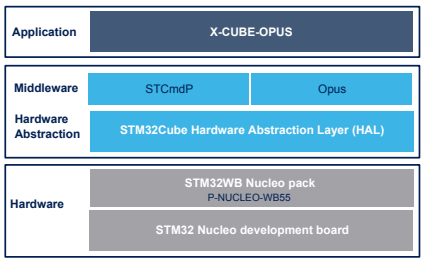
# X-CUBE-OPUS

Data brief

## Opus evaluation and profiling software expansion for STM32Cube





| Product summary | |
|---|---|
| Opus evaluation and profiling software expansion for STM32Cube | X-CUBE-OPUS |
| Bluetooth 5 and 802.15.4 Nucleo pack including USB dongle and Nucleo-68 with STM32WB55 MCUs | P-NUCLEO-WB55 |
| STM32 Nucleo-144 development board with STM32F413ZH/ STM32H743ZI/ STM32F746ZG/ STM32-L552ZE MCUs | NUCLEO-F413ZH/ NUCLEO-H743ZI/ NUCLEO-F746ZG/ NUCLEO-L552ZE-Q |
| Applications | Wireless Connectivity |

## Features

- Complete tool to evaluate and profile the advanced Opus audio codec with each possible configuration on different STM32 MCU families (ARM Cortex-M4, M7, M33)
- Firmware example that shows how to use and integrate Opus on different STM32 MCU families
- Sample application (compatible with Python 3.7) that allows to configure Opus, send audio data to STM32 Nucleo development boards and receive profiling results
- Third-party Opus v1.3.1 (downloadable from https://www.opus-codec.org): an open, royalty-free and highly versatile audio codec that is standardized by the Internet Engineering Task Force (IETF) as RFC 6716
- Custom serial protocol to allow easy communication between the STM32 Nucleo development board and the Host using dedicated commands
- Sample implementation available on NUCLEO-F413ZH,NUCLEO-H743ZI, NUCLEO-F746ZG, NUCLEO-L552ZE-Q or P-NUCLEO-WB55 development boards
- Easy portability across different MCU families, thanks to STM32Cube
- Free, user-friendly license terms

## Description

The X-CUBE-OPUS expansion software package for STM32Cube runs on different STM32 MCU families and includes a firmware example that allows to easily configure and profile Opus encoder and decoder.

The expansion is built on STM32Cube software technology to ease portability across different STM32 microcontrollers.

The software comes with a sample implementation of the drivers running on NUCLEO-F413ZH,NUCLEO-H743ZI, NUCLEO-F746ZG, NUCLEO-L552ZE-Q or P-NUCLEO-WB55 development boards.

The package provides a Python application to be used together with the STM32 example to create a point-to-point bidirectional communication. The software allows the user to choose Opus settings, via an intuitive GUI, select different audio input files for profiling test and receive back results as well as encode/decode data.

The two nodes (the host with Python app and the STM32) communicate through the ST-Link Virtual COM port with a custom protocol.

The X-CUBE-OPUS expansion software package allows the user to evaluate Opus performance depending on his target application, facilitating the choice of the correct STM32 and easily integrating the audio codec.

# 1 Detailed description

## 1.1 What is STM32Cube?

STM32Cube is a combination of a full set of PC software tools and embedded software blocks running on STM32 microcontrollers and microprocessors:

- STM32CubeMX configuration tool for any STM32 device; it generates initialization C code for Cortex-M cores and the Linux device tree source for Cortex-A cores
- STM32CubeIDE integrated development environment based on open-source solutions like Eclipse or the GNU C/C++ toolchain, including compilation reporting features and advanced debug features
- STM32CubeProgrammer programming tool that provides an easy-to-use and efficient environment for reading, writing and verifying devices and external memories via a wide variety of available communication media (JTAG, SWD, UART, USB DFU, I2C, SPI, CAN, etc.)
- STM32CubeMonitor family of tools (STM32CubeMonRF, STM32CubeMonUCPD, STM32CubeMonPwr) to help developers customize their applications in real-time
- STM32Cube MCU and MPU packages specific to each STM32 series with drivers (HAL, low-layer, etc.), middleware, and lots of example code used in a wide variety of real-world use cases
- STM32Cube expansion packages for application-oriented solutions

## 1.2 How does this software complement STM32Cube?

The proposed software is based on the STM32CubeHAL, the hardware abstraction layer for the STM32 microcontroller. The package extends STM32Cube by providing a Board Support Package (BSP) for each STM32 Nucleo development board supported, an ST middleware that implements a serial communication protocol and the third-party middleware Opus for audio encoding and decoding.

The drivers abstract low-level details of the hardware and allow applications to access the communication channel in a hardware independent fashion.

The package also includes a sample Python application that the user should use together with the STM32 example to evaluate Opus resources demand and performance. The software allows to select all the different Opus configuration settings, choose an input audio file to be encoded and decoded, obtain profiling results shown in an intuitive plot or saved in a detailed log file.

The X-CUBE-OPUS expansion software package offers, together with the profiling tool, an easy to use interface that facilitates the integration of Opus audio codec into other firmware for any STM32.

# Revision history

**Table 1. Document revision history**

| Date | Version | Changes |
|---|---|---|
| 18-Nov-2020 | 1 | Initial release. |

**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.