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STM32U5 AWS IoT Hands-on

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Agenda

1 STM32U5 Introduction

2 FreeRTOS STM32U5 Reference Integration

3 STM32U5 AWS QuickConnect

4 Boards distribution

5 Hands-on

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STM32U5 Microcontrollers

The new reference for secure and smart IoT applications

Higher Security
Certified PSA L3 and SESIP L3

Lower Power
58 ULPMark-CM

Richer applications
Cortex-M33 @160MHz, extended features set

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STM32U5 IoT Kit

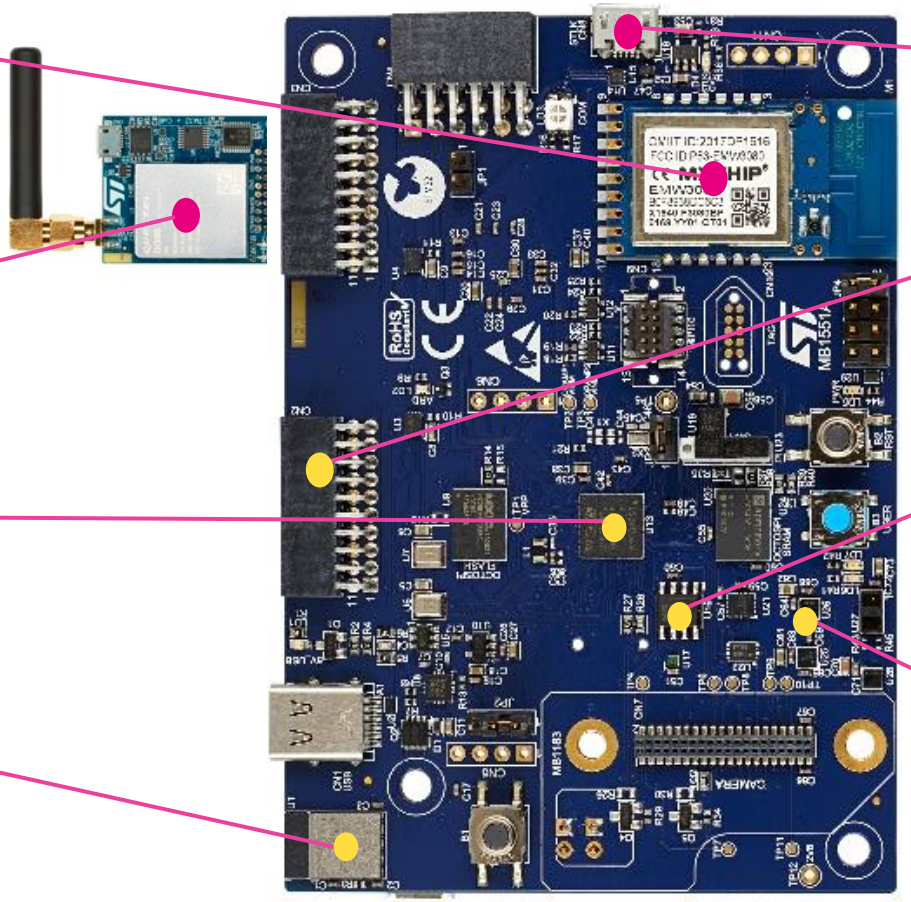
Your reference board for IoT Proof-of-Concept

Wi-Fi Module

Extension modules

STM32U5 MCU

BLE module



Programming and Debug

Extension connectors
Arduino (backside), PMOD, STMOD+

STSAFE secure element

Sensors
Accel, Magnetometer, Pressure, Humidity, ToF, Temperature

B-U585I-IOT02A

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AWS IoT on STM32U5

X-CUBE-AWS reference integration simplifying your development

STM32 CubeExpansion

X-CUBE-AWS

- **AWS Certified**
- **Leveraging ARM Trusted Firmware-M (TF-M)**
- **Based on FreeRTOS LTS Library**
- **Over The Air Update**
- **AWS IoT Defender**

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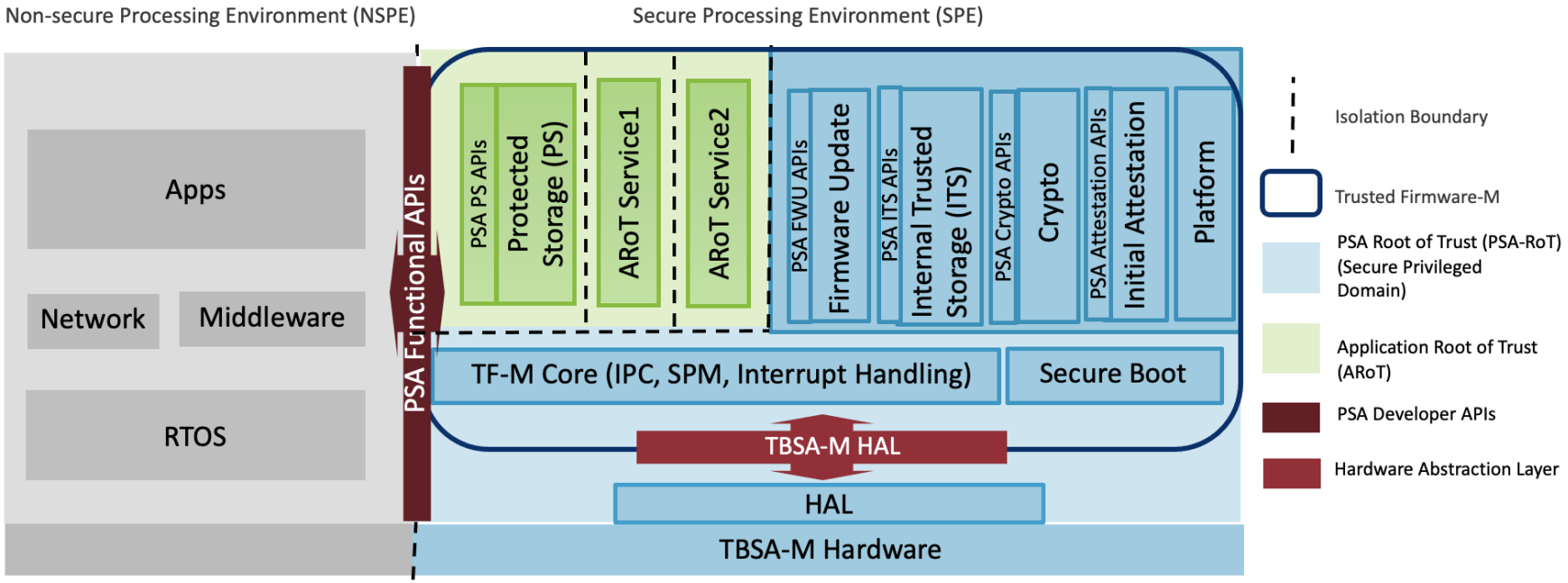
Trusted Firmware-M (TF-M)

- Trusted Firmware for Cortex M (TF-M) implements the Secure Processing Environment (SPE) for Armv8-M, Armv8.1-M
- **Trusted Firmware-M consists of:**
  - Secure Boot , Control the isolation, communication and execution within SPE and with NSPE
  - Crypto, Internal Trusted Storage (ITS), Protected Storage (PS) and Attestation secure services



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STM32U5 FreeRTOS reference

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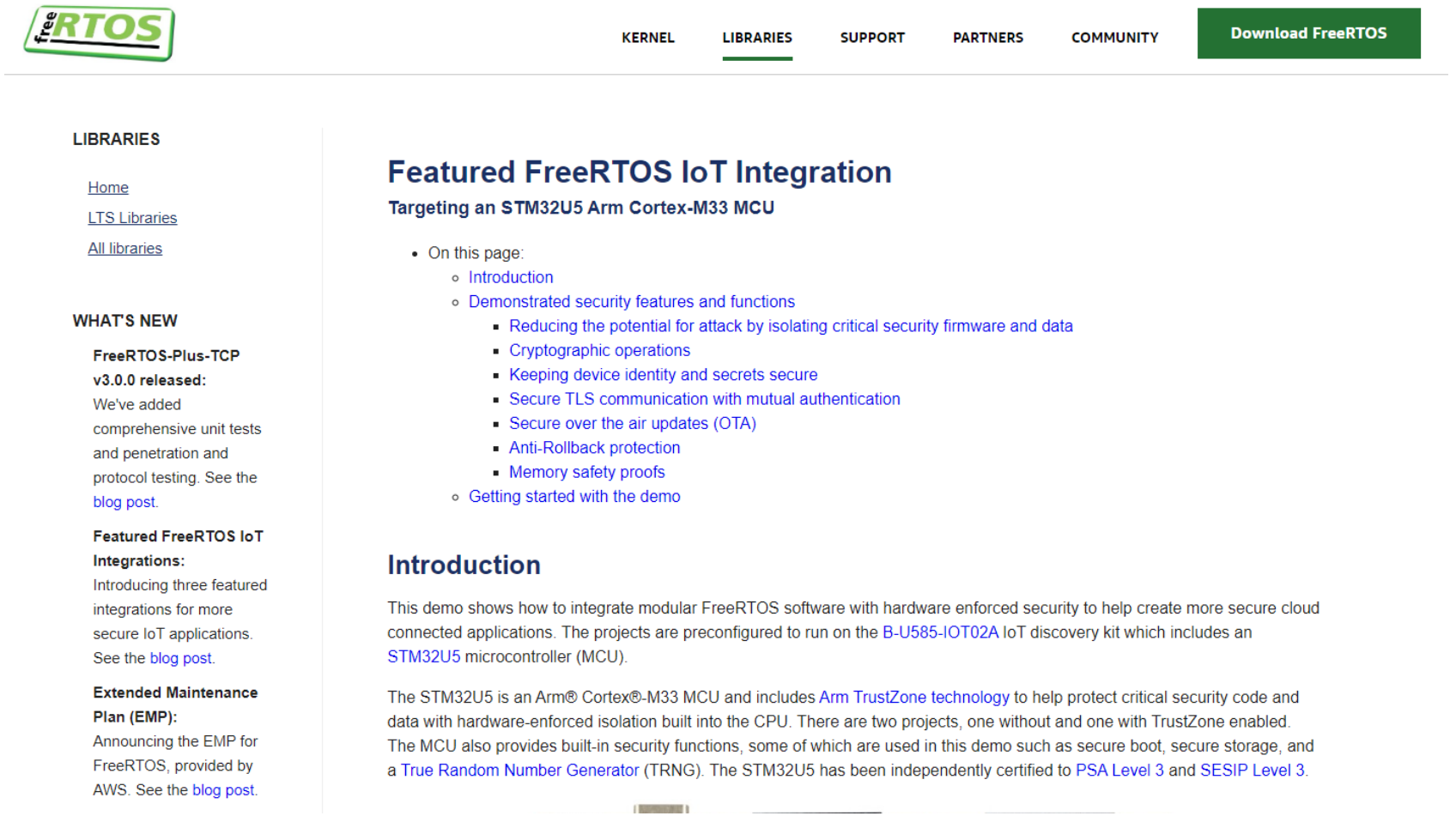
Featured FreeRTOS IoT Integration

- https://www.freertos.org/STM32U5/



KERNEL LIBRARIES SUPPORT PARTNERS COMMUNITY Download FreeRTOS

LIBRARIES

Home
LTS Libraries
All libraries

WHAT'S NEW

FreeRTOS-Plus-TCP v3.0.0 released: We've added comprehensive unit tests and penetration and protocol testing. See the blog post.

Featured FreeRTOS IoT Integrations: Introducing three featured integrations for more secure IoT applications. See the blog post.

Extended Maintenance Plan (EMP): Announcing the EMP for FreeRTOS, provided by AWS. See the blog post.

Featured FreeRTOS IoT Integration

Targeting an STM32U5 Arm Cortex-M33 MCU

- On this page:
  - Introduction
  - Demonstrated security features and functions
    - Reducing the potential for attack by isolating critical security firmware and data
    - Cryptographic operations
    - Keeping device identity and secrets secure
    - Secure TLS communication with mutual authentication
    - Secure over the air updates (OTA)
    - Anti-Rollback protection
    - Memory safety proofs
  - Getting started with the demo

Introduction

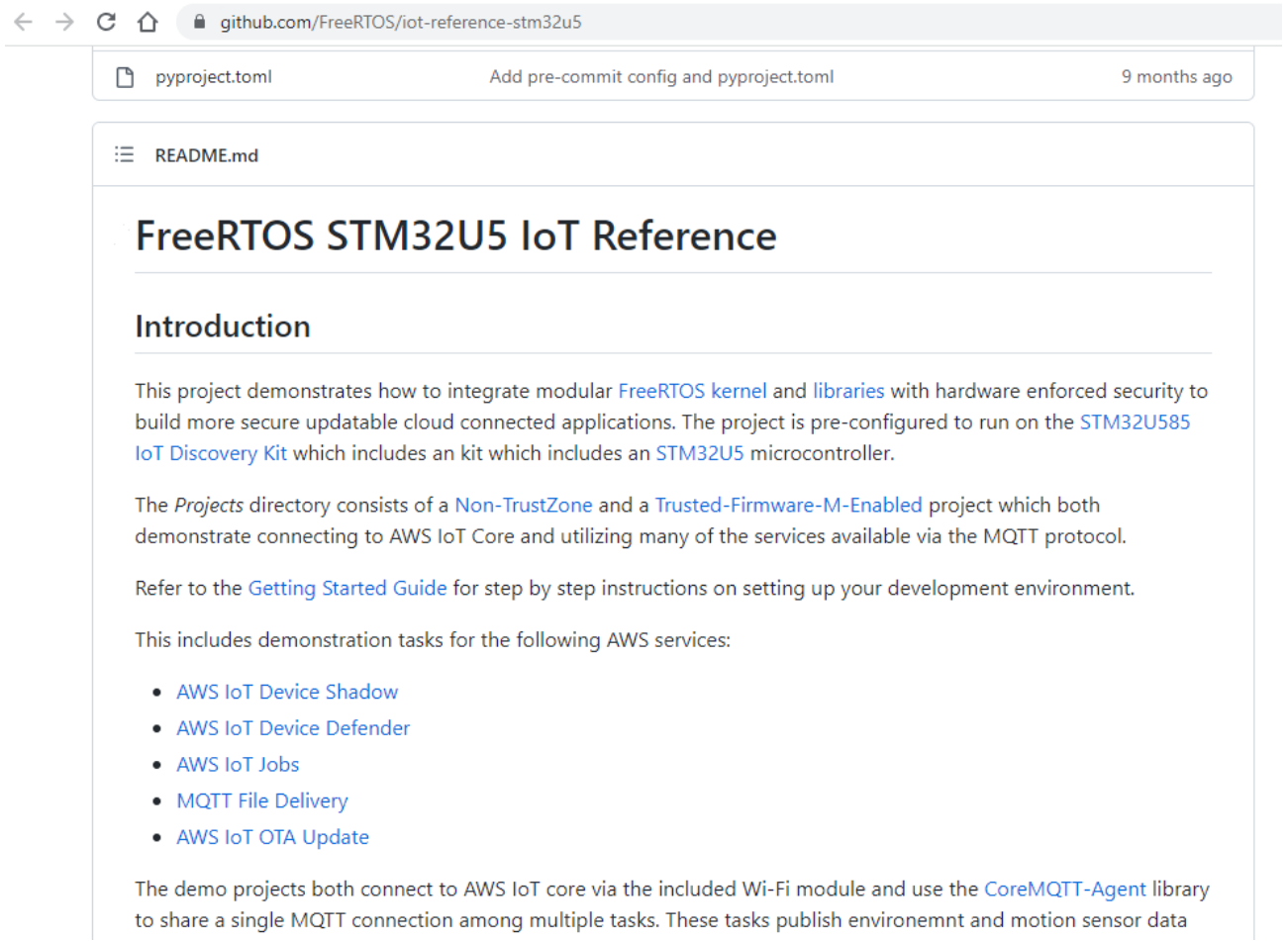
This demo shows how to integrate modular FreeRTOS software with hardware enforced security to help create more secure cloud connected applications. The projects are preconfigured to run on the B-U585-IOT02A IoT discovery kit which includes an STM32U5 microcontroller (MCU).

The STM32U5 is an Arm® Cortex®-M33 MCU and includes Arm TrustZone technology to help protect critical security code and data with hardware-enforced isolation built into the CPU. There are two projects, one without and one with TrustZone enabled. The MCU also provides built-in security functions, some of which are used in this demo such as secure boot, secure storage, and a True Random Number Generator (TRNG). The STM32U5 has been independently certified to PSA Level 3 and SESIP Level 3.

FreeRTOS STM32U5 GitHub repository

- https://github.com/FreeRTOS/iot-reference-stm32u5

```
git clone https://github.com/FreeRTOS/iot-reference-stm32u5.git --recurse-submodules
```



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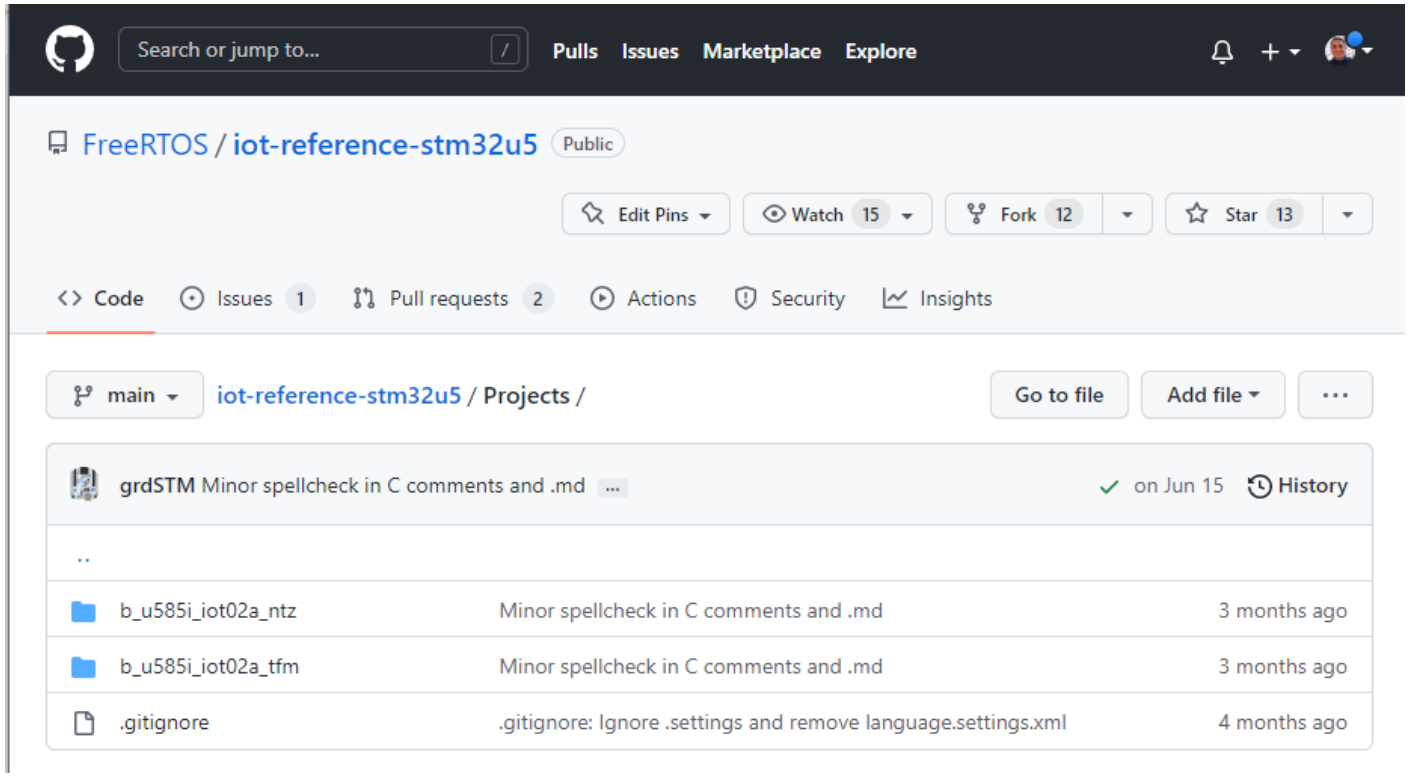
Projects

- Two projects
  - b_u585i_iot02a_ntz (For POC only)
  - b_u585i_iot02a_tfm (For production)



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STM32U5 AWS Quick Connect

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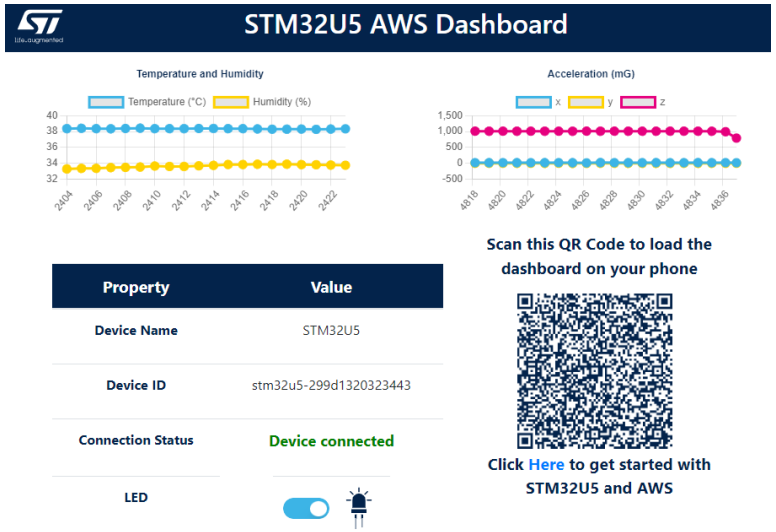
AWS Quick Connect

Abstracts Firmware customization and registration process

- Allows Cloud IoT/Data architects to focus on developing power of the Cloud IoT platform proof of concepts.
- Connect to AWS IoT and perform telemetry in minutes
- Solution Components:
  - *B-U585I-IOT02A Discovery Kit*
  - *Reference Binary*
  - *Quick connect scripts*
  - *Cloud visualization*



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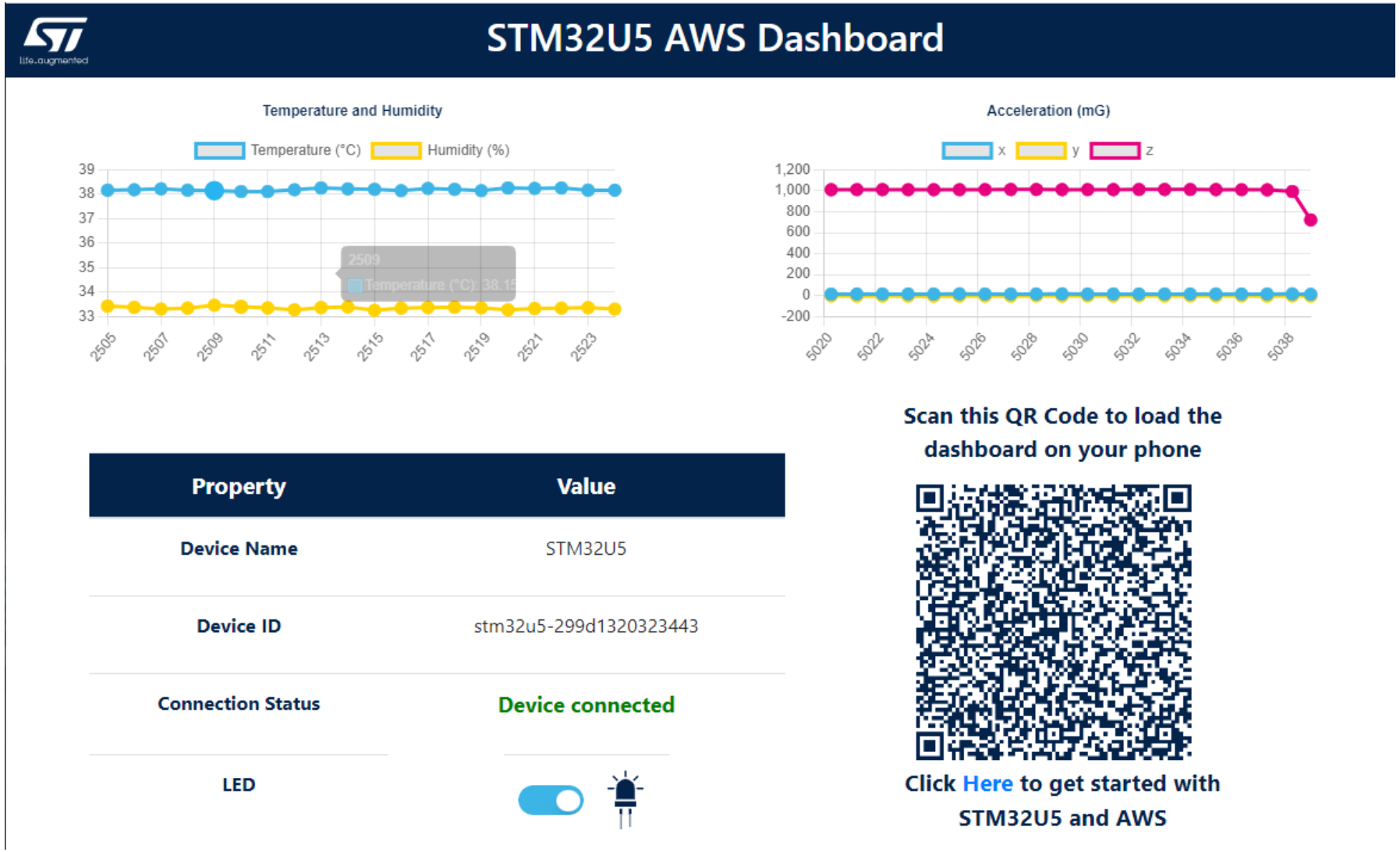
STM32U AWS Dashboard



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Boards distribution

Boards distribution

- Believe it or Not, even at ST we have hard time to get boards. Unfortunately, we need to collect the board at the end of the workshop to use them in the next one.
- We’ll disinfect the boards at the end of the workshop and before re-distribution.
- A voucher is handed at the end of the workshop

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Lab 1

Lab 1: System preparation

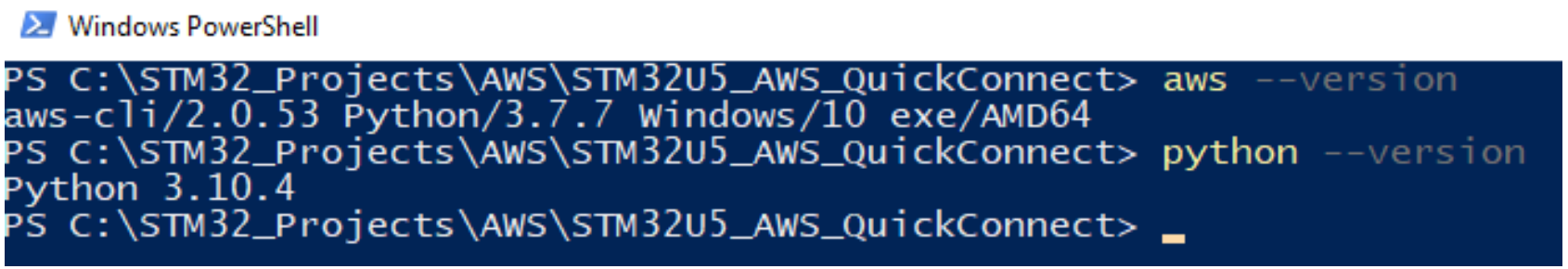
- In this lab we'll make sure that all the tools are properly installed and that your PC is ready to run the STM32U5_AWS_QuickConnect script

System Check

- Clone the workshop repo:

```
git clone https://github.com/SlimJallouli/ST_DevCon_2022_AWS_Workshop.git --recurse-submodules
```

- Open a command window (example PowerShell or bash)
  - Run:
    - `aws –version`
    - `python –version`

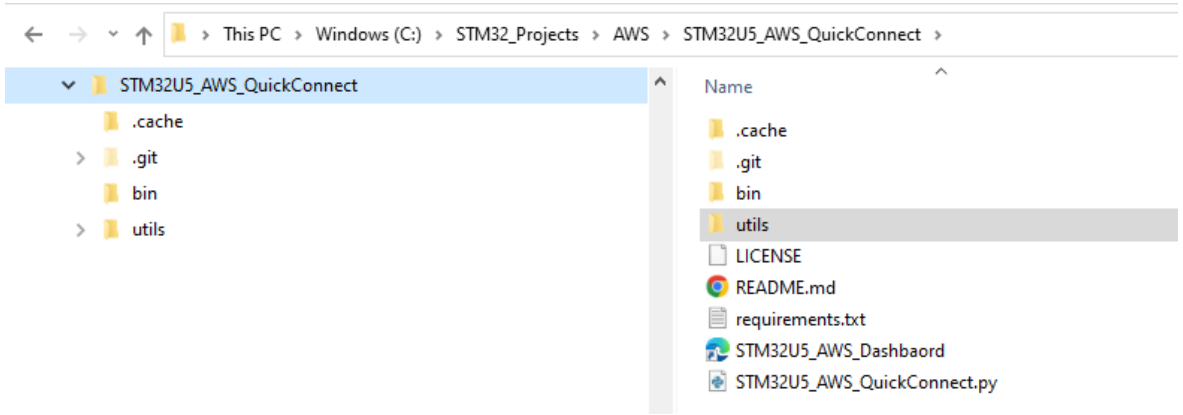


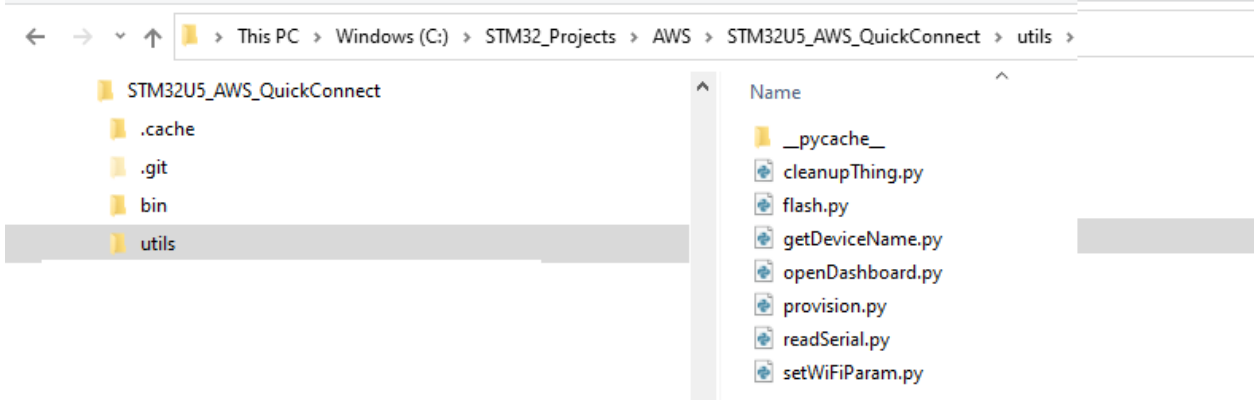
  - Navigate to the `STM32U5_AWS_QuickConnect` directory
  - Run: `pip install –r requirements.txt`

AWS CLI profiles

- Navigate to the `STM32_AWS_QuickConnect` directory
- Open a command window (example PowerShell or bash)
  - For Windows users double click on `AWS_CLI_ProfileConfig.bat`
  - For Linux and MAC users run `AWS_CLI_ProfileConfig.sh`
  - The scripts will add two AWS CLI profiles called `provision` and `dashboard`.
  - The first profile is used to provision your board with AWS IoT core
  - The second profile is used to open the STM32U5 AWS Dashboard

STM32U5 AWS QuickConnect





pip install –r requirements.txt

Link to your device dashboard

STM32U5 QuickConnect script

Utils:

- Flash the binary
- Generate a device name
- Change Wi-Fi ssid and password
- Provision the board
- Open dashboard and create shortcut
- Read and print the serial port

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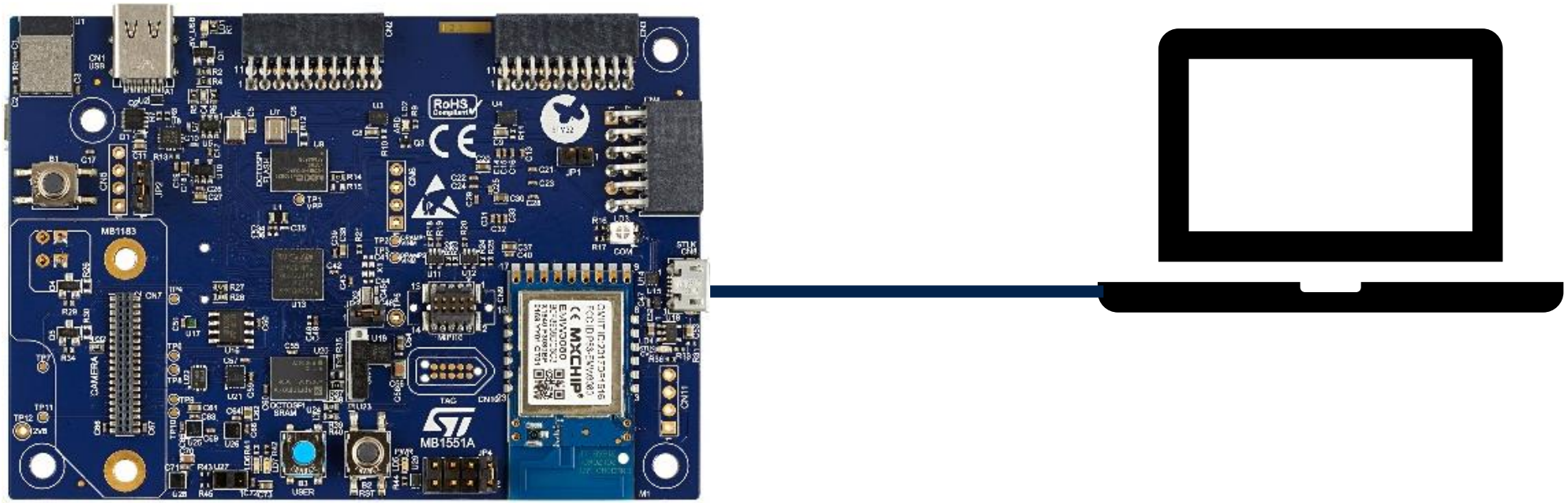
Lab 2

Lab 2: Connect the board to AWS IoT Core

- In this lab we'll use the STM32_AWS_QuickConnect to connect your board AWS IoT Core and open a dashboard to visualize the sensor data and control the LED.

Connect your board

- Connect your board to the PC

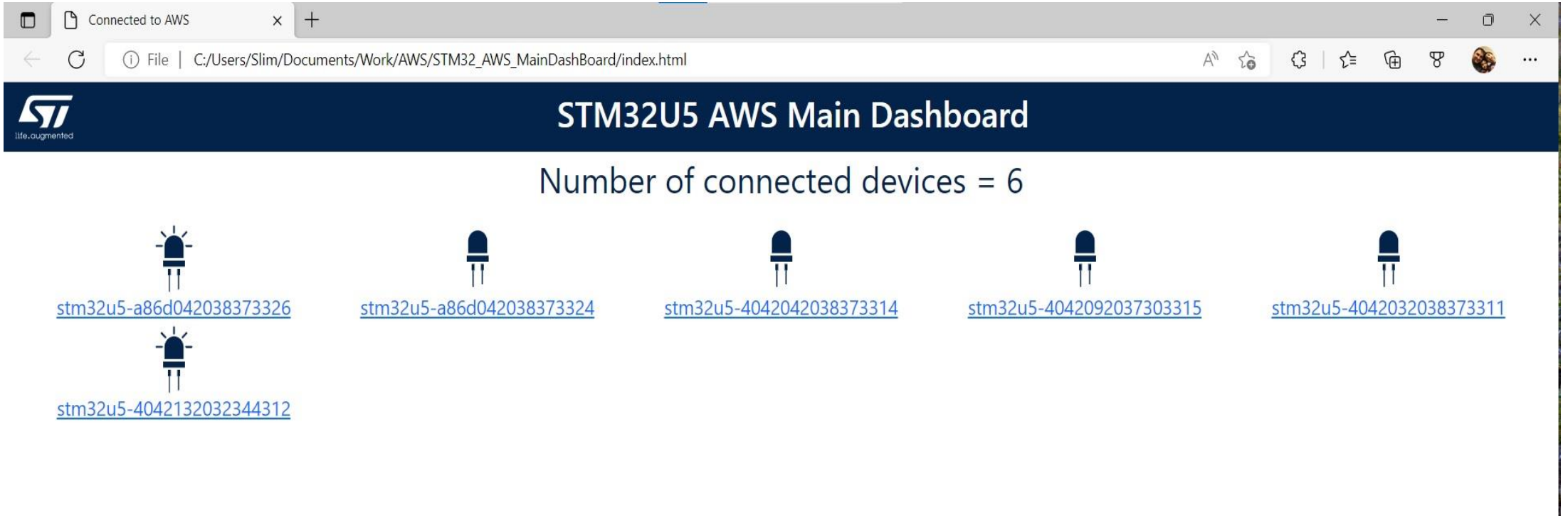


Run the quick connect script

- Navigate to `STM32U5_AWS_QuickConnect` directory
- Open a PowerShell console
- Type `python .\STM32U5_AWS_QuickConnect.py -i`
- Accept all the default settings
- The script will:
  - Flash your board with the binary
  - Provision your board with AWS IoT Core
  - Set the Wi-Fi SSID and password
  - Create a shortcut link to the dashboard specifically for your board
  - Open the dashboard for your board

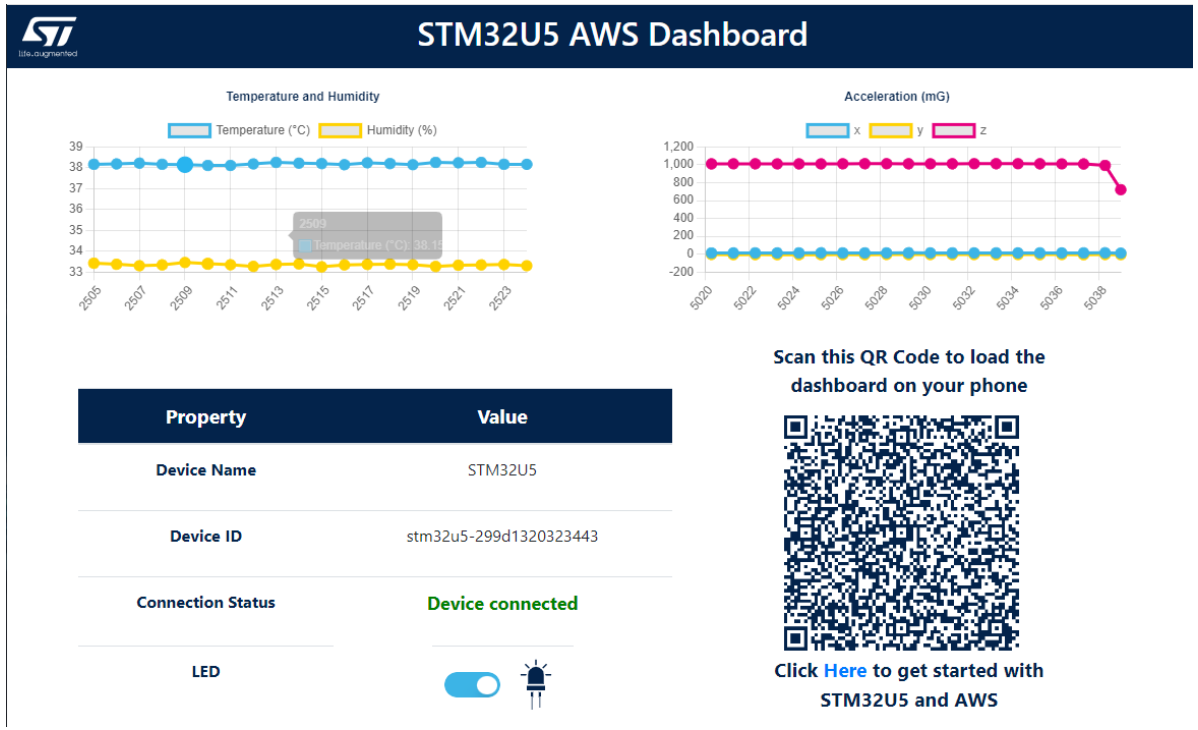
Main Dashboard

- I'll have a special dashboard showing the number of connected devices, the device ID and the corresponding LED status in real time as your boards get connected.



STM32U5 AWS Dashboard

- Scan the QR code with your phone camera
- Move the board to see the sensor data changing
- Use the toggle button to toggle the LED On/Off



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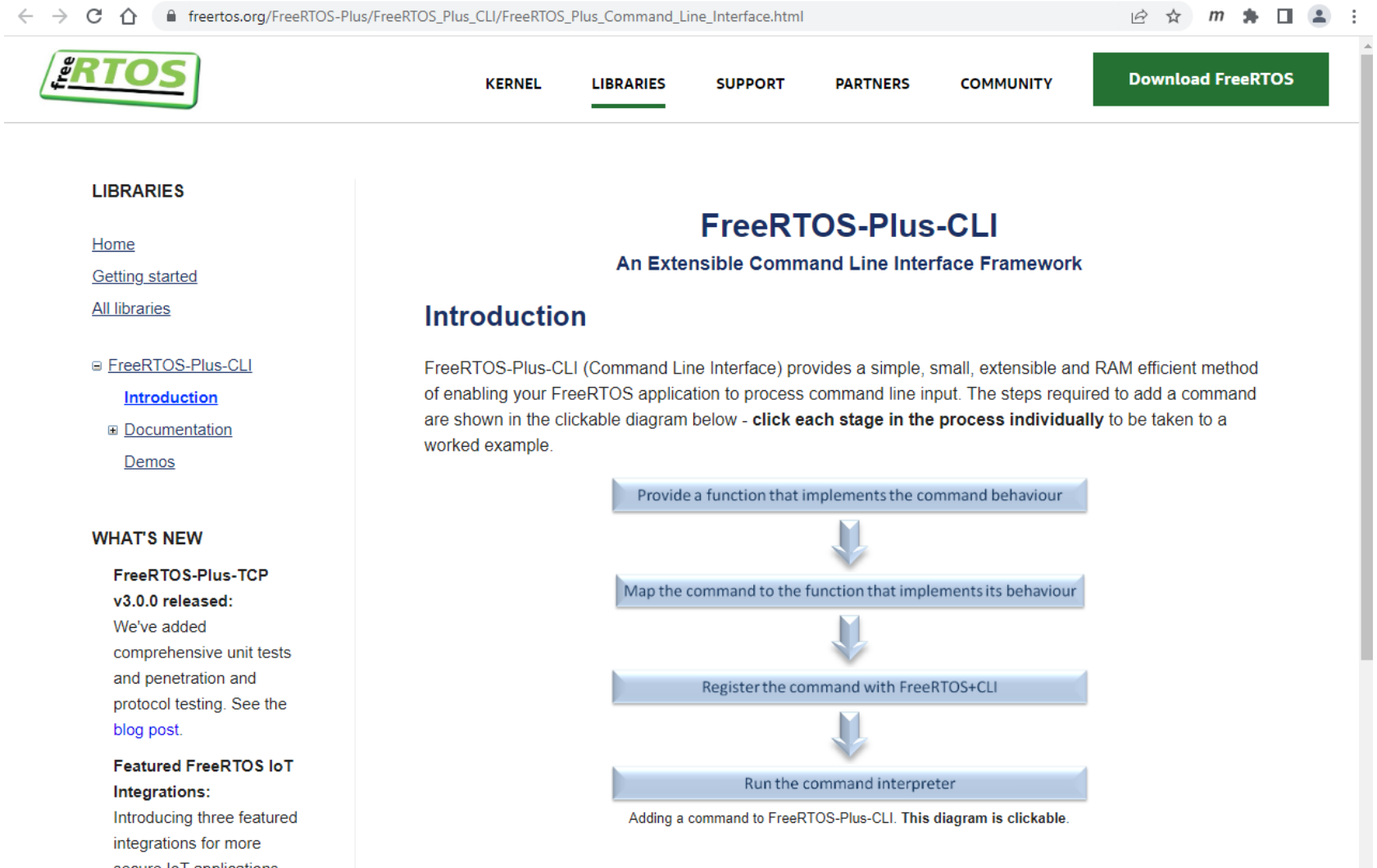
Lab 3

Lab 3: FreeRTOS-Plus-CLI

- In this lab we'll use the **FreeRTOS-Plus-CLI to** check and change the board configuration and check the application status

FreeRTOS-Plus-CLI

https://www.freertos.org/FreeRTOS-Plus/FreeRTOS_Plus_CLI/FreeRTOS_Plus_Command_Line_Interface.html



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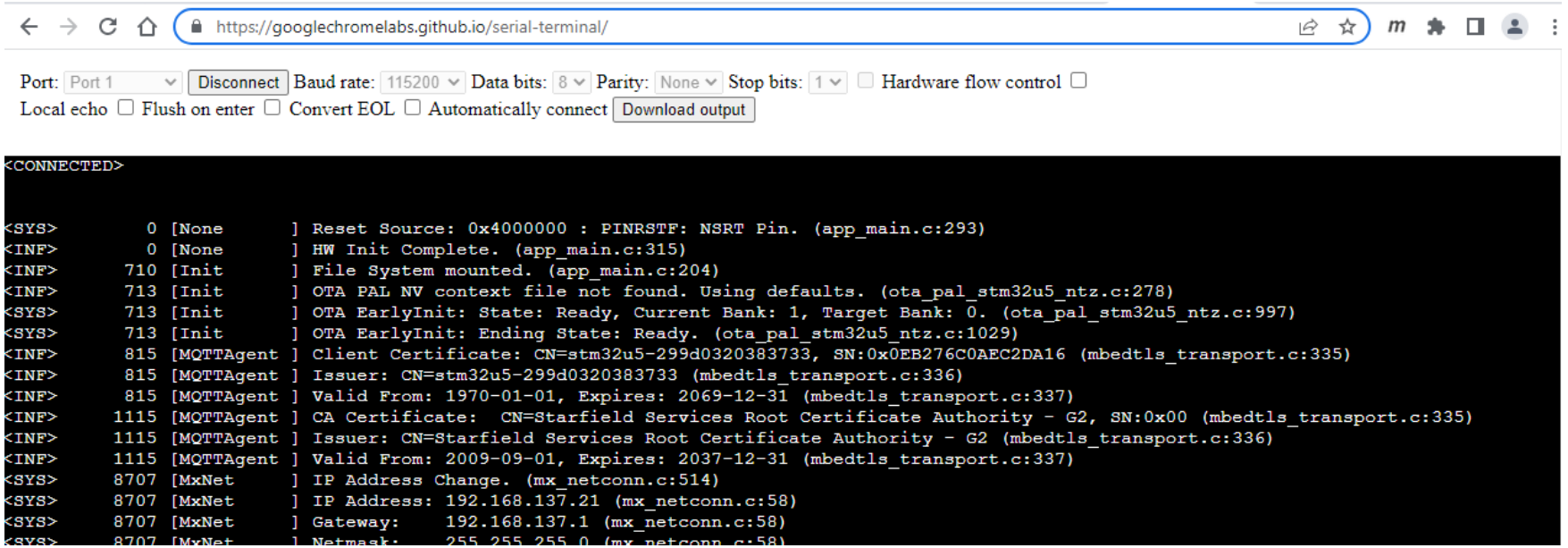
Connect to the board over serial port

- Close the quick connect script window
- You can use a serial terminal like TeraTerm or this web based serial terminal

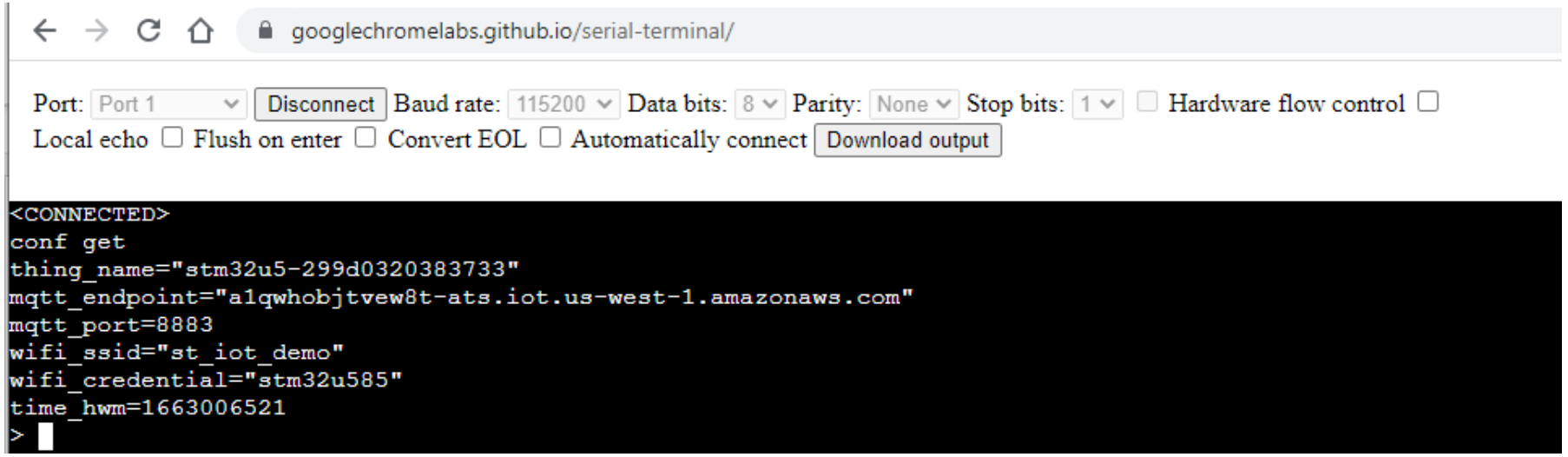
https://googlechromelabs.github.io/serial-terminal/

- Connect to the board (8-bits, 1-stop, 115200)



FreeRTOS CLI: Check your board configuration

- On the terminal type `conf get`

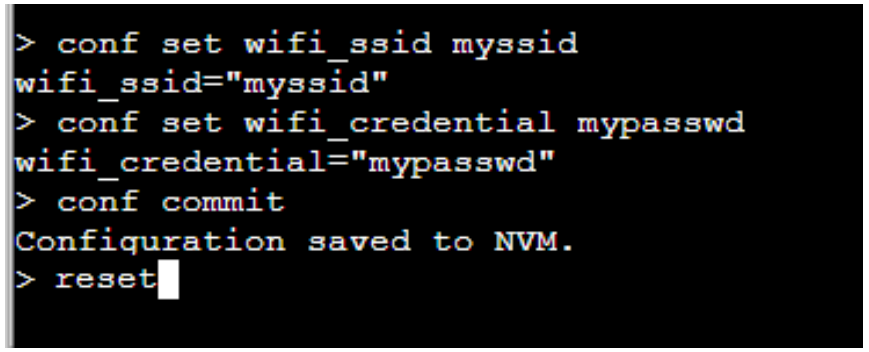


- Type `help` for help menu

FreeRTOS CLI: Change your board Wi-Fi settings

- Two ways to change the board Wi-Fi settings

1- You can use the terminal and type the following commands



2- Use the STM32_AWS_QuickConnect\utils\setWiFiParams.py

```
python setWiFiParams.py --ssid=mysid --password=mypassword
```

Our technology starts with You

Find out more at www.st.com

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