



Hewlett Packard
Enterprise

VERIFICATION BEYOND COVERAGE

ENABLING ENGINEERS WITH VERIFICATION BIG DATA



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Design Automation Conference
July 10th, 2023

My Verification Methodology Goals

Drive a **high-quality design** in first silicon

Drive increased **engineering efficiency**

Drive **maximum value** from expensive licenses



Our Starting Point: What is the “Coverage Life”?

And what would “Beyond Coverage Life” be?



Coverage Life is...

- Just a source of Verification Big Data
- Analyzed to identify useful information which drives intelligent decisions

Beyond Coverage Life involves...

- An expanded set of Verification Big Data across multiple data domains
- With tools that enable more complex data analysis and decision assist
- That produces more valuable and more useful information driving more intelligent decisions

Current Coverage Opportunities HPE Has Working Today



Basic Coverage Opportunities

Define relationships between coverage and test plans
Automated aggregation methodologies



Intermediate Coverage Opportunities

Prove coverage reachability
Test grading analysis
Coverage data management methodologies



Advanced Coverage Opportunities

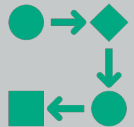
Track hard-to-hit coverage points (tests and constraints that hit them)
Identify optimal iterations of each test contributing to coverage
Provide feedback on most effective/ineffective tests based on coverage

New Opportunities With Coverage Data



Smart Regression (save/restore/reseed)

Identify interesting simulation states to create save point
Many-rats analysis by creating pre-failure save point
Relaunch regression from these interesting save points



Stimulus-co verage relationship s

Enables engineers to more quickly create precise tests targeting specific features



Dynamic Cover Groups

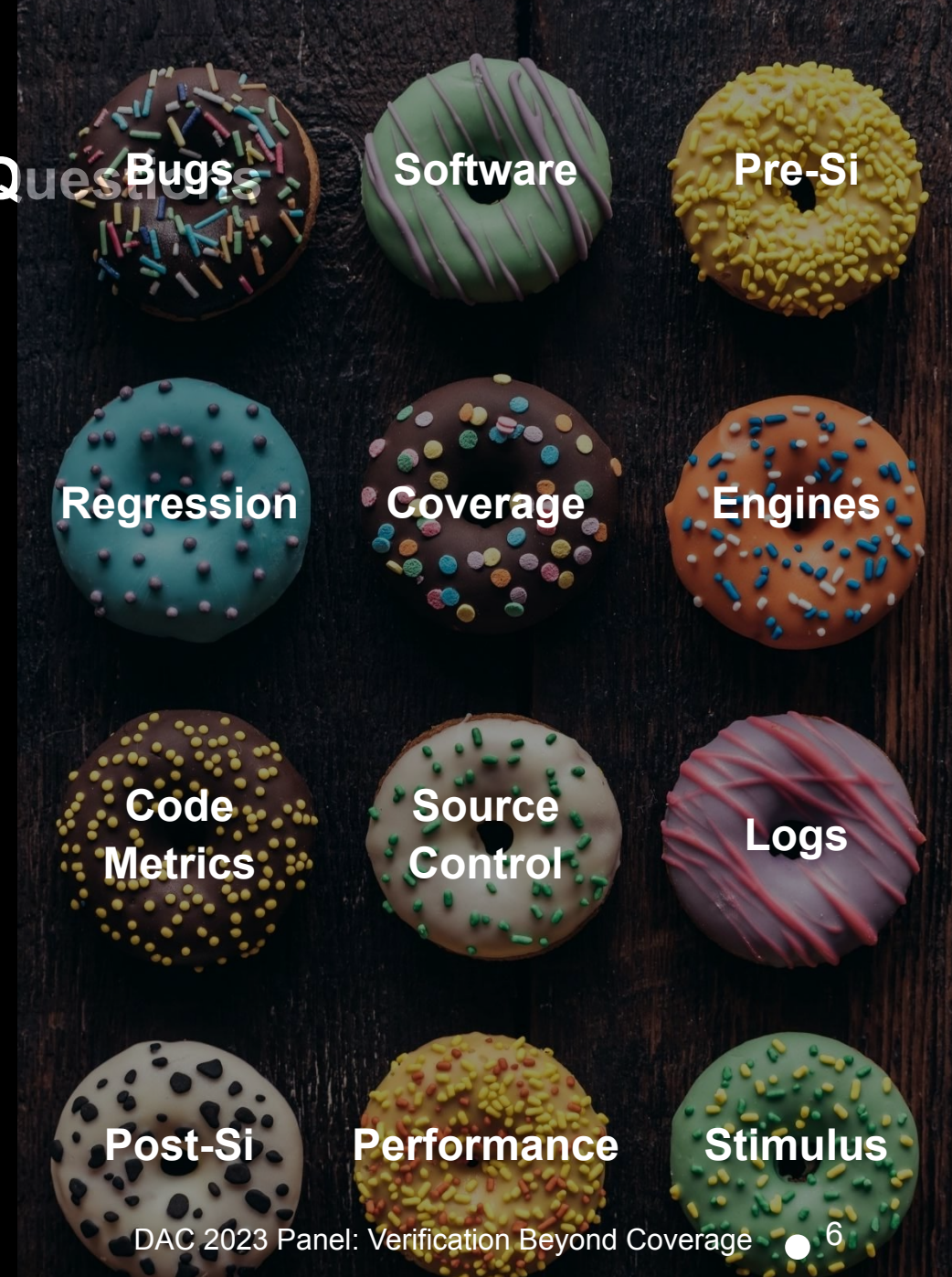
Post processing to evaluate newly defined cover groups

Beyond Coverage Opportunities

Many Data Domains to Answer More Complex Questions

Analyze multiple data domains as one data set

- How does LOC/#FIXMEs/assertion density relate to bug rates?
- Are code complexity or change rate good measures of bug risk?
- Is stimulus source (UVM, SW, Stone, Stress) driving bugs?
- Which engines are providing the biggest return on investment?
- How can we dynamically steer test stimulus based on coverage?
- How can we merge coverage from multiple engines to remove duplicate work?
- How do I measure the tests that are the most productive



Beyond Coverage Opportunities: Intelligent Tools to Assist in Multi-Domain Analysis



Intelligent Data-Driven Test Selection

- **Tune** job manager (i.e. LSF) test memory requirements
- **Maximize** test iterations driving most coverage OR bugs
- **Prioritize** tests (valuable tests, starved tests, coverage focused tests, bug hunting tests, short/long running tests, ...)
- **Skip** repeatedly failing tests until fix comes in, then prioritize

Triage Assist

- **Optimize** efforts consuming mode of engineers' time

Tools to Increased Reuse Across Domains

- Pre/Post-Silicon, ASIC/SW, Performance Validation
- **Optimize** Use of Verification Engines: How can data analysis help split workload across engines versus just duplicating work on multiple engines?
- **Utilize** common test definitions used across domains
- **Enable** technology independent checkers

Beyond Coverage Opportunities: Tools Without Methodologies Doesn't Enable Engineers



All Must Be Supported by Solid Methodologies



Intelligent Test
Selection

Triage Assist

Reuse Across
Domains

VLSI R&D in HPE

David Lacey

- Master's Degree in EE from Louisiana Tech University
- Working in system design for over 30 years
- Experience spans from embedded systems specification and design, hardware design, and FPGA and ASIC design and verification
- Currently serves as Chief Verification Scientist at Hewlett Packard Enterprise where he helps shape VLSI methodologies across HPE

Aruba

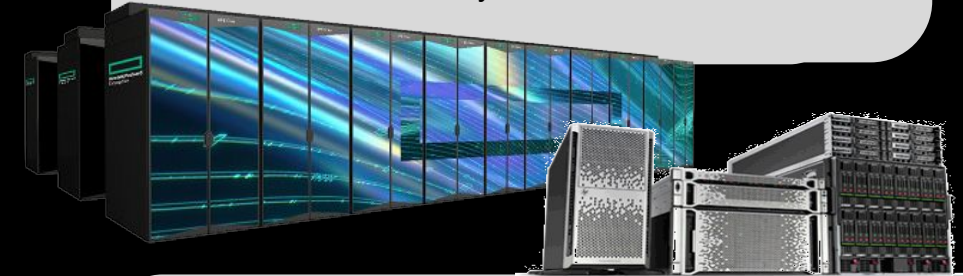
Campus Edge Switching
Network switch ASICs



HPC and AI

Slingshot
Supercomputers,
Data storage and
analytics

**Mission Critical
x86 Systems**
Scale Out and Scale Up
systems



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Systems Management
(iLO)