STM32 LoRaWAN® software expansion for STM32Cube

Application

Application packages
Sync | Fragments | Multicast

SBSFU(*)

MAC

Secure Element

PHY

Middleware

HAL

BSP

Drivers

STM32

LoRa® module

Sensors

Hardware components

Nucleo boards

LoRa® radio expansion

X-NUCLEO-IKS01A2

B-L072Z-LRWAN1

Development boards

(*) Limited to mbedTLS component.

Product status link
I-CUBE-LRWAN
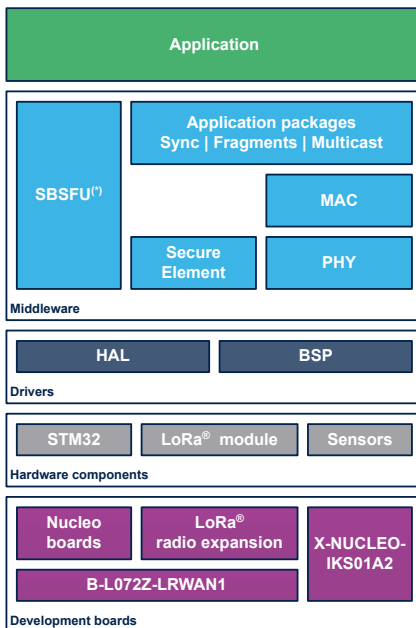
Features

- Compliant with the LoRa Alliance® specification protocol, named LoRaWAN® version V1.0.3 July 2018
- Compliant with the LoRa Alliance® TS-003-Application Layer Clock Synchronization V1.0.0
- Compliant with the LoRa Alliance® TS-004-Fragmented Data Block Transport V1.0.0
- Compliant with the LoRa Alliance® TS-005-Remote Multicast Setup V1.0.0
- Bidirectional end devices with class-A, class-B, and class-C protocol support
- EU 868 MHz ISM band ETSI (European telecommunications standards institute) compliant
- EU 433 MHz ISM band ETSI compliant
- US 915 MHz ISM band FCC (federal communications commission) compliant
- End-device activation either through OTAA (over-the-air activation) or ABP (activation by personalization)
- End-device FUOTA class-C mode application running on NUCLEO-L476 RG
- Adaptive data rate support
- LoRaWAN® test application for certification tests included
- Low-power optimized
- Compliant with the CMWX1ZZABZ-091 LoRa® module from Murata
- Compliant with the WM-SG-SM-42 LoRa® module from USI®
- Compliant with the RHF0M003 modem from RisingHF
- Easy secure element integration

Description

LoRaWAN® is a low-power wide-area network protocol based on LoRa® modulation, allowing low-power sensors to report over ranges of up to dozens of kilometers.

The I-CUBE-LRWAN Expansion Package consists of a set of libraries and application examples for STM32L0 Series, STM32L1 Series, and STM32L4 Series microcontrollers acting as end devices.

This package supports the Semtech LoRa® radio expansion boards SX1276MB1MAS, SX1276MB1LAS, SX1272MB2DAS, and the new generation sx126x mounted on SX1262DVK1DAS, SX1262DVK1CAS, and SX1262DVK1BAS.

This package includes an application running on NUCLEO-L053R8, NUCLEO-L073RZ, NUCLEO-L152RE, NUCLEO-L476RG, and B-L072Z-LRWAN1 embedding the CMWX1ZZABZ-091 LoRa® module (Murata).

It also supports a USI LoRaWAN® technology module through the I-NUCLEO-LRWAN1 expansion board (available standalone or included in P-NUCLEO-LRWAN2) and the RisingHF modem RHF0M003 mounted on LRWAN-NS1 expansion board available in P-NUCLEO-LRWAN3. The application reads sensor data from the X-NUCLEO-IKS01A2 expansion board and sends the sensor data to the LoRa® network in class-A.

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For further information contact your local STMicroelectronics sales office.

www.st.com

1 General information

I-CUBE-LRWAN runs on STM32 microcontrollers based on Arm® Cortex® cores.

Note: *Arm is a registered trademark of Arm Limited (or its subsidiaries) in the US and/or elsewhere.*

1.1 Ordering information

I-CUBE-LRWAN is available for free download from the *www.st.com* website.

1.2 Product information

Table 1 shows the I-CUBE-LRWAN versions available for download for which structure and major supported features.

Table 1. I-CUBE-LRWAN versions

I-CUBE-LRWAN x.y.z version		
x **Structure**	**y** **Major supported features**	**z** **Minor version**
x=1: Legacy structure	Supported LoRa® stack version: y=0: LoRaWAN® stack v1.0.1 y=1: LoRaWAN® stack v1.0.2 y=2: LoRaWAN® stack v1.0.3 y=3: LoRaWAN® stack v1.0.3 + FUOTA	Incremented from 0 for each release with no change in major supported features
x=2: STM32Cube structure	y=0: LoRaWAN® stack v1.0.3 + FUOTA	

1.3 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 conception to realization, among which are:
    - 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 (STM32CubeMonitor, STM32CubeMonPwr, STM32CubeMonRF, STM32CubeMonUCPD) powerful monitoring tools to fine-tune the behavior and performance of STM32 applications in real-time
- STM32Cube MCU and MPU Packages, comprehensive embedded-software platforms specific to each microcontroller and microprocessor series (such as STM32CubeL0 for the STM32L0 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 hardware
    - A consistent set of middleware components such as FAT file system, RTOS, USB, and Touch library
    - 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 and MPU Packages with:
    - Middleware extensions and applicative layers
    - Examples running on some specific STMicroelectronics development boards

1.4 Software architecture

The top-level architecture of the I-CUBE-LRWAN Expansion Package is shown in Figure 1.

Figure 1. I-CUBE-LRWAN architecture
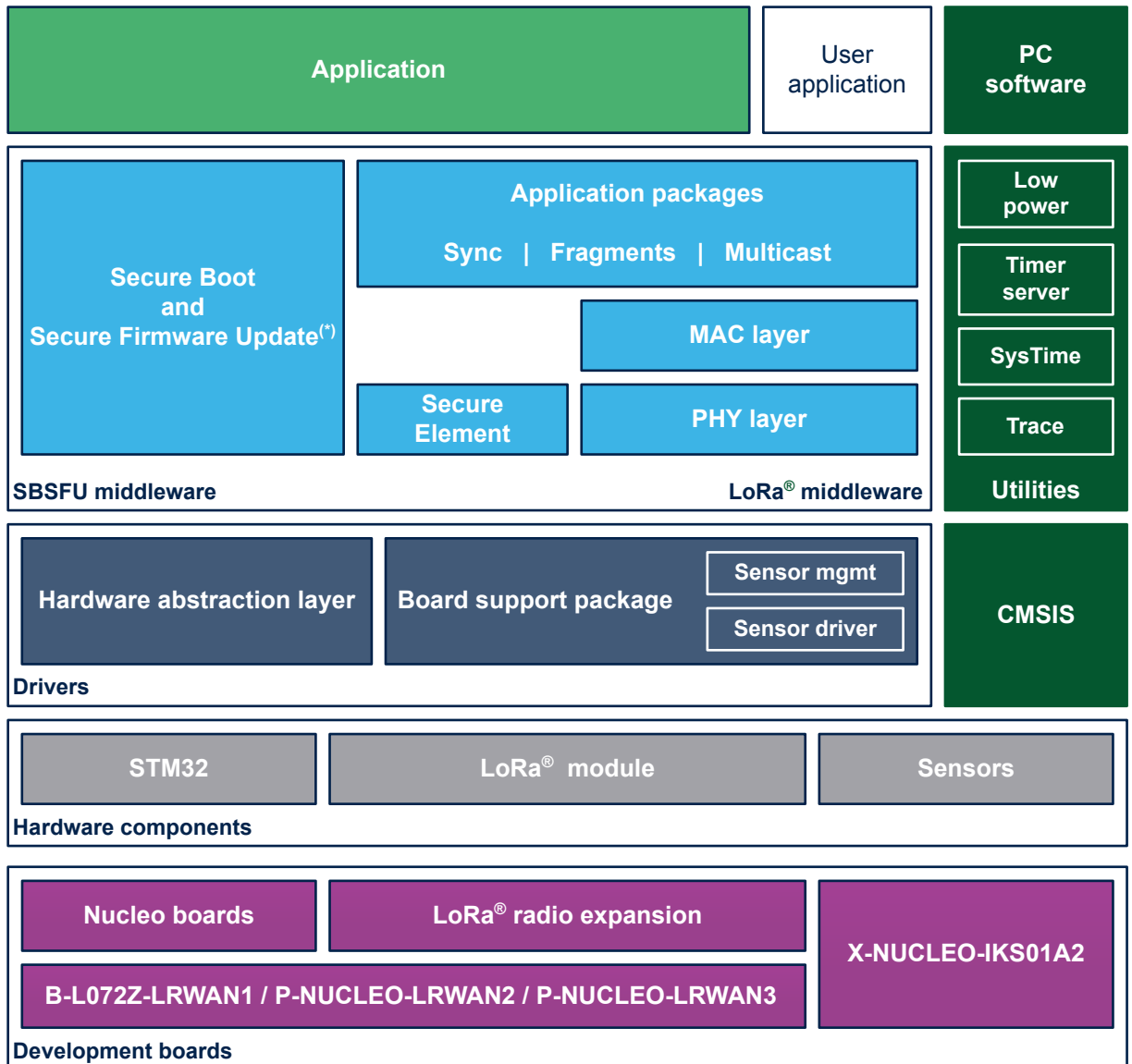
(*) Limited to mbedTLS component.

2 License

I-CUBE-LRWAN 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 2.

Table 2. Software component license agreements

Software component	Copyright	License
Cortex®-M CMSIS	Arm Limited	BSD-3-Clause or Apache License 2.0[1]
HAL STM32L0/L1/L4	STMicroelectronics	BSD-3-Clause
LoRaWAN® stack	Semtech	BSD-3-Clause
mbedTLS	Arm Limited	Apache License 2.0
Project examples	STMicroelectronics	Proprietary

1. *Depends on the CMSIS version.*

Revision history

Table 3. **Document revision history**

Date	Revision	Changes
28-Jun-2016	1	Initial release.
29-Aug-2016	2	Updated *Features*: • Updated compliance of LoRaWAN® version from V1.0 January 2015 to V1.0.1 February 2016 • Specified "V1.0" for class-A certification.
10-Nov-2016	3	Updated *Features*.
22-Dec-2016	4	Updated *Features* and reference to the CMWX1ZZABZxxx LoRa® module from Murata.
7-Feb-2017	5	Updated *Features* and reference to the CMWX1ZZABZ-091 LoRa® module from Murata.
16-Mar-2017	6	Updated *Features* and *Description* to introduce support of the USI LoRaWAN® technology module.
14-Dec-2017	7	Updated *Features* and *Description* to introduce support of the RISINGHF modem RHF0M003.
4-Jul-2018	8	Updated *Features*, *Description*, and the diagram for the new version with class-B protocol, secure element, and new expansion boards
9-Jul-2019	9	Updated *Features*, *Description*, and *License*.
4-Nov-2019	10	Updated diagram, *Features* with three LoRa Alliance® compliances and FUOTA application, and *Table 2* with mbedTLS software component.
22-Feb-2021	11	Added Section 1 General information with Section 1.3 What is STM32Cube? and Section 1.4 Software architecture. Updated Title, Table 1. I-CUBE-LRWAN versions and Table 2. Software component license agreements.