STM32 Open Development Environment

Fast Affordable Development and Prototyping

STMicroelectronics

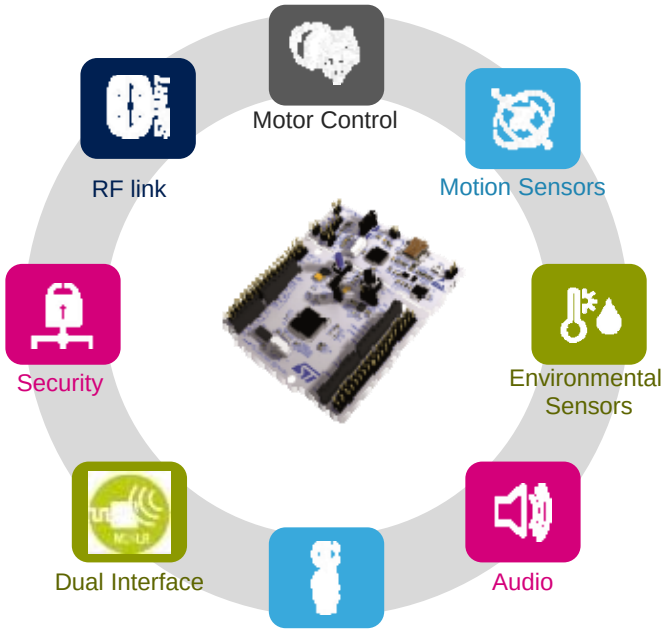
Agenda

- **STM32 Open Development Environment**
- Hardware Portfolio
- Software Ecosystem
- Function Packs
- BlueMicrosystem1 DEMO

STM32 Open Development Environment

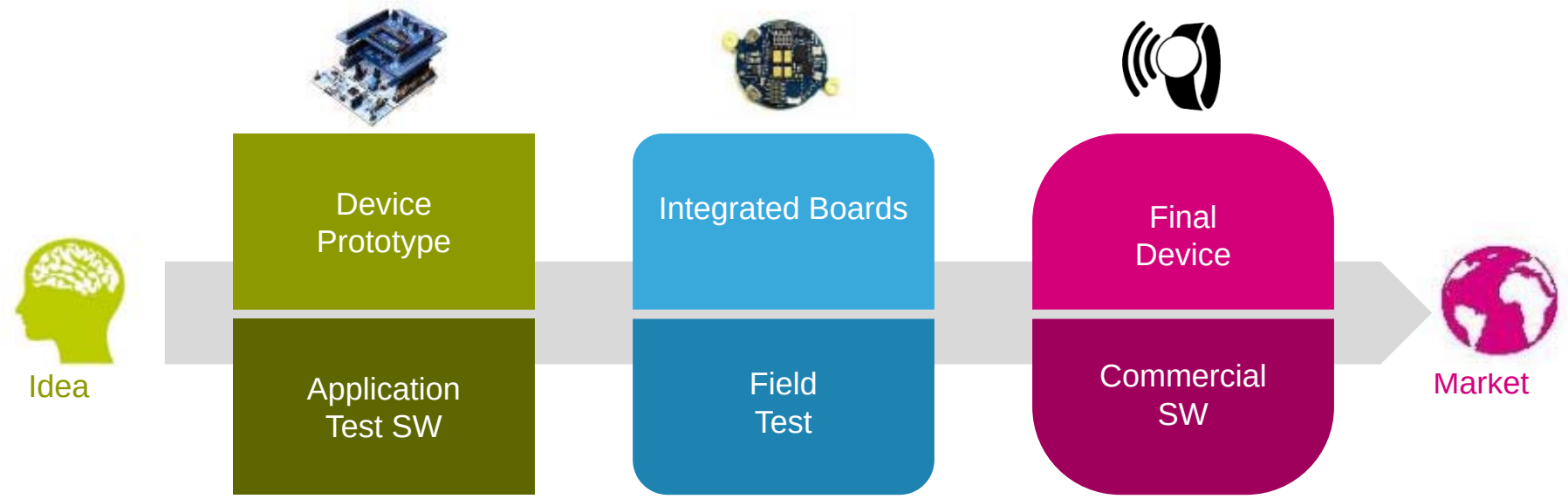
How to address the Developer Needs

- A microcontroller is usually the first choice of developers when designing a new application
  - Need to pick from low power to high performance microcontroller based on application needs
- A set of extra functions are keys to implement the system
  - Sensing, data conversion, processing, connectivity, power management, …
- Easy to use Integrated Development Environment to allow fast development and production
  - Support of multiple IDE
  - Free of charge tools and embedded software to enable fast and easy development



Lowering the Barriers for Developers

Fast, affordable prototyping with development continuity to final device



STM32 Open Development Environment

The building blocks | Your need | Our answer

- Sensors
- Connectivity
- Audio
- Actuators
- Power
- Processing
- Software

27 Processor Boards
23 Expansion Boards now,

- Motion & Environ. Sensors
- Bluetooth Low Energy
- Sub-GHZ
- NFC
- Microphone
- Motor control
- Microcontroller

Integrated Development Environment and Middleware

STM32 Open Development Environment

STM32 Open Development Environment

www.st.com/stm32ode

STM32 Open Development Environment

Fast, affordable prototyping & development

An STM32 Nucleo open development platform using pre-integrated ST components and SW

STM32 Nucleo Development Boards

STM32 Nucleo Expansion Boards X-Nucleo

STM32 Open Development Environment

STM32Cube Development Software

STM32Cube expansion software X-Cube

Sense..

Move Actuate

Connect

Translate

Power

Function Packs

Set of function examples for some of the most common application cases

Developer community and support

Compatibility with free & commercial Development Environments

Agenda

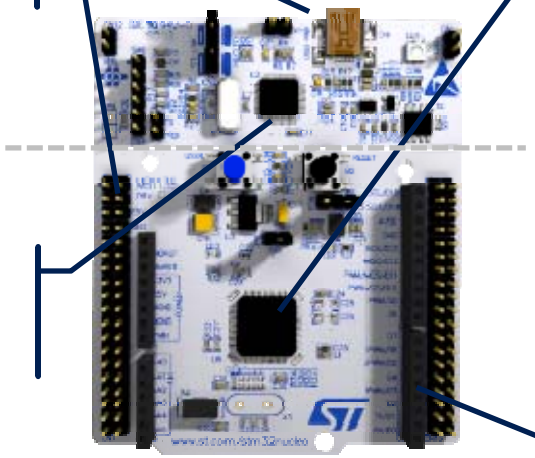
- STM32 Open Development Environment
- **Hardware Portfolio**
- Software Ecosystem
- Function Packs
- BlueMicrosystem1 DEMO

STM32 Nucleo Development Boards

A comprehensive range of affordable development boards for all STM32 microcontroller series, with unlimited unified expansion capability, and with integrated debugger/programmer

Flexible power supply through USB or external source

Integrated debugging and programming ST-LINK probe



STM32 microcontroller

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

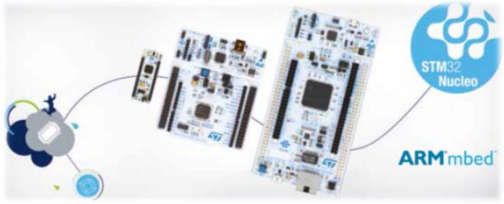
ST Morpho and Arduino expansion headers

STM32 Nucleo

www.st.com/stm32nucleo

STM32 Nucleo Board

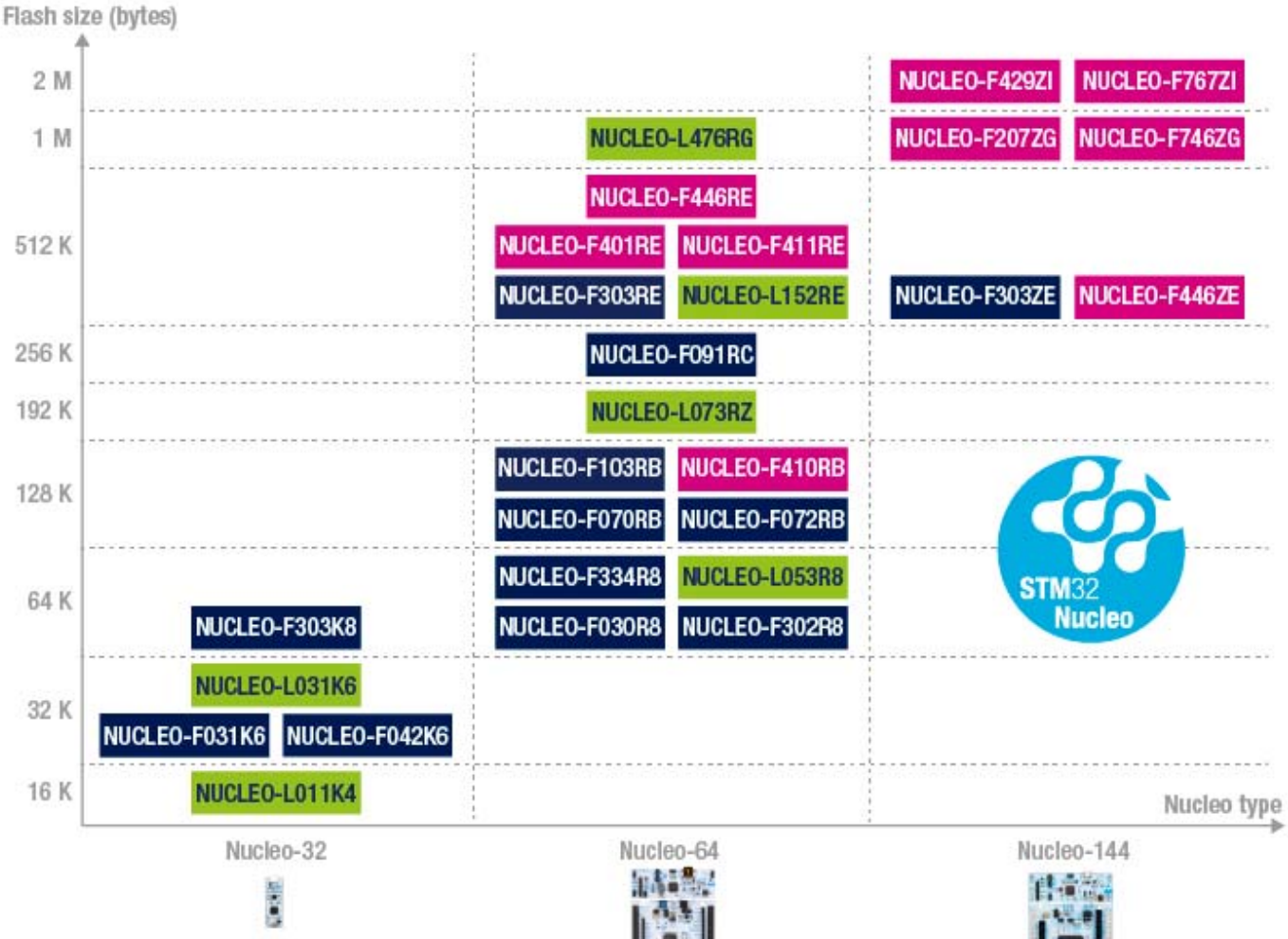
27 Processor Boards Now



Nucleo-32

Nucleo-64

Nucleo-144



www.st.com/stm32nucleo

STM32 Nucleo Expansion Boards

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

Sense

Connect

Power

Move / Actuate

Translate

X-NUCLEO-IKS01A1

Motion MEMS sensors

LIS3MDL

LSM6DS0

Environmental sensors

LPS25HB

HTS221

DIL24 support for new devices

24 Expansion Boards Now

www.st.com/x-nucleo

X-Nucleo family overview

24 Boards available end May 2016

Sense 4
Connect 8
Power 1
Move / Actuate 8
Translat 3


Motion MEMS & Environmental Sensors
X-NUCLEO-**IKS01**A1


Digital MEMS microphones (MP34DT01-M)
X-NUCLEO-**CCA02**M1


FlightSense VL6180X
X-NUCLEO-53L0A1


FlightSense VL53L0X
X-NUCLEO-**6180X**A1


Bluetooth Low Energy (BlueNRG)
X-NUCLEO-**IDB04**A1


Bluetooth Low Energy (SPBTLE-RF)
X-NUCLEO-**IDB05**A1


Dynamic NFC Tag (M24SR)
X-NUCLEO-**NFC01**A1


Dynamic NFC Tag (M24LR)
X-NUCLEO-**NFC02**A1


NFC card reader
X-NUCLEO-NFC03A11


Wi-Fi (SPWF01SA.11)
X-NUCLEO-**IDW01**M1


Sub-1 GHz RF (SPSGRF-868,)
X-NUCLEO-**IDS01**A4


Sub-1 GHz RF (SPSGRF-915)
X-NUCLEO-**IDS01**A5


Stepper Motor Driver (L6474)
X-NUCLEO-**IHM01**A1


Two Axes Motor Driver (L6470)
X-NUCLEO-**IHM02**A1


High Power Stepper Motor (PowerStep01)
X-NUCLEO-**IHM03**A1


Dual Brush DC Motor Driver (L6206)
X-NUCLEO-**IHM04**A1


Bipolar Stepper Motor Driver (L6208)
X-NUCLEO-**IHM05**A1


3-phase Brushless DC Motor Drivers (L6230)
X-NUCLEO-**IHM07**M1


Low-Voltage BLDC Mot. Drv (F7 MOSFET)
X-NUCLEO-**IHM08**M1


Motor CTRL Connector
X-NUCLEO-**IHM09**A1


Multifunctional (Operation Amplifier)
X-NUCLEO-**IKA01**A1


Sound Terminal (STA350BW)
X-NUCLEO-**CCA01**M1


Industrial Input/Output (CLT01-38SQ7, VNI8200XP)
X-NUCLEO-**PLC01**A1


LED lighting (LED6001)
X-NUCLEO-**LED61**A1

Video Available

STM32 Nucleo Expansion Board Portfolio

Connect (8)

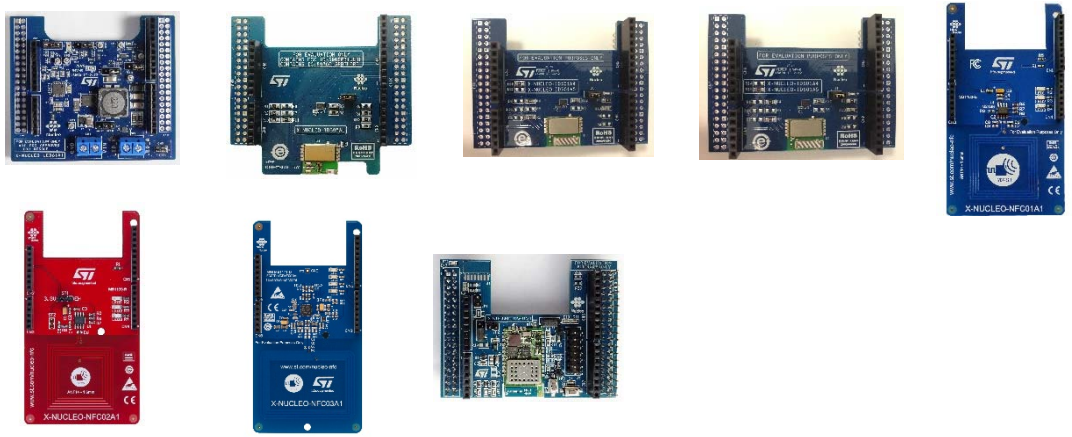
Part Number	Core Product	General Description
X-NUCLEO-IDB04A1	BlueNRG; BALF-NRG-01D3	Bluetooth low energy expansion board based on BlueNRG for STM32 Nucleo
X-NUCLEO-IDB05A1	SPBTLE-RF;BlueNRG-MS;BALF-NRG-01D3	Bluetooth Low Energy expansion board based on SPBTLE-RF module for STM32 Nucleo
X-NUCLEO-IDS01A4	SPSGRF-868	Sub-1 GHz RF expansion board based on the SPSGRF-868 module for STM32 Nucleo
X-NUCLEO-IDS01A5	SPSGRF-915	Sub-1 GHz RF expansion board based on the SPSGRF-915 module for STM32 Nucleo
X-NUCLEO-NFC01A1	M24SR64	Dynamic NFC tag expansion board based on M24SR for STM32 Nucleo
X-NUCLEO-NFC02A1	M24LR04E-R	Dynamic NFC tag expansion board based on M24LR for STM32 Nucleo
X-NUCLEO-NFC03A1	CR95HF	NFC card reader expansion board based on CR95HF for STM32 Nucleo
X-NUCLEO-IDW01M1	SPWF01SA.11	Wi-Fi expansion board based on SPWF01Sx Module for STM32 Nucleo

Bluetooth Smart

SubGhz

NFC

Wi-Fi



STM32 Nucleo Expansion Board Portfolio

Move/Actuate (8)

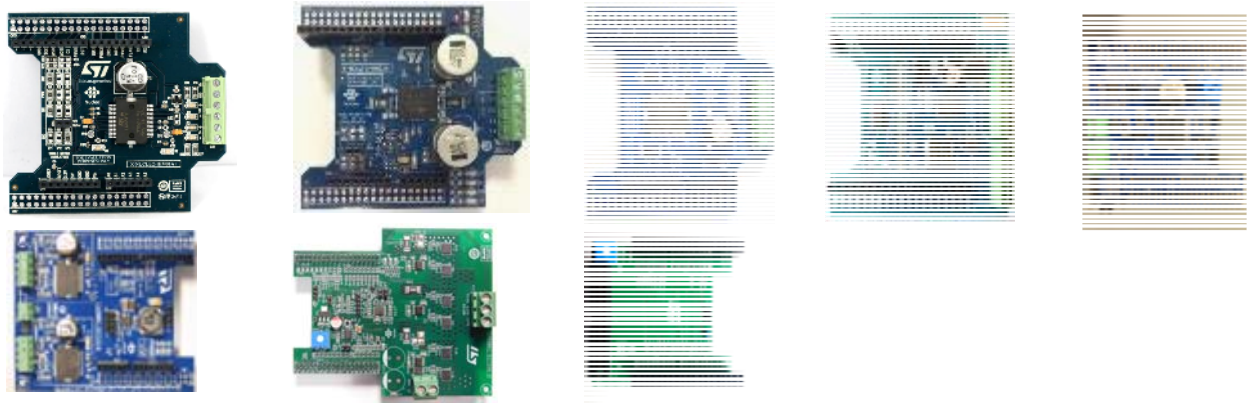
Part Number	Core Product	General Description
X-NUCLEO-IHM01A1	L6474PD	Stepper motor driver expansion board based on L6474 for STM32 Nucleo
X-NUCLEO-IHM03A1	powerSTEP01	High power stepper motor driver expansion board based on powerSTEP01 for STM32 Nucleo
X-NUCLEO-IHM04A1	L6206	Dual brush DC motor driver expansion board based on L6206 for STM32 Nucleo
X-NUCLEO-IHM05A1	L6208	Bipolar stepper motor driver expansion board based on L6208 for STM32 Nucleo
X-NUCLEO-IHM07M1	L6230	Three-phase brushless DC motor driver expansion board based on L6230 for STM32 Nucleo
X-NUCLEO-IHM02A1	L6470	Two axes stepper motor driver expansion board based on L6470 for STM32 Nucleo
X-NUCLEO-IHM09M1	STL220N6F7	Low-Voltage BLDC motor driver expansion board based on STL220N6F7 for STM32 Nucleo
X-NUCLEO-IHM09M1	Adaptor	Motor Control Connector expansion board for STM32 Nucleo

Stepper Motors

Brush DC

BLDC

Adaptor



STM32 Nucleo Expansion Board Portfolio

Power-Drive (2)

Part Number	Core Product	General Description
X-NUCLEO-LED61A1	LED6001	DC-DC LED driver expansion board based on LED6001 for STM32 Nucleo
P-NUCLEO-USB001	USB Type-C	USB Type-C and Power Delivery Nucleo Pack with NUCLEO-F072RB

LED Driver

USB Type-C & PD

STM32 Nucleo Expansion Board Portfolio

Sense (4)

Part Number	Core Product	General Description
X-NUCLEO-6180XA1	VL6180X	Proximity and ambient light sensor expansion board based on VL6180X for STM32 Nucleo
X-NUCLEO-53L0A1	VL53L0X	Ranging sensor expansion board based on VL53L0X for STM32 Nucleo
X-NUCLEO-CCA02M1	MP34DT01-M	Digital MEMS microphones expansion board based on MP34DT01-M for STM32 Nucleo
X-NUCLEO-IKS01A1	LSM6DS0; LIS3MDL; LPS25HB; HTS221	Motion MEMS and environmental sensor expansion board for STM32 Nucleo

- Proximity
- Motion MEMS
- Environmental Sensors
- MEMS Microphones

STM32 Nucleo Expansion Board Portfolio

Translate (3)

Part Number	Core Product	General Description
X-NUCLEO-PLC01A1	CLT01-38SQ7;VNI8200XP	Industrial input/output expansion board based on VNI8200XP and CLT01-38SQ7 for STM32 Nucleo
X-NUCLEO-IKA01A1	TSZ124	Multifunctional expansion board based on operational amplifiers for STM32 Nucleo
X-NUCLEO-CCA01M1	STA350BW	Sound terminal expansion board based on STA350BW for STM32 Nucleo

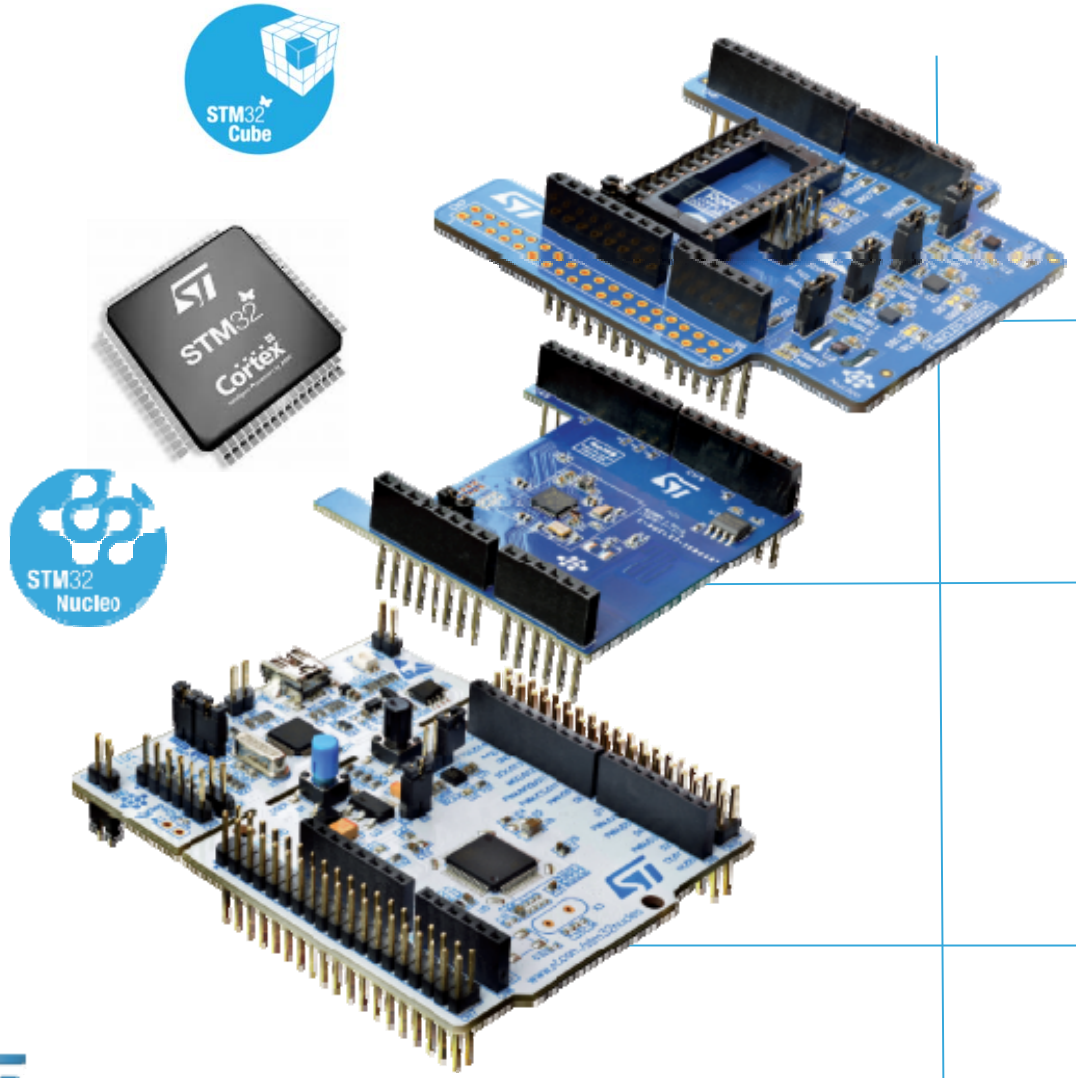
Industrial I/O

Operational Amplifier

Sound Terminal

STM32 Open Development Environment

Fast, affordable Development and prototyping



- Motion MEMS
- Environmental Sensors
- Ultra-low power connectivity
- Algorithms
- Sensor fusion

Agenda

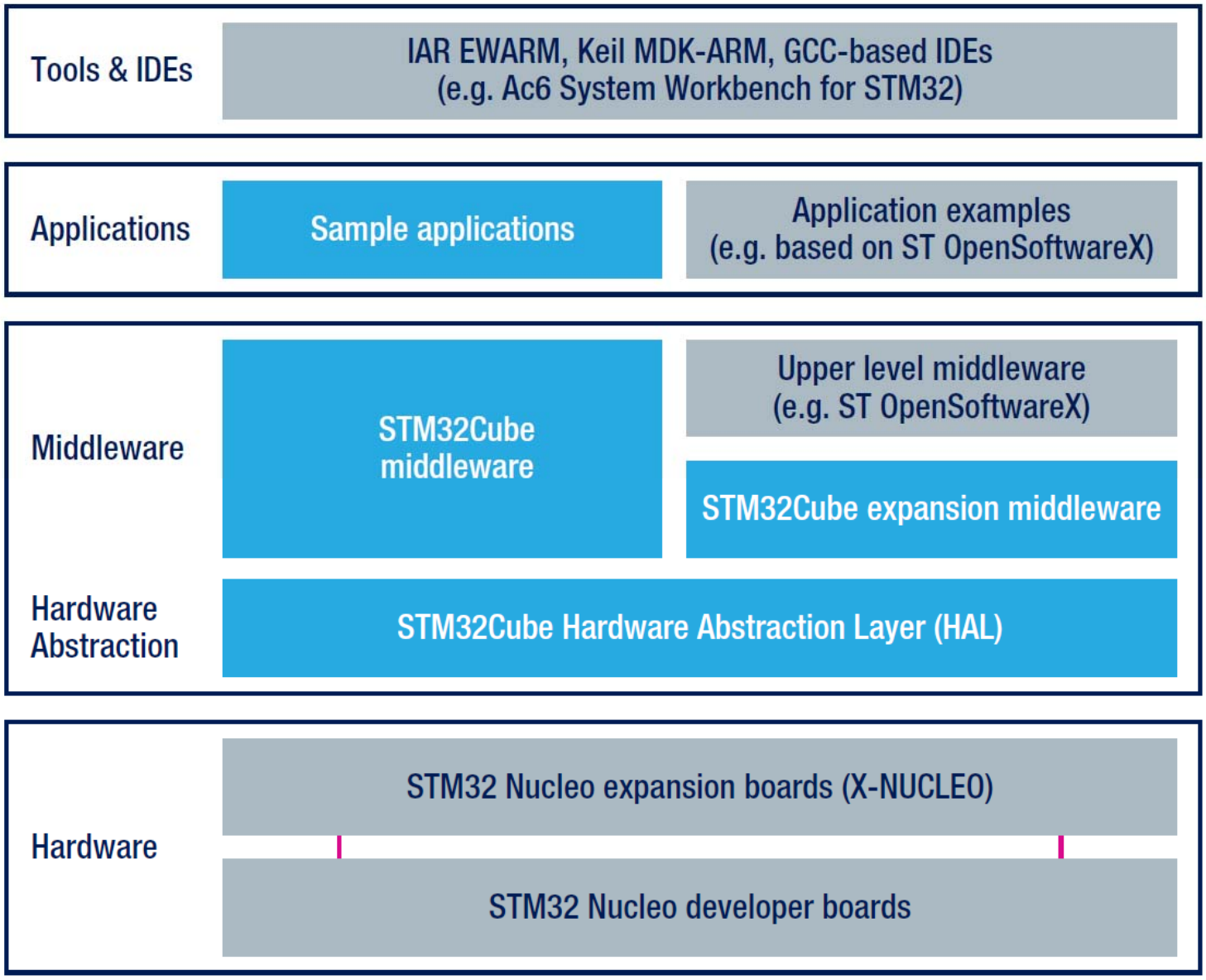
- STM32 Open Development Environment
- Hardware Portfolio
- **Software Ecosystem**
- Function Packs
- BlueMicrosystem1 DEMO

STM32 ODE SW Ecosystem
Quickly build your final SW

SW is the most resource consuming task in any new design

STM 32ODE makes available to the customers a coherent SW development environment with **open source, industrial quality, ready to use SW** packages and application examples

STM32 ODE
Development Software Architecture

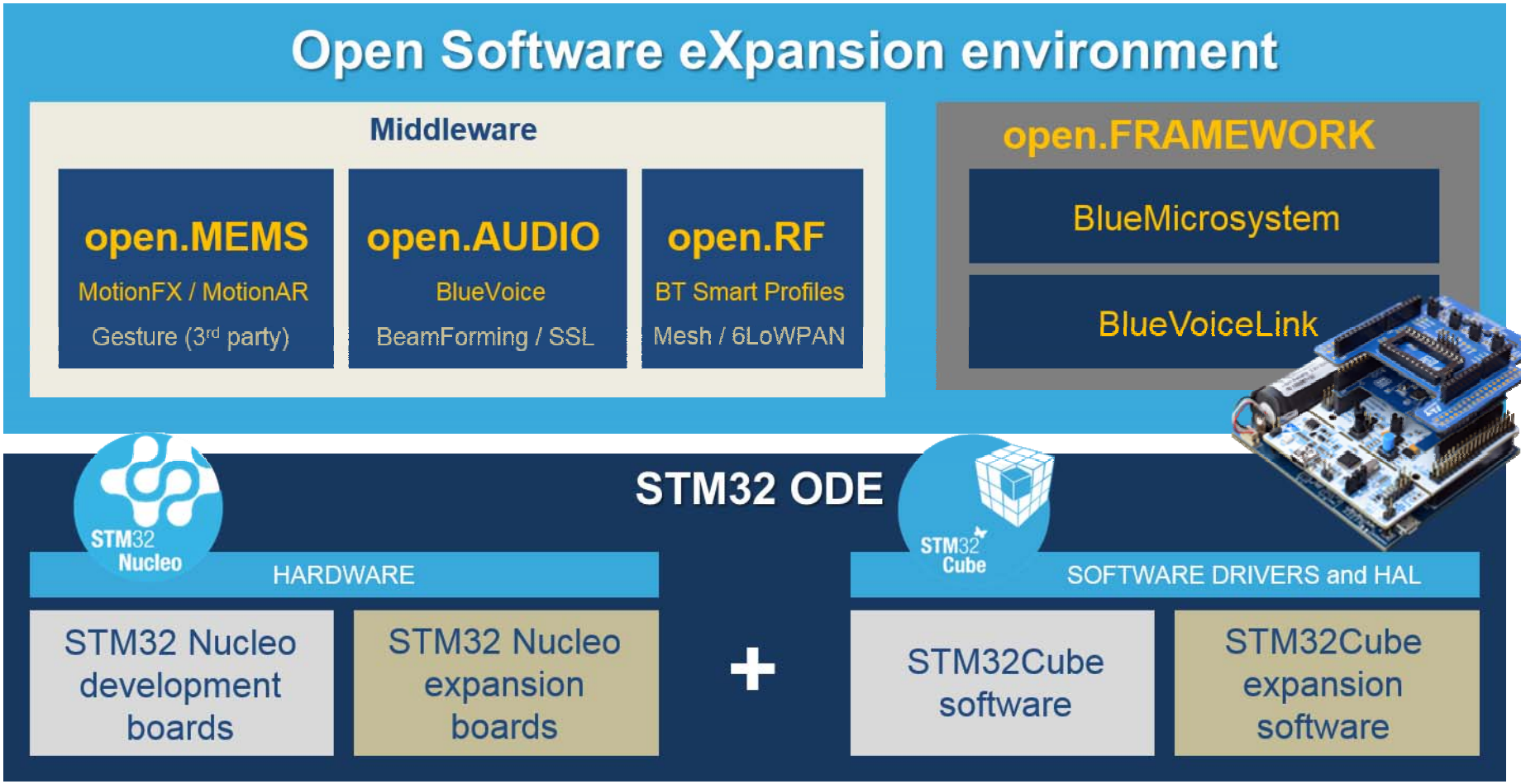


STM32 Open Development Environment

SW Ecosystem

- Each STM32 Nucleo expansion board Board is provided with X-CUBE SW extension based on STM32CUBE SW
- Those SW extensions are homogeneous in terms of SW structure and API abstraction level to allow to easily combine multiple functions
- All SW packages are coming with full documentation (data brief, user manual, quick start guide, and videos)
- All SW packages come with pre-built projects with IAR, Keil and SW4STM32 IDEs, and binary that can be run out of the box.
- Pre-integrated application examples combining several expansion boards/SW are available on st.com to cover the most popular use cases

Open.SoftwareX free SW licensing program



Open.MEMS

Open.MEMS is a free and easy-to-use software program for the development of best-in-class MEMS and sensor applications.

Open.MEMS libraries combine data from several sensors achieving the high level of accuracy required by portable and wearable devices and other emerging applications, such as the IoT

Development set-up:

HW platform composed by:

- STM32 NUCLEO-F401RE board;
- X-NUCLEO-IKS01A1 Expansion board;
- STEVAL-MKI160V1 Evaluation board.

SW package composed by:

- X-CUBE-MEMS1 software package for STM32Cube;
- Specific core engine algorithm.

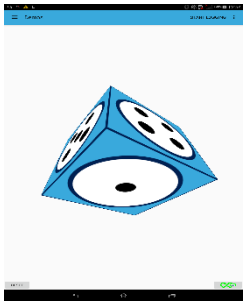
NUCLEO-F401RE

X-NUCLEO-IKS01A1

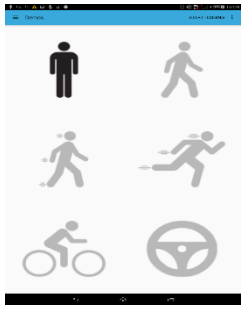
STEVAL-MKI160V1

Available software packages:

Library	Notes
FX V1.5.0	Sensor Fusion Algorithm
AR V1.3.0	Activity Recognition
CP V1.2.0	Carry Position Recognition
GR V1.1.0	Gesture Recognition

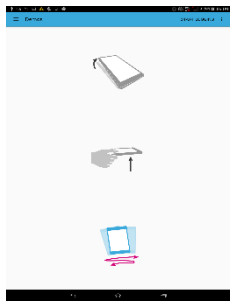


Sensor Fusion



Activity Recognition

Carry Position



Gesture Recognition

Open.RF

Open.RF: a free and easy-to-use software program for the development of best-in-class RF applications

Bluetooth public profiles:

HW platform composed by:

STM32 NUCLEO-F401RE or NUCLEO-L053R8 board;

X-NUCLEO-IDB04A1 or X-NUCLEO-IDB05A1 Expansion board;

SW package composed by:

X-CUBE-BLE1 software package for STM32Cube;

OSXSmartConnPS add-on library

NUCLEO-F401RE
Or NUCLEO-L053R8

X-NUCLEO-IDB04A1
Or X-NUCLEO-IDB05A1

***osxSmartConnPS**: available for download at www.st.com*

Contiki 6LowPAN for Sub-GHz radio:

HW platform composed by

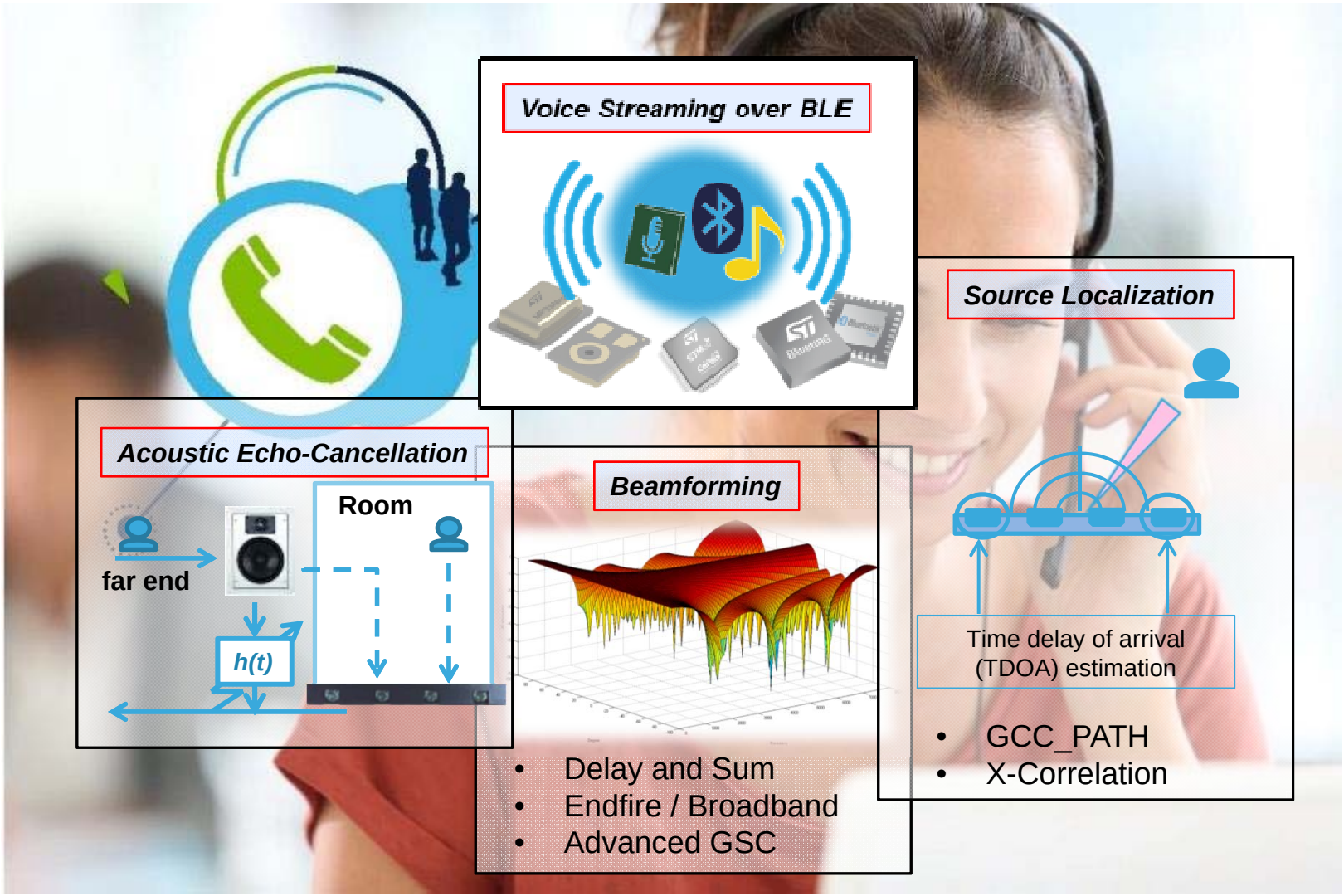
- NUCLEO-F401RE or NUCLEO-L152RE
- X-NUCLEO-IDS01A4 (operating at 868 MHz) or X-NUCLEO-IDS01A5 (operating at 915 MHz)

NUCLEO-F401RE
Or NUCLEO-L152RE

X-NUCLEO-IDS01A4
Or X-NUCLEO-IDS01A5

***osxContiki6LP**: available for download at www.st.com*

Embedded Audio Software Building Blocks



Agenda

- STM32 Open Development Environment
- Hardware Portfolio
- Software Ecosystem
- **Function Packs**
- BlueMicrosystem1 DEMO

Function Packs and Open.Framework

Pre-integrated application packages

Sample applications

OpenSoftwareX Libraries

STM32Cube middleware
for development and expansion boards

STM32Cube
Hardware Abstraction Layer

STM32 Nucleo
development boards

STM32 Nucleo
expansion boards

**A set of key building blocks
used in most popular application domains**

Cloud

Wearable

IoT
Smart Things

Home
applications

Building
automation

Pre-packaged offer
integrating functionality
from several expansion
boards

STM32 ODE Functional Packages

- A set of key building blocks ..
  - Local and Cloud Connectivity Functions
  - Network Infrastructure Functions
  - Sensing Functions
  - Audio/Video Processing and GUI Functions
  - Energy Management Functions
  - Actuators & Motion Control Functions
  - Safety & Security Functions
  - Application Specific Functions

… used in most popular application domains such as Cloud, Wearable, IoT, Home and Building Automation …

Function Pack Example

FP-SNS-MOTENV1

FP-SNS-MOTENV1

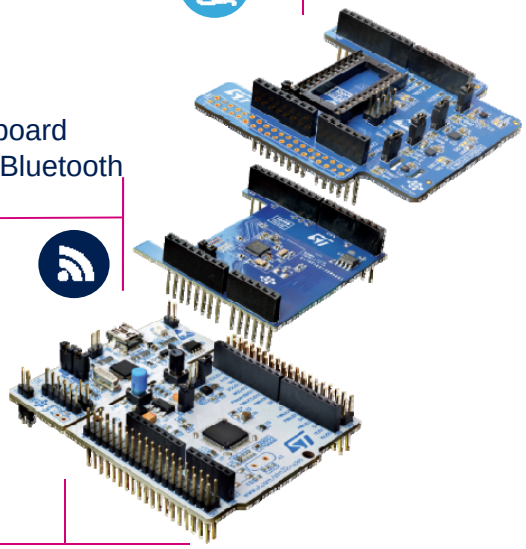
HARDWARE

Motion MEMS 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 low power, low energy Bluetooth network processor

X-NUCLEO-IDB04A1



NUCLEO-F401RE

STM32 Nucleo-64 development board
STM32F401RET6 MCU

SOFTWARE

Free of charge

FP-SNS-MOTENV1 SW package:

X-CUBE-BLE1

Bluetooth LE software expansion for STM32Cube

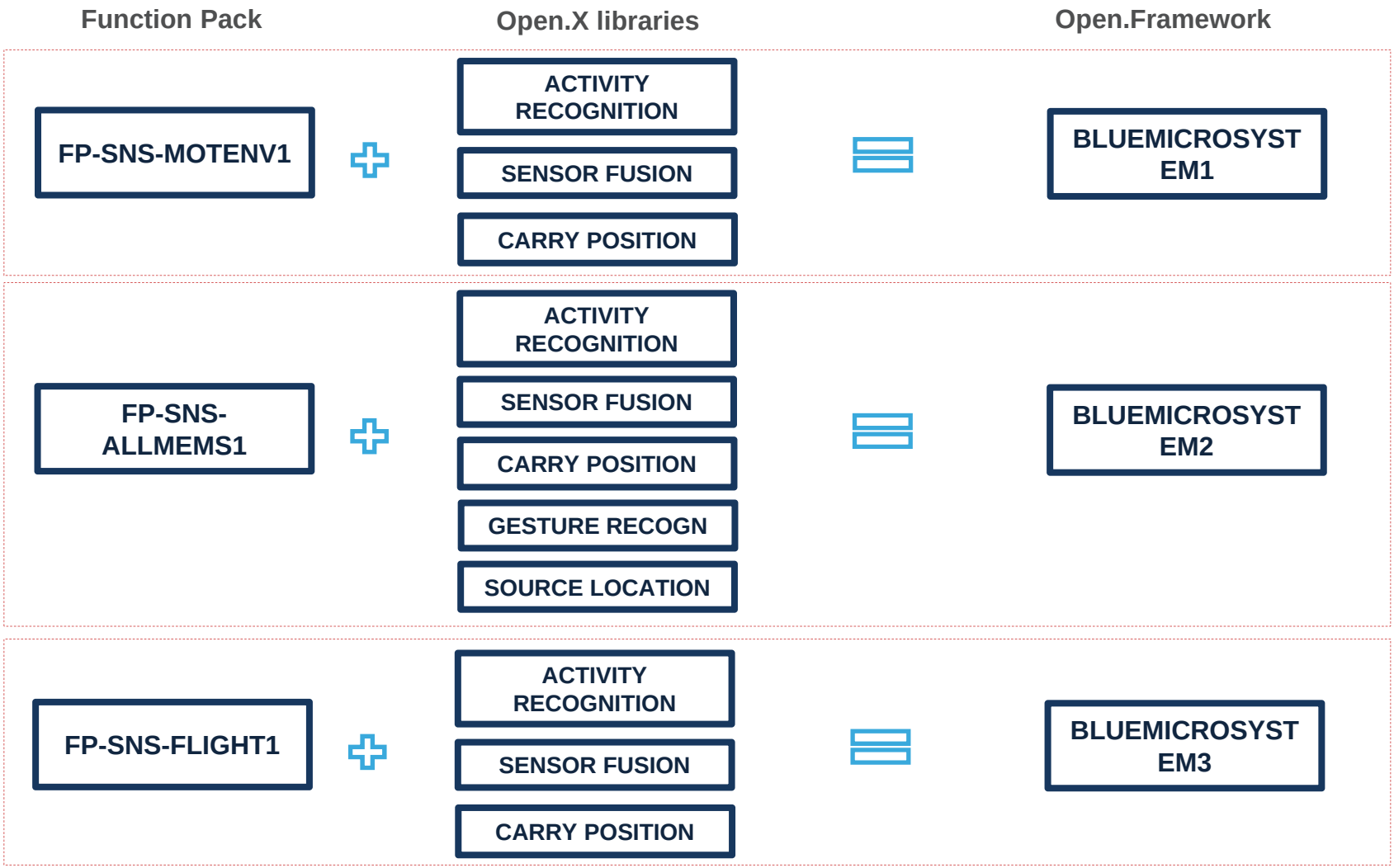
X-CUBE-MEMS1

BlueMS

Android™ and iOS™

Open.Framework vs Function Packs

- There is a direct connection between FP-SNS and BLUMICROSYSTEM
  - FP-SNS contains the same code, but without OSX middleware and application



Open.Framework Example

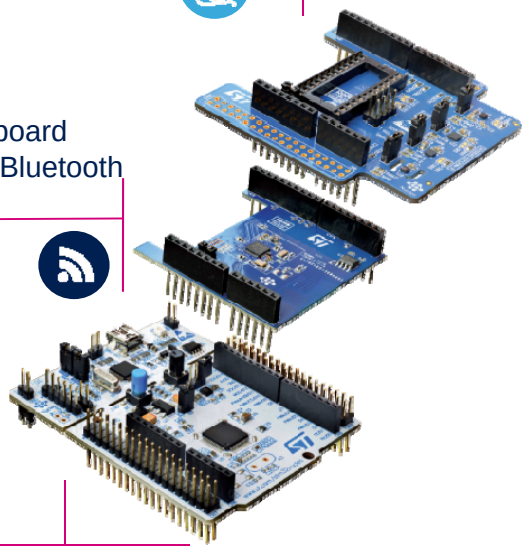
BlueMicrosystem1

BLUEMICROSYSTEM1

HARDWARE

Motion MEMS 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 low power, low energy Bluetooth network processor

X-NUCLEO-IDB04A1

NUCLEO-F401RE

STM32 Nucleo-64 development board
STM32F401RET6 MCU

SOFTWARE

Free of charge

BLUMICROSYSTEM1 SW package:

X-CUBE-BLE1

Bluetooth LE software expansion for STM32Cube

X-CUBE-MEMS1

Sensors software expansion for STM32Cube

open.MEMS

Motion & Gesture Open Software expansion libraries

BlueMS

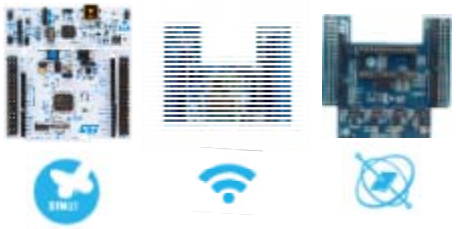
Android™ and iOS™

http://www.st.com/bluemicrosystem

End-to-End Pre-Integrated Applications for Cloud Connectivity

Secure sensor to cloud development environment

Hardware Building Blocks



Processing	Connect	Sense
Nucleo F4	X-NUCLEO-IDW01M1	X-Nucleo-IKS01A1

Pre-integrated SDK and protocol stacks

SDK

MQTT.ORG

TLS

Ecosystem of cloud providers supported

Microsoft Azure

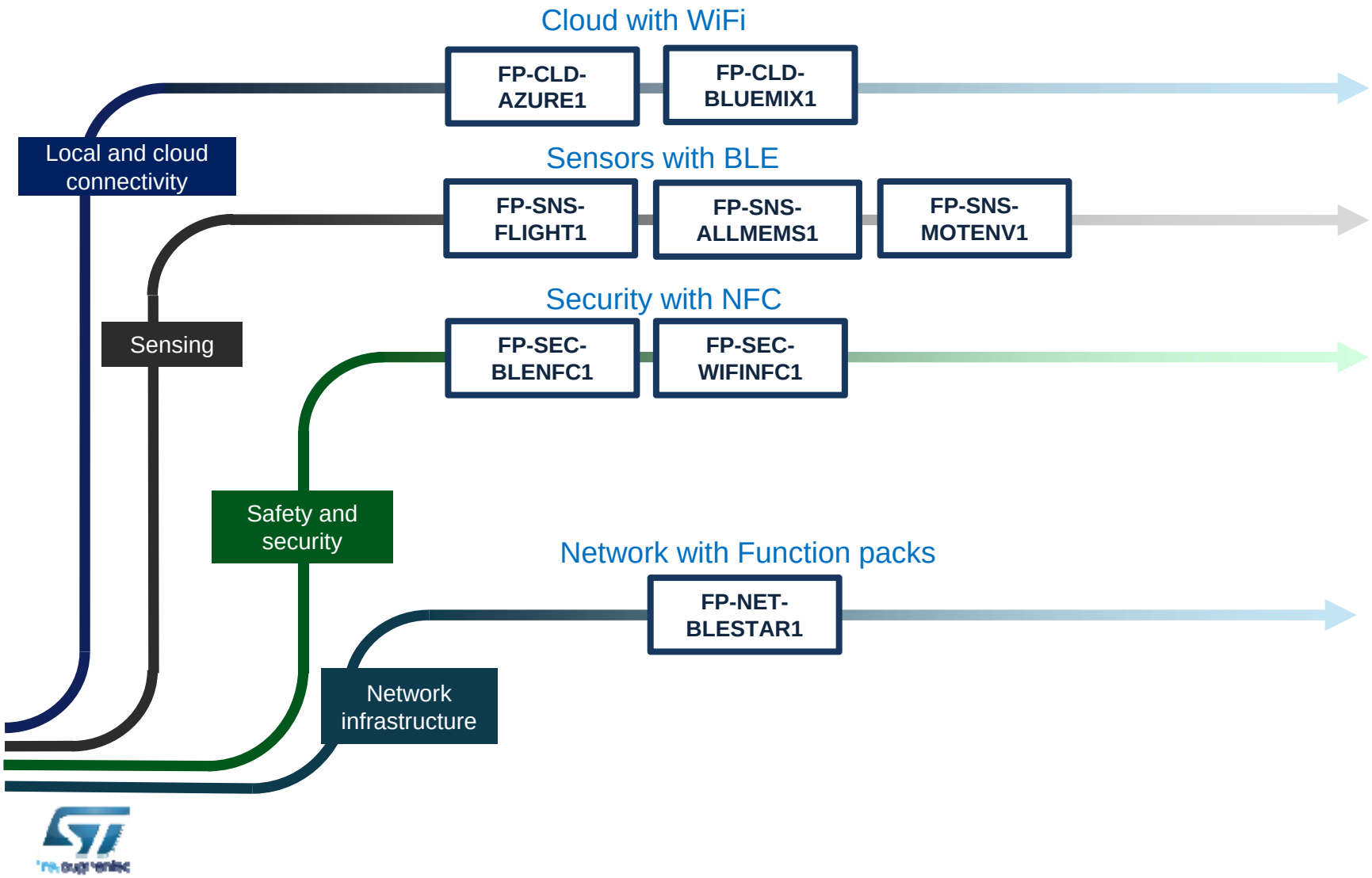
amazon web services

IBM Bluemix

Secure sensor to cloud development environment

- HW kit composed by STM32 Nucleo and Expansion boards
- Pre-integrated SW freely available in source code
- Quick-start telemetry application to visualize data in Cloud application in no time

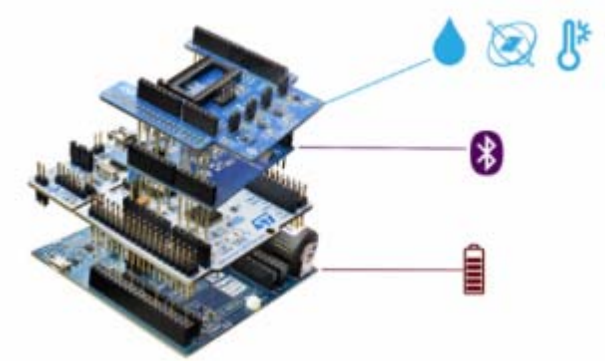
Available Function Packs



Optimized Solutions

Example IoT Wearable → STEVAL-WESU01

STM32 ODE Application Packages



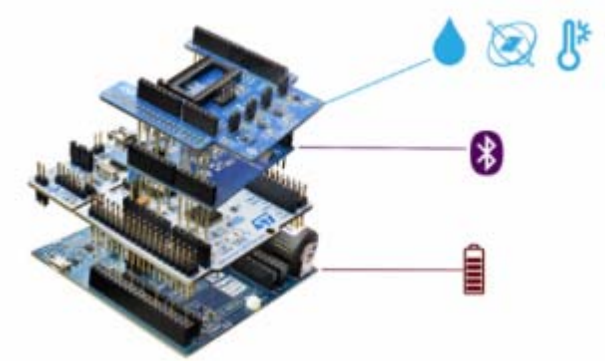
- STM32 Nucleo Board
- MEMS Inertial and Environmental Board
- Bluetooth Low Energy Board
- Battery Management Board
- BLUEMICROSYSTEM MIDDLEWARE

Optimized evaluation boards (WESU)

- Single & Compact Board (< 380 mm^2)
- BLUEMICROSYSTEM MIDDLEWARE

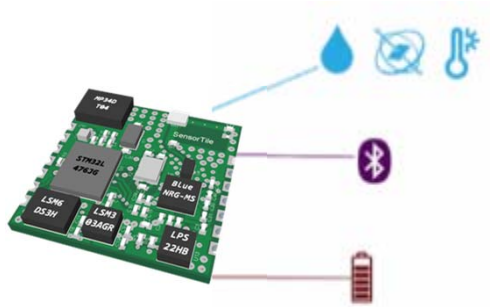
System Integration

STM32 ODE Application Packages



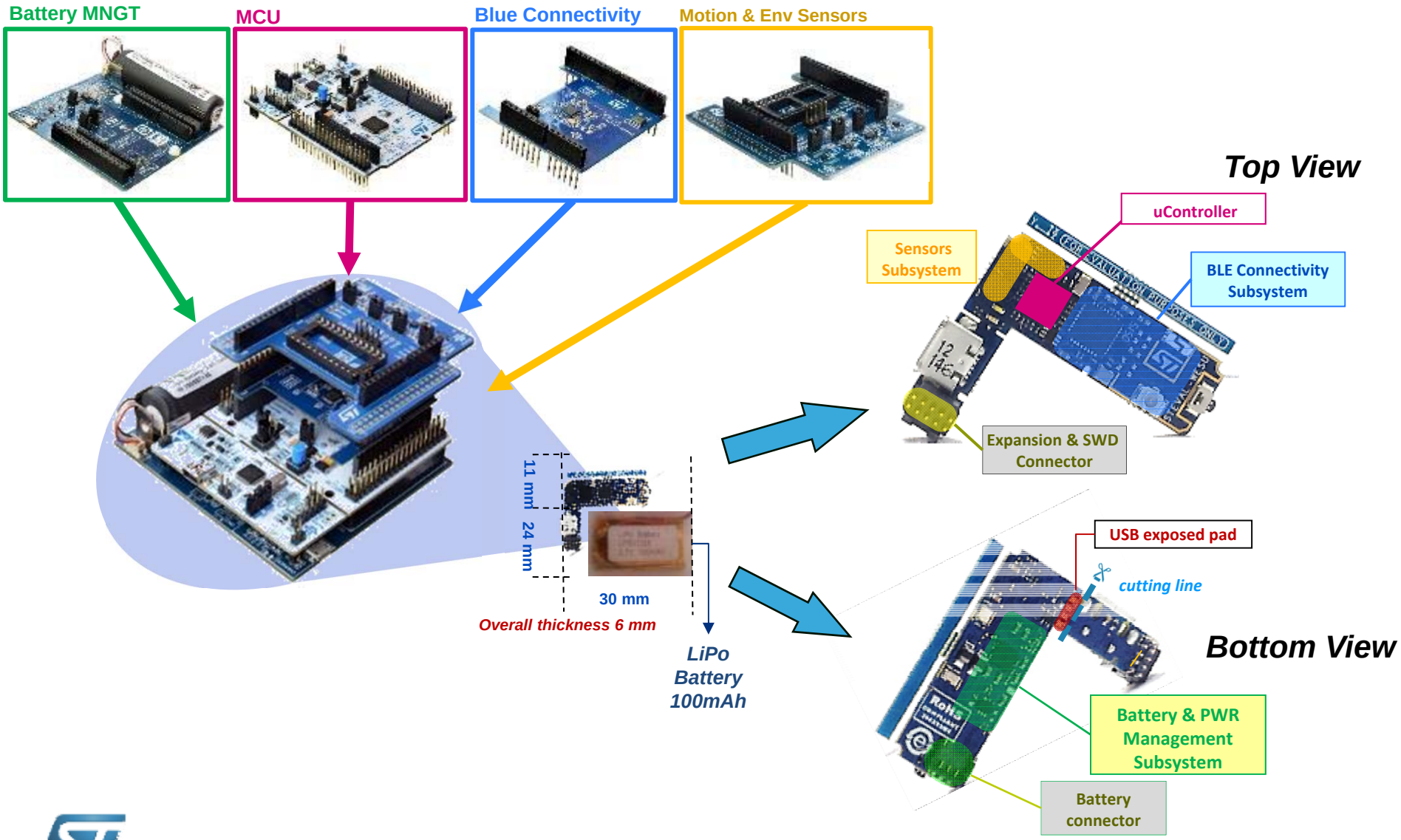
- STM32 Nucleo Board
- MEMS Inertial and Environmental Board
- Bluetooth Low Energy Board
- Battery Management Board
- BLUEMICROSYSTEM MIDDLEWARE

Optimized evaluation boards (CUSTOM)



- Single & Compact Board
- BLUEMICROSYSTEM MIDDLEWARE

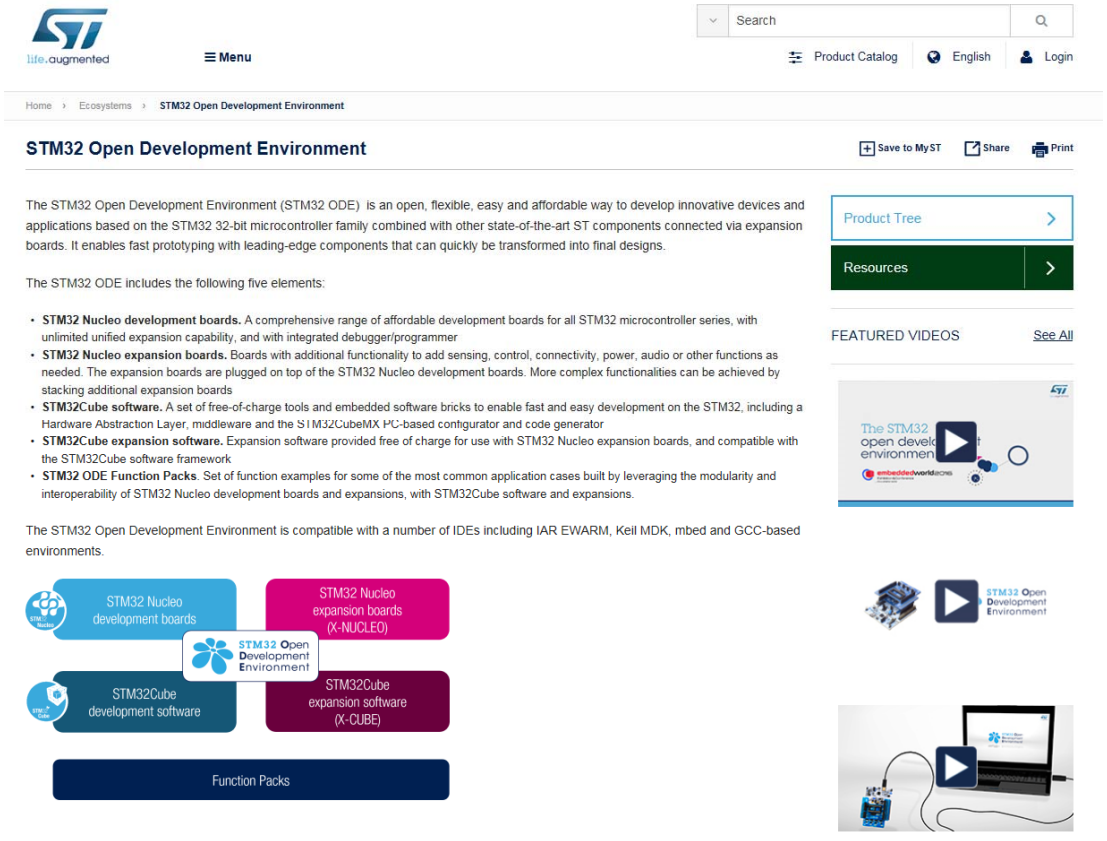
From Vertical to Wearable: WeSU



STM32 Open Development Environment

www.st.com/stm32ode

- New Navigation Tree
- Hardware / Software classified by functions
- New Function Packs



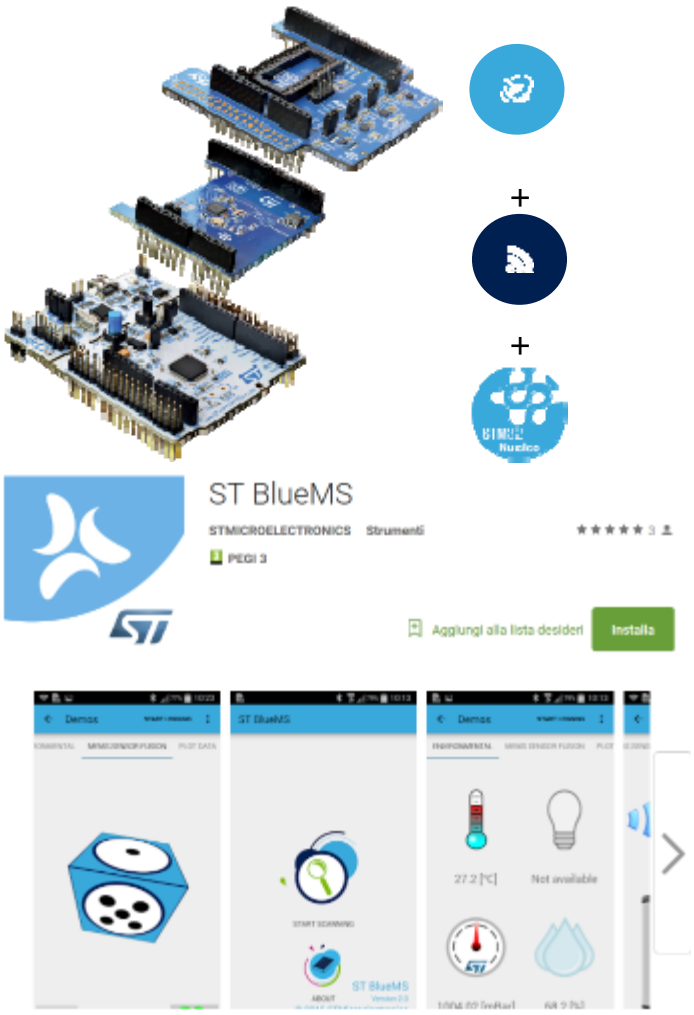
ST partner of major industry ecosystems

Agenda

- STM32 Open Development Environment
  - The Environment
  - Overview of Boards
- Software Ecosystem
- **BlueMicrosystem1 DEMO**

Bluemicrosystem1

STM32 Open Development Environment



Pre-integrated application

- Complete SW for an environmental & motion sensor node connecting via Bluetooth Smart
- Including middleware libraries for motion sensor data fusion
- Very low power Bluetooth Low Energy (BlueNRG) single-mode or Master-Slave network processor
- Connecting and exporting data to Smartphones App

Building blocks

- STM32L476 Nucleo with Ultra Low Power MCU (also available on STM32F401RE Nucleo)
- ST Bluetooth low energy (BlueNRG) or BlueNRG-MS module exp board
- ST Motion and Environmental sensors expansion board
- Sensor Fusion, Activity Recognition and Carry Position open.MEMS libraries
- Sample smartphone application available on Google Play or Apple AppStore, and in source code
- Available also on Mbed

BlueMicrosystem1 Demo

- Project Block diagram & Folders
- License Wizard
- Console Terminal & Mobile Application

THANK YOU!

STM32 Open
Development
Environment