP)

    hmmer(INT)

    mcf(INT)

    milc(FP)

    sjeng(INT)

Installation of simplescalar

- Simplescalar 3.0 is already installed in CSE lab W204
- Path setup

  1) log on into one of the linux machines

  2) Go to your home directory: cd

  3) > vim .cshrc (or gedit .cshrc)

     setenv SIMPLESIM /home/software/simplesim

     > source .cshrc

  4) to verify, run

     > echo $SIMPLESIM

  the return should be /home/software/simplesim

Installation of simplescalar

- create a local directory

  >mkdir simplescalar

  >cd simplescalar

  >cp –r $SIMPLESIM/ss-benchmark .

  >cd ss-benchmark

- Download tmp.cfg from CANVAS
  - Save it in /ss-benchmark

Running Benchmarks

- Run benchmark (bzip2)

  >cd bzip2

  >$SIMPLESIM/simplesim-3.0/sim-outorder –config ../**tmp.cfg** bzip2_base.i386-m32-gcc42-nn dryer.jpg

Check results

- Check simulation results
  - vim sim1.out (or gedit sim1.out)

```
sim: ** fast forwarding 300000 insts **
sim: ** starting performance simulation **

sim: ** simulation statistics **
sim_num_insn                2000000 # total number of instructions committed
sim_num_refs                 711143 # total number of loads and stores committed
sim_num_loads                306852 # total number of loads committed
sim_num_stores          404291.0000 # total number of stores committed
sim_num_branches             212047 # total number of branches committed
sim_elapsed_time                  4 # total simulation time in seconds
sim_inst_rate           500000.0000 # simulation speed (in insts/sec)
sim_total_insn              2000000 # total number of instructions executed
sim_total_refs               711143 # total number of loads and stores executed
sim_total_loads              306852 # total number of loads executed
sim_total_stores        404291.0000 # total number of stores executed
sim_total_branches           212047 # total number of branches executed
sim_cycle                   7787523 # total simulation time in cycles
sim_IPC                      0.2568 # instructions per cycle
sim_CPI                      3.8938 # cycles per instruction
sim_exec_BW                  0.2568 # total instructions (mis-spec + committed) per cycle
sim_IPB                      9.4319 # instruction per branch
```

Modify config

- Modify a parameter in the config file

  > cd ..

  > vim tmp.cfg (or gedit tmp.cfg)

  -Increase L2 Data Cache Latency from 4 to 10

  -cache:dl2lat 10

  - Change output file name (-redir:sim sim2.out)

  - Save and close tmp.cfg

Re-run Benchmark

- Run benchmark (bzip2)

```
>cd bzip2
>$SIMPLESIM/simplesim-3.0/sim-outorder
  –config ../tmp.cfg
   bzip2_base.i386-m32-gcc42-nn dryer.jpg
```

Check result

- Check simulation results
  - vim sim2.out (or gedit sim2.out)

```
sim: ** fast forwarding 300000 insts **
sim: ** starting performance simulation **

sim: ** simulation statistics **
sim_num_insn                2000000 # total number of instructions committed
sim_num_refs                 711143 # total number of loads and stores committed
sim_num_loads                306852 # total number of loads committed
sim_num_stores          404291.0000 # total number of stores committed
sim_num_branches             212047 # total number of branches committed
sim_elapsed_time                  5 # total simulation time in seconds
sim_inst_rate           400000.0000 # simulation speed (in insts/sec)
sim_total_insn              2000000 # total number of instructions executed
sim_total_refs               711143 # total number of loads and stores executed
sim_total_loads              306852 # total number of loads executed
sim_total_stores        404291.0000 # total number of stores executed
sim_total_branches           212047 # total number of branches executed
sim_cycle                   8683285 # total simulation time in cycles
sim_IPC                      0.2303 # instructions per cycle
sim_CPI                      4.3416 # cycles per instruction
sim_exec_BW                  0.2303 # total instructions (mis-spec + committed) per cycle
sim_IPB                      9.4319 # instruction per branch
```

Log into Lab W204 using SSH

- Visit 2FA.psu.edu and configure a device to receive your second factor codes, or alternatively enable “push” verification.

- Visit https://vpn.cse.psu.edu to install VPN client. This step requires 2 factor authentication. – This website requires a CSE login and password, you will need to be on the CSE network – Machine names are in the following format: XYZabcd@e5-cse-204-XX.cse.psu.edu, where XX is a number for the machine ID, XYZabcd is your PSU user name. (e.g., you can use “hzj5142@e5-cse-204-01.cse.psu.edu” to ssh to a machine in lab W204)