WIND RIVER
Simics - Reducing Product Development Risks with Full System Simulation

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Agenda

- Wind River – Overview

- Simics
  - Examining Risks
  - Minimizing Risks
  - Customer Examples

- Questions and Answers
Wind River Platform Solutions

- **Aerospace and Defense**
- **Industrial and Medical**
- **Network Equipment**
- **Consumer**

- Wind River Workbench, Simics and Wind River Test Management
- Networking, Graphics, Security, and Connectivity Middleware Technologies
  - VxWorks MILS
  - VxWorks 653
  - VxWorks Cert
  - VxWorks 5.x/6.x
  - Wind River Linux
- Virtualization: Wind River Hypervisor, Linux Kernel Virtual Machine (KVM)
- Optimized Hardware Integration
### Major Customers by Segment

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<tr>
<th>Aerospace and Defense</th>
<th>Network Equipment</th>
<th>Industrial and Medical</th>
<th>Mobile and Consumer</th>
<th>Automotive</th>
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Typical Risks on an A&D Project

- Hardware availability impacts software development
- Incorporating new technology, such as multi-core
- Architectural defects found during system integration
- Multiple companies working on the same project
- Cannot use physical hardware for testing and/or debugging
Risks Occur Throughout the Product Lifecycle

- **System Definition**
  - Is architecture adequate?
  - Incorporating new/unproven technology
  - Poor collaboration between different teams

- **Platform Customization & Stabilization**
  - Board bring-up delayed due to HW delays or flaky HW
  - OS, Kernel bring-up difficult b/c debug tools not available
  - Limited quantity hardware

- **Application Development**
  - Limited quantity hardware
  - Different dev platform for app dev, than for other phases

- **System Integration & Test**
  - Complex & large systems
  - Big-bang integration at the end
  - Limited system hardware

- **Deploy & Maintain**
  - Support product for long time (10+ years)
  - Many different customer configurations
  - HW is no longer accessible (in space)
Full System Simulation!

- Simulation has been proven over decades in other industries
- Why not software & system development?
What Is Wind River Simics?

Wind River Simics is a full system simulator used by software developers to simulate the hardware of large & complex electronic systems.

Simics allows you to break the rules of embedded product development.
Target Hardware:
- CPU (or SoC),
- Memory,
- Interrupt controller,
- System controller,
- Ethernet controller,
- PCIe, SRIO, VME,
- MIL/STD1553
- Etc.

Target Software:
- Firmware, hypervisor
- RTOS, middleware,
- application code

Simics

Unmodified Target Software
Binary

Model of target hardware
including all devices

- Very high performance
- Functionally accurate
- Runs unmodified target software

Explain that again please…
Simics Models Complex Systems

- Simulate multiple networked boards
- Mixed architectures, mixed RTOS
- Multi-core, multi-processor, multi-board
- Control all boards as a single entity
  - Breakpoint stops all
  - Save and restore system state of all boards
Complexity Practically Unlimited

- Create a model of an arbitrarily complex system
  - 100’s of boards/100’s of processors
  - Mixture of target architectures
- Flexible & configurable
  - Easily create a different configuration for each supported system
  - Share complete virtual system with developers, testers, integrators, customers
- A complete target system for every engineer

- Ethernet, VME, Spacewire, ARINC, etc
- Rack or Chassis
Simulate any size embedded system

Customer Value

Processor & Memory  SoC Devices  Complete Boards  Devices, Racks of Boards & Backplanes  Complete Systems & Networks
Simics Reduces Risks Throughout the Product Life Cycle

- **System Definition:**
  - *Use real target software with virtual hardware*
    - Pre-silicon architecture analysis using actual target software
    - Legacy system upgrade analysis using actual target software
    - Collaborate between engineering and customer

- **Platform Customization & Stabilization:**
  - *Eliminate HW availability & flaw issues*
    - Hardware and software co-development
    - Prototype virtually
    - Target before hardware availability

- **Application Development:**
  - *Utilize virtual target instead of host-based development*
    - Advanced debug capabilities
    - Target hardware for everyone
    - Easily collaborate amongst entire team

- **System Integration & Test:**
  - *Eliminate system availability issues*
    - Iterative & incremental integration & test
    - Debug at the system level
    - Access to full system for everyone

- **Deploy & Maintain:**
  - *Utilize virtual platform even after development is complete*
    - Maintain legacy products for 5,10,20+ years
    - Support many different customer configurations
    - Train sales, customers, partners
Unique Simics Assets Reduces Risks

- **Virtual Platforms (Collaboration)**
  - Enable collaboration by evolving from prototype to development platform to deployed customer configuration
  - A complete target system for everyone

- **Checkpoints (Collaboration)**
  - Enable collaboration through easy transfer of complete system state
  - Enable automation by capturing and reproducing bugs

- **Execution Data (Reporting)**
  - Unintrusive execution metrics, code coverage metrics
  - Complete system coverage, not just for a component

- **Scripts (Automation)**
  - Automate target configuration
  - Automate testing & fault injection

Through *collaboration, automation* and *reporting* the PLC is drastically improved
Reducing Risks associated with Debugging & Testing

- Synchronous stop for entire system
- Determinism and repeatability
- Reverse execution
- Repeatable fault injection on any system component
- Checkpoint and restore
- Connect the virtual world to the real world

Any Hardware
SOME CUSTOMER EXAMPLES
Customer’s Risks
- Very large software stack from multiple vendors including lots of legacy code
- Need to test & integrate before hardware available to support aggressive schedule
- Development spread across many different development sites – how to ensure a consistent development configuration
- Insufficient # of development labs due to budget constraints

Without Simics:
- Waterfall development approach
- Integration occurs years in the future & bugs found then puts program at risk
- Developers utilize development platforms not similar to target

With Simics:
- Create a virtual target that can be easily provided to all team members
- Virtual target available years ahead of hardware; allows system integration & testing to start years ahead of schedule

Customer Value
- Reduce costs, address risks earlier in cycle, begin integration & testing earlier
- Improve 30 year old process paradigm by being able to develop more efficiently
### Customer’s Risks

- Need to train operators on how to safely operate satellite
- Hardware costs prohibitive; risk of error risk prohibitive

### Without Simics:

- Create host-based version of target software, but not very accurate
- Create custom hardware training units – very expensive

### With Simics:

- Create virtual system of satellite hardware
- Run exact same target software
- Connect up virtual target to other hardware to create a very realistic simulation of satellite

### Customer Value

- Reduced risks of error when operators controlled the satellite
- Reduced costs of training platforms
Unmanned Space Vehicle Developer

**Customer’s Risks**
- Need to maintain an aging satellite network without access to original development systems
- A bad upgrade could make a satellite inoperative
- Hardware fails in unpredictable ways due to harsh environment

**Without Simics:**
- Use a reference board, but will not be able to run complete target software
- Hope that satellite can be rebooted after a failed upgrade

**With Simics:**
- Create virtual system of each satellite hardware, even matching its unique hardware failures
- Run exact same target software as will run on satellite before uploading to satellite

**Customer Value**
- Reduced risks of error when uploading new software
- Keep satellites running for longer

**Deploy & Maintain**
Observations

- A&D customers are very risk adverse, more so than most industries

- This risk adversity has created some very rigid development processes
  - Resulting in cost overruns & missed schedules

- Full system simulation can help you address these risks and change your development processes to:
  - Reduce costs
  - Meet or exceed project schedules
What Simics Customers Say…

- “…shorten bring-up time from 22 weeks to **29 days**…”

- “…find and solve a problem in **30 minutes** instead of three weeks and three people…”

- “…prevent the loss of **$10 million** by getting the ASIC right before manufacturing …”

- “…configure complex labs in **minutes** instead of weeks …”

- “…save **$6M** in target hardware labs…”
Wind River Simics Reduces Risks

- A full system simulator capable of simulating any complexity target system
- Capable of running unmodified target production binaries

Allows you to **break the rules** of embedded product development:

**REPLACE**
- Use virtual hardware
  - Equip everyone with Targets
  - Retrofit & support legacy products
  - Enable support, sales, marketing

**ACCELERATE**
- Shift Schedules Left
  - Expedite system architecture exploration
  - Start software development earlier
  - Integrate & test earlier

**OPTIMIZE**
- Manage Complexity
  - Manage large systems
  - Debug large systems
  - Improve engineering collaboration