Shift Left with Synopsys Virtual Prototype

Using VDKs for Early Software Bring-up & Test of Power Management Software for AP SoC

Xiaowei Pan

March 23, 2017

CONFIDENTIAL INFORMATION

The following material is confidential information of Synopsys and is being disclosed to you pursuant to a non-disclosure agreement between you or your employer and Synopsys. The material being disclosed may only be used as permitted under such non-disclosure agreement.

IMPORTANT NOTICE

In the event information in this presentation reflects Synopsys' future plans, such plans are as of the date of this presentation and are subject to change. Synopsys is not obligated to develop the software with the features and functionality discussed in these materials. In any event, Synopsys' products may be offered and purchased only pursuant to an authorized quote and purchase order or a mutually agreed upon written contract.

Agenda

- From Reference Software to Production
- Shift Left – with Virtual Prototype & Virtualizer Development Kits
- Case Study – Power Management SW Bring-Up using VDK
- Q&A

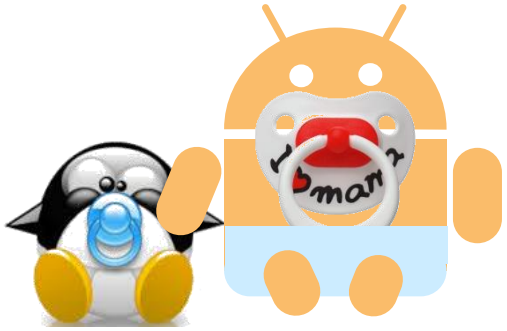
From Reference Software to Production

SYNOPSYS®

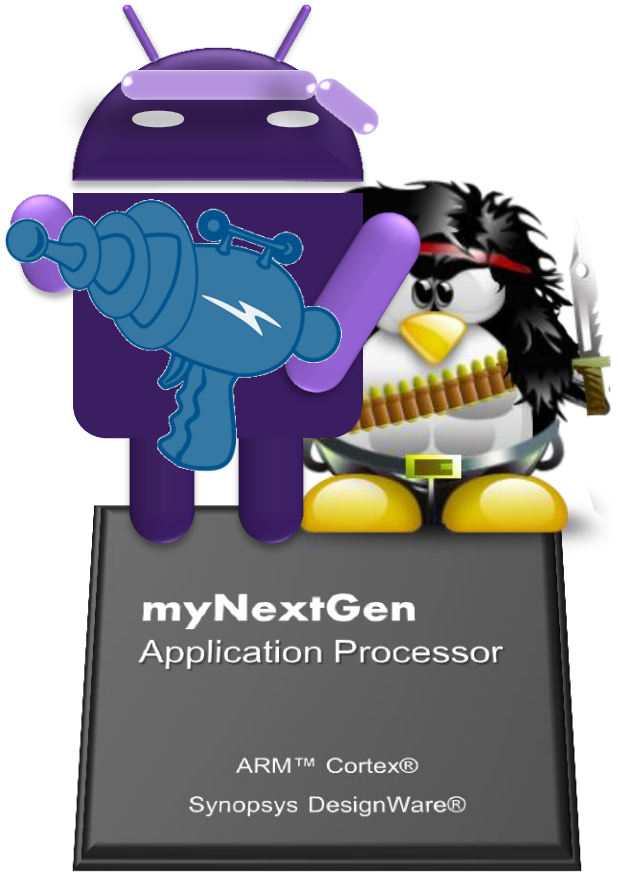
From Reference Software to Production

Still some miles to go

Open source reference



Benchmark winning production SW



SYNOPSYS®

SoC Software Bring-Up

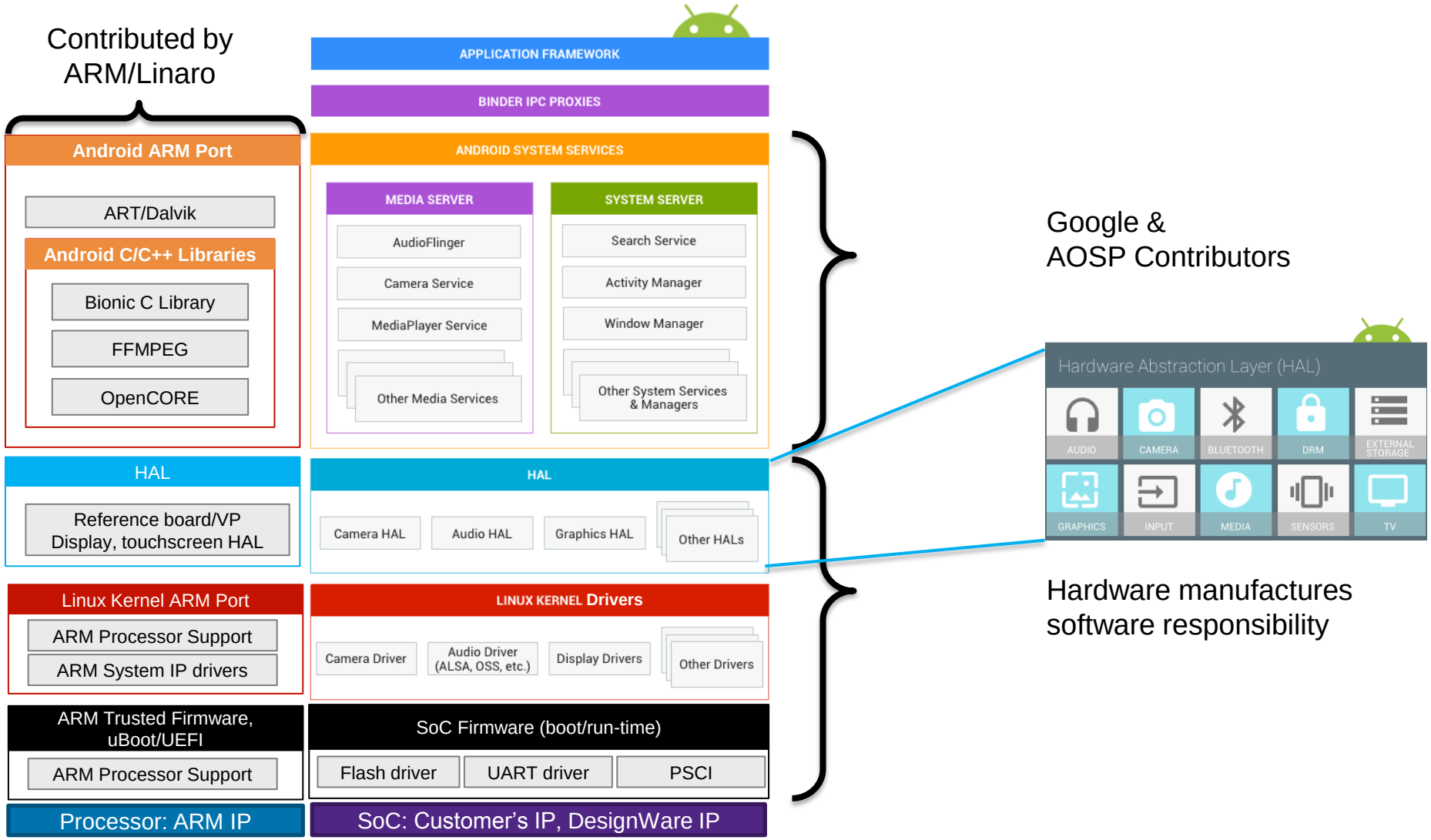
Software re-use is key, but not everything

- Android mobile hand-set software stack is open source
  - ARM firmware, uBoot/UEFI, Linux, Android
  - Enables fast bring up of a minimal Android
- Reference software is targeting reference platforms
  - Targets: VExpress TC2, Juno board, ARM foundation model
  - SoC specification is different
- Open source IP drivers of existing hardware platforms
  - Tailored and tested only for specific IP configurations
  - High risk of inefficiencies or defects for your IP configuration

Significant work to be done before software is production ready!

Android System Architecture

Layers, components and ownership

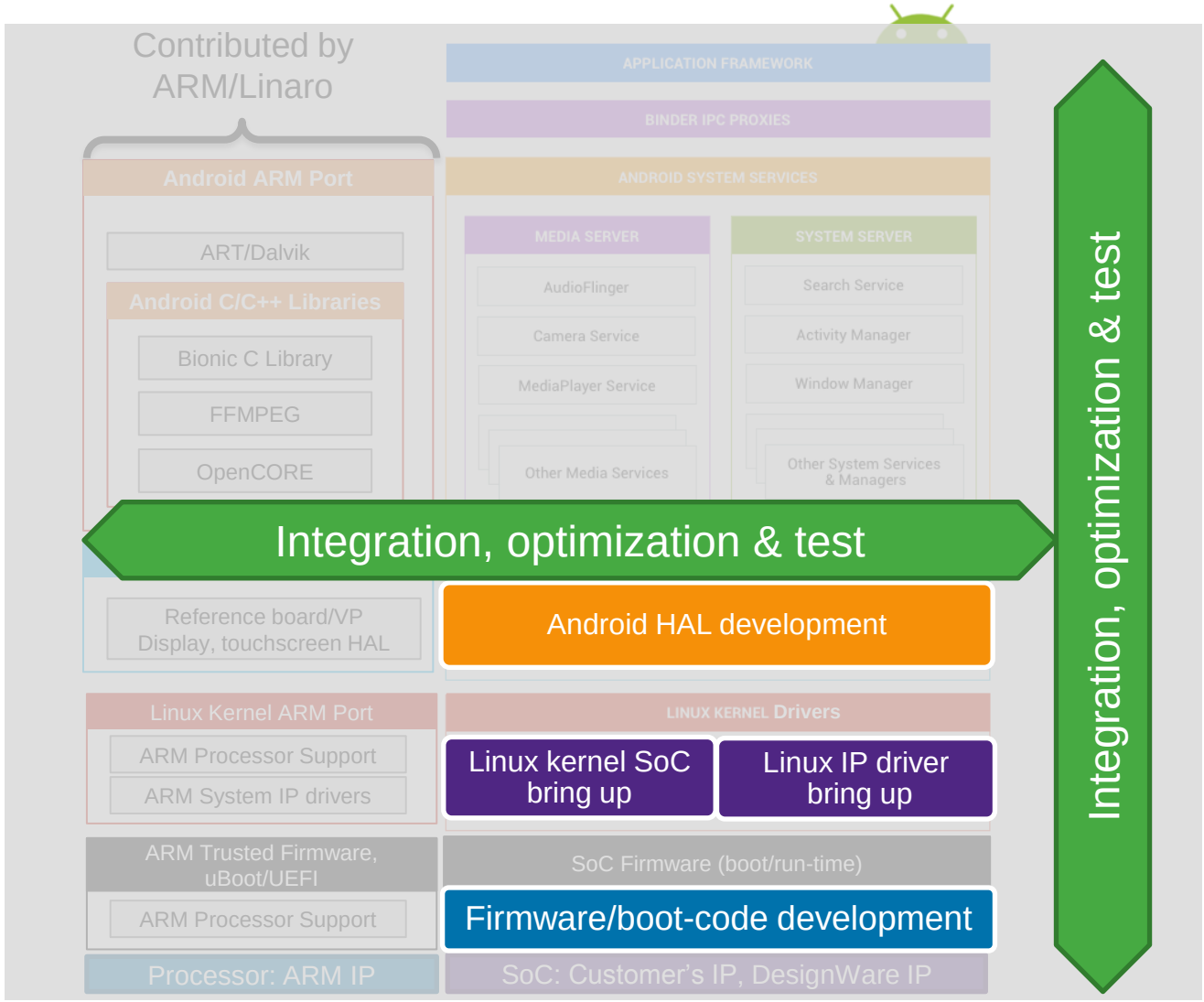


Sources: https://source.android.com/devices/index.html

SYNOPSYS®

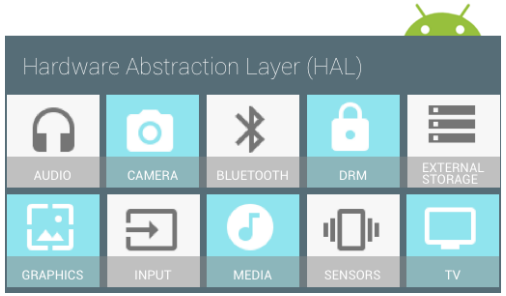
Android System Architecture

Layers, components and ownership



Sources: https://source.android.com/devices/index.html

Google &
AOSP Contributors

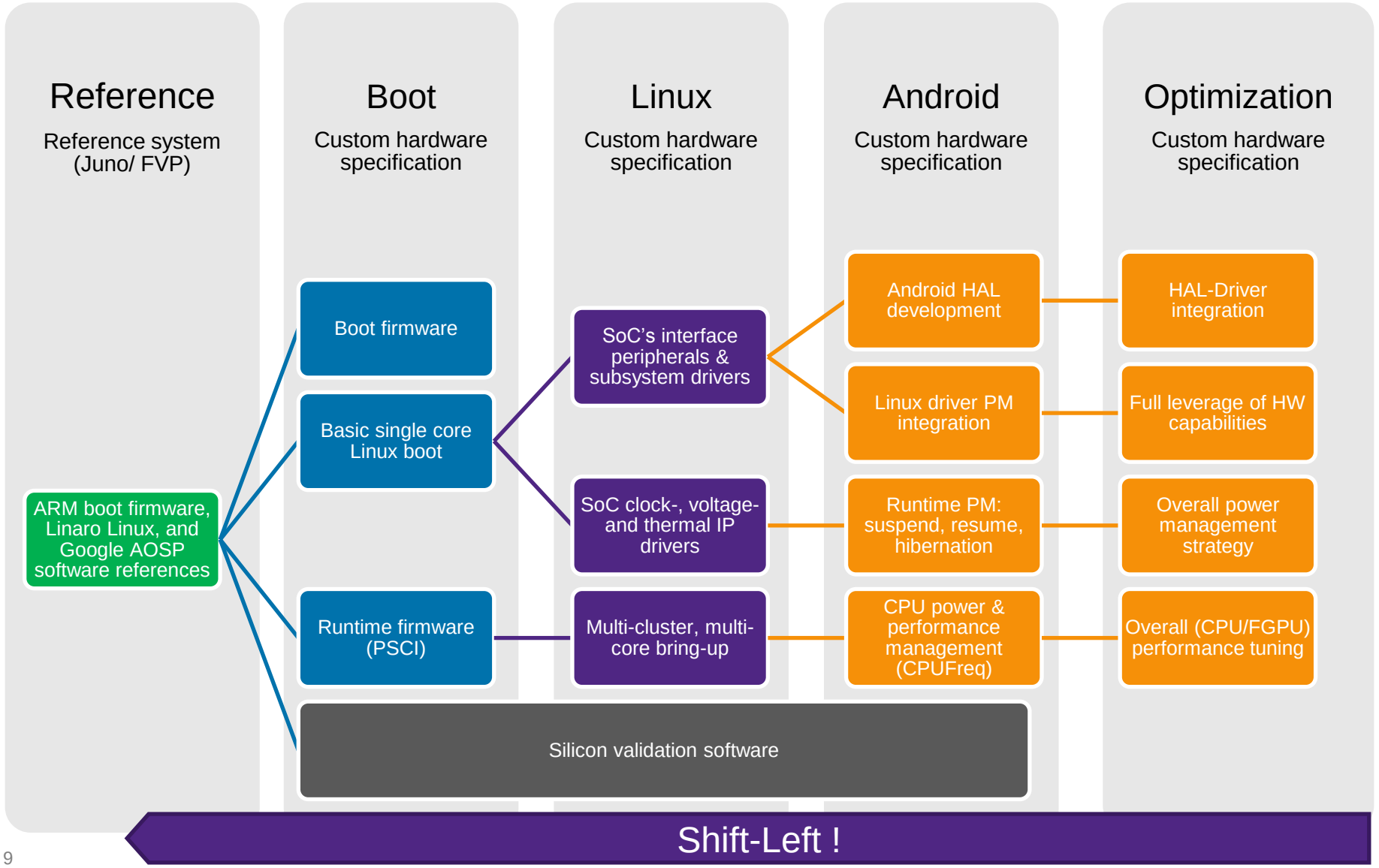


Hardware manufactures
software responsibility

SYNOPSYS®

Steps to Software Readiness

From open source reference to final software



SYNOPSYS®

Shift Left

Virtual Prototype & Virtualizer Development Kits

McKinsey&Company

McKinsey on Semiconductors

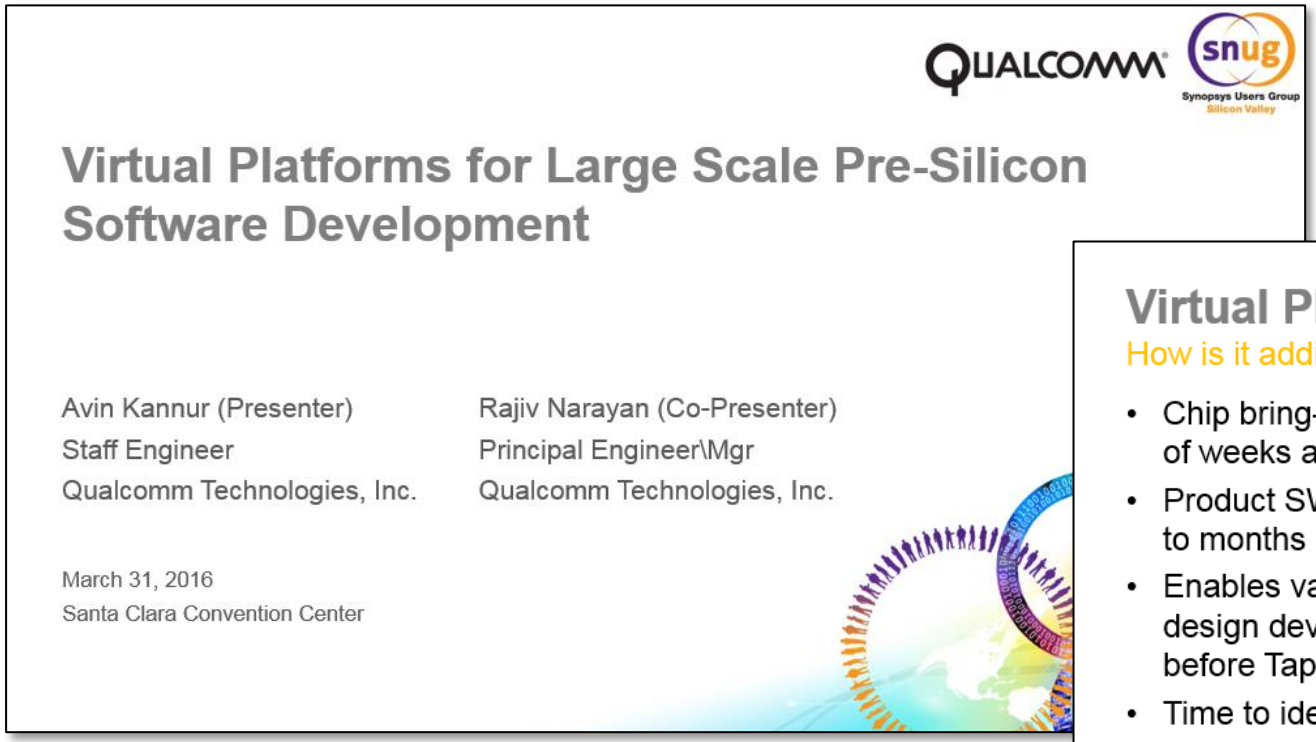
In fact, semiconductor companies of any size could realize great cost savings and productivity benefits by making virtual platforms an integral part of their SOC planning and design cycles. The

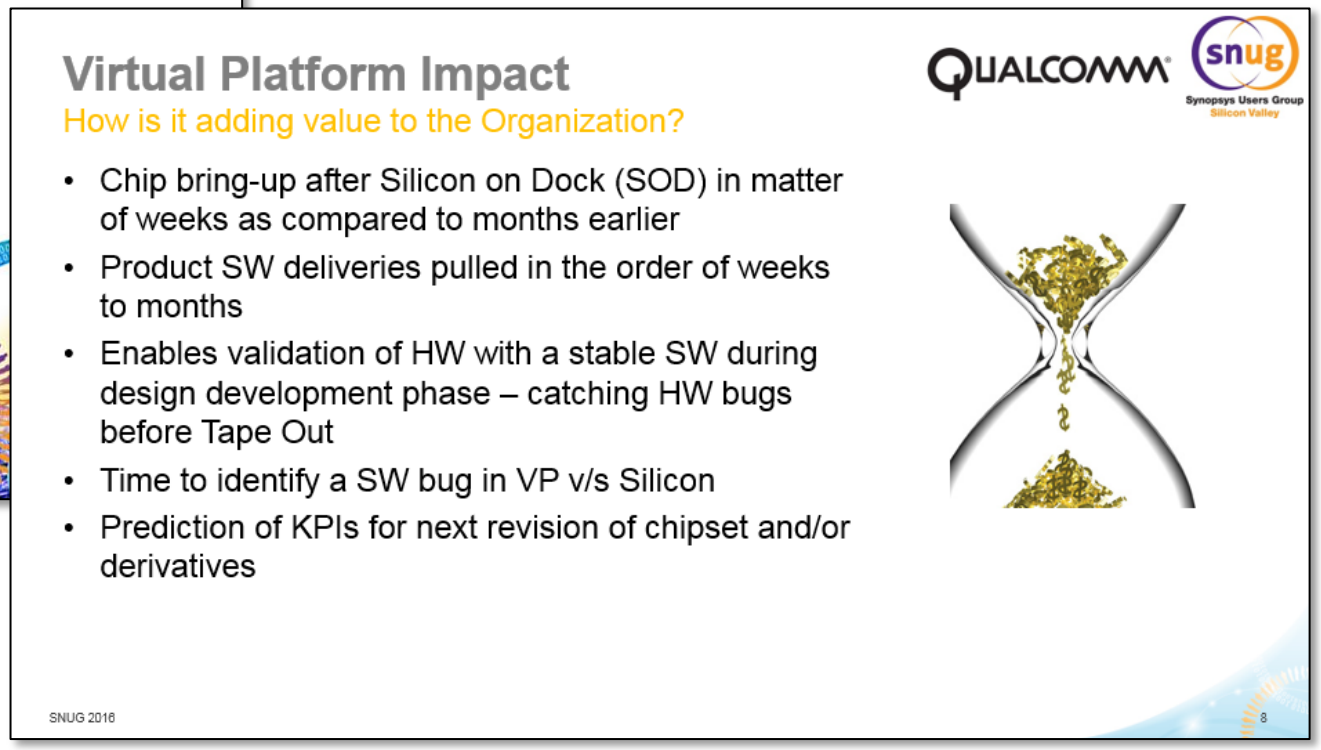
SYNOPSYS®

Qualcomm Shifts Left with Virtualizer and VDKs

SNUG Silicon Valley 2016

QUALCOMM



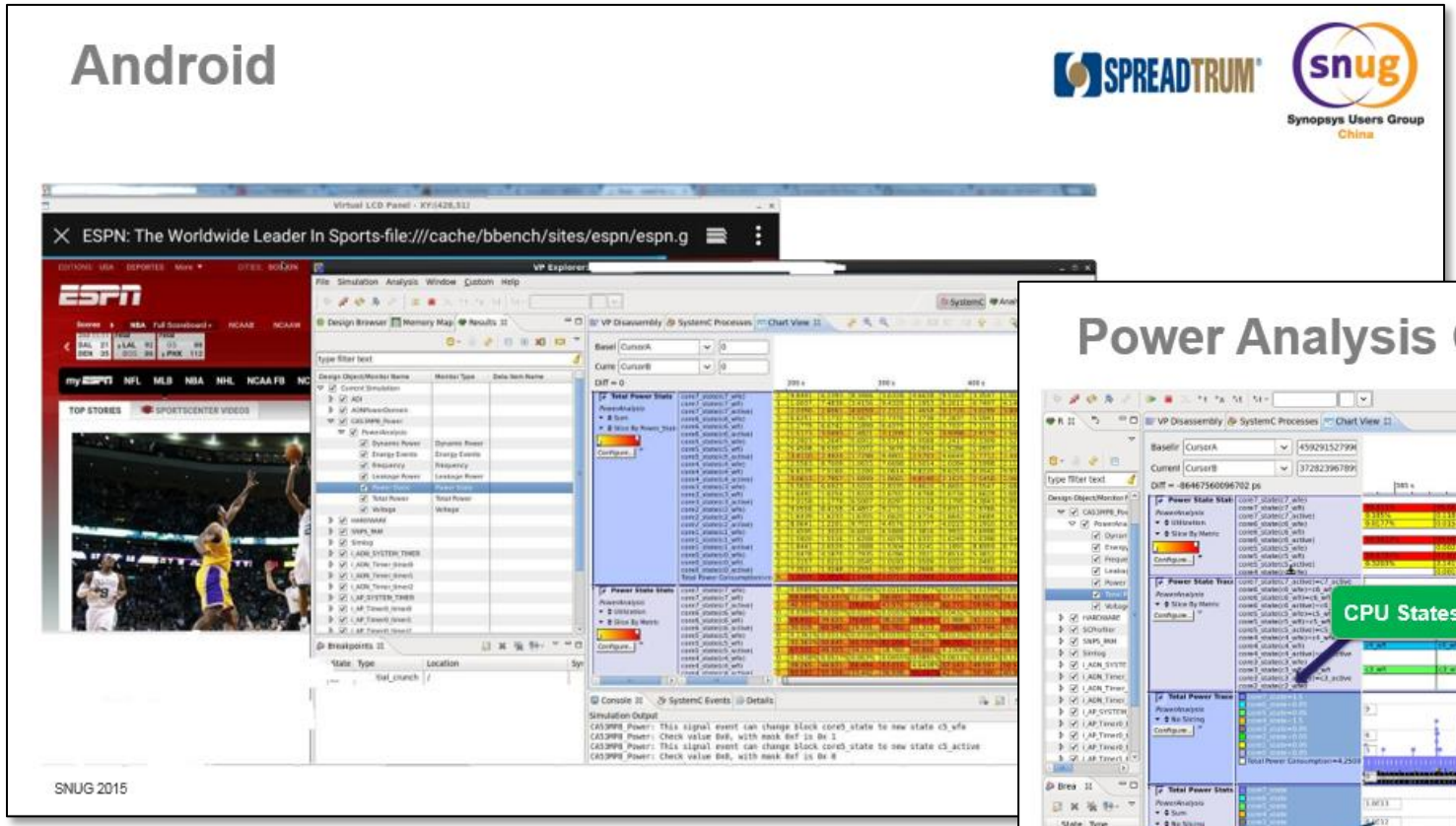


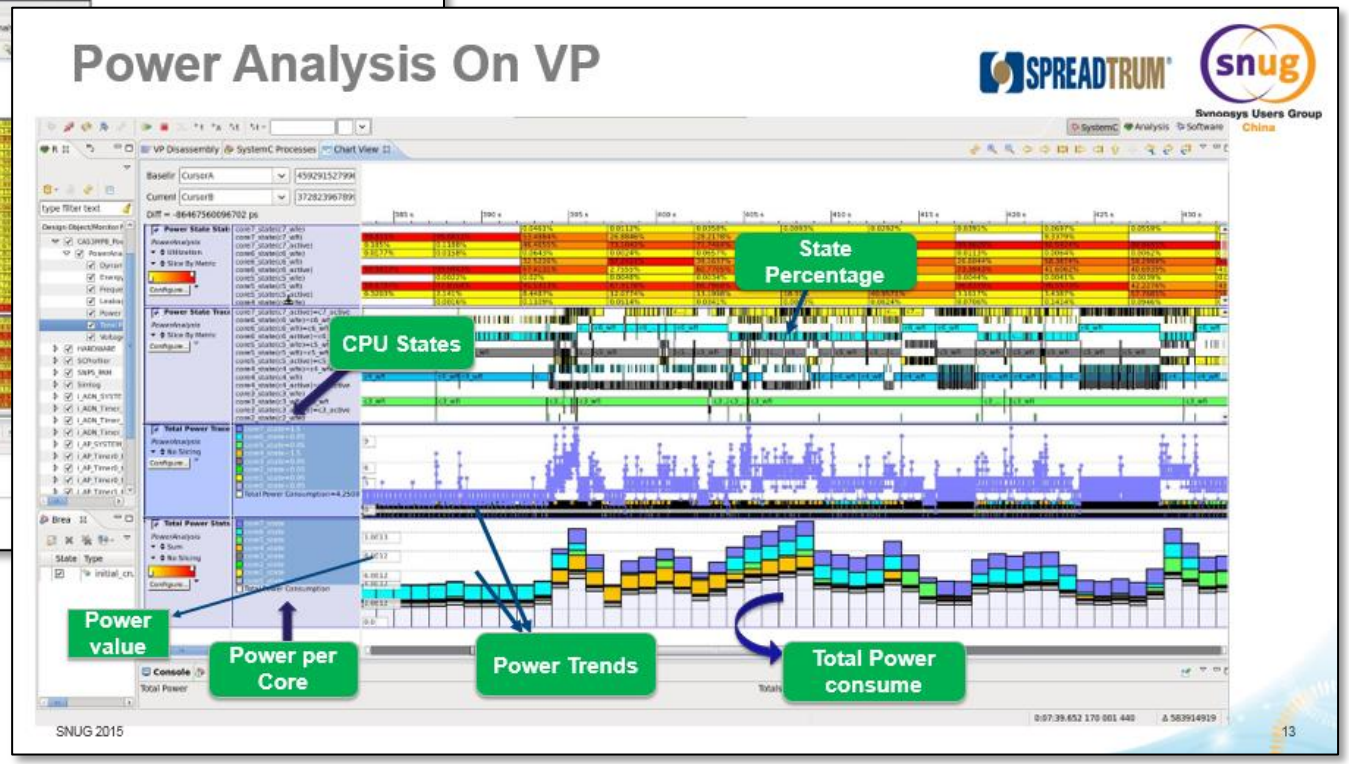
Download presentation

SYNOPSYS®

Early SW Bring-up & Power Analysis with Virtual Prototype

SNUG Shanghai 2016



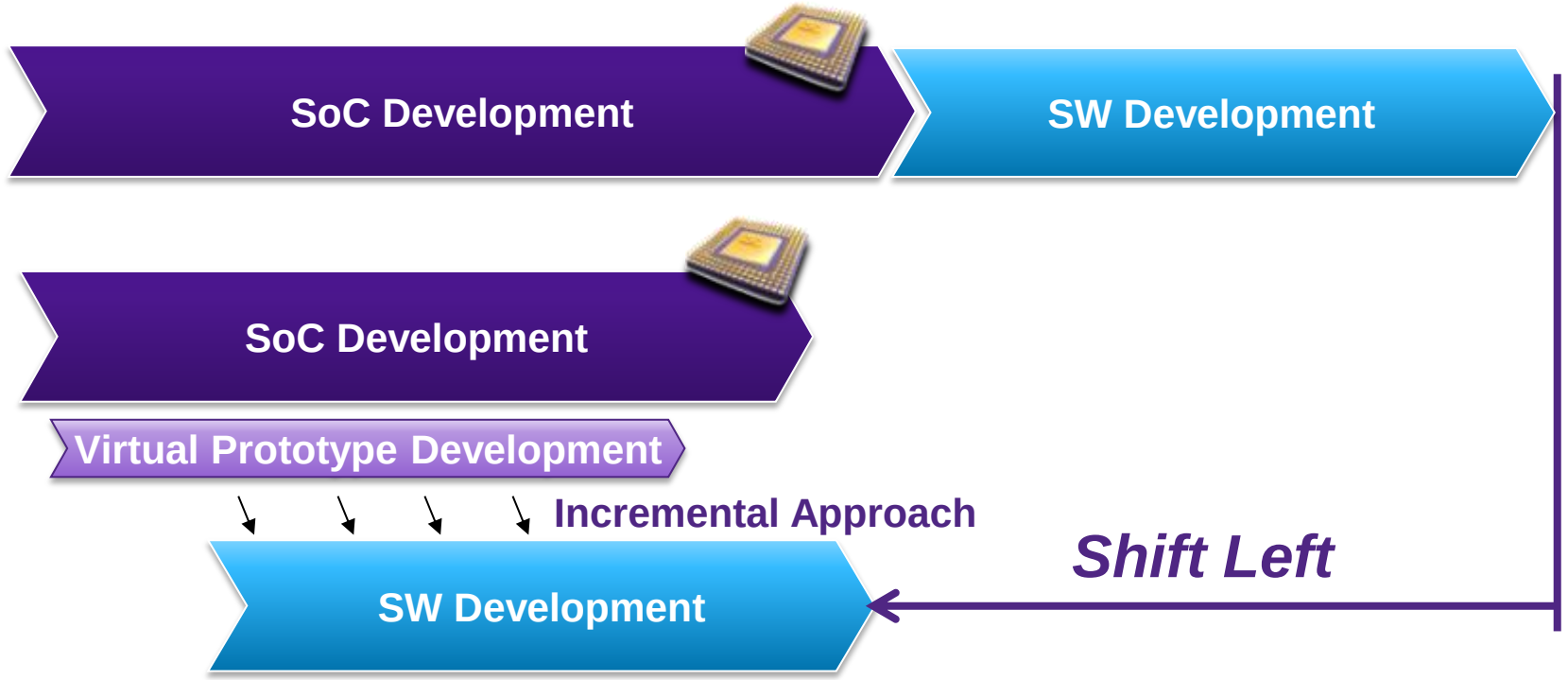


SPREADTRUM

SYNOPSYS®

Why do Virtual Prototyping?

Challenges of the Sequential Design Flow



- Break Dependencies on RTL Availability (by using Transaction Level Models)
- Agile Software Development in Lock Step with Virtual Prototype Development

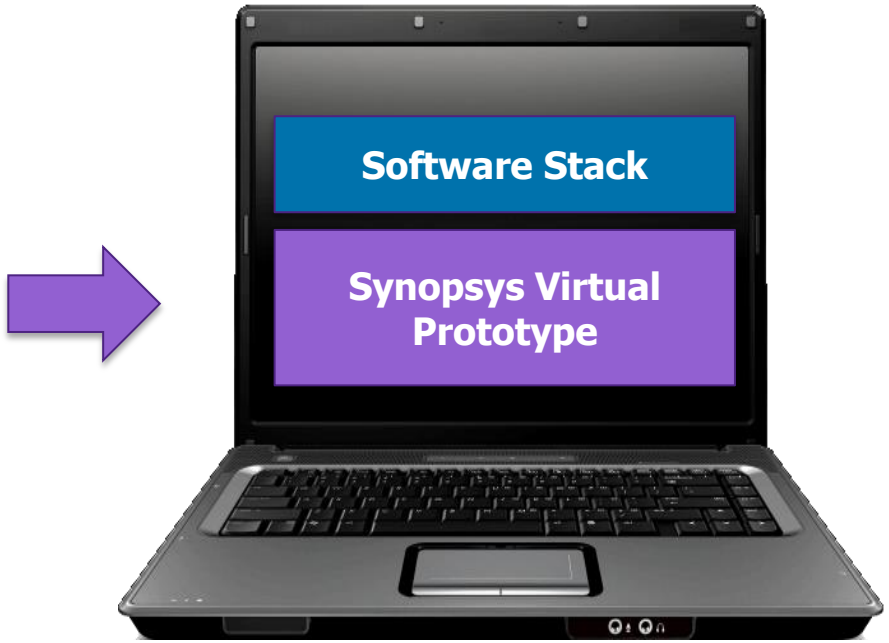
SYNOPSYS®

What are Virtualizer™ Development Kits?

Also Known as VDKs

- Software Development Kits that use a Virtual Prototype as a target
- VDK's are fully functional models of the system executing target code (SW / FW)

Development board



Early Availability

Easier Deployment

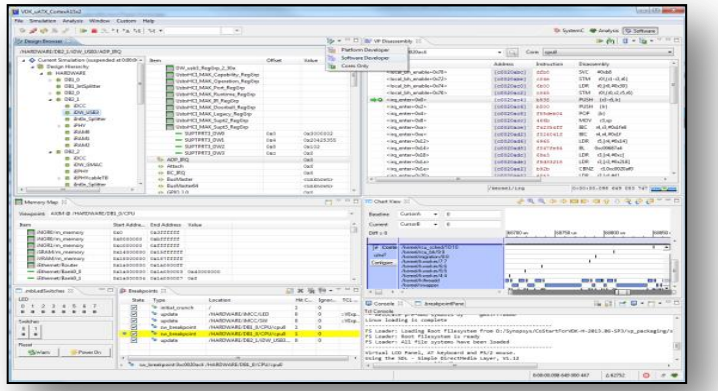
Better SW Development Productivity

- Visibility
- Control and repeatability
- Fault Injection support
- Scriptable

SYNOPSYS®

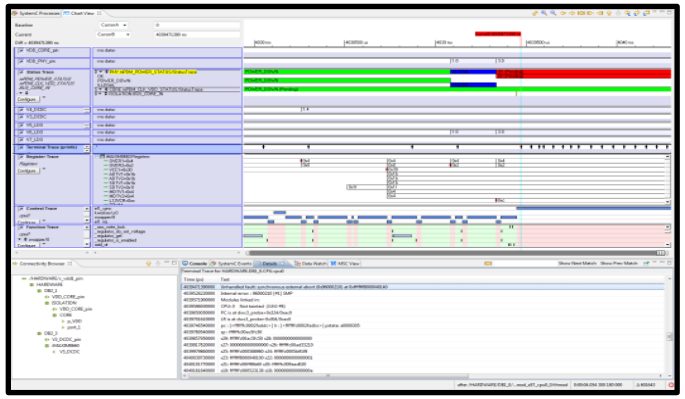
Software Developer's Extended View

System wide debug



- Memories
- Registers
- Signals
- States
- Disassembly
- Log messages

System wide trace



Python/TCL command based control and Inspection APIs

A Virtual Prototype is not a black box!

Watch & modify each component's registers and even interrupt signals!

SYNOPSYS®

Efficient Solution for VDK Creation

Synopsys Virtualizer™ Prototyping Solution

VDK Creation - Lowest Creation Cost

- **Large model library**
- **Efficient Authoring tools**
- **Extendable Reference VDKs**

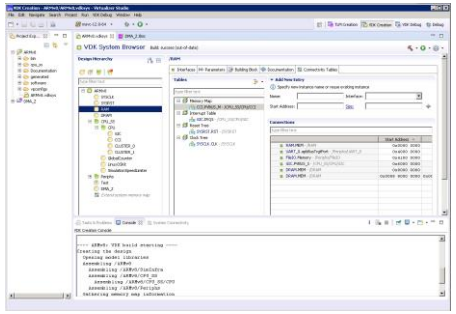
Standards-based (SystemC)

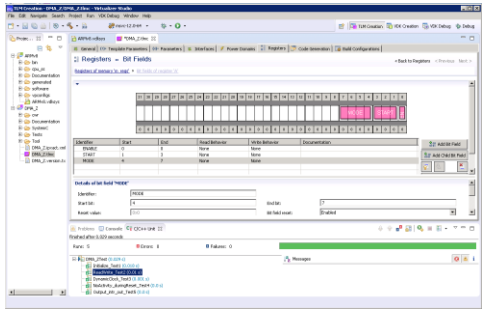
ARM® ARC Synopsys CEVA tensilica

Synopsys DesignWare (USB, PCIe, UFS, GMAC …)

Software Stack

Virtualizer Studio





ARM v8 Base; ARC HS; Automotive MCU/ADAS,..

ARM ARC Synopsys RENESAS freescale Infineon

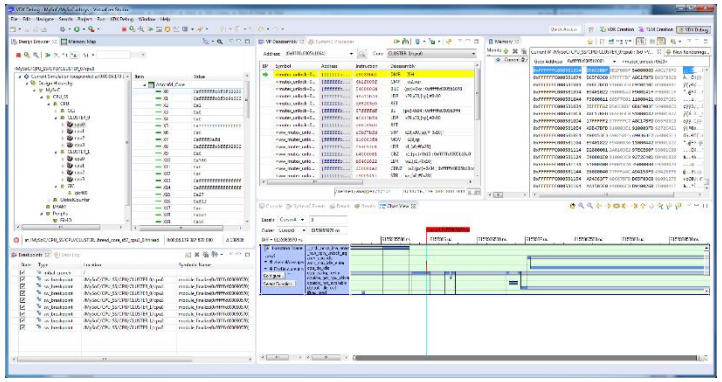
Efficient Solution for VDK Use

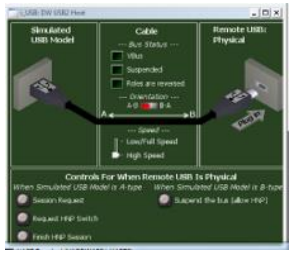
Synopsys Virtualizer™ Prototyping Solution

Embedded SW Debuggers

LAUTERBACH DEVELOPMENT TOOLS · Green Hills SOFTWARE · IAR SYSTEMS · ARM DS Development Tools · ARC Synopsys · CEVA · tensilica

VDK Debugger





VDK Use - Highest Productivity

Integration with SW Engineers Tools

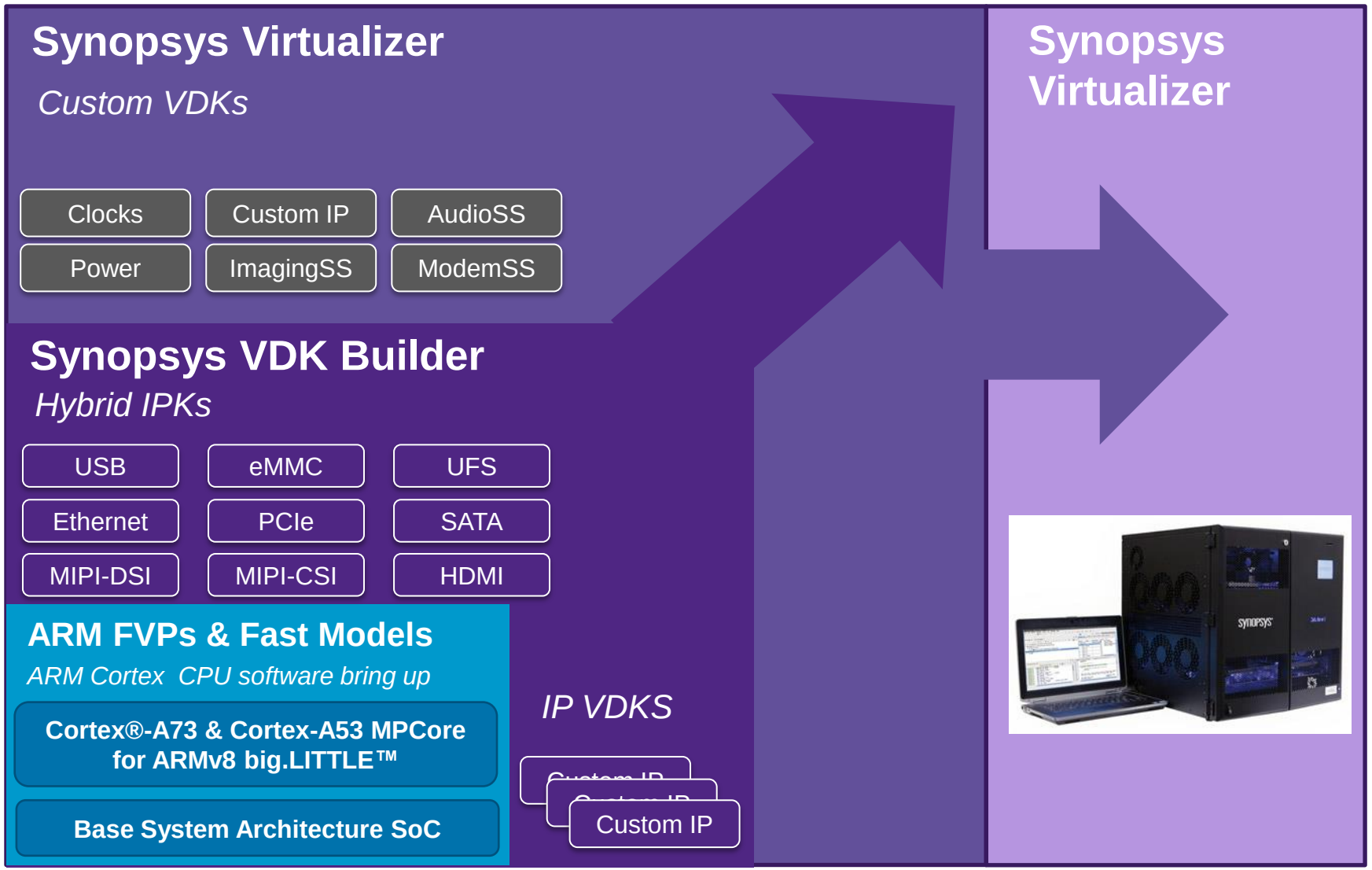
Full Platform Debug
Tracing and correlation of HW/SW execution

Support for Extended Use-Case
- Virtual- and Real-world IO
- Hybrid emulation and prototyping …

SYNOPSYS®

SoC SW development beyond the CPU

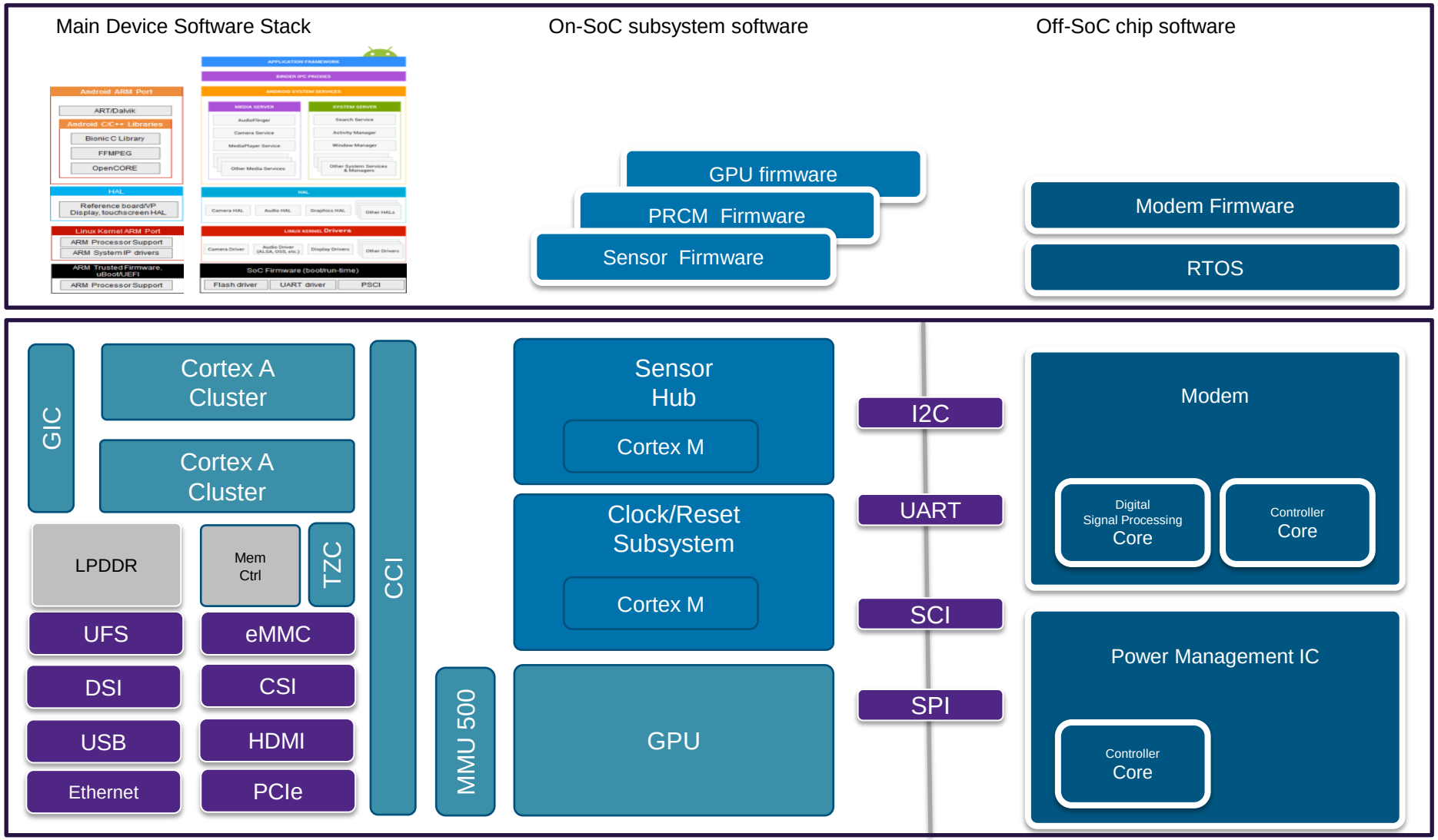
Software Binary Compatible with the ARM Base Platform



SYNOPSYS®

Broader Hardware & Software Scope

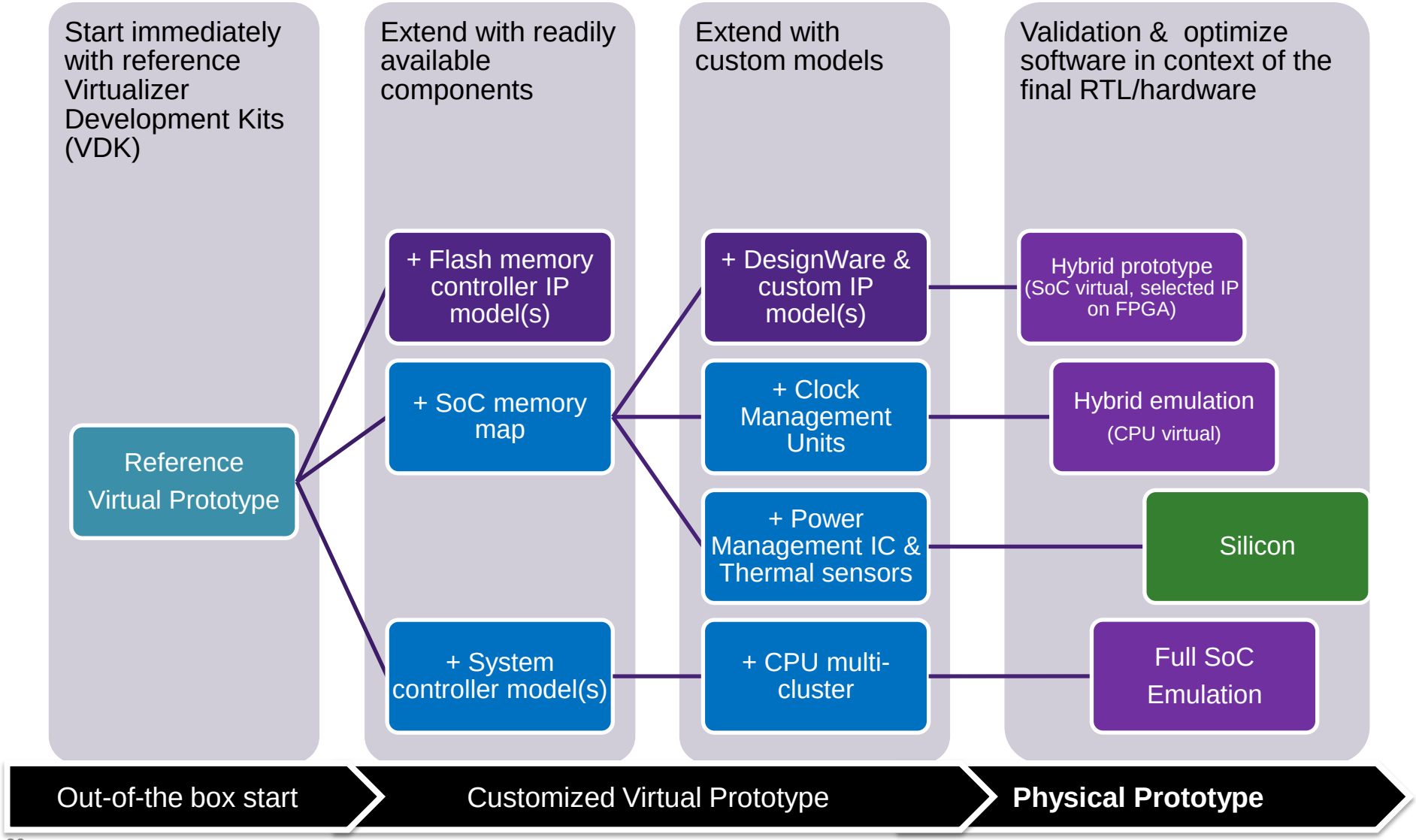
Mobile Application Processor SoC



SYNOPSYS®

Incremental VDKs → Immediate Impact

Steps to software readiness



SYNOPSYS®

Power Management SW Bring-Up Using VDKs

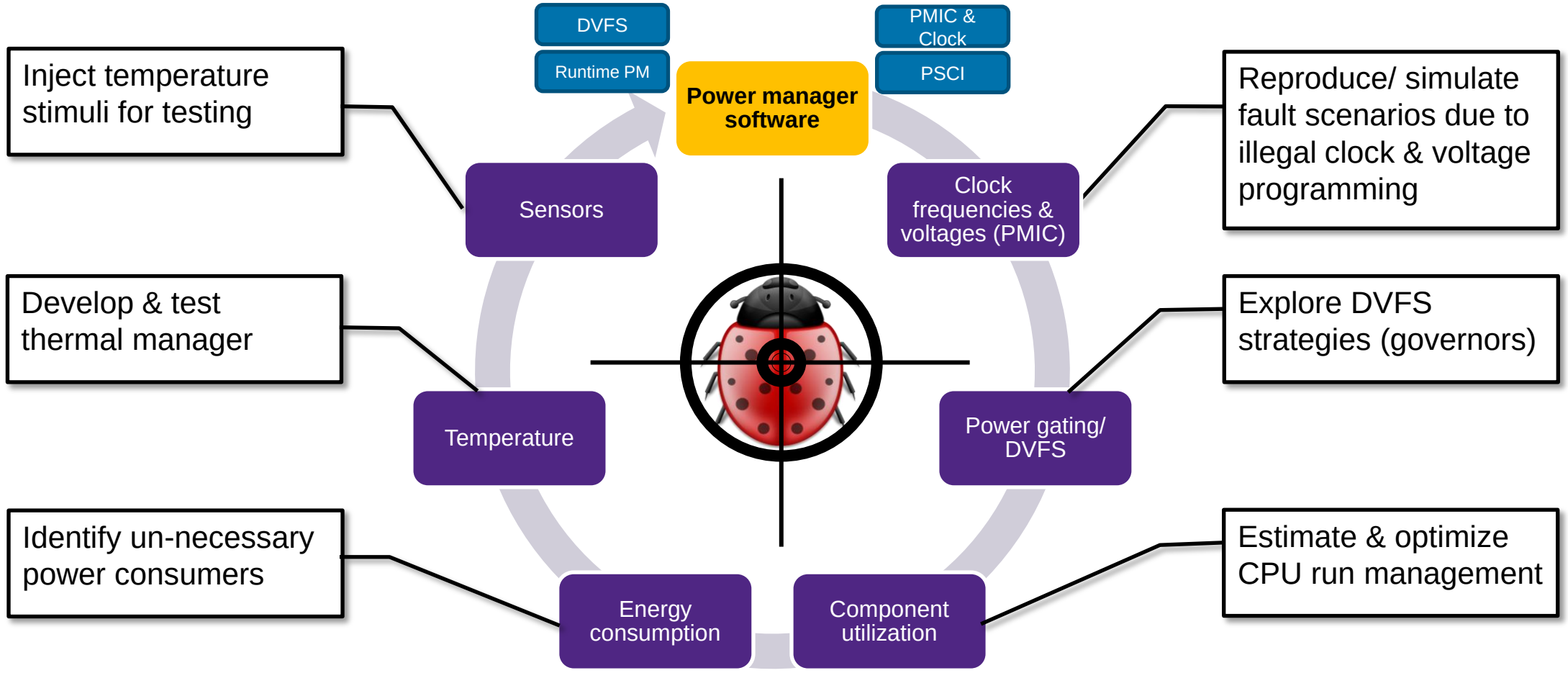
Case Study

- Accurate Implementation and Verification for Low power control
  - Driver functionality was confirmed to be same as target specifications
- Connection between Linux and power management system
  - Successfully developed whole functionality before final HW RTL or silicon availability
- Debug Power management system firmware

SYNOPSYS®

Software Power Management Bring-Up

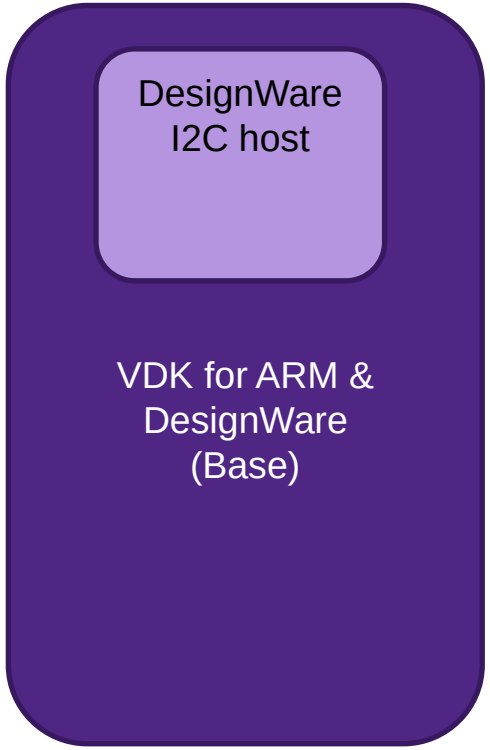
Use-cases

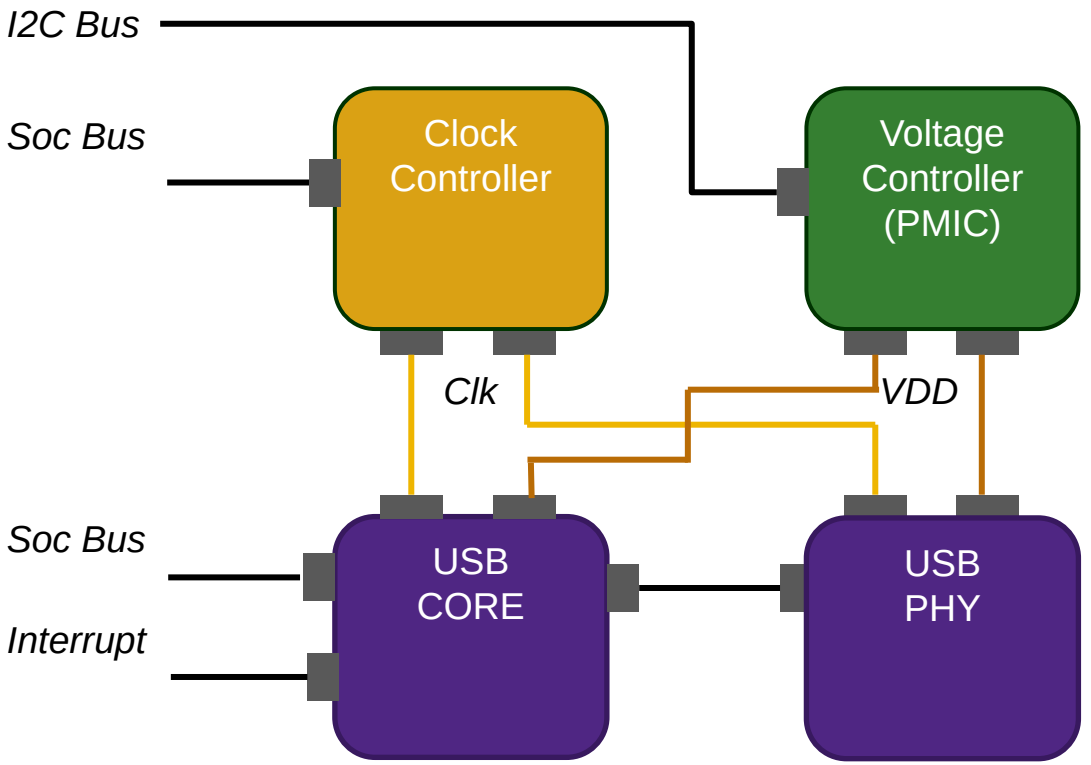


SYNOPSYS®

Tiny Case Study: SoC Power Management

USB subsystem with your specific PMIC and Clock Controller

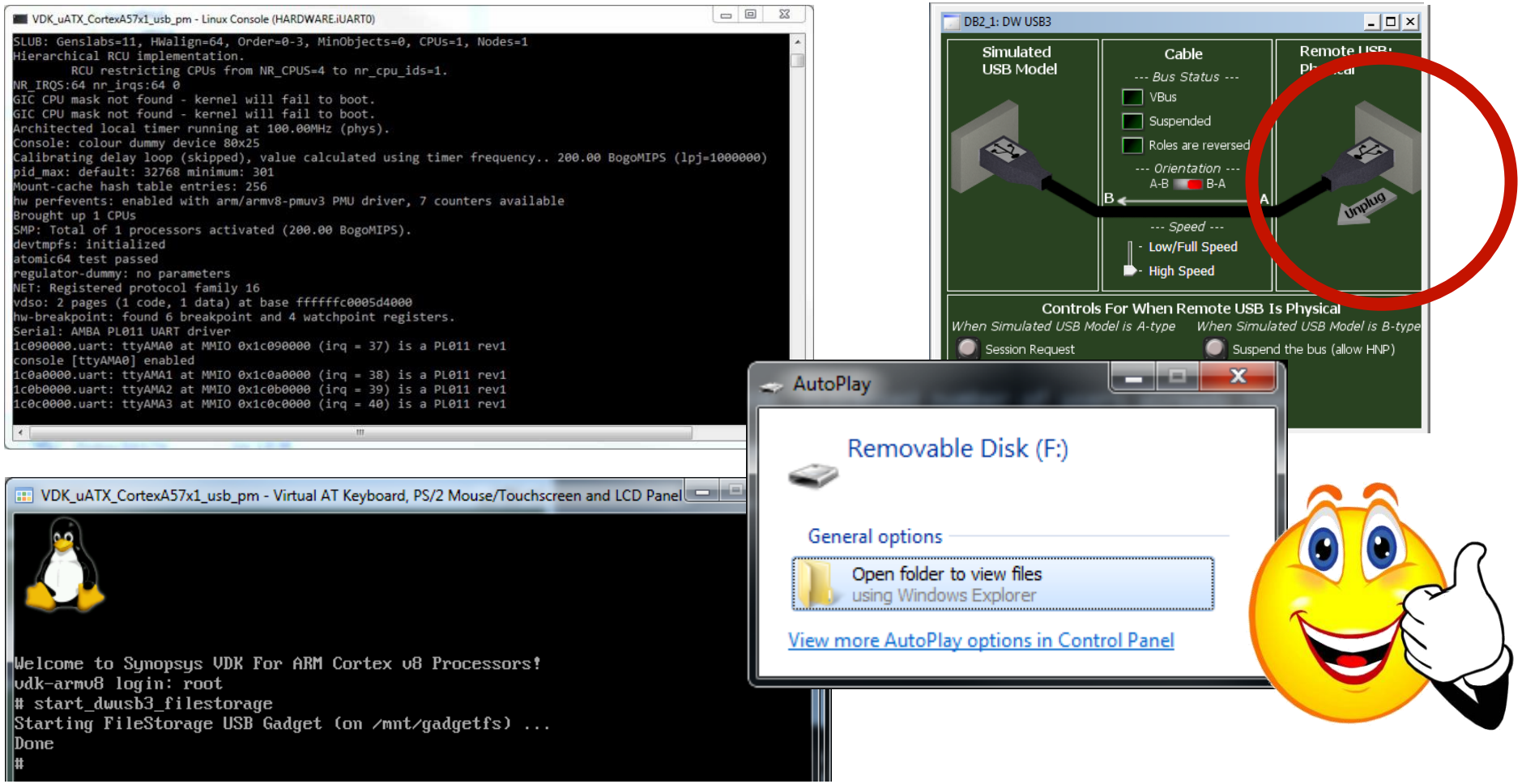




SYNOPSYS®

Case Study: Normal OS & Driver Operation

Booting and using USB for a file storage gadget

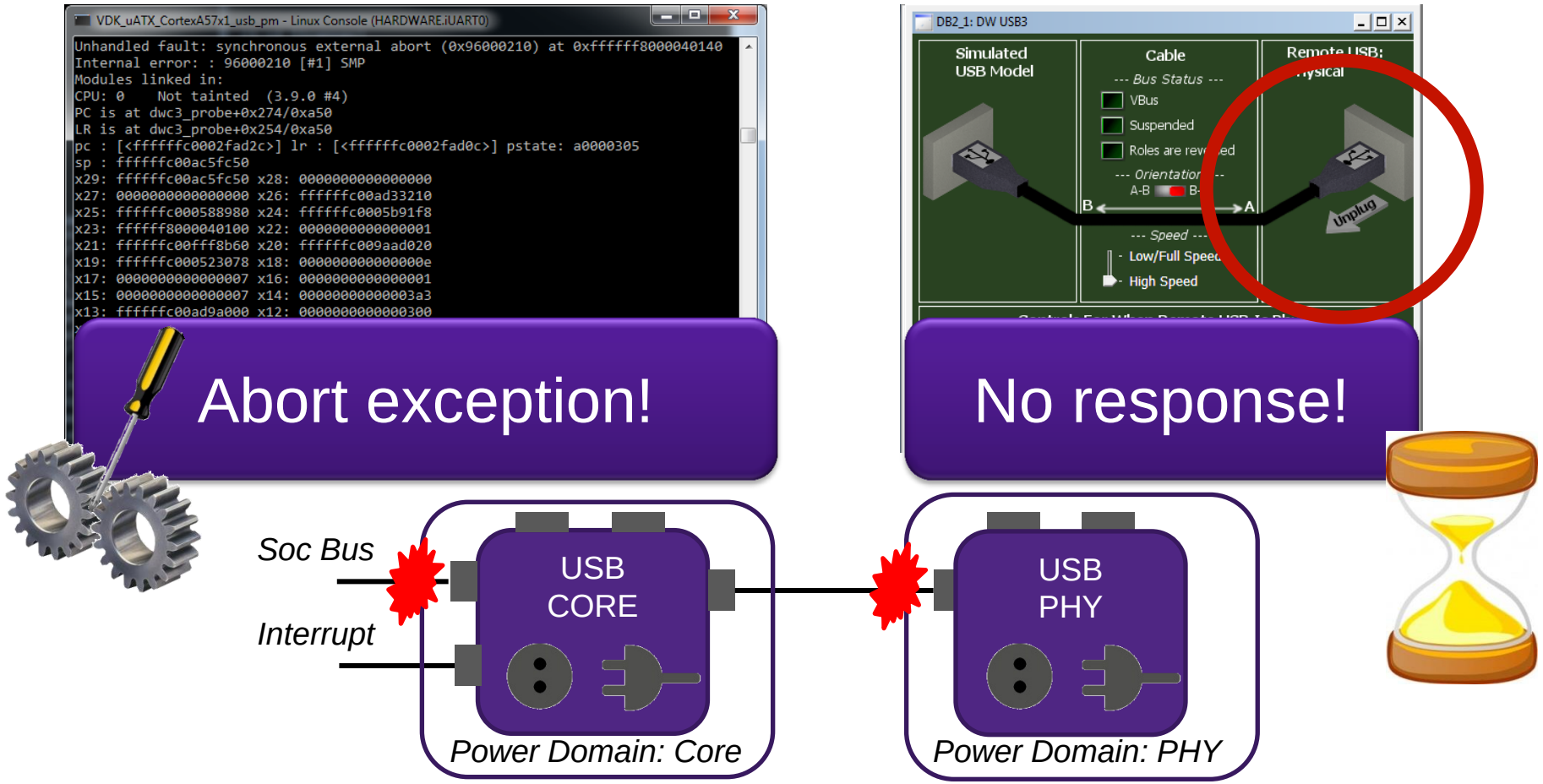


SYNOPSYS®

Case Study: Driver Faults from Power Bug

Booting and using USB for a file storage gadget

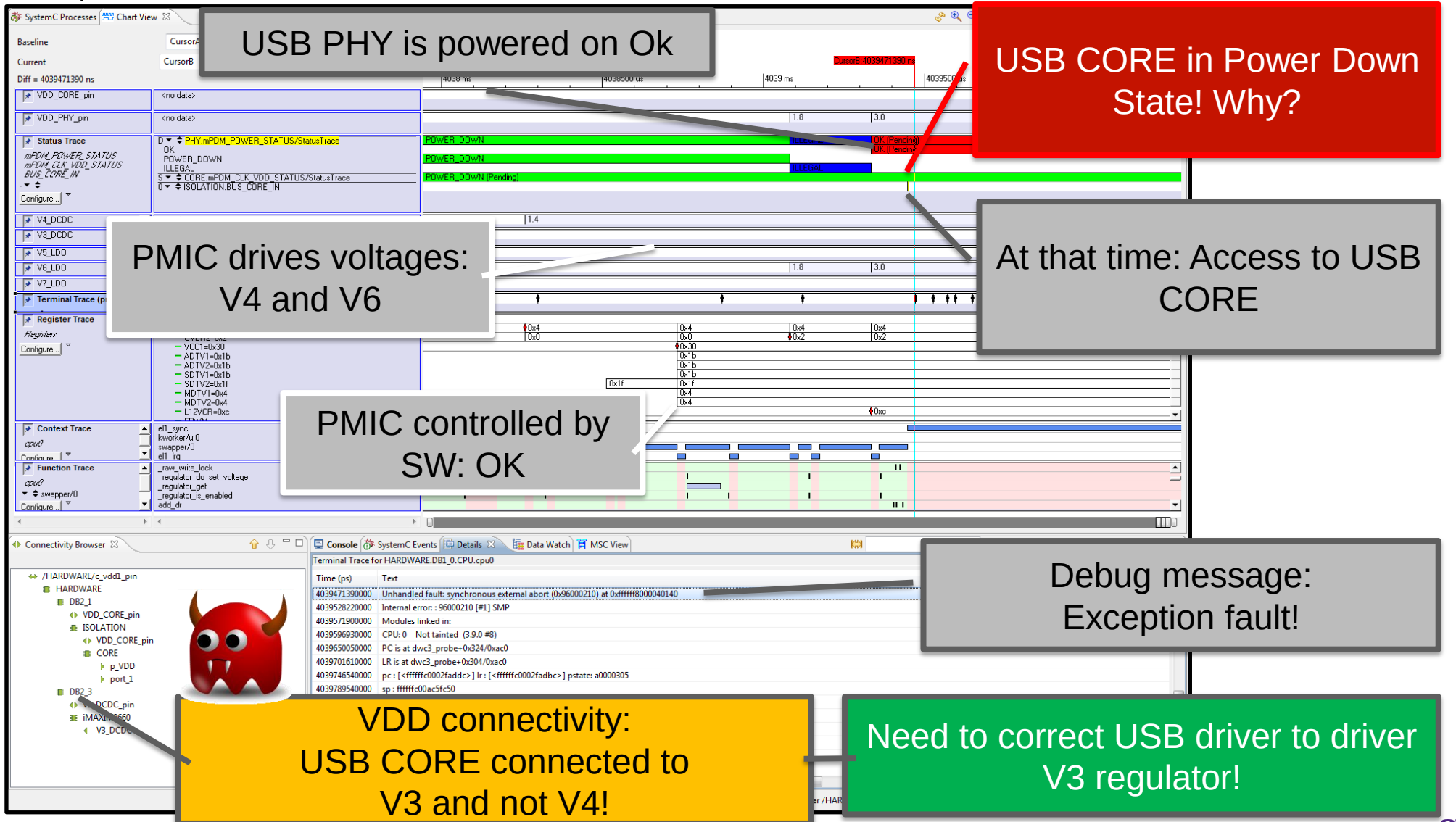
- Unpowered USB core
- Unpowered USB PHY



SYNOPSYS®

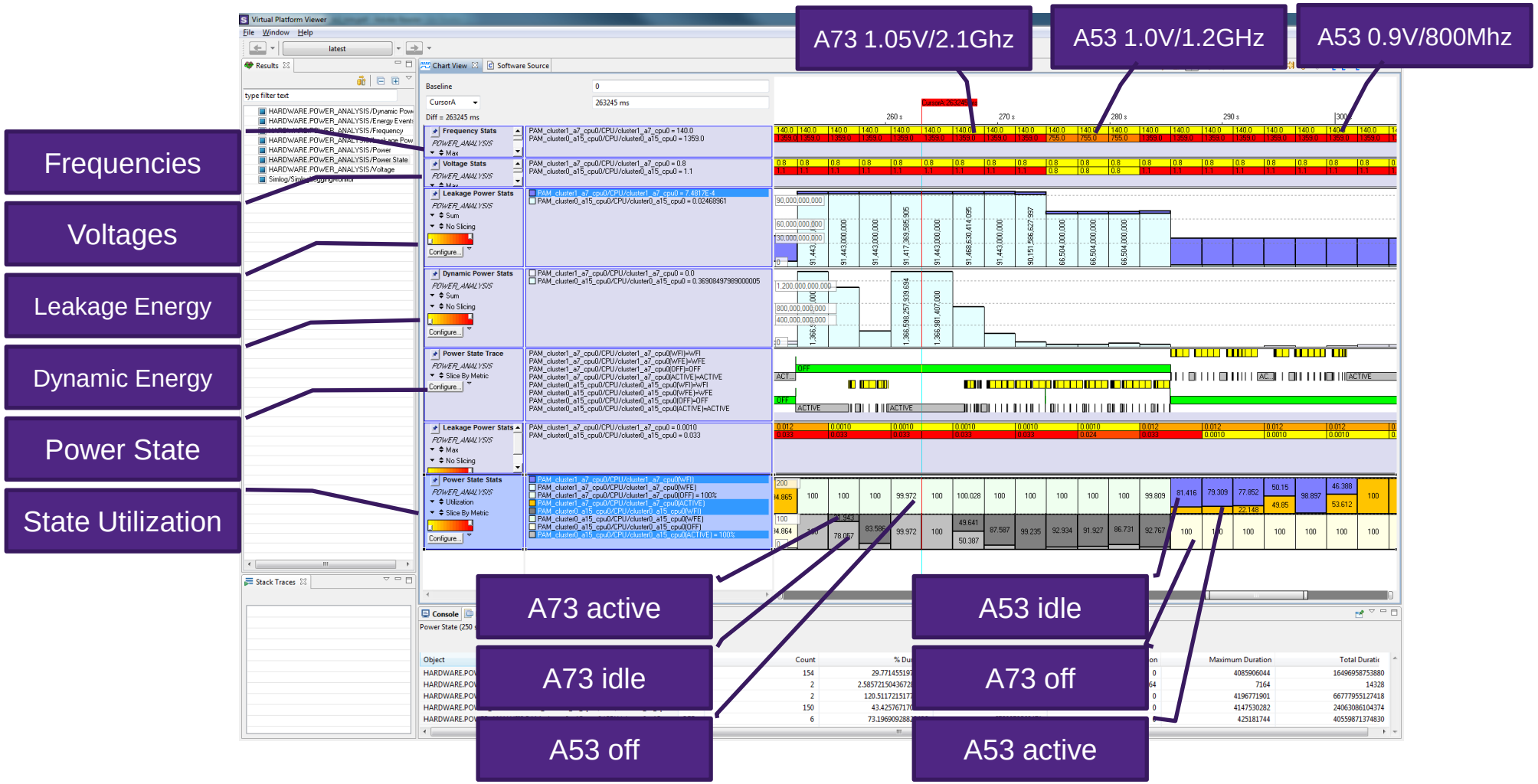
Case Study: Root Cause Analysis with VDK

Using a VDK, there is more to see!



Dynamic Power Analysis: DVFS Support for ARM Cortex

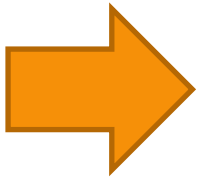
Frequency, Power, Performance and Workload analysis based on VDK



SYNOPSYS®

Agenda

- From Reference Software to Production
- Shift Left – with Virtual Prototype & Virtualizer Development Kits
- Case Study – Power Management SW Bring-Up using VDK
- Q&A



SYNOPSYS®

SYNOPSYS®
Silicon to Software™

Thank You