



Introduction to Lab 1

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What is lab 1?

... or why are they dragging us to the computer lab at 8am?

The purpose of this assignment is to give insights into:

- 1 how a cache works
- 2 how program execution is affected by cache parameters
- 3 how to tune an application for a specific cache configuration

What is Uppmax?

Uppsala Multidisciplinary Center for Advanced Computational Science (UPPMAX) is Uppsala University's resource of high-performance computers and know-how of high-performance computing (HPC).¹

¹<http://www.uppmax.uu.se/>

The Os Cluster Specifications

- Runs Scientific Linux (RedHat Enterprise Linux customized for scientific applications)
- 10 nodes with:
 - Dual Opteron 2220SE nodes @ 2.8GHz (dual-core)
 - 8 GB ram
 - Gigabit Ethernet

The Os Cluster

Logging in transferring files

- Use SSH to connect to *os.uppmax.uu.se*
 - `ssh -Y username@os.uppmax.uu.se`
 - `-Y` – Enables X-forwarding
- Transfer files using the *scp* command
 - `scp ./foo username@os.uppmax.uu.se:bar/`
 - Transfers the file `./foo` to the directory `bar` in your home directory on Uppmax

The Os Cluster

Submitting interactive jobs

You **should not** run Simics on the login node. Long running jobs on the login node will be **terminated**.

- Use `qsh -P g2010003 -l mem=2G -l h_rt=04:00:00`
 - Starts an *xterm*
 - `-P g2010003`—Request the course project for CPU time accounting
 - `-l mem=2G`—Request 2 G memory
 - `-l h_rt=04:00:00`—Expected runtime for the job
- Jobs running longer than the runtime time will be **terminated**
- Jobs using more memory then requested will be **terminated**

What is Simics?

You already know this, so let's get down to business!

Target and Host

- The *target* is the simulated system
- The *host* is the machine running Simics
- The prompts:
 - `target#` – the target system's prompt
 - `host$` – the host system's prompt
 - `simics>` – Simic's command prompt

Simics commands

- `simics> help`
 - Does exactly what you would expect...
- `simics> run`
 - Starts or continues the simulation
 - **Ctrl-C** or `simics> stop` breaks the execution if Simics is running
- `simics> run 1000`
 - Runs another 1000 instructions and stops
- `simics> quit`
 - Exits Simics

Hostfs

- Module to mount the *host* machine's file system in the *target* machine.
- `target# mount /host`
 - mounts the host's file system on `/host`

Simics snapshots

... or how to travel in time.

- Allows you to store the complete state of a machine
- You can restart Simics with the data in the snapshot
- Convenient way to "fast forward" through the boring boot processes

Simics snapshots

Creating them

- `simics> write-configuration`
 - Stores a snapshot of a machine.
 - E.g.: `simics> write-configuration ./my_snapshot`

Simics snapshots

Loading them

- `simics> read-configuration`
 - Loads a snapshot.
 - E.g: `simics> read-configuration ./my_snapshot`
- `host$./simics -c ./my_snapshot`
 - Starts Simics using a snapshot.

Magic instructions

- Allows the target machine to communicate with Simics
- Uses no-ops in the target architecture
- Simics modules can hook into a *hap* (callback) to handle magic instructions

Magic instructions

Magic breakpoints

- A special case is the *magic breakpoint*
- Causes Simics to stop the simulation
- `simics> enable-magic-breakpoint`
 - Enables magic breakpoints.
- `simics> disable-magic-breakpoint`
 - Disables magic breakpoints.

Magic instructions

Using them in C code

```
#include <simics/magic-instruction.h>

static void
foo ()
{
    MAGIC_BREAKPOINT;
}
```

- ... but you have to make sure that Simic's include directory is included in the compiler's include path!

```

ansan501@os1:~/dark2_lab1
File Edit View Terminal Tabs Help
[ansan501@os1 ~]$ cd dark2_lab1/
[ansan501@os1 dark2_lab1]$ ./simics -c booted
workspace '/bubo/home/h24/ansan501/dark2_lab1' is not up-to-date.

Simics 4.0 (build 2548 amd64-linux) Copyright 1998-2009 Virtutech AB

Use of this software is subject to appropriate license.
Type 'copyright' for details on copyright and 'help' for on-line documentation.

[con0 info] PC keyboard detected
simics>
    
```



```

Simics Console: con0 - Mouse Input Disabled
P486px Core release 5 (hardaux)
Kernel 2.6.15-1.2854.PCS on an x86_64

ossmo login: root
Password:
Last login: Wed Sep 16 16:08:50 on tty1
[root@ossmo ~]#
    
```

- Groups:
 - Prep. Room 1549, now-12:00
 - A 2010-09-15, Room 1549, 08:15-12:00
 - B 2010-09-16, Room 1549, 08:15-12:00
 - C 2010-09-17, Room 1549, 08:15-12:00
- Deadline: See course homepage

- You will:
 - Simulate a 64-bit x86 machine
 - Implement a cache simulator extension to Simics
 - Optimize a C implementation of matrix-matrix multiplication
- Complete lab manual on the course homepage²

²<http://www.it.uu.se/edu/course/homepage/avdark/ht10>

Summary

And remember...

*Thou shalt not follow the NULL pointer, for chaos and
madness await thee at its end.³*

³<http://www.lysator.liu.se/c/ten-commandments.html>