DARK2: Simics & Lab 1

Frédéric Haziza

Department of Information Technology
Uppsala University, Sweden
daz@it.uu.se

November 10th
1 Introduction

2 Simics
   - Virtutech AB
   - Simics is ...
   - Application Areas
   - Supported Architectures and OSes

3 Laboration
   - A simulation with Simics...
   - About the Lab ...
   - The End...
1 Introduction

2 Simics
   - Virtutech AB
   - Simics is ...
   - Application Areas
   - Supported Architectures and OSes

3 Laboration
   - A simulation with Simics...
   - About the Lab ...
   - The End...
Simulation

- Simulation vs Emulation
- Advantages
  - Understanding real systems
  - Debugging
  - Fault injection
  - Prototyping Hardware before expensive implementations
  - Less dangerous
- Possible problems
  - Can I trust the results?
  - How do I verify the results?
  - Realistic workloads?
Speed vs Accuracy

- Gate/RTL model (>1,000,000x)
- "Cycle-accurate" architecture simulator (>10,000x)
- Emulator (~5x)
- Virtual PC, VMware, Crusoe, etc.

Spice, etc
Outline

1 Introduction

2 Simics
   - Virtutech AB
   - Simics is ...
   - Application Areas
   - Supported Architectures and OSes

3 Laboration
   - A simulation with Simics...
   - About the Lab ...
   - The End...
Small swedish company (70 people)
Offices in Stockholm\textsuperscript{1} and USA
Simics is the only full system simulator which
- supports multiple targets
- is capable of booting unmodified operating systems
Interesting reading: www.virtutech.com

\textsuperscript{1}Norrtullsgatan 15, SE-113 27 Stockholm, Sweden
Simics is...²

- simulator
  (designed from the ground up to gather information on execution)
- efficient
- instrumented
- system level
  models the target computer at the level that an OS acts
  - binary interfaces, buses, disks, video memory, etc...
  - can run arbitrary workloads
  - can boot unmodified OS
- instruction set simulator
  models the target system at the level of individual instructions
  executing them one at a time

²From the user guide documentation cf http://www.simics.net
Application Areas

- Software Development
- System Architecture
- Software Testing
- Field Operations
- Hardware Verification
- System Security
Supported architectures

- x86
- AMD-64
- Itanium
- SUN Sunfire & Serengeti (USII & USIII)
- PowerPC
- Alpha
- ARM, MIPS and lots of devices
Supported unmodified OS

- Windows (XP, NT, 98, 95, ...)
- Solaris 9 (and more)
- Linux
- Tru64
- VxWorks
Example

- Linux on Itanium
- VxWorks on PowerPC
- Solaris on Sun SunFire
- Windows NT on x86
- Windows XP/64 on AMD Hammer
- Linux on x86
- All running on a Linux host
Outline

1. Introduction

2. Simics
   - Virtutech AB
   - Simics is ...
   - Application Areas
   - Supported Architectures and OSes

3. Laboration
   - A simulation with Simics...
   - About the Lab ...
   - The End...
Target and Host

- The target is the simulated system
- The host is the machine which runs Simics
- The prompts:
  - `target#` (the target’s prompt: root on the target system)
  - `host$` (the host’s prompt: user on the host system)
  - `simics>` (the simics prompt)
Simics commands

- **simics** > c
  - Simics continues its simulation
  - **Ctrl-C** stops it (when Simics is running)
- **simics** > c 1000
  - Simics runs another 1000 machine instructions and stops
- **simics** > help
  - Huh, guess....
- **simics** > help dark2-cache
  - Lists the commands created for Lab1
Simics commands (cont’d)

- `simics > q`
  - quits
- `simics > load-module`
  - Loads an extra module onto the Simics platform
- `simics > list-modules`
  - prints a list of all available modules
  - and their current status, loaded or not.
Hostfs

- Virtutech module to mount the host file system into the simulated OS.
- `target# mount /host`
  - mounts the host file system into `/host`
  - the hostfs module must be loaded
The different screens

Time for a little demo...

...with pictures
Simics and Target windows

```
xterm@typhoeus.it.uu.se
[
  /dark2-lab/simics-2.0.23_ht06/src/extensions|]$ rm -rf dark2-cache/
  /dark2-lab/simics-2.0.23_ht06/src/extensions|]$ ls

total 2
lrwxrwxrwx    1 daz   it      55 Nov 6 09:31 common -> /it/kurs/dark2/simics-2.0.23_ht06/src/extensions
dark2-cache/
dark2-cache/Makefile
dark2-cache/commands.py
dark2-cache/dark2-cache.c
[
  /dark2-lab/simics-2.0.23_ht06/src/extensions|]$ cd `~/dark2-lab/simics-2.0.23_ht06/v9-sol8-64/lib`
  /dark2-lab/simics-2.0.23_ht06/src/extensions|]$ tar xvfz /it/kurs/dark2/ht06/lab1/dark2-cache.tar.gz
dark2-cache/
dark2-cache/Makefile
dark2-cache/commands.py
[
  /dark2-lab/simics-2.0.23_ht06/src/extensions|]$ cd `~/dark2-lab/simics-2.0.23_ht06/v9-sol8-64/lib`
  /dark2-lab/simics-2.0.23_ht06/src/extensions|]$ make dark2-cache

Generating new module list

== Building module "dark2-cache" ==

Creating dependencies: module_id.c
Creating dependencies: dark2-cache.c
Compiling dark2-cache.c
Compiling module_id.c
Linking dark2-cache.so

Creating module commands for dark2_cache
[
  /dark2-lab/simics-2.0.23_ht06/v9-sol8-64/lib|]$ cd `~/dark2-lab/simics-2.0.23_ht06/home/sarek`
[
  /dark2-lab/simics-2.0.23_ht06/home/sarek|]$ /simics -x dark2-cache-new,simics

Checking out a license... done: evaluation license.
Looking for additional Simics modules in /home/daz/dark2-lab/simics-2.0.23_ht06/v9-sol8-64/lib

> Virtutech
> Simics

Copyright 1998-2004 by Virtutech. All Rights Reserved
Version: simics-2.0.23
Compiled: Fri Oct 15 02:06:30 MEST 2004

www.simics.com  "Virtutech" and "Simics" are trademarks of Virtutech AB

Type 'copyright' for details on copyright.
Type 'license' for details on warranty, copying, etc.
Type 'readme' for further information about this version.
Type 'help help' for info on the on-line documentation.

simics> c
```
Simics and Target windows

```
login: root
password: 

Home Directory: /home/sa
Shell: /bin/bash
```

```
$ mount /host
$ ls -l /host/it/kurs/dark2/ht06/lab1
$ bash-2.05# mount /host
$ bash-2.05# ls /host/it/kurs/dark2/ht06/lab1
$ bash-2.05# ls -l /host/it/kurs/dark2/ht06/lab1
```

```
total 56
-rw-r--r--  1 1018  8031  5186 Nov 6 2006 dark2-cache.tar.gz
-rw-r--r--  2 1018  8031   512 Oct 31 2006 multiply
-rw-r--r--  1 1018  8031  21212 Oct 31 2006 RADIX
bash-2.05# 
```
Simics and Target windows

```
xterm@typhoeus.it.uu.se
Virtutech  |  Version: simics-2.0.23
Simics     |  Compiled: Fri Oct 15 02:06:30 MEST 2004

"Virtutech" and "Simics" are trademarks of Virtutech AB

Type 'copyright' for details on copyright.
Type 'license' for details on warranty, copying, etc.
Type 'readme' for further information about this version.
Type 'help help' for info on the on-line documentation.

simics> c
%[cpu0] v:0x00000000010426f0 p:0x0000000002c426f0 ldw [%13 + 348], %g2

simics> do0.
dc0,dbg-disable  dc0,disable  dc0,enable  dc0,info  dc0,reset-statistics
dc0,stats

dc0,dbg-enable  dc0,do-access  dc0,flush  dc0,print-internals  dc0,resize

simics> do0.info
Cache Info
size: 512, assoc: 1, line-size: 64

simics> help dark2-cache-commands
dark2-cache-commands

<dark2-cache>,dbg-disable  — disable dbg printing
<dark2-cache>,dbg-enable   — enable dbg printing
<dark2-cache>,disable      — disable the cache
<dark2-cache>,do-access    — do a read/write access.
<dark2-cache>,enable       — enable the cache
<dark2-cache>,flush        — flush the cache
<dark2-cache>,info         — print the cache information
<dark2-cache>,print-internals — print the data array
<dark2-cache>,reset-statistics — reset statistics
<dark2-cache>,resize      — resize the cache
<dark2-cache>,statistics — print statistics

Type help command-name for further documentation.
simics>
```
Some dates...

- **Deadline**: November 15\textsuperscript{th} 12:01
- **Groups**:
  - A: November 13\textsuperscript{th}, Room 1515, 15:15-19:00
  - B: November 15\textsuperscript{th}, Room 1515, 08:15-12:00
Some things you’ll do...

- Well-explained: \([HOMEPAGE_{DARK2}]/assignments/lab1\)
- Read it carefully. All instructions and helpers are there.
- **DO NOT START READING AT THE LAB SESSION.** (Don’t loose time!)
- You will be:
  - Creating a workspace (a directory to work, installing simics...)
  - Installing an extension for the cache model
  - Simulating a *Sarek* machine
  - Executing host programs on the simulated machine
  - Modifying the cache model (and recompiling it) to do:
    - Cache simulation (Understand & modify it)
    - Miss ratio measurements (Some tests)
    - Cache performance improvements (Adjust it)
La Fin ...

Questions ? Frågor ?
La Fin ...

A vous de jouer...³

³Your turn to play...