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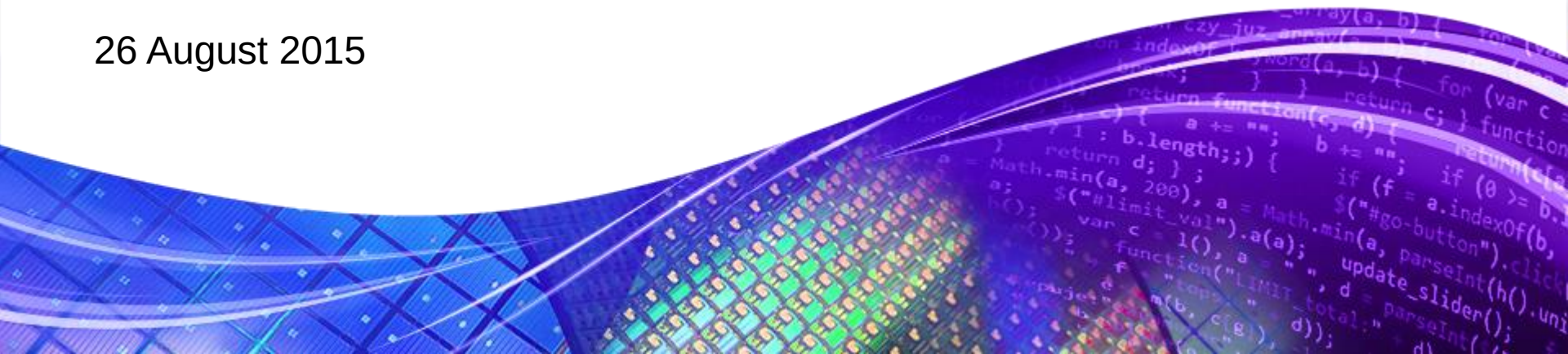
Silicon to Software™

Autonomous Cars 2015

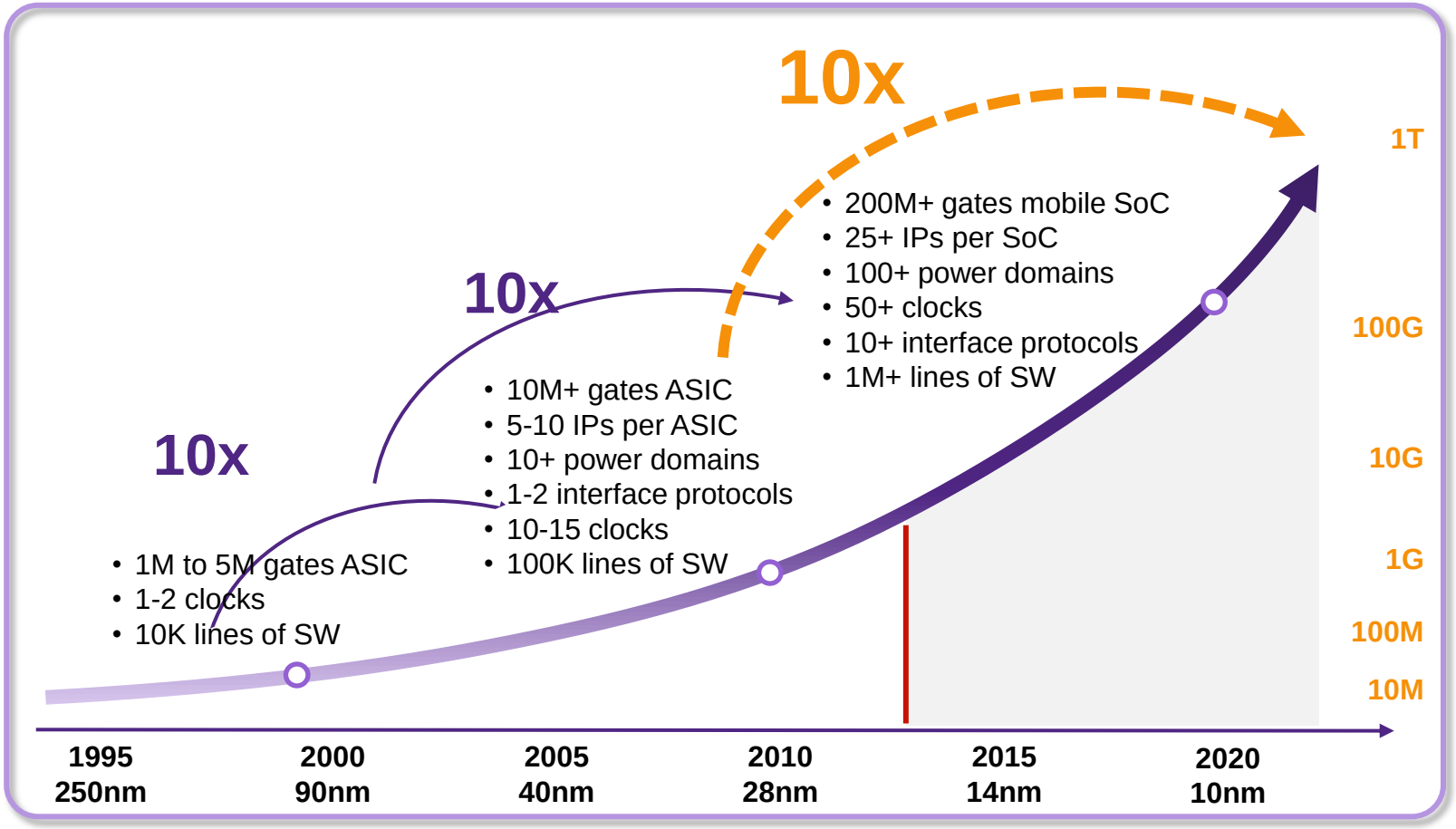
Process, Simulation, and Validation Strategies for Large SoCs. Including Safety

Jeff Hutton

26 August 2015



What Will it Take to Verify the Next Generations of SoCs?



Multiple Advanced Technologies Are Needed

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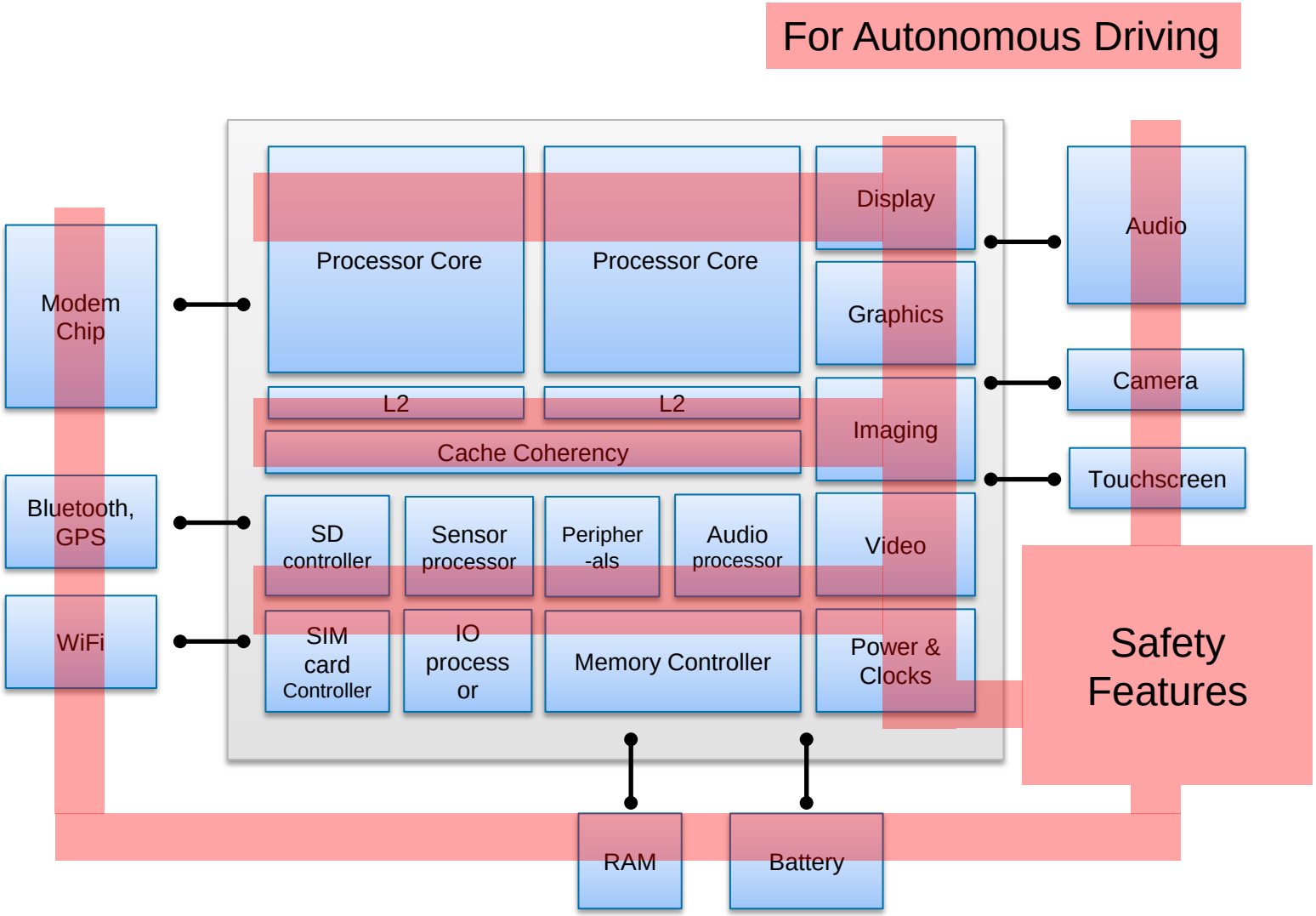
SoC Example

Mobile Applications Processor



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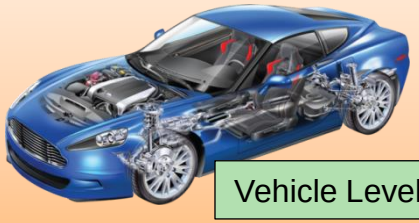
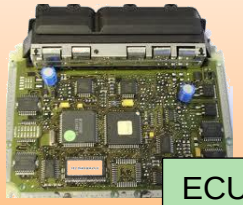
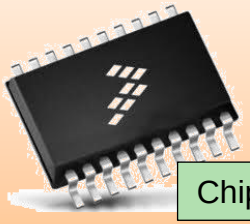
Automotive Systems - Functional Failure

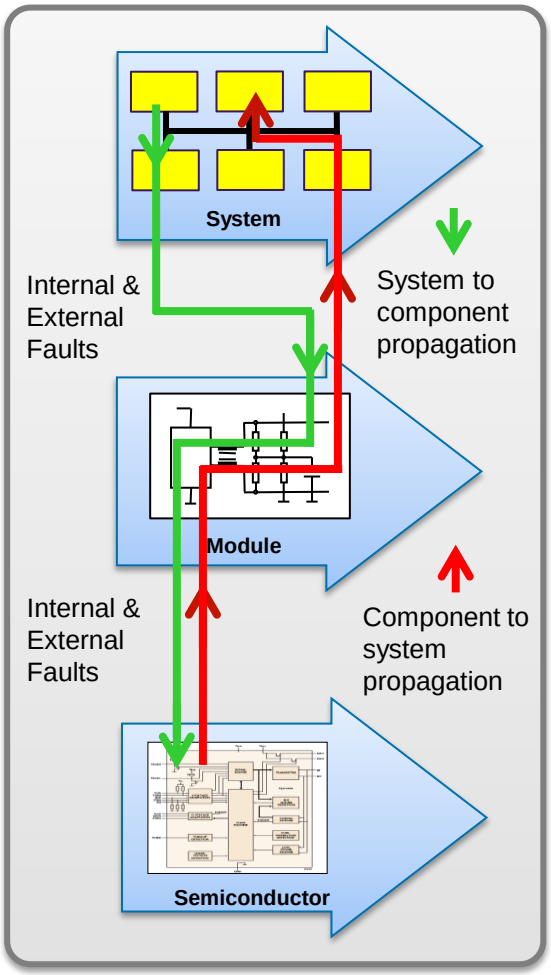
System Complexity, Fault Propagation & Analysis

Aplication Level | **Fault Origination & Propagation** | **Fault Analysis & Verification**









Diversity of Failure

- Systematic Hardware (HW) Failure
- Random HW Failure
- Systematic Software (SW) Failure

Tight HW & SW Interaction

Example 1: Falsified signal due to random HW failure in sensor -> faulty data properly processed by SW & distributed to vehicle system

Example 2: Systematic SW failure in signal processing algorithm causing falsification of original sensor signal and causing fault propagation up to system level

Multi Level HW/SW Task

- Multi-level HW/SW analysis required
- Integrated solution needed to analyze the impact of faults and to develop/verify safety concepts

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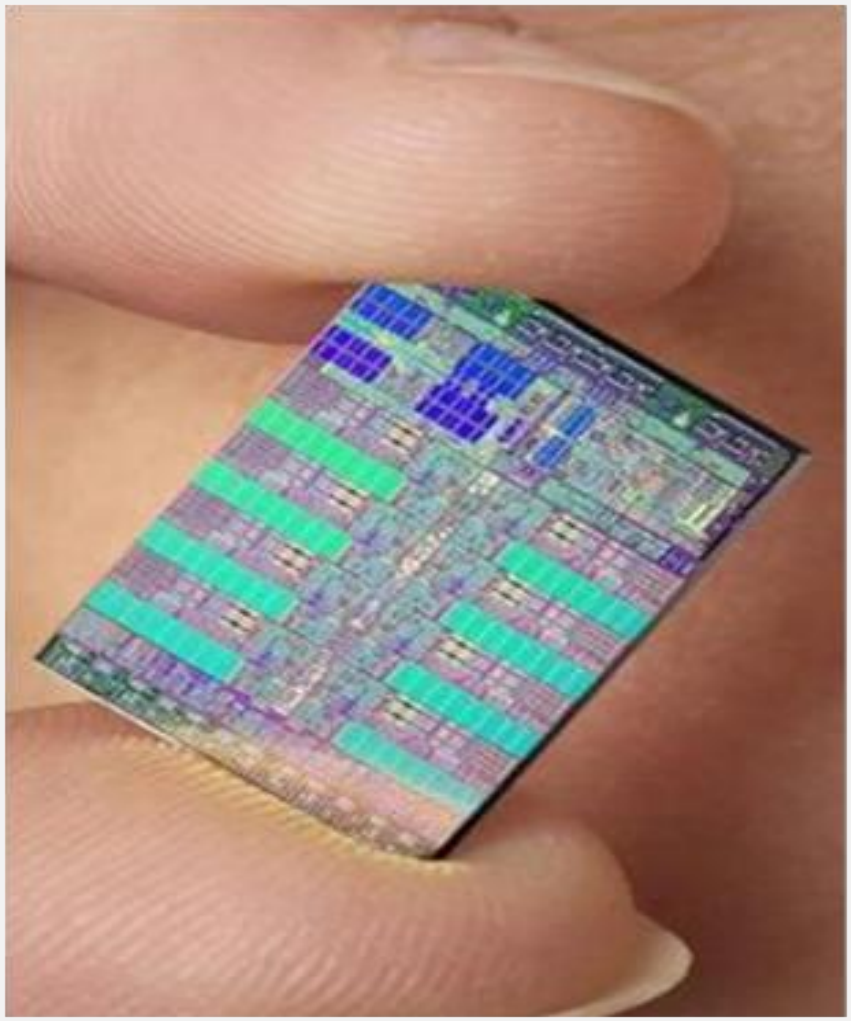
Discussion Questions (Observations)



- The SoCs are only part of an Automotive System
- Levels of models required for automotive systems
  - Behavioral Models
  - Transaction Level (Virtual Models)
  - Register Transfer Level
  - Gate Level
  - Transistor Level
  - Multi Domain Models
- Static and Formal Methods are required for very large SoCs
- Faults will need to be tested at multiple levels HW &SW

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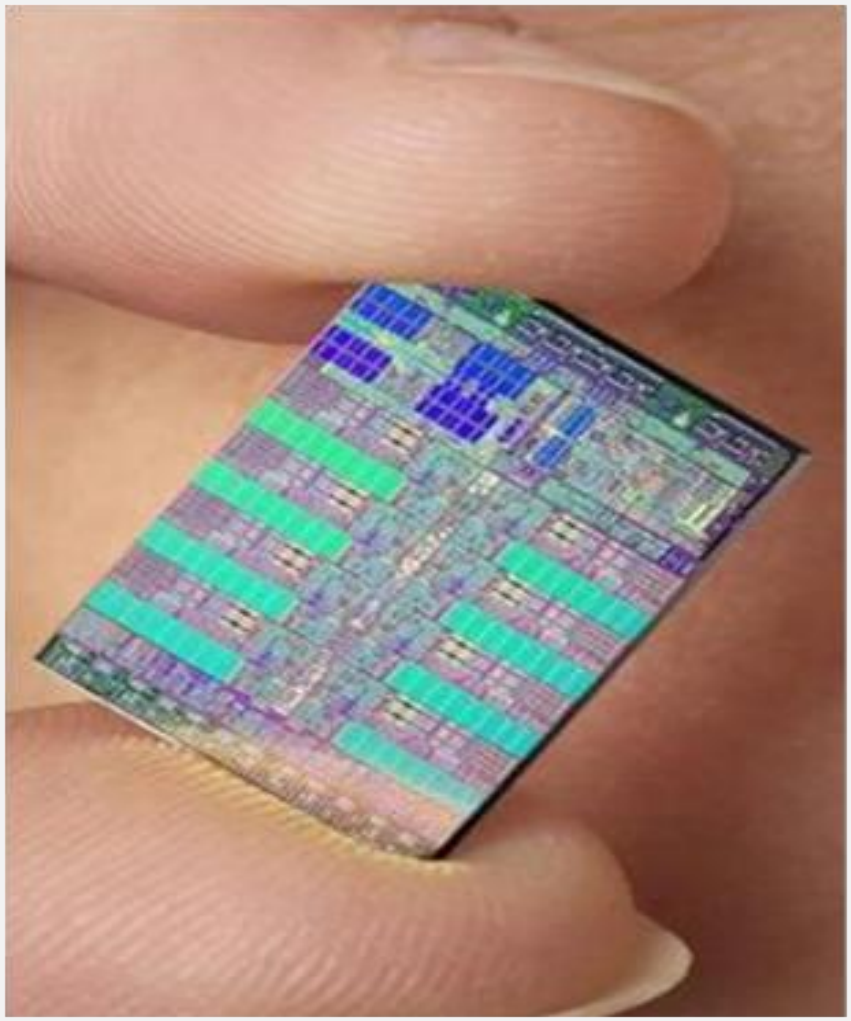
Discussion Questions



- What are your toughest challenges in validating safety critical automotive systems with very large SoCs?
  - Size/Capacity limitations
  - Time limitations
  - Technology limitations
  - How do I fault a system this large
  - ??
- What verification/validation areas need the most improvement?
- How much additional effort is required for safety critical designs?

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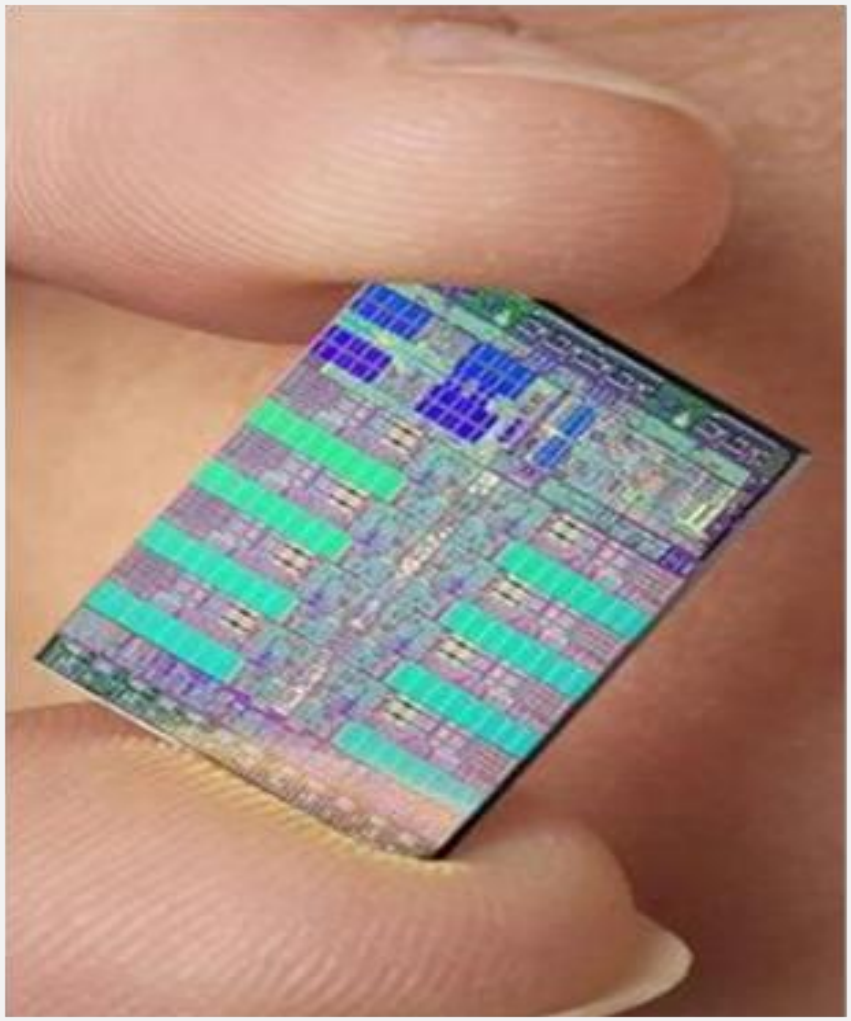
Discussion Questions



- How are you using Virtual Modeling?
  - Now
  - Future
- Are you cosimulating mechanical and electrical systems together? Faulting?
- Are you simulating SW/HW together? What level of modeling? Faulting?
- Are you using a HW Emulation system or a prototyping system for SoCs?

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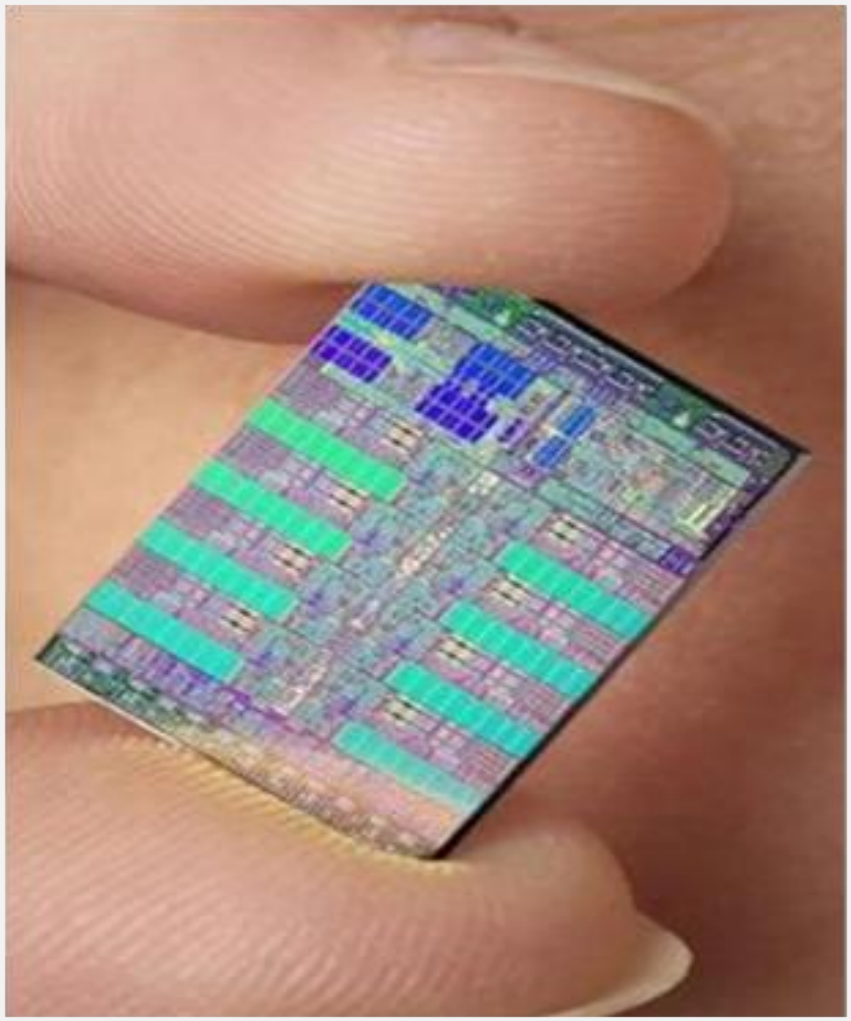
Discussion Questions



- How are you capturing, storing, and archiving all of the data?
- How is traceability (requirements, design/models, code, and tests) evolving. How has 26262 effected this evolution.
- Is code coverage being utilized adequately? Trends, Limitations?
- How can we define efficient fault containment regions?

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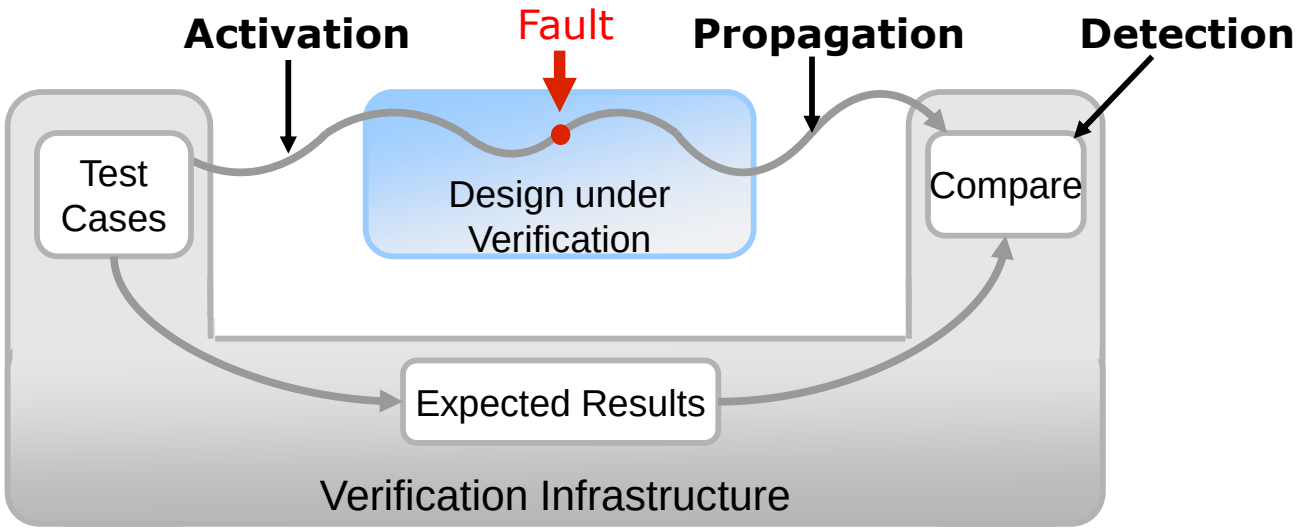
Assessing Verification Effectiveness

Exercise, propagate, and detect faults



To detect a fault…

- The test must **activate** the fault
- An effect of the fault must **propagate** to an "output" of the software
- The testing infrastructure must **detect** the behavior difference due to the fault

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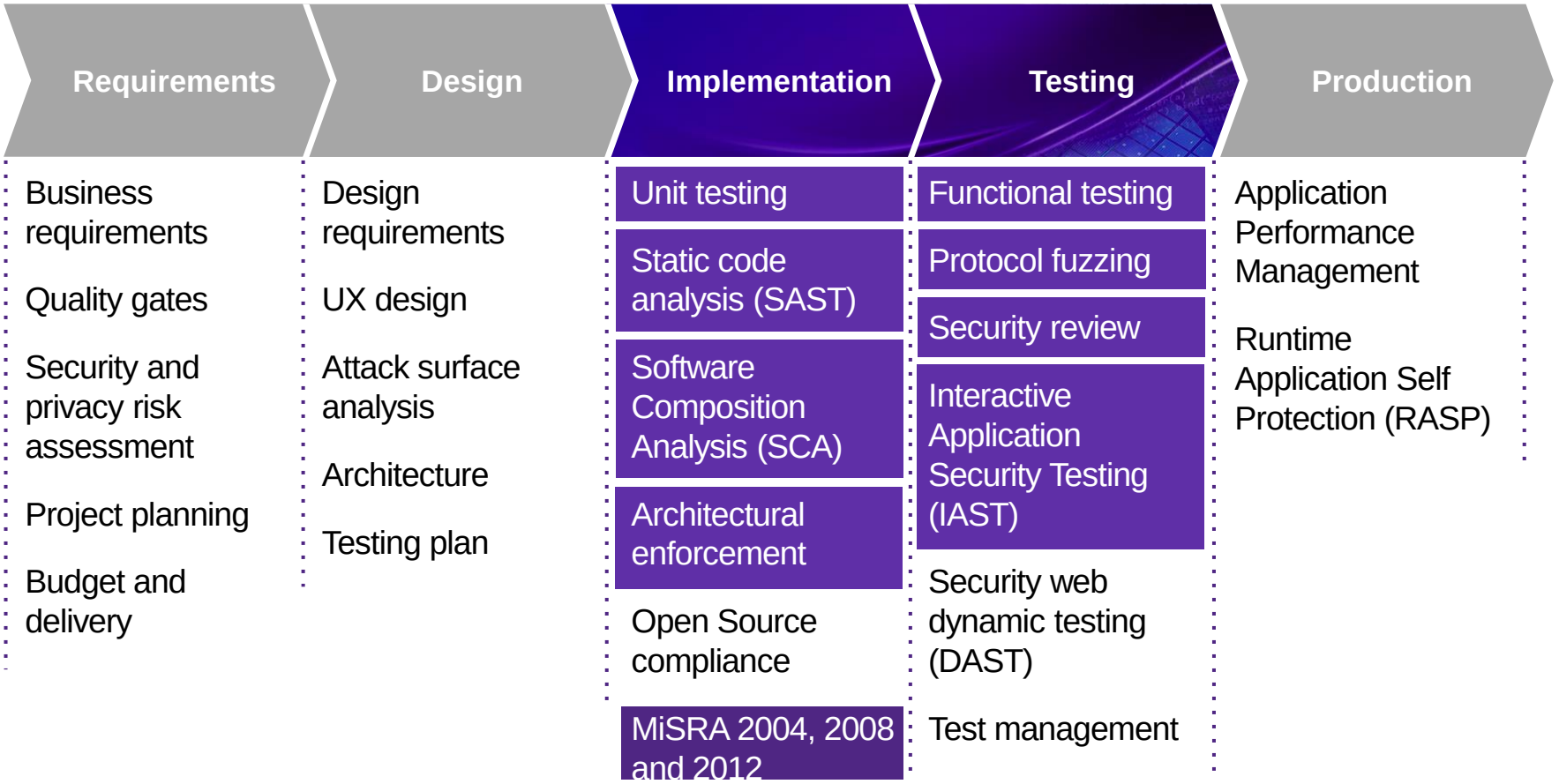
Software Development Life Cycle (SDLC)



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