Accessories Authentication with TrustFLEX Secure Elements

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Embedded Security Snapshot

All features require a

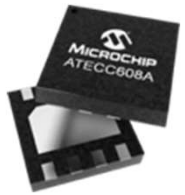
Crypto-ALGORITHM (the math) triggered by a KEY (the secret)

Application Layer Security	Leverage cryptographic capabilities of the system to further harden the implementation (access rights - privileges)
Secure Connectivity	Authenticate and encrypt the device communication
Secure Update	Leverage secure communication and secure boot mechanisms to ensure safe delivery of genuine images
IP Protection	Prevents adversaries to steal IP residing in the firmware of the MCU or RTL of the FPGA
Counterfeit Protection	Prevents adversaries to counterfeit disposable goods (cartridge) or protect from copies of accessories
Hardware Root of Trust	Trustable identity Firmware validation (aka secure boot – for all systems)

Microcontrollers
32/16/8-bit
Ex : Arm® Cortex®- M23 +

Microprocessors
Arm® Cortex®-A5

Secure Elements
Common Criteria (JIL) Rated HIGH



Network controllers
Wired & Wireless
Integrated Communication Stacks

FPGA
Solutions

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Save Costs, Reduce Risk, Protect Revenue

Secure Your Ecosystem

- **Brand protection and preserve quality**
  - Avoid counterfeit
  - Avoid low quality and low performance
  - Controlled ecosystem strategy

- **Enable service revenue streams**
  - Maintenance service strategy
  - Part replacement strategy

- **Revenue stream protection**
  - Start with authentication from the start
  - Protect user experience
  - Avoid discounted copies

- **Reduce cost**
  - Makes sure the IP in your firmware is genuine
  - Reduce/mitigate warranty cost of returned products

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Accessories Authentication

The **value** is the Intellectual Property (IP) that represent the **accessory**.

Consequently, the signed code needs to be verified at any relevant point of time during the operation of the system.

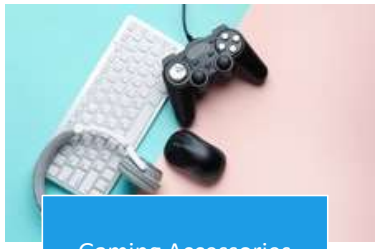
Applications

CLIENT
= The peripheral

Challenge

Response

HOST
= The central computing unit



Gaming Accessories

Computing Peripherals

Tablet / Smartphone Accessories

Mobile Phone Battery Authentication

Docking Station Authentication

USB
Power Delivery

Virtual
Reality

Qi Wireless Charging Authentication (Tx)

Bluetooth Accessories

Power Supply
Data Center

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Importance of Keys in Security

- **Security: It's All About the Key**

- **A cryptosystem should be secure if everything about the system – *except the key* – is public knowledge**

  Kerckhoff's Principle

What a private key really looks like
JVFDvdfvJvfdnjvjk543524cds9ics9cCDSCcs0dcw8eidpciswsn8934XSCDS

- **The Enemy Knows the System**

  Claude Shannon

- **Why are the keys important ? With the possession of the key, critical transactions can be impersonated**

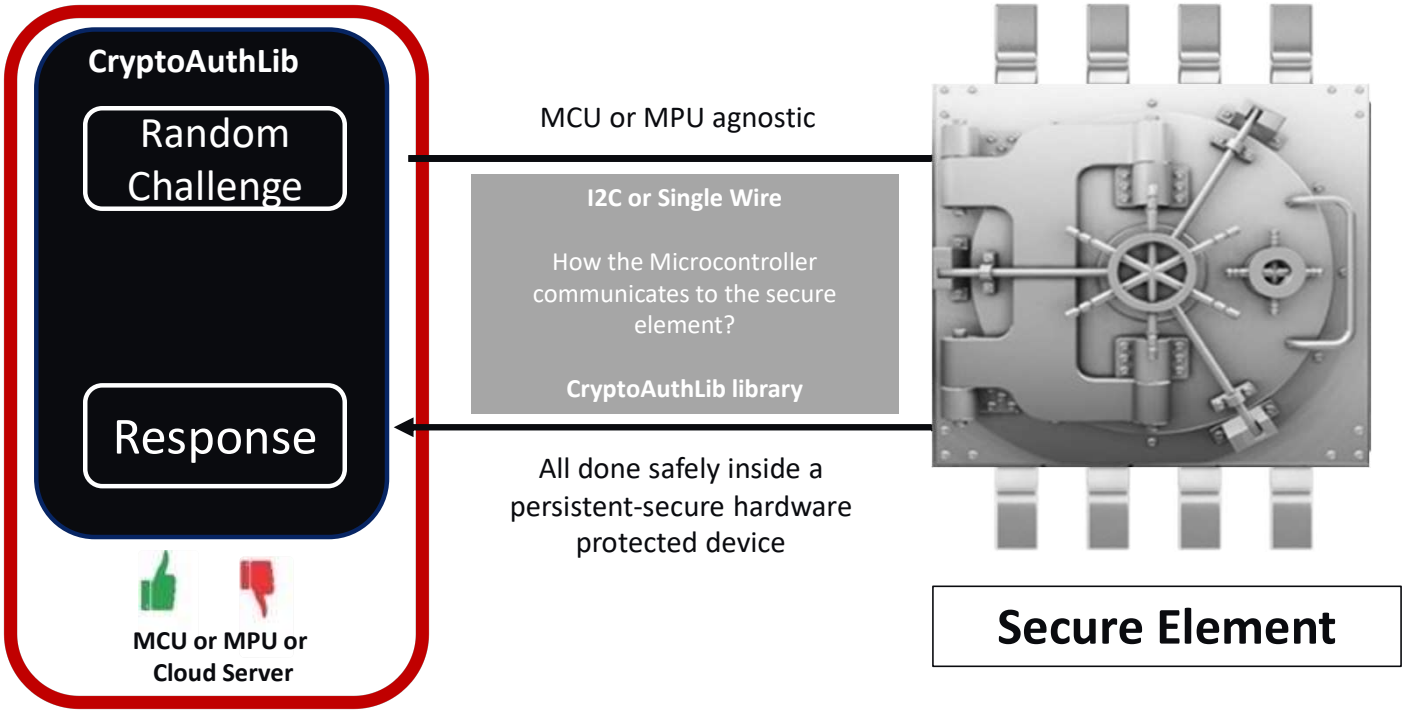
How to Protect the Keys in an IoT System ?

Use a Secure Element

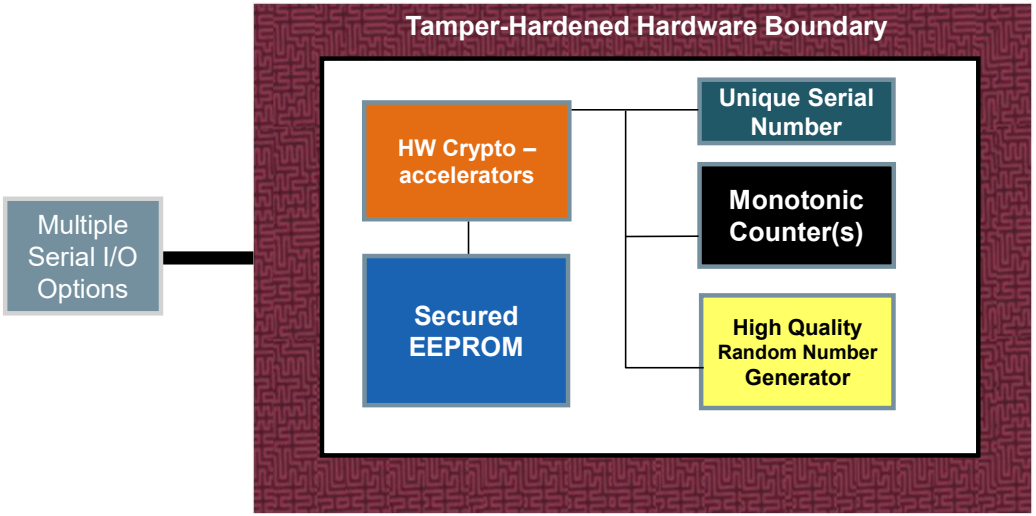
A secure element is a **vault that protects secrets**, it's a companion device to the microcontroller

Inside the vault secrets are **generated during manufacturing** - inside Microchip secured factories

The secrets (keys, certificates) are **not exposed** and handled by Microchip **secure provisioning** process



Secure Element Basic Architecture



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The Challenge

Notion of Personalization

- **Customization due to each key being unique to each product.**
- **How to handle security complexity and customization:**
  - In product development?
  - In the supply chain?

Microchip Trust Platform

		TRUST&GO	TRUST FLEX	TRUST CUSTOM
Pre-configured		YES	YES	NO
Pre-provisioned		YES	YES (flexible)	NO
MOQ	**Low MOQ flow**	10 units	2 000 units	4 000 units
	High Volume flow*	30 000 units	30 000 units	30 000 units
Development time		Lowest	Lower	Custom
Complexity		Lowest	Lower	Custom
Secure Key Storage		JIL High	JIL High	JIL High
Devices		ATECC608A	ATECC608A ATSHA204A (w/o RBH) – Q4/2020	ATECC608A ATSHA204A (w/o RBH) – Q3/2020

* MOQ depending on Package / Silicon – showing here the lowest MOQ through the whole product portfolio – **Minimum Annual Business of 100ku**

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TrustFLEX : Overview

Use Cases

- **What if the customer likes Trust&GO, but their use case requires more than Trust&GO?**
- **TrustFLEX allows an overlay of Trust&GO functionality with any combination of the following use cases:**

- **Start with pre-configured only device policies**
- **Cover the most commonly used use cases**
  - Custom certificate authentication
  - JWT authentication
  - Secure boot (with key attestation)
  - OTA verification
  - FW IP protection
  - Message encryption
  - Key rotation
  - I/O protection key
  - **Host accessory authentication**

- **Needs to be provisioned with customer credentials**
- **Use cases that require some customer information:**
  - Secure boot public key
  - Secure boot master public key
  - Accessory / IP protection master secret
  - PKI chain

microchip.com/**TrustFLEX**

TrustFLEX

Advantages

microchip.com/**TrustFLEX**

Flexible

Flexibility

Support any core, any cloud, any certificate authority providers

Accommodate customer's own secrets

Time to Market

Reduce time to market

Out-of-the-box pre-defined use cases

No time spent on device configuration

Availability

Low MOQ including provisioning

Address all types of project and company volume sizes

Security solution for the fragmented mass market

Support

Simple Engagement Model

The Trust Platform Design Suite removes friction for both development and secret exchange

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Accessory Secure Authentication

Ecosystem control

What do we want to achieve ?

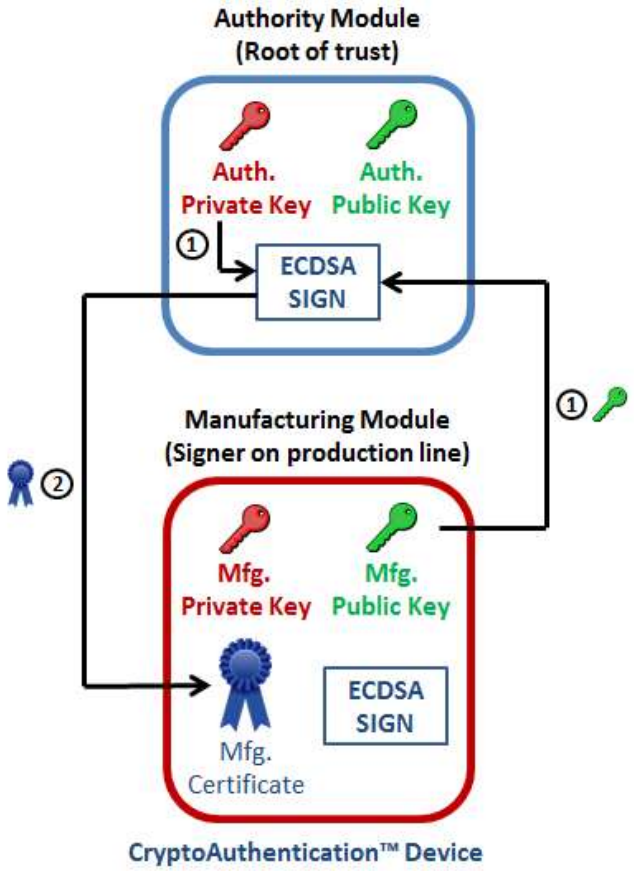
Establish TRUST between the host and the accessory

- The host will need to prove itself to the accessory
- The accessory will need to prove itself to the host

A Genuine Manufacturing Site

The resultant Manufacturing Certificate is sent back to the Manufacturing Module.

This establishes the manufacturing site as a genuine authorized producer of end products



Legend:
Auth. = Authority
Mfg. = Manufacturing

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Authenticating the End Product

- **Step 3:**

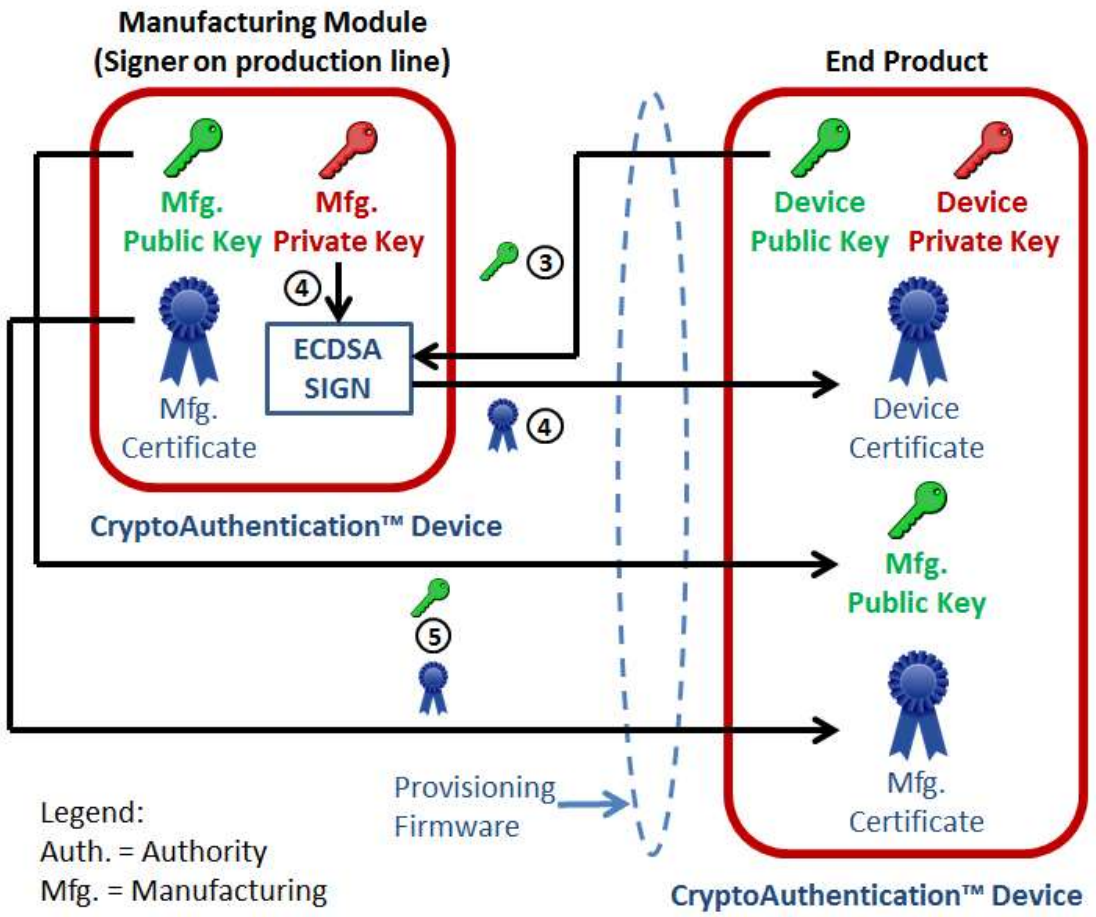
During production, provisioning firmware is run which supplies the End Product (device) Public Key to the Manufacturing Module.

- **Step 4:**

The Manufacturing Module signs the device public key with its Private key and supplies a Device Certificate to the end product.

- **Step 5:**

The Manufacturing public key and the Manufacturing certificate are placed in the end product at the time of manufacture.



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Authenticating the Accessories

- **Step 1:**

Verify Signer Public Key: The Host requests the Manufacturing Public key and Certificate. The Host verifies the certificate with the Authority Public key.

- **Step 2:**

Verify Device Public Key: If the verification is successful, the Host requests the Device Public key and Certificate. The Host verifies the certificate with the Manufacturing Public key.

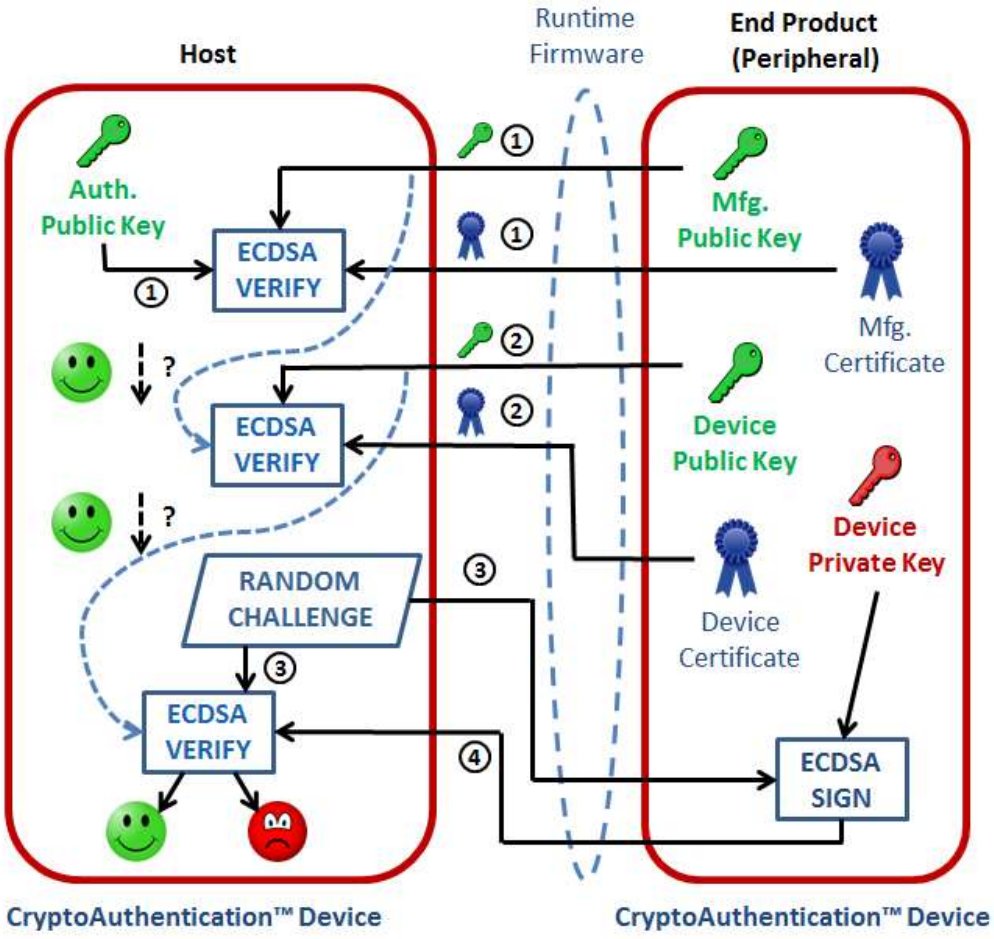
- **Step 3:**

Challenge – Response: If the verification is successful, the Host creates a random number challenge and sends it to the End Product (Peripheral). The End Product signs the random number challenge with the Device Private key.

- **Step 4:**

The signature is sent back to the Host for verification using the Device Public key.

The Chain of Trust has been verified back to the Root of Trust.



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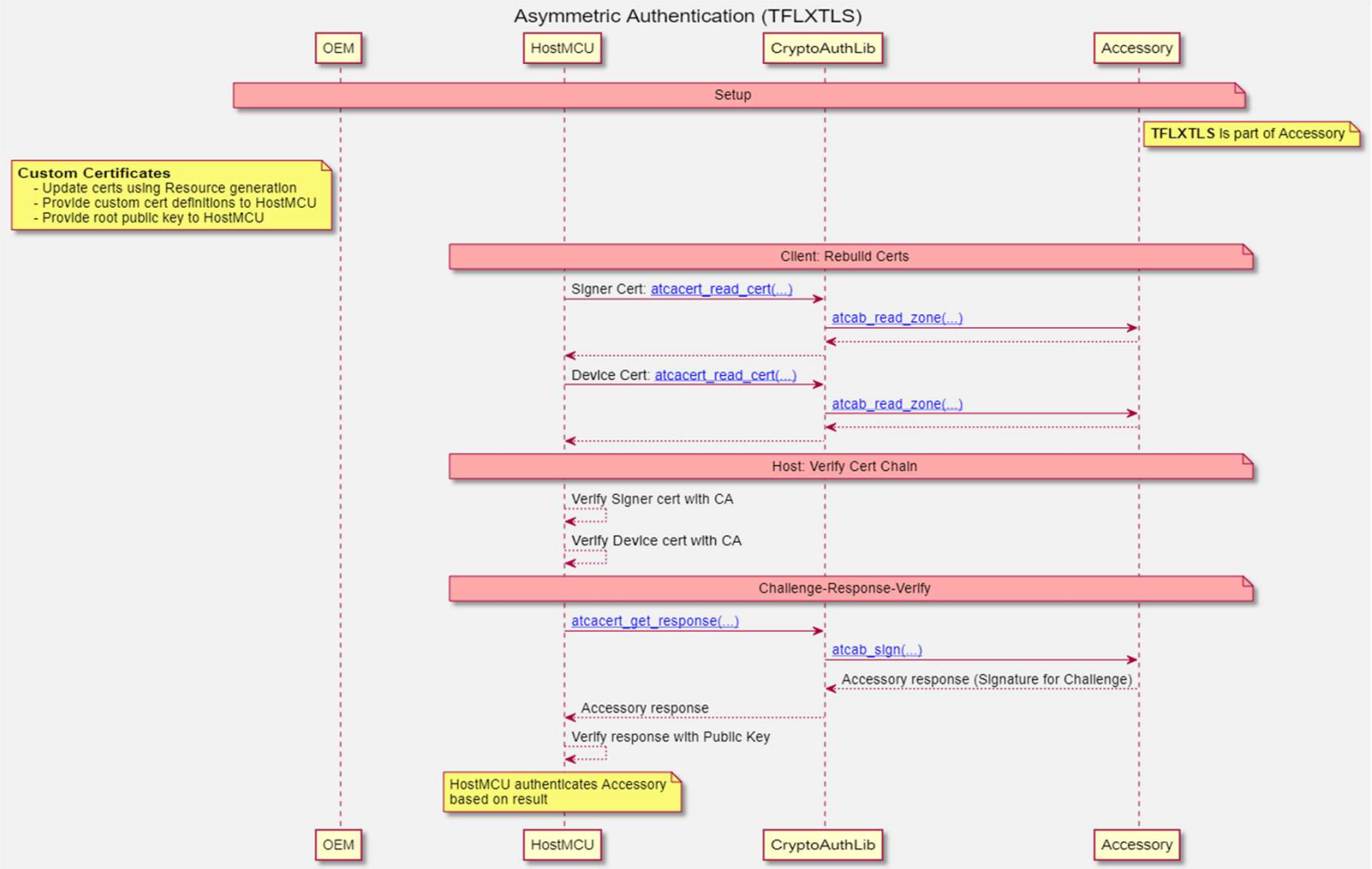
Transaction Diagram



Hardware Development Tools

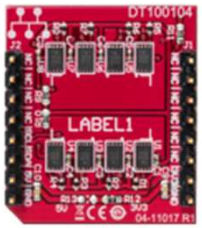
DM320118

Trust Platform USB Kit

- Direct prototyping
- PC Host via USB (with Python Jupyter Notebook tutorials)
- Or onboard SAMD21 with debugger

DT100104

ATECC608A Trust Platform Board



- Onboard
  - Trust&GO
  - TrustFLEX
  - TrustCUSTOM
- MikroBUS male

Mikroe.com Socket

- UDFN and SOIC
- Same functionality as XPRO Socket Boards
- MikroBUS male pinout
- Sold through Mikroe.com

AT88CKSCKTUDFN

CryptoAuthentication™ Socket Kit

- UDFN8 socket
- SOIC8 socket
- Xplain PRO form factor

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Simpler Onboarding

Trust Platform Design Suite Software

1 Define

Map use case to configuration

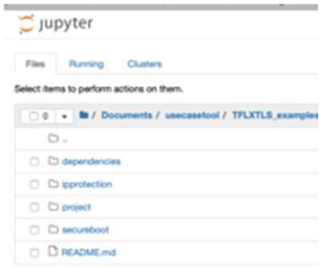
Use Case Tool

2 Prototype

Python executable tutorial

Jupyter Notebook

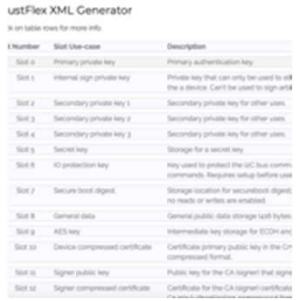
3 Develop



C-code projects for each use case

Any IDE

4 Release



Generates secret exchange file

Secret Exchange

Download from : https://microchipdeveloper.com/authentication:trust-platform

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Takeaways

Easier onboarding with **predefined use cases**

Quick development with **simple toolsets**

Simpler flows leveraging **e-commerce stores**

Fitted for Mass Market with **low MoQ** including **provisioning** and **Microchip certificates**

Architecture Agnostic with any cloud, any PKI*, any controller, any connectivity

*PKI : public key infrastructure

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Microchip Trust Platform

microchip.com/**TrustFLEX**

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Thank You