### Embracing Both Emulation and Simulation Shift-Left and Continuous Functional Testing for Space Software

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### SOFTWARE DESIGN MATTERS

## **Right software**

makes hardware useful and create values for customers















#### WNDRVR

### What Wind River does



# SIMULATION = Hardware



### **System Simulation from Software Lens**

- Run, optimize and debug your intelligent edge applications behavior with the power of system simulation and the scalability of cloud
- Transform your app development process by generating more relevant and intuitive data, when building applications on Wind River operating environments



## SOFTWARE SIMULATION

#### **Digital Virtual Environment to run Software Applications**

- 1. Availability
- 2. Instantiates
- 3. Deterministic
- 4. Automation
- 5. Simplify workflow
- 6. Reduce risks to experiment
- 7. Built for measurement
- 8. Longevity
- 9. Collaboration



### MANAGE & CHOOSE ABSTRACTION LEVELS

#### Emulation for System

- Binary compatible instruction set
- Fast to run
- Simulation for Product
  - Multi-targets synchronized network
  - High fidelity
- Combining Emulation and Simulation
  - Early defect identification
  - Fault injection
- Make data driven decisions WNDRVR



### **Emulation with QEMU**

- System emulation using QEMU opensource project
- Wind River is a supporter to QEMU community, and upstream our enhancements back to the mainline.
- The QEMU supported by VxWorks in system mode for Arm, Intel, PowerPC, and RISCV target machines
- Already integrated with Wind River Workbench
- Debug using TCF with Debug Agent and remote GDB
- Real-world connectivity, snapshot, asynchronous cosimulation and fault injection

WNDR/R

#### Semu 🖉 QEMU (Connecting...) Target Target Type: Connection Mode: **Running Target** Core Dump Stop Mode Advanced Simulation Platform Details File System System Monitor Symbol Files Object Paths Source Paths Terminal X Pauld Console QEMU 🖾 VxWorks 21.07 Build date: Feb 28 2021 20:30:52 \...\ ....\ Copyright Wind River Systems, Inc. ..../ 1984-2021 ..../ \.../ 1.\ Board: Xilinx ZCU102 CPU Count: 4 OS Memory Size: 4096MB ED&R Policy Mode: Deployed Debug Agent: Started (always) Stop Mode Agent: Not started Adding 11278 symbols for standalone. ->

### Intel® Simics® Simulator

- Product mode simulation and Intel's commercial product for platform simulation using unmodified product target binaries
- Detailed simulation models for processors, peripherals, and networks with determinism and synchronisation
- Use unique and powerful debugging techniques with built-in scripting, monitoring and reporting subsystems
- Record, save, and restore simulation runs remotely across all supported host systems
- Opensource modelling language for performance and portability

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### INTEGRATION WITH DEVELOPMENT WORKFLOW



**WNDRVR** 



EMBRACE AGILE WORKFLOW TO IMPROVE DESIGN TESTABILITY, MANAGE COMPLEXITY AND RISK EARLY

> ACCESS TO TARGETS THROUGH SIMULATION, EVEN BEFORE HARDWARE IS AVAILABLE

> > COLLABORATION THROUGH SHARING TOOLS, DATA, AND ASSETS, FOR EFFICIENT CROSS-FUNCTIONAL TEAMS



AUTOMATION FOR DEVSECOPS METHODOLOGY, MAKE DATA-DRIVEN DESIGN DECISIONS

REDUCE TIME-TO-MARKET, MANAGE DEVELOPMENT COSTS, AND AVOID LOSING MARKET SHARE.



### USE CASES DEVELOP, TEST AND INTEGRATE, AUTOMATE ANYTHING, ANYWHERE, ANYTIME

- Reduce CapEx and OpEx by 45%
  - While simultaneously introducing rapid test and integration
- Optimize debug time by +30%
  - While simultaneously increasing quality by finding bugs sooner

#### Go to market 3–6 months faster

- By starting software development activities pre-hardware and even pre-silicon

Safety Testing	Platform Team	5G Equipment Test	Space Software Test
Average time from	Shorten time from	A typical 4-month	A 2-year test
code commit to defect	code build to test from	network test program	compressed for
detection reduced from	55 mins to <1 min	now completes in	completion in 3 days
4.5 weeks to 24 hours		3 weeks	
97%	98%	82%	99%



### **BEST PRACTICE START EARLY & USE OFTEN**

#### Experiment

Plan, simulate, verify.

#### Debug

- Hunt for bugs at any time.

#### Share

- Empower all collaborators.

#### Communicate

- One team. One view. One truth.
- Test and run
  - No need to stand in line.
- Develop
  - Develop on the actual system from the start.
- Configure
  - Use endless configurations with ease.



## RESOURCES

- More questions? Feedback?
  - james.hui@windriver.com
- https://docs.windriver.com/
- https://www.youtube.com/@windriverchannel/playlists
- Certify Faster with Simulation
- Wind River GitHub
- Intel Simics Public Release
- Wind River Lab SDK