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ST Sensors and Solutions for **Industry 4.0**

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What is “smart industry”?

- Industry 1.0: Mechanization, Steam Power
- Industry 2.0: Mass Production, Assembly Line, Electrical Energy
- Industry 3.0: Automation, Computers and Electronics
- Industry 4.0: Cyber Physical Systems, IoT, Networks

Availability of miniature, low cost sensors, low power microcontrollers, and end to end connectivity with distributed computing have been the key enablers of Industry 4.0 revolution..

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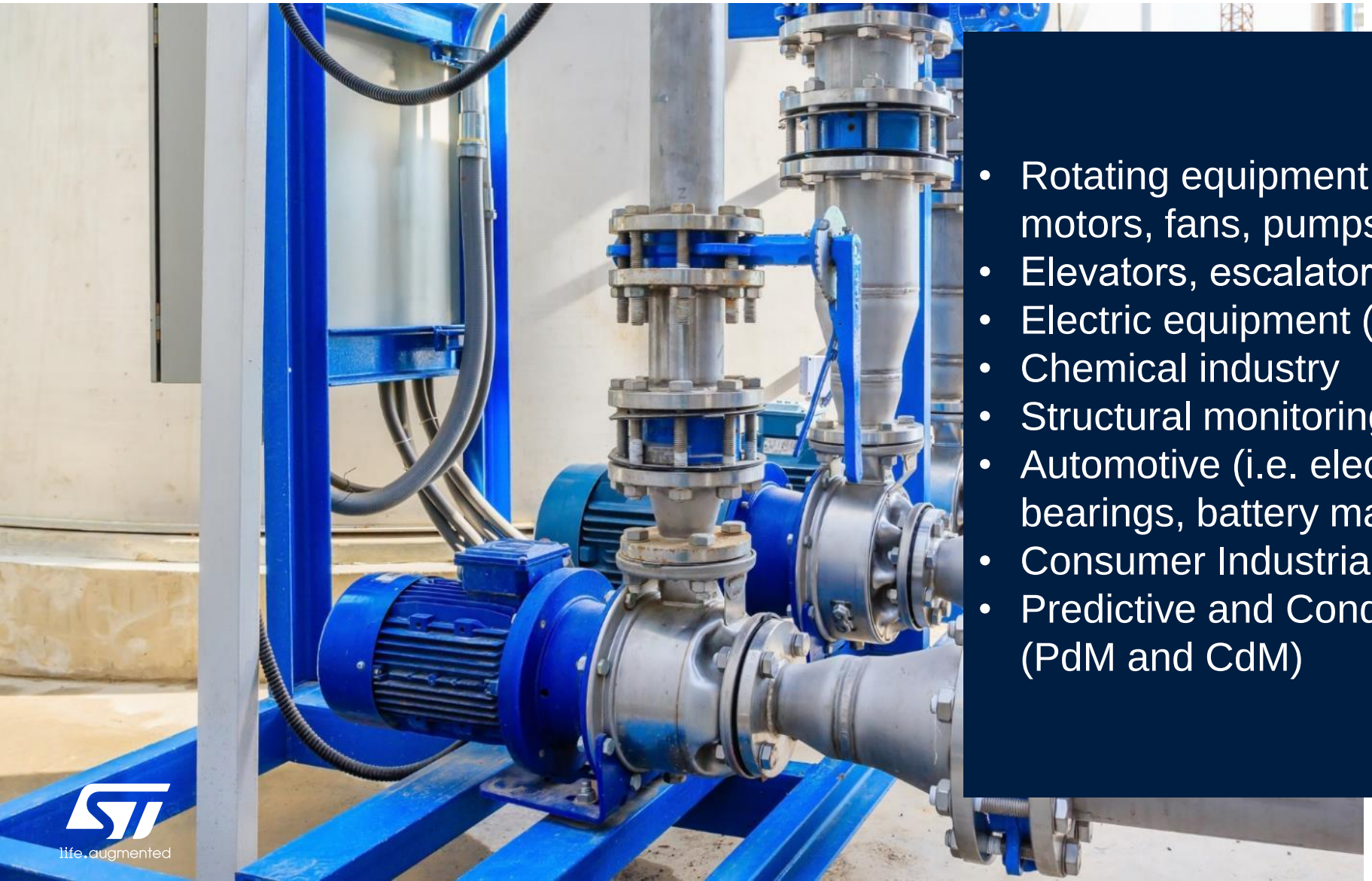
Market and applications



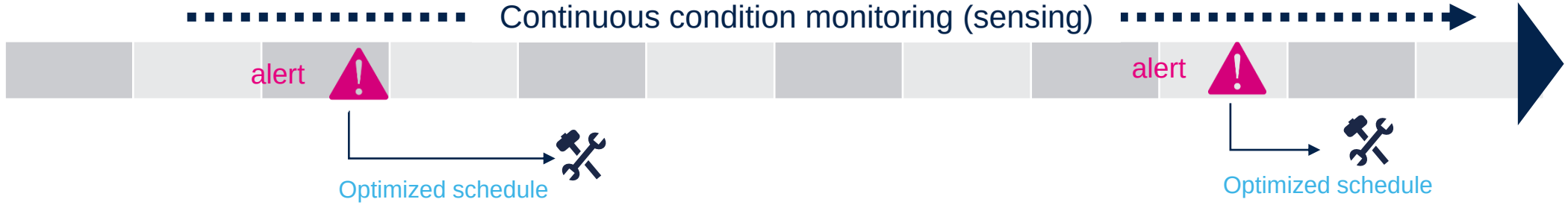
- Rotating equipment and related parts (i.e. motors, fans, pumps, bearings, spindles)
- Elevators, escalators, …
- Electric equipment (i.e. circuit breakers)
- Chemical industry
- Structural monitoring (i.e. bridges, railways)
- Automotive (i.e. electrical motors and parts - bearings, battery management)
- Consumer Industrial (i.e. HVAC)
- Predictive and Condition based maintenance (PdM and CdM)

Why instrument an asset: Predictive Maintenance

Preventive Maintenance (scheduled)

Condition Based Maintenance (at inspection or symptom)

Predictive Maintenance (at the optimal moment)



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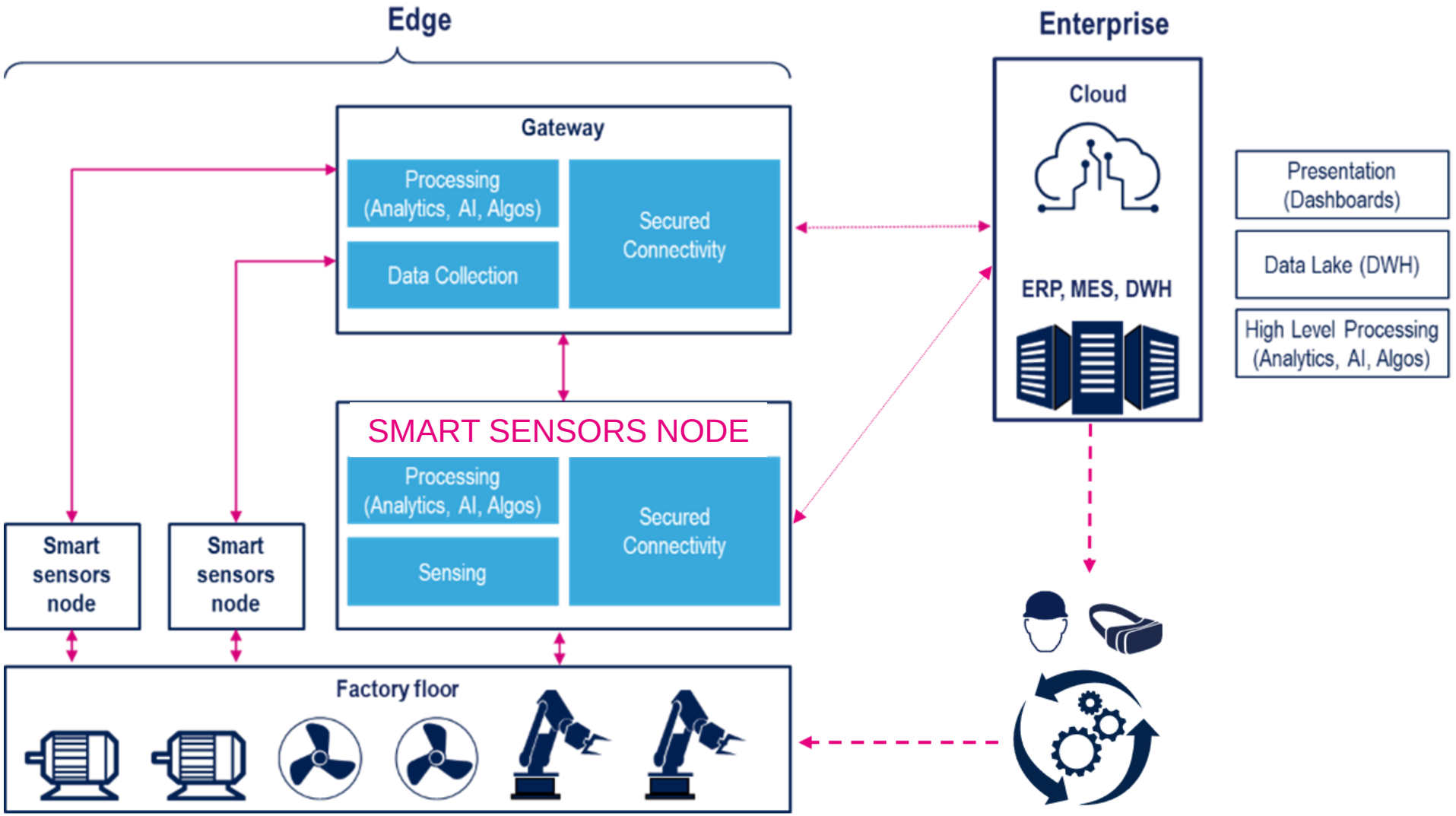
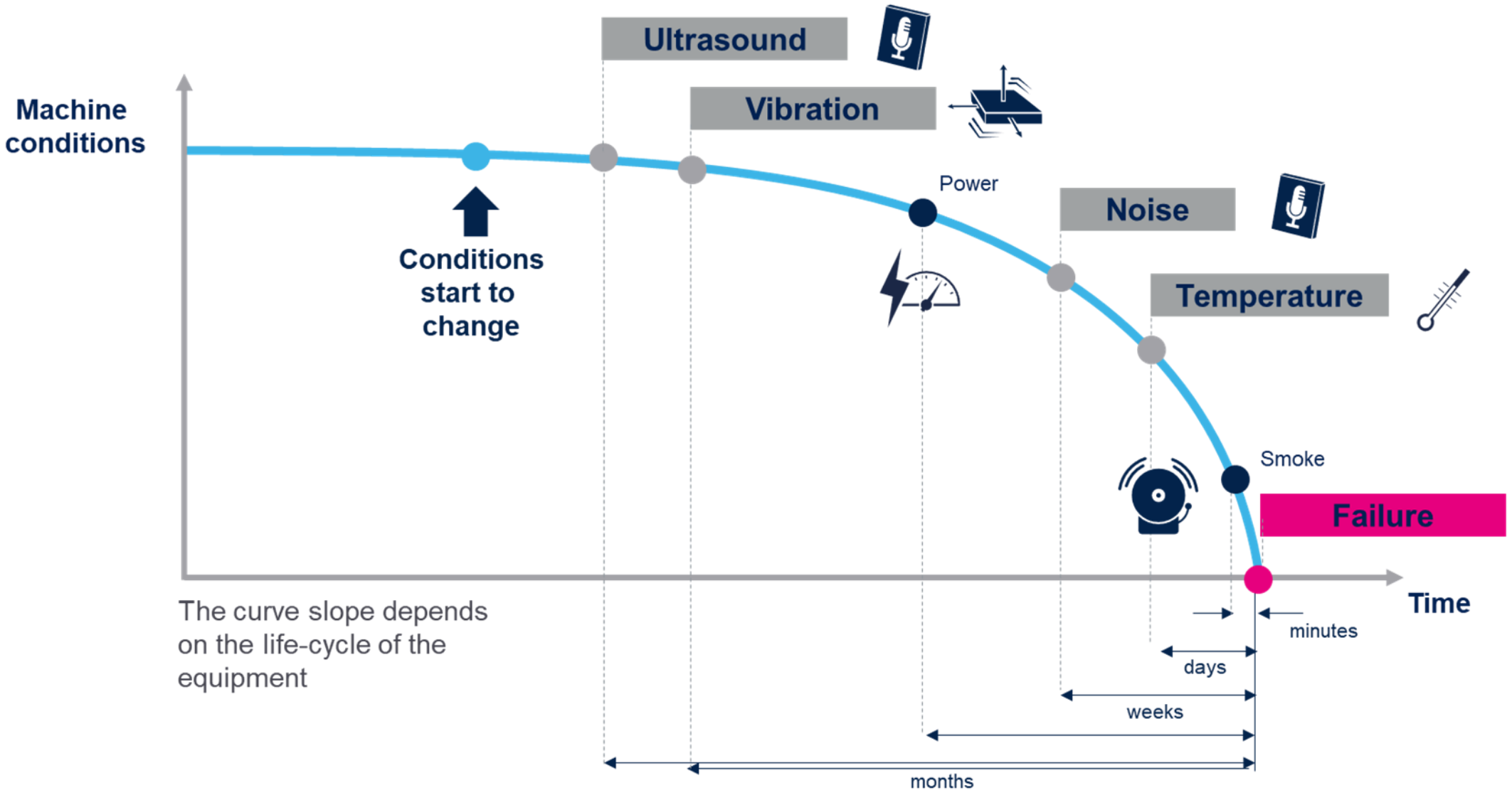
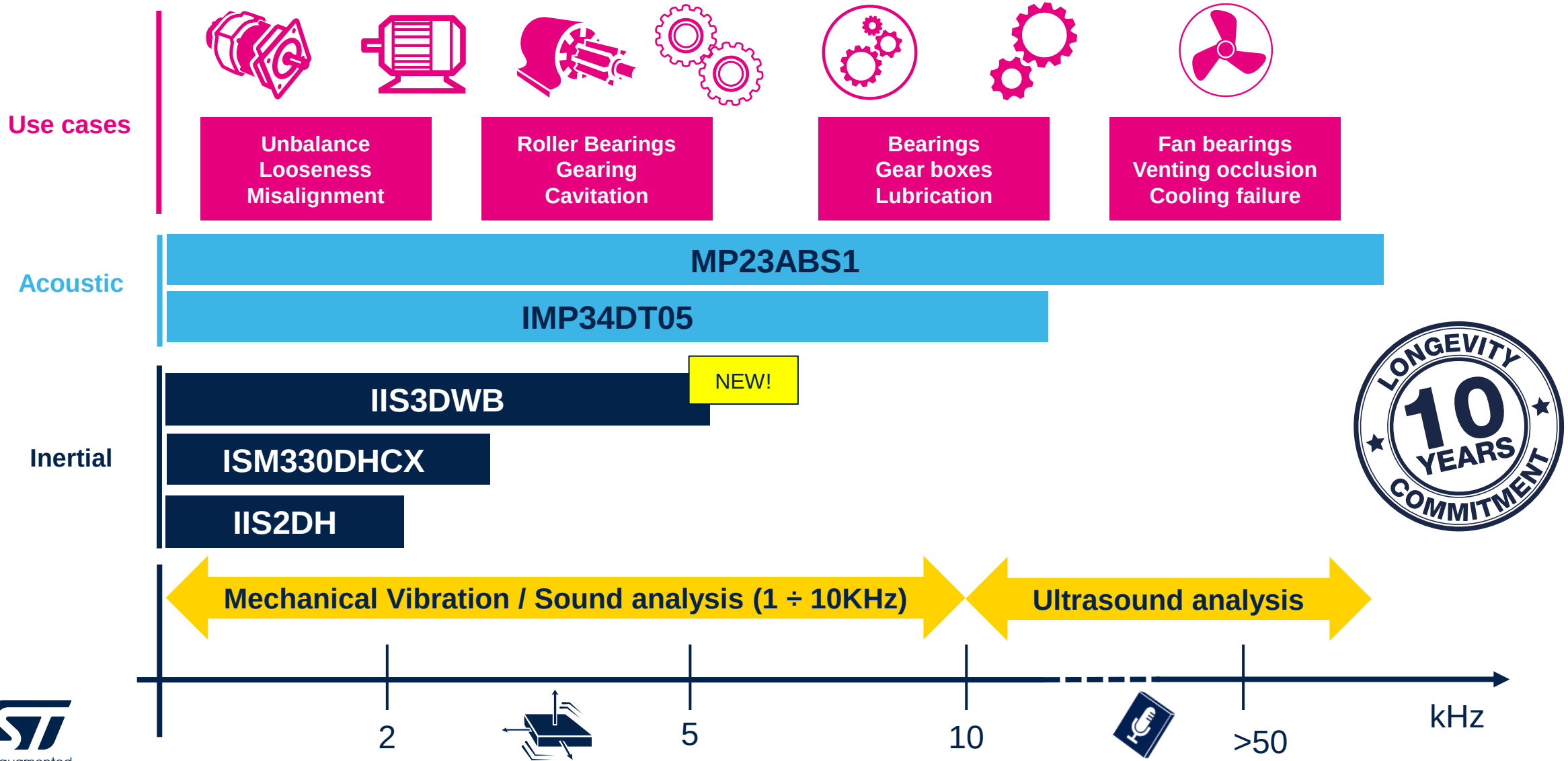
Architecture for Predictive Maintenance



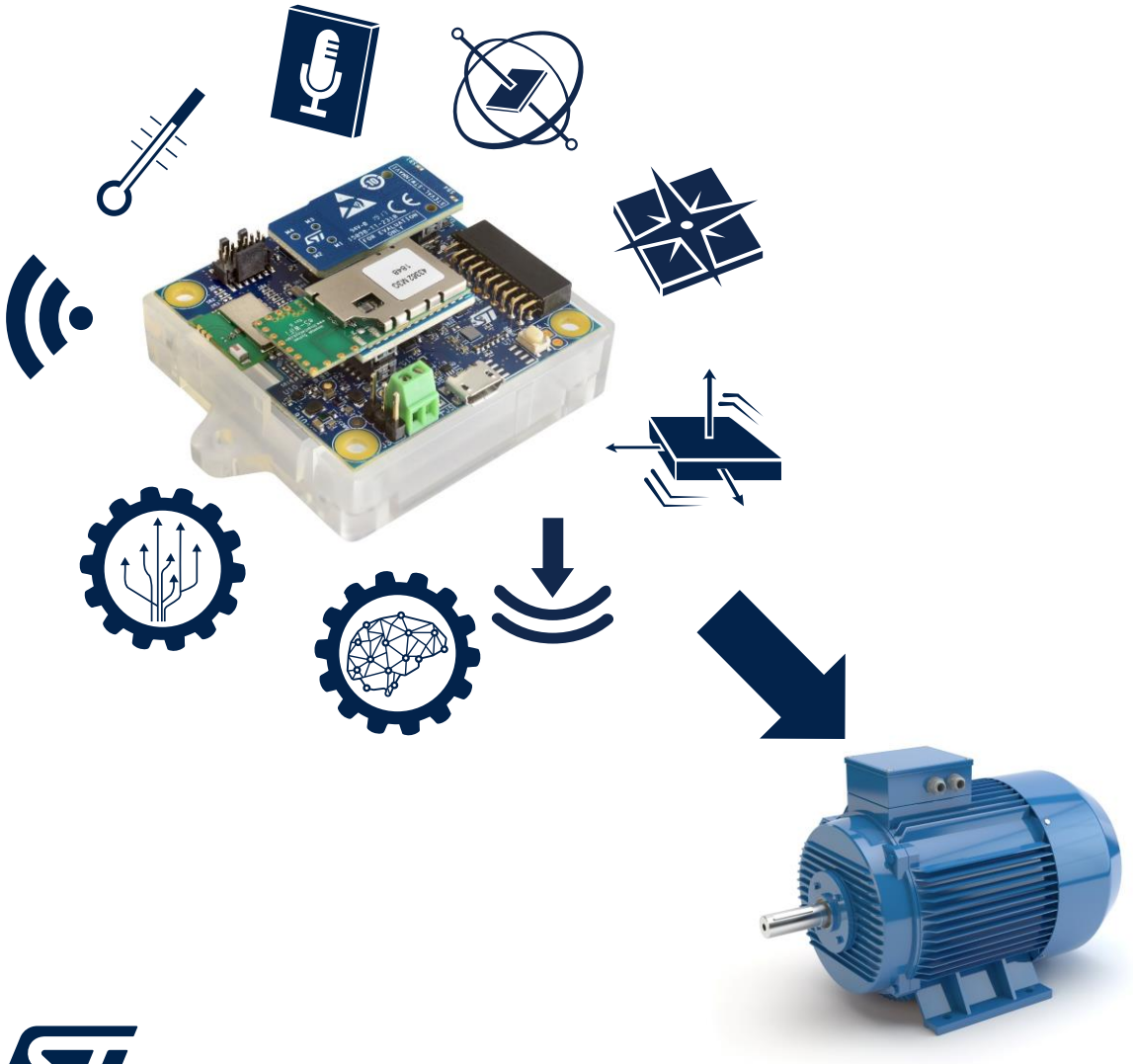
Sensors for Predictive Maintenance



MEMS for Vibration Analysis: Sensors and defects over bandwidth



How to easily retrofit an existing asset? STWIN Smart Sensor for Industry 4.0



Motors | Equipment | Environment

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

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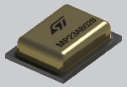
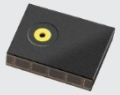
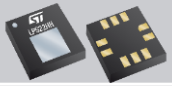
MEMS & Sensors for Condition Monitoring and Predictive Maintenance

Function	IC	Description	Package
Vibration	**IIS3DWB**	Ultra Wide Bandwidth **Accelerometer**	LGA-14, 2.5x3 mm
	ISM330DHCX	Wide Bandwidth **Accelerometer + Gyroscope**	
	IIS2DH	Ultra-low-power **Accelerometer**	LGA-12, 2x2 mm
	IIS2MDC	Low-Noise, Low Power **Magnetometer**	
Acoustic	**MP23ABS1TR**	Analog Differential **Microphone**	RHLGA metal cap 5-L, 3.5x2.65x0.98 mm 
	IMP34DT05-A	Digital Top Port **Microphone**	3x4x1 mm 
Environmental	**LPS22HH**	High Accuracy – Compact Size Absolute **Pressure Sensor**	HLGA-10-L, 2x2x0.76 mm Ultra Compact full molded 
	STTS751	Digital **Temperature Sensor**	2 x 2 x 0.50 mm 6-lead UDFN

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DSH-PREDMNT

HARDWARE

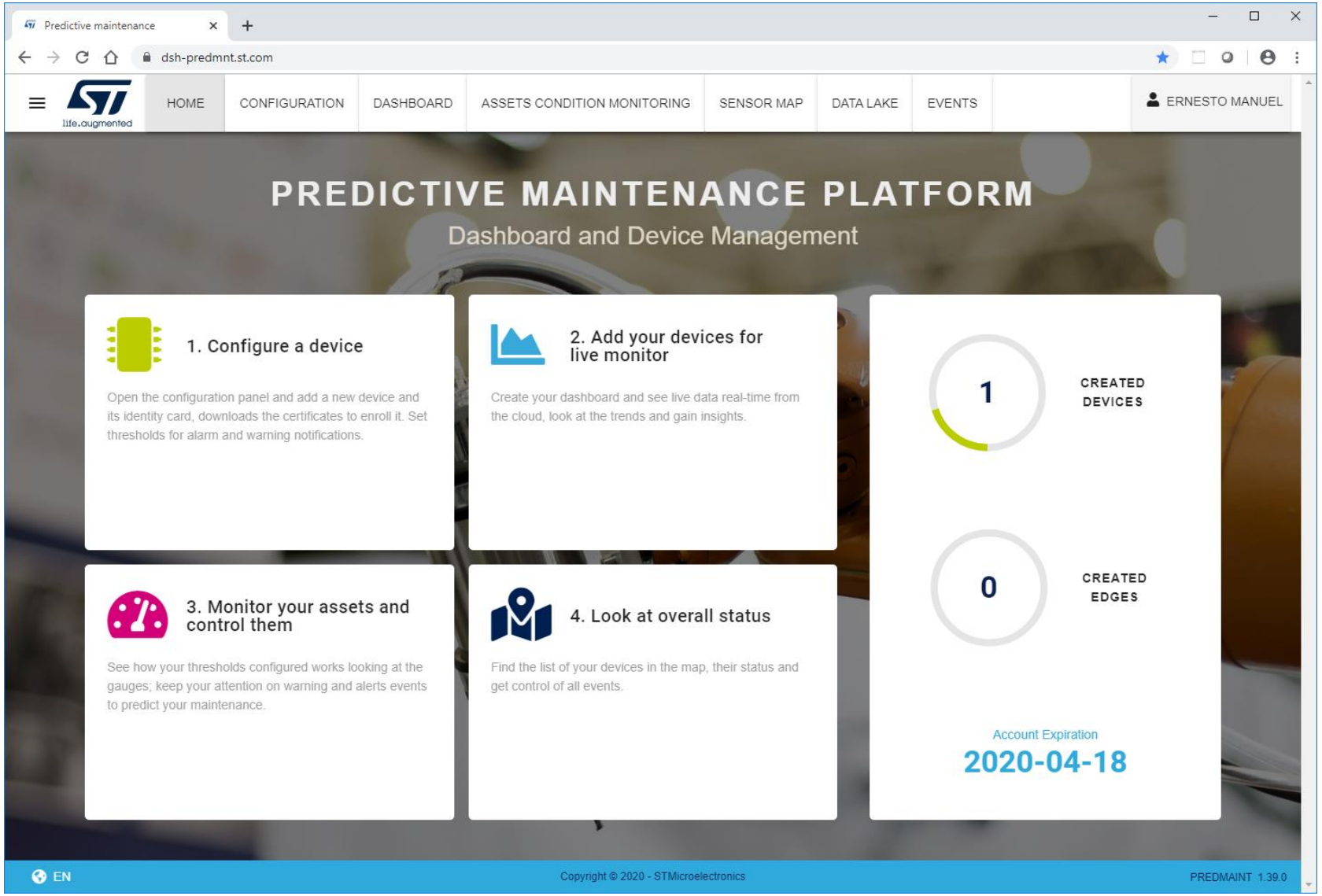
- STEVAL-STWINKT1
- STEVAL-STWINWFV1

FIRMWARE

- FP-IND-PREDMNT1

DASHBOARD

- dsh-predmnt.st.com



Complete ecosystem offering by ST

All building blocks for IoT devices

- Microcontrollers
- Secure solutions
- Sensors & actuators
- Connectivity solutions
- Power management
- Motor control
- Analog components

Lower barriers for developers getting started

Stackable boards & modular SW

STM32 Nucleo Development & Expansion Boards

Form-factor boards

Discovery Kit IoT Node

SensorTile Wireless Industrial Node

NFC Dynamic Tag Sensor Node

SensorTile.box

Lower barriers from prototyping to first product

Pre-integrated software for vertical applications

Smart Things

Smart Home & City

Smart Industry

Development ecosystem

Code generators

Prototyping software

Development environments

Artificial Intelligence toolbox

Debug solutions

Simulation and analysis tools

On-line design tools

Enable product & service commercialization

Integration of Cloud Provider SDKs

Partner Program and ST community

ST Community

Educational Platforms

Questions?

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