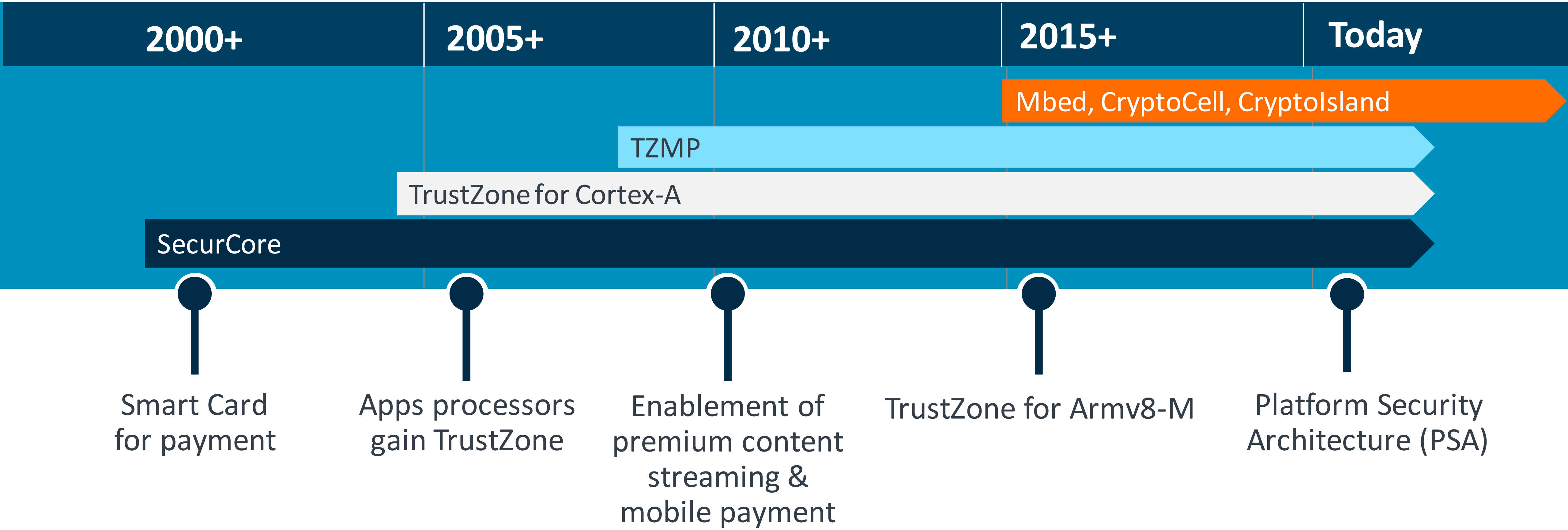
# PSA: building trust in IoT

Ethan Zhang
Security Marketing Manager

# Arm secure IP: Helping to protect billions of devices



2000+

2005+

2010+

2015+

Today

Mbed, CryptoCell, CryptoIsland

TZMP

TrustZone for Cortex-A

SecurCore

Smart Card for payment

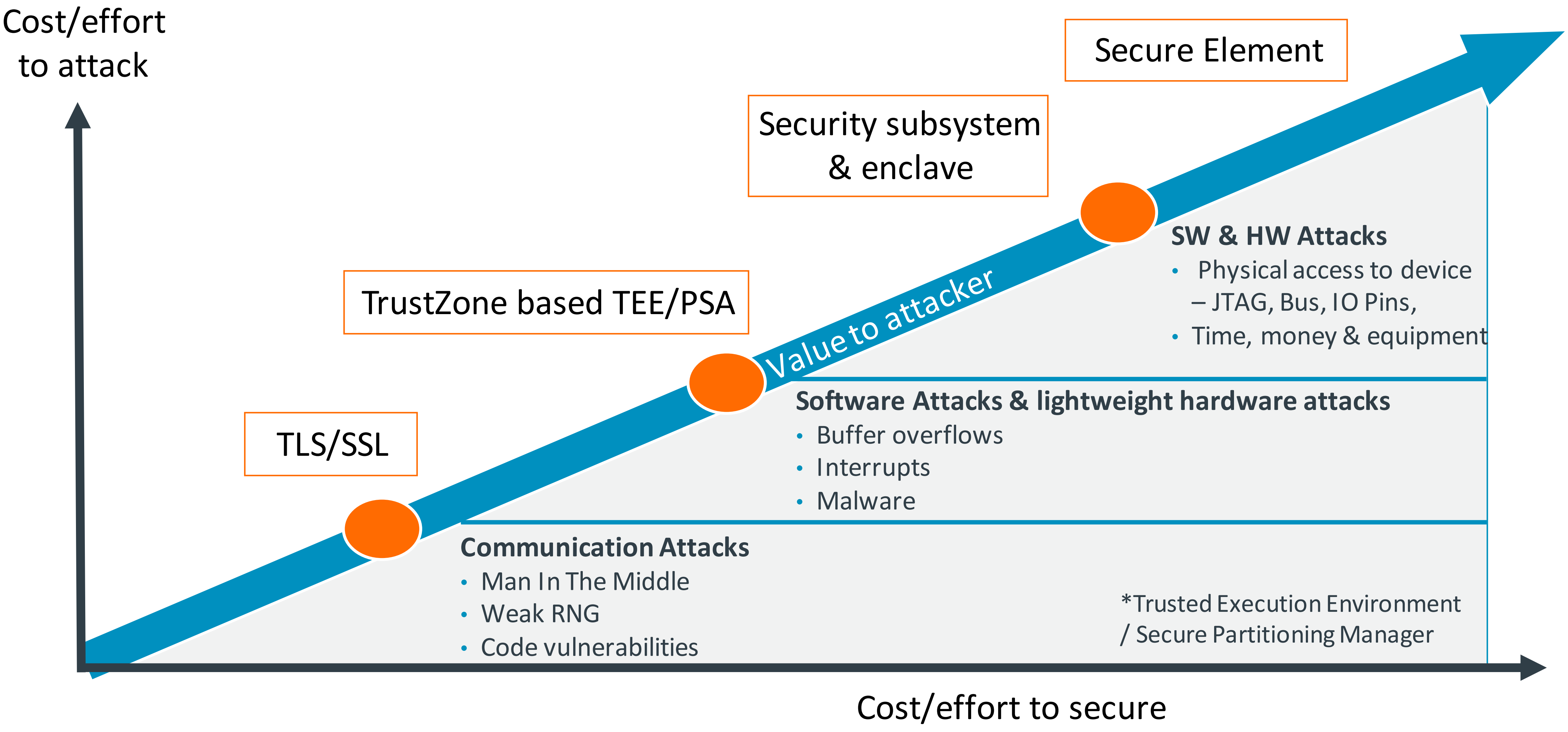
Apps processors gain TrustZone

Enablement of premium content streaming & mobile payment

TrustZone for Armv8-M

Platform Security Architecture (PSA)

# How much security to fit your needs?



**SW & HW Attacks**

- Physical access to device – JTAG, Bus, IO Pins,
- Time, money & equipment

**Software Attacks & lightweight hardware attacks**

- Buffer overflows
- Interrupts
- Malware

**Communication Attacks**

- Man In The Middle
- Weak RNG
- Code vulnerabilities

*Trusted Execution Environment / Secure Partitioning Manager

# ARM TrustZone Technology – A Security Foundation

## Today

Authentication

Mobile Payment

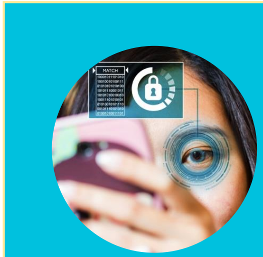
Content Protection

Enterprise Security

ARM TRUSTZONE

System Security

# What can we learn from mobile & apply to IoT?

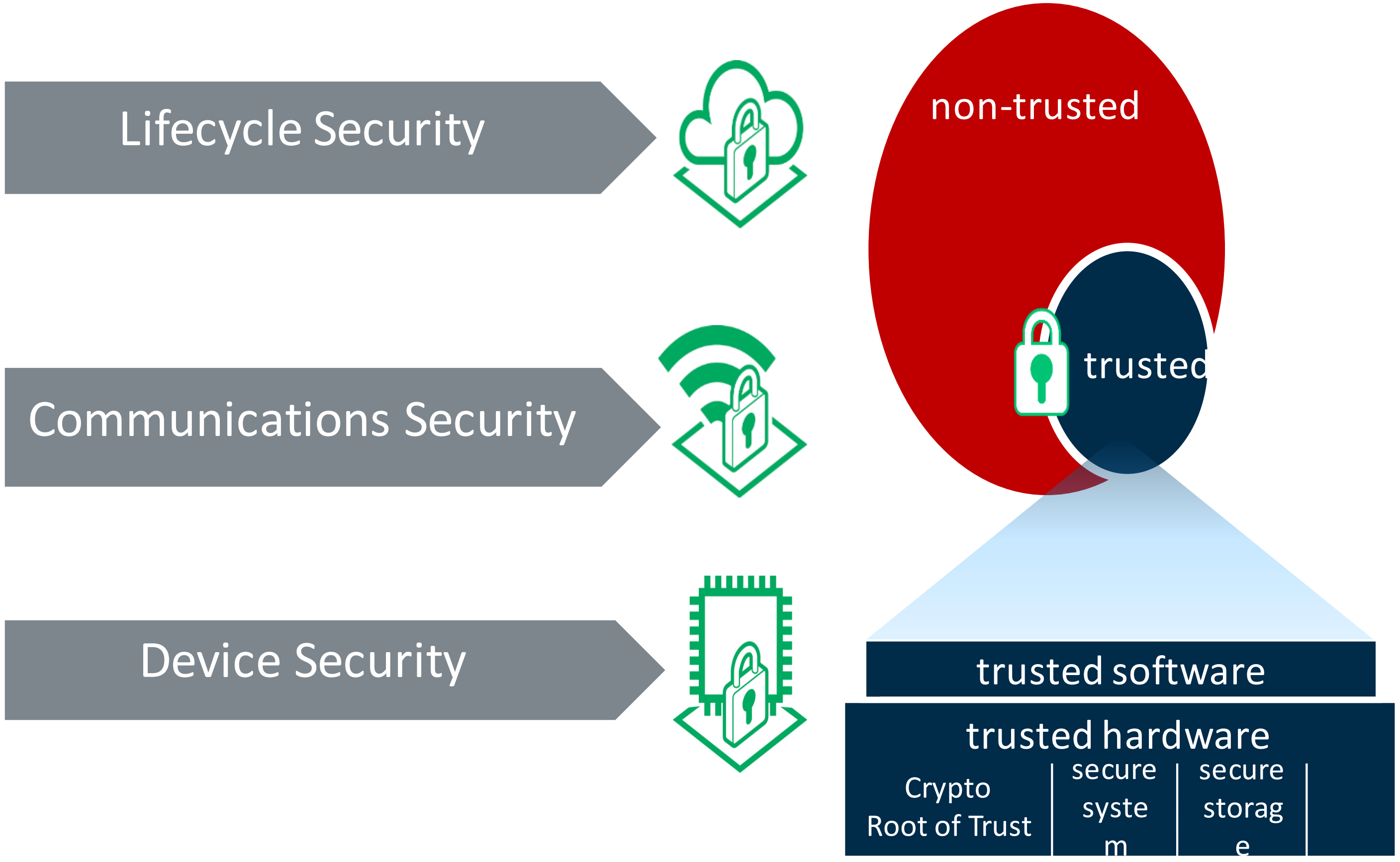


Authentication

Mobile Payment

Content Protection

Enterprise Security



Lifecycle Security

Communications Security

Device Security

non-trusted

trusted

trusted software

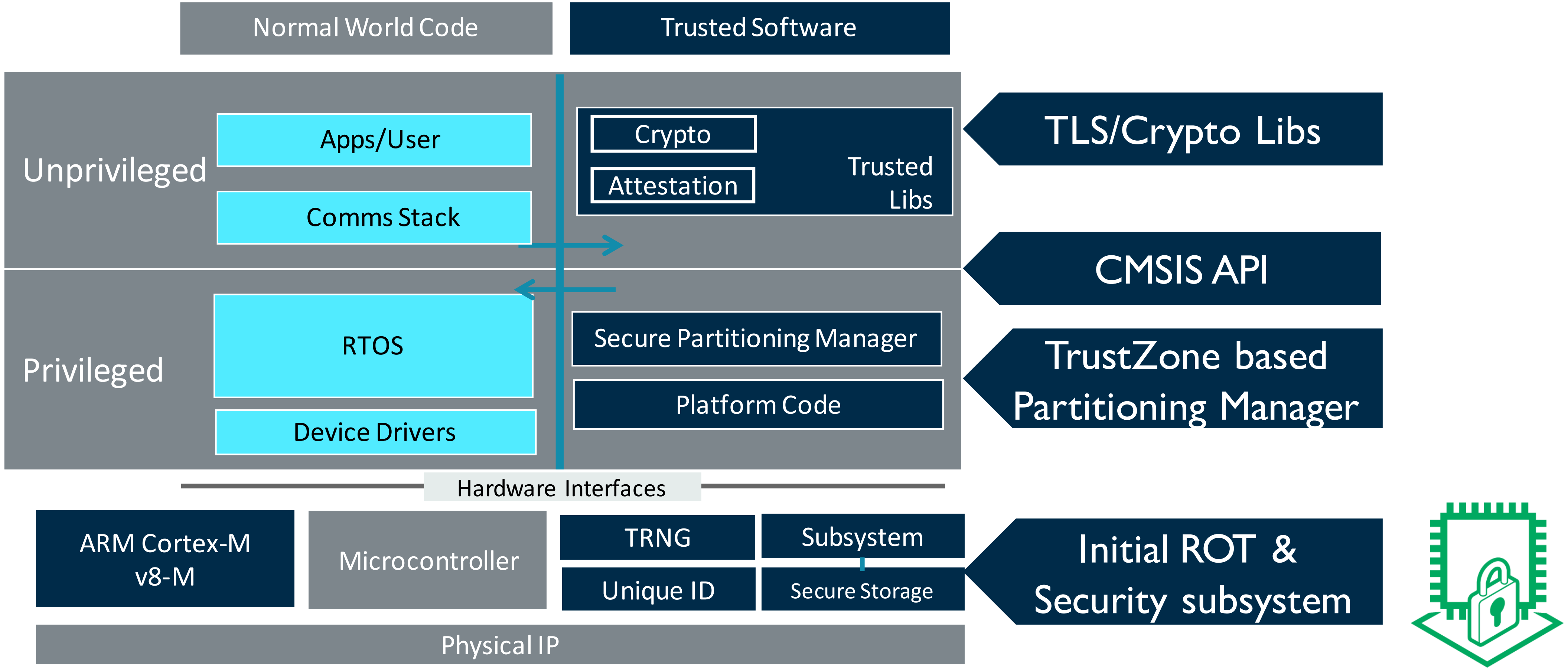
trusted hardware

Crypto Root of Trust

secure system

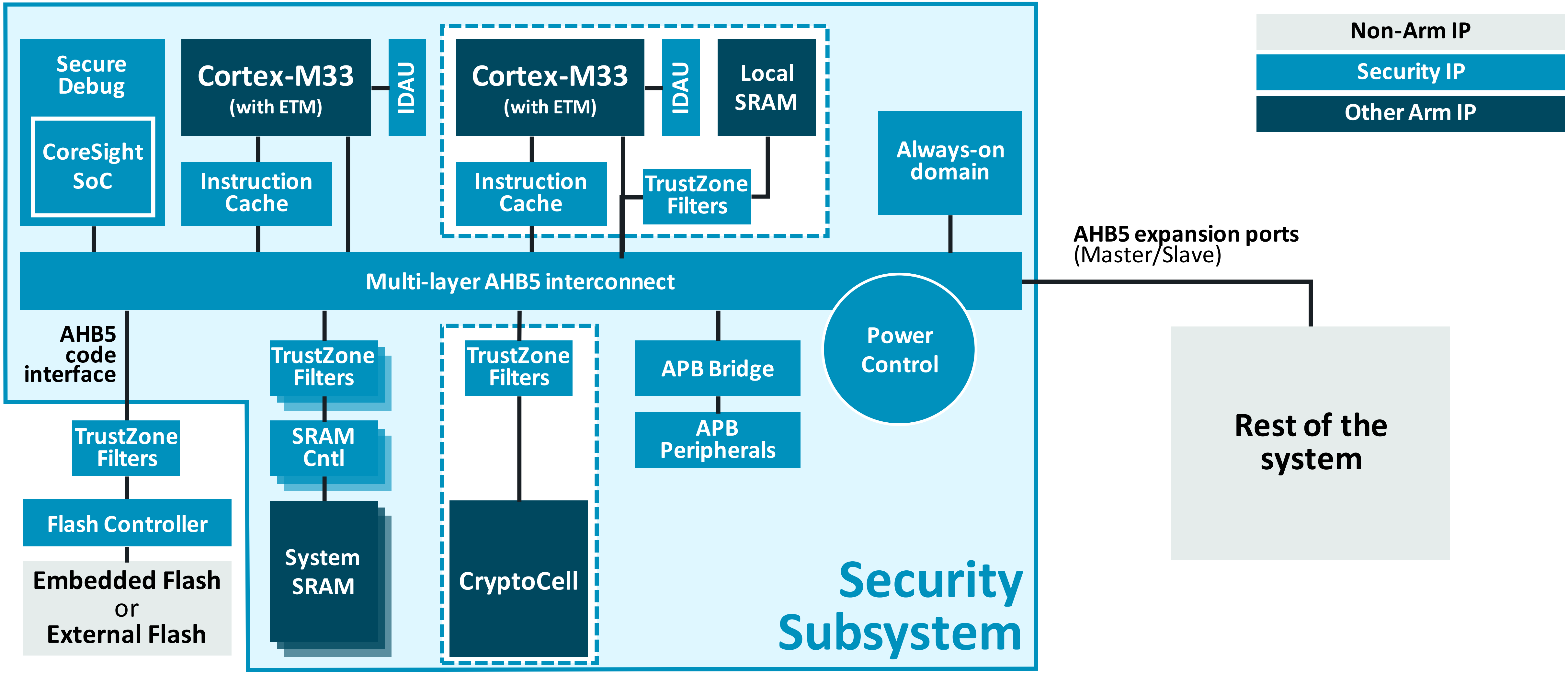
secure storage

# MCU architecture becoming similar to mobile

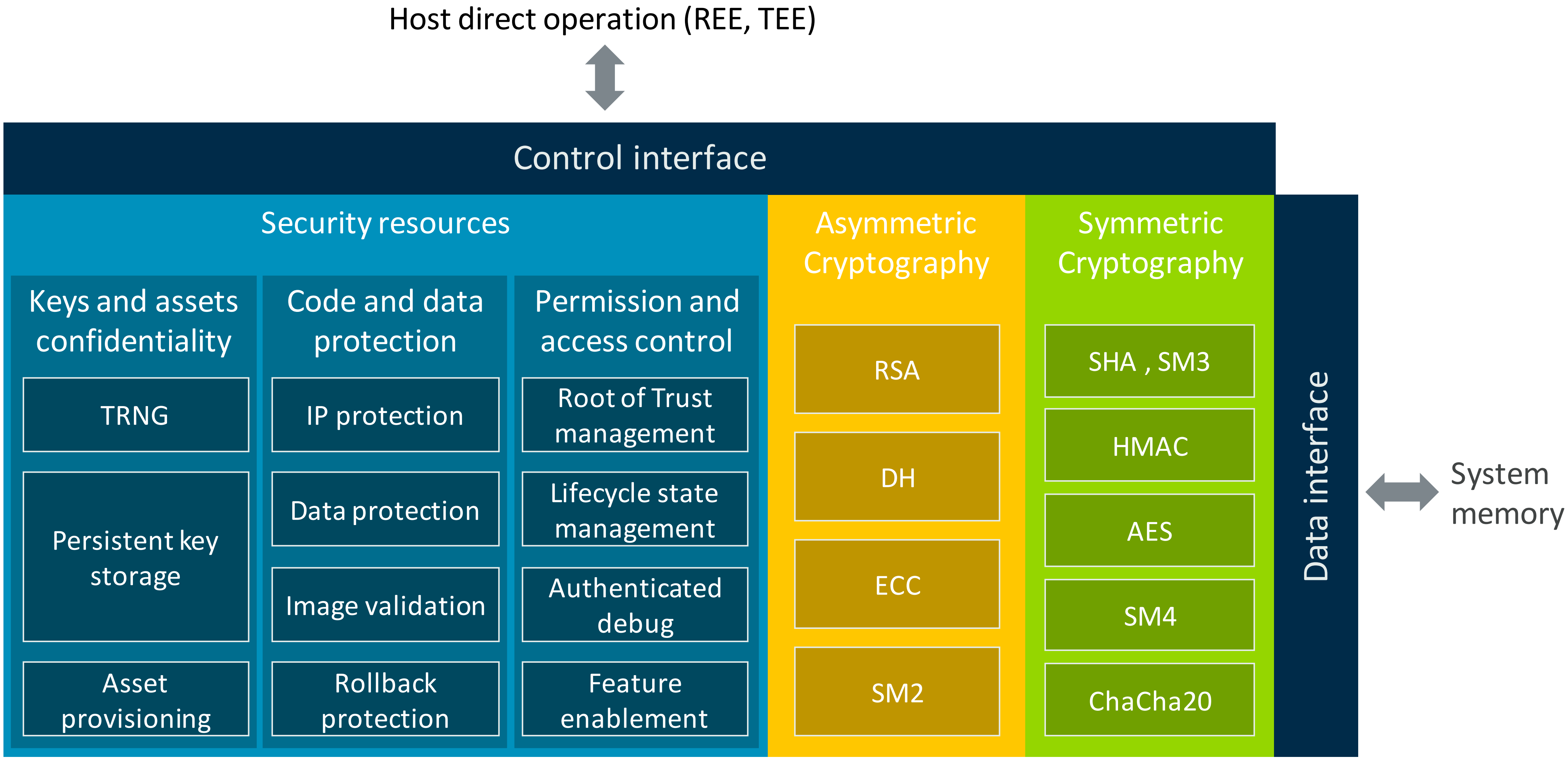


TrustZone enabled MCU

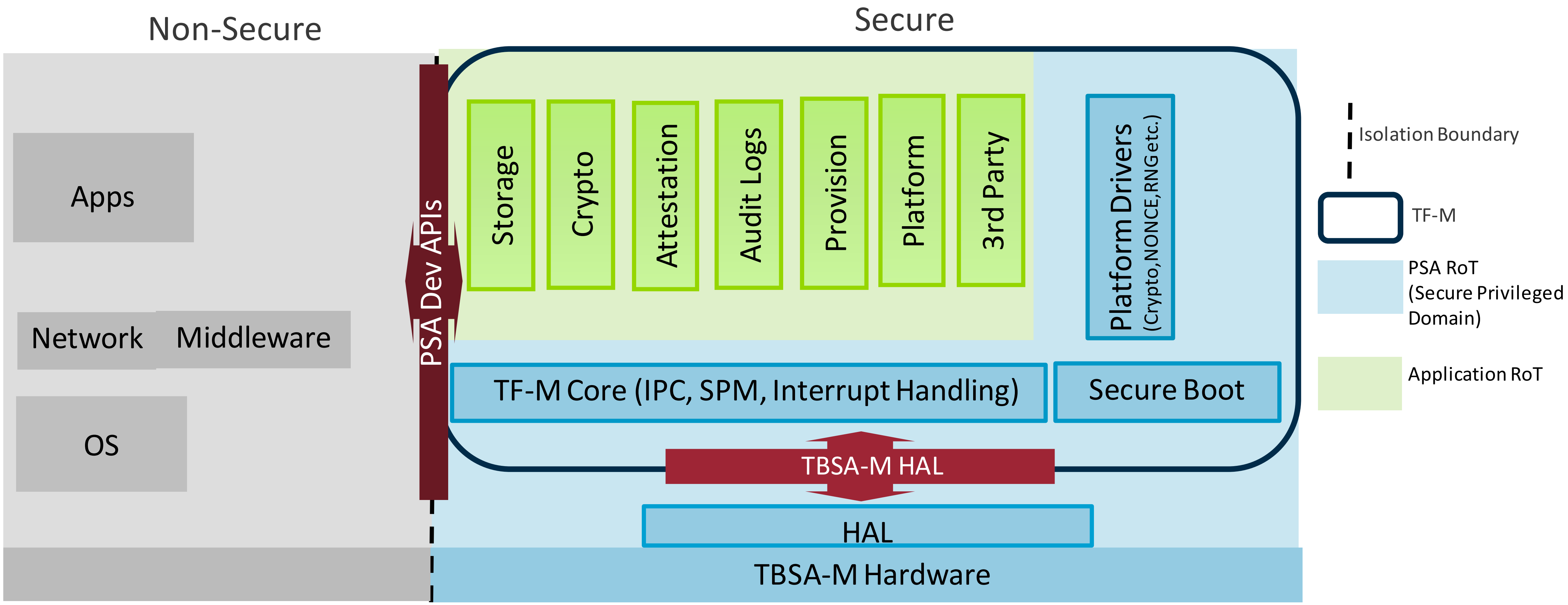
# Security Subsystem Example



# TrustZone CryptoCell



# Trusted Firmware-M



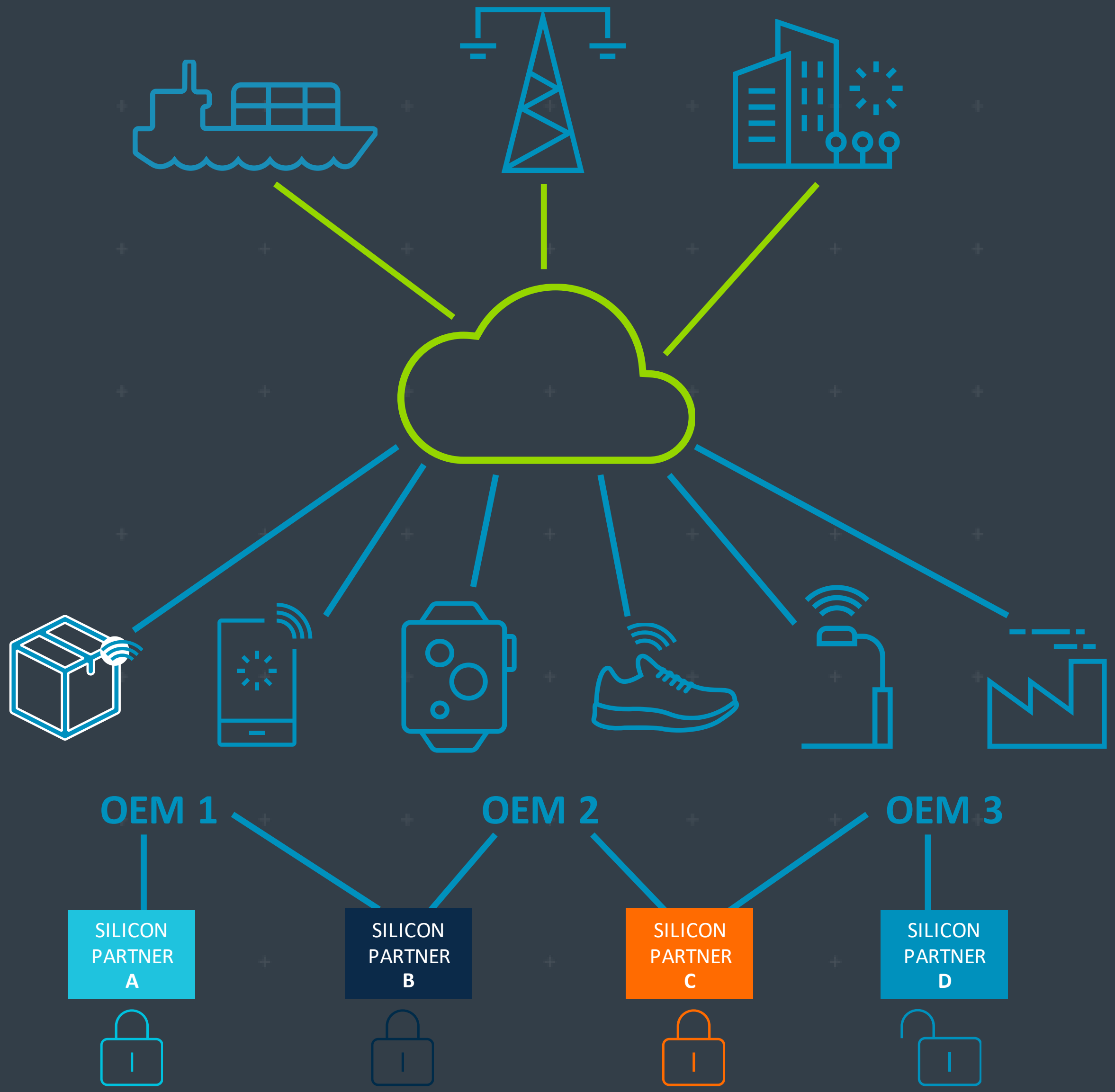
# Platform Security Architecture

# IoT Diversity Demands a Different Approach

Many cloud services needing to trust the data & therefore trust the devices

10,000’s OEMs

100’s of chip vendors with different RoT

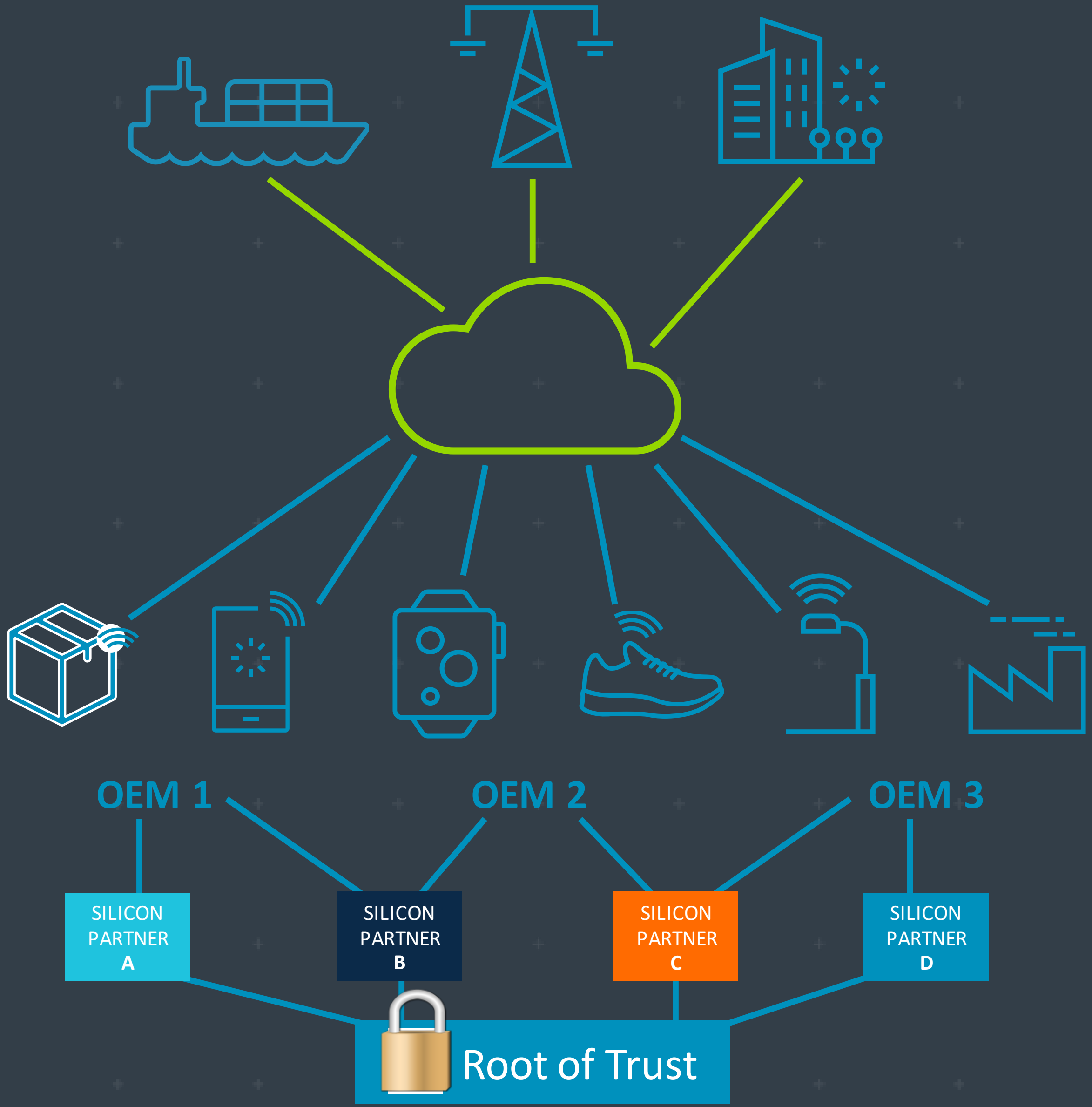


# IoT Diversity Demands a Different Approach

Many cloud services needing to trust the data & therefore trust the devices

10,000’s OEMs

100’s of chip vendors with different RoT



# Platform Security Architecture

## The open device security framework, with independent testing

### Analyze

Threat models
& security analyses

### Architect

Hardware & firmware
architect specifications

### Implement

Firmware
source code

### Certify

psacertified™

# Analyze

## Security should always begin with analysis

Asset Tracker TMSA

Smart Water Meter TMSA

Network Camera TMSA

Analyze

Threat models & security analyses

**Understand application security requirements**

- What are my assets?
- What do I need to protect against ?
- What security IP is needed to mitigate against attacks ?
- **Threat model examples available free-of-charge at [www.arm.com/psa-resources](www.arm.com/psa-resources)**

# Architect

## A set of blueprints for developing secure SoC & firmware

Architect

Hardware & firmware architect specifications

| Security Model (PSA-SM) | PSA Firmware Framework (PSA-FF) | Trusted Boot and Firmware Update | Trusted Base System Architecture for M (TBSA-M) |
|---|---|---|---|
| Home to our security principles | Firmware architecture and language | System and firmware technical requirements for firmware boot and update | Guide on building a secure Arm-based Chip |

**Available free-of-charge at www.arm.com/psa-resources**

# Implement

## Getting to market fast with reference PSA implementation

Implement

Firmware source code

Chip design

Operating system

Trusted Firmware-M

**Available free-of-charge at www.trustedfirmware.org**

# PSA Certified – An Overview

## Building trust through independent testing

psacertified™

Builds on IoT threat models, PSA docs, Government IoT security best practice

Backed by reputable experts

Supporting complementary vertical evaluations ✓ ✓ ✓

brightsight® the number one security lab in the world

riscure

arm

TRUSTCB®

CAICT 中国信息通信研究院 China Academy of Information and Communications Technology

UL

PROVE & RUN

# PSA Security Model- 10 Goals

## Fundamental security requirements

Secure Storage

Secure Boot

Isolation of Root of Trust

Secure update process

Validation of updates

Attestation

Unique instance ID

TRNG services

Security lifecycle

Anti-rollback feature

# How it Works

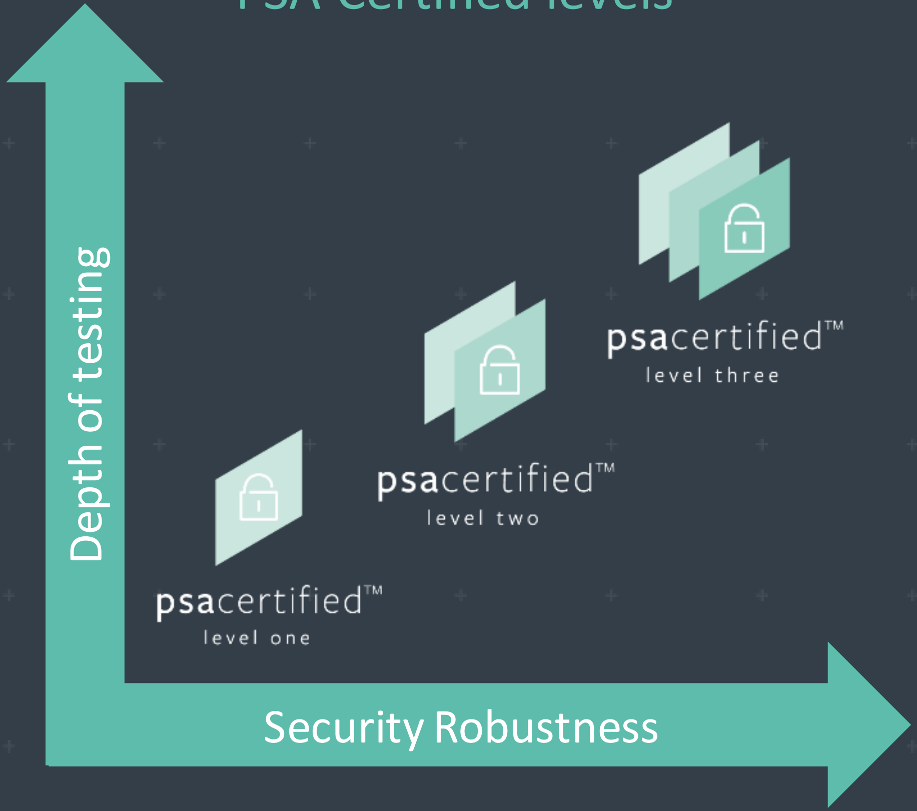
- PSA Certified provides three progressive levels of security assurance/robustness: PSA Certified Level 1, 2 and 3

- PSA functional API enables software scalability

psacertified™

psacertified™ functional API

PSA Certified levels



# Who it targets

- Level 1 targets silicon, OS, and OEM
- Level 2 & Level 3 focus on silicon companies PSA RoT implementations

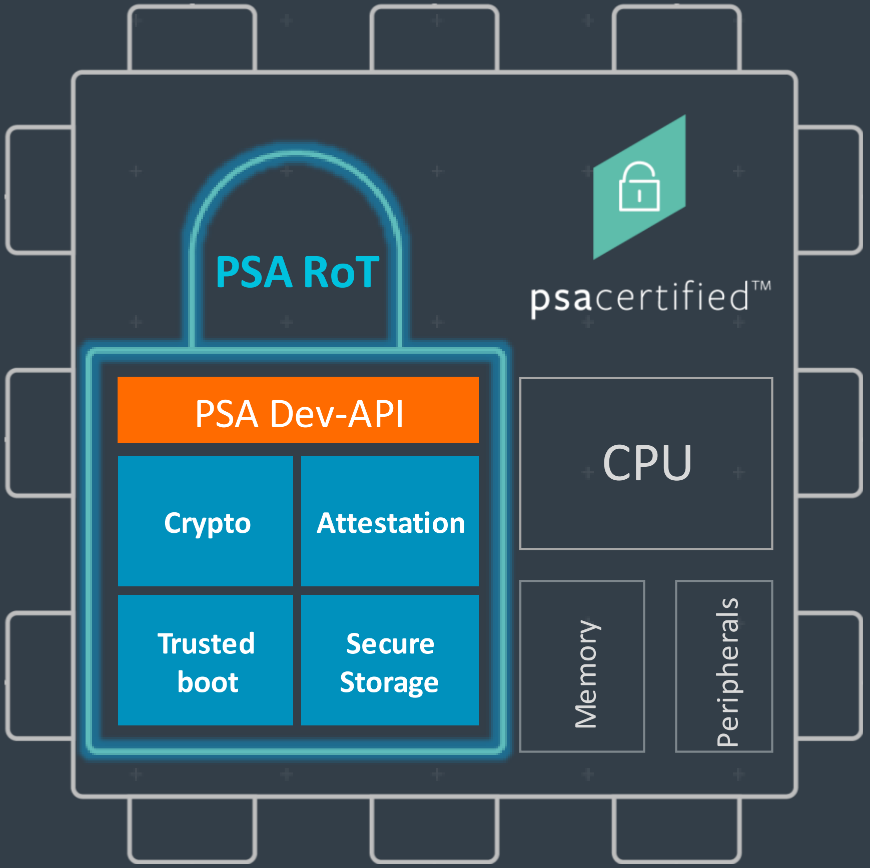
| **PSA Certification level & test time** | **Silicon** | **OS** | **OEM** |
|---|---|---|---|
| Level 3<br>*Months* | ✓ | 3rd party evaluation schemes | |
| Level 2<br>*1 month* | ✓ | | |
| Level 1<br>*1 day* | ✓ | ✓ | ✓ |

www.psacertified.org

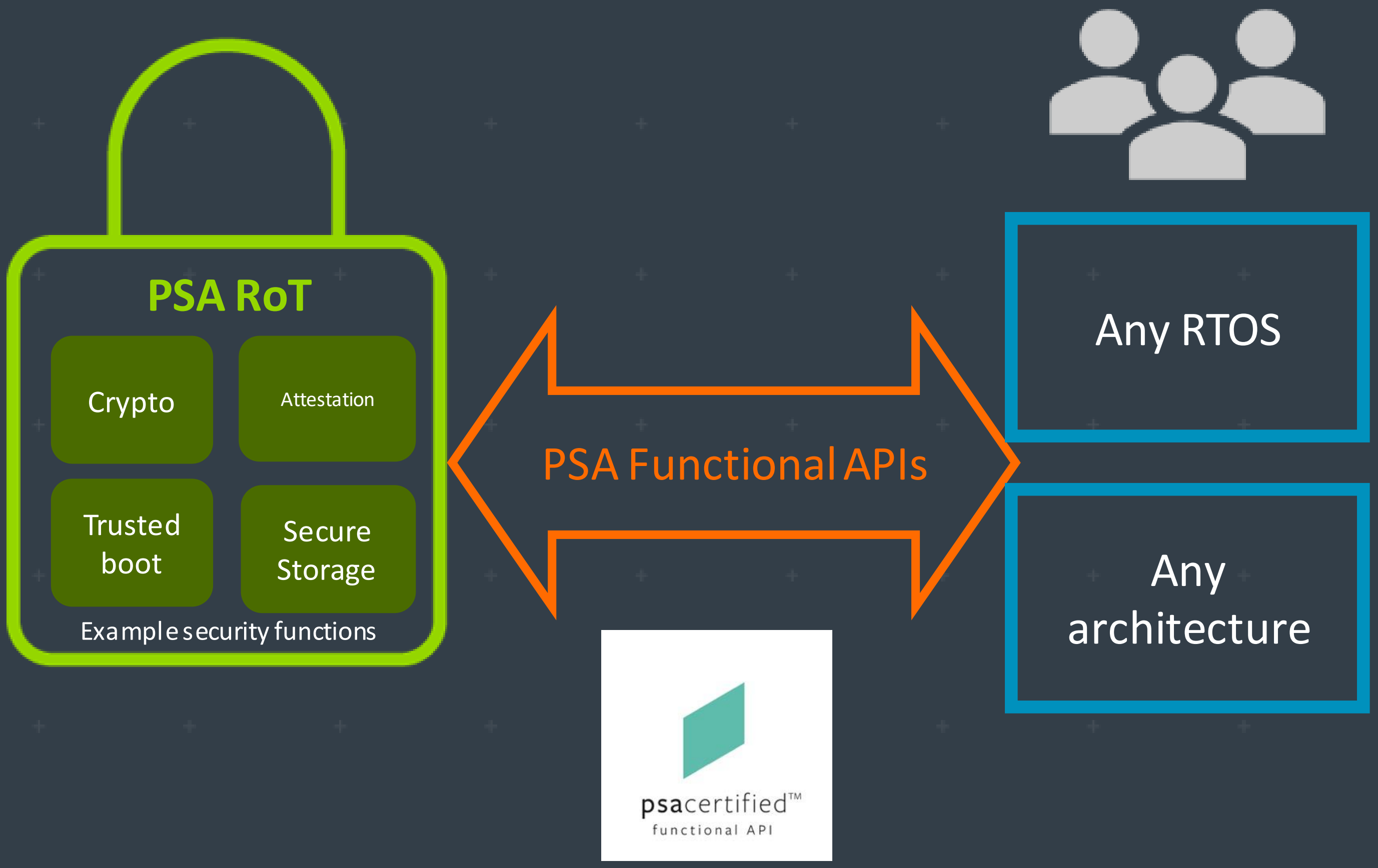
# Devices Need a Source of Trust

## PSA Root of Trust (PSA-RoT)

- The source of integrity and confidentiality
- Provides **hardware isolation** of the critical security functions from the rest of the system
- Typically used for security functions such as boot, storing keys, cryptography, attestation, audit logs
- Defines PSA developer APIs to simplify access to secure services



# PSA Functional API Certification



PSA RoT

Crypto

Attestation

Trusted boot

Secure Storage

Example security functions

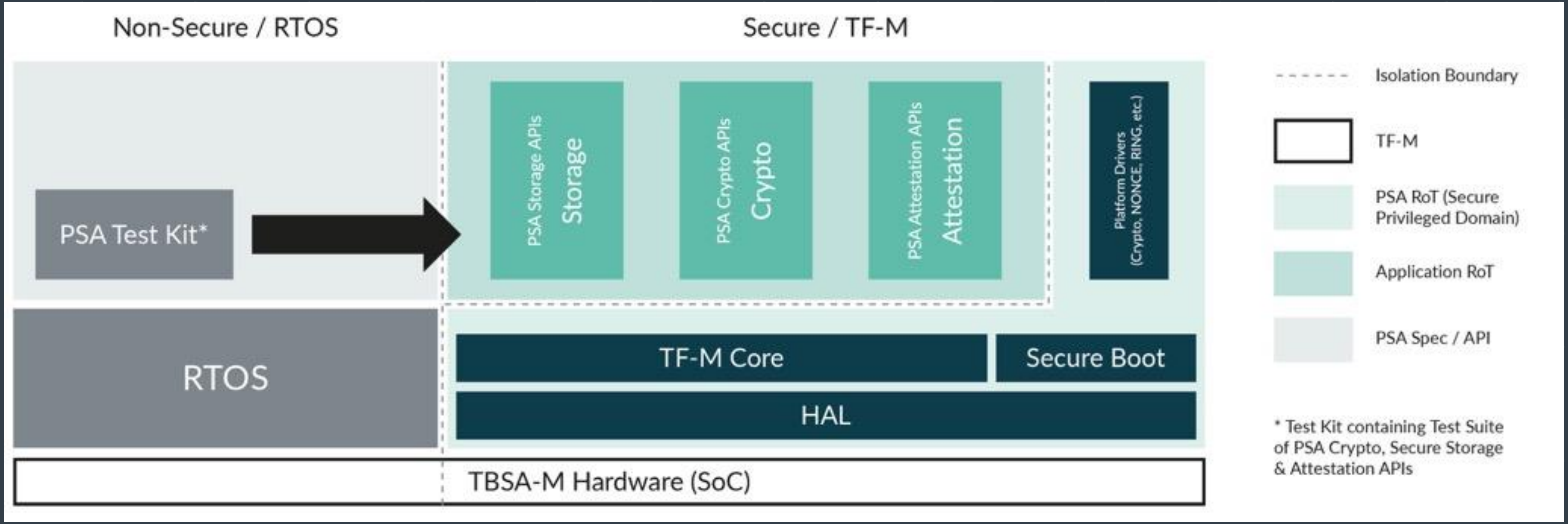
PSA Functional APIs

Any RTOS

Any architecture

psacertified™ functional API

# PSA Developer API test suite



* Test Kit containing Test Suite of PSA Crypto, Secure Storage & Attestation APIs

# Visit psacertified.org

## Download the documents and get started

Supported by the world’s leading chip vendors

Easy process for OEMs and software platforms to build on this momentum and demonstrate they are getting basic security principles correct

PSA Certified: building trust in IoT

Building trust through independent security assessment

# Certified Products

## Chip Vendor, RTOS, OEM

arm CHINA

arm MBED

CYPRESS EMBEDDED IN TOMORROW

ECOLUX IoT Lifecycle Security

expresslogic

lierda 利尔达科技集团

Zephyr™ Project

MICROCHIP

NORDIC SEMICONDUCTOR

NXM

NXP

RENESAS

security platform connecting trusted

SILICON LABS

ST

紫光展锐™ UNISOC

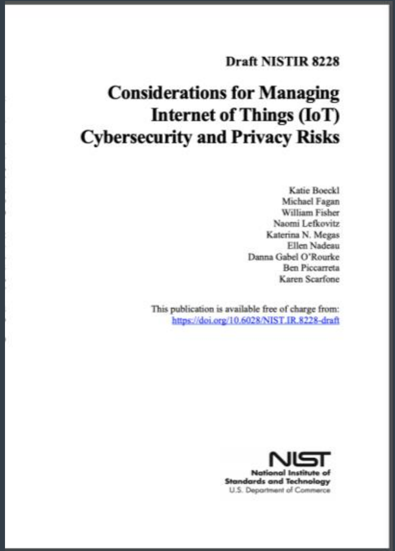
winbond

ZAYA

……

# Governments are creating IoT security requirements

## PSA & PSA certified help address common IoT security


Draft NISTIR 8228

**Considerations for Managing Internet of Things (IoT) Cybersecurity and Privacy Risks**

Katie Boeckl
Michael Fagan
William Fisher
Naomi Lefkovitz
Katerina N. Megas
Ellen Nadeau
Danna Gabel O'Rourke
Ben Piccarreta
Karen Scarfone

This publication is available free of charge from:
https://doi.org/10.6028/NIST.IR.8228-draft

NIST
National Institute of Standards and Technology
U.S. Department of Commerce

US: NIST

ICS 35.040
L 80

GB

中华人民共和国国家标准

GB/T 36951—2018

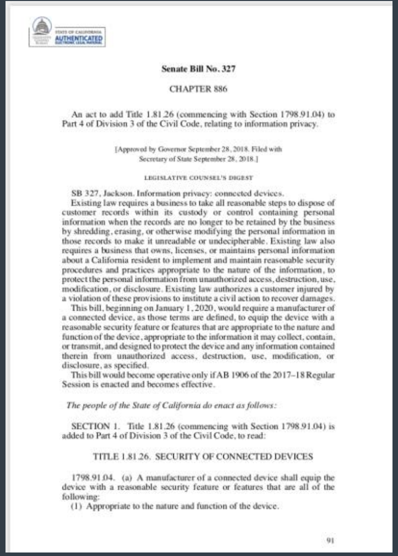
信息安全技术
物联网感知终端应用安全技术要求

Information security technology—Security technical requirements for application of sensing terminals in internet of things

2018-12-28 发布　　2019-07-01 实施

国家市场监督管理总局
中国国家标准化管理委员会　发布

China


STATE OF CALIFORNIA
AUTHENTICATED
ELECTRONIC LEGAL MATERIAL

**Senate Bill No. 327**

CHAPTER 886

An act to add Title 1.81.26 (commencing with Section 1798.91.04) to Part 4 of Division 3 of the Civil Code, relating to information privacy.

[Approved by Governor September 28, 2018. Filed with Secretary of State September 28, 2018.]

LEGISLATIVE COUNSEL'S DIGEST

SB 327, Jackson. Information privacy: connected devices.

Existing law requires a business to take all reasonable steps to dispose of customer records within its custody or control containing personal information when the records are no longer to be retained by the business by shredding, erasing, or otherwise modifying the personal information in those records to make it unreadable or undecipherable. Existing law also requires a business that owns, licenses, or maintains personal information about a California resident to implement and maintain reasonable security procedures and practices appropriate to the nature of the information, to protect the personal information from unauthorized access, destruction, use, modification, or disclosure. Existing law authorizes a customer injured by a violation of these provisions to institute a civil action to recover damages.

This bill, beginning on January 1, 2020, would require a manufacturer of a connected device, as those terms are defined, to equip the device with a reasonable security feature or features that are appropriate to the nature and function of the device, appropriate to the information it may collect, contain, or transmit, and designed to protect the device and any information contained therein from unauthorized access, destruction, use, modification, or disclosure, as specified.

This bill would become operative only if AB 1906 of the 2017–18 Regular Session is enacted and becomes effective.

*The people of the State of California do enact as follows:*

SECTION 1. Title 1.81.26 (commencing with Section 1798.91.04) is added to Part 4 of Division 3 of the Civil Code, to read:

TITLE 1.81.26. SECURITY OF CONNECTED DEVICES

1798.91.04. (a) A manufacturer of a connected device shall equip the device with a reasonable security feature or features that are all of the following:

(1) Appropriate to the nature and function of the device.

91

US: California

enisa

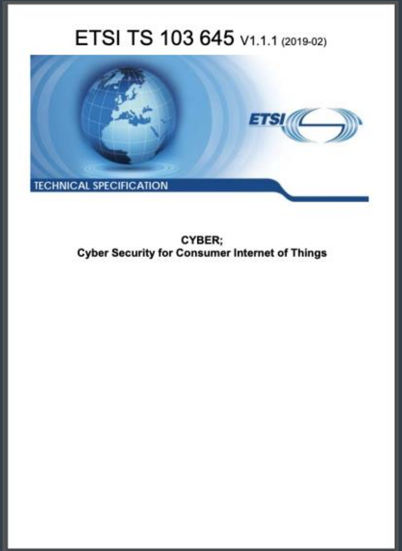
Baseline Security Recommendations for IoT

in the context of Critical Information Infrastructures

NOVEMBER 2017

www.enisa.europa.eu　European Union Agency For Network And Information Security

EU: ENISA


ETSI TS 103 645 V1.1.1 (2019-02)

ETSI

TECHNICAL SPECIFICATION

CYBER;
Cyber Security for Consumer Internet of Things

UK: ETSI

IoT security is an issue that affects citizens lives, crime reduction & counter terrorism

# Summary

## PSA Certified™ builds trust in devices and data

**Security certification**
A multi-level scheme testing the security assurance/robustness of IoT chips, platforms & devices designed for systems that contain a PSA-RoT

psacertified™

**Functional API certification (API Compliance)**
Uses test kits to prove that PSA based solutions have a consistent set of APIs for essential security functions, ensuring a consistent developer experience

psacertified™
functional API

# Questions?

Get started with PSA Certified and visit www.psacertified.org

Find out more about Trusted Firmware-M at www.trustedfirmware.org

平台安全架构(PSA)专栏 https://aijishu.com/blog/pingtaianquanjia

AIOT安全系列文章 https://aijishu.com/u/wangdawei/articles

Cortex-M和Cortex-A的TrustZone差异 https://aijishu.com/a/1060000000003352

IOT安全方案有了SE，为什么还要用TrustZone? https://aijishu.com/a/1060000000009143

# 欢迎到极术社区提问和讨论

Jishu AIoT
developer community
极术社区

https://aijishu.com/questions