HARDWARE BASED AUTHENTICATION AND TRUSTED PLATFORM MODULE FUNCTIONS(HAT) FOR IOTS

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Outline

- Security challenges in IoTs.
- Hardware security attacks and countermeasures
- Research overview
- Q&A

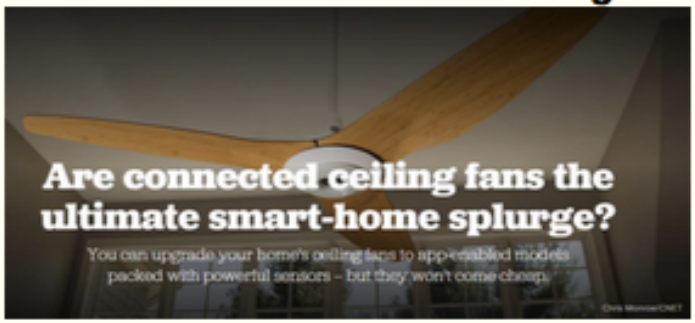
Era of "Smartness"

Smart Thermostat

Google Home

CUJO: Smart firewall

Smart Talkies



with motion & climate sensors…automatically adjust as you come and go, or as the temp. rises.

Virtual Reality Headset

4-in-1 Smart Connect™ Cradle 'n Swing
"… Baby, that's genius."

Internet of Things (IoTs) Charactristics

- **Unique requirements for IoT security**
  - Long, complex life cycles
  - Never intended to be connected
  - Machine-to-Machine interactions
  - Mass produced in same configuration ("Hardware Homogeneity")
- **Changing environment for security assurance**
  - Increasingly globalized supply chain
  - Increasingly stringent time-to-market
  - Increasingly connected world

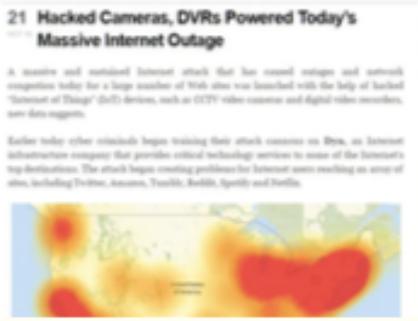
How can we protect diverse, connected, and highly complex modern computing systems against malicious attacks?

IoTs: Security and Trust Threats and Attacks

July 2015

September 2015

October 2016



October 2016

January 2017

March 2017

https://www.wired.com/2015/07/hackers-remotely-kill-jeep-highway/
https://motherboard.vice.com/en_us/article/hackers-killed-a-simulated-human-by-turning-off-its-pacemaker
https://krebsonsecurity.com/2016/10/hacked-cameras-dvrs-powered-todays-massive-internet-outage /
http://www.reuters.com/article/us-johnson-johnson-cyber-insulin-pumps-e-idUSKCN12411L
http://www.fda.gov/MedicalDevices/Safety/AlertsandNotices/ucm535843.htm
https://www.wired.com/2017/03/worried-cia-hacked-samsung-tv-heres-tell/

Internet of things needs to be redefined as securely connecting devices, exchanging trusted data and delivering value through analytics and smart decisions

Cyber security: Where and Why it is important

Cloud and distributed system security

IoT Security

Network Security

Biometrics and Security

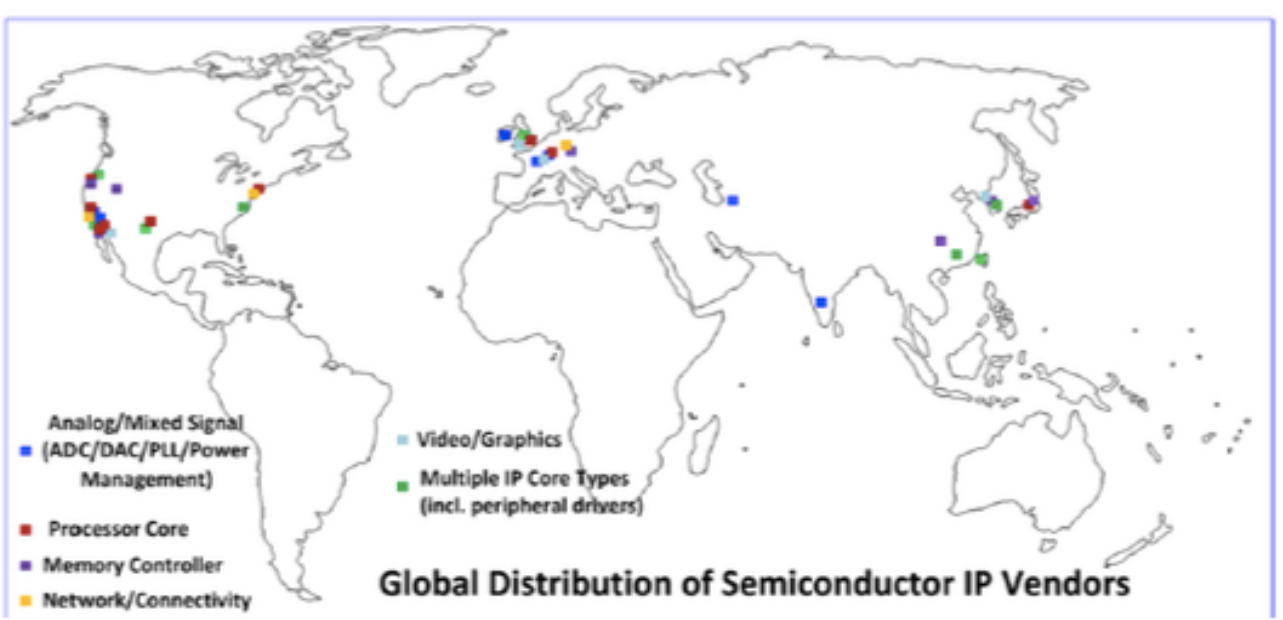
Supply Chain Security

Nanoscale Security

Hardware Security

Cyber security traditionally meant software, network and data security considering hardware as root of trust. This assumption is no longer true with evolving semiconductor business landscape .

IP Vendors Distributed Across the Globe



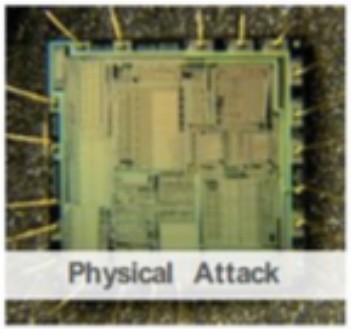
Long and globally distributed supply chain of hardware IPs makes SoC design increasingly vulnerable to diverse trust/integrity issues.

Security Attacks on Hardware


Trojans

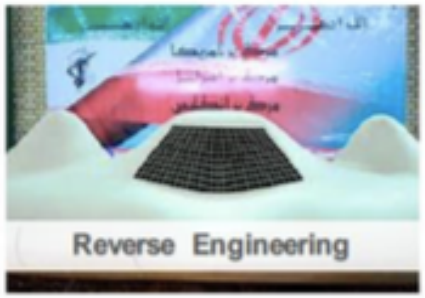

Untrusted Foundry


Counterfeit ICs


Physical Attack


Side-channel


Fault Injection


Reverse Engineering

Fake Parts

Research Projects

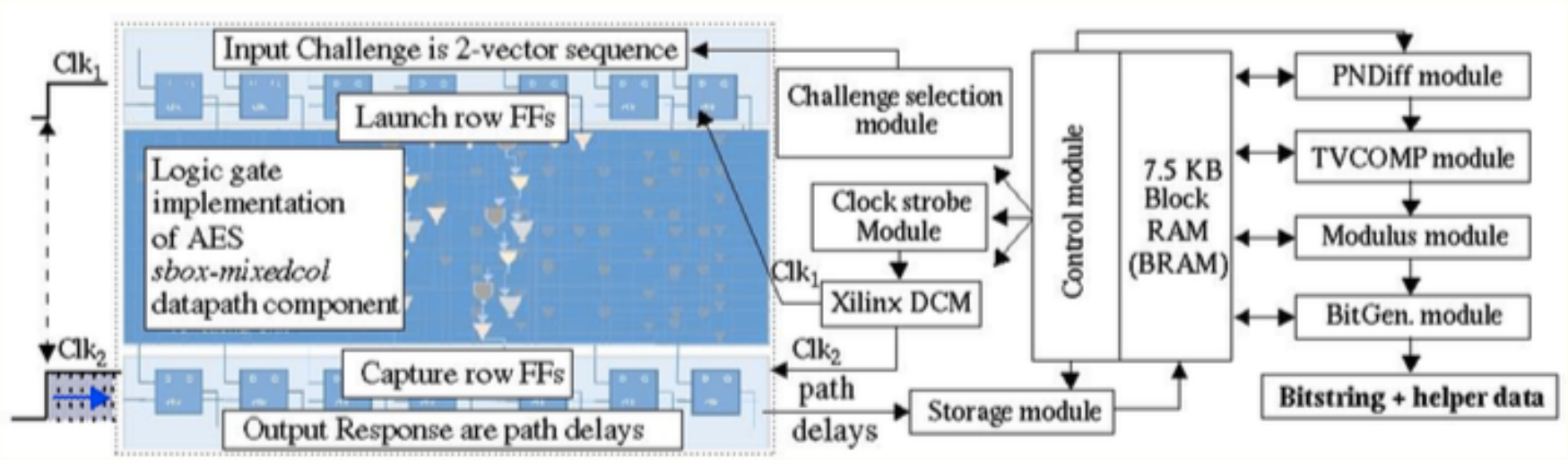
- **Hardware-Oriented Security and Trust (HOST)**
  - Physical Unclonable Functions
  - Authentication and Encryption
  - Differential power analysis countermeasures
  - Hardware Trojan Detection
  - Obfuscation of chip functionality
  - Secure Automotive ECU Design

- **Embedded Systems**
  - TrustZone based hardware isolation
  - FPGA-based embedded systems
  - Hardware acceleration

Security Research: PUFs

HELP entropy is path delays of existing functional units.

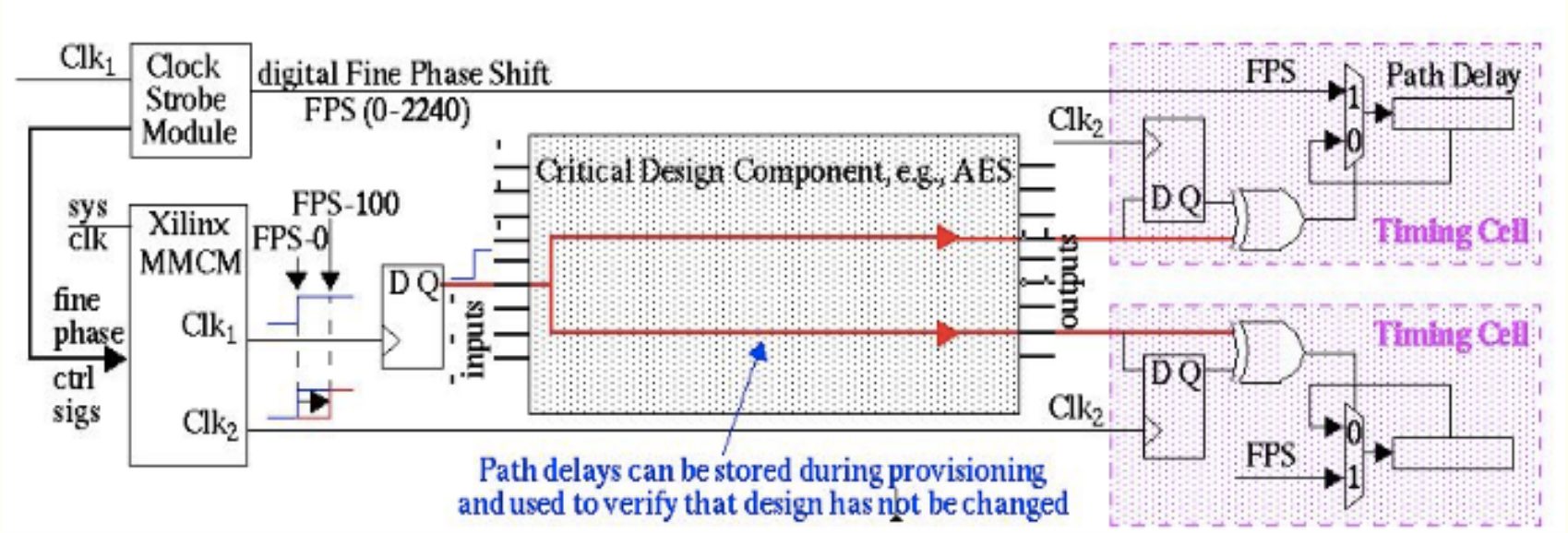
On-chip bitstring generation provides real-time identification.



Trust Research: Tamper Detection

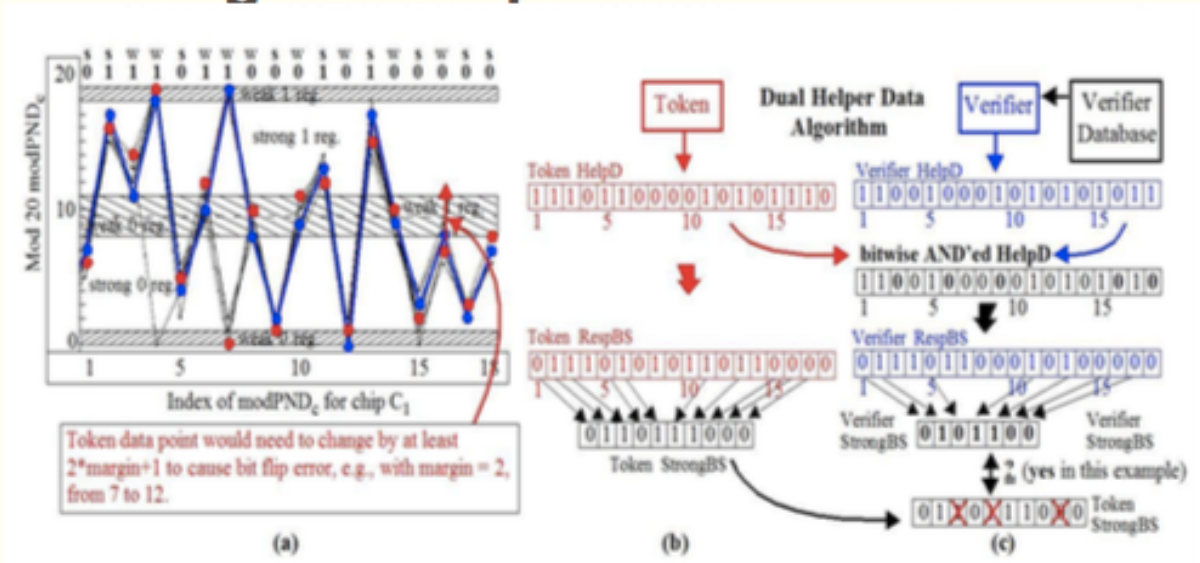
Devise a water-marking mechanism by profiling path delays

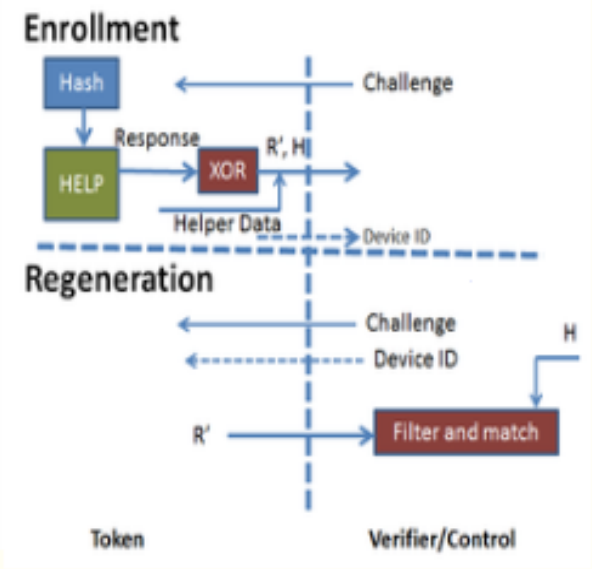
In-field chips compared with the time 0 to detect tamper



Privacy Preserved Authentication in Distributed Environment

A privacy-preserving, mutual authentication protocol using dual helper data





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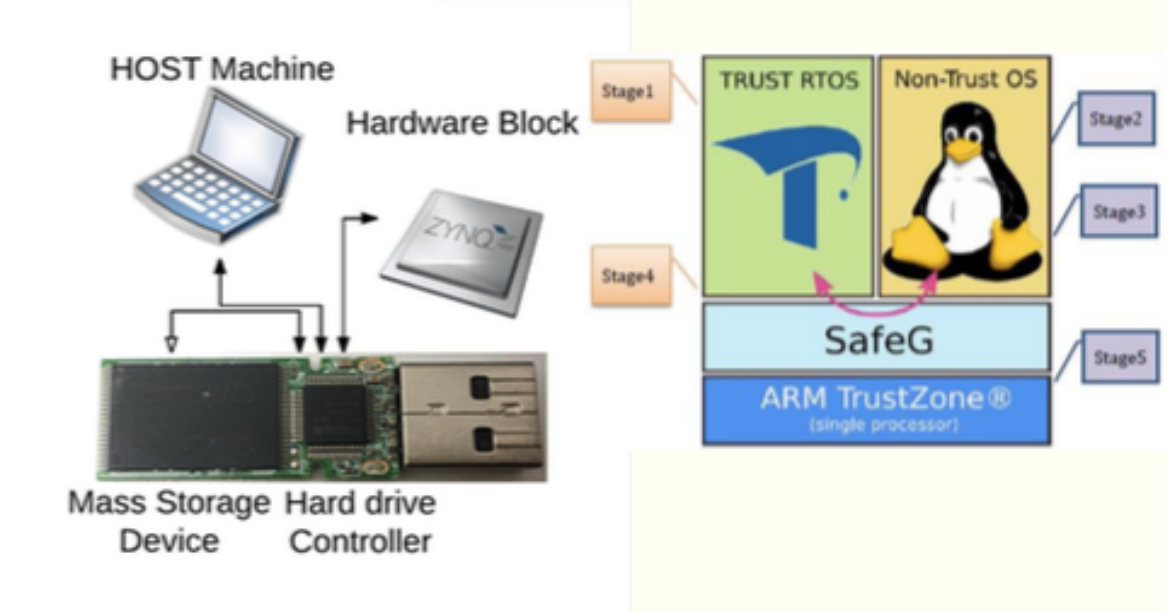
Security based hardware isolation and Access Control

Techniques to mitigate malwares such as Rootkits and Bootkits



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IoT Security Issues

- Provisioning keys and key management life cycle
- Security assessment of equipment connected via gateways, that were never intended to be connected.
- Device identification for device-to-device communication
- Availability and system resilience.
- Scalability

Requires holistic view of device to gateway to cloud and the communication between them.

Questions