Quick Start Guide

STM32Cube Function Pack for connecting IoT sensors nodes to Amazon AWS IoT Cloud through a Wi-Fi or Cellular Network (FP-CLD-AWS1)
Quick Start Guide Contents

FP-CLD-AWS1: STM32Cube Function Pack for connecting IoT sensors nodes to Amazon AWS IoT Cloud through a Wi-Fi Network
Hardware and Software overview

Setup & Demo Examples
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STM32 Open Development Environment: Overview
STM32L4 Discovery Board for IoT node (B-L475E-IOT01A)

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
P-L496G-CELL02 Hardware Description

- The STM32 Discovery pack (P-L496G-CELL02) is a turnkey development platform for cellular and cloud technology based solutions.

- The pack contains an STM32L496AGI6-based low-power Discovery mother board and an STMod+ Cellular LTE IoT worldwide expansion board with antenna.

- It features STM32L496AGI6 Arm®-based microcontroller featuring 1 Mbyte of Flash memory and 320 Kbytes of RAM in a UFBGA169 package

- Board expansion features Quectel BG96 worldwide cellular modem LTE Cat M1/Cat NB1/EGPRS module, 300 kbps downlink, 375 kbps uplink.
X-NUCLEO-IKS01A3 Hardware description

- The X-NUCLEO-IKS01A3 is a motion MEMS and environmental sensor evaluation board system.
- It is compatible with the Arduino UNO R3 connector layout, and is designed around ST's latest sensors.

Key products on board

- **LSM6DSO**: MEMS 3D accelerometer ($\pm 2/\pm 4/\pm 8/\pm 16$ g) + 3D gyroscope ($\pm 125/\pm 250/\pm 500/\pm 1000/\pm 2000$ dps)
- **LIS2DW12**: MEMS 3D accelerometer ($\pm 2/\pm 4/\pm 8/\pm 16$ g)
- **LIS2MDL**: MEMS 3D magnetometer ($\pm 50$ gauss)
- **LPS22HH**: MEMS pressure sensor, 260-1260 hPa absolute digital output barometer
- **HTS221**: Capacitive digital relative humidity and temperature
- **STTS751**: Digital Temperature sensor
- **DIL 24-pin**: Socket available for additional MEMS adapters and other sensors (UV index)

Latest info available at [www.st.com](http://www.st.com)
FP-CLD-AWS1 Software Description

FP-CLD-AWS1 is an STM32Cube Function Pack. Thanks to this package you can directly connect your IoT sensor node to Amazon AWS IoT, transmit sensors data and receive command from Cloud applications.

Key features

- Complete firmware to safely connect an IoT node with sensors to Amazon AWS IoT using Wi-Fi and Cellular communication technology
- Middleware libraries featuring the Amazon AWS IoT software development kit, Wi-Fi, Cellular, and transport-level security (mbedTLS)
- Ready-to-use binaries to connect the IoT node to a web dashboard running on Amazon AWS services for sensor data visualization and device control
- Sample implementations available for STM32L4 Discovery Kit for IoT node (B-L475E-IOT01A), or for P-L496G-CELL02 and X-NUCLEO-IKS01A3 for Cellular communication.
- Easy portability across different MCU families, thanks to STM32Cube
- Free, user-friendly license terms
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SW prerequisites

• **STM32 ST-Link Utility**
  • Download and install STSW-LINK004 from www.st.com

• **FP-CLD-AWS1**
  • Download FP-CLD-AWS1 package from www.st.com, copy the .zip file content into a folder on your PC. The package contains binaries and source code with project files (Keil, IAR, System Workbench) based on B-L475E-IOT01A and P-L496G-CELL02.

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

• **Chrome** web browser ([https://www.google.com/chrome/](https://www.google.com/chrome/)); tested with Chrome version v56.0.2924.76
Setup using a B-L475E-IOT01A board
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
FP-CLD-AWS1 with B-L475E-IOT01A
Get results in few minutes (1/3)

1. Go to www.st.com/stm32ode-fp

2. Select FP-CLD-AWS1

3. Download & unpack FP-CLD-AWS1

4. Open project examples for different IDEs

5. Download and install STSW-LINK004

6. Build & Run the application (or use pre-compiled binaries)

7. Configure Wi-Fi and read the MAC address from the terminal

FP-CLD-AWS1 package structure:
- Docs
- BSP, HAL and Drivers
- AWS IoT SDK, Wi-Fi, MbedTLS
- AWS IoT MQTT Client application
- Release Notes
- Download Notes

Download and install STSW-LINK004

Open project examples for different IDEs

Configure Wi-Fi and read the MAC address from the terminal

Build & Run the application (or use pre-compiled binaries)

Download and install STSW-LINK004

Open project examples for different IDEs

Configure Wi-Fi and read the MAC address from the terminal

Build & Run the application (or use pre-compiled binaries)
FP-CLD-AWS1
Get Results in few minutes (2/3)

8 Go to [http://st-dashboard-iot-v2.s3-website-us-east-1.amazonaws.com](http://st-dashboard-iot-v2.s3-website-us-east-1.amazonaws.com)

9 Signup and Sign in to ST AWS Dashboard

10 Enroll new device in Dashboard by clicking + sign.

11 Use any descriptive name as “Custom name”, MAC address from Step 7. Click Submit to Enroll.

12 Download Device credentials

13 Open .Cert file in text editor. Select the first certificate as device certificate

14 Update Device Cert & Key through serial terminal
FP-CLD-AWS1
Get Results in few minutes (3/3)

15. Go to http://st-dashboard-iot-v2.s3-website-us-east-1.amazonaws.com/#/devices

16. Click on Telemetry and Click on Select the devices to monitor

17. Select devices to monitor for Data

18. Select measure and click play button

19. Accelerometer Data displayed

20. Change Acc to Meg & get Meg data displayed

21. Toggle Onboard LED
FP-CLD-AWS1. Step by step setup in details
Launch Firmware application (1/2)

• Connect the board to your laptop using micro (for B-L475E-IOT01A) USB cable
FP-CLD-AWS1. Step by step setup in details
Launch Firmware application (2/2)

- Precompiled binaries are provided in folders:
  - Projects\B-L475E-IOT01\Applications\Cloud\AWS\Binary
  - Projects\32L496DISCOVERYleo\Applications\Cloud\AWS\Binary

- Drag binary to connected board to flash the microcontroller
FP-CLD-AWS1. Step by step setup in details

Configure Serial Terminal (1/2)

- Open serial terminal then configure baud rate speed to 115200 (Setup → Serial port in TeraTerm).
FP-CLD-AWS1. Step by step setup in details
Configure Serial Terminal (2/2)

- Configure New-line (Rx:AUTO/Tx:CR+LF) and enable local echo in Terminal configuration (Setup → Terminal in TeraTerm).
FP-CLD-AWS1. Step by step setup in details

Configure Wi-Fi parameters and read MAC address

- **Enter SSID, Security mode and Password**

  ```
  *****************************************
  *** STM32 IoT Discovery kit for ***
  *** STM32L475/STM32L496 MCU ***
  *** FP-CLD-AWS1 Cloud Connectivity Demonstration ***
  *** FW version 2.1.0 – 26-July-2019 05:00:00 PM ***
  *****************************************
  *** Board personalization ***
  - Network Interface initialized:
  *** WIFI connection ***
  Your WiFi parameters need to be entered to proceed.
  **Enter SSID: Airtel-WD670-1C33**
  You have entered Airtel-WD670-1C33 as the ssid.
  **Enter Security Mode (0 - Open, 1 - WEP, 2 - WPA, 3 - WPA2): 2**
  You have entered 2 as the security mode.
  **Enter password:**
  - Network Interface started:
  ```

- **Read MAC address**

  ```
  - Network Interface started:
  - Network Interface connected:
  - To Sign-up for SI Dashboard visit: [http://et-dashboard-iot-v2.s3-websites-us-east-1.amazonaws.com/#/signup](http://et-dashboard-iot-v2.s3-websites-us-east-1.amazonaws.com/#/signup)
  - To register board visit: [http://et-dashboard-iot-v2.s3-websites-us-east-1.amazonaws.com/#/signin](http://et-dashboard-iot-v2.s3-websites-us-east-1.amazonaws.com/#/signin)
  - MAC address to use for Board registration: C4:7F:51:03:EE:82.
  - To find your Data Signin to: [http://et-dashboard-iot-v2.s3-websites-us-east-1.amazonaws.com/#/signin](http://et-dashboard-iot-v2.s3-websites-us-east-1.amazonaws.com/#/signin)
  ```

DEFAULI ST IoT Web Dashboard is hosted @ AWS account: aidyruwtjpm0en-ats.iot.us-east-1.amazonaws.com

Do you want to modify DEFAULI SI IoT Web Dashboard hosting AWS account? (y/n):
FP-CLD-AWS1. Step by step setup in details
Register a new board (1/2)

- Sign in to http://st-dashboard-iot-v2.s3-website-us-east-1.amazonaws.com/#/signin and Enroll the new device in Dashboard with a descriptive name to your device as Custom name and MAC address as Thing Id. Click submit.
FP-CLD-AWS1. Step by step setup in details

Register a new board (2/2)

- After the board has been registered, a popup will appear; click on download to download a file containing device certificate and key.
FP-CLD-AWS1. Step by step setup in details

Use default value of AWS IoT endpoint & Thing name

• In serial terminal, enter ‘n’ to confirm first default value of AWS IoT endpoint.

```
***** SIM3 IoT Discovery kit for
**** STM32L475-STM32L496 M0U
**** FP-CLD-AWS1 Cloud Connectivity Demonstration
**** FW version 2.1.0 - 26-July-2019 05:00:00 PM

**** Board personalization ****
- Network Interface initialized:
- WIFI connection ****

Push the User button (Blue) within the next 5 seconds if you want to update the WiFi network configuration.
- Network Interface started:
- Network Interface connected:
- To Sign-up for ST Dashboard visit: http://st-dashboard-iot-v2.s3-website-us-east-1.amazonaws.com/#/signup
- To register board visit: http://st-dashboard-iot-v2.s3-website-us-east-1.amazonaws.com/#/signin
  - MAC address to use for Board registration: C4:7F:51:03:EE:A2.
- To Find your Data Signin to: http://st-dashboard-iot-v2.s3-website-us-east-1.amazonaws.com/#/signin

Do you want to modify DEFAULT ST IoT Web Dashboard hosting AWS account? (y/n): 
```

** DEFAULT ST IoT Web Dashboard is hosted @ AWS account: aidyowjtjw0@ats.iot.us-east-1.amazonaws.com **

```
Do you want to modify DEFAULT Thing Name? [y/n]
```

• In serial terminal, enter ‘n’ to confirm first default value MAC address as Thing Name.
FP-CLD-AWS1. Step by step setup in details

Use default value of ROOT CA Certificate

- In serial terminal, enter ‘n’ to confirm first default value of Root CA.

- The default value of Root CA will be printed in terminal.
FP-CLD-AWS1. Step by step setup in details

Asked to enter device certificate

- You will now be asked to enter your device certificate
FP-CLD-AWS1. Step by step setup in details

Copy Device certificate to device

• Open certificate file in a text editor, copy the Device certificate section from file.

• Right Click on Terminal and Click OK in pop up window to copy file content to terminal.

• Press Enter twice in the Terminal to Paste data to Device
FP-CLD-AWS1. Step by step setup in details

Copy Device Key to device

• Follow the same process as explained in the previous step
The data entry process is now complete.

The device will connect to the network and publish data.

Go to the AWS web dashboard to see the data.

see the “Using the AWS Web Dashboard” section hereafter.
Setup using a P-L496G-CELL02 board
Setup & Application Examples
HW prerequisites with P-L496G-CELL02

- 1x STM32 Nucleo expansion board with motion MEMS and environmental sensors (X-NUCLEO-IKS01A3)
- 1x P-L496G-CELL02 STM32 discovery pack for cellular to cloud, which contains:
  - 1x expansion board with Quectel BG96 LTE modem (for CELL02), compatible with STMod+ connector
  - 1x STM32 Discovery development board 32L496GDISCOVERY
  - 2G/3G antenna
- Laptop/PC with Windows 7, 8 or 10
- 1x Micro USB cable
• Get your P-L496G-CELL02 Discovery Pack
• Open it and follow the getting started instructions from the Discovery Pack Insert Card inner pages

Note: there is no need to check the position of the jumpers, the setup is fine with the kit delivered as is

• Get the digital ST Voucher from the Pack by using TeraTerm (STLINK serial port 9600, N, 8, 1)

Welcome to STM32-Cellular to Cloud (STM32-C2C)
For more information about this pack, please go to: http://www.st.com/stm3214-discovery
This pack comes with a quick start method:
1. Open a web browser and go to http://www.stm32-c2c.com
2. Register and login
3. Add a new board
4. Redeem this personal voucher code: [REDACTED]
5. Available services linked with your pack will show up

For general QnA, go to the ST Community Portal at: community.st.com
For support, please contact your nearest ST Sales Office: http://www.st.com/content/st_com/en/contact-us.html
• Go to the ST Concierge Portal (https://www.stm32-c2c.com)
• Register & Create an account
• Note: You will receive an email and click to confirm your email address entered before to continue…
• Add a board using your ST Voucher number
• Your pack P-L496G-CELL02 should show up and available services are displayed
From the ST Concierge Portal (https://stm32-c2c.com/)

Activate the Emnify Telecom service on the Pack embedded SIM

Click to go to the partner service page.

Click to enter your email address.

Enter your email address
Enter a password that fulfills the requirement
Click on “Create my account”
Activate Emnify Telecom service (2/3)

- From the ST Concierge Portal (https://stm32-c2c.com/)
  - Activate the Emnify Telecom service on the Pack embedded SIM

1. Click on « Skip »
2. Click on « SIMs »
Activate Emnify Telecom service (3/3)

7. Click on SIM

Confirmation that the SIM is actually activated
P-L496G-CELL02 Hardware Description

• If the Cell02 board you have does not support Emnify Telecom service you can use your local telecom service.

• Use your local telecom service SIM and Insert it to Micro SIM card socket

• The SW will detect it and connect it to your local telecom service provider.
Setup & Applications Examples
Connecting the X-NUCLEO-IKS01A3 to the L496G-DISCOVERY kit

X-NUCLEO-IKS01A3

P-L496G-CELL02

(back side)
FP-CLD-AWS1 with P-L496G-CELL02
Get results in few minutes (1/3)

1. Go to www.st.com/stm32ode-fp
2. Select FP-CLD-AWS1
3. Download & unpack FP-CLD-AWS1

FP-CLD-AWS1 package structure
- Docs
- BSP, HAL and Drivers
- AWS IoT SDK, Cellular, FreeRTOS
- AWS IoT MQTT Client application
- Release Notes

4. Download and install STSW-LINK004
5. Open project examples for different IDEs
6. Build & Run the application (or use pre-compiled binaries)
7. Read First 16 bytes of SIM Id from terminal
8. Go to [http://st-dashboard-iot-v2.s3-website-us-east-1.amazonaws.com](http://st-dashboard-iot-v2.s3-website-us-east-1.amazonaws.com)

9. Signup and Sign in to ST AWS Dashboard

10. Enroll new device in Dashboard by clicking + sign.

11. Deselect “Device ID is a MAC address”. Use any descriptive name as “Custom name”, Device Id from Step 7. Click Submit to Enroll.

12. Download Device credentials

13. Open .Cert file in text editor. Select the first certificate as device certificate

14. Update Device Cert & Key through serial terminal
Go to http://st-dashboard-iot-v2.s3-website-us-east-1.amazonaws.com/#/devices

Click on Telemetry and Click on Select the devices to monitor

Select devices to monitor for Data

Select measure and click play button

Toggle Onboard LED

Change Acc to Meg & get Meg data displayed

Accelerometer Data displayed
FP-CLD-AWS1. Step by step setup in details
Launch Firmware application (1/2)

- Connect the board to your laptop using micro (for B-L475E-IOT01A) or mini (for NucleoF401RE) USB cable
FP-CLD-AWS1. Step by step setup in details
Launch Firmware application (2/2)

• Precompiled binaries are provided in folders:
  • Projects\B-L475E-IOT01\Applications\Cloud\AWS\Binary
  • Projects\32L496GDISCOVERY\Applications\Cloud\AWS\Binary

• Drag binary to connected board to flash the microcontroller
FP-CLD-AWS1. Step by step setup in details
Configure Serial Terminal (1/2)

- Open serial terminal then configure baud rate speed to 115200 (Setup → Serial port in TeraTerm).
Configure New-line (Rx: AUTO/Tx:CR+LF) and enable local echo in Terminal configuration (Setup → Terminal in TeraTerm).
FP-CLD-AWS1. Step by step setup in details
Retrieving the SIM ID

- Read First 16 bytes of SIM Id from terminal

![COM18 - Tera Term VT](image)

Initializing the cellular module
- Network Interface connecting:
  - Trying to connect with the external SIM

Waiting for BG96 modem running
- Signal not known or not detectable yet (be patient)

Signal Level: -51 dBm

C2C module registered

Registration done in 150843 milliseconds

Retrieving the cellular operator: "IND airtel airtel"

Module initialized successfully: Quectel

Product ID: BG96

FW version: BG96MAR02A06616

SIM Id (IccID): 89915309299973043878
- Network Interface started:
- Waiting Network Interface to connect...
- Network Interface connected:

- To Sign-up for ST Dashboard visit: [http://st-dashboard-iot-u2.s3-website-us-east-1.amazonaws.com/#/signup](http://st-dashboard-iot-u2.s3-website-us-east-1.amazonaws.com/#/signup)
- For Board registration visit: [http://st-dashboard-iot-u2.s3-website-us-east-1.amazonaws.com/#/signin](http://st-dashboard-iot-u2.s3-website-us-east-1.amazonaws.com/#/signin)
- First 16 Bytes of SIM Id to use for Board registration: **899153092997304.**
- To find your Data Sign in to: [http://st-dashboard-iot-u2.s3-website-us-east-1.amazonaws.com/#/signin](http://st-dashboard-iot-u2.s3-website-us-east-1.amazonaws.com/#/signin)

Do you want to update your IoT device connection parameters? (y/n)
Register a new board (1/2)

- Sign in to [http://st-dashboard-iot-v2.s3-website-us-east-1.amazonaws.com/#/signin](http://st-dashboard-iot-v2.s3-website-us-east-1.amazonaws.com/#/signin)
- Enroll the new device in Dashboard with a descriptive name to your device as Custom name and SIM ID as Device ID.
- Uncheck “Device ID is a MAC address”, then Click submit.
FP-CLD-AWS1. Step by step setup in details
Register a new board (2/2)

• After the board has been registered, a popup will appear; click on download to download a file containing device certificate and key.
FP-CLD-AWS1. Step by step setup in details
Copy certificate and key to device(1/2)

• In serial terminal, enter ‘n’ to confirm first default value of AWS IoT endpoint.

• In serial terminal, enter ‘n’ to confirm first default value SIM Id (First 16 bytes) as Device ID.
FP-CLD-AWS1. Step by step setup in details
Copy certificate and key to device (1/2)

- In the serial terminal, enter ‘n’ to confirm first default value of Root CA.

```
 Enter the x509 certificates or keys as per the following format:
 -----BEGIN CERTIFICATE-----
 YMPGn8u67GB9t+aEMr5P+1gm1gLb1LTU+/Xj1i5wwOQvfwu7uJBVcA0Ln0kcmnL 
 R7EUQ1N9Z/SG9jGr8Xmksr0UEvnEF/Bibyc+E1ixUA0hnnM3oTDPh5Lc9un8rNsU 
 ---------
 -----END CERTIFICATE-----
 -----BEGIN CERTIFICATE-----
 YMPGn8u67GB9t+aEMr5P+1gm1gLb1LTU+/Xj1i5wwOQvfwu7uJBVcA0Ln0kcmnL 
 ---------
 -----END CERTIFICATE-----

Do you want to change DEFAULT ROOT CA for ST IoT Web Dashboard? [y/n] 
```
FP-CLD-AWS1. Step by step setup in details
Copy certificate and key to device (2/2)

- Open certificate file in a text editor, then copy/paste device certificate and key in serial terminal when requested.
FP-CLD-AWS1. Step by step setup in details

Data entry process complete

- Now data entry process is complete
- The device will connect to the network and publish data
- Go to the AWS web dashboard to see the published data
Using the AWS Web Dashboard
FP-CLD-AWS1. Step by step setup in details
Visualize sensors data (1/2)

• Return to http://st-dashboard-iot-v2.s3website-us-east-1.amazonaws.com/#/signin and sign in to dashboard.
FP-CLD-AWS1. Step by step setup in details

Visualize sensors data (2/2)

- Get the list of connected devices
FP-CLD-AWS1. Step by step setup in details
Select the devices to monitor

- Click on Telemetry
- Click to find the list of devices available to monitor
FP-CLD-AWS1. Step by step setup in details

Select the devices to monitor

- Select devices from which you want to monitor data
- You can select more than one device
FP-CLD-AWS1. Step by step setup in details
Device selected to monitor

- Device Selected
FP-CLD-AWS1. Step by step setup in details

Select measure to monitor

• Select a telemetry sensor from “Select measure” and click play button to display data.
FP-CLD-AWS1. Step by step setup in details

Accelerometer data displayed

- Accelerometer data displayed
FP-CLD-AWS1. Step by step setup in details

Gyroscope data displayed

- Gyroscope data displayed
FP-CLD-AWS1. Step by step setup in details

Magnetometer data displayed

- Magnetometer data displayed
FP-CLD-AWS1. Step by step setup in details

- Temperature data displayed
FP-CLD-AWS1. Step by step setup in details
Humidity data displayed

- Humidity data displayed
FP-CLD-AWS1. Step by step setup in details

Pressure data displayed

- Pressure data displayed
FP-CLD-AWS1. Step by step setup in details

Control LED

- To switch LED control (ON/OFF) click on the connected device Select Icon.
FP-CLD-AWS1. Step by step setup in details
Find status of onboard LED

• A pop-up window shows the current status of onboard LED. Current status is OFF.
FP-CLD-AWS1. Step by step setup in details

**Toggle LED**

- Toggle the slider button to change the current status of the LED
- Now it is ON.
FP-CLD-AWS1. Step by step setup in details

Deleting a Device

• To delete a device from the dashboard click on the trash bin icon.
FP-CLD-AWS1. Step by step setup in details

Logout from the Dashboard

• Click on Logout to Exit the Dashboard
Documents & Related Resources

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

FP-CLD-AWS1:
• DB3232: STM32 ODE function pack for IoT node with Wi-Fi and sensors, connected to Amazon AWS IoT cloud – data brief
• UM2186: Getting started with the FP-CLD-AWS1 software package for IoT node with Wi-Fi and sensors, connected to Amazon AWS IoT cloud – user manual
• Software setup file

X-NUCLEO-IKS01A3:
• Gerber files, BOM, Schematic
• DB3851: Motion MEMS and environmental sensor expansion board for STM32 Nucleo – product specification
• UM2559: Getting started with motion MEMS and environmental sensor expansion board for STM32 Nucleo – user manual

P-L496G-CELL02:
• Gerber files, BOM, Schematic
• DB3530: STM32 discovery pack for LTE IoT cellular to cloud – data brief
• UM2365: STM32 Discovery pack for LTE IoT cellular to cloud – user manual

B-L475E-IOT01A:
• Gerber files, BOM, Schematic
• DB3009: Motion MEMS and environmental sensor expansion board for STM32 Nucleo – product specification
• UM2121: Getting started with motion MEMS and environmental sensor expansion board for STM32 Nucleo – user manual

Consult www.st.com for the complete list
FP-CLD-AWS1: STM32Cube Function Pack for connecting IoT sensors nodes to Amazon AWS Cloud through a Wi-Fi Network
Hardware and Software overview

Setup & Demo Examples
Documents & Related Resources

STM32 Open Development Environment: Overview
The STM32 Open Development Environment (ODE) consists of a set of stackable boards and a modular open SW environment designed around the STM32 microcontroller family.

- STM32Cube development software
- STM32 Nucleo development boards
- Function Packs (FP)
- STM32 Nucleo expansion boards (X-NUCLEO)
- STM32Cube expansion software (X-CUBE)

www.st.com/stm32ode
STM32 Nucleo Development Boards (NUCLEO)

- A comprehensive range of affordable development boards for all the STM32 microcontroller series, with unlimited unified expansion capabilities and integrated debugger/programmer functionality.

Power supply through USB or external source

Integrated debugging and programming ST-LINK probe

STM32 microcontroller

Complete product range from ultra-low power to high-performance

ST morpho extension header

Arduino™ UNO R3 extension headers
STM32 Nucleo Expansion Boards (X-NUCLEO)

- Boards with additional functionality that can be plugged directly on top of the STM32 Nucleo development board directly or stacked on another expansion board.

Example of STM32 expansion board (X-NUCLEO-IKS01A1)

www.st.com/x-nucleo
STM32 Open Development Environment
Software components

- **STM32Cube software (CUBE)** - A set of free tools and embedded software bricks to enable fast and easy development on the STM32, including a Hardware Abstraction Layer and middleware bricks.

- **STM32Cube expansion software (X-CUBE)** - Expansion software provided free for use with the STM32 Nucleo expansion board and fully compatible with the STM32Cube software framework. It provides abstracted access to expansion board functionality through high-level APIs and sample applications.

- **Compatibility with multiple Development Environments** - The STM32 Open Development Environment is compatible with a number of IDEs including IAR EWARM, Keil MDK, and GCC-based environments. Users can choose from three IDEs from leading vendors, which are free of charge and deployed in close cooperation with ST. These include Eclipse-based IDEs such as Ac6 System Workbench for STM32 and the MDK-ARM environment.

**Tools & IDEs**
- IAR EWARM, Keil MDK-ARM, GCC-based IDEs (e.g. Ac6 System Workbench for STM32)

**Applications**
- Sample applications (e.g. based on ST OpenSoftwareX)

**Middleware**
- STM32Cube middleware
- Upper level middleware (e.g. ST OpenSoftwareX)

**Hardware Abstraction**
- STM32Cube Hardware Abstraction Layer (HAL)

**Hardware**
- STM32 Nucleo expansion boards (X-NUCLEO)
- STM32 Nucleo developer boards

**OPEN LICENSE MODELS**: STM32Cube software and sample applications are covered by a mix of fully open source BSD license and ST licenses with very permissive terms. www.st.com/stm32cube www.st.com/x-cube
STM32 Open Development Environment
Building block approach

The building blocks

Sense
- Accelerometer, gyroscope
- Inertial modules, magnetometer
- Pressure, temperature, humidity
- Proximity, microphone

Connect
- Bluetooth LE, Sub-GHz radio
- NFC, Wi-Fi, GNSS

Translate
- Audio amplifier
- Touch controller
- Operation Amplifier

Move / Actuate
- Stepper motor driver
- DC & BLDC motor driver
- Industrial input / output

Power
- Energy management & battery

Process
- General-purpose microcontrollers
- Secure microcontrollers

Software

Your need

COLLECT

Our answer

TRANSMIT

ACCESS

CREATE

POWER

PROCESS

www.st.com/stm32ode