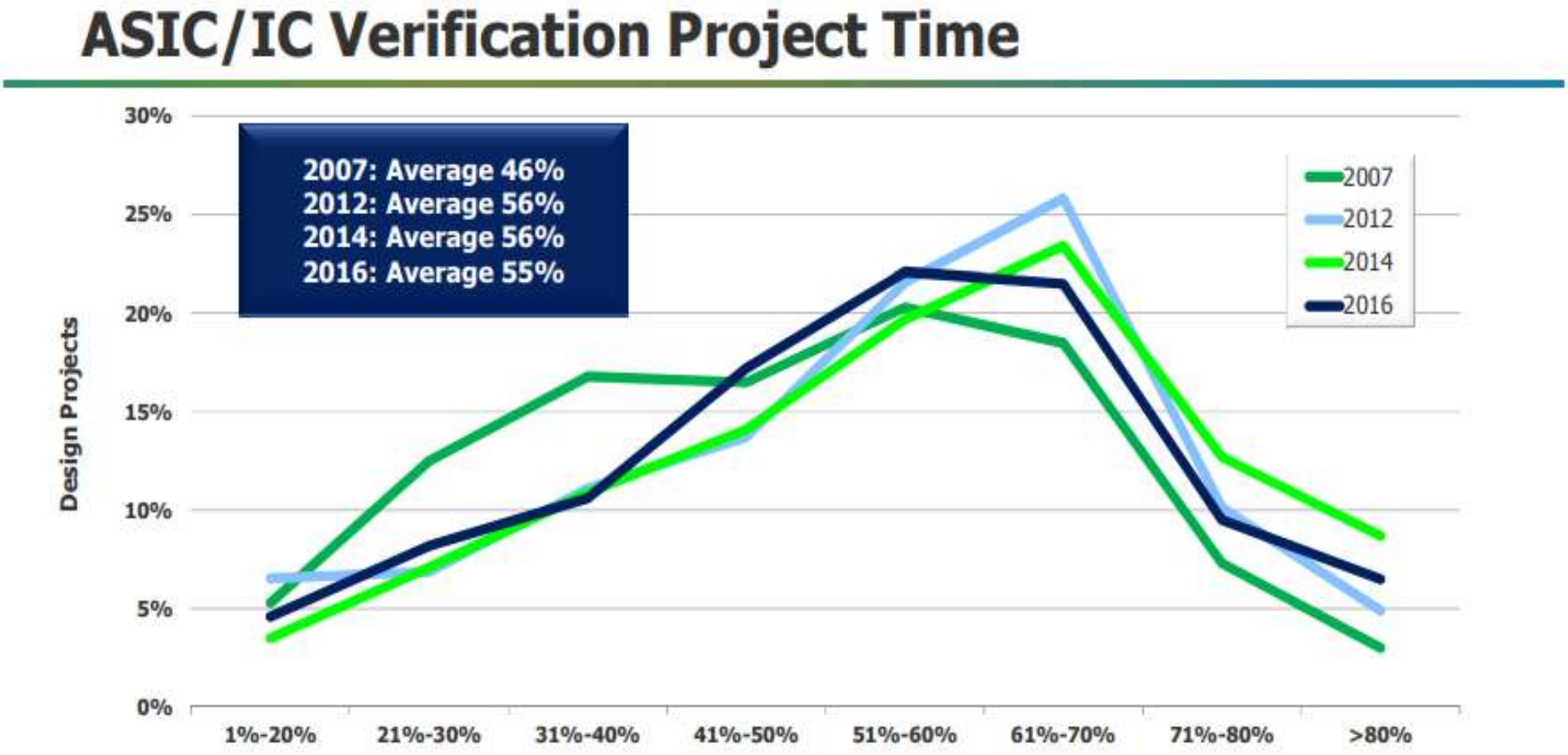
SoC Design Verification

COE 838: Systems-on-Chip Design

What is SoC Design Verification?

- Design Verification is the process of checking that a given design correctly implements the specification.
- The largest task in SoC development that has the biggest impact on the key business drivers:
  - quality, schedule, design to market and cost.
- Verification team to Design team ratio ranges from 2:1 to 3:1
- > 70% development cycle is dedicated to verification.
- A diverse domain/field with endless strategies/techniques to sign-off (finalize) the chip.
- Every design needs verification - need for highly skilled design verification engineers to meet the challenges of the state-of-the-art technological innovations.

Verification Development Cycle Time



SoC Design/Verification in Industry

- For Example: Advanced Micro Devices and Qualcomm are “Chip and SoC Makers”
- They make SoCs for living.
- Their SoCs are ranging in all computational applications.
- CPU, GPU, and all SoC elements that we can observe in:
  - Enterprise servers, Google, Facebook, Amazon, etc.
  - Smart Phones, Laptops, Desktops, Gaming Desktops.
  - Game consoles such as Xbox and Play-station.
  - Discrete Graphics Cards.

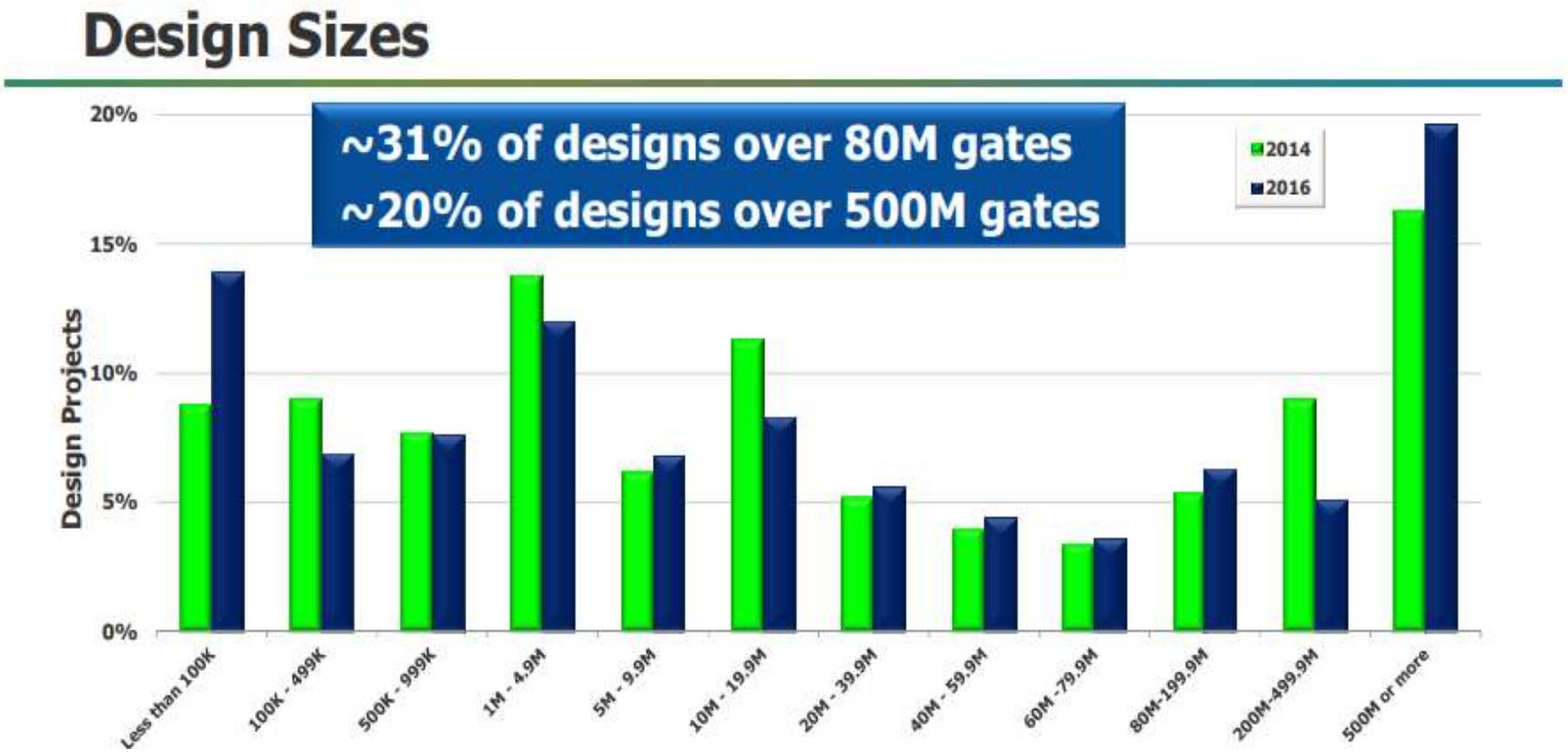
Verification Group in the SoC Developer - AMD

- RTG “Radeon Technologies Group” design and verify the AMD dGPU…
- dGPU : Discrete Graphics Processing Units
- Graphics in advanced applications of daily usage:
  - Virtual Reality, Augmented Reality, Gaming consoles/stations, Artificial Intelligence, Machine Learning..
- Compute graphics - a parallel processing computational engine convenient for certain applications than a typical sequential CPU….

What is an SoC

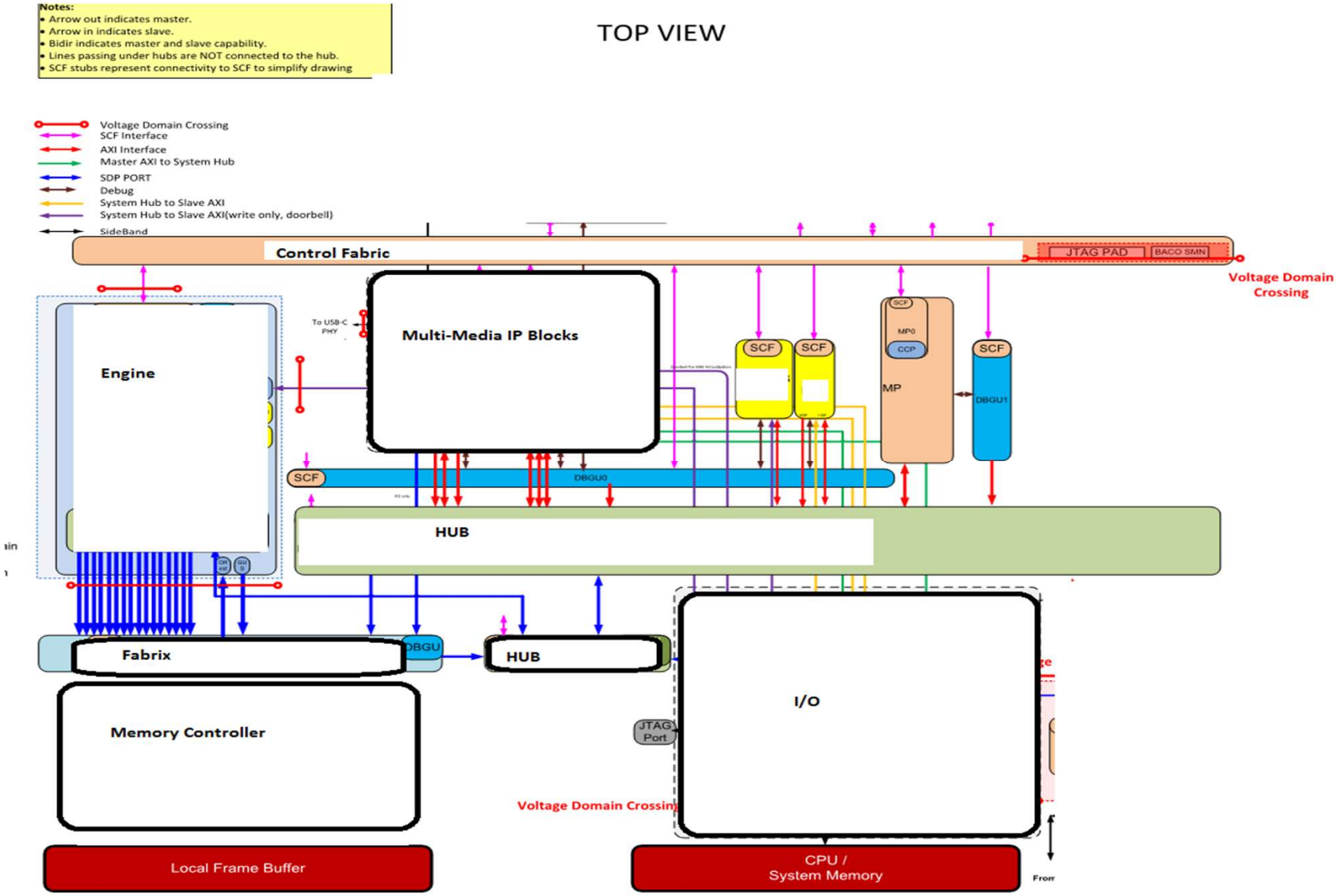
* A **system on a chip** or **system on chip** (**SoC** or **SOC**) is an integrated circuit (also known as an "IC" or "chip") that integrates all components of a computer or other electronic systems.
* It may contain digital, analog, mixed, and often radio-frequency functions all on a single chip.
* SoCs are very common in mobile computing market due to low power consumption.
* Main applications are the area of embedded systems.

SoC is too complex!



Industry Always Look for Verification Engineers

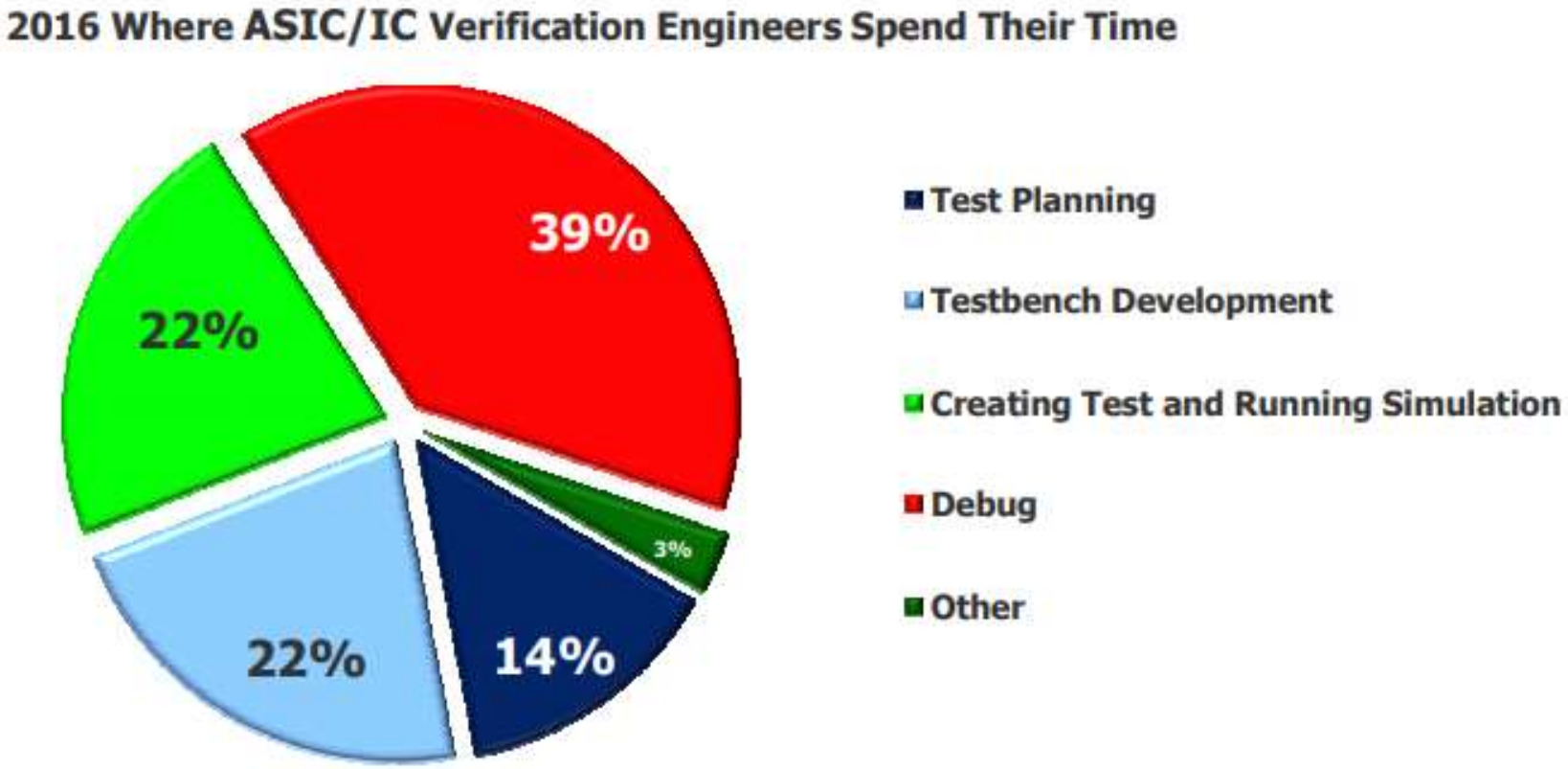
An SoC Architecture



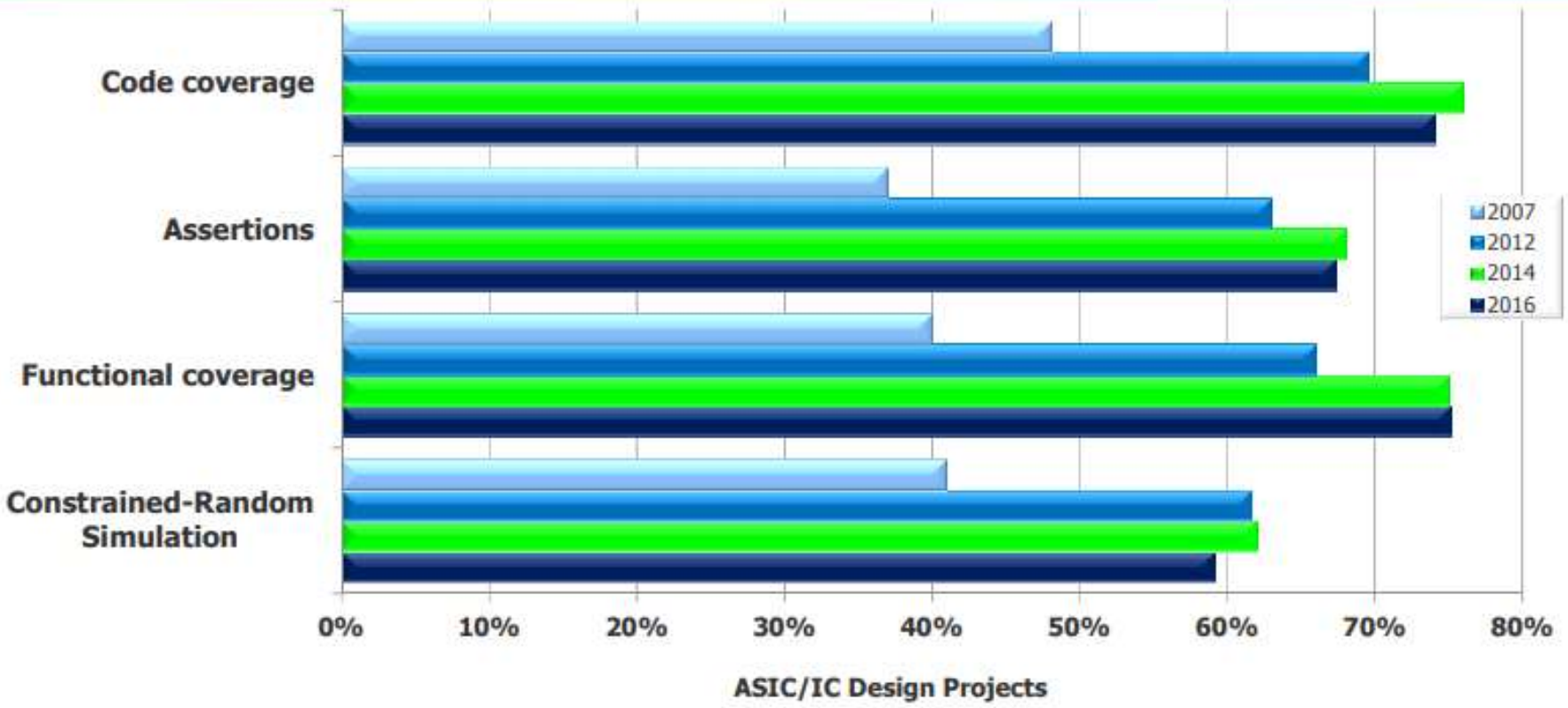
Verification Strategies

- **Functional Verification, Power Verification, Performance Verification**
- **Stimulus Generation**
- **Simulation based verification**
- **Directed testing**
- **Random and Constraint-Random Verification**
- **Formal Verification**
- **Verification Methodologies: UVM**
  - **FPGA-based Verification**
  - **Emulation**
  - **Verification tools and Infrastructure.**

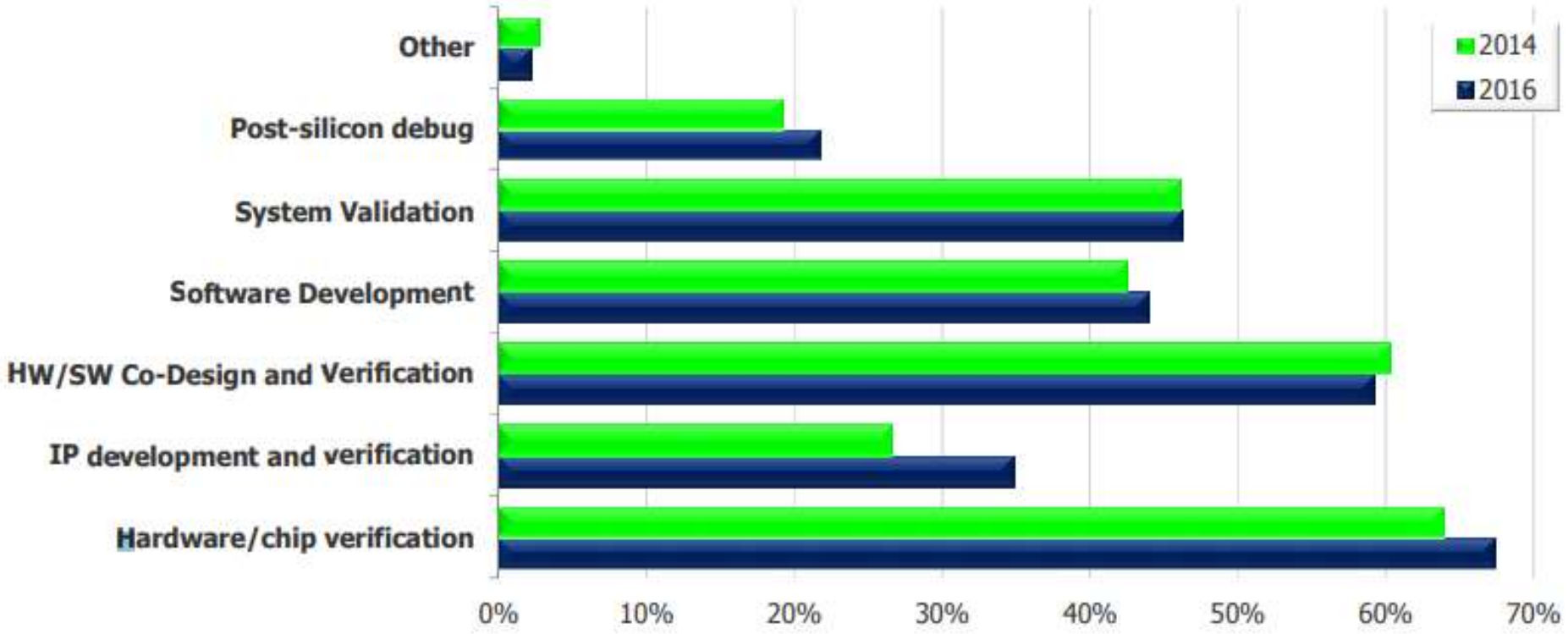
Verification Engineers and their Time Consumption?



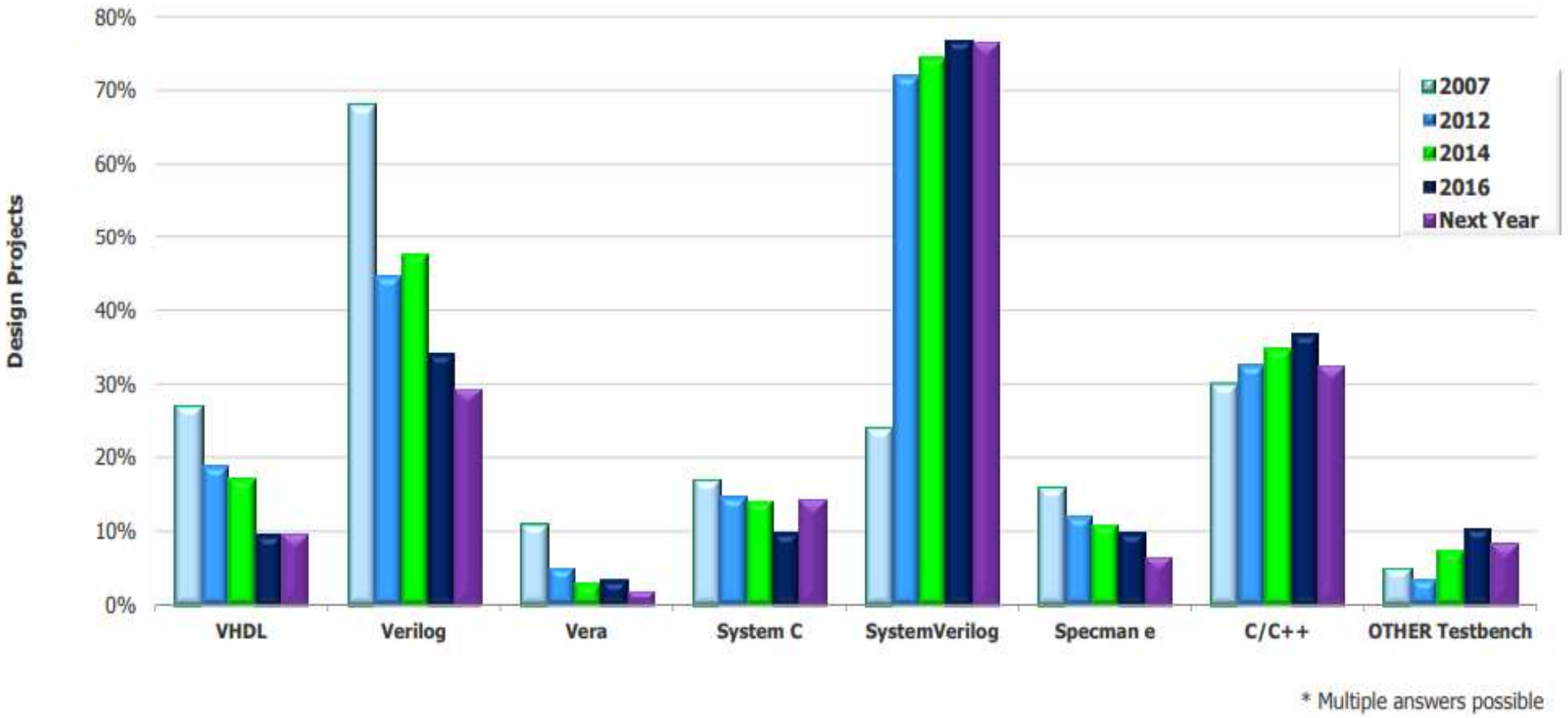
Mix & Match Verification Efforts and Trends!



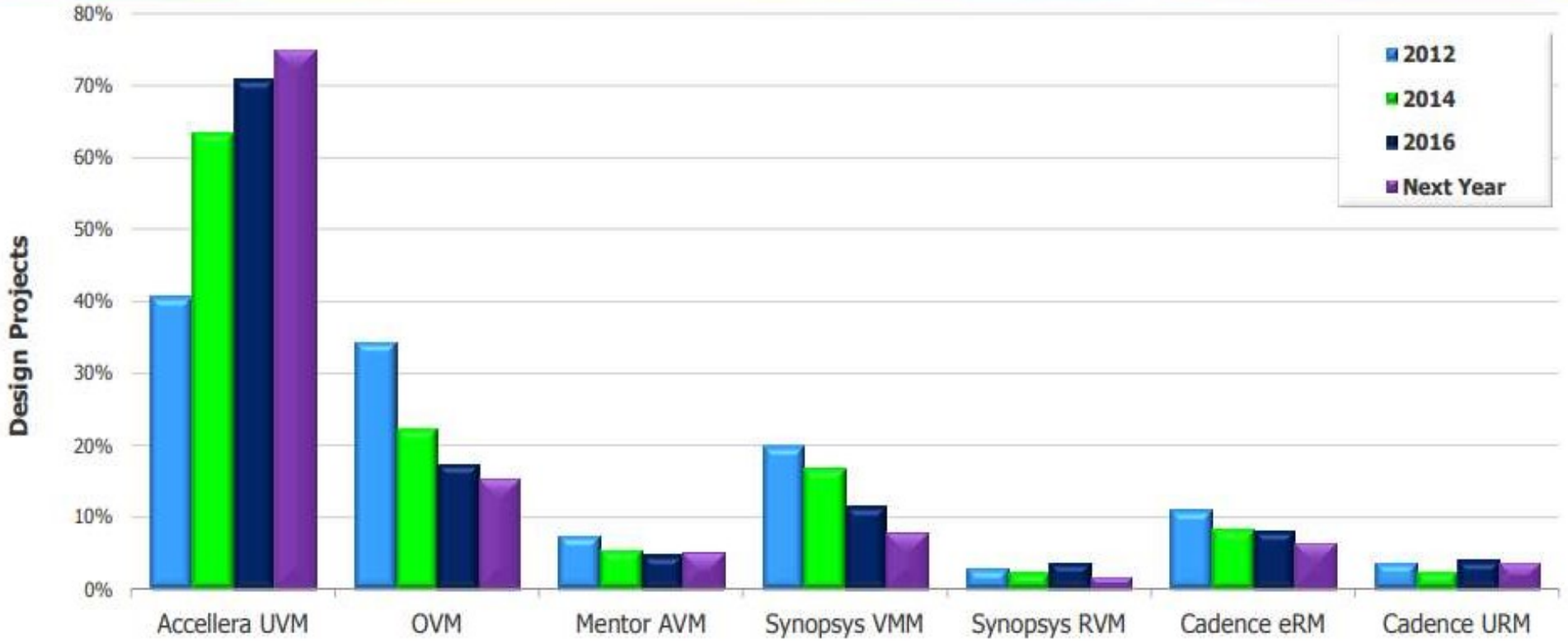
Acceleration is the Key
Emulation & FPGA Verification



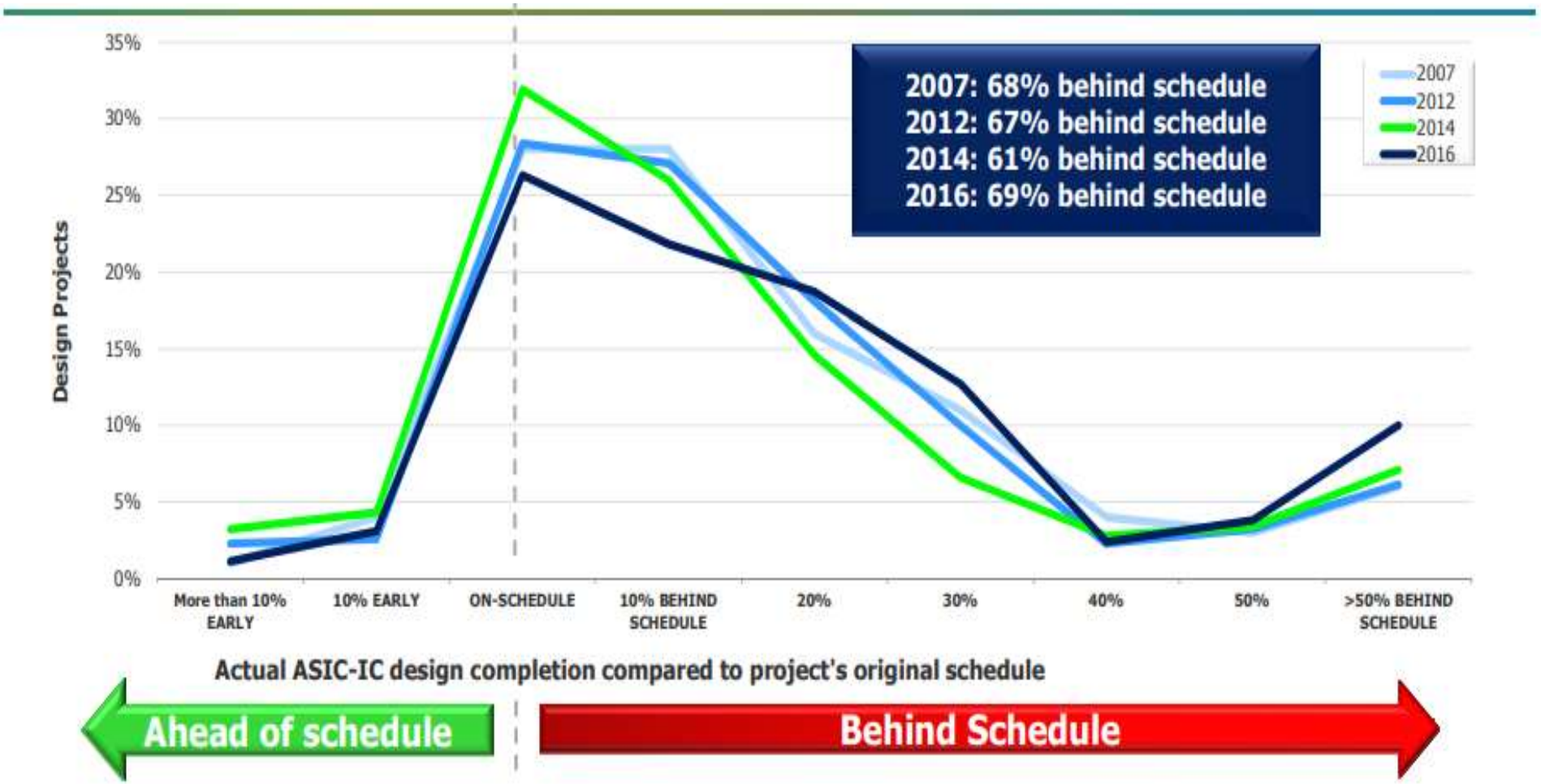
Verification Languages



Verification Methodologies Evolution….



SoC Design Projects
Typical Schedules



How many times would it take to launch a product? Spins Headache…