Combining Emulation and Virtual Prototyping – The Whole Is Greater Than the Sum of Its Parts

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Agenda

Hybrid System Level Emulation – Platform Goals

Shift left with Pre-Silicon Platforms

Bringing the Platform to Life

Technical Challenges

Results

The Bigger Picture – Pre-Silicon Continuum

Hybrid System Level Emulation
Platform Goals

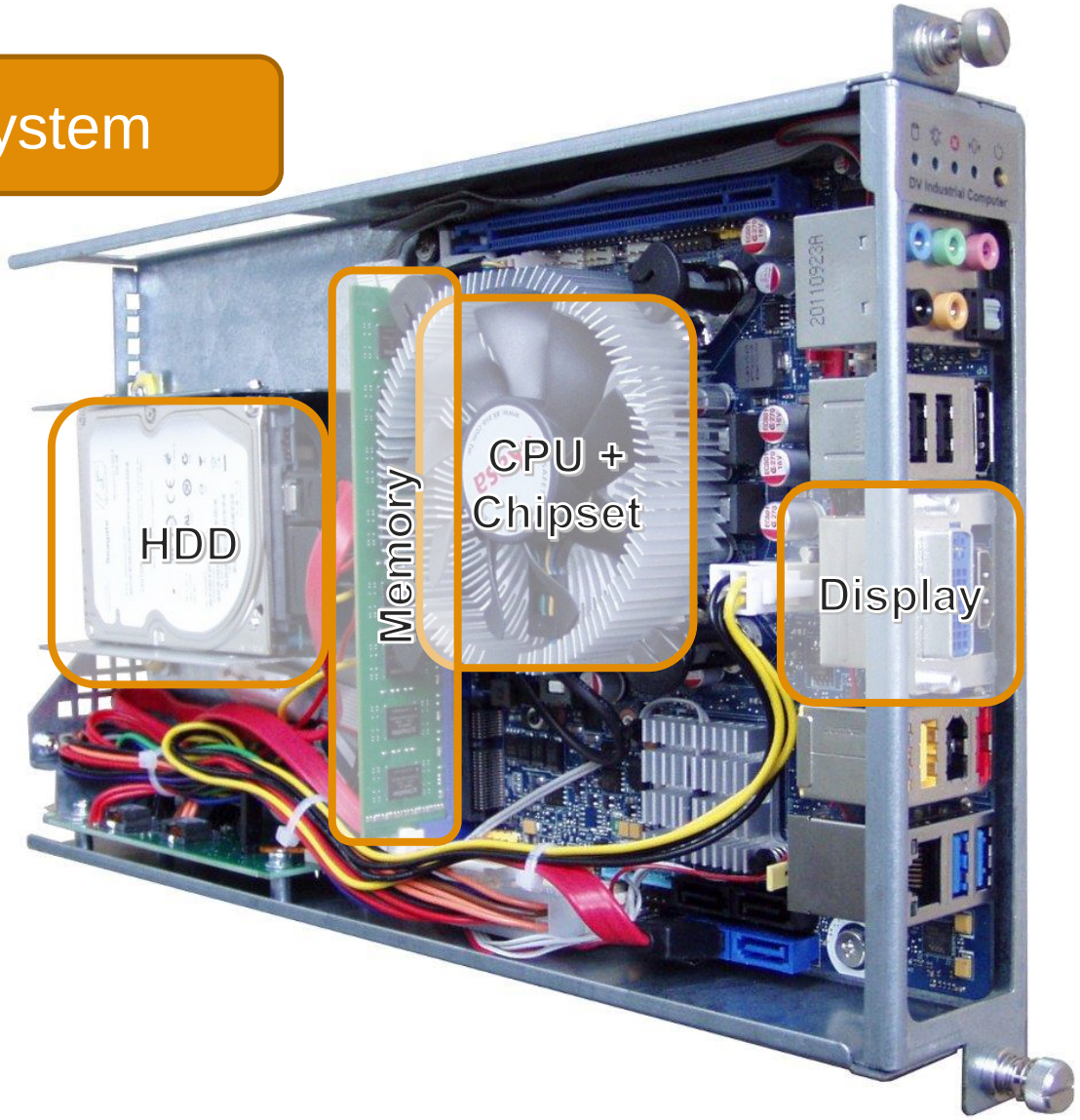
- Speedup effective performance
- Reduce emulation model size
- Meet system validation goals
  - Shift Left System Validation (SV)
  - HW/SW Co-validation

Enabling use cases not possible with system level emulation (SLE)

- Execute operating system (OS) based validation with production SW stack pre-silicon (Pre-Si)

Shift left with Pre-Silicon Platforms

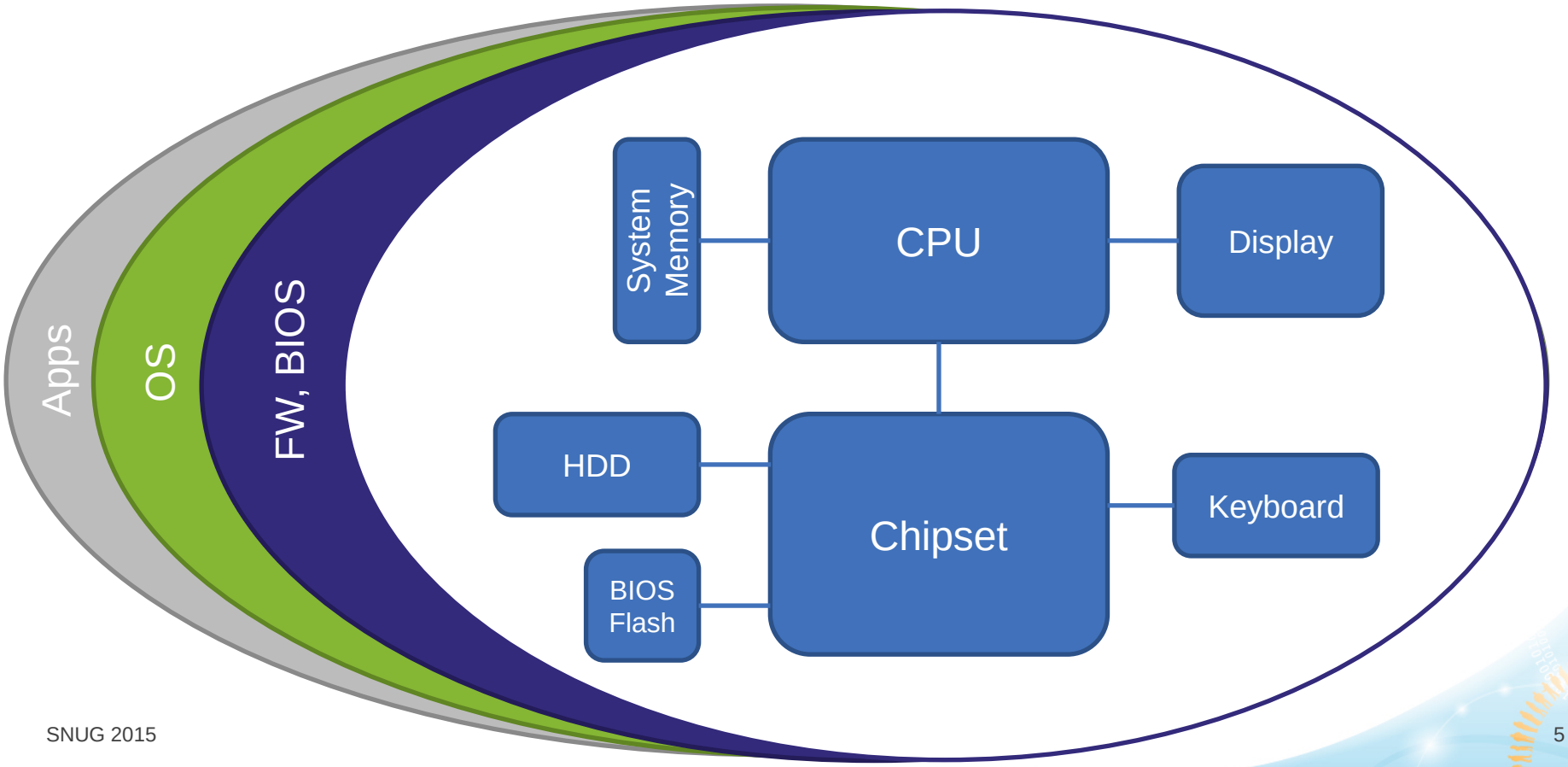
Think System



Shift left with Pre-Silicon Platforms

Think System

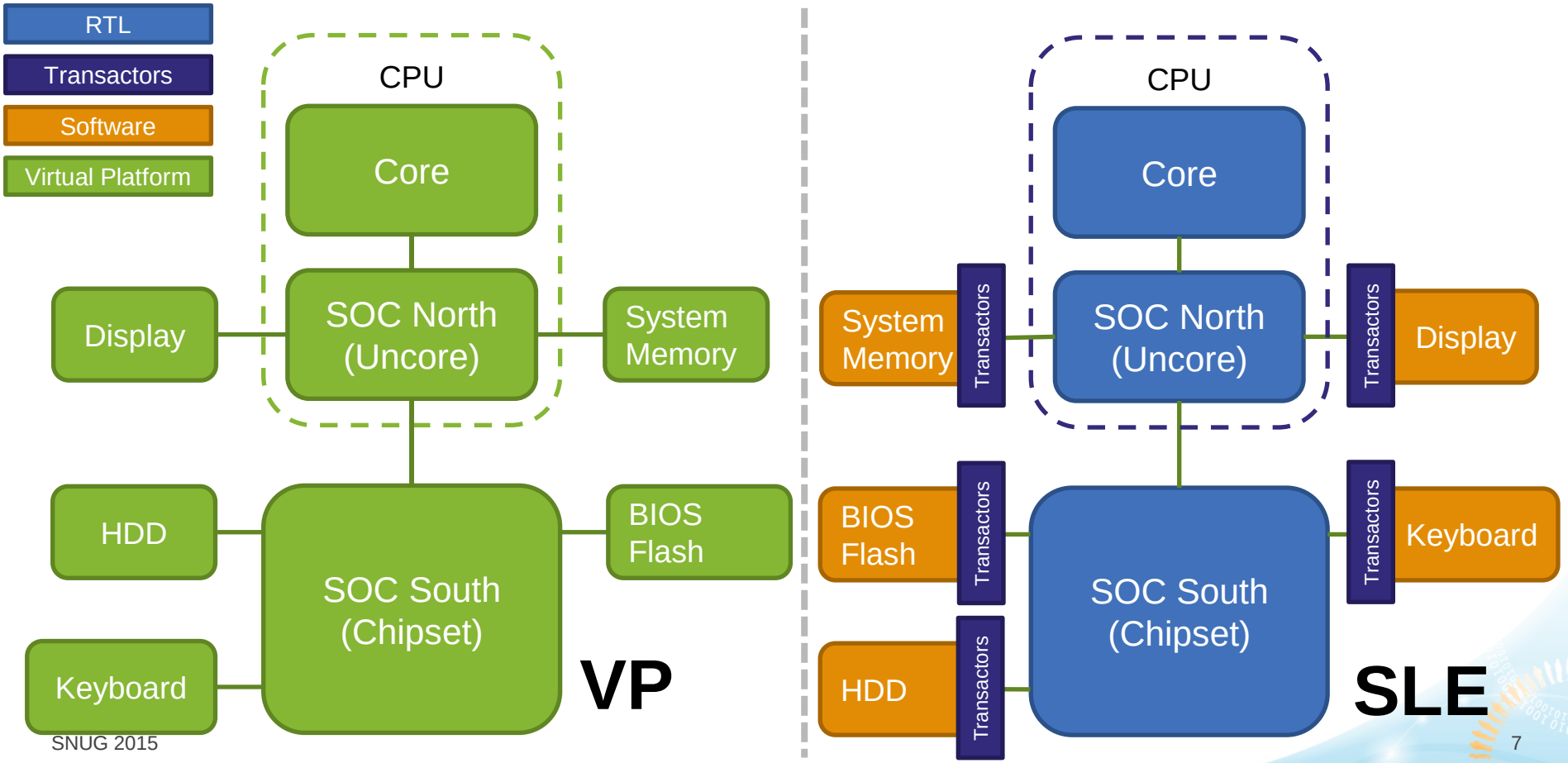
Think Platform



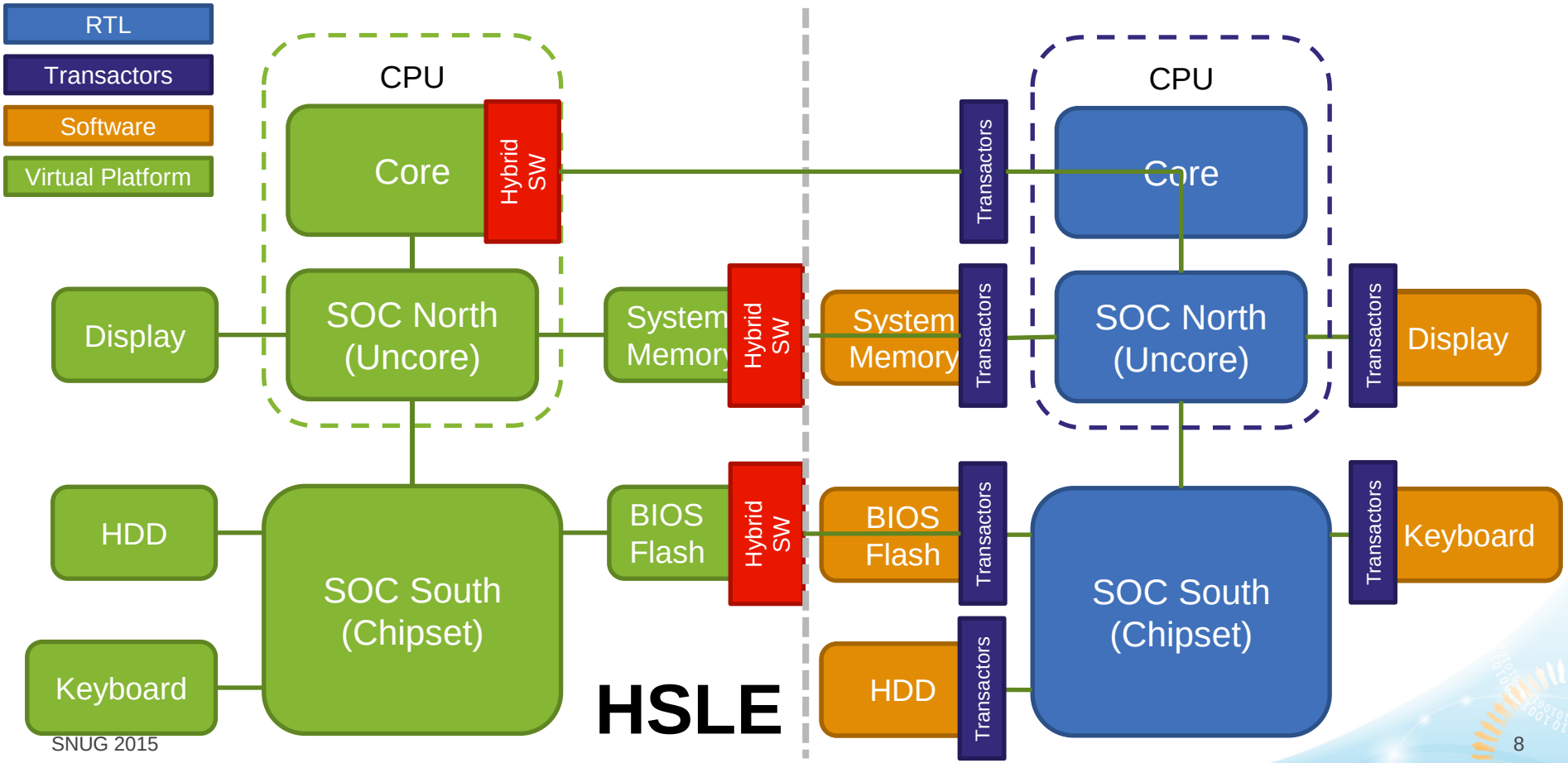
Pre-Si Platforms We Use

	Virtual Platform (VP)	Emulation (SLE)	Hybrid Emulation + VP (HSLE)
Properties	• High speed functional simulator • Good debug-ability • Early availability	• RTL accuracy • Good debug-ability • Longer integration time	• RTL accuracy + functional accuracy • Great debug-ability • Less expensive by ~33% (#boards)
Drawbacks	Not the real HW	Low runtime speed vs. VP/FPGA Expensive ($)	Single outstanding transaction from Core
Use Cases	• Software and Firmware development	• RTL development and validation	• HW/SW Co-validation • System use case validation
Time for OS Boot	Minutes	Weeks	350X

Bringing the Platform to Life

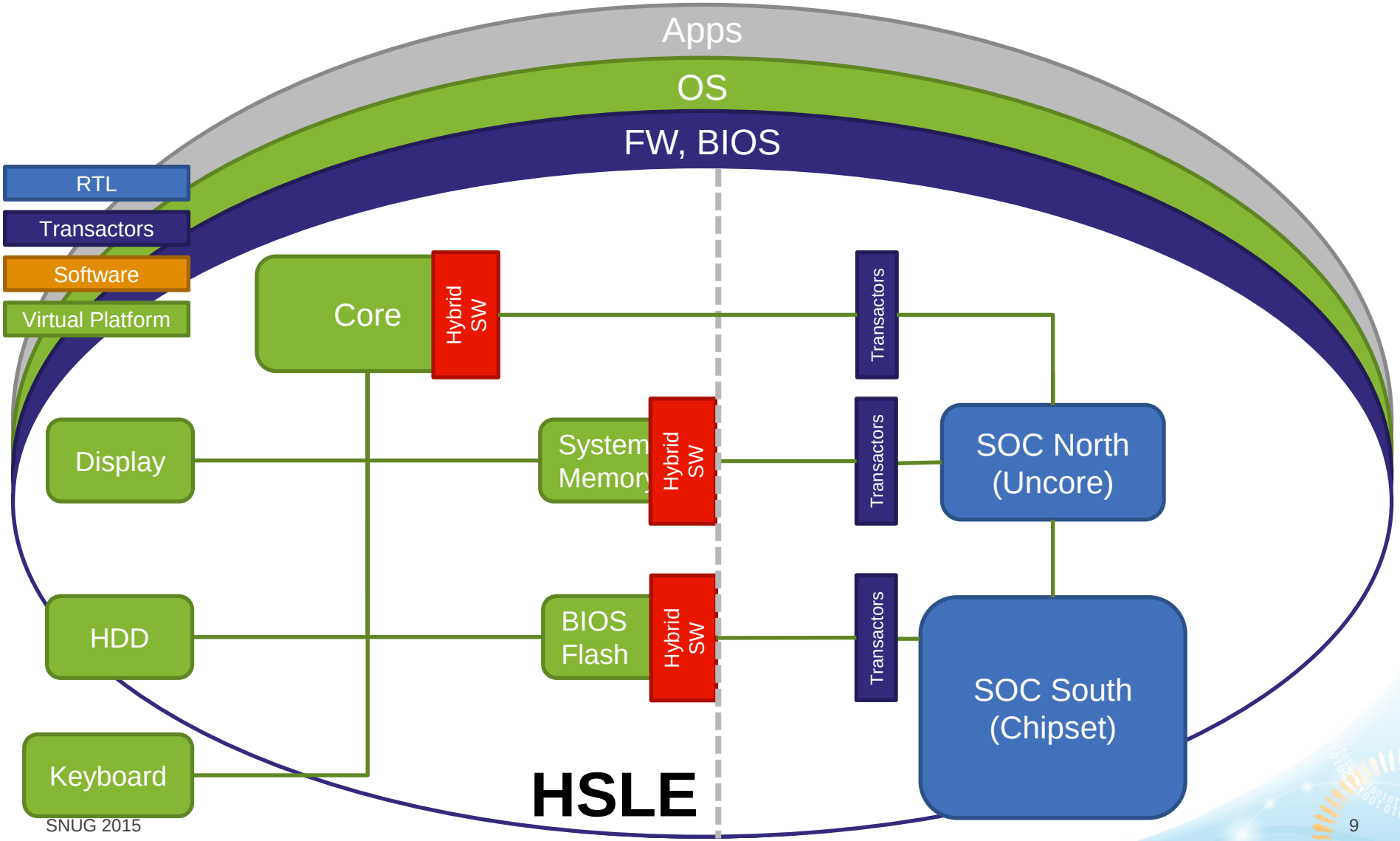


Bringing the Platform to Life



Bringing the Platform to Life

Enabling the use case: Execute OS based validation with production SW stack Pre-Si



Technical Challenges

- The hybrid SW bridges the gap between levels of abstraction
  - Keeping both platforms “unaware” of the hybrid connection
    - SLE is RTL level accuracy
    - VP is architectural level simulator
- HSLE partitioning – Balance between emulation and VP
  - Balance validation coverage and runtime performance
    - Different configurations for different use cases
  - Execute code at VP speed boosts the effective performance
    - System memory and BIOS flash in VP
    - What about other devices? e.g. HDD, keyboard, display, etc.

Results

- The hybrid SLE partitioning significantly **increases effective performance**
  - Booting OS with production SW
  - Achieved speed of several hundreds KHz driver clock
    - Same as SLE
  - Dense and complex design fitted into ZSE1

X350 Speedup!

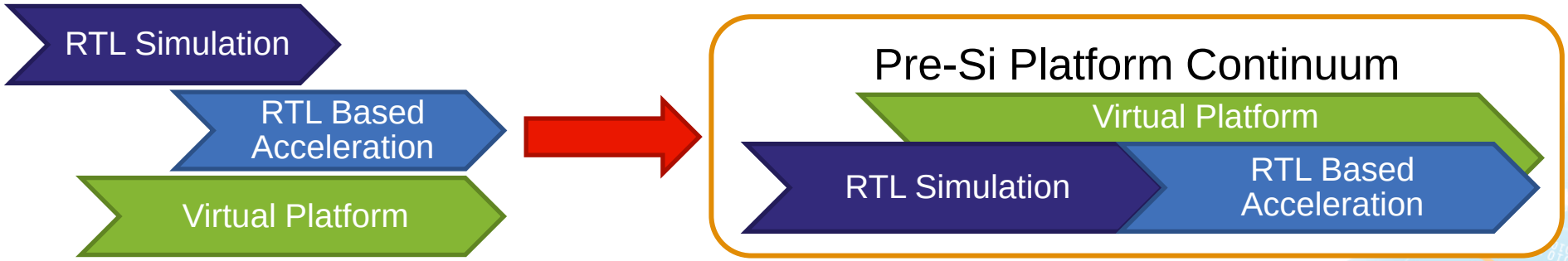
- Removing the CPU core **reduces the emulation model size**
  - Better Utilization of Emulation Capacity

33% Reduction!

Enabling use cases not possible with SLE

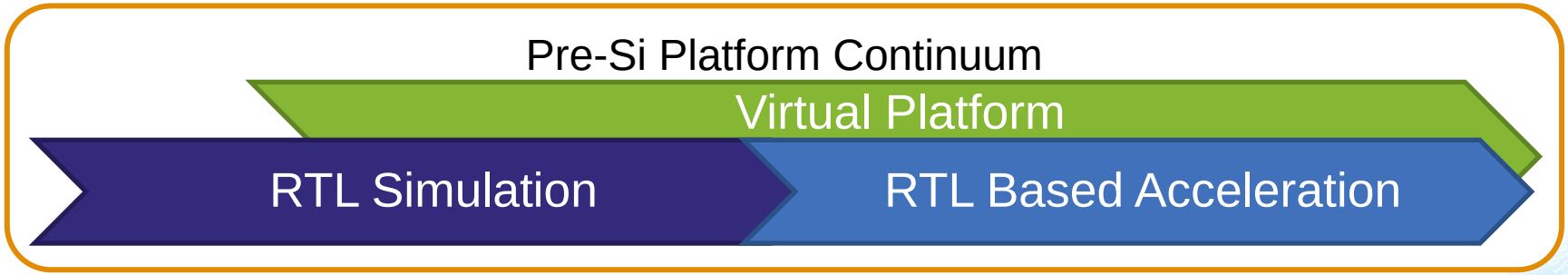
Result Retrospective

- We're taking advantage of a mature and stable VP and SLE
  - Intel is investing in development of a functional accurate VP
- Can we avoid effort duplication?
  - Share virtual device model between RTL simulation, SLE and VP
    - Share across products
  - IP vendors can provide virtual model and collaterals
  - EDA tools can enable reusing the same collateral across platforms



The Bigger Picture – Pre-Si Continuum

- The need for continuum across the product life cycle and seamlessly support reuse from platform to platform
  - Maximum reuse and minimal additional work per platform
- Easily reuse functional validation content across IP and integration
  - Reuse across different technologies and usage models
- → Develop software and firmware Pre-Si
- → Verify end product use cases Pre-Si



(*) Chris Lawless, Intel Corporation, EDPS 2014, California USA
(*) Bill Hodges, Intel Corporation, SNUG 2014, Texas USA

Summary

- **Enabling SV use cases not possible with SLE**
  - Booting OS with production SW executing SV applications
- **Speedup effective performance** → X350 speedup
  - Enabling Use Cases Not Possible With SLE
  - Some workloads are speed-up better (CPU centric workloads)
- **Reduce emulation model size** → ~33% reduction
  - Better Utilization of Emulation Capacity
- **The need for continuum** across the product life cycle and seamlessly support reuse from platform to platform
  - Need to shift our partners and vendors

Thank You