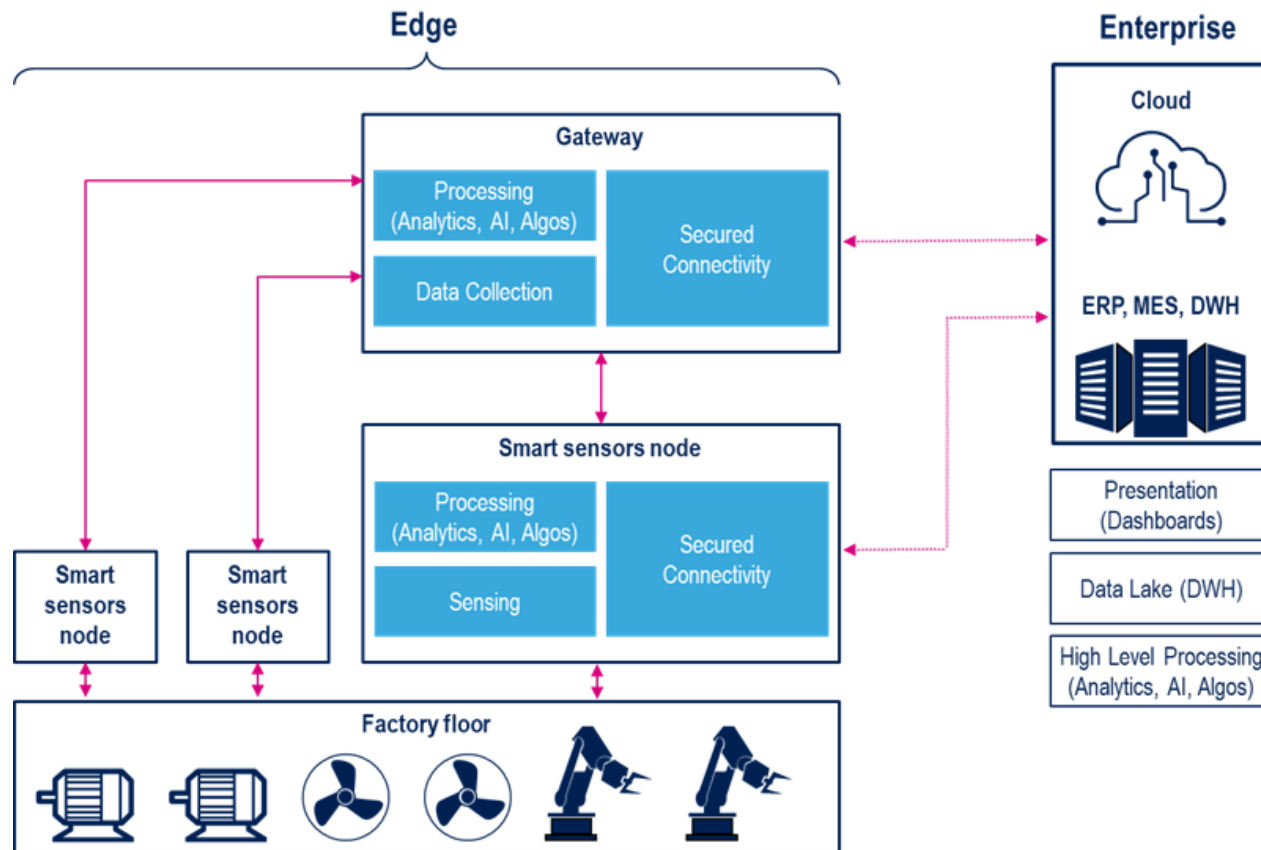


Solutions for Industry 4.0

Condition Monitoring & Predictive Maintenance

- Anomaly Detection at the Edge



Industrial Sensors

STM32 and Platform Security

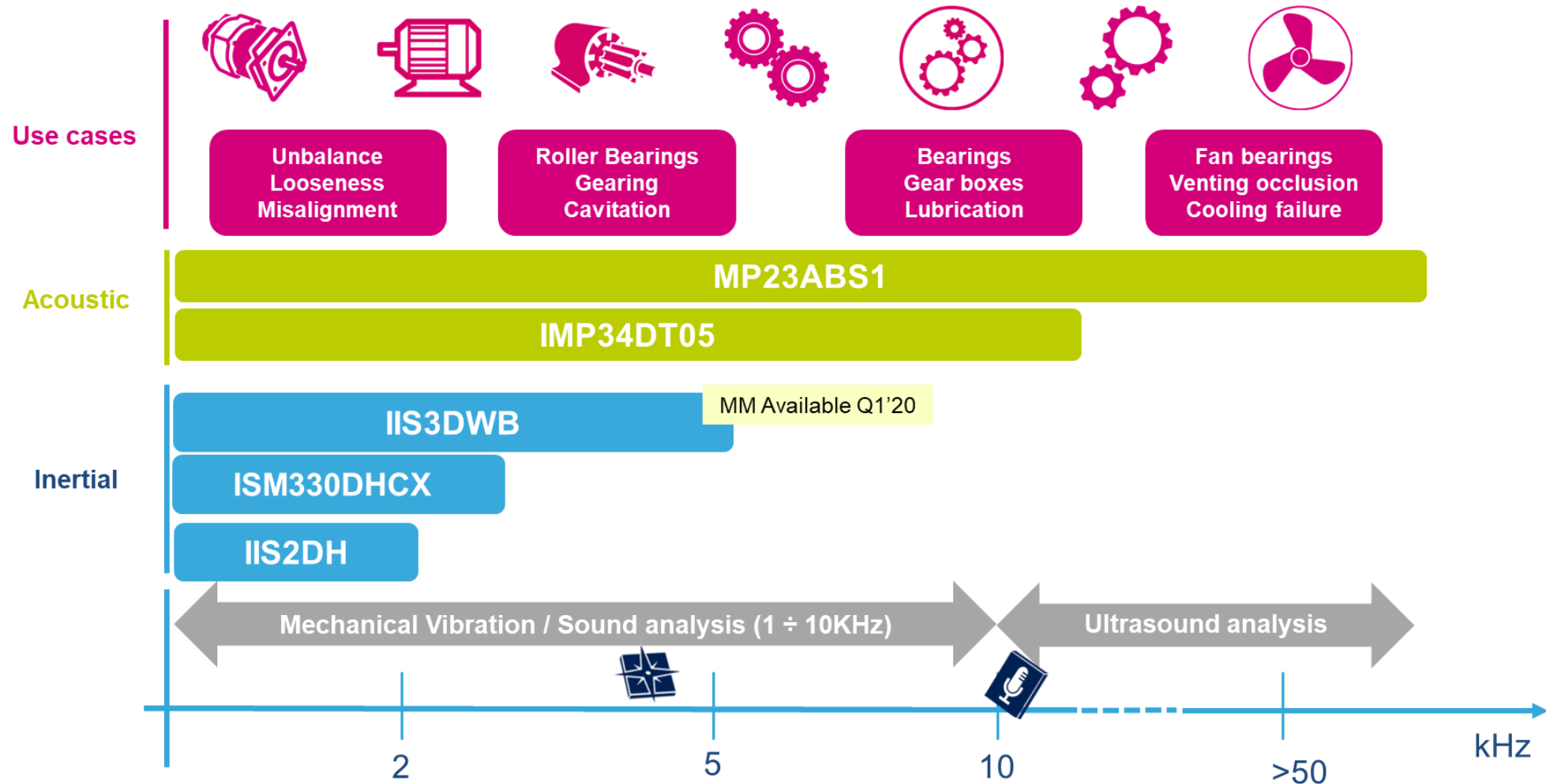
SW Libraries, Tools
and Partners

Dashboards and
Development kits

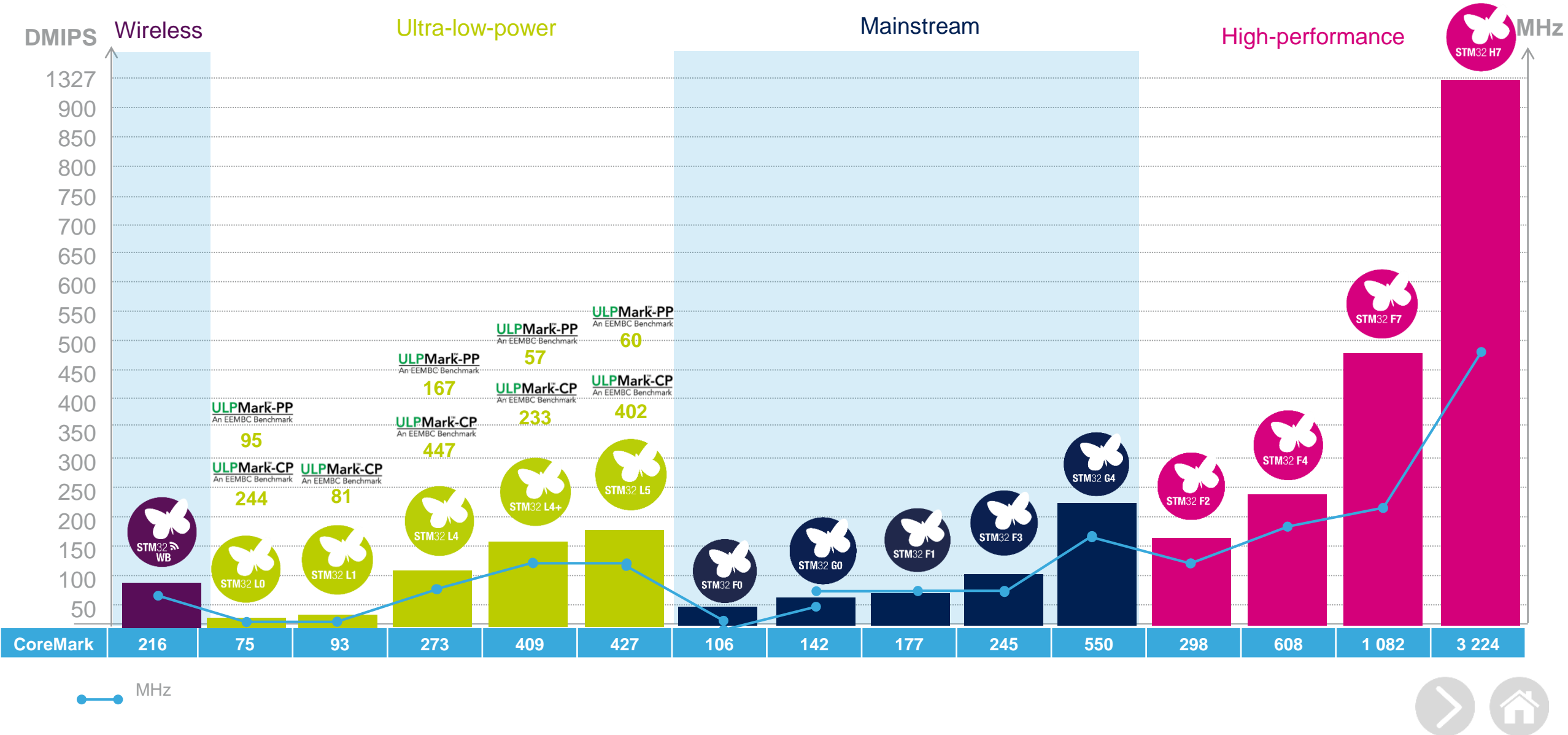
MEMS for Vibration Analysis

Sensors and Defects over Bandwidth

High-value & cost-competitive industrial sensors: high bandwidth accelerometer and analog microphone



Broadest 32-bit MCU Product Portfolio





Today - STM32 Portfolio Positioning

The broad STM32 family offering ranges from ultra-low-power MCUs to dual-core MPUs

MPUs							
High-performance MCUs							
Mainstream MCUs							
Ultra-low-power MCUs							
Wireless MCUs							
Arm® Cortex® core	Cortex®-M0 / M0+	Cortex®-M3	Cortex®-M33	Cortex®-M4	Cortex®-M7	Dual Cortex®-M7 & Cortex®-M4	Dual Cortex®-A7 & Cortex®-M4

Note : Cortex-M0+ Radio Co-processor



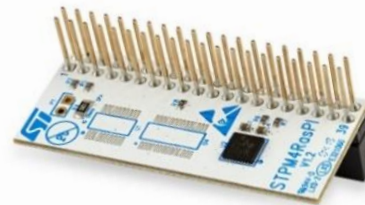
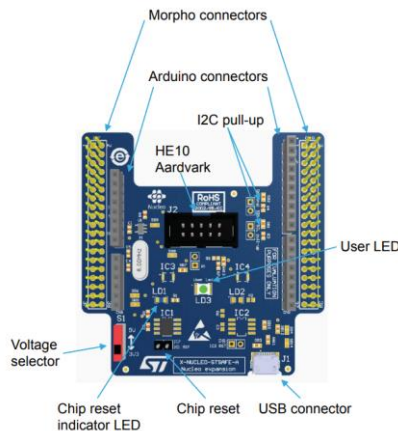
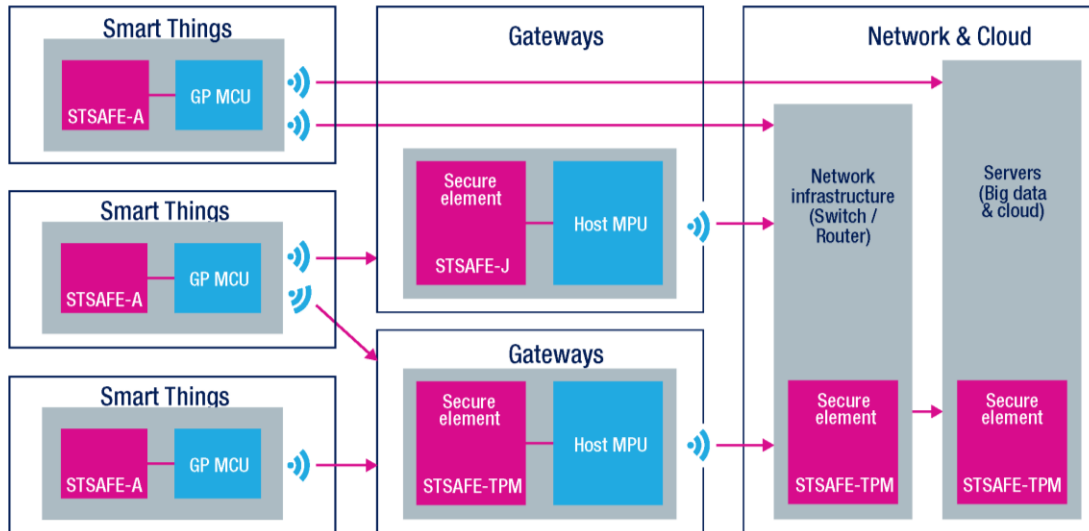
Over 60,000 customers





Secure Microcontroller Solutions

Securing The Platform



- **STSAFE-A Authentication** is an optimized solution
 - Secure Boot and firmware upgrade
 - Secure communications and data storage
 - Secure provisioning services
 - EAL5+ Common Criteria-certified chip
- **STSAFE-J Flexible** Java-based solution
 - Trusted network access with Authentication
 - Secure Data storage, Secure communication
 - Secure personalization services
 - Common criteria and BSI certification
- **STSAFE-TPM** Standard-based solution
 - Platform integrity, Authentication
 - Secure Boot and firmware upgrade
 - Secure data storage and communication
 - Solution CC EAL4+ and TCG 1.2 / 2.0 certified



Predictive Maintenance in 5 Steps

Paving the Way from Condition Monitoring to Predictive Maintenance

5 Reaching Predictive Maintenance

Reaching Leading Edge: **remaining life computation**



4 Event Detection and Classification: test machine learning

To increase predictive capabilities with each failure and create predictive models, apply machine learning

3 Event Detection and Classification triggered by failure thresholds

Data is reliably and remotely connected. An asset has provided enough failure data so failure thresholds can be optimized

2 Condition Monitoring

Collect data and start preprocessing for gathering insights on the machine: behavior, performance, failure

1 Needs understanding: data selection and processing

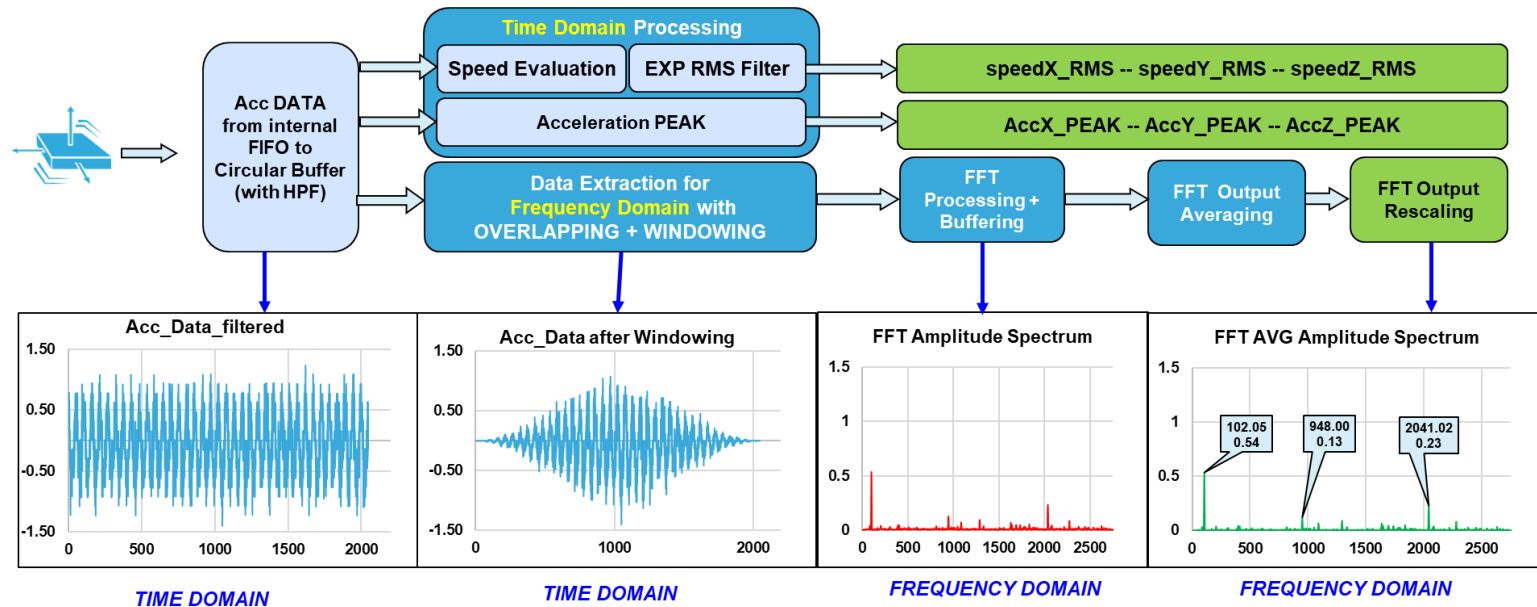
Choose sensors, data streaming & data log options, as well as initial performance visualization dashboards



MotionSP Library

The middleware for advanced time and frequency domains signal processing

- Programmable FFT size (256, 512, 1024, 2048 points)
- Programmable FFT overlapping
- Programmable acquisition time window
- FFT averaging during acquisition time
- Programmable windowing (Flat Top, Hanning, Hamming)
- Speed RMS moving average, acceleration max peak.
- Developed for STM32F4, STM32L4+ with easy portability across different MCU families
- Agnostic to sensors
- Available in source code
- Integrated and available in:
 - **X-CUBE-MEMS1**
 - **STSW-BFA001V1**
 - **FP-IND-PREDMNT1**

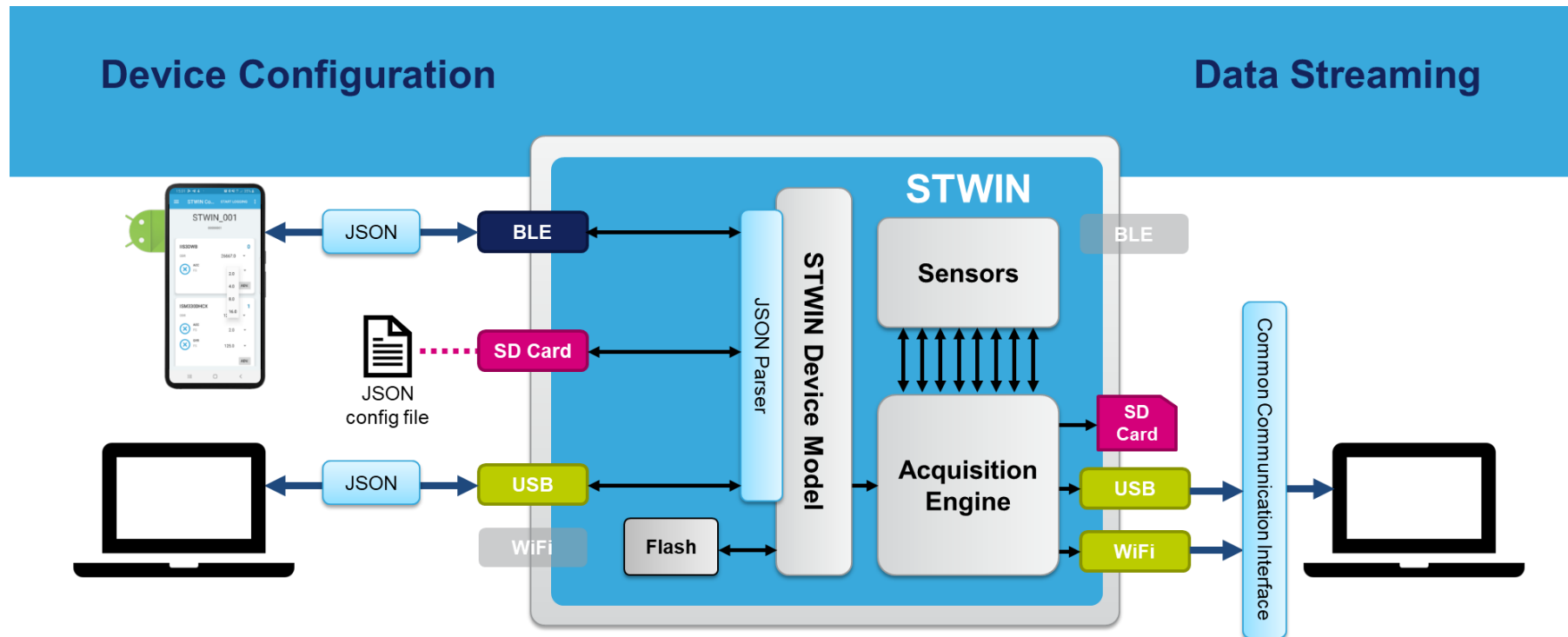


See "Capacitive MEMS accelerometer for condition monitoring" [White Paper](#) for more details



Intelligent, Full-Speed Data Logging

High-speed data log is included in STSW-STWINKT1 software



- Optimized STM32 SW supports streaming of all sensors at full data rate

- USB Virtual Com Port
- SD Card (.csv)
- PC GUI, DLL

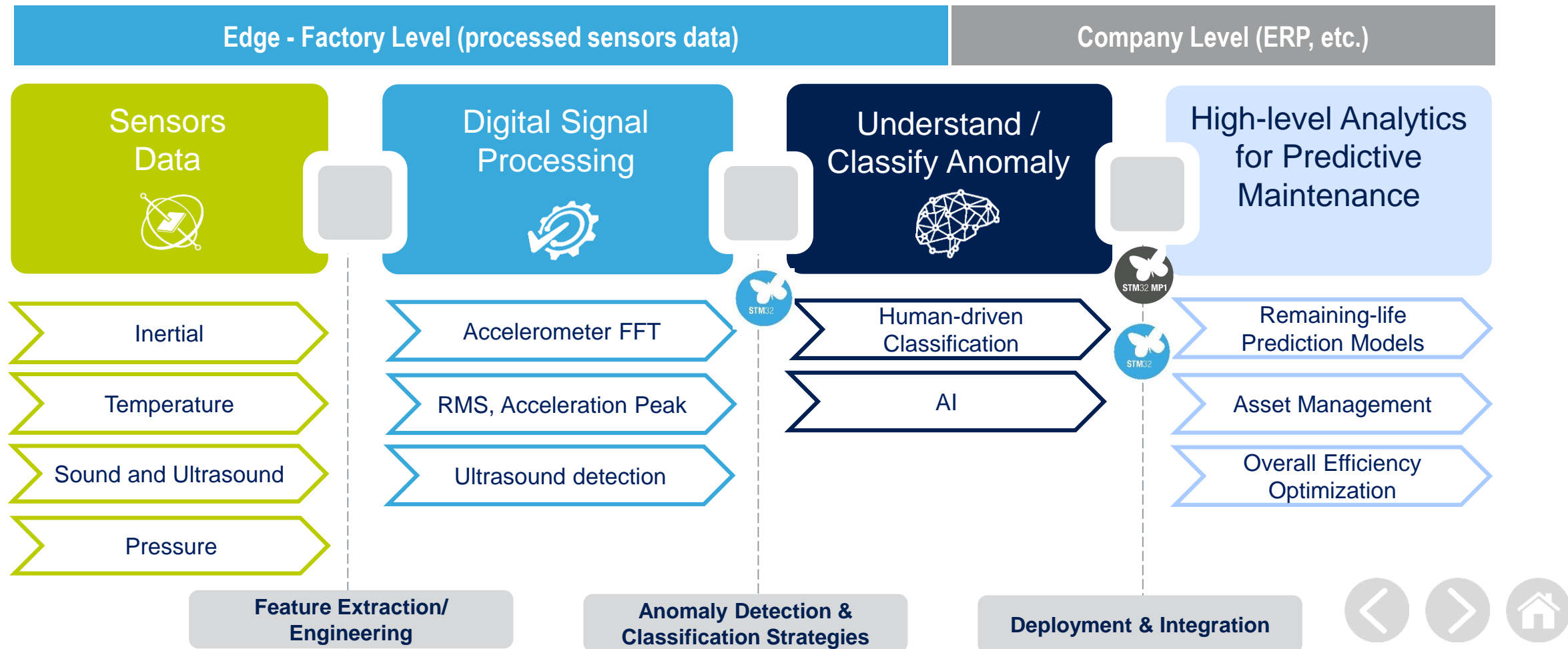
Soon available:

- Full control of acquisition via BLE app
- Support for Wi-Fi streaming

Sensor-Based Models

ICs Embedded Processing with MCU/MPU Core

Advanced processing SW libraries, dedicated tool chain for a deep learning approach, multiple partner program expert companies





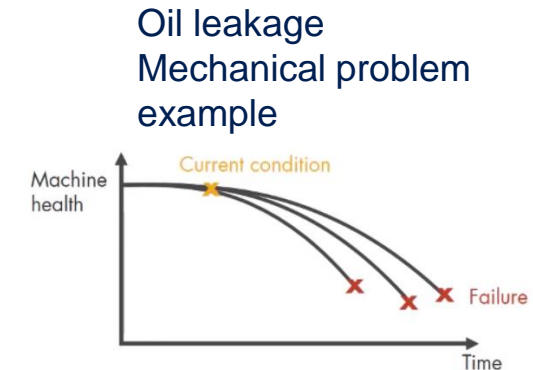
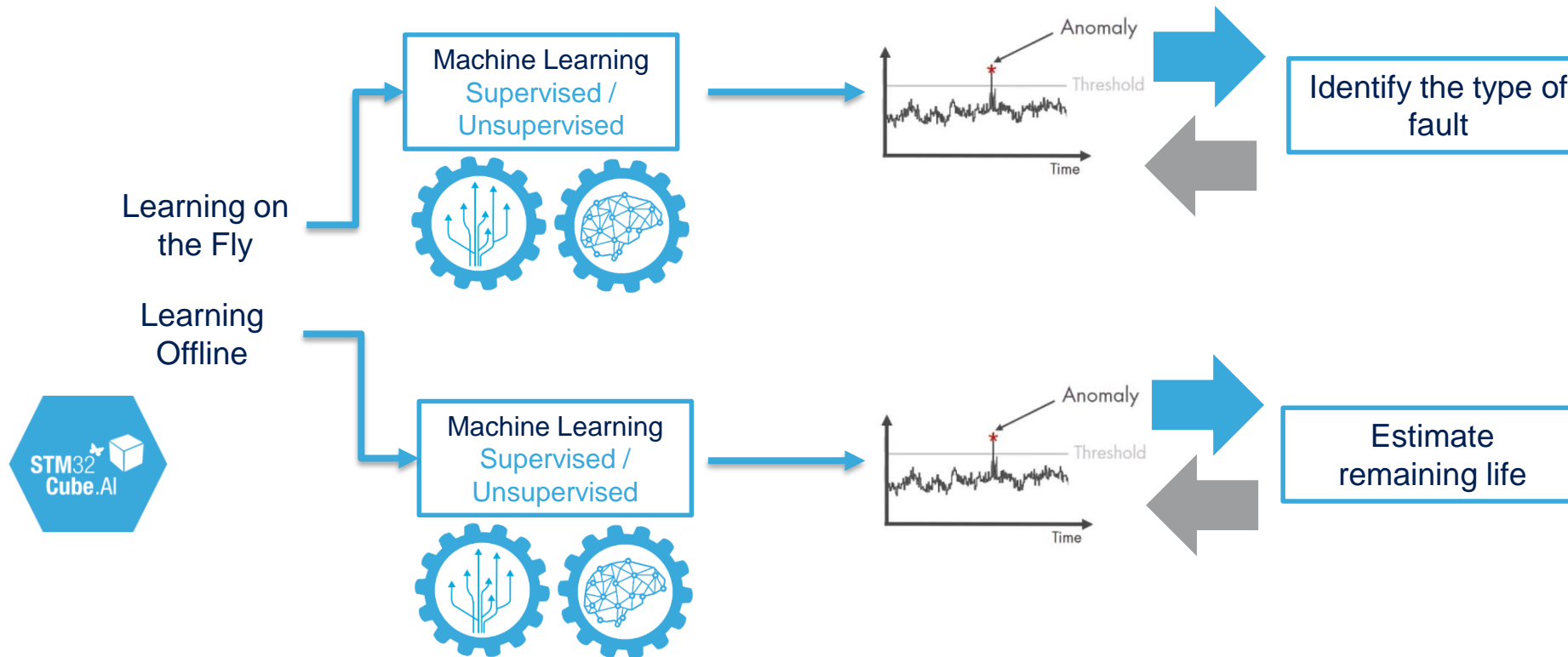
Anomaly Detection at the Edge

AI Strategies

Edge - Factory Level (processed sensors data)



Company Level (ERP, etc.)



The engine will fail after 10 ± 2 flights

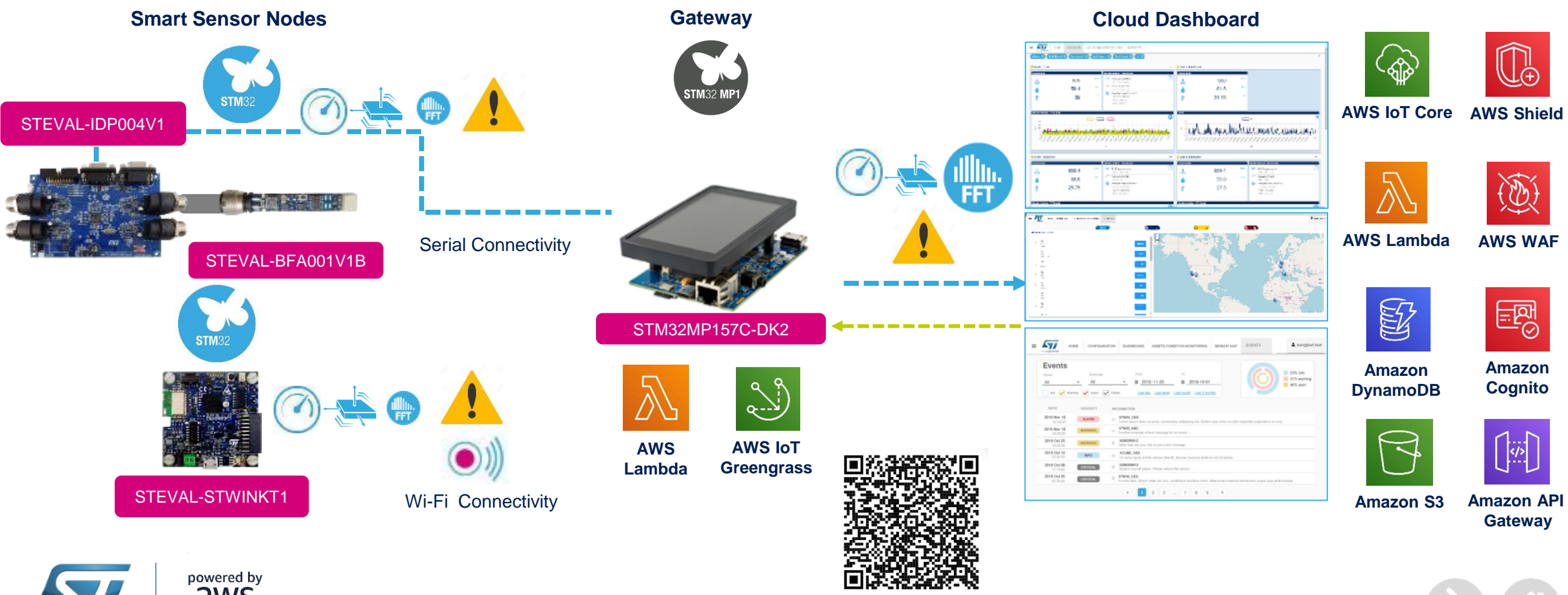


Click on Dev Kits
for further infos

SL-PREDMNT-E2C

Enabling End-to-End Edge Processing

Ultrasound, Vibration, Environmental Monitoring and Anomaly Detection

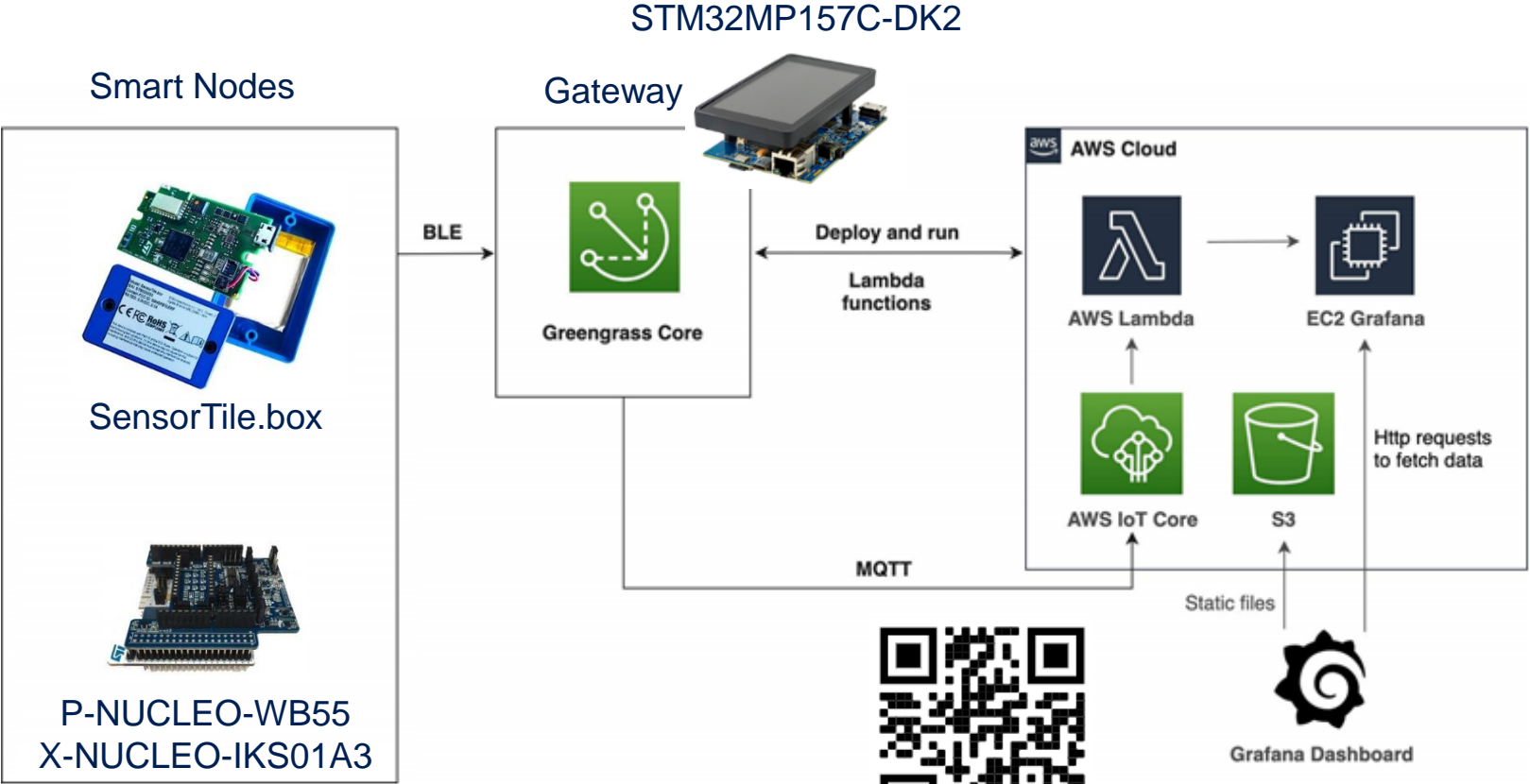




Click on Dev Kits
for further infos

BLE Smart Nodes

Secure, bidirectional communication from devices and multiple distributed beacons.



Find out more on
klika-tech.com



Kits for Predictive Maintenance

Kit with Sensors and IO-Link Capability

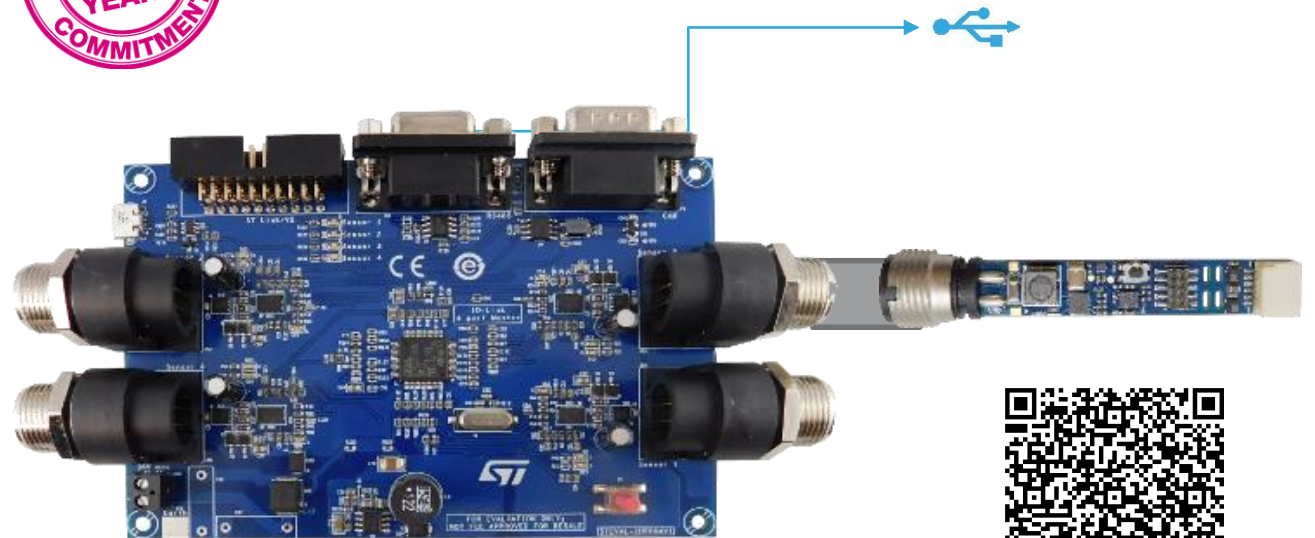
STEVAL-BFA001V1B
Stand Alone Sensor Node



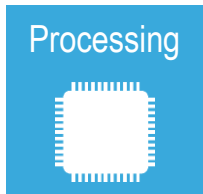
Find out more on [st.com](https://www.st.com)



STEVAL-IDP004V1
Expand your capabilities up to **4** nodes



Find out more on [st.com](https://www.st.com)

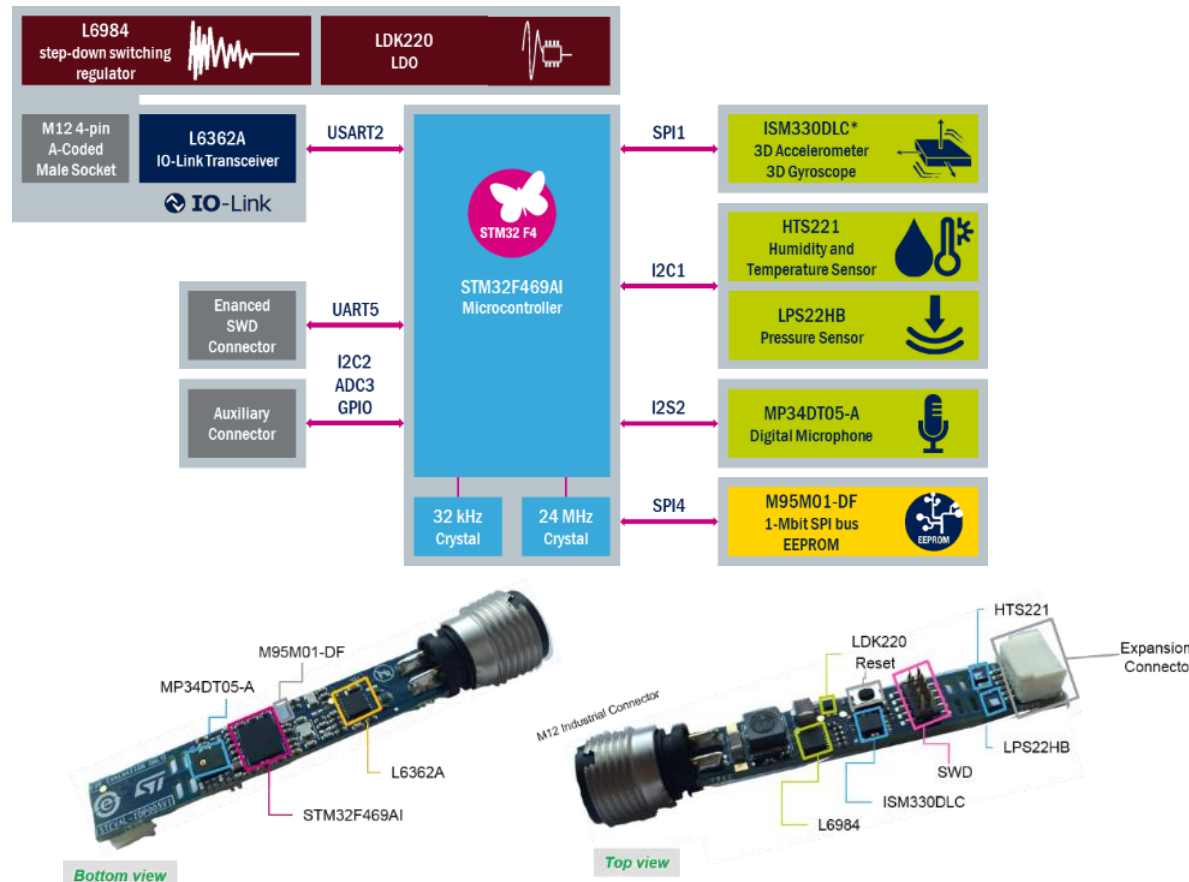




STEVAL-BFA001V1B

Hardware Overview

STEVAL-BFA001V1B Architecture



- Main supply voltage: 18 to 32 V
- Industrial Grade IMU (Accelerometer + Gyroscope) and Digital Microphone for vibration and acoustic analysis
- EEPROM for data and settings storage
- Embedded algorithms for sensors data analysis running on the embedded STM32F4 (up to 180 MHz).
- Integrated MotionSP middleware.
- IO-Link capability with L6362A (**)
- Optimized form factor for industrial M12 connector
- Expansion connector with GPIO, ADC, I2C bus

*ISM330DLC bandwidth is 3 kHz. Replacement with IIS3DWB (5 kHz) – STEVAL-BFA001V2B available in Q1 '20

**IO-Link stack available in Q1 '20



STWIN SensorTile Wireless Industrial Node

STEVAL-STWINKT1

Use cases



Motors



Equipment



Environment

Alpha
engagements

Sensing



Industrial-grade sensors for

- Vibration analysis
- Sound Emission up to 80 kHz
- Environment monitoring

Connectivity



Embedded Wireless and Extension

- BLE, WiFi (Inventek)
- Modular expansion: LTE, LoRa, Industrial Ethernet

Processing



Local Processing & Security

- Ultra-low-power ARM® Cortex®-M4 STM32L4R9
- Secure Element STSAFE-A110

Power

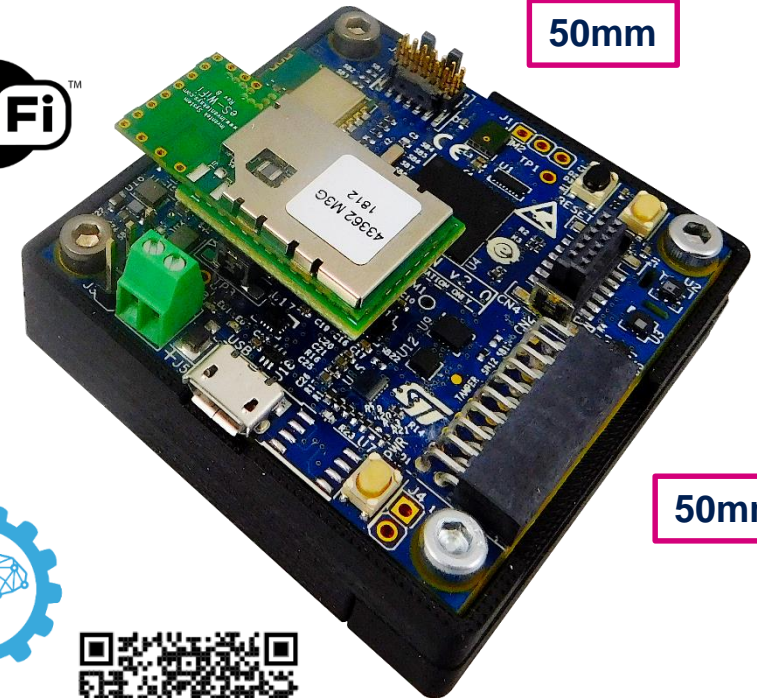


Power Management

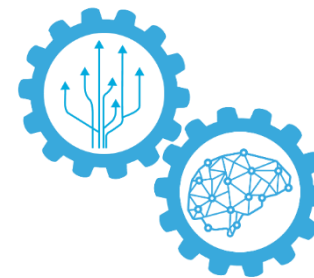
- Li-Ion linear battery charger with load switches
- Miniaturized synchronous step down converter with high-efficiency conversion



50mm



50mm

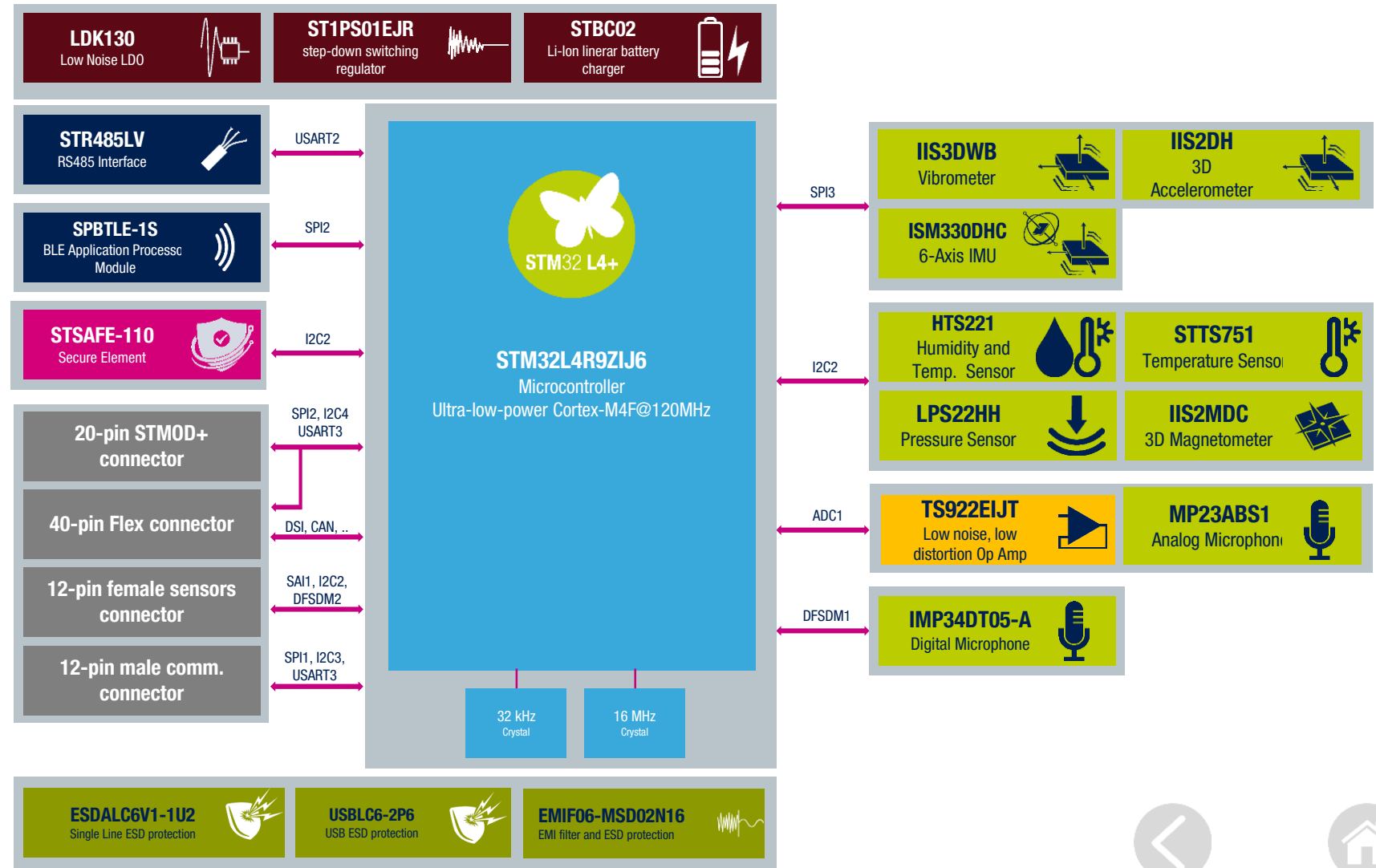




STEVAL-STWINKT1

Block diagram, ICs and features

- Power supply: Li-Po battery or ext. 5V
- Best-in-class Industrial Grade Sensors (i.e. ultrasound detection, to vibration analysis)
- Smart Power to increase battery life
- Multiple algorithms running on the STM32L4+
- Secure Connection and Authentication with **STSAFE-110**
- BLE Connectivity
- Connectivity and sensor expansions support
- USB and SD-Card holder
- **FP-IND-PREDMNT1** to connect to AWS Cloud with Wi-Fi expansion kit





STM32MP157C MPU Discovery Kit

STM32MP157C-DK2

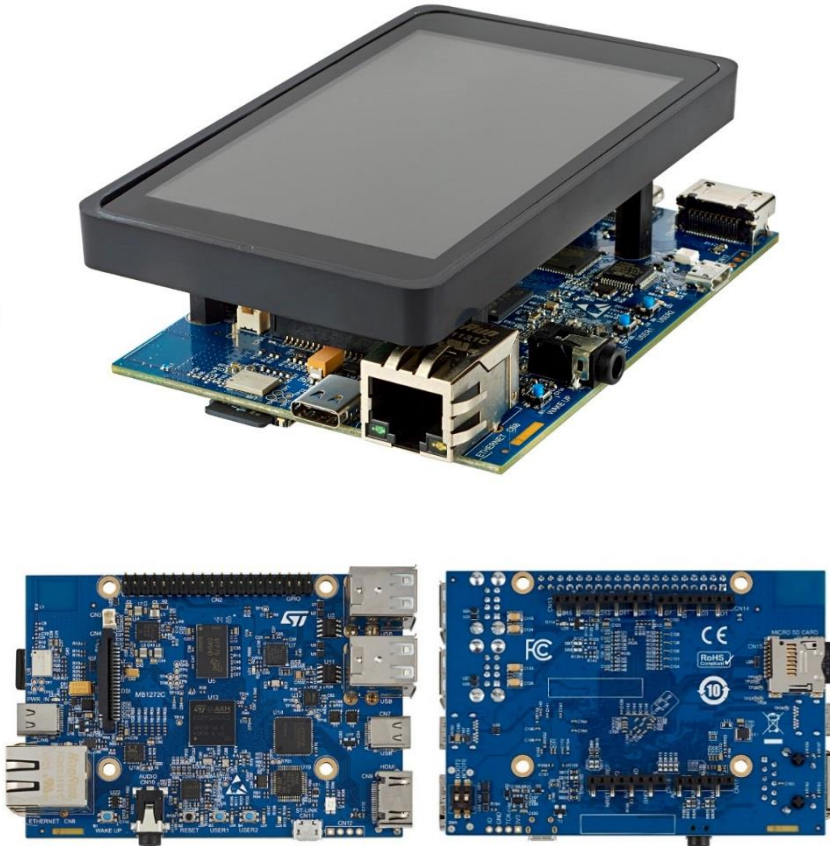
AWS IoT Greengrass v1.8.0 Certified



OpenSTLinux
Distribution



Find out more on
st.com



- STM32MP157 Arm®-based dual Cortex®-A7 32 bits + Cortex®-M4 32 bits MPU in TFBGA361 package
 - ST PMIC : STPMIC1
 - 4-Gbit DDR3L, 16 bits, 533 MHz
 - 1-Gbps Ethernet (RGMII) compliant with IEEE-802.3ab
 - USB OTG HS
 - Audio codec
 - 4 user LEDs
 - Ethernet RJ454, USB Type-A, USB Type-C™, DRPMIPI DSISM, HDMI®, headset jack including analog microphone input, micro SD™ card
 - GPIO expansion connector
 - Raspberry Pi® shields capability
 - ARDUINO® Uno V3 expansion connectors
- Secure Platform using STSAFE-TPM
 - For a Greengrass HSI solution





STM32MP157C MPU Discovery Kit

STM32MP157C-DK2

AWS IoT Greengrass v1.8.0 Certified



OpenSTLinux
Distribution



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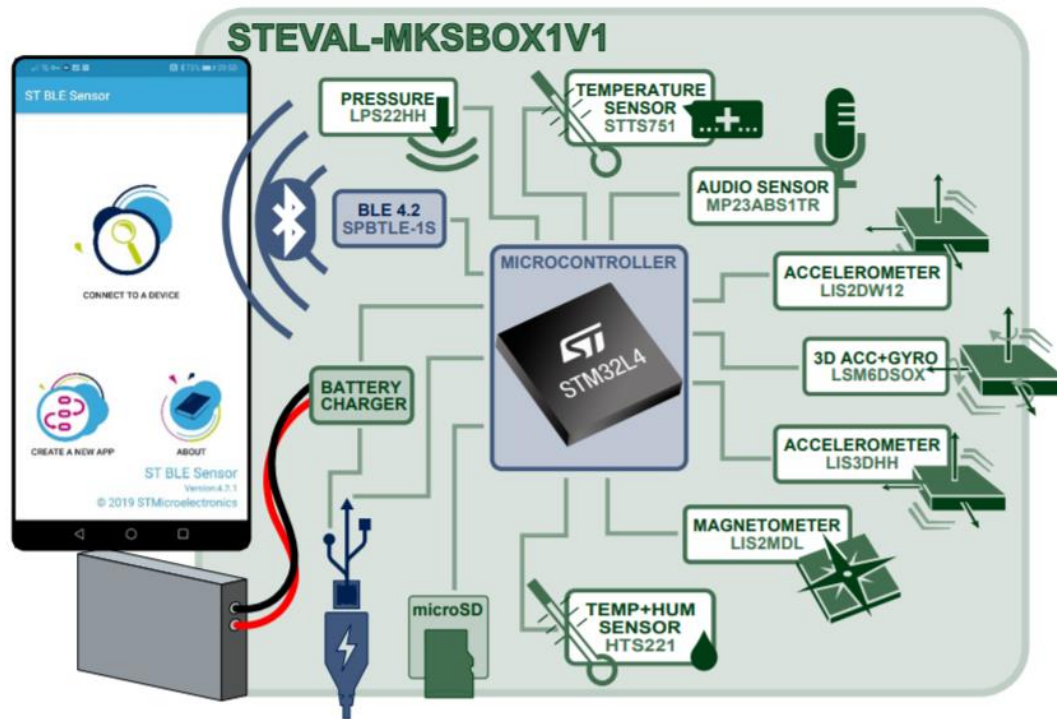




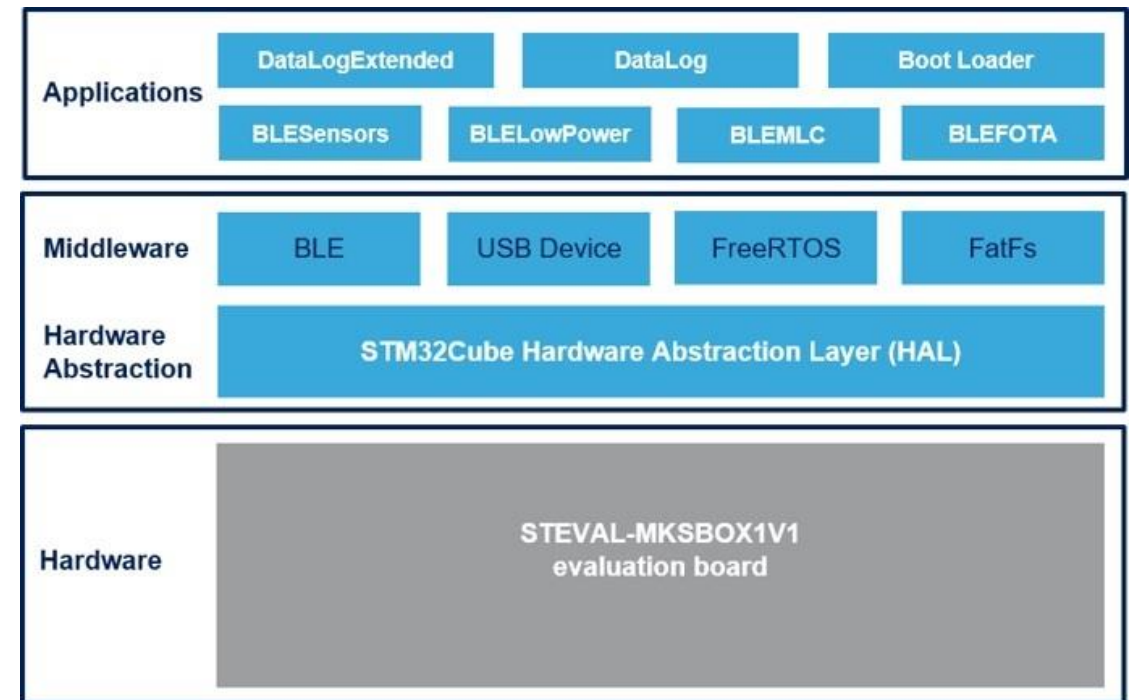
SensorTile.Box Sensor Node

Ready-to-use box kit with wireless IoT and wearable sensor platform

STEVAL-MKSBOX1V1



FP-SNS-STBOX1



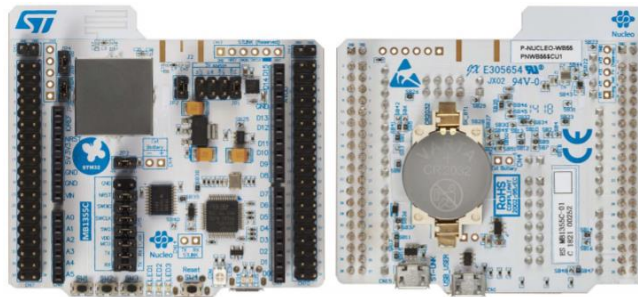


STM32WB Sensor Node

FP-SNS-MOTENVWB1 function pack for STM32Cube

- Connect your IoT node to a smartphone or gateway via BLE

P-NUCLEO-WB55



X-NUCLEO-IKS01A3



Find out more on
st.com

FP-SNS-MOTENVWB1

Application	FP-SNS-MOTENVWB1		
Middleware	BLE	MotionFX/AR	MotionCP/GR
	MotionID/PM		
Hardware Abstraction	STM32Cube Hardware Abstraction Layer (HAL)		
Hardware	STM32 Nucleo expansion boards X-NUCLEO-IKS01A3 (Sense)		
	STM32 WB55 Nucleo development board P-NUCLEO-WB55		

