Selected ongoing EU funded R&D projects in Cybersecurity and advanced communications systems

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R&D Programs Manager
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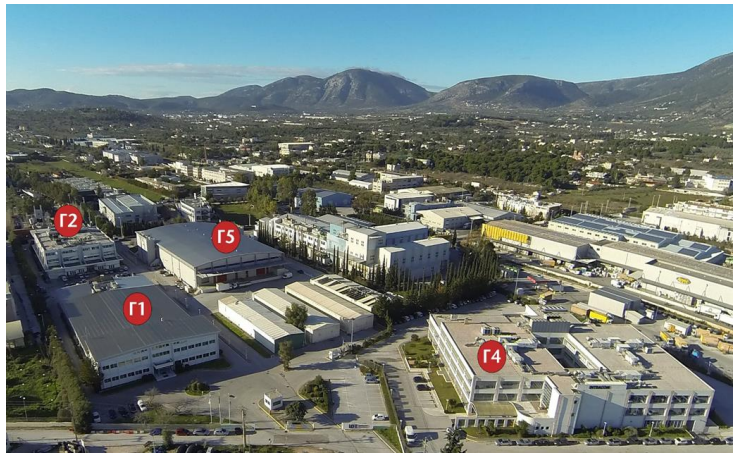
COMPANY PROFILE

- Leading Hellenic Communications and Electronic Systems Industry in the Defense and Security area
- Member of the Intracom Holdings group
- Proven record since: 1992
- Revenue: € 60 M (2021) – more than 90% from exports
- Employees: 430
  (62% Postgraduate and University Studies)
- Investments in R&D: 7% of annual revenue
- State-Of-The-Art R&D infrastructure and verification laboratories
- Manufacturing Capabilities (Floor Space 7.300m^2)
- Several certifications, such as QM certifications ISO 9001:2015 and EN/AS 9100:2018 (D)



INTERNATIONAL RECOGNITION

2005 — Raytheon
Appreciation for the extraordinary contribution to the production of the Patriot System

2006 2009 — Boeing
Appreciation for IDE outstanding support to the AWACS NATO Mid-Term Program

2011-2019 — Raytheon Supplier Excellence Award

2011 — EU Parliament
IDE classified as International competitive company

2013 — Saab
Appreciation award for the Arthur Program

2016 — Active Greece Awards
High Percentage of exports

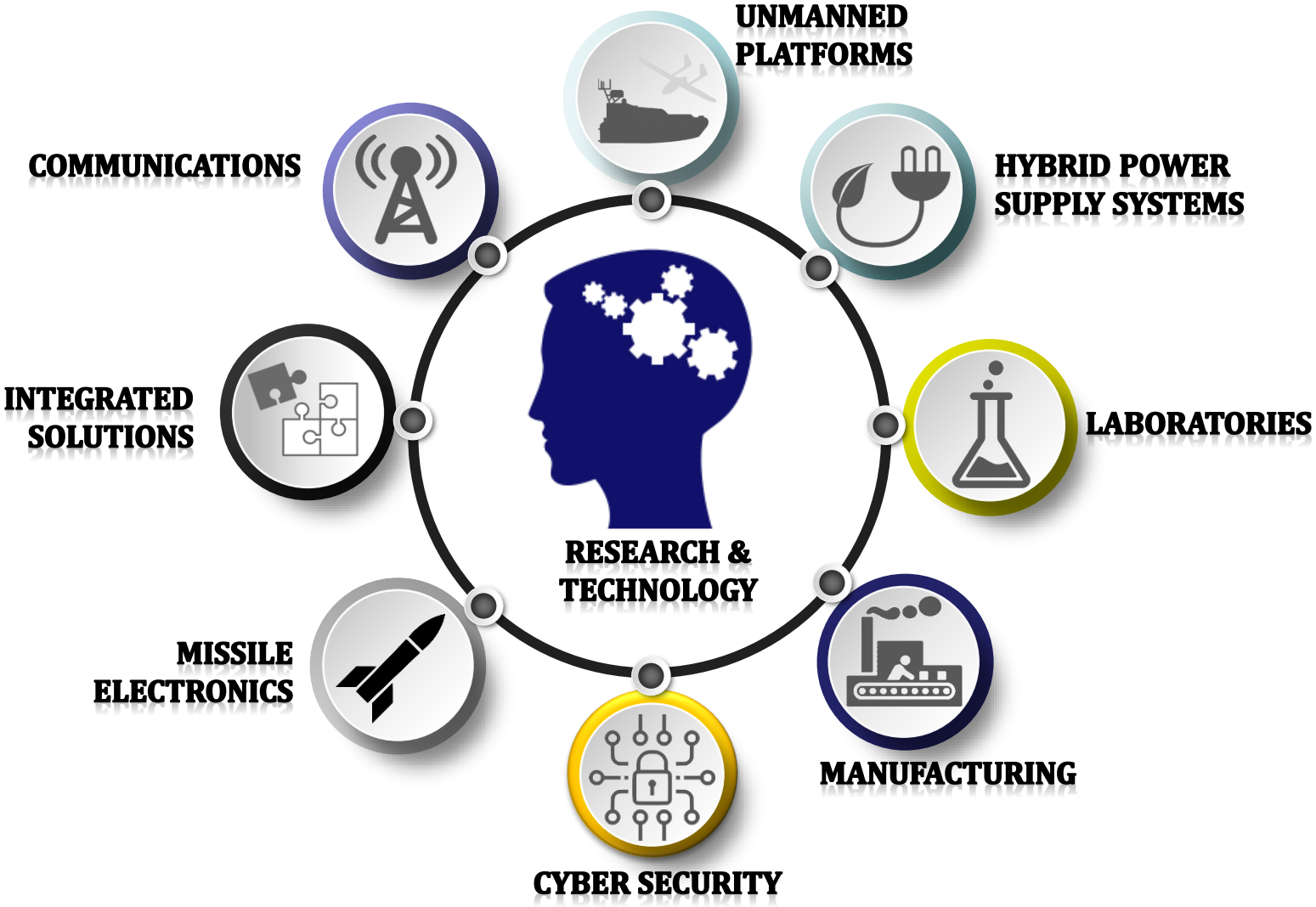
2017 2018 — Fortune Magazine
IDE in the list of the 30 Fastest Growing Companies in Greece

2018 — Creative Greece Awards
High Percentage of exports

2019 — Made in Greece
Golden Award for Export Excellence of Industrial Product

IDE exports reach 4% of the total Hellenic exports to the USA over the last 7 years

TECHNOLOGY AREAS



DEFENSE PRODUCTS

INDUSTRIAL COOPERATIONS

RESEARCH & TECHNOLOGY PROGRAMS

e-COLORSS

***E**uropean **CO**mmon **LO**ng **R**ange Indirect Fire **S**upport **S**ystem*

ODIN'S EYE

Multinational Development Initiative for a Space-based Missile Early-warning Architecture

PRIVILEGE

PRIV**acy and homomorph**I**c encryption for artificia**L** int**E**lli**G**enc**E

HERMES

***H**igh **E**fficiency wi**R**eless C**M**OS transceiver boosted by artificial intelligenc**E** for 6G band**S** and beyond*

LOTUS

***L**ow **O**bservable **T**actical **U**nmanned air **S**ystem*

INTERACT

***INTER**operability Standards for Unmanned **A**rmed For**C**es Sys**T**ems*

SMOTANET

Development of **S**oftware Defined **MO**bile Ad-hoc **TA**ctical **NET**work Devices and Testbed

SPARK Transponder

DELAER

***DE**velopment of a novel BWB UAV p**L**atform for r**A**pid delivery of liv**E**saving supplies in Greek isolated Te**R**ritory*

HCUAV

Hellenic Civil Unmanned Air Vehicle

AVICOM

Innovative Communications System to increase situational awareness in the event of natural disasters

OCEAN 2020

***O**pen **C**ooperation for **E**uropean m**A**ritime aware**N**ess*

RE-COGNITION

***RE**newable **COG**eneration and storage tech**N**ologies **I**ntegra**TI**on for energy aut**ON**omous buildings*

SMOTANET Project Info

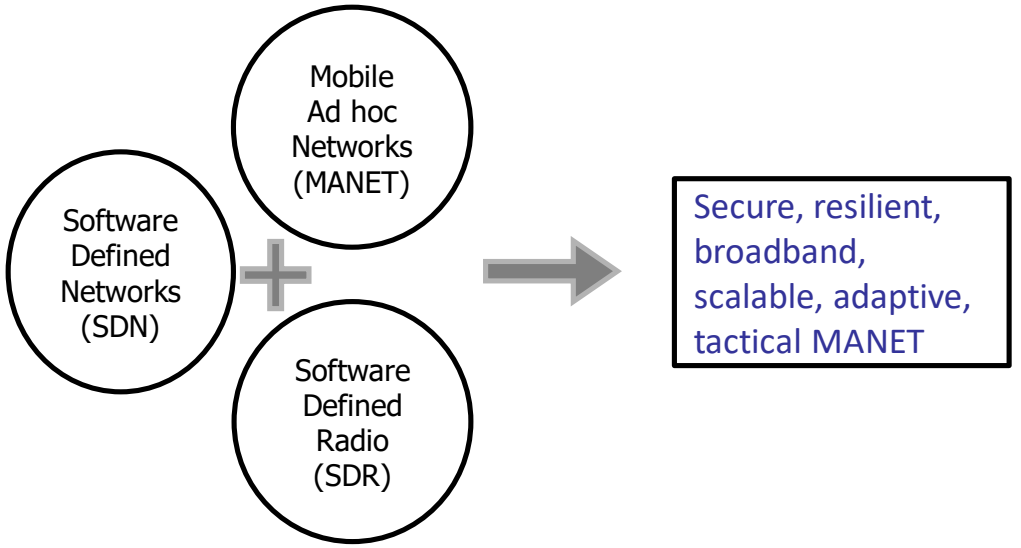
- **Title:** Development of Software Defined Mobile Ad-hoc Tactical Network Devices and Testbed
- **Instrument:** EDIDP (European Defense Industrial Development Programme) 2019
- **Project Budget:** 3,907,724.00 €
- **Duration:** 36 months; **Start:** 1/12/2020, **End:** 30/11/2023
- **Partners**: 5 (**IDE**, GRD, AUB, SGX, and ITT)
- **Supporting MoDs:** Greece and Cyprus
- **Project Logo:**

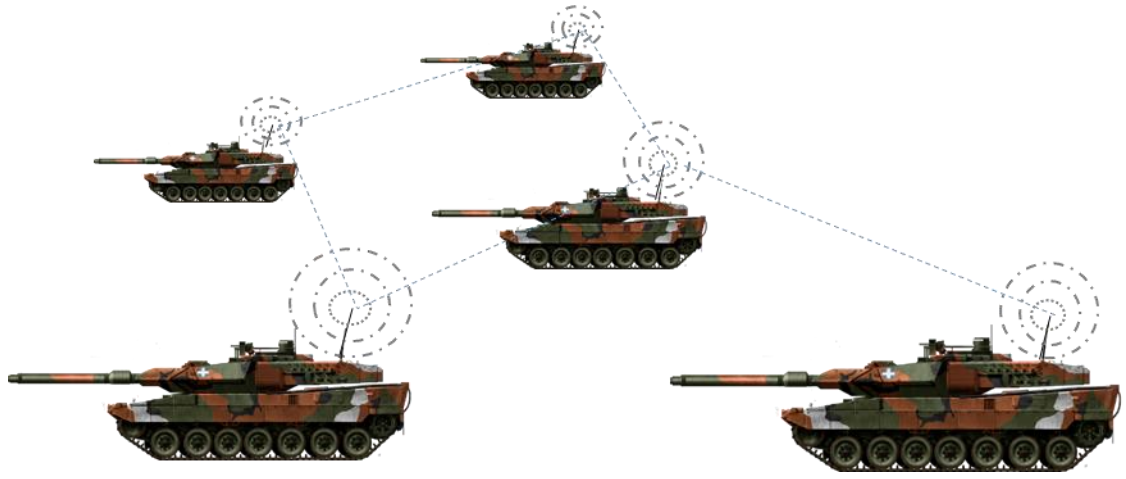
SMOTANET

This project has received funding from the European Defence Industrial Development Programme (EDIDP) under Grant Agreement No. EDIDP-CSAMN-SDN-2019-038-SMOTANET

SMOTANET Concept

- SMOTANET is an EDIDP project which aims to design an advanced wireless network suitable for tactical use.
- This network integrates 3 key technologies:
  - Software Defined Networking (SDN), Mobile Ad hoc Networking (MANET), and Software Defined Radio (SDR)
- And is designed following a cybersecurity-by-design methodology.
- In order to achieve the following characteristics: security / resilience, broadband communications, scalability, and adaptivity.

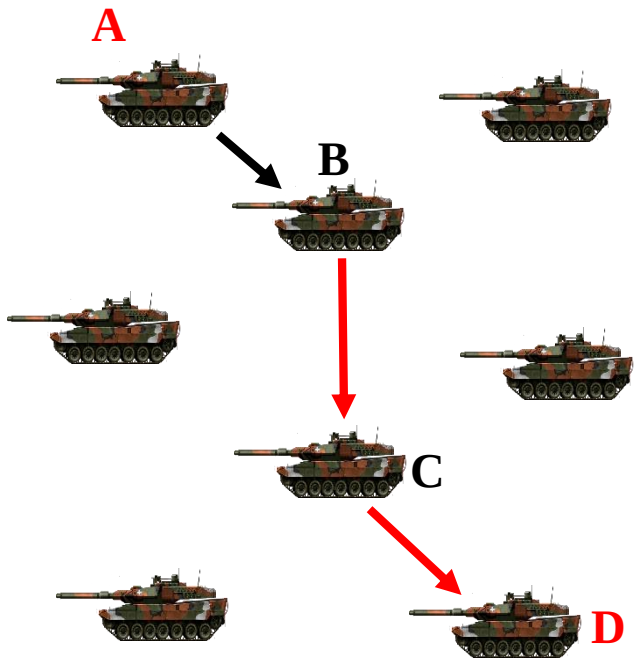




SMOTANET technologies: MANET

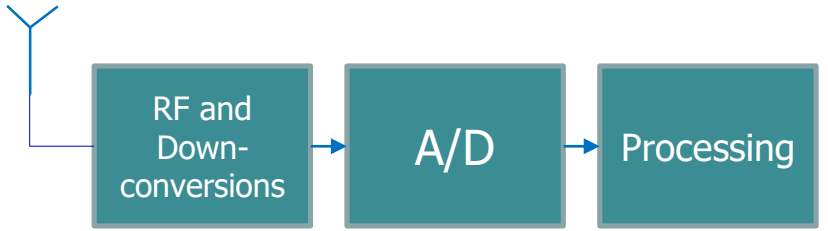
- A Mobile Ad hoc NETwork (MANET) is a collection of mobile hosts which communicate wirelessly and co-operatively form a network without using any fixed infrastructure or centralized administration.

- Key MANET characteristics of SMOTANET:
  - Nodes in vehicles (no severe SWAP restrictions)
  - Special mobility patterns
  - Nodes not only move but may be suddenly destroyed
  - Need for ease of deployment, self-configurability
  - QoS: minimum service interruption caused by topological changes.



SMOTANET technologies: SDR

- Software Defined Radio can be defined as Radio implemented in SW over general purpose HW modules.
- The idea is that one common hardware with elevated computational capacity and suitable software modules can replace all the traditional hardware modules of the transceivers.



- Key advantage: a different radio interface can be implemented on the same device by changing SW modules – easy upgrades.
- The wireless communication module in SMOTANET will be based on an IDE proprietary PHY and MAC protocol.
  - To address the need to comply with defense sector requirements (such as robustness to jamming).
- It will be implemented on a SotA SDR platform.

SMOTANET technologies: SDN

- Software Defined Networking (SDN) is a relatively new paradigm for computer networking.
- Based on a few simple principles:
  - Separation of control and data planes.
  - Replacement of all traditional network elements (routers, switches, NAT, firewalls, wireless APs) by a configurable SDN “switch”.
  - Replacement of distributed routing protocols by centralized algorithms with full network knowledge.
  - Monitoring and management of SDN switches from a central SDN controller.
  - The manipulation of data “flows” rather than isolated packets.

The challenge of bringing SDN to MANET

SDN relies in **separating control and data planes** and moving the control to a central omniscient controller.

- The controller holds the entire network description as a graph on which centralized optimization algorithms can be performed.
- Sends routing information to all switches in the network thus building their forwarding tables.

The centralized control in SDN contradicts with the dynamic nature of MANETs.

- Slow reaction to network topology, link quality, and traffic changes.
- Large control overhead.
- Single point of failure.

Key research effort in SMOTANET: to reap the benefits of SDN while overcoming the challenges introduced by the dynamic nature of MANETs.

The cybersecurity aspect

Key cybersecurity considerations:

- Cybersecurity by design
- Robustness – no single point-of-failure
- COMSEC / TRANSEC
- Implementing secure policies through SDN
- Secure OTA updates
- Secure logs for forensics analysis

PRIVILEGE Project Info

- **Title:** PRIVacy and homomorphIc encryption for artificiaL intElliGEnce
- **Instrument:** PADR 2019 PADR-FDDT-OPEN-03-2019
- **Project Budget:** 1,415,296 €
- **Duration:** 24 months; **Start:** 1/11/2020, **End:** 30/10/2022
- **Partners**: 4 (**THA**, CEA, CESNET, and IDE)
- **Project Logo:**

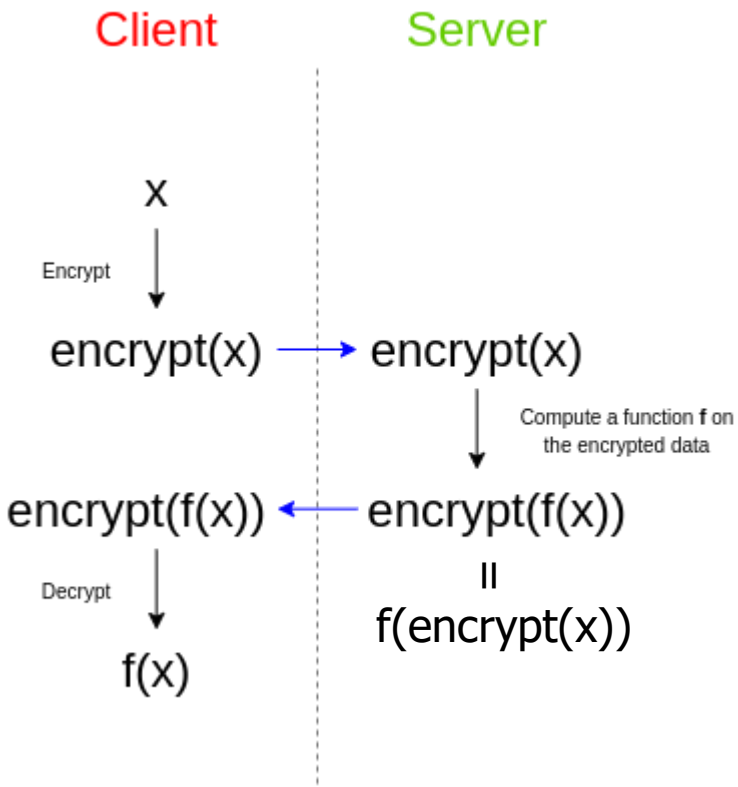
The PRIVILEGE project has received funding from the PADR-FDDT-OPEN-03-2019 Framework Programme of the European Union. The presented materials reflect only the presenter's views and the European Commission is not responsible for any use that may be made of the information contained herein.

PRIVILEGE Project Overview

- **Data sharing** between the members of an alliance (e.g., NATO) is unquestionably beneficial for training AI algorithms. However, unrestricted sharing of sensitive **military** training data between military partners is currently unthinkable.
- The main objective of PRIVILEGE is the design and the development of new **privacy-preserving collaborative machine learning training technologies**.
- The approach relies on the use of **Homomorphic Encryption** (HE), **Verifiable Computing** (VC), **Federated Learning** (FL), and **Private Aggregation of Teachers Ensemble** (PATE) technologies.
- PRIVILEGE solutions will be validated on three defense originated use-cases, namely, **waveform recognition**, **network cybersecurity**, and **video processing**.

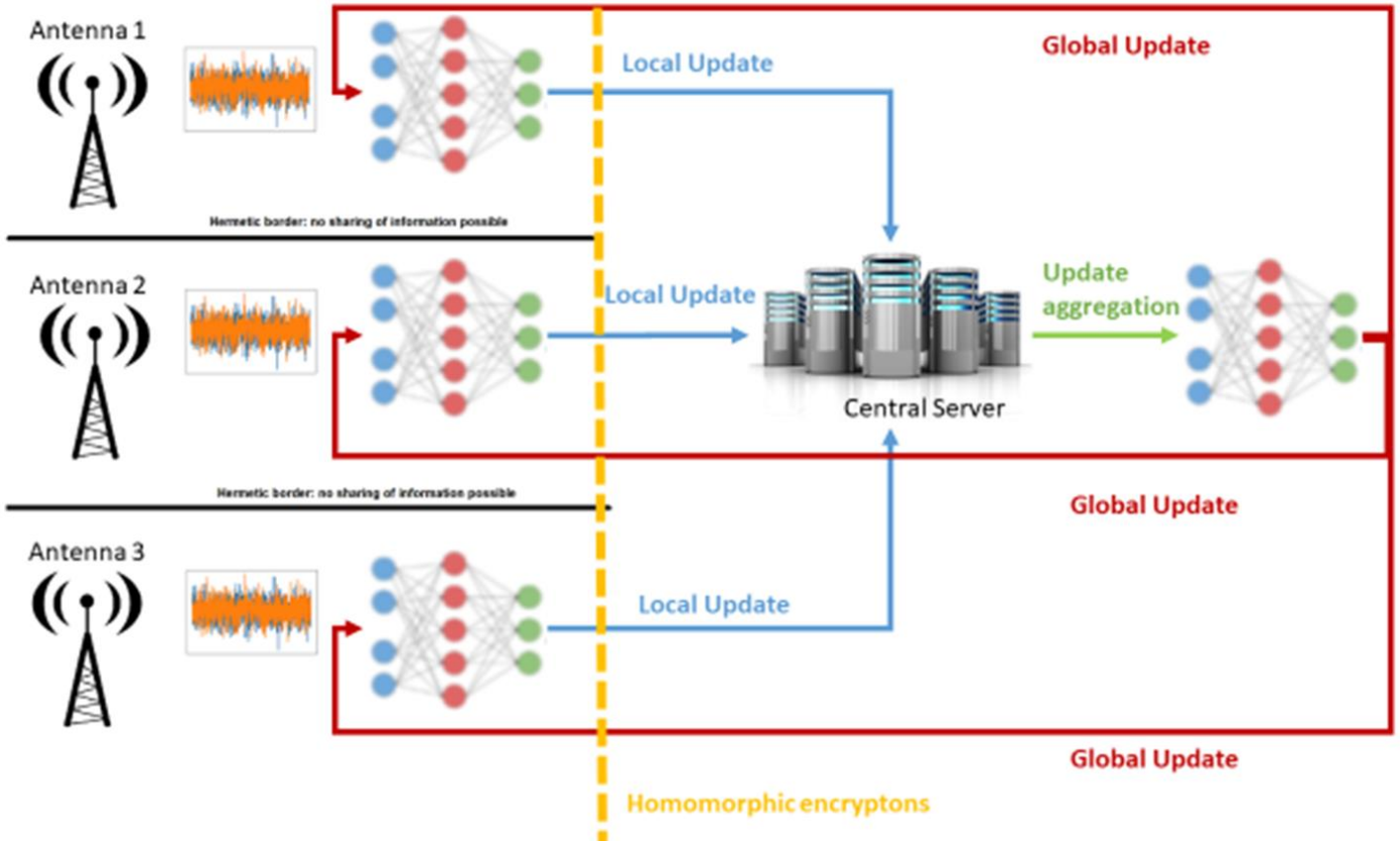
What is Homomorphic Encryption?

- **Homomorphic encryption** is a form of encryption that permits users to perform computations on its encrypted data without first decrypting it.
- Homomorphic encryption can be used for privacy-preserving outsourced storage and computation. This allows data to be encrypted and out-sourced to commercial cloud environments for processing, all while encrypted.



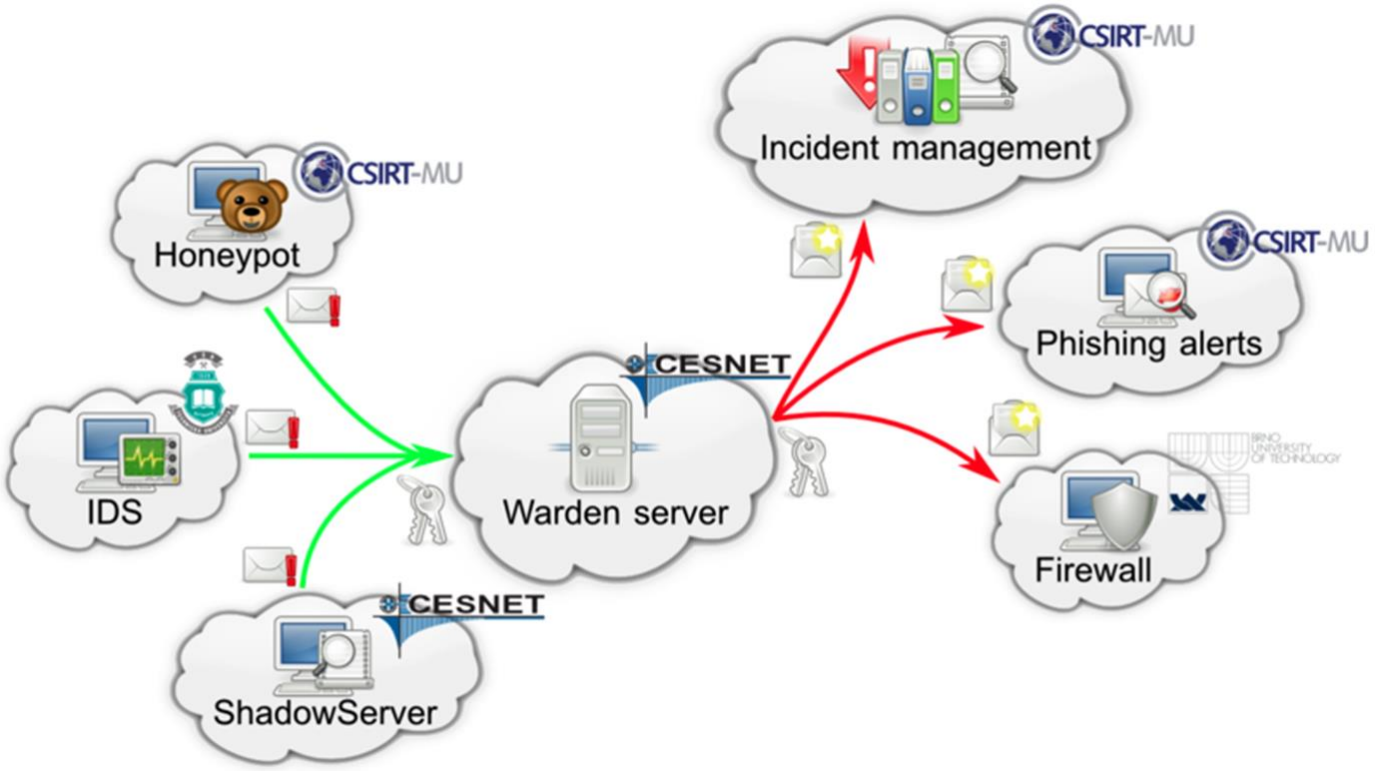
PRIVILEGE Use Case 1

Radio waveform recognition and classification, utilizing AI technologies.



PRIVILEGE Use Case 2

Network log classification for reputation and Future Misbehavior Probability score, with AI techniques.



PRIVILEGE Use Case 3

Video processing for Unmanned Vehicles in ISR missions, involving AI techniques.

HERMES Project Info

- **Title:** High Efficiency Wireless CMOS transceiver boosted by AI for 6G bands and beyond
- **Instrument:** Horizon 2020 - FET (Future and Emerging Technologies) Open
- **Project Budget:** 3,271,457.50 €
- **Duration:** 48 months; **Start:** 1/9/2021, **End:** 31/8/2025
- **Partners**: 6 (**UBx**, CEA, BPTI, SAL, KUL, and IDE)
- **Project Logo:**

- **Project Website:** https://www.h2020-hermes.eu/
- **Project LinkedIn profile:** www.linkedin.com/in/hermes-project/
- **Project Twitter account:** https://www.twitter.com/HermesEUProject

HERMES has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 964246

HERMES Project Overview

Project objectives:

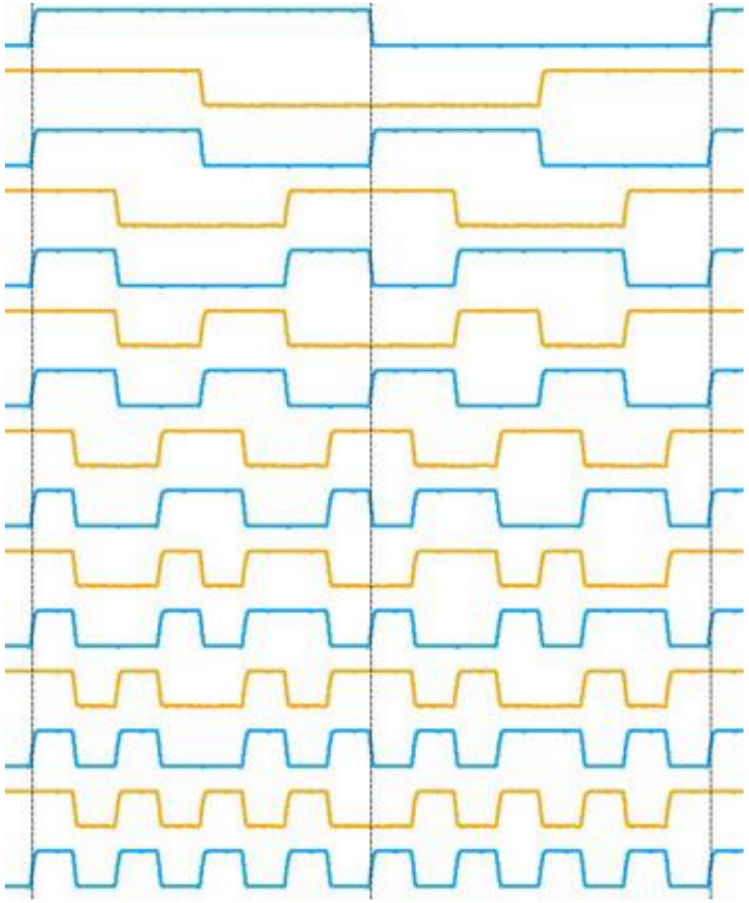
- To design a chipset to **achieve a true sub-THz cognitive radio** using AI to convert tens of Gbps from digital to sub-THz bands using CMOS technology.
- To develop a novel integrated RF (Radio Frequency) transceiver for frequencies beyond 100GHz.
- To achieve efficient wideband spectrum sensing (e.g., monitoring 5 GHz of spectrum).

Using the following tools and key ideas:

- Explore **sub-THz frequencies** to find the necessary bandwidth to pass tens of Gbps of data.
- Efficiently process wideband signals based on **Walsh mathematics.**
- Use deep sub-micron **CMOS technology** to achieve low-cost and highly integrated radio.
- Use **Artificial Intelligence** techniques to address CMOS non-linearities and wireless channel impairments in order to achieve encoding – decoding performances never seen before.

Why Walsh series?

- What is Walsh series?
  - Think of Fourier series: represent any periodic function as a weighted sum of sine and cosine waves.
  - In Walsh series: use a weighted sum of square waves instead.
- Advantages:
  - Only a few waves needed to represent an arbitrary wideband waveform with good accuracy.
  - The Walsh waves are easily generated by PLL type of circuits.
  - Less power consumption and silicon area required to implement the generators of the wave functions in the basis.

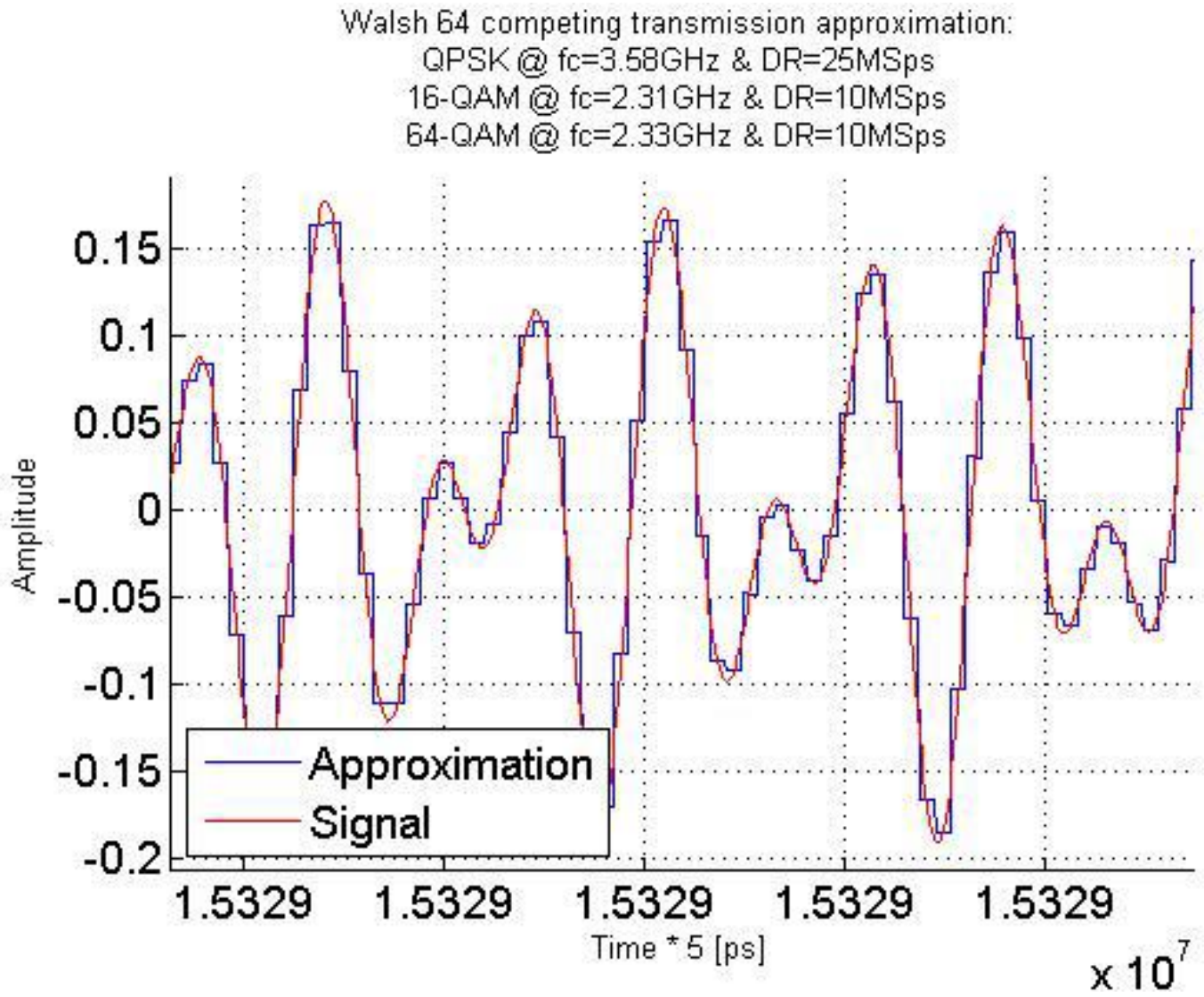


Why Walsh series?

An example: carrier aggregation

An aggregated signal composed from 3 independent signals with different modulations and different carrier frequencies is approximated by a Walsh series of 64 square waves.

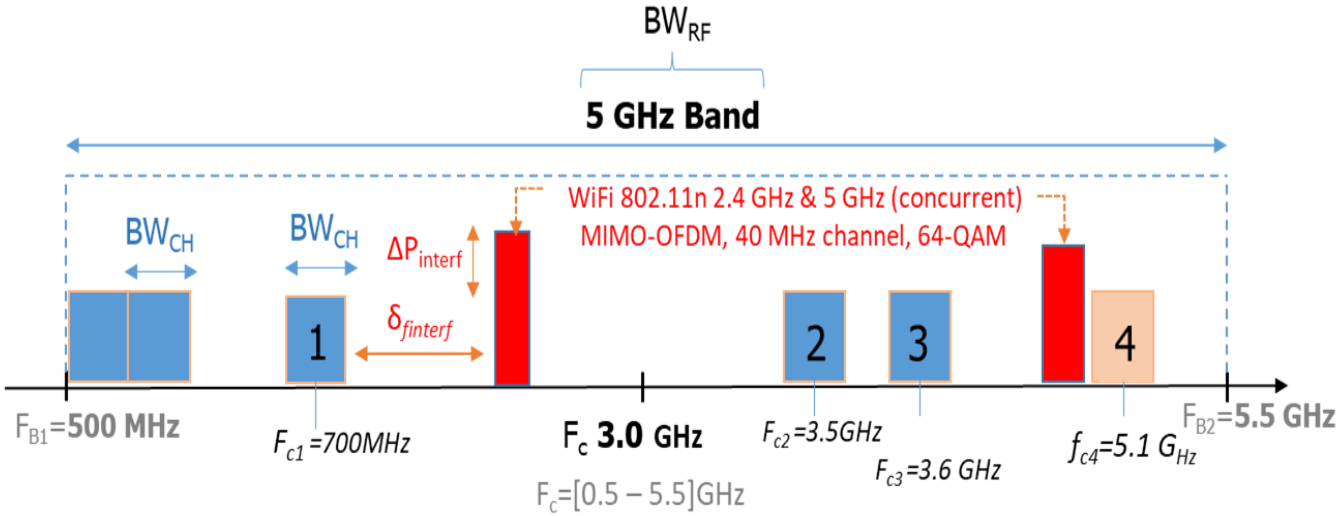
Note that, as the original signal is not periodic, the Walsh weights change over time.



IDE's main involvement

Two use cases of interest for maritime patrolling and border control applications:

1) **Spectrum management** to support the seamless operation of the multiple radio communication & sensing devices in interference congested environments **based on the ones integrated in IDE's maritime platforms (manned or unmanned)**.
2) **Signal Intelligence**: efficient wideband sensing to detect, collect and analyze signals **in a maritime operational environment for border protection and security**. The final sensing equipment will be scalable to fit in different operational requirements, from small-scale to midscale UxV, and large-scale fixed stations.



Closing remarks

- Intracom Defense is actively participating in EU funded R&D projects.
  - To further enhance our product line by introducing new technologies and developing better products and solutions
  - To expand to new areas within our business sector
  - To keep our employees at the forefront of their technical field
- We have received funding under a variety of EU and national instruments
  - In particular we had good success rates in the EDIDP calls, we have submitted 9 proposals in the 1st EDF call (under evaluation) and we plan to continue submitting proposals in EDF calls
- We are particularly interested in R&D projects in the fields of:
  - Communications and networking
  - Cybersecurity
  - Unmanned systems
  - Hybrid power supply systems
  - Relevant applications of Artificial Intelligence

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