Introduction to Lab 1

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Introduction

Uppmax

Using Simics

Summary

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]

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

[^1]: [http://www.uppmax.uu.se/](http://www.uppmax.uu.se/)
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

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 than 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> 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

Using them in C code

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

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

- 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

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

The host/Simics terminal

Simics and Target windows

The target window

Important dates

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

Summary

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

²http://www.it.uu.se/edu/course/homepage/avdark/ht10
Thou shalt not follow the NULL pointer, for chaos and madness await thee at its end.\(^3\)