Welcome to our Live session!
TRACK 2: Asset tracking

ST LIVE DAYS

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Live sessions

12:30 to 2:10 PM
Asset tracking

1	**Asset tracking solution overview**
2	**Efficient tracker solutions for smart pallets**
3	**BlueNRG-LP wireless SoC for BLE-enabled applications**
4	**Smarter supply chains: goods guarantee with NFC Sensor Tag**
5	**Ultra wideband technology for industrial indoor positioning**

3:00 to 4:40 PM – Smart factory

Introduction
Smart factory solution overview

Session 1
High-performance STM32 MCU for industrial applications

Session 2
Simple IIoT condition monitoring solutions

Session 3
Versatile IO-Link transceivers for factory automation

Session 4
Optimize manufacturing processes and warehouse operations

Industrial - Tracking applications and segmentation

Outdoor real-time monitoring

| Containers | Fleet management | Livestock monitoring | Tractor | Mobility sharing |

Indoor localization & Warehouse logistics
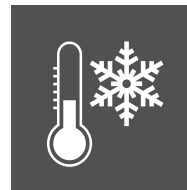
| RTLS | Mobile Assets | Pallet | Smart parcels | Employ Safety |

Good guarantee

| Cold chain | Food tracing | Medical |

Disposable

| Letters | Packages | Parcels |

RTLS = Real Time Localization System

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Asset tracking
Needs per applications

	Processing & Security	Sensing	Connectivity	Power Management
Outdoor real-time monitoring	Dedicated MCU / Dedicated Secure chip	HI-G, gyro, temp, humidity, pressure	NFC, UHF, cloud, Sigfox, LoRa, Bluetooth, UWB, Zigbee, GNSS, NB-IoT/LTE-M	secure power, battery
Indoor localization & warehouse logistics	Dedicated MCU / Embedded security	HI-G, gyro, temp, humidity, ToF	NFC, UHF, cloud, Sigfox, LoRa, Bluetooth, UWB, Zigbee, Wi-Fi, NB-IoT/LTE-M	battery
Good guarantee	Dedicated MCU / Embedded security	HI-G, gyro, temp, humidity, ToF	NFC, UHF, cloud, Sigfox, LoRa, Bluetooth, Wi-Fi, NB-IoT/LTE-M	battery
Disposable	Sensor with processing / Embedded security	HI-G, temp	NFC, UHF, cloud, Sifox, UHF	battery

Complexity
(# of sensors, connectivity)

Asset tracking
ST 360° portfolio delivers 100% flexibility

Outdoor real-time monitoring
Containers, livestock monitoring, Mobility sharing, fleet management, tractor

Indoor localization & warehouse logistics
Pallets, mobile assets, Real Time Localization, Smart Parcels, Employ safety

Good guarantee
Cold chain, food tracing, medical

Disposable
Letters, packages, parcels

Evaluation Platforms

Processing

Sensing & Actuating

Security

Connectivity

Power & Energy Management

Signal Conditioning & Protection

Multiple applications, one platform, one vendor

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STM32 MCU Portfolio

Arm® Cortex® core		-M0	-M0+	-M3	-M33	-M4	-M7	dual -A7& -M4
MPU								STM32**MP1** 4158 CoreMark 800 MHz Cortex -A7 209 MHz Cortex -M4
High Perf MCUs				STM32**F2** 398 CoreMark 120 MHz		STM32**F4** 608 CoreMark 180 MHz STM32**H7** Up to 3224 CoreMark 240 MHz Cortex -M4 Up to 550 MHz Cortex -M7	STM32**F7** 1082 CoreMark 216 MHz	
Mainstream MCUs	STM32**F0** 106 CoreMark 48 MHz	STM32**G0** 142 CoreMark 64 MHz	STM32**F1** 177 CoreMark 72 MHz		STM32**F3** 245 CoreMark 72 MHz STM32**G4** 550 CoreMark 170 MHz		
Ultra-low Power MCUs		STM32**L0** 75 CoreMark 32 MHz	STM32**L1** 93 CoreMark 32 MHz	STM32**L5** 443 CoreMark 110 MHz	STM32**L4** 273 CoreMark 80 MHz STM32**L4+** 409 CoreMark 120 MHz		
Wireless MCUs		Most suitable for asset tracking applications			STM32**WL** 161 CoreMark 48 MHz STM32**WB** 216 CoreMark 64 MHz		

● Cortex-M0+ Radio co-processor

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Sensors for asset tracking

Temperature, Humidity sensors to monitor environmental changes/activate the de-humidification system, check sealing, consistency of cold chain
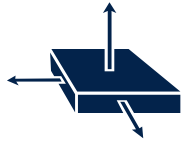
Accelerometer to detect motion/wake-up, vibration, crash/shocks, freefall, upright and orientation

Proximity and Light Sensor for container door open/close monitoring and shipment security

Pressure airplane Take off and landing detection or altitude detection

Microphones for security and emerging applications.

ST sensors for asset tracking
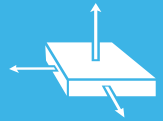
Accelerometers

High-g shock accelerometer	**H3LIS331DL**
Vibration	**IIS3DWB**
Ultra-low power	**LIS2DW12 LIS2DH12**
With embedded temperature sensor	**LIS2DTW12**
Inclinometer	**IIS3DHHC IIS2ICLX**
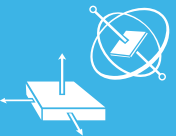
iNEMO® Inertial Module

6x IMU	**LSM6DSOX LSM6DSO32**

Magnetometer

Magnetometer	**LIS2MDL**

Pressure Sensors

Precision pressure sensor	**LPS22HH**
Waterproof pressure sensor	**LPS27HHW LPS27HHTW * LPS33W**

Temperature & Humidity Sensors

Humidity & temperature sensor	**HTS221**
Digital temperature sensor	**STTS751 STTS22H**
Analog temperature sensor	**LM235 STLM20**

MEMS Microphones

Digital high-performance Microphone	**MP34DT05-A MP23DB01HP**
Analog high-bandwidth Microphone	**MP23ABS1 IMP23ABSU**

FlightSense Time-of-Flight sensor

Proximity sensor (with ALS)	**VL6180/80X**
Ranging sensor	**VL53L0X**
Long distance ranging sensor	**VL53L1X**
Extra-long distance & Multi-target	**VL53L1CB**

9

* Available soon   Blue = high runner for asset tracking   Gray = other relevant products

Complementary products for Asset Tracking

DC/DC converters

Synchronous converter, Output voltage flexibility, 400 mA output current, Nano-quiescent current (500 nA) for extended sensors battery life	ST1PS01/02
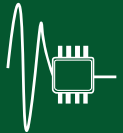
Voltage regulators

200 mA ultra-low quiescent current LDO	STLQ020
Low Iq, ultra low noise 300 mA LDO with power good	LDLN030
Low Iq, ultra low noise 250 mA LDO	LDLN025
Low Iq, ultra low drop 300 mA LDO	LD59030

Operational amplifiers

Zero Drift CMOS amplifier • Very low offset 5 µV max • Very low drift in temperature 30 nV/°C	TSZ12 Series
Zero Drift & Speed Amplifier • Very low offset 25 µV max • Very low drift in temperature 0.1 µV/°C • Excellent speed/power ratio 3 MHz/1 mA	TSZ18 Series
Nano-power amplifiers - Zero Drift • 900 nA current consumption • Only 150 µV max input offset voltage • Operating from 1.5 V	TSU11 Series
Nano-power amplifiers • 580 nA current consumption • Operating from 1.5 V	TSU10 Series
Nano-power comparator • 200 nA current consumption • Operating from 0.9 V • Push Pull & Open Drain	TS88 Series

Protection devices

SD card protection	EMIF06-MSD02N16
USB 2.0 dataline	ECMF02-4CMX8
DC-DC protection	ESDA7P120-1U1M
ESD protection	USBULC6-2M6
USB TYPE-C Power Delivery protection	TCPP01-M12

IoT wireless connectivity
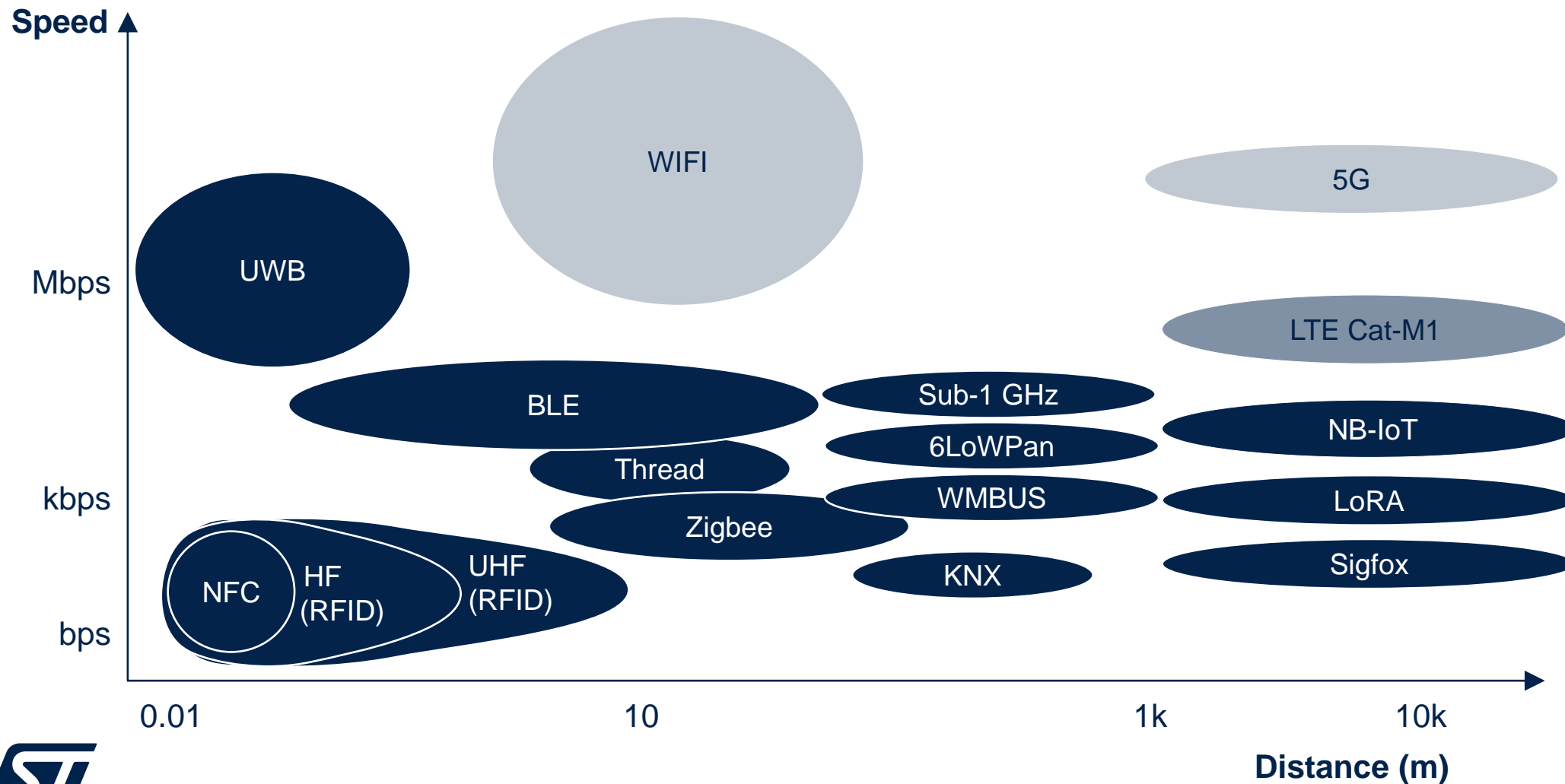
ST Connectivity for Asset Tracking

NFC & RFID

NFC / RFID tags	ST25TV
Dynamic NFC / RFID tags	ST25DV-I2C
NFC Readers	ST25R
NFC Readers for UHF	ST25RU

Bluetooth Low Energy

Multi-protocol (Bluetooth 5.0 / 802.15.4) Wireless SOC with integrated balun	STM32WB55 / 50 / 35 / 30
Multi-protocol Module (Bluetooth 5.0 / 802.15.4)	STM32WB5MMGH
Highly energy-efficient Bluetooth 5.x Wireless SoC	BlueNRG-2 BlueNRG-LP
Bluetooth 5.0 Modules	BlueNRG-M2
Balun & Filter	BALF-NRG-02D3 MLPF-NRG-01D3 MLPF-WB55-0xE3

Sub-1 GHz

Sub-1 GHz Transceiver/Transmitter Sigfox compatibility	S2-LP S2-LPTX
Balun for S2-LP	BALF-SPI2-01D3
STM32 Sub-1 GHz SOC LoRa/Sigfox compatibility	STM32WL

WPAN

Bluetooth LE 5, Zigbee, Thread, proprietary Wireless SOC (integrated balun)	STM32WB
Balun for UWB	BAL-UWB-01E3
Ultra wideband connectivity	STM32-UWB-MOD1*

Positioning

GNSS Module	TESEO-LIV3x
GNSS Multi-Bands Module	TESEO-LIV4x*

Cellular

Cellular connectivity	STM324Gx*
eSIM	ST4SIM

* Available soon

Asset tracking reference design by connectivity

NFC & RFID

NFC Sensor Tag
STEVAL-SMARTAG1

Bluetooth® Low Energy

SensorTile.box
STEVAL-MKSBOX1V1

Sub-1 GHz

Sigfox Tracker
FR-ATR-SIGOFX1

Sub-1 GHz

IoT LoRA® Tracker
STEVAL-STRKT01

Cellular & GNSS

LTE™ Tracker
FR-ATR-LTE1

NFC sensor TAG for asset tracking
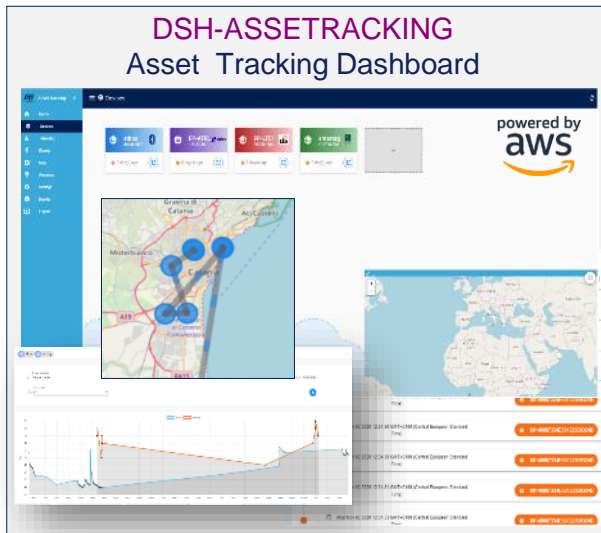
What it is

ST25DV64K NFC Dynamic Tag sensor node (motion, environmental)

Key components

LIS2DW12 – 3x accelerometer

LPS22HH – Pressure sensors

HTS221 – Temperature & humidity

STLQ015 – Voltage regulator

Ecosystem

Eval board: STEVAL-SMARTAG1

Function Pack: FP-SNS-SMARTAG1

Mobile app: ST Asset Tracking

Cloud dashboard: DSH-ASSETRACKING

DSH-ASSETRACKING
Asset Tracking Dashboard

powered by aws

ST Asset Tracking
Asset Tracking Dashboard

FP-ATR-BLE1

FP-SNS-SMARTAG1

Download on the App Store

GET IT ON Google play

STM32

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SensorTile.box
Bluetooth tracking
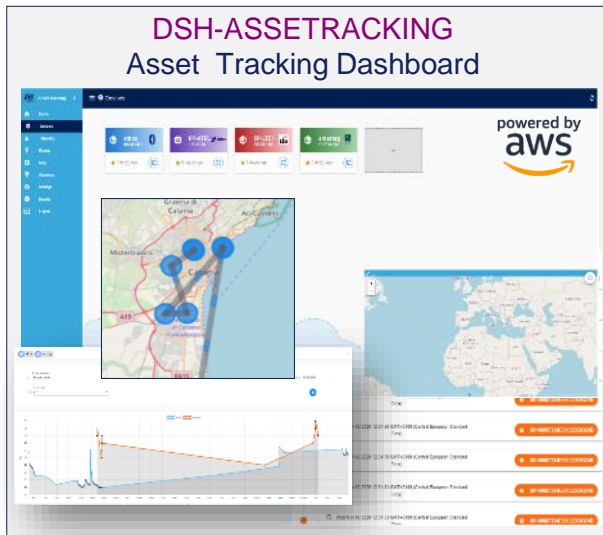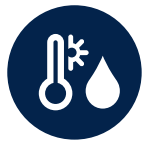
What it is

Bluetooth® Low Energy solution data logger with Environmental and Motion Sensors with Machine Learning

Key components

LSM6DSOX – 6x IMU with ML	LIS2DW12 – Accelerometer
LPS22HH – Pressure sensors	LIS3DHH – Inclinometer
HTS221 – Temp. & humidity	LIS2MDL – Magnetometer
STTS751 – Temperature	MP23ABS1 – Analog Microphone

Ecosystem

Eval board: STEVAL-MKSBOX1V1

Function Pack: FP-ATR-BLE1

Mobile app: ST Asset Tracking

Cloud dashboard: DSH-ASSETRACKING

Sigfox Tracker for Asset tracking
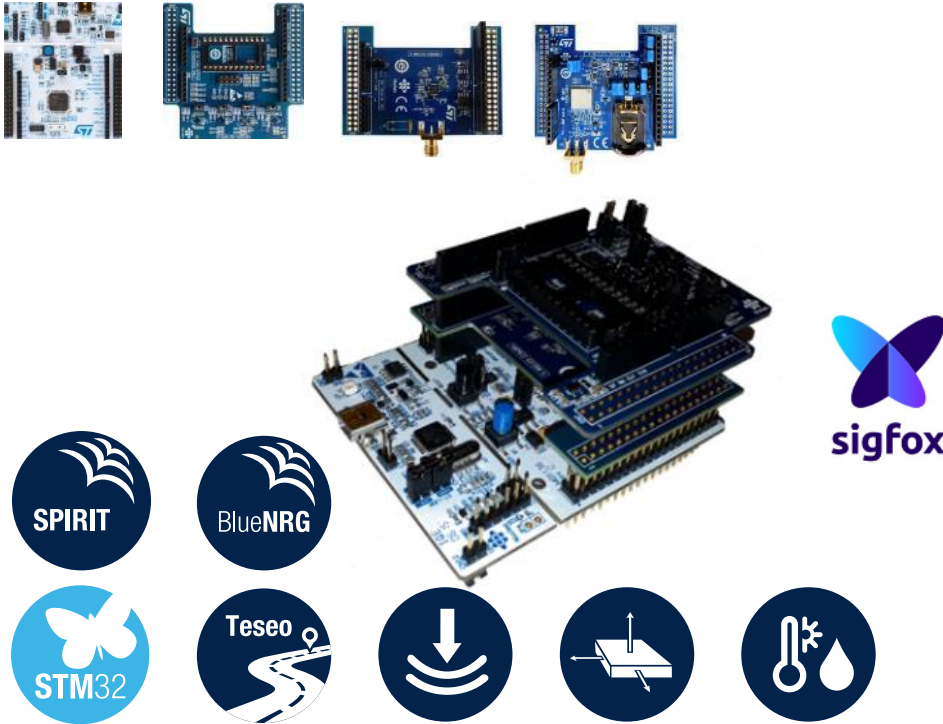
What it is

IoT tracker node with Sigfox connectivity and sensors

Key components

S2-LP, ULP RF Sigfox
w/ and w/o GNSS

LSM6DSL – Accelerometer + gyroscope

LSM303AGR – Accelerometer + magnetometer

LPS22HB – Pressure sensor

HTS221 – Humidity and temperature sensor

Ecosystem

Eval board: NUCLEO-L053R8/L476RG

X-NUCLEO-S2868A2/915A1 / X-NUCLEO-IKS01A2

X-NUCLEO-IDB005A1 / X-NUCLEO-GNSS1

Function Pack: FP-ATR-SIGFOX1

Mobile app: ST Asset Tracking

Cloud dashboard: DSH-ASSETRACKING

DSH-ASSETRACKING
Asset Tracking Dashboard

powered by aws

SPIRIT

BlueNRG

STM32

Teseo

sigfox

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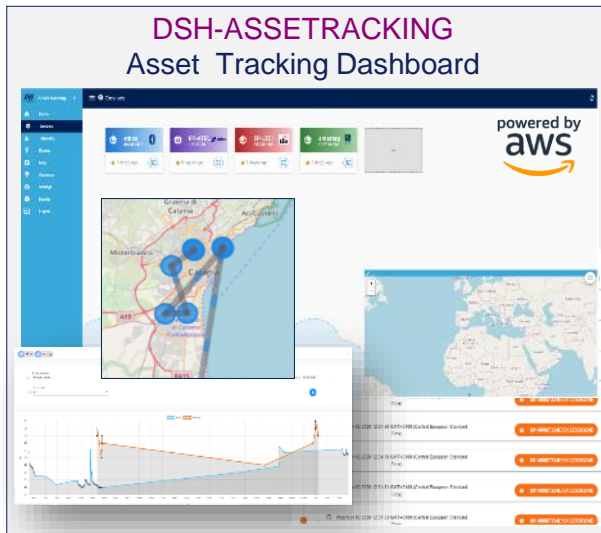
IoT LoRa® Tracker
for Asset tracking
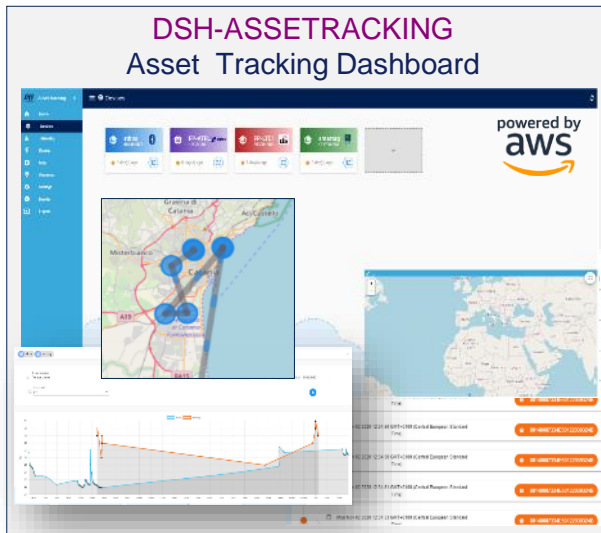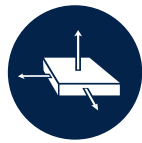
What it is

RF Sub-1 GHz LoRa sensor node (motion, environmental)

Key components

CMWX1ZZABZ LoRa®	HTS221 – Humidity and temperature sensor
TESEO-LIV3F GNSS positioning	STBC02 – Li-Ion battery charger
LIS2DW12– accelerometer	ST1PS01 – Step-down converter
LPS22HH - pressure	STUSB1600A – USB Type-C controller

Ecosystem

Eval board: STEVAL-STRKT01 / B-L072Z-LRWAN1

X-NUCLEO-GNSS1A1 / X-NUCLEO-IKS01A2

Function Pack: FP-ATR-LORA1

Cloud dashboard:

- TAGOIO DSH
- DSH-ASSETRACKING

LTE Solution for Asset tracking
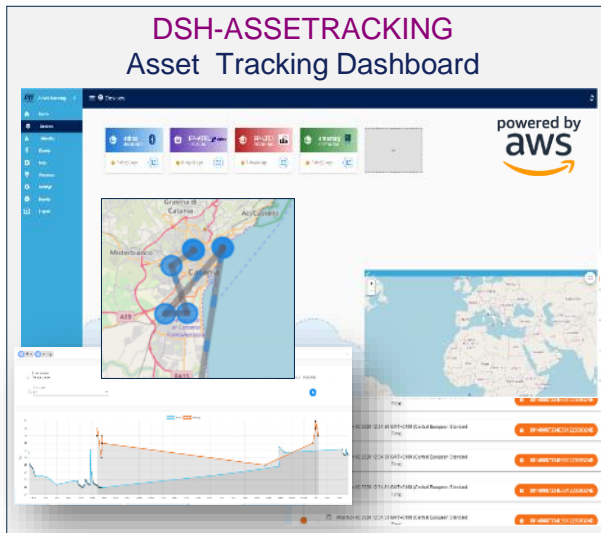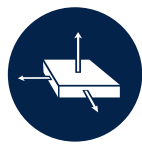
What it is

Asset tracking with LTE cellular connectivity (Quectel BG96), with GNSS and MEMS sensors

Key components

STM32L496 Discovery Board

Quectel Modem

ST4SIM-110M eSIM for M2M

Ecosystem

Eval board: X-NUCLEO-GNSS1A1 : X-NUCLEO-IKS01A3

P-L496G-CELL02

Function Packs:

- FP-ATR-TOMTOM1
- FP-ATR-LTE1

Cloud dashboard: DSH-ASSETRACKING

DSH-ASSETRACKING
Asset Tracking Dashboard

powered by aws

Asset Tracking
a complete solution from ST

To address all the applications

Outdoor real-time monitoring
Containers, livestock monitoring, Mobility sharing, fleet management, tractor

Indoor localization & warehouse logistics
Pallets, mobile assets, Real Time Localization, Smart Parcels, Employ safety

Good guarantee
Cold chain, food tracing, medical

Disposable
Letters, packages, parcels

A broad portfolio of products

HI-G

NFC — UHF — Sigfox — LoRa

Bluetooth — UWB — Zigbee — GNSS — NB-IoT / LTE-M

ToF

A full set of evaluation platforms

NFC Sensor Tag

IoT LoRA® Tracker

LTE Tracker

Sigfox™ Tracker

BLE Tracker

DSH-ASSETRACKING
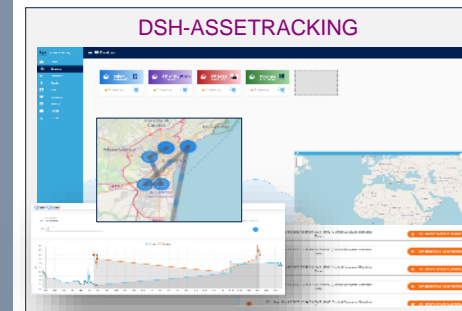
Discover much more in the event exhibit hall

Live sessions

12:30 to 02:05 PM - Asset tracking

Asset tracking solution overview

Efficient tracker solutions for smart pallets

BlueNRG-LP wireless SoC for BLE-enabled applications

Smarter supply chains: goods guarantee with NFC Sensor Tag

Ultra wideband technology for industrial indoor positioning

Exhibit hall

Asset Tracking

With its broad product portfolio and full set of evaluation platforms, ST offers a complete solution to address your asset tracking applications

< Back to IoT & 5G - Part 2

Comprehensive asset tracking solution
Discover our complete offering for asset tracking applications and pre-integrated solutions to speed-up your development

Efficient tracker solutions for smart pallets
Learn more about ST solutions for smart trackers implemented in pallets to locate assets' position inside logistics hubs

Outdoor realtime tracking
Enabling powerful and efficient real-time monitoring system for container tracking, vehicle tracing and geo-fencing

Smarter supply chains: goods guarantee with NFC Sensor Tag
Monitoring of goods to provide supply chain stakeholders with information to effectively apply warranty conditions

Stay tuned!

12:30 to 2:10 PM
Asset tracking

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3:00 to 4:40 PM – Smart factory

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High-performance STM32 MCU for industrial applications

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Simple IIoT condition monitoring solutions

Session 3
Versatile IO-Link transceivers for factory automation

Session 4
Optimize manufacturing processes and warehouse operations

How to track pallets from the warehouse to final destination ?

Efficient tracker solutions for smart pallets

SensorTile.box

STEVAL-MKSBOX1V1
Wireless multi sensor development kit with user friendly app for IoT and wearable sensor applications

SensorTile.box
Ready-to-go IoT node

Built into a compact IP54 casing

Bundled with app for Smartphone

Motion sensors

Low-power 6-axis IMU, embedded Neural Network
LSM6DSOX

High-performance accelerometer
LIS3DHH

Low power accelerometer
LIS2DW12

Magnetometer
LIS2MDL

Environmental sensors

Altimeter / Pressure sensor
LPS22HH

Accurate temperature sensor
STTS751

Humidity sensor
HTS221

Analog wide-band microphone
MP23ABS1

Processing

STM32 low-power MCU
STM32L4

Connectivity

Bluetooth Low Energy Module
BlueNRG-M2SA

Power management

Battery charger
STBC02

Mobile app

ST Asset Tracking

On google Play store and Apple App store
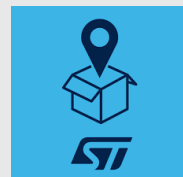
Cloud dashboard

DSH-ASSETRACKING

Cloud Amazon-based web application for asset tracking

Function Packs

FP-ATR-BLE1

Firmware package for asset tracking using BLE connectivity

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Demo setup

**SensorTile.box
with FP-ATR-BLE firmware**

**Smartphone
with ST Asset Tracking app installed**

**Laptop with DSH-ASSETRACKING
dashboard on Chrome browser**

Sigfox
backend

SensorTile.box
Ready-to-go IoT node

- Motion sensors
- Environmental sensors
- Processing
- Connectivity
- Power management
- Mobile App
- Cloud dashboard
- Function Packs

Stay tuned!

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ST LIVE DAYS

Live sessions

BlueNRG-LP wireless SoC for Bluetooth® Low Energy-enabled applications

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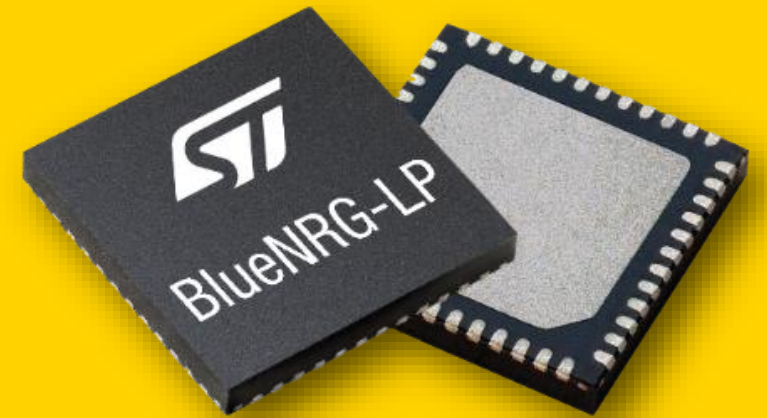
BlueNRG Family : a cost-effective value line

Flexibility

Portfolio to fit application and associated technical requirements
From basic add-on to SoC

Simplicity

Single-core architecture
Powerful SDK with SW examples and smartphone app in source

Customer support

Hardware and software design checks and guidance
RF bring up & pre-certified

Bluetooth® Low Energy 5.2-certified SoC

Low-Power
BLE programmable SoC

Go faster, go further!

- **High-speed 2 Mbps** for faster data transfer
- **Long range** (125 / 500 kbps) connectivity
- **Advertisement Extension** and Dataset
- **Improved channel selection** and mapping
- **GATT Caching for** energy-efficiency improvements
- **Up to 128 concurrent connections**

LONGEVITY 10 YEARS COMMITMENT

**BlueNRG-LP part numbers
Portfolio scalability**

QFN48	BlueNRG-345M	BlueNRG-355M
QFN32	BlueNRG-345A	BlueNRG-355A
WLCSP49	BlueNRG-345V	BlueNRG-355V
	32Kbytes RAM	64Kbytes RAM

BlueNRG-LP vertical markets

Tracking and monitoring

Asset tracking and beacons

- **Ultra-low power consumption**
- Market leading BLE range
- SigFox LPWAN with S2-LP
- **Cost optimized** (2-layer PCB, integrated Balun & xtal caps, device variants)

People and animal tracking

- Social distancing and tracing, worker tracking, pet & livestock tracking
- Ultra-low power

Lighting and building automation

- Lighting, ventilation, heating, HVAC, smart locks
- MESH, +105ºC, security
- Adv. ext., Long Range, CSA #2

Industrial applications

Industrial connectivity

- Remote UI, remote control units
- Enhanced processing & peripherals
- Audio IF (PDM, Analog, I2S)

Smart tools and appliances

- Future proof with BTH5.2 certification
- Flexible architecture

Healthcare, wearables

- Auto injectors, dispensers, inhalers, sports sensors
- 10 years longevity, security

Consumer applications

Personal electronics

- Toothbrush, shaver, e-cigarette, massage tools, gaming, etc.
- 2Mbps PHY and secure OTA

Connected toys, consumer robots

Toys, robot vacuum, lawn mover, pool robot. etc.
Flexible architecture (SoC or add on)
Cost optimized

An easy way to implement Bluetooth® LE

Flexibility

Simplicity

Customer support

Stay tuned!

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ST LIVE DAYS

Live sessions

Smarter supply chains: goods guarantee with NFC Sensor Tag

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How can I monitor the status of my goods during shipment in a cost effective way ?
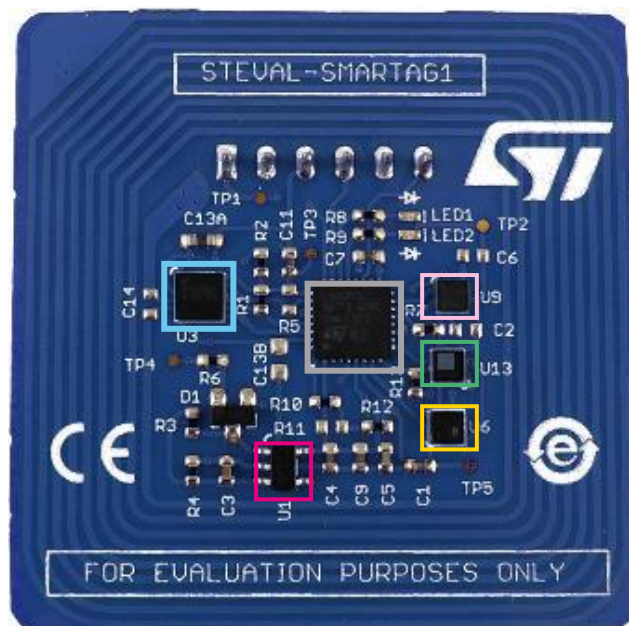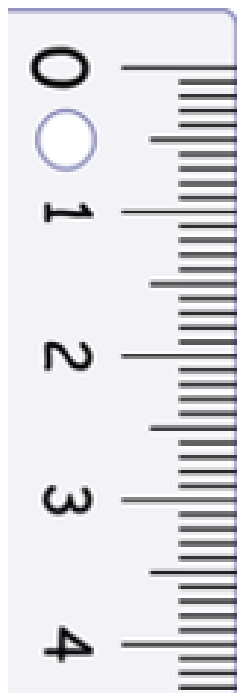
Smarter supply chains: goods guarantee

NFC Sensor TAG

STEVAL-SMARTAG1
Ultra-low power sensor node that collects and logs sensor data, before sending it to a secure NFC reader within range

NFC Sensor Tag evaluation board STEVAL-SMARTAG1

- **ST25DV64K,** NFC Dynamic Tag
- **STM32L031,** MCU ARM Cortex M0+
- **STLQ015,** Low Drop Linear Regulator
- **HTS221,** Temperature & Humidity sensor
- **LPS22HB,** Pressure sensor
- **LIS2DW12,** Accelerometer

NFC

Mobile app	Cloud dashboard	Function Packs
ST Asset Tracking	**DSH-ASSETRACKING**	**FP-SNS-SMARTAG1**
On Google Play store and Apple App store	Cloud Amazon-based web application for asset tracking	STM32Cube function pack for IoT node with Dynamic NFC Tag, environmental and motion sensors

STEVAL-SMARTAG1
with FP-SNS-SMARTAG1 firmware

Smartphone
with ST Asset Tracking app installed

Laptop with DSH-ASSETRACKING
dashboard on Chrome browser

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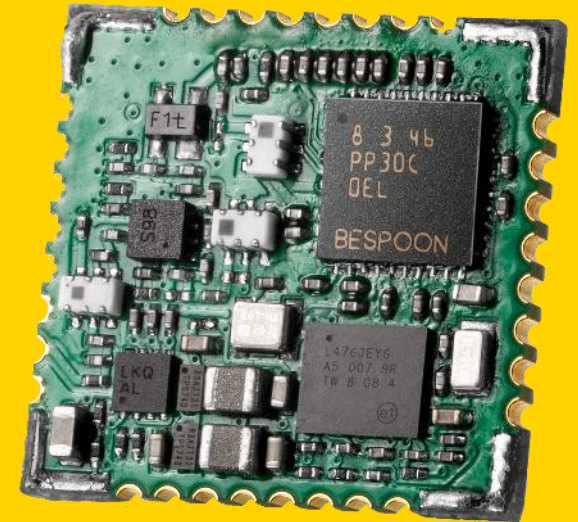Optimize manufacturing processes and warehouse operations

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Real-Time Location System (aka RTLS)

UWB module MOD1

- Mature solution
- Deployed in Industry 4.0 projects

TRUMPF Track&Trace

**UWB-based
real-time location system**

What our workshop looks like

What makes UWB robust, scalable and sustainable?

- Unlike other technologies, UWB is not about the measurement of signal strength. We measure the time of flight of a very short radio pulse.
  Short pulses of 2 ns generate a modulation over large bandwidth, hence the name UWB.

- Radio pulses travel at the same speed across air, bodies, walls, etc.
  The measurement is not affected by attenuations. But radio pulses travel at the speed of light.

➔ We need a **very good chronometer** (current generation ticks once every 125 ps)

➔ Devices must **be synchronized** with a high level of accuracy (only a few ppB drift)

Strengths of UWB Real Time Location Systems

- Reconstructed Time-of-Flight (RToF) algorithm ➔ **robustness, high density**

- Adaptable density ➔ **cost effectiveness**

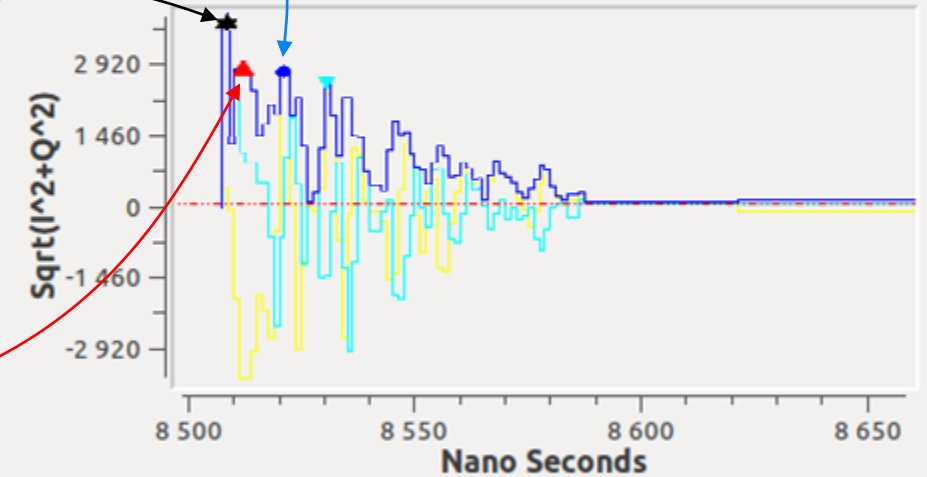- Low sensitivity to multipath / interferences ➔ **reliability**

Achieving reliable distance measurement

MARKER in
TRUMPF Track&Trace

Tracker for smart factories

Addressing the cost issue of RTLS
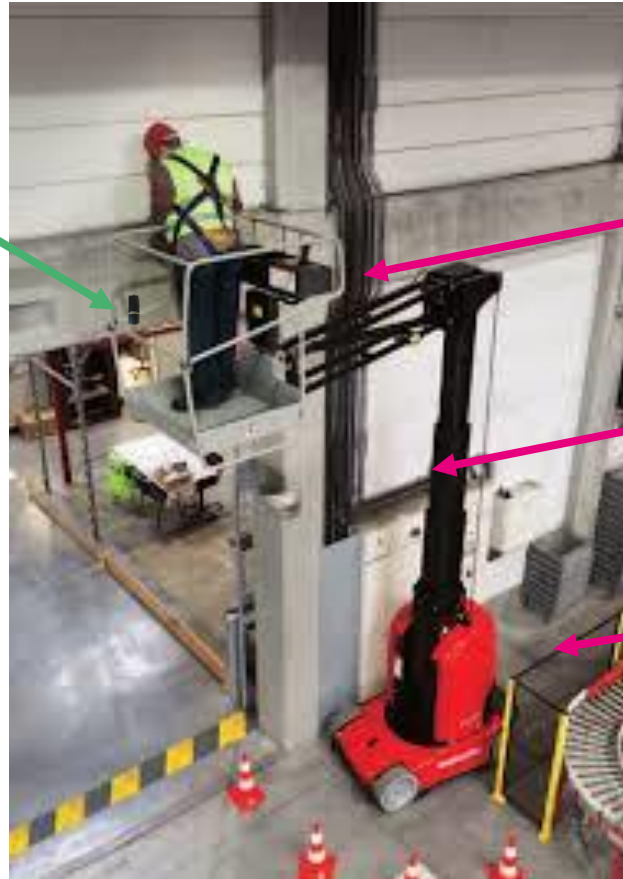
Tag cost is only the tip of the iceberg

Tag costs affect scalability

The real issue is the **entry ticket**

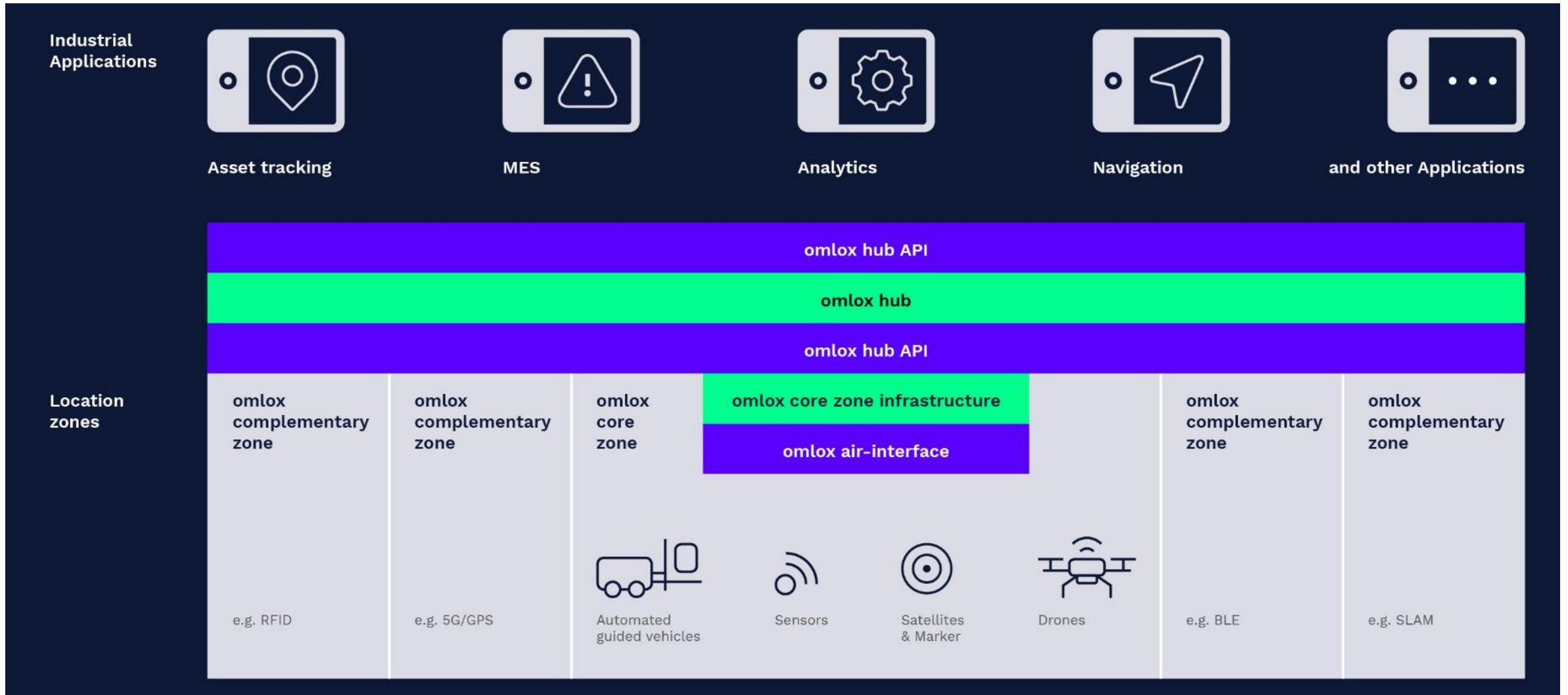# Entry ticket is the cost of infrastructure

Satellite $

Manpower $

Wiring $

Tooling $

Hardware infrastructure cost adds on to service cost

life.augmented

Solution lies in standardization

omlox

Standardization creates an ecosystem

- Main issue with current RTLS market is <mark>fragmentation</mark>
  - like cellular communications in 80's, prior to GSM standard
  - a lot of monolithic, incompatible offers

Unified system:

Advantages for customers	Advantage for suppliers
Sustainability (supplier default mitig.)	Access to a wider market
Lower prices (sound competition)	Focus on their own added value
Mutualization of RoI	Benefit of incremental cost

Mutualizing expenditures reaching break-even point

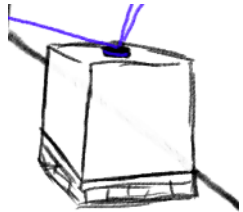|	Entry Ticket	ROI 6 months	ROI 1 year
Anticollision	100	40	80
Asset Tracking	100	60	**120**
Navigation	100	30	60
TOTAL	**100**	**130**	**260**
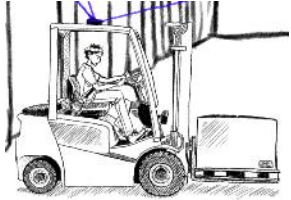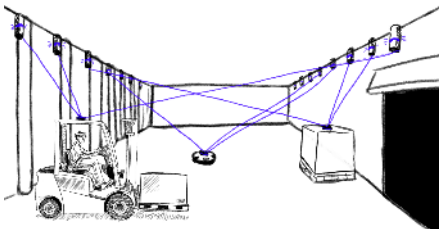
Tracking one single, fast-moving mobile device very precisely, at very high speed, using 6 evaluation boards:

- 5 boards used fixed bases

- 1 board used as mobile device
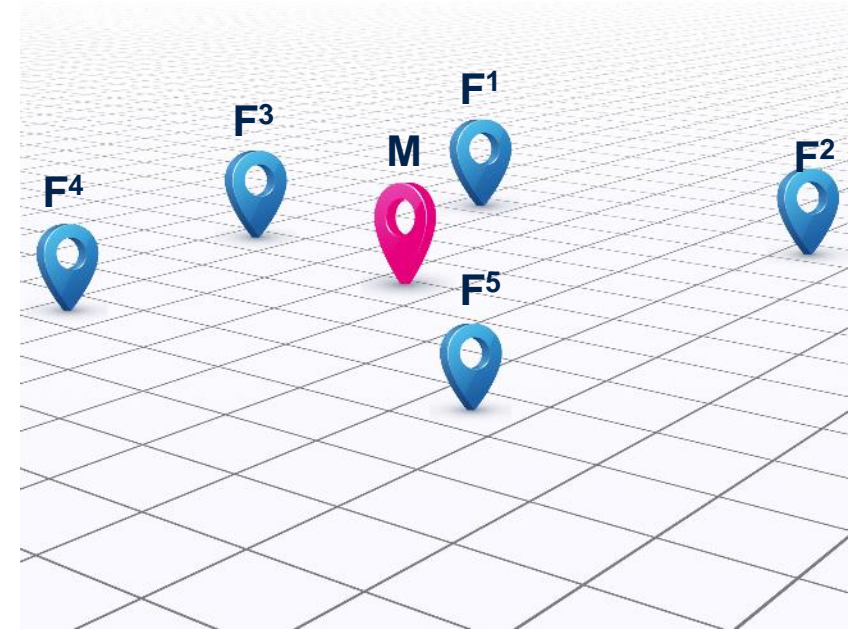
M = mobile board / F^x = fixed boards

M's real-time position computed on board and provided at M interface (UART link)
➔ Stream of 3D coordinates – terminal app
➔ Visualization – client app

Thank you!

ST LIVE DAYS