EASYTECH

DÉCOUVREZ LES COMPÉTENCES DES LABORATOIRES QUI INTERVIENNENT DANS LE PROGRAMME EASYTECH

20 ANS MINALOGIC Auvergne-Rhône-Alpes

NANOELEC.

Le programme

EASYTECH
L'INNOVATION FACILE POUR LES PME

De NANOELEC.

Partenaires ORDC CAP'TRONIC, GRENOBLE INP UGA, cea

Focus microélectronique, photonique/systèmes embarqués

Soutenu par FRANCE 2030, + clermont auvergne métropole, SÉM SAINT-ÉTIENNE la métropole, valence romans AGGLO

LS2PR, Signal, Protocols and Radio platform lab

Benoit Miscopein

LS2PR in LETI

Directeur du CEA-Leti

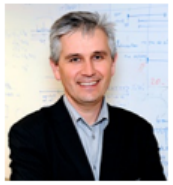
Sébastien Dauvé

Assistante :
Virginie Pochat

Unités opérationnelles

DOPT
Cyril Fellous

DTIS
Virginie Brun



DCOS
Olivier Faynot

DSYS
Fabien Clermidy

DPFT
Anne Roule

3 services

STSF - Service Technologies Sans Fils

Dimitri Ktenas

Adjoint : Eric Mercier

Assistante : Cindy Scannella

3 Labs

LS2PR - Laboratoire Signal Protocole
Plateforme Radio **Benoit Miscopein**

40 **staff**

45 **articles per year**

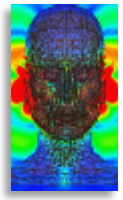
12 **patents per year**

Wireless technologies department (DSYS/STSF): research axes

110+ persons, 110+ publications & 30 patents / year

Antennas optimization

Miniature
Smart
Integration



Channel propagation modeling

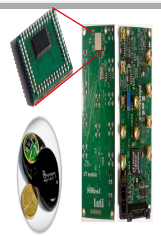
Characterization
Modeling
Emulation

Contactless

Arduous application
VHBR (Very High Bit Rate)
Power harvesting

Specification of RF transceiver solution

Architecture definition
Model development
Specs derivation



ASIC design and implementation

IC Design of key enabler RF functions
Design full RF front end transceiver
Analyze impact of technology

RF characterization and validation

ASIC test and characterization
HW in the loop for RF validation

Signal Processing

Physical layers
Disruptive air interface
Multimodal localization algorithms

Protocols

Network architecture
Orchestration & smart protocols
Communication, Compute and Control

Radio Platforms

HW/SW implementation
Advanced prototyping & customization
Demonstration platforms

COMMUNICATION & SENSING

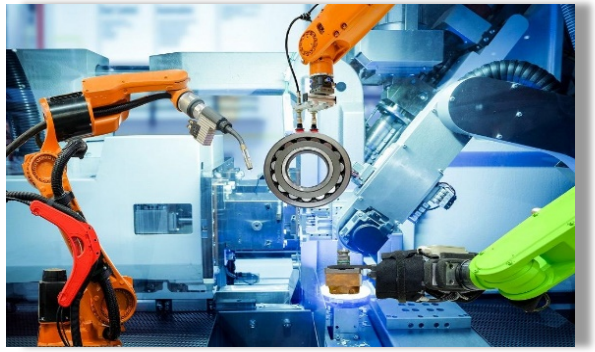
RF IC and RADIO LINK DESIGN, OPTIMIZATION & CHARACTERIZATION

ANTENNAS MINIATURIZATION & INTEGRATION

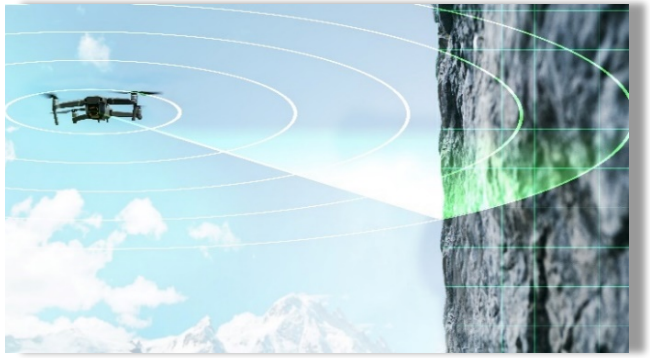
RFID SOLUTION DESIGN FOR HARD ENVIRONMENT

LOCALIZATION, NAVIGATION & SENSING

Connectivity on the move



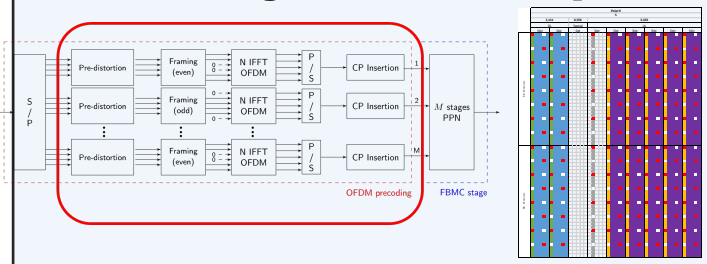
Industrial IoT & traceability

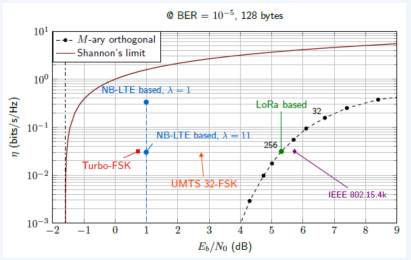


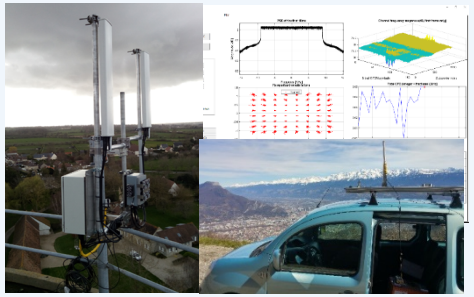
RF sensors

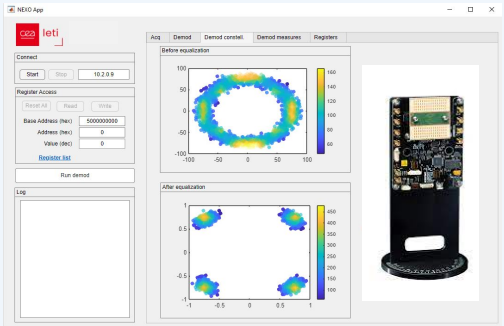
Lab field of expertise

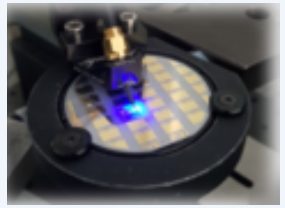
Wireless system development



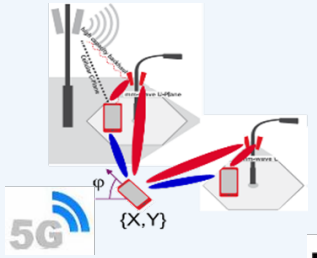


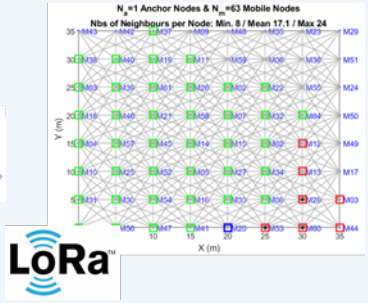


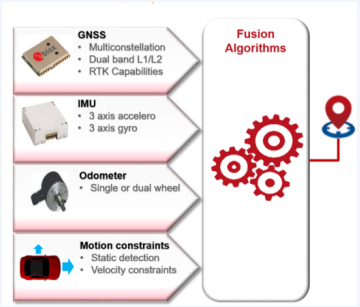


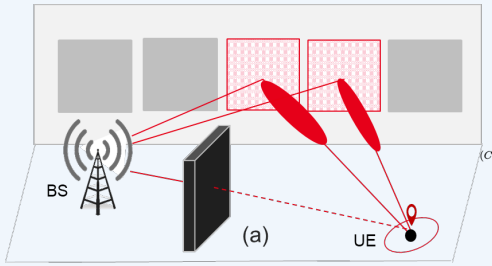


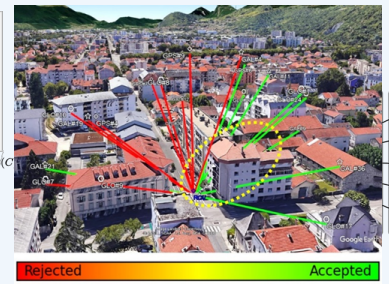
Localisation

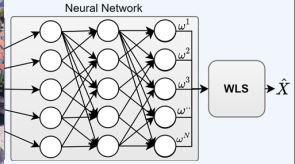




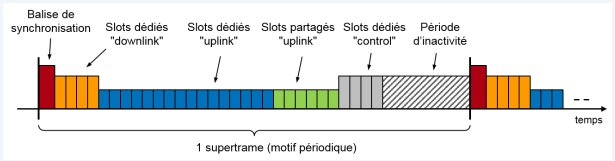


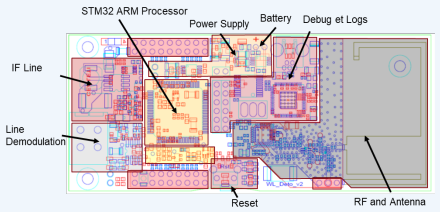


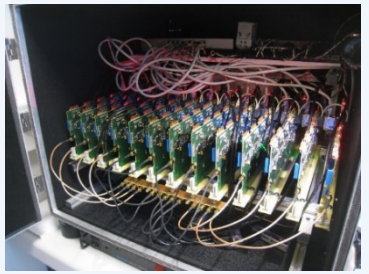




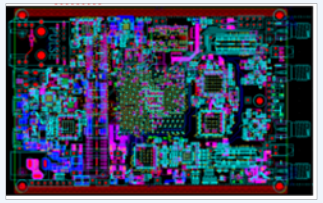
Custom radio protocols for critical IoT





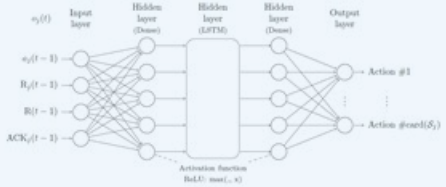


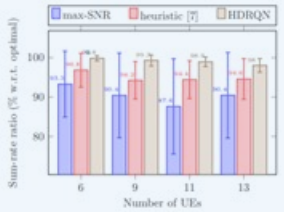
SDR platforms

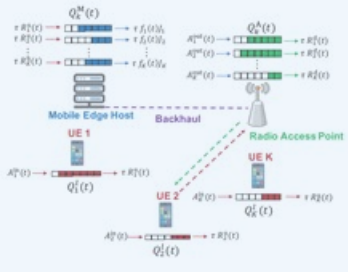


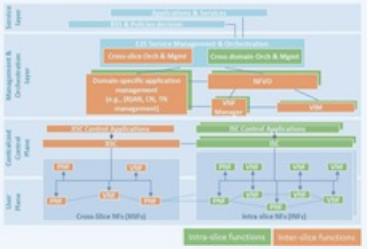
Lab field of expertise

Resource optimisation techniques

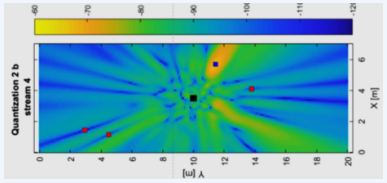


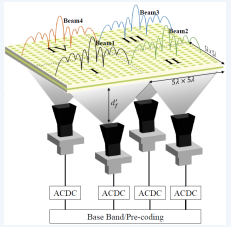


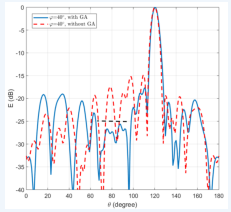


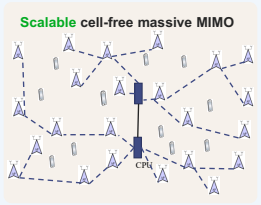


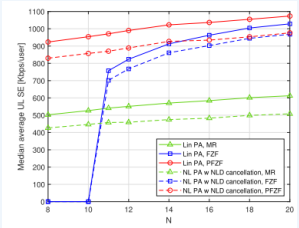
MIMO systems

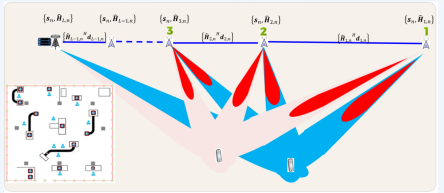




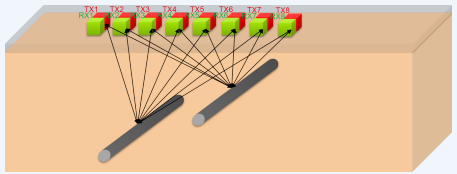


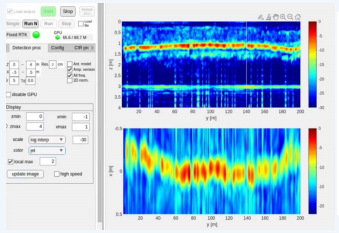


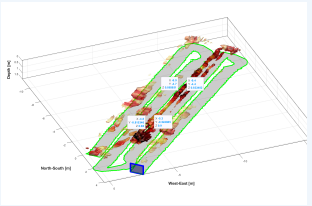


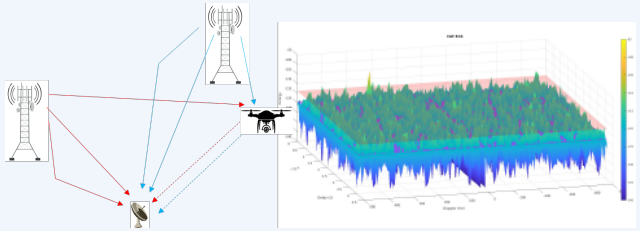


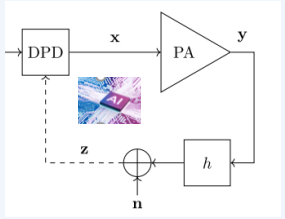
Signal processing

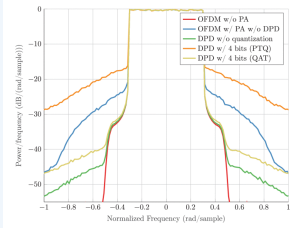




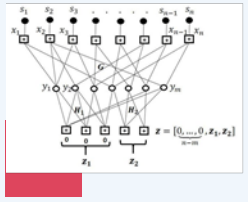


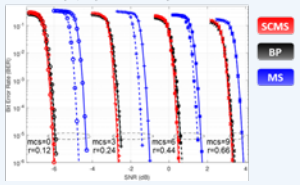


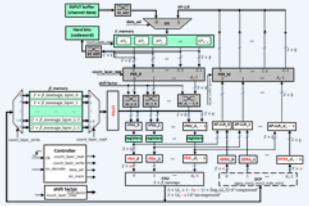


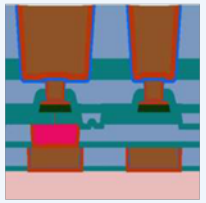


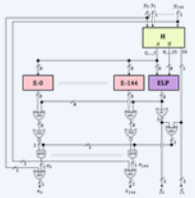
Error correcting codes

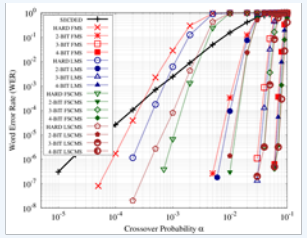


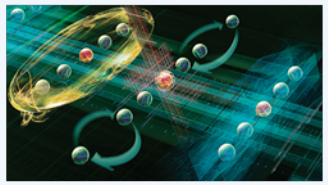


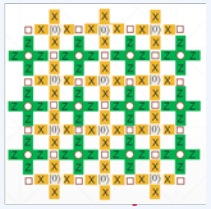













“deployment, safety, monitoring, tracking, ...”
To stay competitive or to reach new markets,
using a wireless technology could be a great opportunity


Off-the-shelf products or standardized protocols
can not cover all the requirements.
In this case, a custom solution is needed

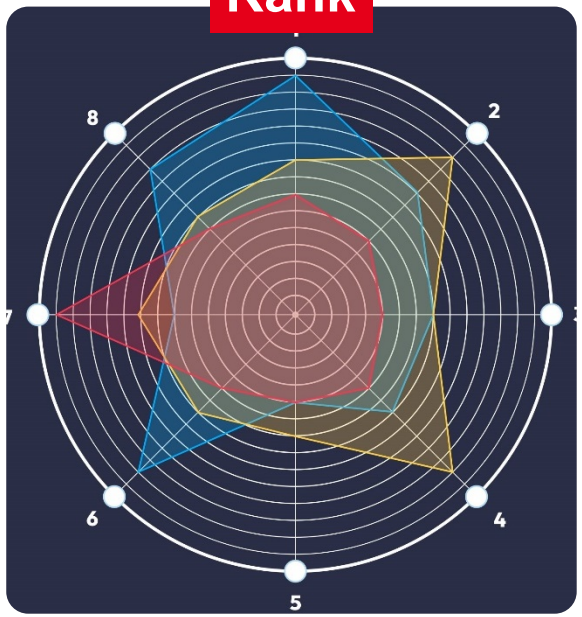
From research to industrialization : delivering wireless protocols for critical IoT applications

How we specify a custom protocol ?

Talk

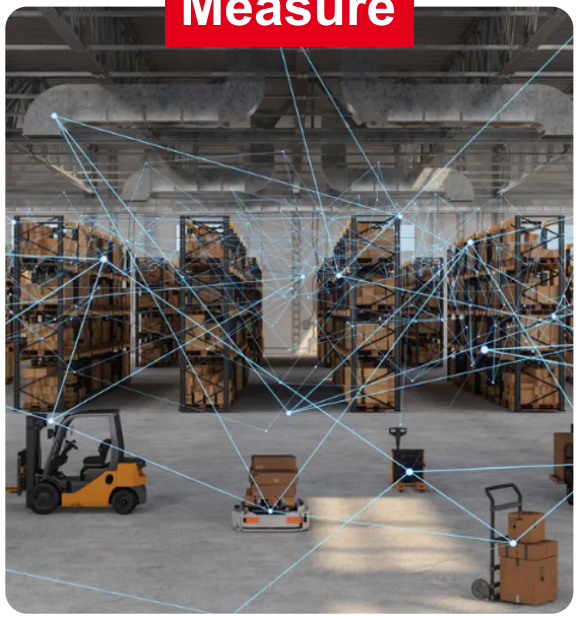
Understand the domain, use cases, KPIs

Rank



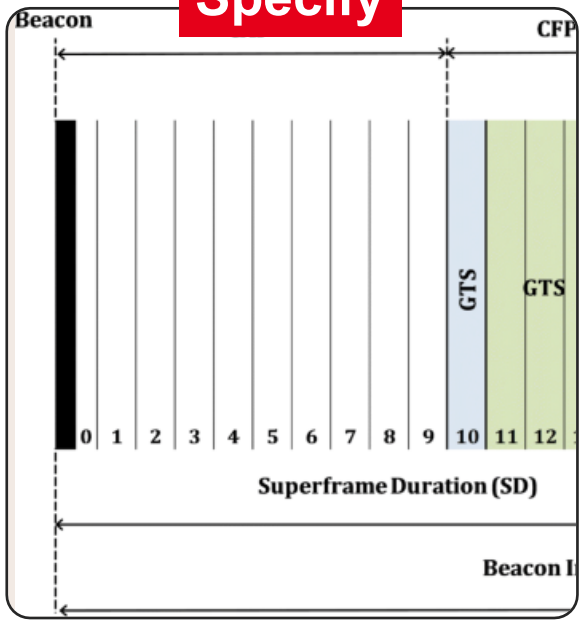
From research background, regulations, COTS

Measure



Find out the physical layer parameters

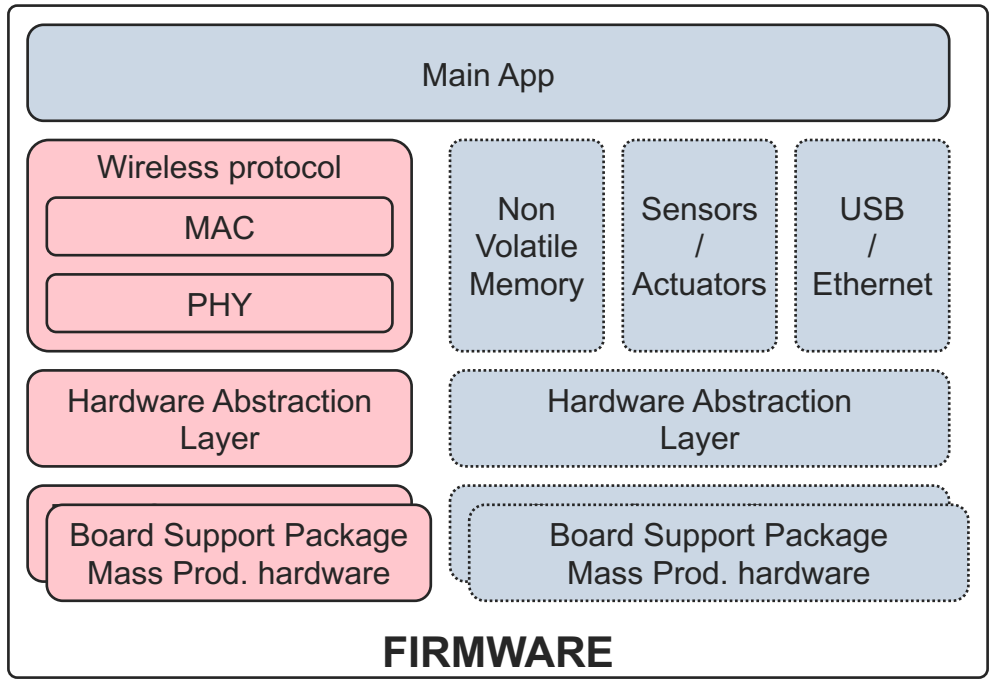
Specify

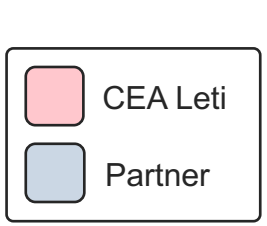


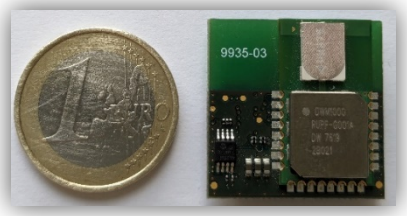
Sizing, commissioning

From a proof of concept to the final product

Allocating responsibilities within the system architecture







CEA Leti is entirely focused on the protocol stack software development

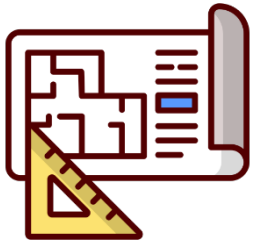
- The partner, or its subcontractor, develops the part related to its know-how and integrate our wireless protocol stack
- We support all hardware versions up to the mass production

Anticipating the industrial transfer

Delivering stable and very-well tested intermediate software versions

Releases with a clearly defined content

Precise list of evolutions and bug fix, associated documentation, deadline for completion

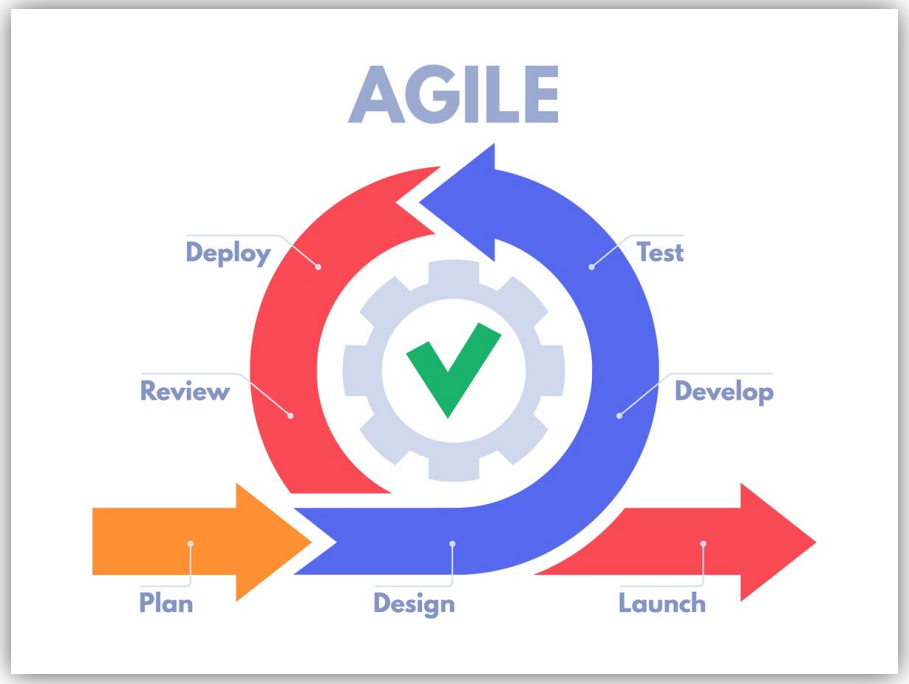


Modular and documented software architecture to ease the integration

High-level API to describe MAC layer services, scheduling constraints to preserve the real-time behavior

Continuous integration to maintain a high TRL level and to prevent non-regression

Coding rules, no compilation warnings with the most demanding flags, static analysis, unitary tests and system tests

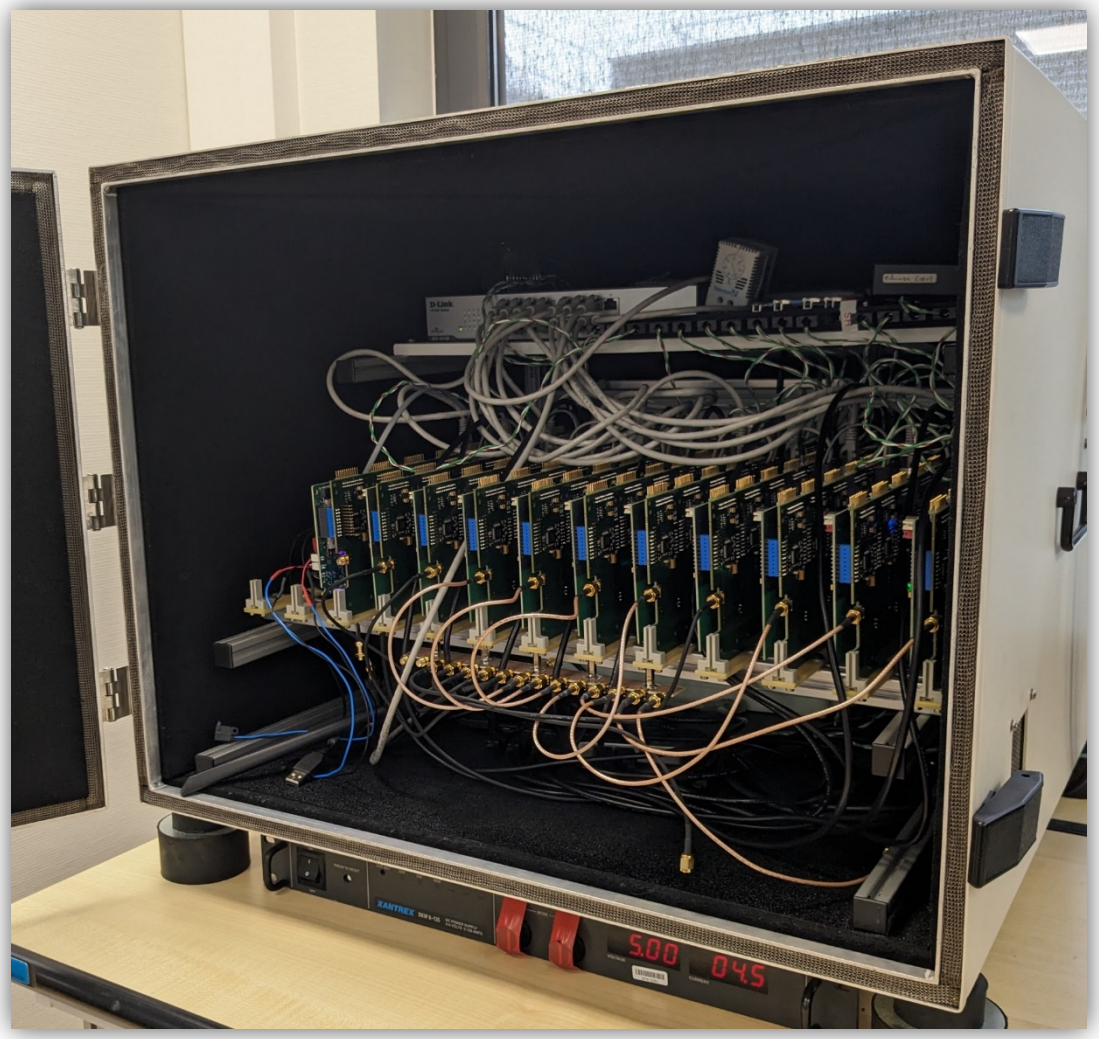


Pushing the limits of the non-regression principle

Dedicated system test bench with a high number of independent devices

Play scenarios to challenge the stack on all network topologies

- 13 racks of 7 devices that collects **hardware** and **software** event logs, timestamped on a common time basis (~10 µs accuracy)
- Analyse by **post processing** to check main characteristics of the protocol : synchronization, TX/RX events, transceiver states, superframe period, ...



3 recent examples of industrial transfers

Mining

Industry 4.0

Smart building


Deploying detonators is a long and tedious process
which can lead to reliability issues.
The number of detonators that can be fired is limited.

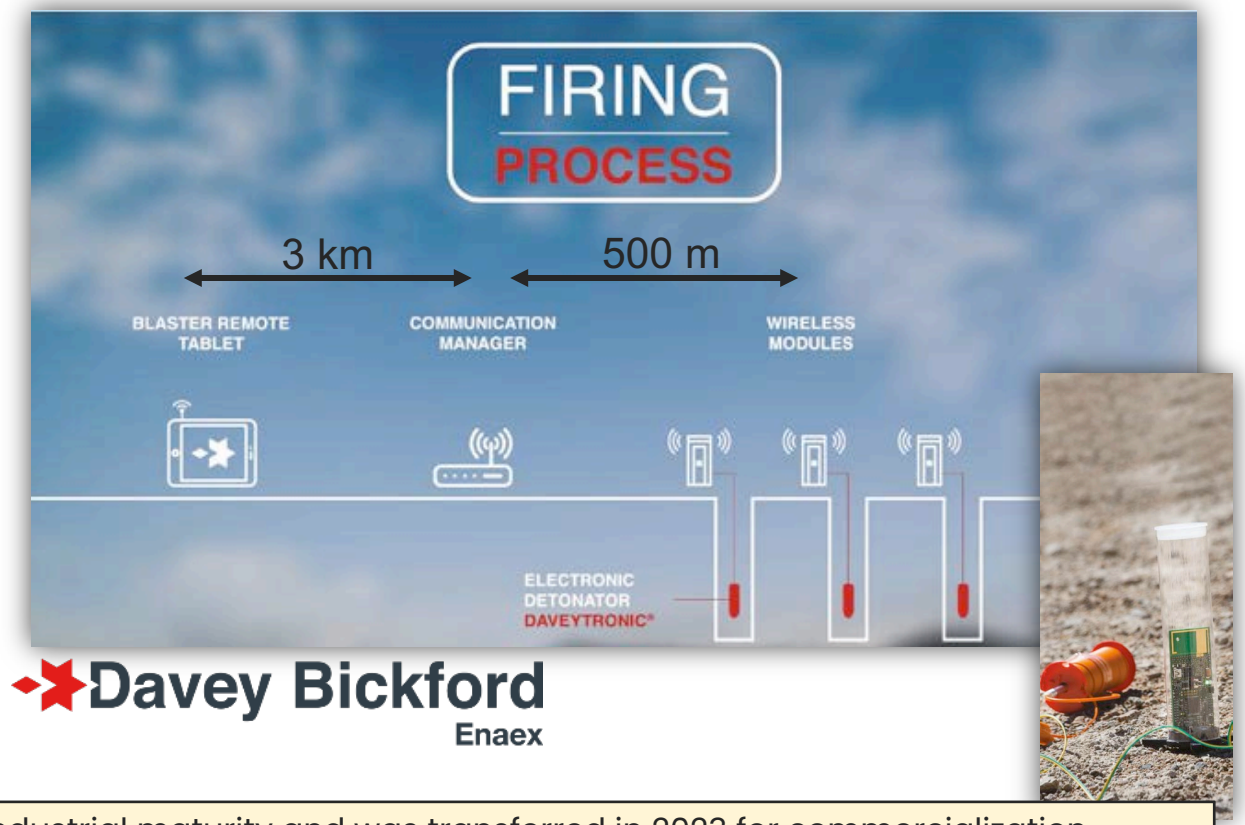
Go beyond the limits of the wired system

Highly reliable long range bidirectional protocol at UHF (868/915 MHz)

PATENTS 4 PATENTS

Support 1000s of wireless modules, with a reduced procedure time and an improved firing timing accuracy (~10 µs)

- Compliant with American (FCC) and European (ETSI) radio regulations
- Compliant with EN 13763-27 [1] regulation



The technology has reached industrial maturity and was transferred in 2023 for commercialization.

[1] Explosives for civil uses. Detonators and relays. Part 27: Definitions, methods and requirements for electronic initiation systems


Tracking battery-operated tools
in a car assembly line is becoming a necessity
to comply with manufacturing standards

Locating objects in a harsh environment

Ultra Wide Band customized protocol

The technology is commercialized since 2020

The solution is reactive and optimized to manage up to 64 tools

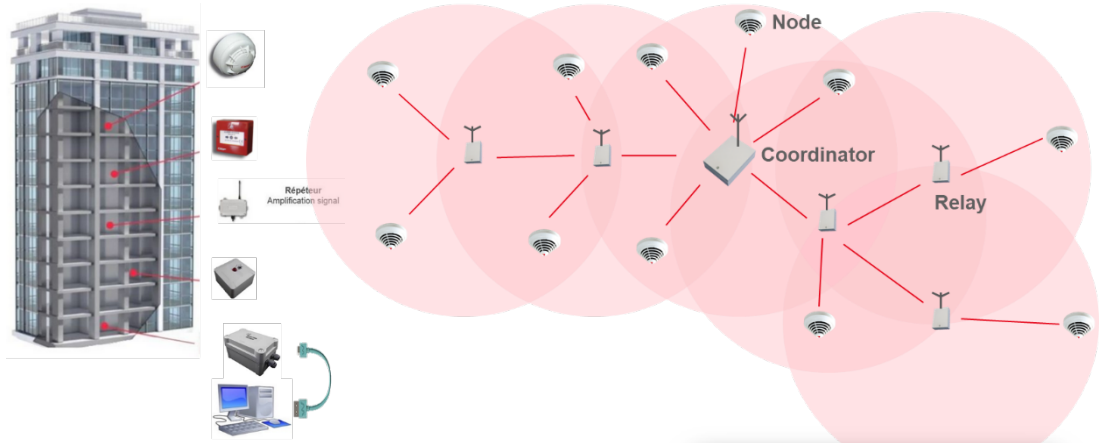
The localization infrastructure is very easy to deploy

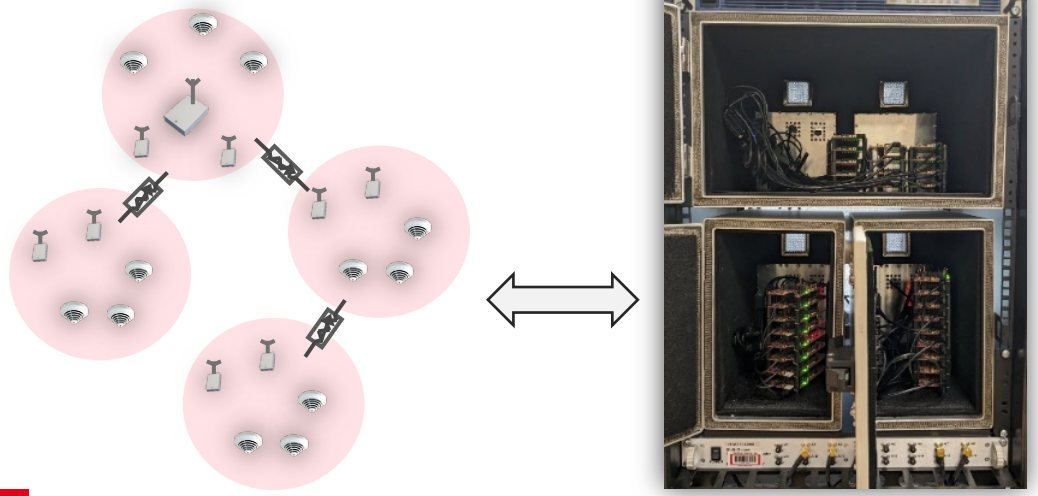
- 10 cm ranging accuracy, 250 ms latency to detect a zone crossing
- UWB network anchors auto positioning
- Location algorithm embedded in the tool
- Based on COTS components


Installing emergency detectors
is costly and time-consuming,
especially in existing buildings

How to cover a building with several floors ?

Tree-relayed low-power protocol for emergency detection sensors and actuators





The protocol is resilient to radio interferences, relay failures and sudden temperature rises

- Multi-hop topology : 1 coordinator, 128 devices, 3 hops
- 3 years battery life
- Dedicated test bench to validate the protocol on various topologies

This technology has been transferred in 2020
Security features added in 2024


CEA Leti develops and transfers
high-TRL custom wireless protocol stacks
for industrial IoT applications
Research
for industrial
innovation

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