STM32 Ecosystem

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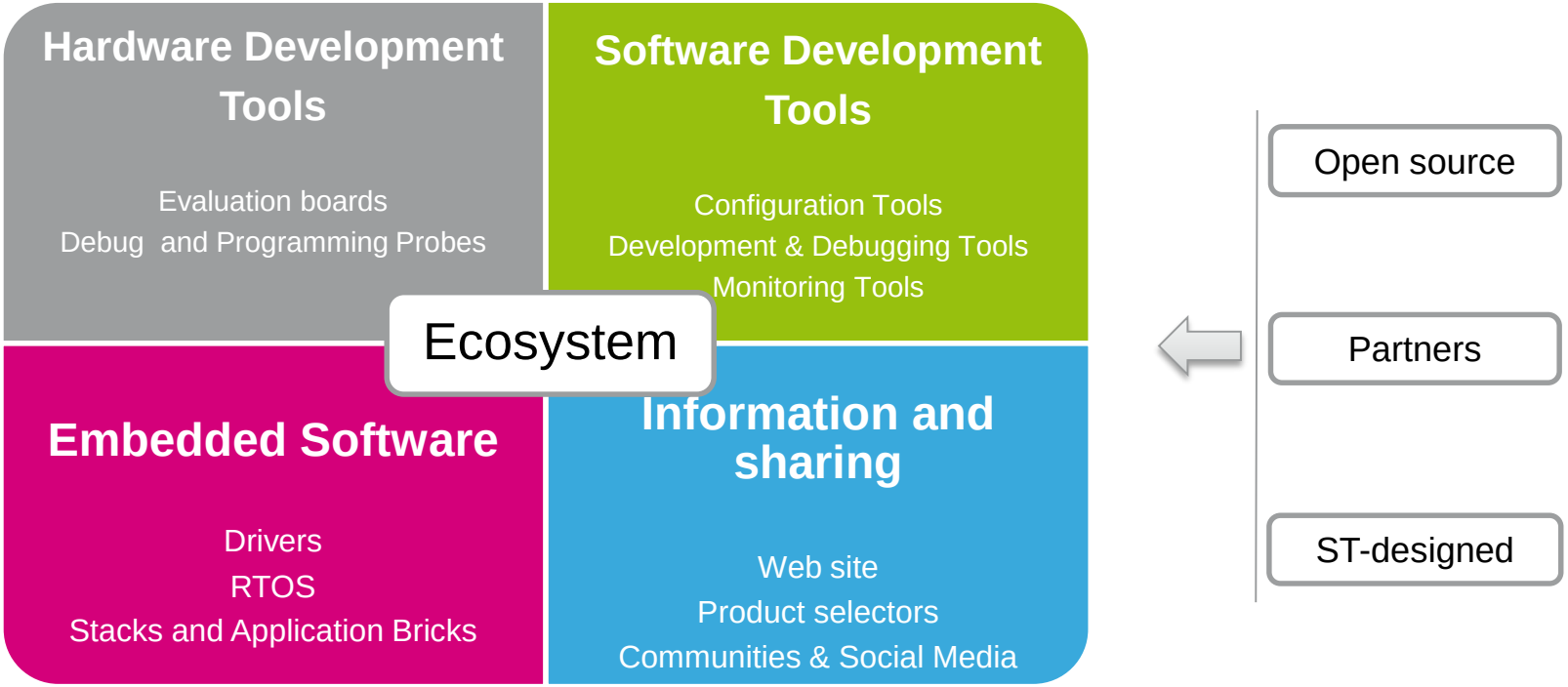
What is MCU Ecosystem ?

All collaterals required to develop with an MCU



STM32 Open Development Environment

Fast, affordable development and prototyping

STM32 Open Development Environment

Agenda

- **STM32 Open Development Environment**
- Hardware portfolio
- Software portfolio
- STM32 ODE product accelerators

ST's solutions for IoT

INTEGRATION

Common SW platform

3 Cloud provider SDKs supported, enabling sensor-to-cloud platforms

131 SW packages from drivers to full application examples and mobile applications

STM32 Cube

STM32 Open Development Environment

Wearable | IoT Smart Things | Smart Home | Building automation

STM32

27 STM32 Nucleo development boards
Covering the broad portfolio of STM32 MCU families

31 STM32 Nucleo expansion boards (X-NUCLEO)
Offering peripheral functions

STM32 Nucleo

Modular hardware

ST & 3rd-party form-factor boards

Bluecoin

IoT Discovery

Sensor Tile

Form factor boards

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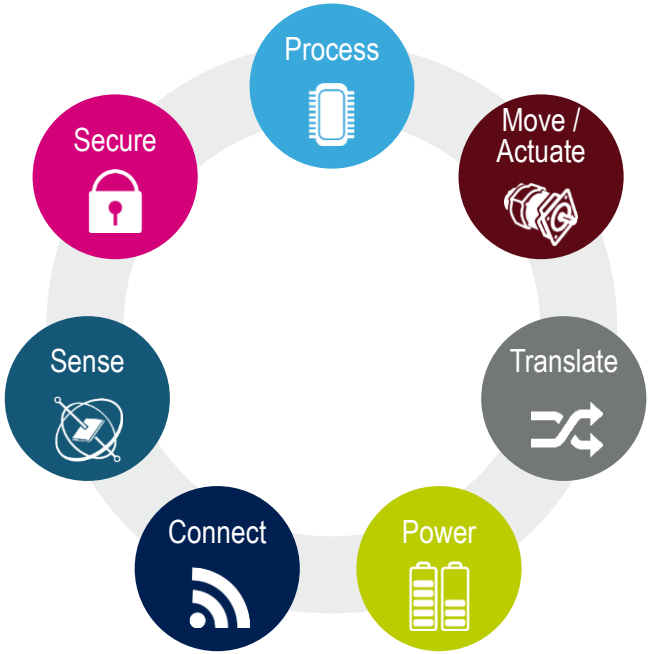
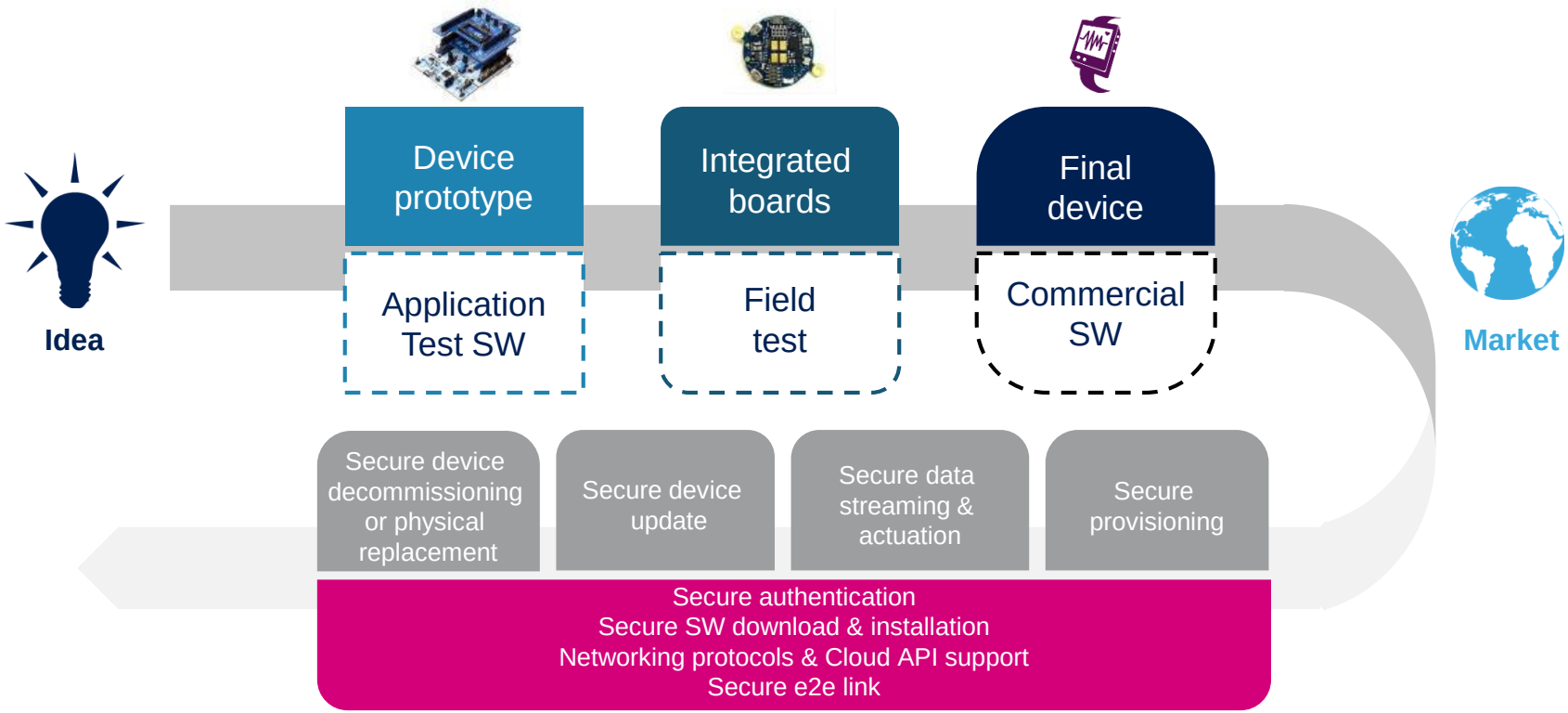
How to address developers' needs

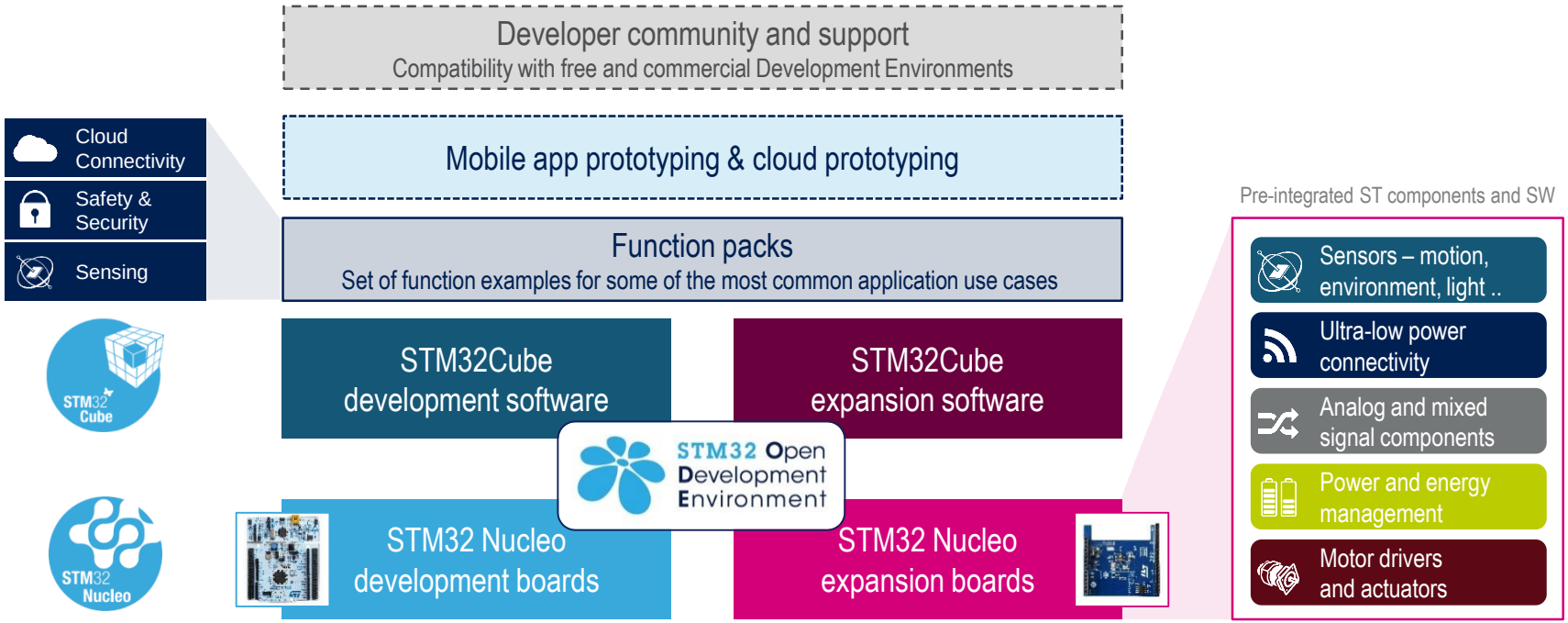
- Offer a large range of microcontrollers from low power to high performance to meet application needs
- Ensure that extra functions are covered in the main domains
  - Sensing, connectivity, power management, motor control and audio
- Ease the Development Environment to allow fast development and production
  - Support of multiple IDEs
  - Free-of-charge tools and embedded software to enable fast and easy development



The real IoT lifecycle



Fast, affordable prototyping & development



www.st.com/stm32ode

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Agenda

- STM32 Open Development Environment
- **Hardware portfolio**
- Software portfolio
- STM32 ODE product accelerators

An application-oriented approach

Your need

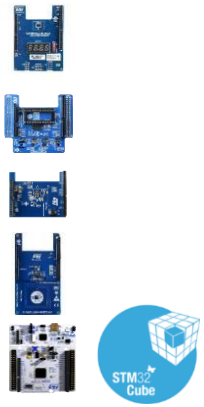
- Sensors
- Connectivity
- Translate
- Motor drivers
- Power
- Processing

Application software
and development tools

The building blocks

Processor boards (Nucleo 64)
Expansion boards (X-Nucleo)

- Motion
- Environmental
- Bluetooth LE
- Sub-GHz
- NFC
- OpAmp
- Motor controller
- Power manager
- Microcontroller



Integrated Development Environment
and middleware

Our answer

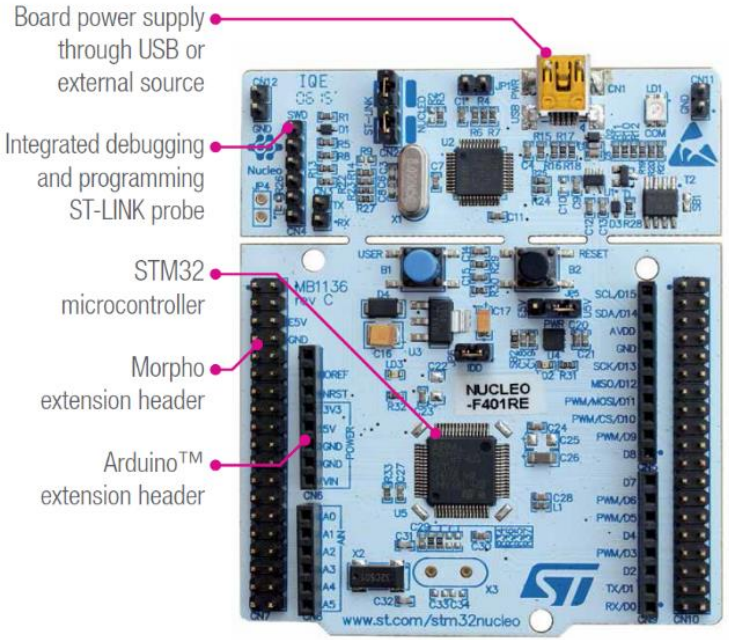
Function Packs (FP)

Ready-to-use
application-oriented package

STM32 Nucleo development boards

www.st.com/stm32nucleo

27 development boards and growing… in two flavors (Processing & Security)



STM32 Nucleo

STM32 complete product range
from ultra-low power to high performance

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

STM32 L0 | STM32 L1 | STM32 L4

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STM32 Nucleo expansion boards

www.st.com/x-nucleo

31 expansion boards and growing… covering all the key functions

Sense (5)	Connect (8)	Power Drive (3)	Move Actuate (12)	Translate (3)
Motion & environmental sensors	BLE	Power management	Motor drive	Audio amplifier
Proximity sensor	Wi-Fi	LED boost	Actuator	OpAmp
Microphone	Sub-GHz			
	NFC			

STM32 Nucleo expansion boards

Portfolio (1/3)

		Order Code	Description	Key products
Sense	Motion and environment sensors	**X-NUCLEO-IKS01A1**	Motion MEMS & environmental sensors	LIS3MDL, LSM6DS0, HTS221, LPS25HB
		X-NUCLEO-IKS01A2		LSM303AGR, LSM6DSL, HTS221, LPS22HB
	Proximity sensors	**X-NUCLEO-6180XA1**	Proximity, gesture and ambient light sensor expansion board	VL6180X
		X-NUCLEO-53L0A1	Ranging and gesture sensor expansion board	VL53L0X
	Microphone	**X-NUCLEO-CCA02M1**	Digital MEMS microphone expansion board	MP34DT01-M, STPS160A, ESDA7P60-1U1M, USBLC6-2SC6
Connect	Bluetooth Low Energy 4.1	**X-NUCLEO-IDB05A1**	Bluetooth Low Energy module expansion board	SPBTLE-RF, M95640-R
	Wi-Fi	**X-NUCLEO-IDW01M1**	Wi-Fi expansion board	SPWF01SA.11, STLQ50C25R
		X-NUCLEO-IDW04A1		SPWF04S
	Sub-GHz radio	**X-NUCLEO-IDS01A4**	868 MHz RF expansion board	SPSGRF-868, M95640-R
		X-NUCLEO-IDS01A5	915 MHz RF expansion board	SPSGRF-915, M95640-R
	NFC	**X-NUCLEO-NFC01A1**	Dynamic NFC Tag expansion board	M24SR
		X-NUCLEO-NFC02A1		M24LR
		X-NUCLEO-NFC03A1	NFC card reader expansion board	CR95HF

STM32 Nucleo expansion boards
Portfolio (2/3)

		Order Code	Description	Key products
Move/ Actuate	Motor driver	**X-NUCLEO-IHM01A1**	Stepper motor driver expansion board	L6474
		X-NUCLEO-IHM02A1	Two-axis stepper motor driver expansion board	L6470, STPS1L60A, SMAJ48A-TR, ST1S14
		X-NUCLEO-IHM03A1	High-power stepper motor expansion board	PowerSTEP01
		X-NUCLEO-IHM04A1	Dual-brush DC motor driver expansion board	L6206
		X-NUCLEO-IHM05A1	Bipolar stepper motor expansion board	L6208
		X-NUCLEO-IHM06A1	Low-power stepper motor driver expansion board	STSPIN220
		X-NUCLEO-IHM07M1	3-phase brushless DC motor drivers expansion board	L6230, TSV994IPT, SMBJ48A-T
		X-NUCLEO-IHM08M1	Low-voltage BLDC motor driver expansion board	L6398D, ST1S14PHR, LD1117S50TR, LMV331ILT, TSV994IPT, STL220N6F7, SMBJ48A-TR, STPS0560Z
		X-NUCLEO-IHM09M1	Motor control connector	-
		X-NUCLEO-IHM11M1	3-phase BLDC motor driver	STSPIN230, TSV991ILT, BAT30KFILM
		X-NUCLEO-IHM12A1	Low-voltage dual-brush DC motor driver	STSPIN240
		X-NUCLEO-IHM13A1	Low-voltage DC motor driver	STSPIN250
Translate	Audio processing	**X-NUCLEO-CCA01M1**	Sound terminal expansion board	STA350BW, SMA6J26A, ESDA25W
	Op amp	**X-NUCLEO-IKA01A1**	Multifunctional expansion board (operational amplifiers)	TSZ124 ,TSV734IPT TSU104IPT, ESDALC6V1-1M2, ESDALCL6-2SC6, ESDA7P60-1U1
	Industrial Input/output	**X-NUCLEO-PLC01A1**	Industrial input/output expansion board	VNI8200XP, CLT01-38SQ7, SM15T33CA, STPS1H100A

STM32 Nucleo expansion boards
Portfolio (3/3)

		Order Code	Description	Key products
Power / drive	Battery and energy management	**X-NUCLEO-IPS02A1**	24 V Intelligent power switch expansion board	VPS2535H
	LED lighting	**X-NUCLEO-LED61A1**	DC-DC LED driver expansion board	LED6001, STL3N10F7, STL8N10LF3, STPS2L60A, BAS70KFILM, ESDAULC5-1BF4, SMM4F33A-TR
		X-NUCLEO-LED16A1	16-channel LED driver board	LED1642GW

For more information on STM32 Nucleo expansion boards:
http://www.st.com/en/ecosystems/stm32-nucleo-expansion-boards.html

Agenda

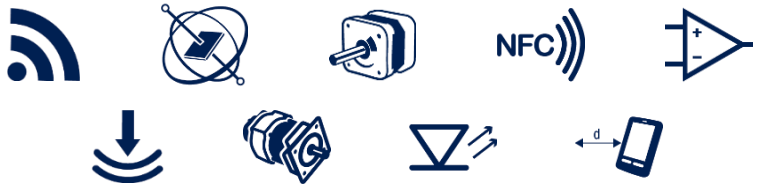
- STM32 Open Development Environment
- Hardware portfolio
- **Software portfolio**
- STM32 ODE product accelerators

Simple vs advanced use cases

Expansion SW (X-Cube)	vs	Function Pack

- Prototype with a single expansion board

Sample applications



- Create advanced use cases based on multiple expansion boards

Pre-integrated application example

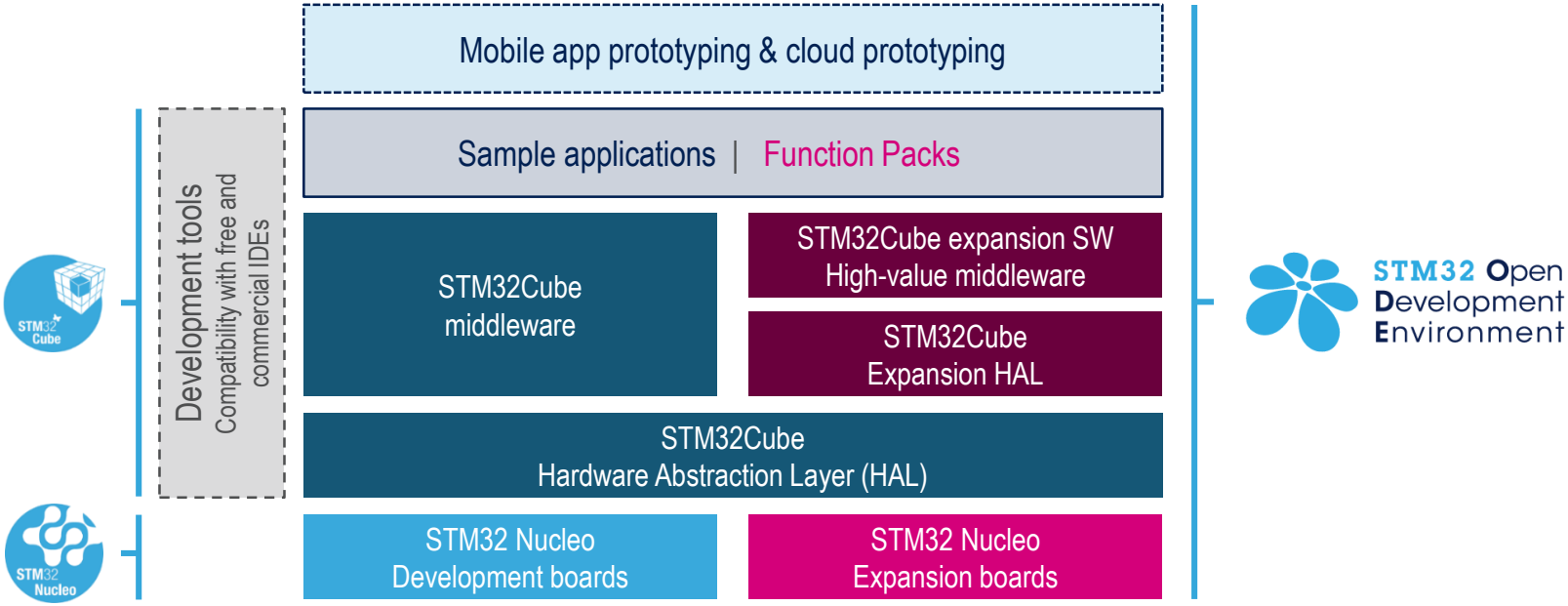
Wearables

IoT Smart Things

Home applications

Building automation

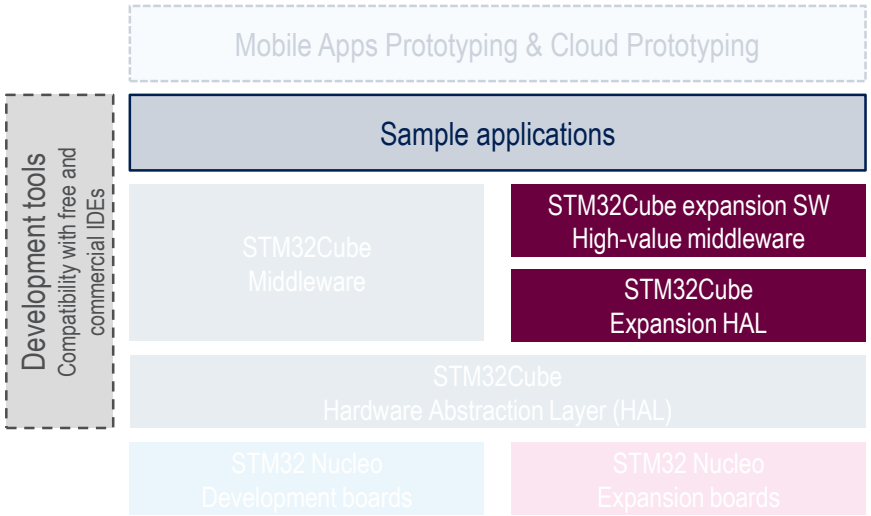
Development software architecture



Expansion software (X-CUBE)

www.st.com/x-cube

- The X-Cube is an expansion SW package for STM32Cube SW and is associated to a single X-Nucleo board and validated on several Nucleo boards
  - Example: X-CUBE-BLE1 runs on the X-NUCLEO-IDB05A1
- Sample implementations are included in the package as well as a full documentation set (data brief, user manual, quick start guide and videos)
- These SW extensions are homogeneous in terms of SW structure and API abstraction level to easily combine multiple functions
- All X-Cube packages come with pre-built projects with IAR, Keil and SW4STM32 IDEs, and binaries that can be run out of the box



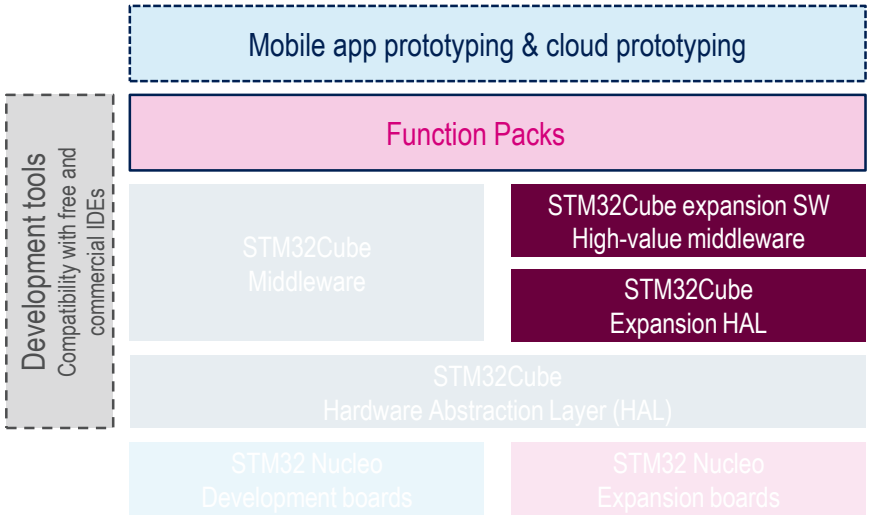
X-NUCLEO-IDB05A1

X-CUBE-BLE1
Firmware package companion

life.augmented

Function Packs

- A Function Pack is a pre-integrated application SW package including a set of key building blocks used in most popular application domains such as Cloud, Wearables, IoT, Home and Building Automation
- Each Function Pack package is associated to two or more X-Nucleo boards
  - Example: FP-NET-6LPBLE1 runs on the X-NUCLEO-IDB05A1 and X-NUCLEO-IDS01A4
- When relevant for the application demonstrated by the Function Pack, mobile applications (Android™ and iOS™) are included
- All Function Pack come with pre-built projects with IAR, Keil and SW4STM32 IDEs, and binaries that can be run out of the box



Detailed X-CUBE advanced libraries

X-CUBE-MEMS1

Former Open.MEMS library	
Library	**Description**
MotionGR	Real-time gesture recognition
MotionFX	Real-time motion-sensor data fusion
MotionCP	Real-time carrying position
MotionPM	Real-time pedometer
MotionAR	Real-time activity recognition
MotionAW	Activity recognition for wrists
MotionPE	Pose estimation
MotionID	Intensity detection
MotionAC	Accelerometer dynamic calibration
MotionMC	Magnetometer dynamic calibration
MotionGC	Gyroscope dynamic calibration
MotionFA	Fitness activity
MotionEC	*eCompass*

X-CUBE-SUBG1

Former Open.RF library	
Library	**Description**
Contiki6LP	Contiki OS/6LoWPAN middleware

X-CUBE-BLE1

Former Open.RF library	
Library	**Description**
SmartConnPS	Bluetooth Low Energy profiles

X-CUBE-MEMSMIC1

Former Open.Audio library	
Library	**Description**
AcousticSL	Real-time sound source localization
AcousticBF	Real-time beam forming
AcousticEC	Real-time acoustic echo cancellation

Function Pack example

FP-SNS-MOTENV1

Required hardware

Motion and environmental sensor expansion board

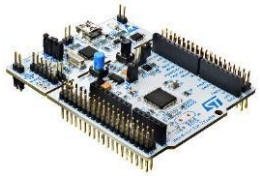
MEMS 3D accelerometer, gyroscope and magnetometer
MEMS pressure and humidity sensors

X-Nucleo-IKS01A1

Bluetooth Low Energy expansion board

BlueNRG Bluetooth Low Energy network processor

X-NUCLEO-IDB05A1



STM32 Nucleo-64 development board

STM32F4 MCU

NUCLEO-F476RG

Software (free of charge)

FP-SNS-MOTENV1 SW package

Sample applications (streaming sensor data to smartphone app)

Bluetooth Low Energy and Sensor expansion software for STM32Cube
X-CUBE-BLE1
X-CUBE-MEMS1

STM32Cube

"ST BlueMS" mobile application

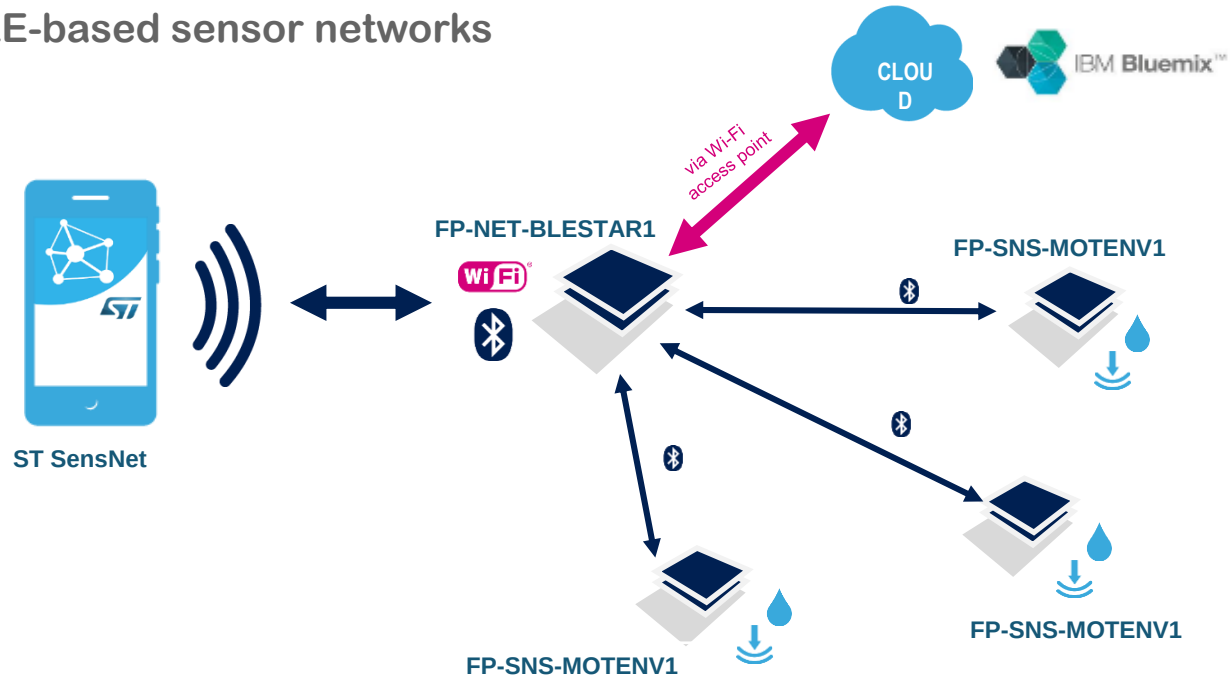
Available on the App Store

ANDROID APP ON Google play

SDK available on Github (BlueSTSDK)

Multiple Function Pack examples

Gateway for BLE-based sensor networks



Available Function Packs (1/3)

Function	Application case	STM32 Nucleo Develop. board	X-NUCLEO Expansion board	STM32 ODE Function Pack	
				Software	Apps iOS / Android
Local and cloud connectivity	An IoT node with Wi-Fi and sensors, securely connected to Microsoft Azure cloud	NUCLEO-F401RE NUCLEO-L476RG	X-NUCLEO-IDW01M1 X-NUCLEO-IKS01A1 X-NUCLEO-NFC01A1	FP-CLD-AZURE1	-
	An IoT node with Wi-Fi, NFC and sensors, securely connected to Amazon AWS cloud	NUCLEO-F401RE	X-NUCLEO-IDW01M1 X-NUCLEO-IKS01A1 X-NUCLEO-NFC01A1	FP-CLD-AWS1	-
	An IoT node with Wi-Fi, NFC and sensors for vibration analysis, connected to IBM Watson IoT Cloud		X-NUCLEO-IDW01M1 X-NUCLEO-IKS01A1 X-NUCLEO-IKS02A1 X-NUCLEO-NFC01A1	FP-CLD-WATSON1	-
Sensing	An IoT node with BLE connectivity, sensors and NFC for simple and secure Bluetooth BLE pairing *Updated with **BLUEMICROSYSTEM3** former Open.Framework package*	NUCLEO-F401RE NUCLEO-L476RG	X-NUCLEO-IDB05A1 X-NUCLEO-IKS01A1 X-NUCLEO-NFC01A1 X-NUCLEO-6180XA1	FP-SNS-FLIGHT1	ST BlueMS
	An IoT node with BLE connectivity and with sensors for temperature, humidity, pressure, motion, and digital microphone *Updated with **BLUEMICROSYSTEM2** former Open.Framework package*	NUCLEO-F401RE NUCLEO-L476RG	X-NUCLEO-IDB05A1 X-NUCLEO-IKS01A1 X-NUCLEO-CCA02M1	FP-SNS-ALLMEMS1	ST BlueMS
	An IoT node with BLE connectivity and with 4 sensors for temperature, humidity, pressure and motion *Updated with **BLUEMICROSYSTEM1** former Open.Framework package*	NUCLEO-F401RE NUCLEO-L476RG NUCLEO-L053R8	X-NUCLEO-IDB05A1 X-NUCLEO-IKS01A1	FP-SNS-MOTENV1	ST BlueMS

Available Function Packs (2/3)

Function	Application case	STM32 Nucleo Develop. board	X-NUCLEO Expansion board	STM32 ODE Function Pack	
				Software	Apps iOS / Android
Safe and security	An IoT node with secure BLE network pairing through NFC	NUCLEO-F401RE NUCLEO-L053R8	X-NUCLEO-IDB05A1 X-NUCLEO-NFC01A1	FP-SEC-BLENFC1	ST BlueMS
	An IoT node with secure Wi-Fi network pairing through NFC	NUCLEO-F401RE	X-NUCLEO-IDW01M1 X-NUCLEO-NFC01A1	FP-SEC-WIFINFC1	ST M24SR
Network infrastructure	A BLE star network connected via Wi-Fi bridge to IBM Bluemix cloud	NUCLEO-F401RE NUCLEO-L476RG NUCLEO-L053R8	X-NUCLEO-IDW01M1 X-NUCLEO-IDB05A1	FP-NET-BLESTAR1	ST SensNet
	A bridge to connect 6LoWPAN IoT nodes connected to smartphones via BLE interface	NUCLEO-F401RE	X-NUCLEO-IDS01A4 (X-NUCLEO-IDS01A5) X-NUCLEO-IDB05A1	FP-NET-6LPBLE1	-
	6LowPAN SPIRIT connectivity and bridge to Wi-Fi connectivity	NUCLEO-F401RE	X-NUCLEO-IDW01M1 X-NUCLEO-IDS01A4 (X-NUCLEO-IDS01A5)	FP-NET-6LPWIFI1	-
	6LowPAN SPIRIT nodes based on the IPSO standard	NUCLEO-F401RE NUCLEO-L152RE	X-NUCLEO-IDS01A4 (X-NUCLEO-IDS01A5) (X-NUCLEO-6180XA1) (X-NUCLEO-IKS01A1) (X-NUCLEO-IKS01A2)	FP-SNS-6LPNODE1	-

Available Function Packs (3/3)

Function	Application case	STM32 Nucleo Develop. board	X-NUCLEO Expansion board	STM32 ODE Function Pack	
				Software	Apps iOS / Android
Audio	Voice streaming over Bluetooth Low Energy in a half-duplex configuration *Based on **BlueVoice** advanced library*	NUCLEO-F401RE	X-NUCLEO-IDB05A1 X-NUCLEO-CCA02M1	**FP-AUD-BVLINK1**	ST BlueMS
	Advanced processing for MEMS microphone arrays, including digital MEMS microphone acquisition, beamforming, source localization and acoustic echo cancellation. *Includes **AcousticEC** advanced library*	NUCLEO-F446RE	X-NUCLEO-CCA01M1 X-NUCLEO-CCA02M1	**FP-AUD-SMARTMIC1**	

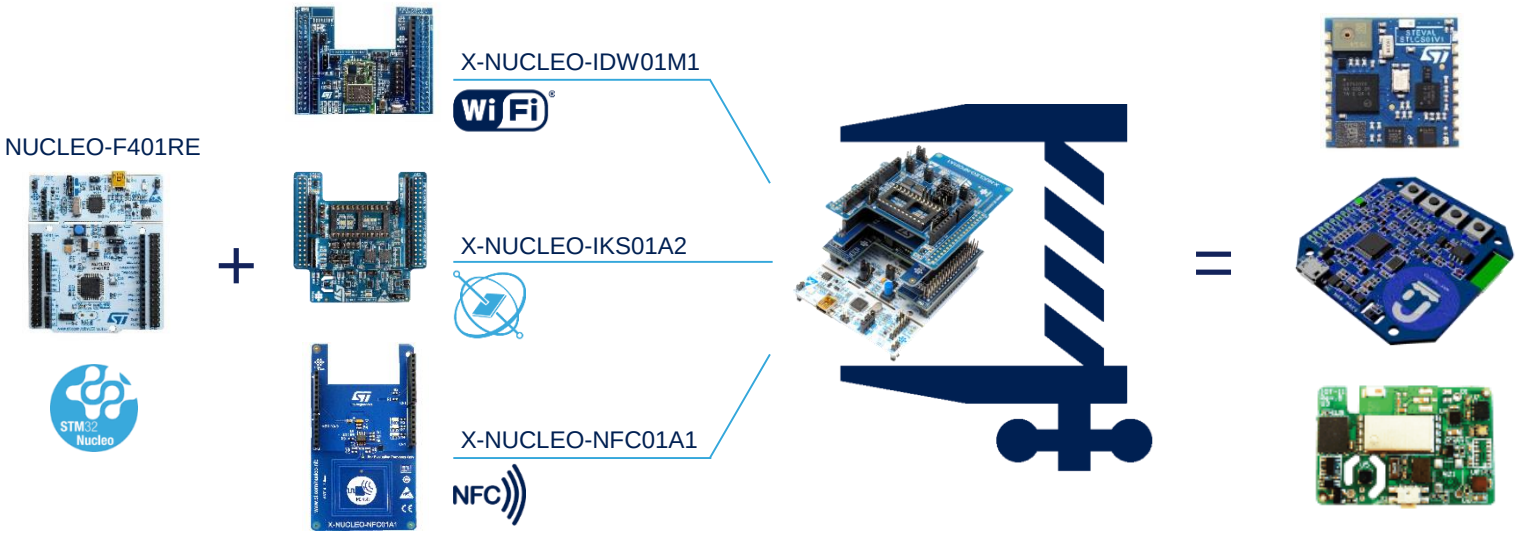
Agenda

- STM32 Open Development Environment
- Hardware portfolio
- Software portfolio
- **STM32 ODE product accelerators**

STM32 Open Development Environment

STM32 ODE product accelerators

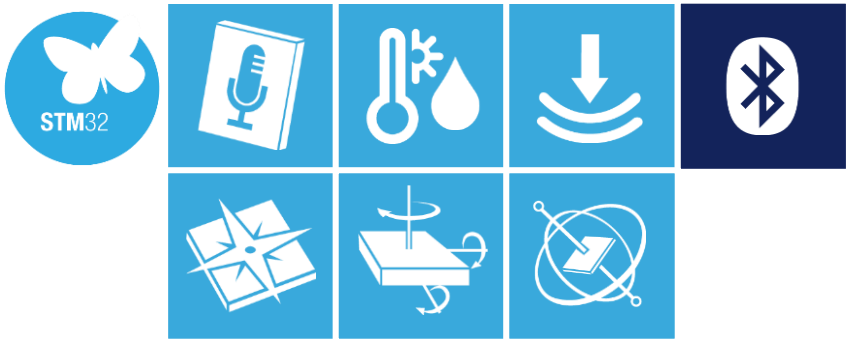
A fast track from idea to production



Idea → Prototype → Engineering sample → **Product**

STM32 ODE product accelerators

SensorTile



By

STMicroelectronics www.st.com

What it is

Bluetooth Smart sensorized development kit for IoT design (motion, environmental, microphone).

Nucleo boards

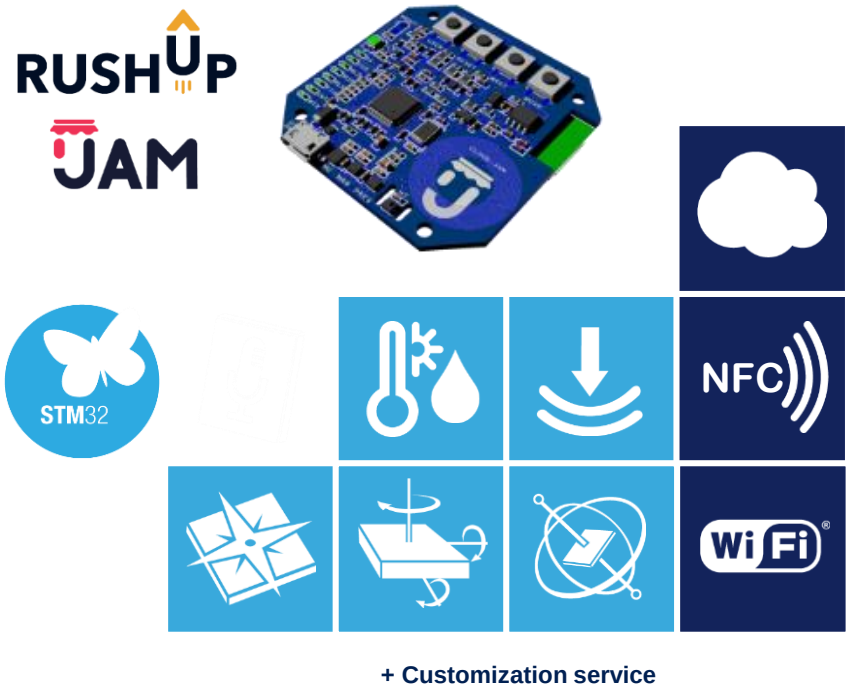
NUCLEO-F401RE
X-NUCLEO-IDB05A1
X-NUCLEO-IKS01A1
X-NUCLEO-CCA02M1

Available Function Packs

FP-SNS-ALLMEMS1
FP-SNS-MOTENV1
FP-AUD-BVLINK1

STM32 ODE product accelerators

Cloud - JAM



+ Customization service

By

RushUp www.rushup.tech/jam

What it is

Motion & environmental sensors board connected to the cloud through Wi-Fi network using SSID, password and web authentication stored in the dynamic NFC.

Nucleo boards

NUCLEO-F401RE
X-NUCLEO-IDW01M1
X-NUCLEO-IKS01A2
X-NUCLEO-NFC01A1

Available Function Packs

FP-CLD-AZURE1
FP-CLD-AWS1
FP-CLD-WATSON1

STM32 ODE product accelerators

SensiBLE

SensiEDGE

+ Customization service

By

SensiEDGE www.sensiedge.com

What it is

Complete platform delivering Sensor reading over Bluetooth Low Energy to smartphone and to the cloud.

Nucleo boards

NUCLEO-L476RG
X-NUCLEO-IDB05A1
X-NUCLEO-IKS01A1
X-NUCLEO-CCA02M1

Available Function Packs

FP-SNS-ALLMEMS1

Quick Links

- STM32 ODE (www.st.com/stm32ode)
  - STM32 Nucleo (www.st.com/stm32nucleo)
  - STM32 Nucleo Expansion (www.st.com/x-nucleo)
  - STM32Cube Expansion (www.st.com/x-cube)
  - STM32 Function Packs
  - STM32Cube Libs (www.st.com/stm32cube)

Embedded software

A full portfolio and several models

- Extensive software ecosystem around the STM32 and STM8
- You will find your solution, fitting your requirements in terms of price, license and support

ST-designed software
- Built in-house, making the most of the STM32 and STM8
- Source code or binaries
- Supported by ST

Open source
- Proposed by community or third parties
- Source code, from BSD or GPL licenses to commercial products
- Supported by open-source community or third parties

Third parties
- Generic solutions proposed by many companies, portable to/from other platforms
- Source code or binaries
- Supported by third parties

A large community of third parties… and growing !

Links

- STM32 Embedded Software (www.st.com/stm32embeddedsoftware)
  - These components are either developed by ST or supplied by ST's partner network or stem from open source initiatives.
- STM8 and STM32 Embedded Software solutions online presentation (www.st.com/stm32-stm8-firmware)

Information and Sharing

STM32 Education webpage

www.st.com/stm32education

Online training

Specific modules focused on teaching the skills and knowledge to get the best performance from our MCUs in your applications.

Available courses :

STM32F7 On-line Training
High-performance
ARM® Cortex®-M7

STM32L4 On-line Training
Ultra-low-power & performance
ARM® Cortex®-M4

Massive Open Online Courses

Register on our MOOC platform and follow one of our high quality online courses. Available courses :

- STM32 F7 Hands-on workshop
- STM32CubeMX & STM32CubeHAL basics
- Discover the STM32F0L0 Developers package

STM32 Community

Join the ST community of developers, makers, schools, universities, customers, partners, ST employees and all STM32 enthusiasts to ask question, find answers, collaborate, connect, communicate, learn and share your project on STM32 MCUs.

Videos

Browse our media library selection of videos on our STM32 platform.

Textbooks

Browse our selection of ST recommended textbooks for microcontrollers. Submit your publication and be part of the selection.

ST training courses

Our teams of training experts provide free multiday courses for our microcontroller products at locations accross continental Europe. Look at the program.

Partner training courses

Check our list of partners providing quality courses completing ST's training portfolio.

STM32 for Motor Control

STM32 & STM8 Motor Control ecosystem overview. By motor type: SW Tools, FW library, HW boards, Application Notes, Getting Started, Videos, Forum…

Online Training

STM32L4 Online Training

Full range of STM32L4 training courses available online

ST offers a full range of training courses in both **ePresentation** and **PDF** format for the STM32L4 series of ultra-low-power MCUs.

These courses provide helpful instructions and specific information on how to design applications that take advantage of the STM32L4's performance and ultra-low-power capabilities.

More than 45 specific training modules focus on teaching the skills and knowledge for getting the most performance from STM32L4 MCUs for your applications.

Introduction

- Welcome session
- STM32L4 Serie Presentation

System

- ARM® Cortex®-M4 core with FPU
- Interconnect matrix
- System configuration (SYSCFG)
- Reset and Clock Control
- Power controller (PWR)

Video and downloadable presentation material

Massive Open Online Courses

STM32F0/L0 MOOC with hands-on exercises

Discover the STM32 with a free 32-bit Cortex-M0/0+ MCU Professional Developer's Package

Enroll in our free-of-charge MOOC (massive open online course).

Who should attend this workshop?

Engineers looking to upgrade their 8/16-bit MCU designs to entry-level and ultra-low-power STM32 microcontrollers using a professional development ecosystem.

Benefits you will take away

This workshop on the free 32-bit Cortex-M0/0+ MCU Professional Developer's Package will show you:

- how to upgrade standard and ultra-low-power 8/16-bit MCU designs with the STM32F0/L0 series of Cortex-M0/M0+ MCUs,
- how to get started with your development using the STM32Cube firmware library and the free Keil MDK-ARM for STM32F0 and STM32L0 (a complete free professional IDE for STM32F0 and STM32L0 MCUs),
- how to generate, debug and run your first project using the STM32CubeMX graphical software configuration tool to rapidly get your next STM32 project off the ground.

An STM32F0 Discovery kit is required for the hands-on exercises. These sub $10 kits are available from distributors listed from the 'distributor availability' button in the STM32F0DISCOVERY product page.

The course is provided in MOOC format with course material available online, mostly as videos complemented with exercises and example files.

Technical experts will be available online to provide help and answer your questions.

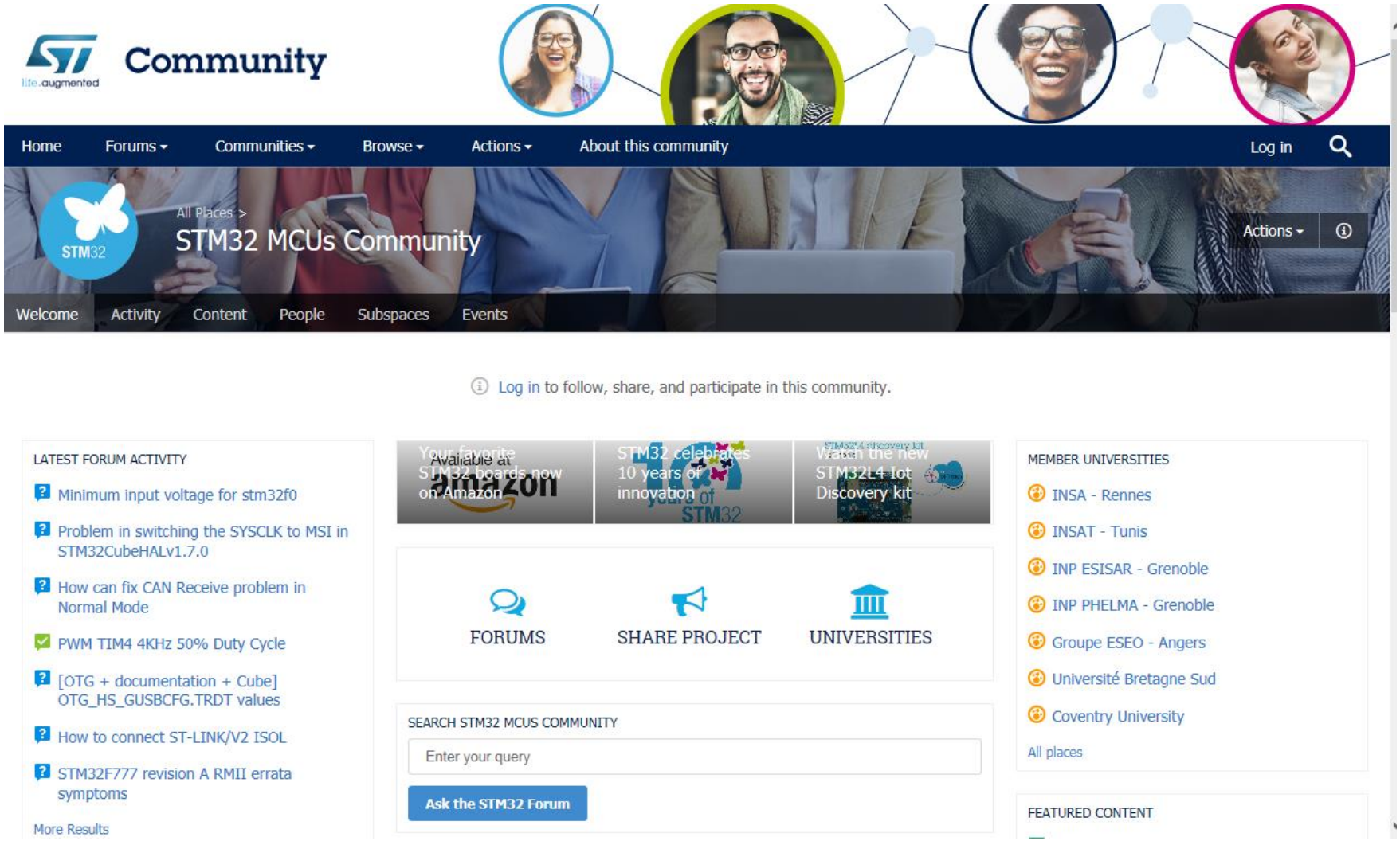
The course takes approximately 90 minutes to complete, depending on your proficiency, and must be completed within the dates listed below.

There is no charge to participate in this event, but you must register through my.st.com.

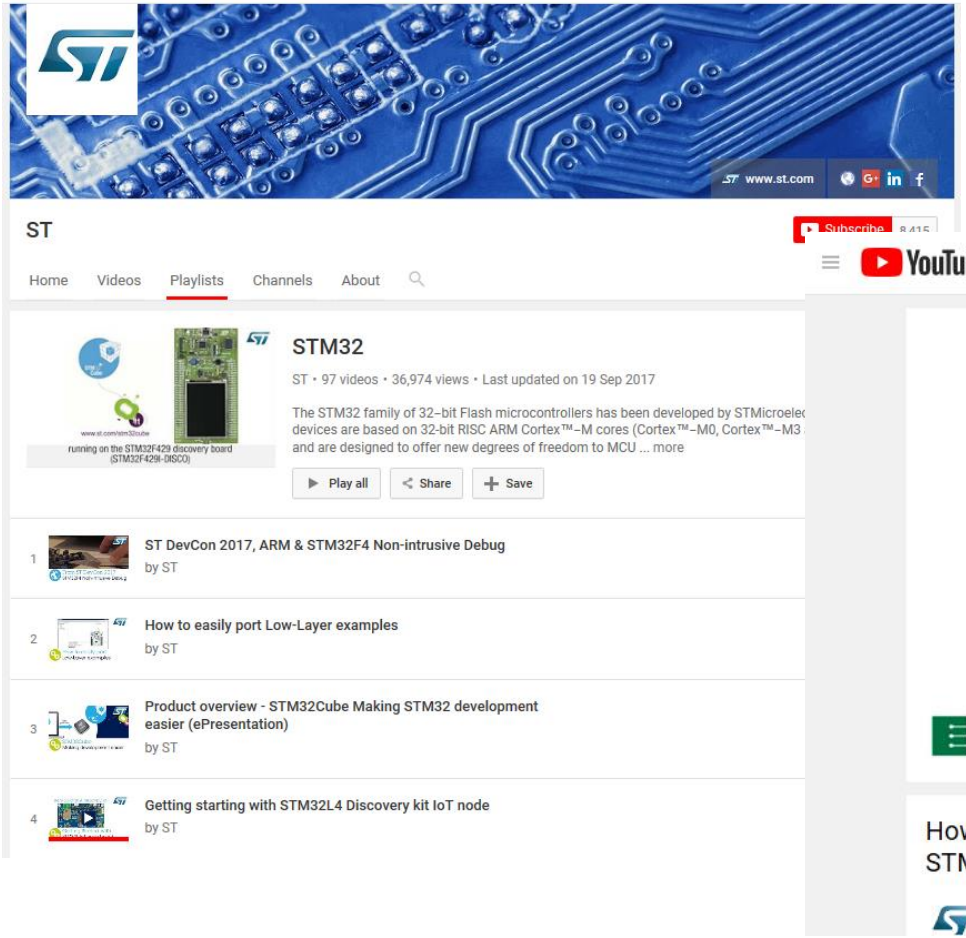
If you already have a my.st.com account, **REGISTER here**.

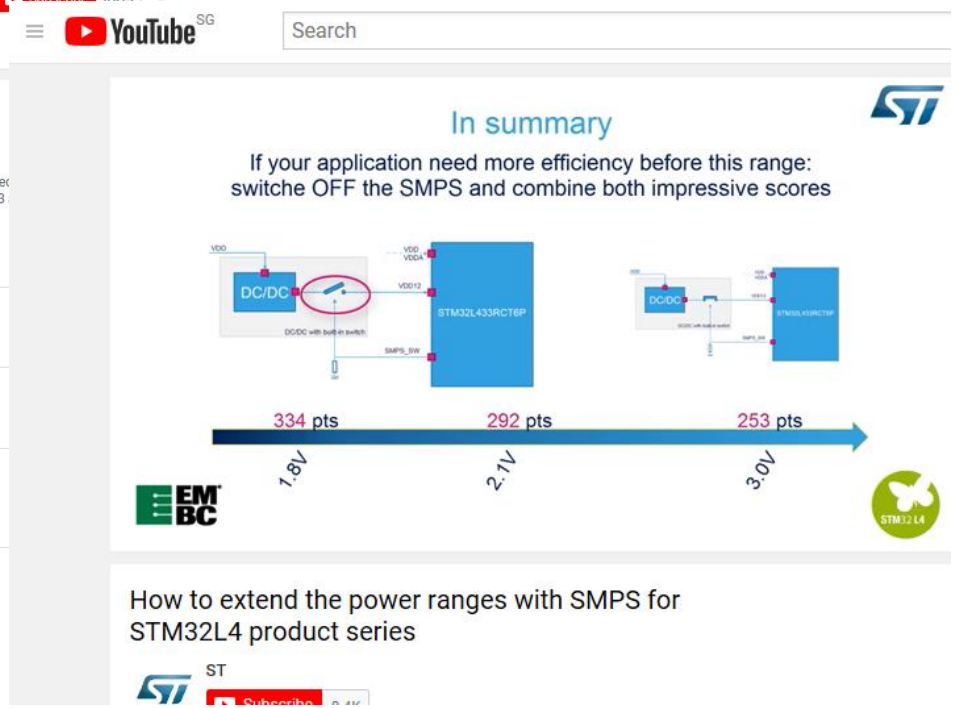
If you do not have a myST account, **click here to create your account** and register.

STM32 Community



Video Tutorials





https://www.youtube.com/user/STonlineMedia

Mobile Application

ST MCU Finder

- Browse STM32 & STM8 families wide portfolio and select the product that best fit their needs
- Access to technical information
- Also works offline !

android Google play

iOS 7 App Store

Windows Phone Windows Store

life.augmented

Documentation

- Main product documentation
  - Datasheet – main reference document for hardware engineer
  - Errata sheet
  - Reference manual – main reference document for firmware/software programmer
  - Programming manual - Cortex M0 CPU architecture details (PM00215)
- Other documentation
  - Evaluation / NUCLEO board User Manual
  - Application note (ANxxxx)
    - AN4080 Getting started with STM32F0x1/x2/x8 hardware development
    - AN2606 STM32 microcontroller system memory boot mode
    - AN2867 Oscillator design guide for STM8 and STM32 microcontroller
    - Etc..
  - Firmware and software stack documentation
    - UM1785 Description of STM32F0 HAL and Low-layer drivers
    - UM1779 Getting started with STM32CubeF0 for STM32F0 Series
    - UM1722 Developing applications on STM32Cube with RTOS
    - Etc..