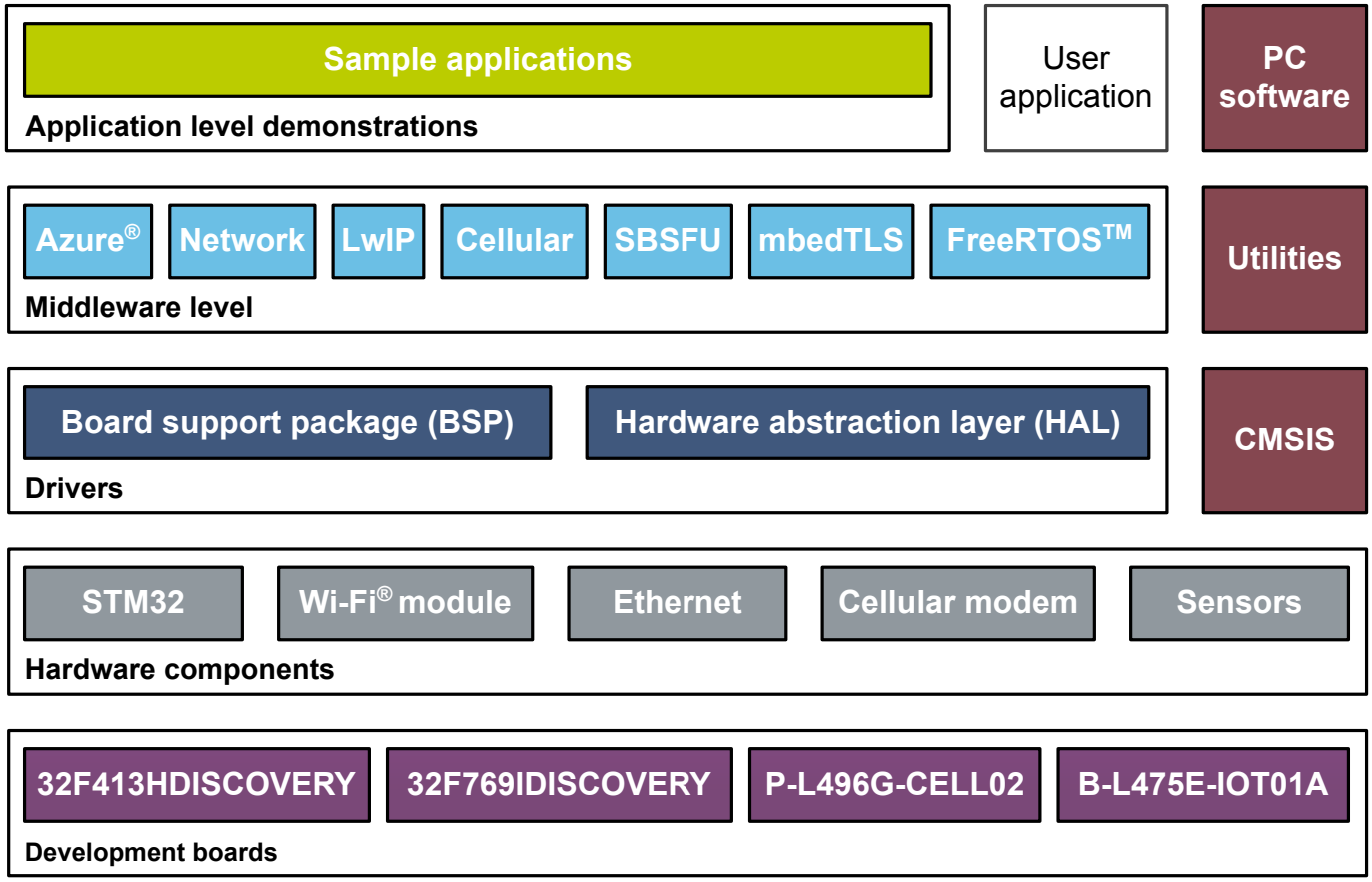
# X-CUBE-AZURE

Data brief

## Microsoft® Azure® IoT software expansion for STM32Cube




| Product status link |
| --- |
| X-CUBE-AZURE |

## Features

- Ready-to-run firmware example using cellular, Wi-Fi®, and Ethernet connectivity to support quick evaluation and development of Microsoft® Azure® cloud-connected applications
- Board configuration interface for connection to the Azure® IoT Hub
- Secure Boot and Secure Firmware Update
- TLS encryption
- Azure® IoT Hub, and bidirectional communication examples implemented
- Azure® X509 device authentication and Azure® Device Provisioning Service (DPS)
- Connection to an Azure® IoT central demonstration
- Connection to STMicroelectronics dashboard for Azure®, for easy sensor data visualization and device control
- Specific features on the B-L475E-IOT01A board such as measurement of humidity, temperature, 3-axis magnetic data, 3-axis acceleration, 3-axis gyroscope data, atmospheric pressure, and time-of-flight

## Description

The X-CUBE-AZURE Expansion Package consists of a set of libraries and application examples for STM32L4 Series, STM32F4 Series, and STM32F7 Series microcontrollers acting as end devices.

X-CUBE-AZURE runs on four platforms. The B-L475E-IOT01A and 32F413HDISCOVERY boards support Wi-Fi® connectivity with an on-board Inventek module. The 32F769IDISCOVERY board provides a native Ethernet interface. The P-L496G-CELL02 pack includes an STM32L496AGI6-based low-power Discovery board equipped with Quectel's BG96 modem (LTE Cat M1/NB/2G fallback) for cellular connectivity.

For the four platforms, a sample application configures the network connectivity parameters, and illustrates the various ways for a device to interact with Microsoft® Azure® IoT Hub. The application shows how a simple client application connects to the Azure® IoT Hub in order to publish device state and telemetry data, and receive device configuration from the cloud.

The application handles Azure® messages, methods and twin update commands. This allows, from the Azure® IoT console, the remote control of the user LED state, the change of the telemetry interval, or the trigger of remote firmware update.

It connects to the ST-AZURE-Dashboard for easy sensor data visualization and device control.

It is possible to securely update firmware based on a bootloader derived from the X-CUBE-SBSFU Expansion Package.

Device authentication and TLS encryption security features are complemented on the client side by the Secure Boot and Secure Firmware Update features.

The B-L475E-IOT01A board reports telemetry data such as measurement of humidity, temperature, and atmospheric pressure.

# 1 General information

## 1.1 Ordering information

X-CUBE-AZURE is available for free download from the *www.st.com* website.

## 1.2 What is STM32Cube?

STM32Cube is an STMicroelectronics original initiative to significantly improve designer's productivity by reducing development effort, time and cost. STM32Cube covers the whole STM32 portfolio.

STM32Cube includes:

- A set of user-friendly software development tools to cover project development from the conception to the realization, among which:
  - STM32CubeMX, a graphical software configuration tool that allows the automatic generation of C initialization code using graphical wizards
  - STM32CubeIDE, an all-in-one development tool with peripheral configuration, code generation, code compilation, and debug features
  - STM32CubeProgrammer (STM32CubeProg), a programming tool available in graphical and command-line versions
  - STM32CubeMonitor-Power (STM32CubeMonPwr), a monitoring tool to measure and help in the optimization of the power consumption of the MCU
- STM32Cube MCU & MPU Packages, comprehensive embedded-software platforms specific to each microcontroller and microprocessor series (such as STM32CubeL4 for the STM32L4 Series), which include:
  - STM32Cube hardware abstraction layer (HAL), ensuring maximized portability across the STM32 portfolio
  - STM32Cube low-layer APIs, ensuring the best performance and footprints with a high degree of user control over the HW
  - A consistent set of middleware components such as FAT file system, RTOS, USB Host and Device, TCP/IP, Touch library, and Graphics
  - All embedded software utilities with full sets of peripheral and applicative examples
- STM32Cube Expansion Packages, which contain embedded software components that complement the functionalities of the STM32Cube MCU & MPU Packages with:
  - Middleware extensions and applicative layers
  - Examples running on some specific STMicroelectronics development boards

# 2 License

X-CUBE-AZURE is delivered under the *Mix Ultimate Liberty+OSS+3rd-party V1* software license agreement (SLA0048).
The software components provided in this package come with different license schemes as shown in Table 1.

**Table 1. Software component license agreements**

| Software component | Owner | License |
|---|---|---|
| Microsoft® Azure® IoT SDKs | Microsoft® Corporation | MIT |
| Board support package (BSP) | STMicroelectronics | BSD-3-Clause |
| Cortex®-M CMSIS | Arm® | BSD-3-Clause or Apache License 2.0(1) |
| FreeRTOS™ | Amazon™ | MIT |
| HAL STM32L4/F4/F7 | STMicroelectronics | BSD-3-Clause |
| Inventek driver | STMicroelectronics | BSD-3-Clause |
| LwIP | 2001-2004 Swedish Institute of Computer Science | BSD-3-Clause |
| mbedTLS | Arm® | Apache License 2.0 |
| STM32_Cellular | STMicroelectronics | Ultimate Liberty (source release) |
| Network library | STMicroelectronics | Ultimate Liberty (source release) |
| STM32_Secure_Engine | STMicroelectronics | Ultimate Liberty (source release) |
| Project examples | STMicroelectronics | Ultimate Liberty (source release) |

1. *Depends on the CMSIS version.*

*Note: Arm is a registered trademark of Arm Limited (or its subsidiaries) in the US and/or elsewhere.*
*All other trademarks are the property of their respective owners.*

# Revision history

**Table 2. Document revision history**

| Date | Version | Changes |
|---|---|---|
| 06-Jul-2017 | 1 | Initial release. |
| 18-Oct-2017 | 2 | Updated *License*. |
| 12-Sep-2019 | 3 | Updated the entire document for the addition of cellular connectivity, Device Provisioning Service, Secure Boot and Secure Firmware Update, and ST-AZURE-Dashboard.<br>Added What is STM32Cube? |

**IMPORTANT NOTICE – PLEASE READ CAREFULLY**

STMicroelectronics NV and its subsidiaries (“ST”) reserve the right to make changes, corrections, enhancements, modifications, and improvements to ST products and/or to this document at any time without notice. Purchasers should obtain the latest relevant information on ST products before placing orders. ST products are sold pursuant to ST’s terms and conditions of sale in place at the time of order acknowledgement.

Purchasers are solely responsible for the choice, selection, and use of ST products and ST assumes no liability for application assistance or the design of Purchasers’ products.

No license, express or implied, to any intellectual property right is granted by ST herein.

Resale of ST products with provisions different from the information set forth herein shall void any warranty granted by ST for such product.

ST and the ST logo are trademarks of ST. For additional information about ST trademarks, please refer to www.st.com/trademarks. All other product or service names are the property of their respective owners.

Information in this document supersedes and replaces information previously supplied in any prior versions of this document.