Quick Start Guide
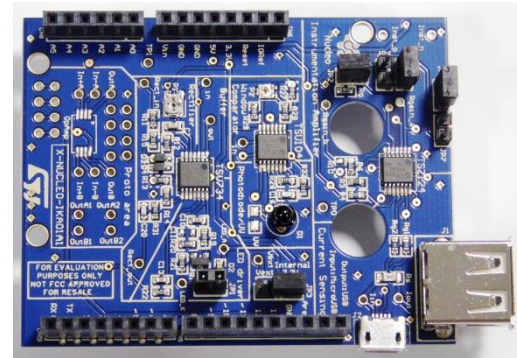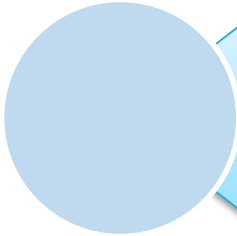
Multifunctional expansion board based on operational amplifiers
for STM32 Nucleo
(X-NUCLEO-IKA01A1)

life.augmented

Version 1.1.0 (May 31, 2016)

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X-NUCLEO-IKA01A1: Multifunctional expansion board based on operational amplifiers

Hardware and Software overview

Setup & Demo Examples

Documents & Related Resources

STM32 Open Development Environment: Overview

Hardware Overview

X-NUCLEO-IKA01A1 Hardware Description

- The X-NUCLEO-IKA01A1 is a multifunctional expansion board based on operational amplifiers. It provides an affordable and easy-to-use solution for different multifunctional use cases with your STM32 Nucleo boards.

- 7 predefined configurations: Instrumentation amplifier structure, Current sensing with or without USB port, Photodiode/UV current sensing, Buffer, Full wave rectifier, Constant current LED driver, Window comparator
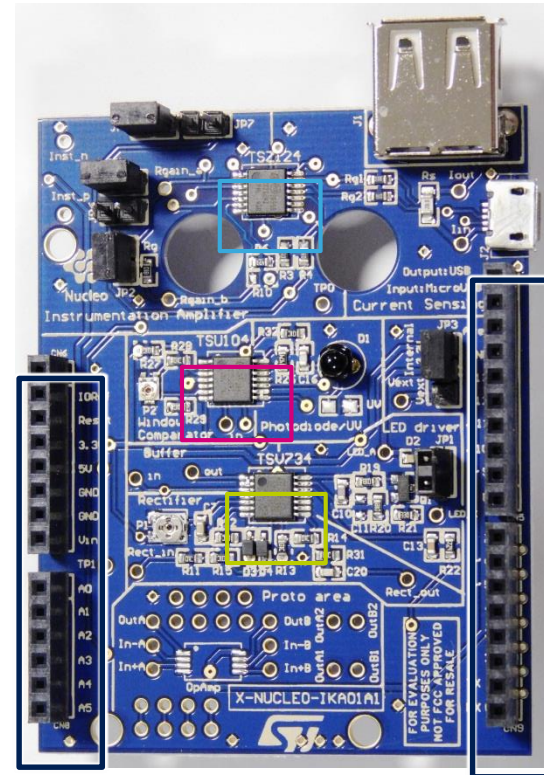
Key Products on board

TSZ124
Very high accuracy (5 μV) zero drift micropower 5 V operational amplifiers

TSV734
High accuracy (V$_{io}$<200uV) Micropower (60uA) CMOS operational amplifiers

TSU104
Nanopower 5V CMOS operational amplifiers

☐ TSZ124   ☐ TSU104   ☐ TSV734   ☐ Arduino UNO R3 connector

Latest info available at www.st.com
X-NUCLEO-IKA01A1

Multifunctional expansion board based on operational amplifiers
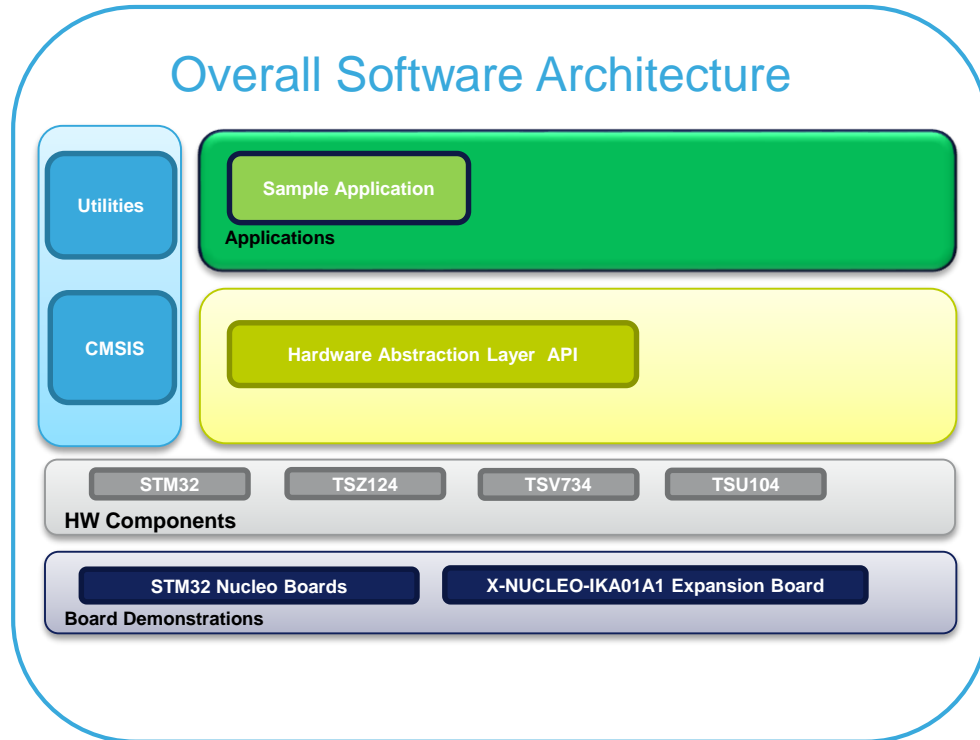## Software overview

X-CUBE-ANALOG1 Software description

- The X-CUBE-ANALOG1 is a SW package which provides drivers running on STM32 for the X-NUCLEO-IKA01A1 expansion board. It is expansion for STM32Cube tool that eases portability across different STM32 MCUs

- Implementation examples are available for the STM32 Nucleo multifunctional expansion board (X-NUCLEO-IKA01A1) plugged on top of an STM32 Nucleo development board (NUCLEO-F401RE, NUCLEO-L053R8, NUCLEO-F103RB)

Key features

- Complete middleware to build applications using Instrumentation Amplifier, Current Sensing (TSZ124), LED Driver (TSV734), Photodiode/UV and Window Comparator (TSU104)

- Easy portability across different MCU families, thanks to the STM32Cube

- Sample applications that the developer can use to start experimenting with the code
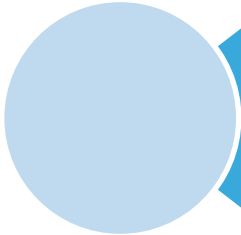
- Free user-friendly license terms

Overall Software Architecture

Utilities	Sample Application
	Applications

| CMSIS | Hardware Abstraction Layer API |

STM32	TSZ124	TSV734	TSU104
HW Components			

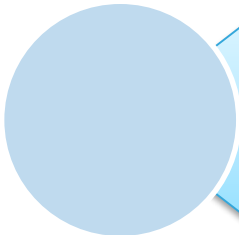| STM32 Nucleo Boards	X-NUCLEO-IKA01A1 Expansion Board
Board Demonstrations	

Latest info available at www.st.com
X-CUBE-ANALOG1

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X-NUCLEO-IKA01A1: Multifunctional expansion board based on operational amplifiers

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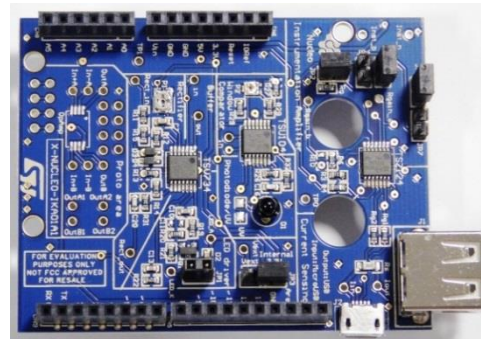
- 1x Multifunctional expansion board based on operational amplifiers (**X-NUCLEO-IKA01A1**)

- 1x STM32 Nucleo development board (**NUCLEO-F401RE, NUCLEO-F103RB or NUCLEO-L053R8**)

- 1x USB type A to Mini-B USB cable to connect the STM32 Nucleo to the PC

- 1x USB type A to micro-B USB extension cable (for current sensing configuration only)

Mini USB Cable

X-NUCLEO-IKA01A1

NUCLEO-F053R8
NUCLEO-F103RB
NUCLEO-F401RE

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

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

- **X-CUBE-ANALOG1**
    - copy the .zip file content into: "c:\Program Files (x86)\STMicroelectronics\" folder on your PC.
    - The package will contain source code example (Keil, IAR, System Workbench) based on **NUCLEO-F401RE**, **NUCLEO-L053R8 and NUCLEO-F103RB**

Multifunctional expansion board based on operational amplifiers
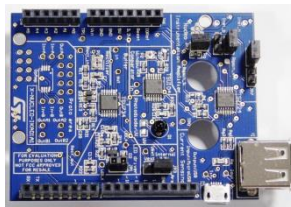
Start coding in just a few minutes with X-CUBE-ANALOG1

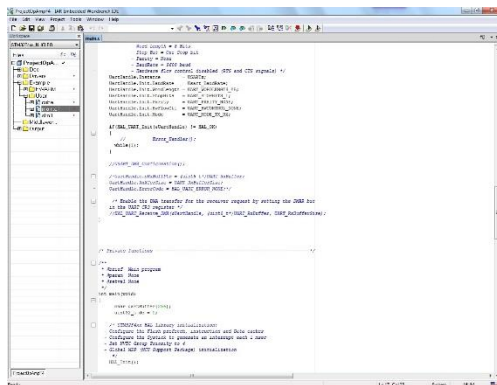**1** Go to www.st.com/x-nucleo

2 Select X-NUCLEO-IKA01A1

3 Download & unpack X-CUBE-ANALOG1

X-CUBE-ANALOG1 package

- _htmresc
- Documentation — **Generic Nucleo docs & Op-Amp API**
- Drivers — Analog driver source code
- Projects — **Application examples**
- 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

Open STM32 Tools

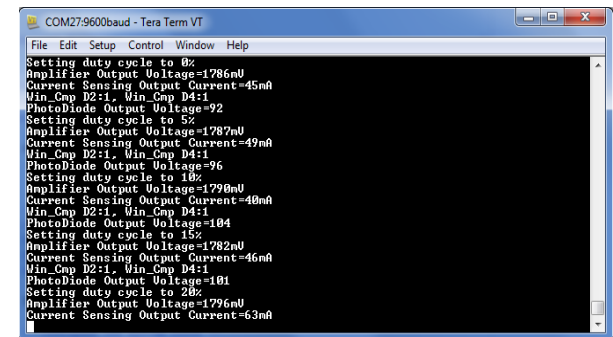**5** Open project example
Example OpAmp App
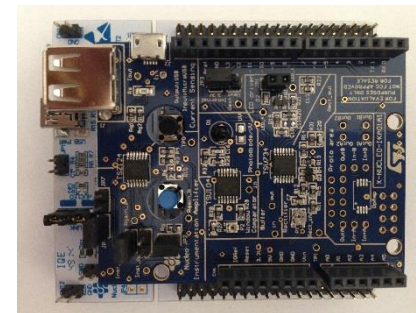
Multifunctional expansion board based on operational amplifiers

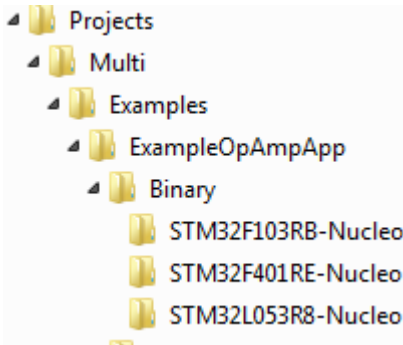## Evaluate using X-CUBE-ANALOG1

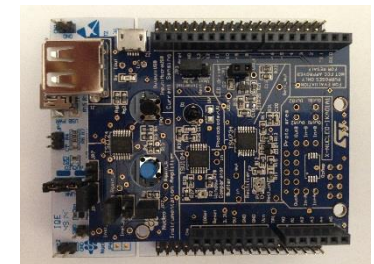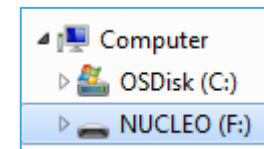**1** Download and Install Tera Term application on Windows PC to see log messages

2

From the X-CUBE-ANALOG1 SW package
Drag and drop
ExampleOpAmpXY.bin
on the NUCLEO drive
(where XY is F4, F1 or L0)

Documents & Related Resources

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

X-NUCLEO-IKA01A1:

- **Gerber files, BOM, Schematic**
- **DB2668**: Multifunctional expansion board based on operational amplifiers for STM32 Nucleo – **data brief**
- **UM1955**: Getting started with the multifunctional expansion board based on operational amplifiers for STM32 Nucleo – **user manual**
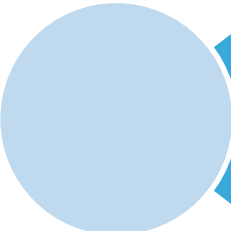
X-CUBE-ANALOG1:

- **DB2678**: Multifunctional software expansion for STM32Cube – **data brief**
- **UM1950**: Getting started with the X-CUBE-ANALOG1 multifunctional software expansion for STM32Cube – **user manual**
- **Software Setup File**

Consult www.st.com for the complete list

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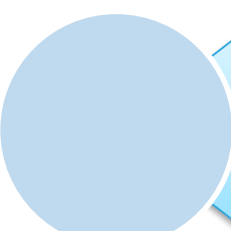
X-NUCLEO-IKA01A1: Multifunctional expansion board based on operational amplifiers

Hardware and Software overview

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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.
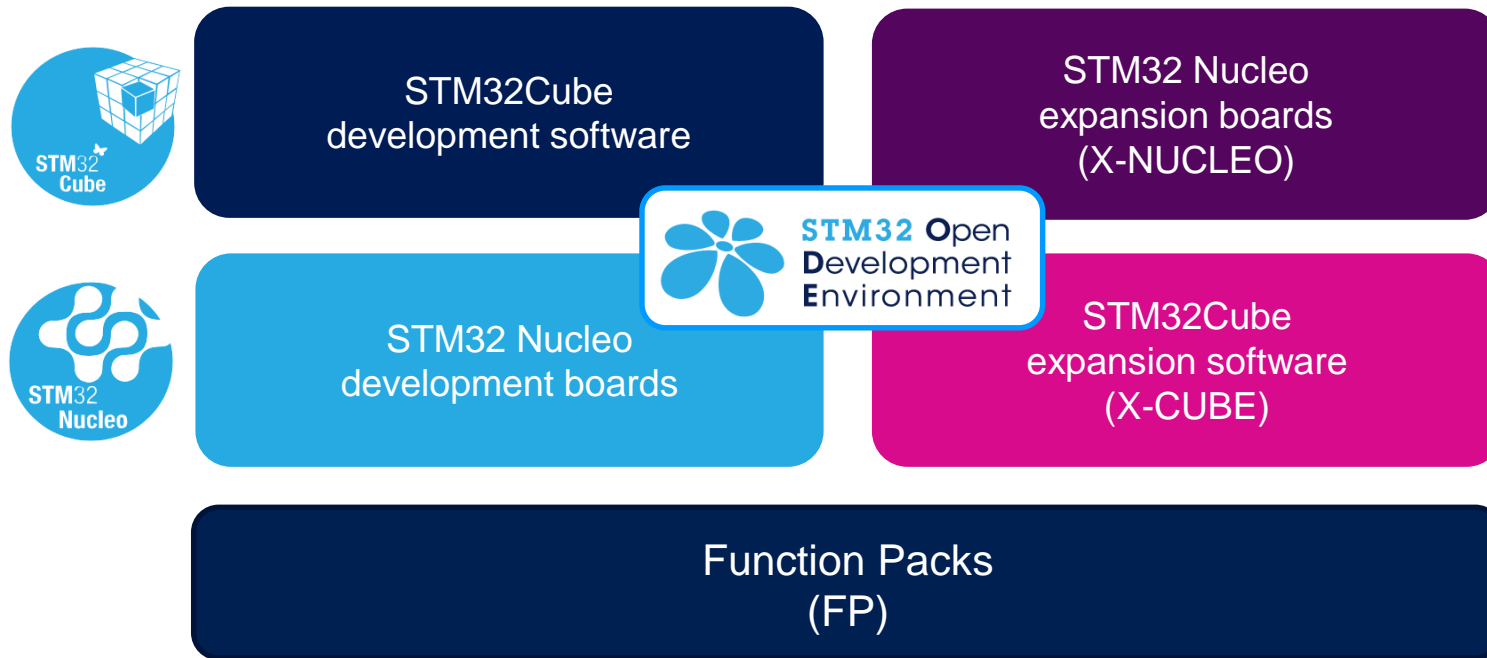
www.st.com/stm32ode

- 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

STM32 F0   STM32 F1   STM32 F2   STM32 F3   STM32 F4   STM32 F7

STM32 L0   STM32 L1

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

Integrated debugging and programming ST-LINK probe

ST morpho extension header

Arduino™ UNO R3 extension headers

STM32 Nucleo

www.st.com/stm32nucleo

- 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.

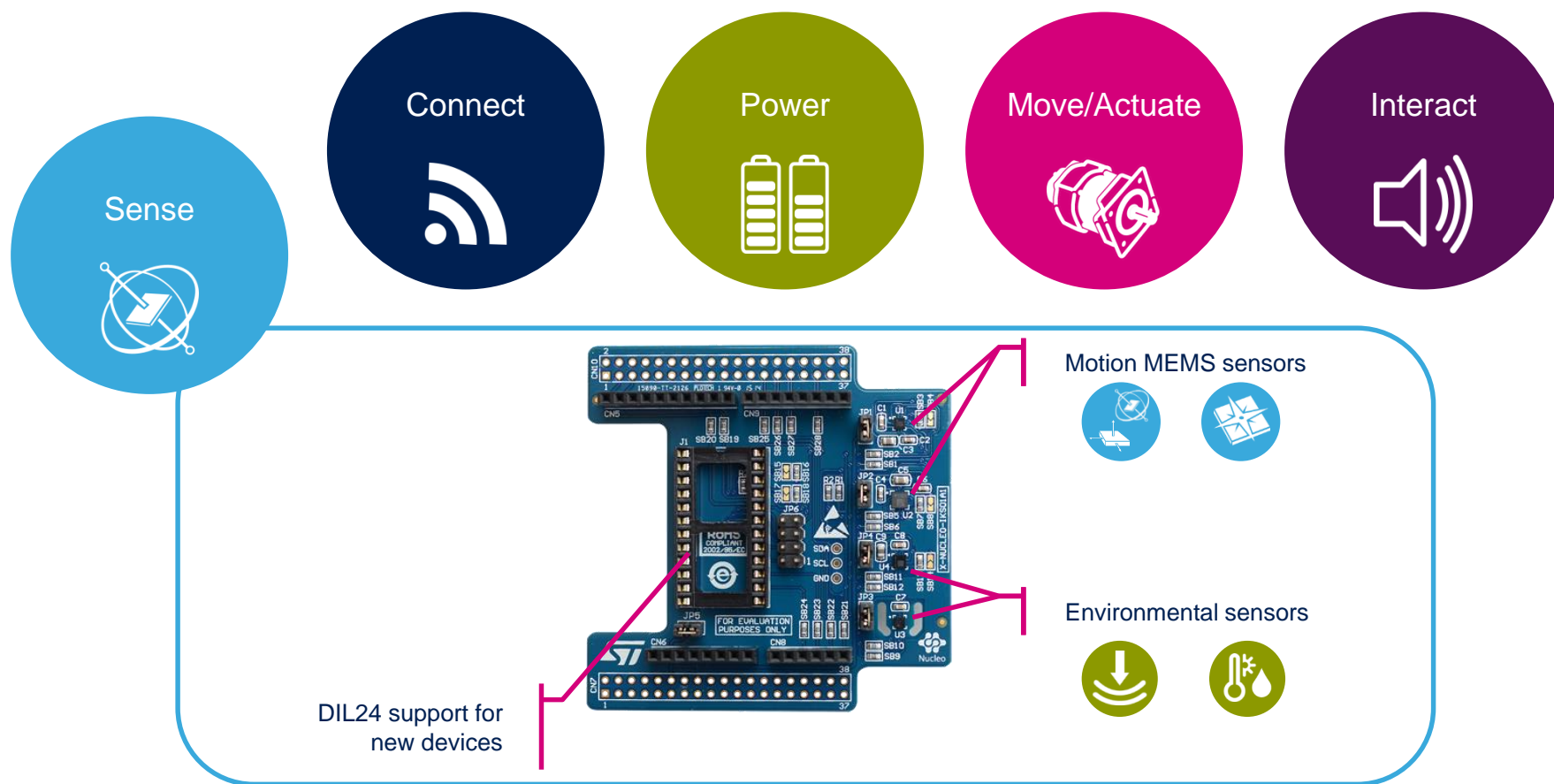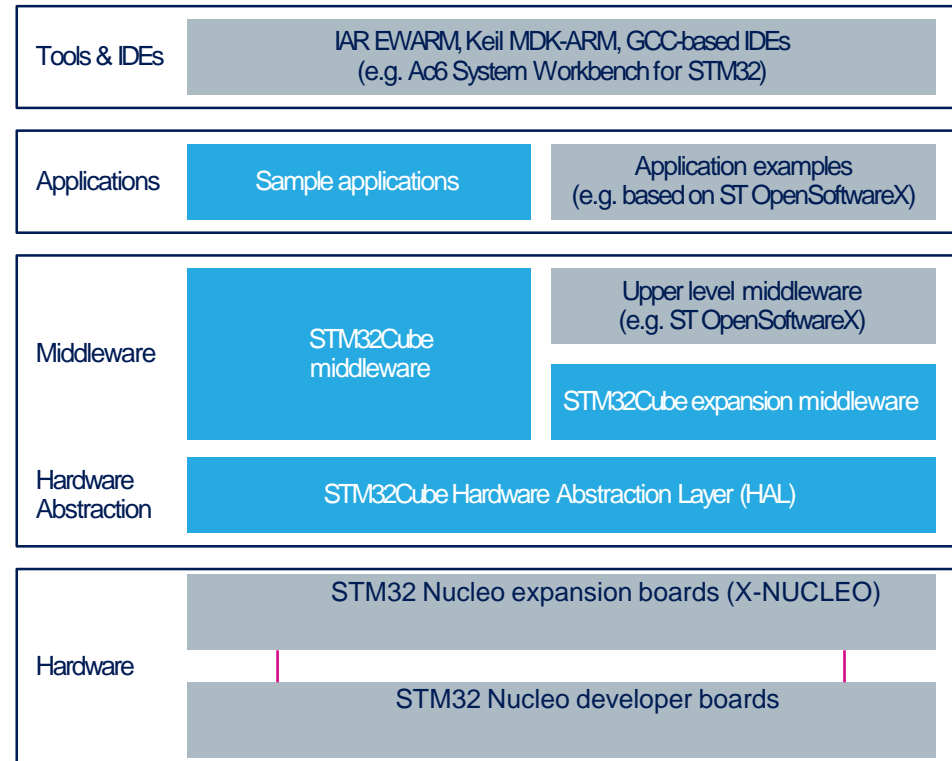|	
Tools & IDEs	IAR EWARM, Keil MDK-ARM, GCC-based IDEs (e.g. Ac6 System Workbench for STM32)

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**

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

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

Translate — ACCESS
- Audio amplifier
- Touch controller
- Operation Amplifier

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

Power — POWER
- Energy management & battery

Process — PROCESS
- General-purpose microcontrollers
- Secure microcontrollers

Software

STM32 Cube

STM32 Open Development Environment

www.st.com/stm32ode

life.augmented