Quick Start Guide

Sound terminal expansion board based on STA350BW for STM32 NUCLEO
(X-NUCLEO-CCA01M1)
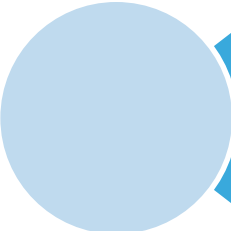
Version 1.1.0 (May 31, 2016)

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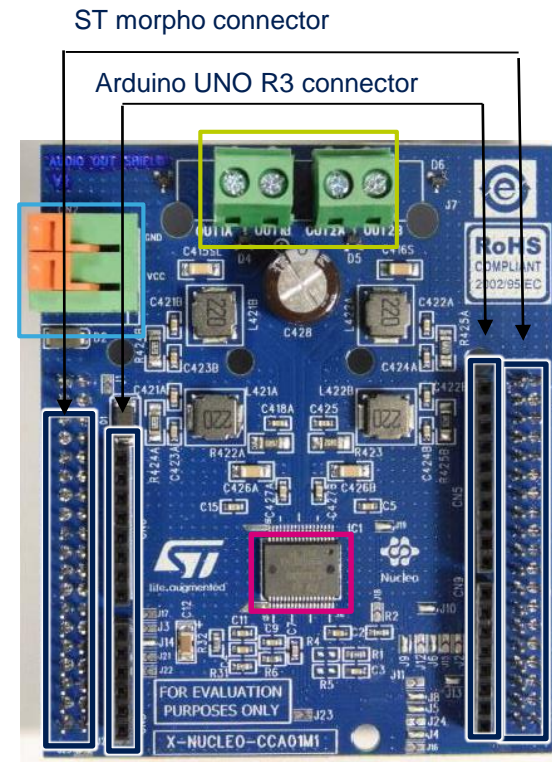
X-NUCLEO-CCA01M1 Hardware Description

The X-NUCLEO-CCA01M1 is an expansion board based on STA350BW Sound Terminal® device, a 2.1-channel high-efficiency digital audio output system. It enables the output of digital audio streams to a speakers pairs connected directly to the board and allows the evaluation of the STA350BW digital audio output component.

Key Features

- 2 channels of ternary PWM 2 x 50W @ 25 V 6 Ω
- FFX ™ 100 dB SNR and dynamic range
- I²C control with selectable device address
- Digital gain +48 dB -80 dB with 0.125 dB/step
- Two independent DRCs configurable as a dual-band anti-clipper (B2DRC) or independent
- limiters/compressors
- I²S input interface
- 3 coefficients banks for EQ preset storing with fast recall via I²C interface
- Up to 8 user-programmable biquads per channel
- Compatible with STM32 Nucleo boards
- Free comprehensive development firmware library and example compatible with STM32Cube firmware

Key Product on board

STA350BW: An integrated solution of digital audio processing, digital amplifier control, and FFX-power output stage, thereby creating a high-power single-chip FFX™ solution comprising high-quality, high-efficiency, and all-digital amplification

ST morpho connector

Arduino UNO R3 connector

☐ STA350BW　　☐ Power connector　　☐ Speaker connectors

Latest info available at www.st.com
X-NUCLEO-CCA01M1
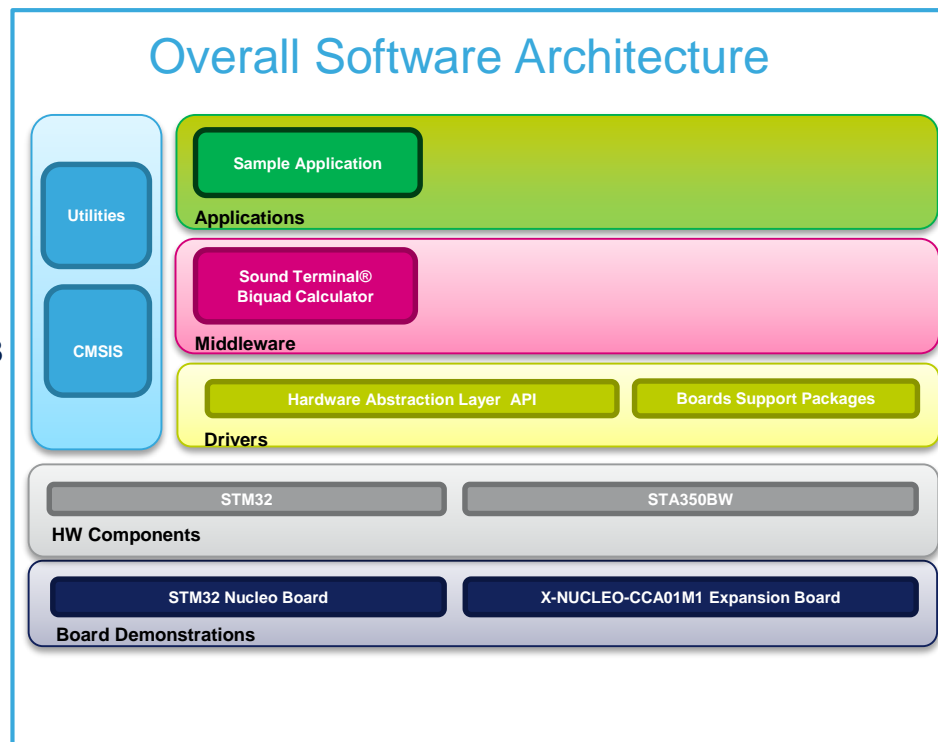
Sound terminal expansion board
Software Overview

X-CUBE-SOUNDTER1 software description

- The software, running on the STM32Cube, includes drivers and middleware for audio data playback using the STA350BW Sound Terminal™ device. It includes drivers and BSP layers designed to exploit all the device features such as tone management, biquadratic filter configuration and initialization, and volume and mute control, as well as the basic initialization routines and audio control functions.

- Implementation examples are available showing X-NUCLEO-CCA01M1 capabilities when connected to a NUCLEO-401RE, a NUCLEO-F072RB or NUCLEO-L053R8 Board.
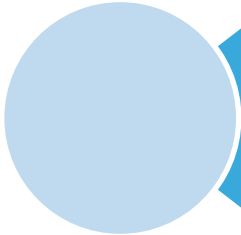
Key features

- Complete driver and middleware to build applications using STA350BW Sound Terminal® device

- Allows STA350BW Sound Terminal control, implementing both basic functions and advanced DSP management

- User friendly BSP interface allowing easy configuration of device functions such as initialization, audio playback, volume and mute control, and biquadratic filter management.

- Dedicated middleware to facilitate biquadratic filter design based on standard filter typologies and parameters.

- Easy portability across different MCU families thanks to the STM32Cube

- Sample applications that the developer can use to start experimenting with the code

- Free user-friendly license terms

Overall Software Architecture

	Applications	
Utilities	Sample Application	
	Middleware	
CMSIS	Sound Terminal® Biquad Calculator	
	Drivers	
	Hardware Abstraction Layer API	Boards Support Packages

HW Components	
STM32	STA350BW

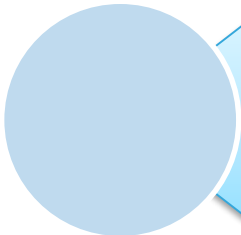| Board Demonstrations	
STM32 Nucleo Board	X-NUCLEO-CCA01M1 Expansion Board

Latest info available at www.st.com
X-CUBE-SOUNDTER1

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STM32 Open Development Environment: Overview

Setup & demo examples
HW prerequisites

- 1x STM32 Nucleo development board (**NUCLEO-F401RE or NUCLEO-F072RB or NUCLEO-L053R8**)

- 1x Sound terminal expansion board based on STA350BW (**X-NUCLEO-CCA01M1**)

- 1x (at least one) 8 Ω passive speaker to be connected to the X-NUCLEO-CCA01M1 expansion board (two are required for stereo audio reproduction)

- 1x USB type A to mini-B USB cable

- 1x external power supply from +5 V to +26 V

- a Windows® (XP, Vista, 7, 8) PC with the following minimum characteristics:
  - at least 128 MB of RAM
  - 40 MB of available hard disk space

NUCLEO-F401RE
NUCLEO-F072RB
NUCLEO-L053R8

Mini USB Cable

Speaker

X-NUCLEO-CCA01M1

X-NUCLEO-PLC01A1 plugged on a compatible STM32 Nucleo board

- **STSW-LINK008:** ST-LINK/V2-1 USB driver

- **STSW-LINK007:** ST-LINK/V2-1 firmware upgrade

- **X-CUBE-SOUNDTER1:**
  - Copy the .zip file content into a folder on your PC. The package will contain source code example (Keil, IAR, SW4STM32) based on **NUCLEO-F401RE, NUCLEO-F072RB or NUCLEO-L053R8** performing audio output to the connected loudspeaker

Sound Terminal Expansion Board
Start coding in just a few minutes with X-CUBE-SOUNDTER1

1 Go to www.st.com/x-nucleo

2 Select X-NUCLEO-CCA01M1

3 Download & unpack X-CUBE-SOUNDTER1

X-CUBE-SOUNDTER1 package

- _htmresc
- Documentation ← **STM32 Nucleo & X-NUCLEO-CCA01M1 docs**
- Drivers ← **STA350BW component and BSP driver**
- Middlewares ← **Sound Terminal™ Biquad calculator**
- Projects ← **Application example**
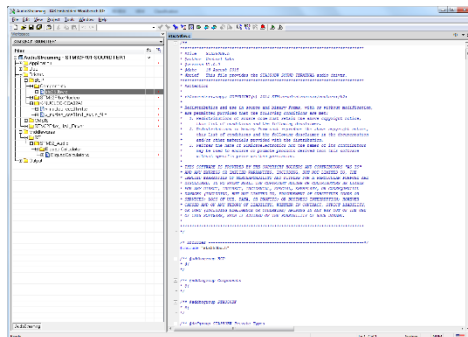- package.xml
- Release_Notes.html

4 Download & install STM32 Nucleo ST-LINK/V2-1 USB driver
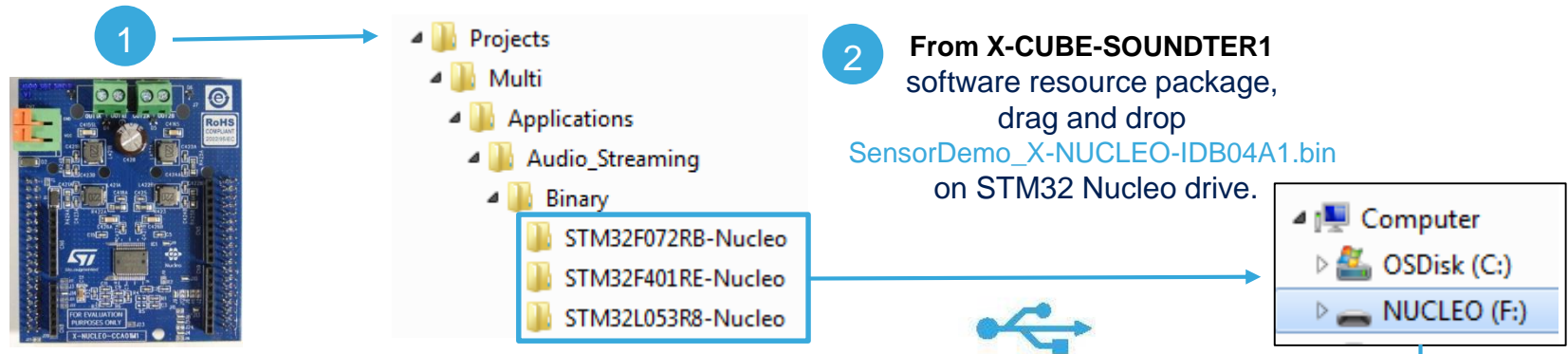
6 Modify, build application

KEIL Tools by ARM

IAR SYSTEMS

aC6 Assistance Conseil Systèmes

5 Open project example Audio Streaming

Sound Terminal Expansion Board
Evaluate using X-CUBE-SOUNDTER1

1

2 **From X-CUBE-SOUNDTER1** software resource package, drag and drop SensorDemo_X-NUCLEO-IDB04A1.bin on STM32 Nucleo drive.

▲ 📁 Projects
　▲ 📁 Multi
　　▲ 📁 Applications
　　　▲ 📁 Audio_Streaming
　　　　▲ 📁 Binary
　　　　　📁 STM32F072RB-Nucleo
　　　　　📁 STM32F401RE-Nucleo
　　　　　📁 STM32L053R8-Nucleo

▲ 💻 Computer
　▷ 💾 OSDisk (C:)
　▷ 🔌 NUCLEO (F:)

Connect Power supply and speakers to
X-NUCLEO-CCA01M1
expansion board connectors.
Verify the solder bridges configuration.

3

4

Reset the STM32 Nucleo board using the black push button: the audio output starts

Press the blue button on the STM32 Nucleo board to change DSP options. Several equalization and volume options are available.

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Documents & Related Resources

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

X-NUCLEO-CCA01M1:

- **Gerber files, BOM, Schematic**

- **DB2756**: Sound terminal expansion board based on STA350BW for STM32 Nucleo – **data brief**

- **UM1979**: Getting started with the sound terminal expansion board based on STA350BW for STM32 Nucleo – **user manual**
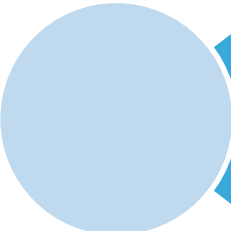
X-CUBE-SOUNDTER1:

- **DB2753:** Sound terminal software expansion for STM32Cube - **data brief**

- **UM1976:** Getting started with the X-CUBE-SOUNDTER1 sound terminal software expansion for STM32Cube - **user manual**
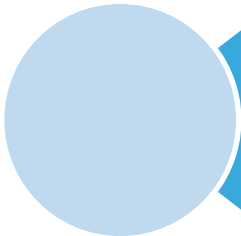
- **Software setup file**

Consult www.st.com for the complete list

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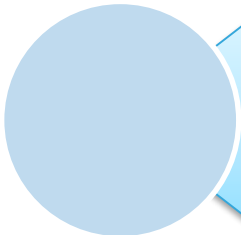
X-NUCLEO-CCA01M1: Sound terminal expansion board
Hardware and Software overview

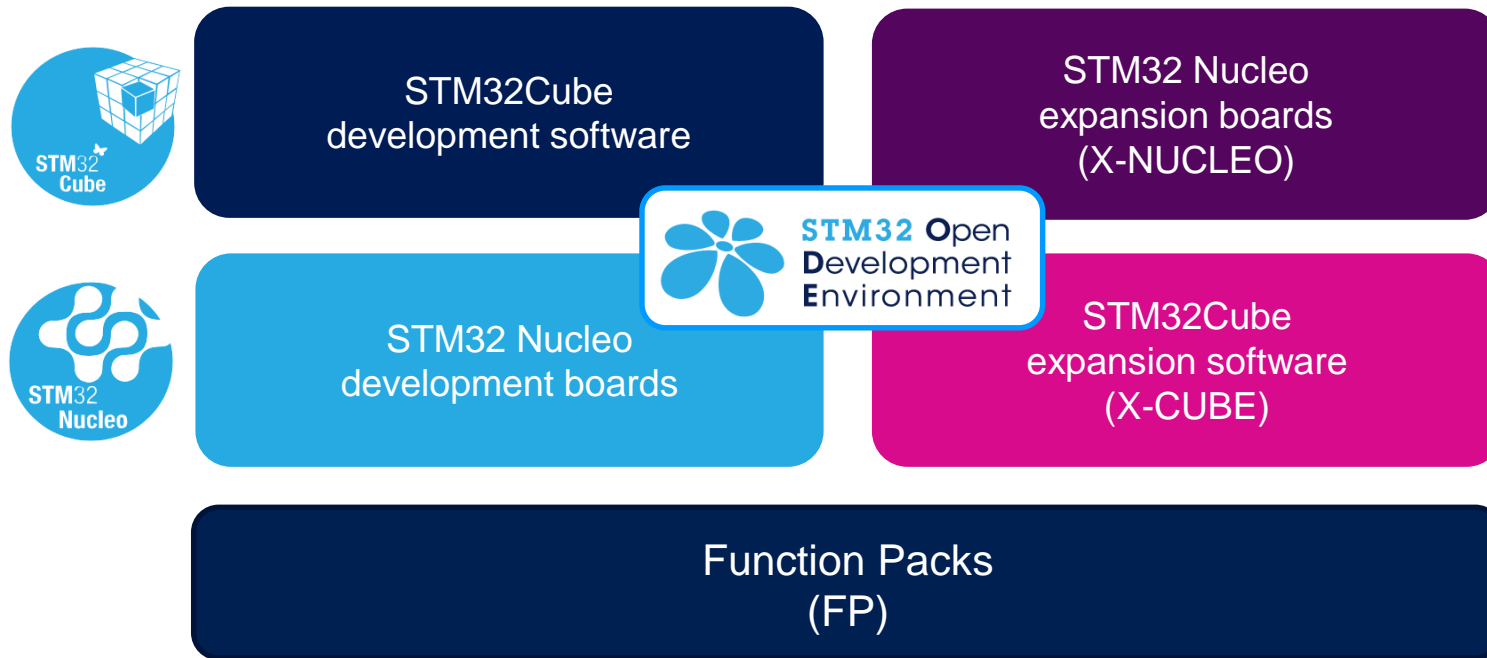Setup & Demo Examples
Documents & Related Resources

STM32 Open Development Environment: Overview

STM32 Open Development Environment
Fast, affordable Prototyping and Development

- 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.

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

STM32 microcontroller

Integrated debugging and programming ST-LINK probe

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

ST morpho extension header

Arduino™ UNO R3 extension headers

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

Sense

Connect

Power

Move/Actuate

Interact

Motion MEMS sensors

Environmental sensors

DIL24 support for new devices
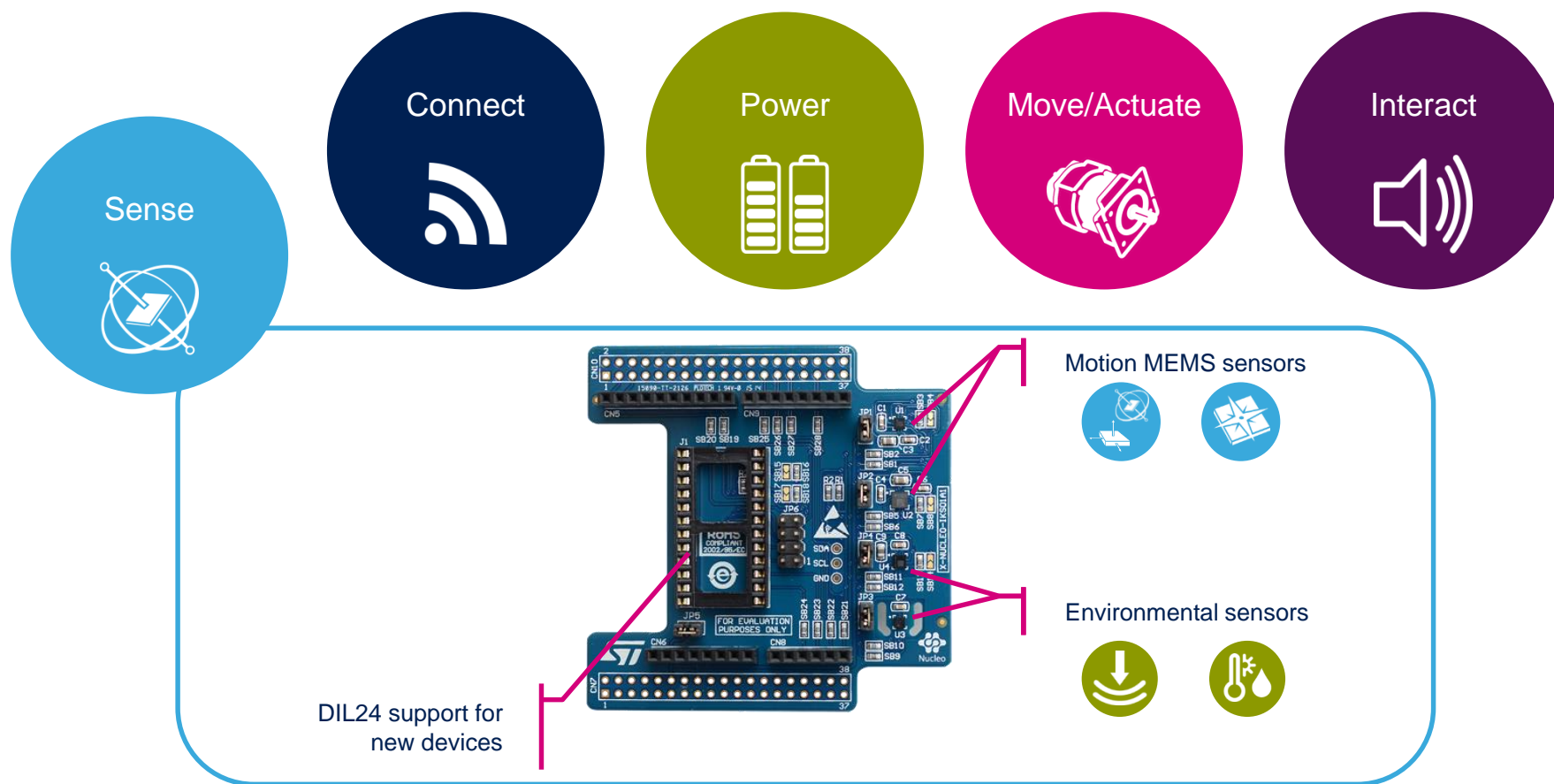
Example of STM32 expansion board (X-NUCLEO-IKS01A1)

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.

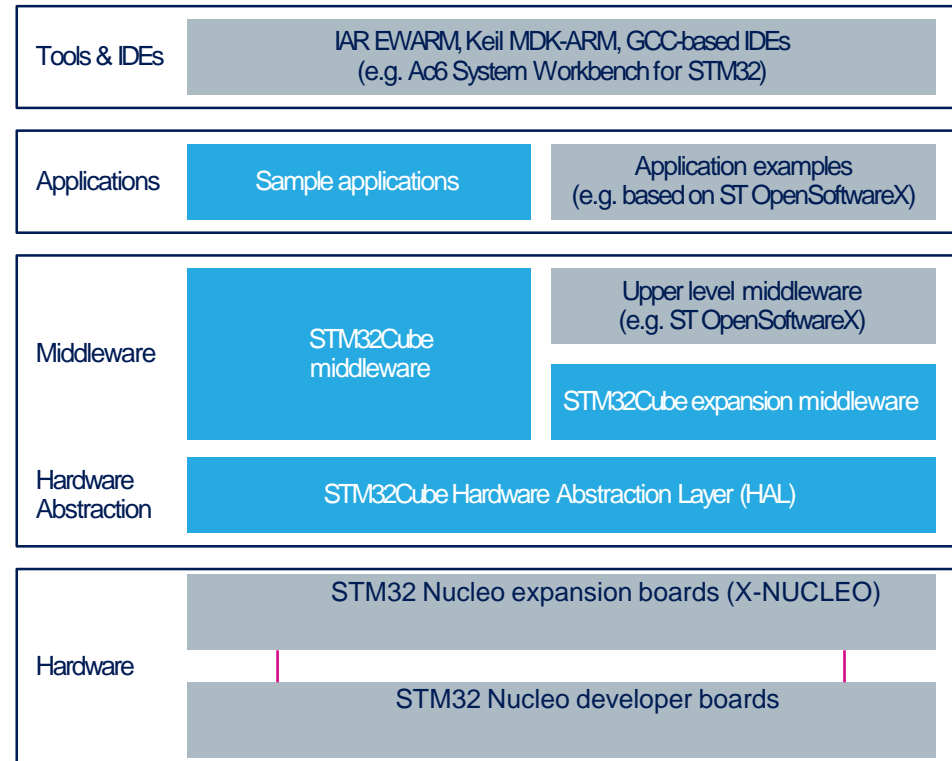- **STM32Cube expansion software (X-CUBE)** - Expansion software provided free for use with the STM32 Nucleo expansion board and fully compatible with the STM32Cube software framework. It provides abstracted access to expansion board functionality through high-level APIs and sample applications.

Tools & IDEs	IAR EWARM, Keil MDK-ARM, GCC-based IDEs (e.g. Ac6 System Workbench for STM32)	
Applications	Sample applications	Application examples (e.g. based on ST OpenSoftwareX)
Middleware	STM32Cube middleware	Upper level middleware (e.g. ST OpenSoftwareX)
		STM32Cube expansion middleware
Hardware Abstraction	STM32Cube Hardware Abstraction Layer (HAL)	
Hardware	STM32 Nucleo expansion boards (X-NUCLEO)	
	STM32 Nucleo developer boards	

- **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.

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	Your need	Our answer

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

Sense — COLLECT

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

Connect — TRANSMIT

Audio amplifier
Touch controller
Operation Amplifier

Translate — ACCESS

Stepper motor driver
DC & BLDC motor driver
Industrial input / output

Move / Actuate — CREATE

Energy management & battery

Power — POWER

General-purpose microcontrollers
Secure microcontrollers

Process — PROCESS

Software

STM32 **O**pen **D**evelopment **E**nvironment

STM32Cube

www.st.com/stm32ode