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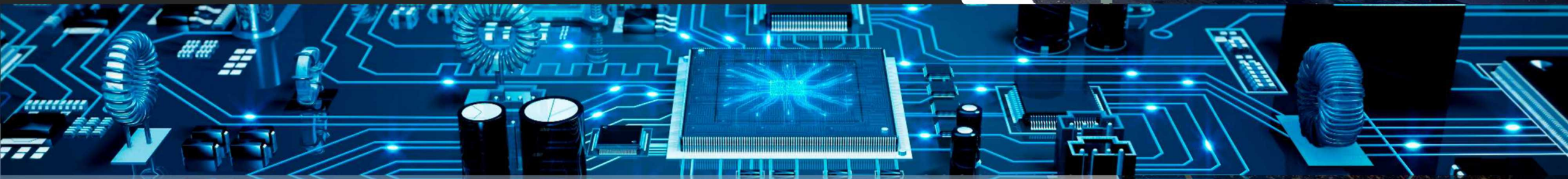

Update: FPGA Trust/Assurance Study

USG/DIB FPGA Assurance Community of Interest Meeting

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29 July 2020

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BACKGROUND

- 2014 "Trust in FPGAs" Study – what was it?
  - In-depth review of the design, development, provisioning, and system considerations of FPGAs and the tools, information, and processes supporting this
  - Focused on US-based FPGA vendors, design tool developers, and end-users/system integrators of FPGA-based systems for the DoD and IC
  - Assessed relative risk across the FPGA lifecycle based upon postulated attacks weighed against their difficulty to conduct and consequence if successful
  - Highlighted areas where USG investment could address highest risk elements of the lifecycle – some of which are being worked today

FPGA Assurance: Lifecycle Considerations

FPGA Vendor

Acquire
Materials
Tools
Hard IP

Develop FPGA Integrated Circuit (ASIC)

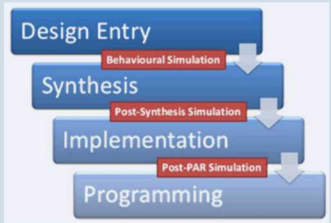
Requirements (user, timing, functional, etc.)			Logical Design (RTL, verification & synthesis)			Physical Design (design rules, place, route, timing analysis)			Manufacture (mask, fab, package)		
Info	V & V	Proto-types	Info	V & V	Models	Info	V & V	Design Rules	Info	V & V	Spare Parts

unprogrammed devices

System Developer

tools

Acquire
FPGAs
Tools
Soft IP



Develop FPGA Application

Requirements (function, I/O, SWAP, etc.)			Design (RTL, simulation, & synthesis, P&R)			Provision (program, burn fuses)		
Info	V & V	Proto-types	Info	V & V	Models, Libraries	Info	V & V	Spare/ Damaged/ Dead Parts

bitstream

upgrade/ re-purpose

Deploy
System

Field FPGA

System Use (at rest, power up, boot up, active operational)			Retirement (disposal, sanitization)		
Info	V & V	Working, Dead Parts	Info	V & V	Spare/ Damaged/ Dead Parts

Why Update the 2014 Study?

- Review and document relevant technical improvements and trust & assurance developments in the FPGA market since 2014
  - Updates from the 4 major US-based FPGA Vendors: Xilinx, Intel, Microchip *and Lattice*
  - Updates pertinent to FPGA EDA tools, IP, and end-user application development
- Help develop FPGA Assurance resources more readily available to leadership, stakeholders, program managers, and engineers
  - Up-to-date technical information
  - Practical best practices and guidance
  - Assurance and verification approaches
  - Investment, partnership, and research opportunities

What's New Since 2014?

Industry Shifts

- Altera → **Intel PSG**; Actel → Microsemi → **Microchip**
- **Lattice** → ~~Canyon Bridge~~
- Trusted Foundry: IBM → **GF US2**; access to SOTA?

- eFPGA

Tech Advancements

- 14nm/16nm → 7nm; novel NV memory technologies
- Complex SoC-FPGA architectures → becoming the "norm" versus "traditional" FPGA
- 2.5D/3D and Heterogenous Integration solutions

- Bitstream authentication, PUFs, secure boot (SoCs), SCA mitigation, etc.

- Research into new methodologies / approaches / tools (game theory)

USG Initiatives

- NDIA Electronics Division: FPGA Sub-Committee; Device Mfr Working Group
- JFAC, T&AM, MINSEC

- 5200.44 Update; Section 224 of 2020 NDAA
- AF, Navy FPGA programs
- FPGA Assurance Strategy

2020 FPGA Study Update: What's Happening?

- Primary motivation is to update the 2014 study with assurance-related technical and market developments since the original study concluded
  - the intention is not to revisit each 2014 topic from scratch
  - assurance considerations pertaining to development and usage of system-on-chip devices will be of special interest – emergent area since 2014 study concluded
- Developing updated Requests for Information (RFIs)
  - RFI Focus Areas: FPGA Vendors, IP Vendors, EDA Tool Vendors (FPGA design + verification), End-user developers
- Assembling a USG Advisory Panel
  - DoD and IC SMEs and Stakeholders to review RFI material and study team results
- Results are intended to consider and complement other ongoing USG FPGA efforts as appropriate
  - Title III FPGA effort, DoD FPGA Assurance Strategy, Rad Hard FPGAs, eFPGA initiatives, other…
- Small Sandia team working preparatory tasks → expect kickoff in August 2020
  - As work progresses and sponsor requests, updates provided to USG groups and to this community

QUESTIONS?