DARK2: Simics & Lab 1

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November 10\textsuperscript{th}
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...
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2. Simics
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Simulation

- Simulation vs Emulation
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- Advantages
  - Understanding real systems
  - Debugging
  - Fault injection
  - Prototyping Hardware before expensive implementations
  - Less dangerous
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- 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)
- Simics™
- Emulator (~5x)
- Virtual PC, VMware, Crusoe, etc.
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Virtutech AB

- Small swedish company (70 people)
- Offices in Stockholm\(^1\) and USA

\(^1\)Norrtullsgatan 15, SE-113 27 Stockholm, Sweden
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Simics is the only full system simulator which
- supports multiple targets
- is capable of booting unmodified operating systems

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- Simics is the only full system simulator which
  - supports multiple targets
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- Interesting reading: www.virtutech.com

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Simics is...

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

Frederic Haziza
DARK2: Simics & Laboration
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

²From the user guide documentation cf http://www.simics.net
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- 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
Simics is...

Example

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

- The target is the simulated system
- The host is the machine which runs Simics
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.
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...
The different screens

Time for a little demo...

...with pictures
Simics and Target windows

```
xterm@typhoeus.it.wu.se
[/dark2-lab1/simics-2.0.23_ht06/src/extensions]
$ rm -rf dark2-cache/
[/dark2-lab1/simics-2.0.23_ht06/src/extensions]
$ ll

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Simics and Target windows
Simics and Target windows

```
root@sarek:~# mount /host
bash-2.05# 1s /host/it/kurs/dark2/ht06
lab1 lab2
bash-2.05# 1s /host/it/kurs/dark2/ht06/lab1
bash-2.05# 1s -l /host/it/kurs/dark2/ht06/lab1
bash-2.05#
```

```
-rw-r--r--  1 sarek  8031  5186  Nov 6  2006 dark2-cache.tar.gz
-rw-r--r--  1 sarek  8031   512  Oct 31  2006 multiply
-rw-r--r--  1 sarek  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
[Cpu0:1 v=0x00000000010426f0 p=0x00000000002c426f0 lduw %13 + 348], %g2
simics> do0,
dc0,dbg-disable  dc0,disable  dc0,enable  dc0,info  dc0,reset-statistics
dc0,statistics
dc0 dbg-enable  dc0,do-access  dc0,flush  dc0,print-internals  dc0,resize
simics> dc0.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 15th 12:01
Some dates...

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

- Well-explained: [HOMEPAGE]DARK2]/assignments/lab1
Some things you’ll do...

- Well-explained: [HOMEPAGE_DARK2]/assignments/lab1
- Read it carefully. All instructions and helpers are there.
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- Well-explained: \[\text{HOMEPAGE}_{\text{DARK2}}]/assignments/lab1
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- DO NOT START READING AT THE LAB SESSION. (Don’t lose time!)
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- 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
Some things you’ll do...

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  - 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)
Questions ? Frågor ?

3 Your turn to play...
Questions ? Frågor ?

A vous de jouer...³

³Your turn to play...