GR740 User Day: Simics

Deterministic Simulation Platform for Virtual GR740

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WNDRVR

WNDRVR

Agenda

1
Introduction

2
Simulation with Determinism

3
Simics Demonstration

WNDRVR

Wind River is well established in aerospace and defence applications

Industry Leader

40% market share in embedded software

Deployed in 2,000,000,000+ devices

Aerospace, defense, industrial, automotive, telecom, medical

1,200 employees

Aerospace & Defense

Over 600 aerospace & Defense customers worldwide

550+ safety certification projects

Across air, ground, maritime, space, and cyber domains

Acquisition of Star Lab

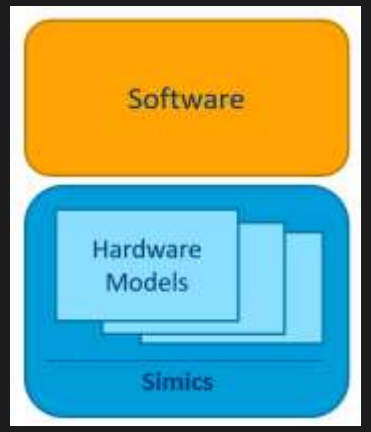
Videos: https://www.youtube.com/watch?v=u6MsSkd280I&t=6s

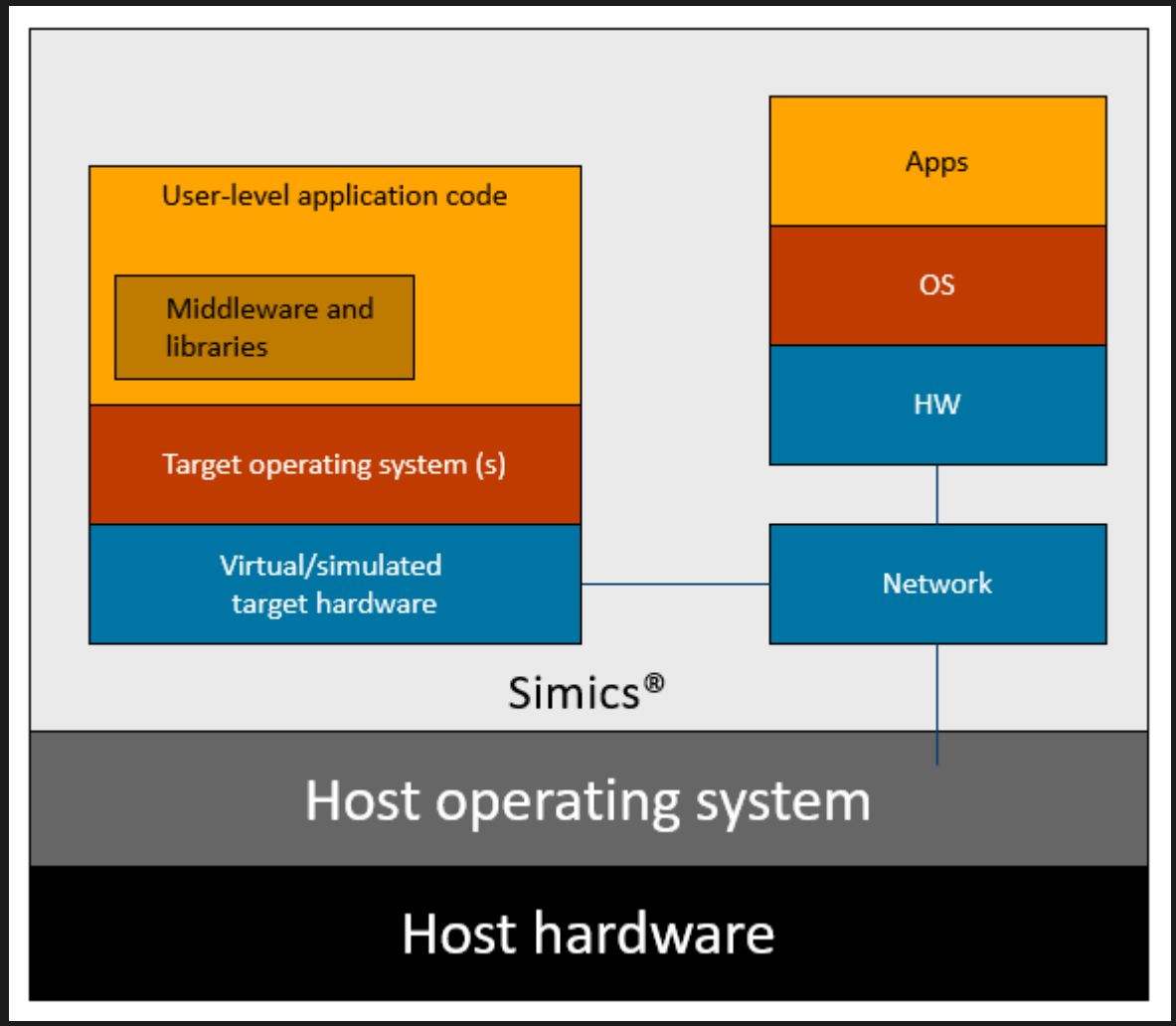
https://www.youtube.com/watch?v=0PWpqmYW-Og

WNDRVR

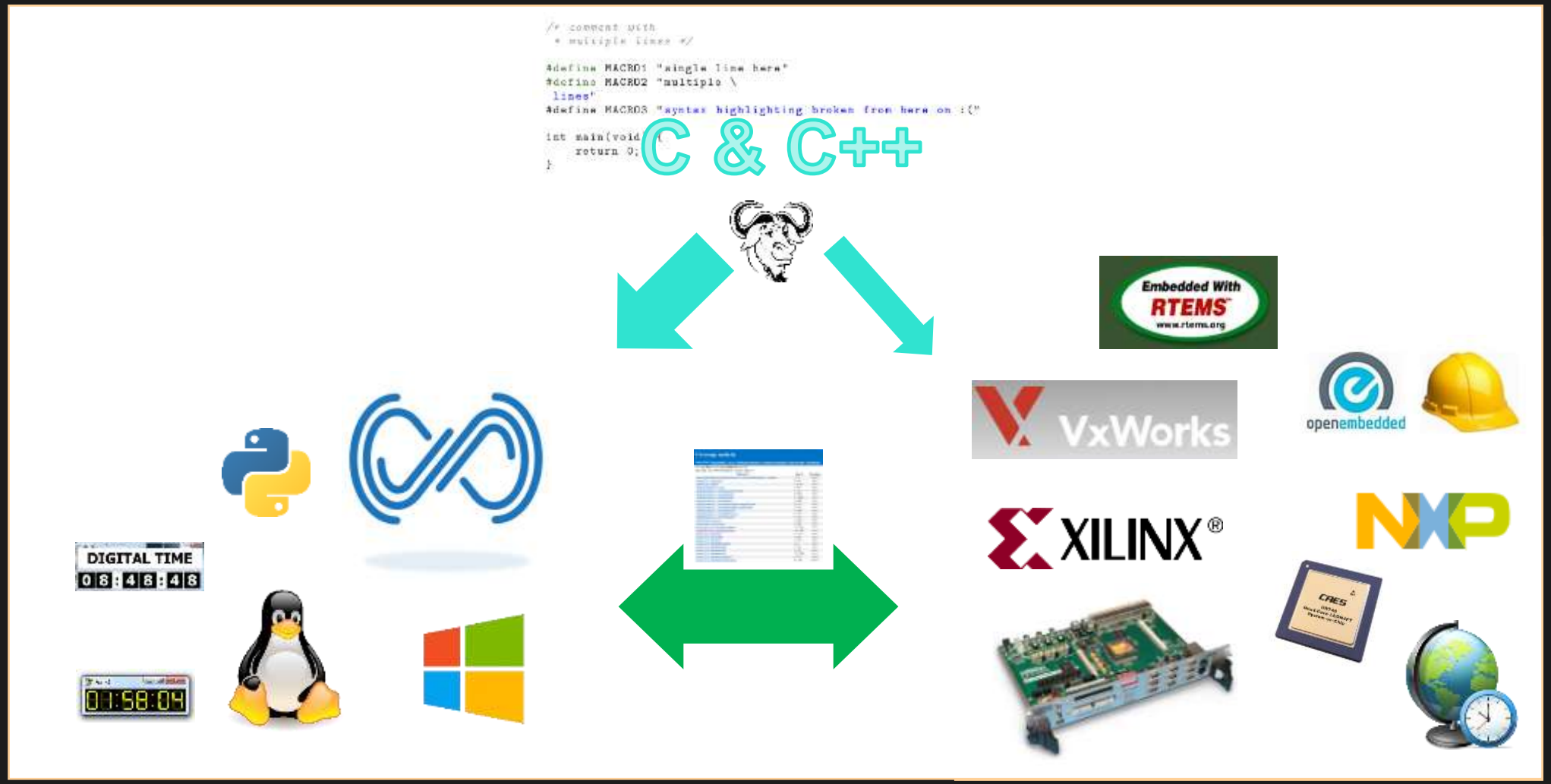
Determinism ensures consistent result anytime anywhere

- 23 years and growing platform
- Operates on modern generic 64bit PC (Windows/Linux)
- Deterministic virtualized hardware platform



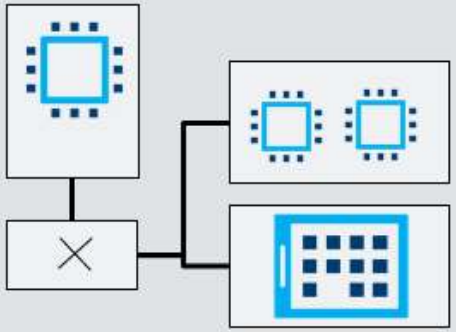


Simics virtual hardware operates the same production code



8 popular Simics system level features

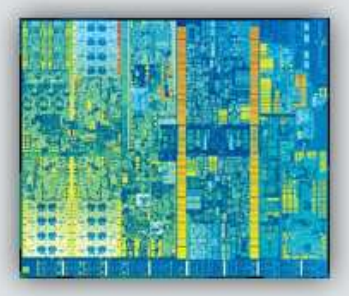
Scalable & heterogeneous



Scripting

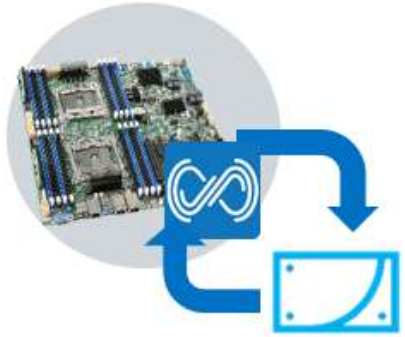
```
con0.wait-for-string "$"
con0.record-start
con0.input "./ptest.elf 5\n"
con0.wait-for-string "."
$r = con0.record-stop
if ($r == "fail.") {
   echo "test failed"
}
```

Bit-exact function



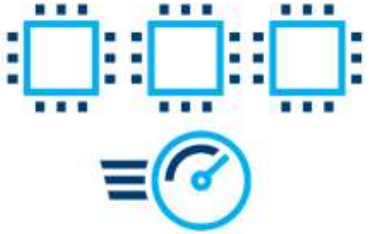
Real-world connections

Checkpoint and restore



Fault injection & control

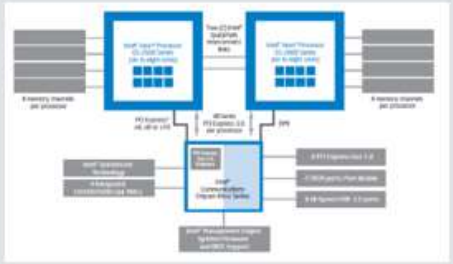
Multicore & -machine multithreading



Modular & user-extensible

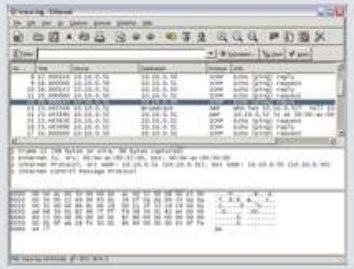
8 popular Simics debug level features

Insight into all components

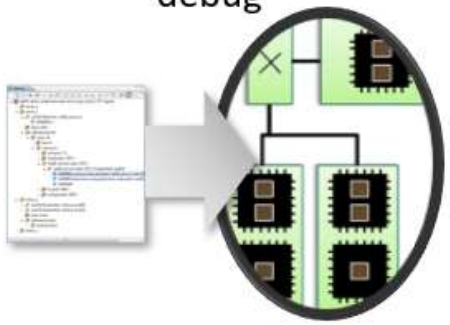


Synchronous entire-system stop

Trace anything



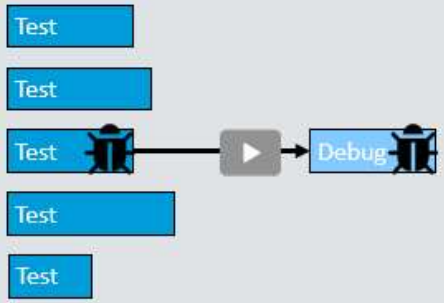
System-level symbolic debug



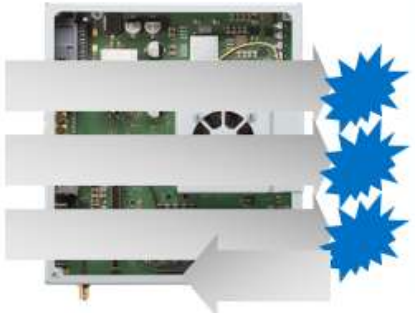
Unlimited powerful breakpoints

```
break -x 0x0000 length 0x1F00
break-io uart0
break-exception int13
break-log "spec violation"
```

Record-replay debug



Repeatability & Reverse debug



Collaboration between developers

Simple demonstration for run, control and test a virtual GR740

1. Using Simics, a full-system simulator, to launch a fully managed virtual platform and boot a complete OS in under 1 min

2. Develop a custom control script to interact with virtual platform autonomously

3. Integrate simulation to preform regression tests in a DevOps pipeline

Simulation is possible to run faster than real time

It depends on host machine, target workloads and target I/O activities.
Example below: booting VxWorks 7 UP (Left); VxWorks 7 SMP (Right)

```
simics> system-perfmeter 0.1 -summary -mips
Using virtual time sample slice of 0.100000s
simics> run 1 s
SystemPerf: Total-vt Total-rt Sample-vt Sample-rt Slowdown  CPU Idle     IPS
SystemPerf: -------- -------- --------- --------- -------- ---- ----   -----
SystemPerf:     0.1s     0.1s     0.10s     0.08s     0.76   82   0%  330.8M
SystemPerf:     0.2s     0.1s     0.10s     0.07s     0.70  155   0%  355.8M
SystemPerf:     0.3s     0.3s     0.10s     0.14s     1.43  306  40%  175.4M
SystemPerf:     0.4s     0.3s     0.10s     0.06s     0.60  104 100%  417.8M
SystemPerf:     0.5s     0.4s     0.10s     0.04s     0.40   79 100%  632.3M
SystemPerf:     0.6s     0.4s     0.10s     0.04s     0.42  111 100%  596.3M
SystemPerf:     0.7s     0.5s     0.10s     0.04s     0.41  114 100%  611.9M
SystemPerf:     0.8s     0.5s     0.10s     0.04s     0.40   77 100%  621.8M
SystemPerf:     0.9s     0.6s     0.10s     0.04s     0.41  115 100%  613.7M
SystemPerf:     1.0s     0.6s     0.10s     0.04s     0.41  113 100%  605.0M
SystemPerf: Performance summary:
--------------------------------
SystemPerf: Target:  4 CPUs in 1 cells [4]
SystemPerf: Running on: Simics build-id 6184 win64 on 8 CPUs with 16051 MiB RAM
SystemPerf: Threads: 1 execution threads, 3 compilation threads
SystemPerf: Virtual (target) time elapsed:      1.00
SystemPerf: Real (host) time elapsed:           0.59
SystemPerf: Slowdown:                           0.59
SystemPerf: Host CPU utilization:             155.22%
SystemPerf: IPS (including idle instr.):      420.93M
simics>
```

```
simics> system-perfmeter 0.1 -summary -mips
Using virtual time sample slice of 0.100000s
simics> run 1 s
SystemPerf: Total-vt Total-rt Sample-vt Sample-rt Slowdown  CPU Idle     IPS
SystemPerf: -------- -------- --------- --------- -------- ---- ----   -----
SystemPerf:     0.1s     0.1s     0.10s     0.10s     0.97  145   0%  258.5M
SystemPerf:     0.2s     0.3s     0.10s     0.17s     1.74  296   0%  143.7M
SystemPerf:     0.3s     0.6s     0.10s     0.37s     3.66  294  60%  173.0M
SystemPerf:     0.4s     0.9s     0.10s     0.28s     2.77  220  73%  361.2M
SystemPerf:     0.5s     1.1s     0.10s     0.17s     1.68  157  85%  593.9M
SystemPerf:     0.6s     1.1s     0.10s     0.05s     0.47   98 100%    2.1G
SystemPerf:     0.7s     1.2s     0.10s     0.06s     0.58  107  99%    1.7G
SystemPerf:     0.8s     1.2s     0.10s     0.05s     0.51  151 100%    1.9G
SystemPerf:     0.9s     1.3s     0.10s     0.06s     0.58  189  99%    1.7G
SystemPerf:     1.0s     1.5s     0.10s     0.18s     1.75  133  87%  570.8M
SystemPerf: Performance summary:
--------------------------------
SystemPerf: Target:  4 CPUs in 1 cells [4]
SystemPerf: Running on: Simics build-id 6184 win64 on 8 CPUs with 16051 MiB RAM
SystemPerf: Threads: 1 execution threads, 3 compilation threads
SystemPerf: Virtual (target) time elapsed:      1.00
SystemPerf: Real (host) time elapsed:           1.47
SystemPerf: Slowdown:                           1.47
SystemPerf: Host CPU utilization:             213.23%
SystemPerf: IPS (including idle instr.):      552.18M
simics>
```

Resources

Wind River
https://www.windriver.com/

Dr. James Hui
James.Hui@windriver.com

Wind River Simics Product Overview
https://www.windriver.com/resource/wind-river-simics-product-overview

Simics One-Pager
https://www.windriver.com/resource/simics-one-page

Simics YouTube Playlist
https://youtube.com/playlist?list=PLUvMA4Jsr79B4LoQFQ9wAWw5x6Pj7zsQ0

Curious & Get in touch

KEEP IT TO TEN WORDS OR LESS AND USE COLOR TO REINFORCE YOUR POINT

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