Quick Start Guide
STM32Cube function pack for IoT sensor node with telemetry and device management applications for Microsoft Azure cloud (FP-CLD-AZURE1)

Version 5.0 (March 26, 2020)
1. Hardware and Software overview
2. Setup & Demo Examples
3. Documents & Related Resources
4. STM32 Open Development Environment: Overview
1- Hardware and Software overview
STM32L4 Discovery Board for IoT node Hardware Description

The STM32L4 Discovery kit for the IoT node (B-L475E-IOT01A) allows users to develop applications with direct connection to cloud servers. The STM32L4 Discovery kit enables a wide diversity of applications by exploiting low-power multilink communication (BLE, Sub-GHz), multiway sensing (detection, environmental awareness) and ARM® Cortex®-M4 core-based STM32L4 Series features. Arduino™ Uno V3 and PMOD connectivity provide unlimited expansion capabilities with a large choice of specialized add-on boards.

Key Product on board

- Ultra-low-power STM32L4 Series MCUs based on ARM® Cortex®-M4 core with 1 Mbyte of Flash memory and 128 Kbytes of SRAM, in LQFP100 package
- Bluetooth® V4.1 module (SPBTLE-RF)
- Sub-GHz (868 or 915 MHz) low-power-programmable RF module (SPSGRF-868 or SPSGRF-915)
- Wi-Fi® module Inventek ISM43362-M3G-L44 (802.11 b/g/n compliant)
- Dynamic NFC tag based on M24SR with its printed NFC antenna
- 2 digital omnidirectional microphones (MP34DT01)
- Capacitive digital sensor for relative humidity and temperature (HTS221)
- High-performance 3-axis magnetometer (LIS3MDL), 3D accelerometer and 3D gyroscope (LSM6DSL), 260-1260 hPa absolute digital output barometer (LPS22HB), Time-of-Flight and gesture-detection sensor (VL53L0X)
- USB OTG FS with Micro-AB connector
- Expansion connectors: Arduino™ Uno V3, PMOD
- Flexible power-supply options: ST LINK USB VBUS or external sources
- On-board ST-LINK/V2-1 debugger/programmer with USB re-enumeration capability: mass storage, virtual COM port and debug port

Latest info available at www.st.com B-L475E-IOT01A
STWIN SensorTile Wireless Industrial Node development kit (STEVAL-STWINKT1) Hardware Overview

STWIN SensorTile Wireless Industrial Node development kit Hardware Description

The STWIN SensorTile wireless industrial node (STEVAL-STWINKT1) is a development kit and reference design that simplifies prototyping and testing of advanced industrial IoT applications such as condition monitoring and predictive maintenance. The kit supports BLE wireless connectivity through an on-board module, and Wi-Fi connectivity through a special plugin expansion board (STEVAL-STWINWFV1).

Key Product on board

- Multi-sensing wireless platform implementing vibration monitoring and ultrasound detection
- Built around STWIN core system board with processing, sensing, connectivity and expansion capabilities
- Micro SD Card slot for standalone data logging applications
- Wireless BLE4.2 (on-board) and Wi-Fi (with STEVAL-STWINWFV1 expansion board), and wired RS485 and USB OTG connectivity
- Option to implement Authentication and Brand protection secure solution with STSAFE-A110 (footprint)
- Wide range of industrial IoT sensors: ultra-wide bandwidth (up to 6 kHz), low-noise, 3-axis digital vibration sensor (IIS3DWB), 3D accelerometer + 3D Gyro INEMO inertial measurement unit (ISM330DHCX) with machine learning core, ultra-low-power high performance MEMS motion sensor (IIS2DH), 3-axis magnetometer (IIS2MDC), digital absolute pressure sensor (LPS22HH), relative humidity and temperature sensor (HTS221) and low-voltage digital local temperature sensor (STTS751)
- Industrial grade digital MEMS microphone (IMP34DT05) and wideband analog MEMS microphone (MP23ABS1)
- Modular architecture, expandable via on-board connectors: STMOD+ and 40-pin flex general purpose expansions, 12-pin male plug for connectivity expansions and 12-pin female plug for sensing expansions
- Other kit components: Li-Po battery 480 mAh, STLINK-V3MINI debugger with programming cable and Plastic box

Latest info available at www.st.com STEVAL-STWINKT1
FP-CLD-AZURE1 Software Description

FP-CLD-AZURE1 is an STM32Cube Function Pack. Thanks to this package you can directly connect your IoT sensor node to the Microsoft Azure IoT, transmit sensor data, and receive commands from Cloud applications.

Key features

• Complete firmware to safely connect an IoT node with sensors and actuators to Microsoft Azure IoT using Wi-Fi communication technology. One sample application for data telemetry/device management that can be connected to ST’s web dashboard or to «Azure IoT Central PnP» (https://apps.azureiotcentral.com)

• Middleware libraries featuring the Microsoft Azure IoT software development kit, transport-level security (mbedTLS), and metadata management

• Ready-to-use binaries to connect the IoT node to the STM web dashboard running on Microsoft Azure, for sensor data visualization, actuator control, and device management (FOTA), or to «Azure IoT Central PnP» (https://apps.azureiotcentral.com)

• Sample implementations available for STM32L4 Discovery Kit for IoT node (B-L475E-IOT01A) and on STWIN SensorTile Wireless Industrial Node development kit (STEVAL-STWINKT1)

• Easy portability across different MCU families, thanks to STM32Cube

• Free, user-friendly license terms

• STM32 Nucleo is Microsoft Azure certified for IoT (for more information on Microsoft Azure Certification please visit http://azure.com/certifiedforiot)
2- Setup & Demo Examples
Setup & Application Examples

HW prerequisites for B-L475E-IOT01A

- 1x B-L475E-IOT01A development board
- Laptop/PC with Windows 7, 8 or 10
- 1 x microUSB cable
- Wi-Fi Router or access to a Wi-Fi network
Setup & Application Examples

HW prerequisites for STEVAL-STWINKT1

• 1x STEVAL-STWINKT1 development board
• Laptop/PC with Windows 7, 8 or 10
• 2 x microUSB cables
• STEVAL-STWINWFV1
  Wi-Fi expansion for the SensorTile Wireless Industrial Node kit
• Wi-Fi Router or access to a Wi-Fi network
• **STM32 ST-Link Utility**
  • Download and install STSW-LINK004 from www.st.com

• **FP-CLD-AZURE1**
  • Download the FP-CLD-AZURE1 package from www.st.com, copy the .zip file contents into a folder on your PC. The package contains binaries and source code with project files (Keil, IAR, STM32CubeIDE) based on B-L475E-IOT01A/STEVAL-STWINKT1.

• **Serial line monitor**, e.g. TeraTerm (https://ttssh2.osdn.jp/)

• To test FP-CLD-AZURE1 with STM Azure IoT Hub, use the **Chrome** web browser

• To test FP-CLD-AZURE1 with IoT Central PnP, in order to use the application template, copy this link to your web browser:
  https://apps.azureiotcentral.com/build/new/4da7263e-510f-4784-91a7-01e26357589e
  Then create your application starting from this application template.
FP-CLD-AZURE1. Sample applications
Start coding in just a few minutes

1. www.st.com/stm32ode
2. Select Function Pack: FP-CLD-AZURE1
3. Download & unpack

4. Use the pre-compiled binaries for registering your device, or alternative re-compile the code adding your device certificate
5. Visualize log of sensors data and control the device
6. FP-CLD-AZURE1 package structure
   - Docs
   - BSP, HAL drivers
   - Azure IoT SDK, mbedTLS
   - Microsoft Azure Client sample applications
   - BootLoader
2.1- Test FP-CLD-AZURE1 with ST Web Dashboard
FP-CLD-AZURE1. Step by step setup
Launch sample application. Configure Serial Terminal

- Open serial terminal then configure baud rate speed to 115200 (Setup → Serial port in TeraTerm) and set the Transmit delay:
FP-CLD-AZURE1. Step by step setup
Launch sample application. Use pre-compiled binary

• The pre-compiled binaries are in the Azure\Binaries folder (Example B-L475E-IOT01A):
  • Projects\B-L475E-IOT01\Applications\Azure\Binary\Azure1_BL.bin (Program + BootLoader)
  • Projects\B-L475E-IOT01\Applications\Azure\Binary\Azure1.bin (Use Only for FOTA)

• To start the application:
  • Connect your board to your PC
  • Using Explorer, drag the binary to the board’s USB storage
FP-CLD-AZURE1. Step by step setup

Configure Wi-Fi parameters

- Open a serial terminal to visualize the log of messages

- Default values for Wi-Fi SSID and PWD can be modified by pressing the USER (blue) button within 3 seconds of boot.

- Press y for changing the Wi-Fi credentials

- Then enter SSID, PWD and Encryption mode when requested

- This data will be saved in flash
The Board will connect to the Azure Device Provisioning Service and it will create one device ID for the board.

- The Device ID will be the STM32 Unique ID.
- Copy the provided device-specific URL to your Chrome browser to access the dashboard.

FP-CLD-AZURE1. Step by step setup

Contacting the Device Provisioning Service
Create a new device group with **name** and **password**

If you are already logged in, you can logout by clicking this button.

Input a group name and password, and click on login/create button.
FP-CLD-AZURE1. Step by step setup
Add the device

The URL printed out by the board should allow the dashboard to retrieve the device.

If the URL doesn’t work
Press the + button and add it manually using the device ID printed out on the serial terminal.
FP-CLD-AZURE1. Step by step setup

Telemetry Page

Go to the Telemetry section

Select the board

Select one measurement and the window Time

Press Play to start the data acquisition
In this section it is possible to deploy a Firmware Over The Air update (FOTA) loaded previously in the Settings section.

Go to Settings

In this section you will see some reported properties and choose the telemetry interval.

In this section you can control the board.

FP-CLD-AZURE1. Step by step setup

Control Page

In this section it is possible to deploy a Firmware Over The Air update (FOTA) loaded previously in the Settings section.
2.2- Test FP-CLD-AZURE1 with IoT Central PnP
FP-CLD-AZURE1. Step by step setup
Launch sample application. Configure Serial Terminal

• Open a serial terminal and then configure the baud rate speed to 115200 (Setup → Serial port in TeraTerm) and set the transmit delay:
FP-CLD-AZURE1. Step by step setup
Launch sample application. Use pre-compiled binary

• The pre-compiled binary are in AzurePnP\Binary folder (Example STEVAL-STWINKT1):
  • Projects\STWINCSV1\Applications\AzurePnP\Binary\Azure1.BL.bin (Program + BootLoader)
  • Projects\STWINCSV1\Applications\AzurePnP\Binary\Azure1.bin (Use Only for FOTA)

• To start the application:
  • Connect your board to your PC
  • Using Explorer, drag the binary to the board’s USB storage
FP-CLD-AZURE1. Step by step setup
Create one IoT Central PnP application

• Go to the following URL using your web browser:
  https://apps.azureiotcentral.com/build/new/4da7263e-510f-4784-91a7-01e26357589e

• Select the application name

• Select the “Pricing plan”
FP-CLD-AZURE1. Step by step setup

Create one device

1. Devices
2. Select device template which matches your board
3. Add one Device
FP-CLD-AZURE1. Step by step setup

Retrieve Device Connection informations

1. Click on Connect
2. Take the:
   - ID Scope
   - Device ID
   - Primary key
• Open a serial terminal to visualize the log of messages

• Default values for Wi-Fi SSID and PWD can be modified by pressing the USER (blue) button within 3 seconds of boot.

• Press y for changing the Wi-Fi credentials

• Then enter SSID, PWD and Encryption mode when requested

• This data will be saved in flash
After the Wi-Fi configuration, the board will ask you to add:

1) The **“ID scope”** (as shown in the previous slides)
   - Answer NO to the next question on Automatic Group enrollment Configured

2) The **“Device ID”** (as shown in the previous slides)

3) The **“Primary Key”** (as shown in the previous slide)
   - This data will be saved in flash
FP-CLD-AZURE1. Step by step setup

Visualize sensors data and control the board
3- Documents & Related Resources
Documents & Related Resources

All documents are available in the DESIGN tab of the related products webpage

**FP-CLD-AZURE1:**
- **DB2891**: STM32Cube function pack for wireless sensor node connected to Microsoft Azure Cloud – databrief
- **UM2043**: Getting started with the FP-CLD-AZURE1 software B-L475E-IOT01A/STEVAL-STWINKT1 node with Wi-Fi and sensors connected to Microsoft Azure cloud – user manual
  - Software setup file

**STEVAL-STWINKT1:**
- Gerber files, BOM, Schematic
- **DB3969**: STWIN SensorTile Wireless Industrial Node development kit and reference design for industrial IoT applications – databrief
- **UM2622**: How to use the STEVAL-STWINKT1 SensorTile Wireless Industrial Node for condition monitoring and predictive maintenance applications – user manual

**STEVAL-STWINWFV1:**
- Gerber files, BOM, Schematic
- **DB3971**: Wi-Fi expansion for the SensorTile Wireless Industrial Node (STWIN) kit - databrief

**B-L475E-IOT01A:**
- Gerber files, BOM, Schematic
- **DB3143**: Discovery kit for IoT node, multi-channel communication with STM32L4 – databrief
- **UM2153**: Discovery kit for IoT node, multi-channel communication with STM32L4 – user manual
- **UM2052**: Getting started with STM32 MCU Discovery Kits software development tools – user manual

Consult www.st.com for the complete list
4- STM32 Open Development Environment: Overview
The STM32 Open Development Environment (STM32 ODE) is an open, flexible, easy, and affordable way to develop innovative devices and applications based on the STM32 32-bit microcontroller family combined with other state-of-the-art ST components connected via expansion boards. It enables fast prototyping with leading-edge components that can quickly be transformed into final designs.

For further information, please visit [www.st.com/stm32ode](http://www.st.com/stm32ode)
Thank you