

# ANDANTE

AI for New Devices And Technologies at the Edge

Starting Date : June 1st, 2020 - Duration : 3 years

Countries involved :



France



Belgium



Germany



Netherlands



Spain



Portugal



Switzerland

## Challenges

Nowadays, AI is strongly penetrating large market segments. Data analysis using AI/Deep learning techniques are being adopted in IoT systems. For many IoT applications, this analysis is moving from the Cloud to the Edge creating new opportunities for the European semiconductor industry. However, several challenges should be addressed to have innovative and cost-effective Edge products:

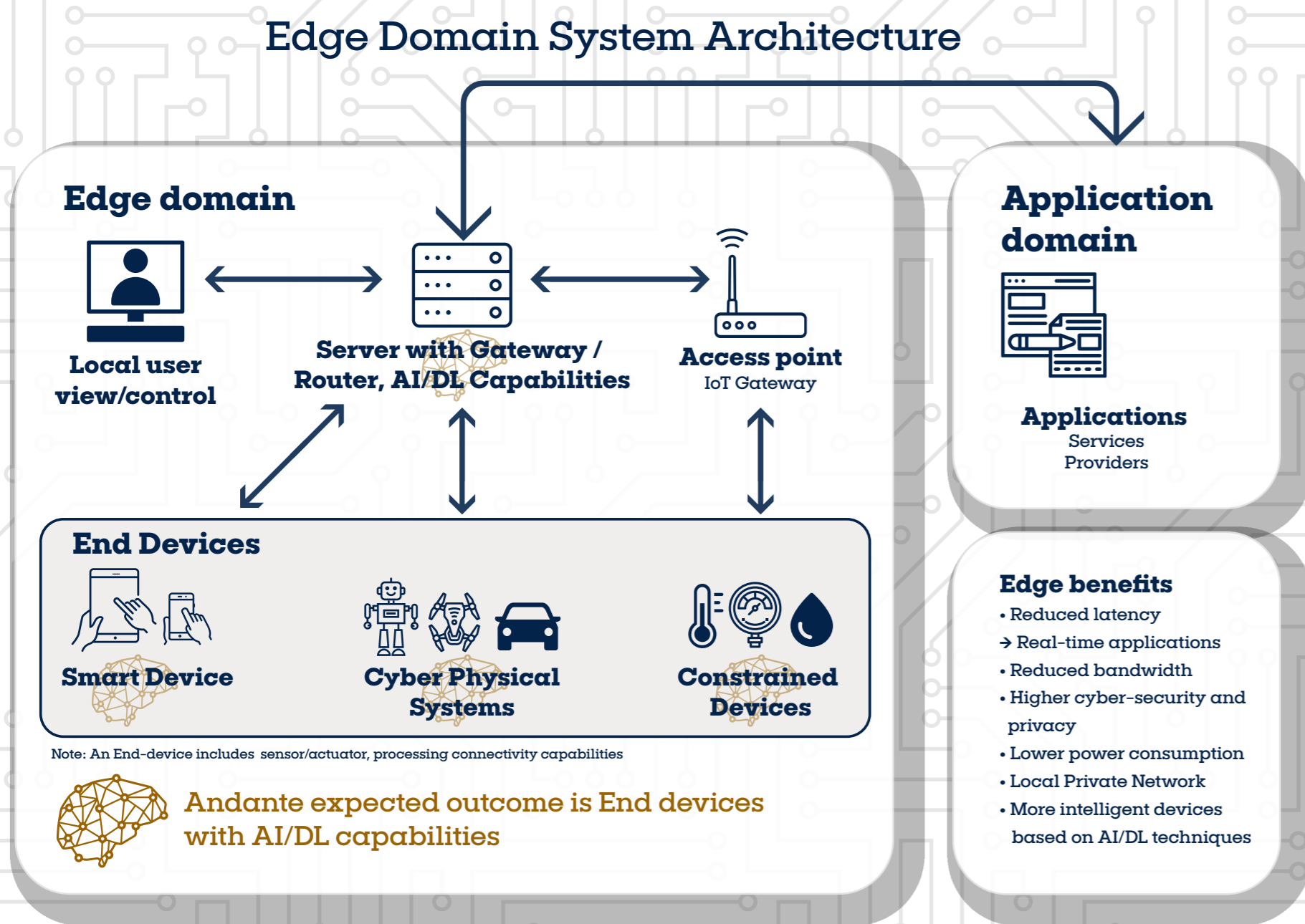
- High memory density > 50 Mbytes
- Good trade-off computing power vs Power consumption < Tops/W
- Highly efficient SW to obtain high AI/DL performances
- Integrated design flows and toolset to facilitate and reduce the costs of application developments.

## Objectives

- Develop efficient eNVM technologies OxRAM, PCM, FeFET, 3D MRAM, and TFT
- Develop, based on Artificial Neural Network (ANN) and Spiking Neural Network (SNN) building blocks, advanced AI/DL prototypes (ASIC accelerators) for future innovative Edge IoT products.
- Build an AI/DL design flow, with its associated methods, toolset, and boards to facilitate the development of smart applications based on different AI/DL techniques
- Develop innovative applications in the Edge with strong market impact in different areas (Digital Industry, Transport and Smart Mobility, Digital Farming, Healthcare, and Digital Life.) to demonstrate the project relevance.

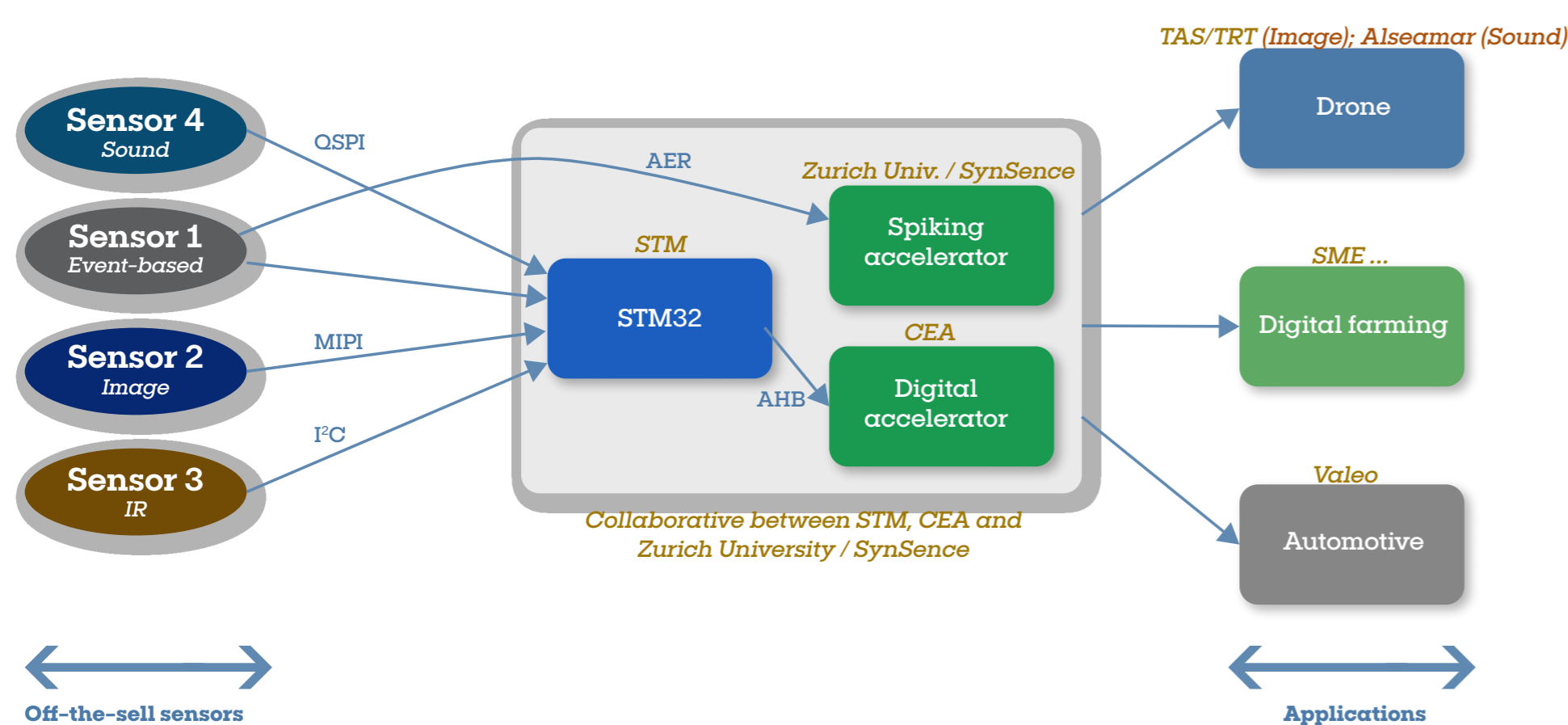
## System Diagram

In the Edge domain, data analysis can be performed at three different levels at Edge (in the server), in the end-device (end- node) and directly in the sensors. ANDANTE targets ICs solutions mainly for the two last levels.



## Multi-Usage Platforms

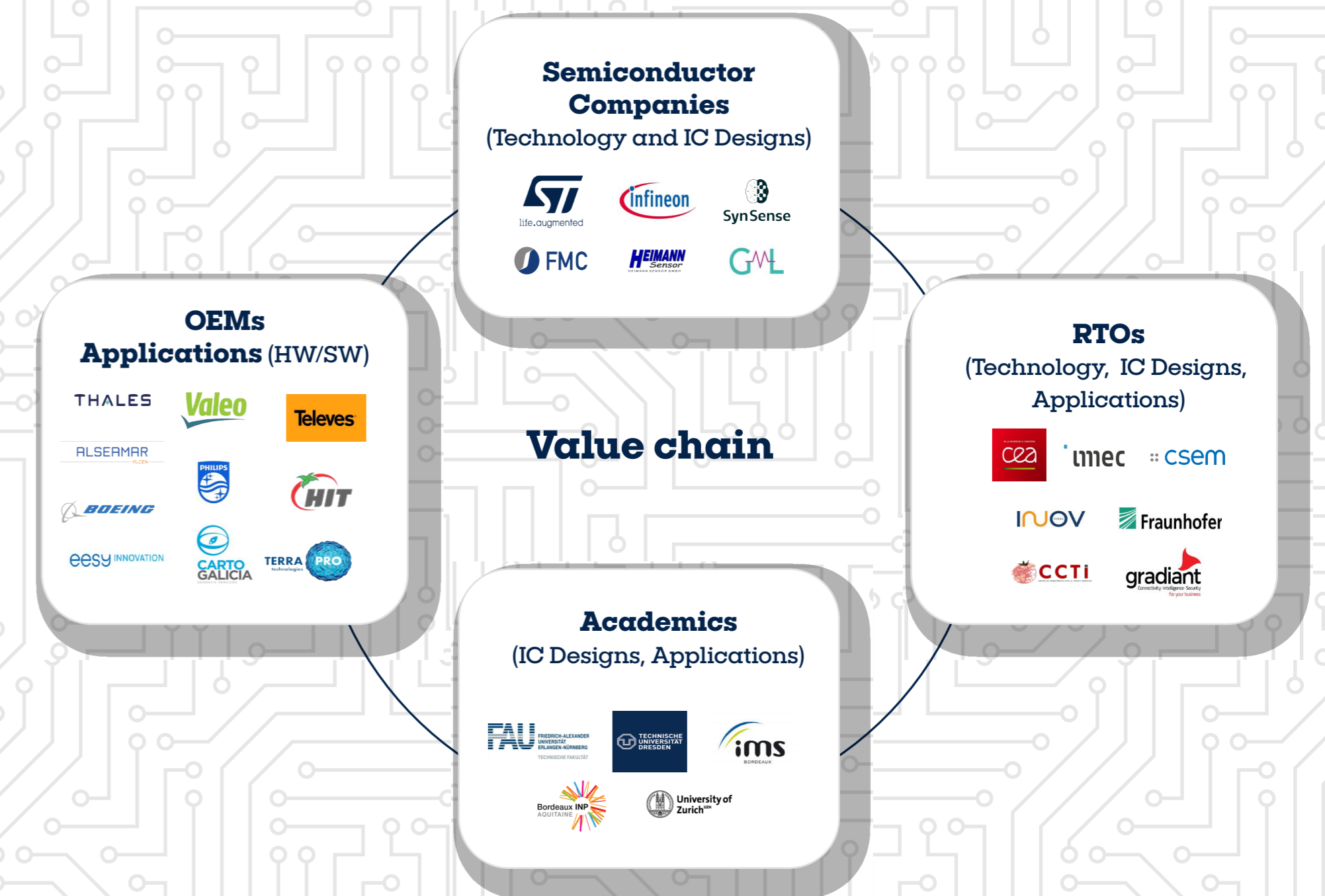
Several HW/SW platforms will be developed to validate the different neural networks accelerators developed in the project and to be used in the different use case demonstrators.



## Economic impact

- Market analysis (source Tractica) forecasts Deep learning Chip-set revenue of 70 \$ Billion worldwide
- European semiconductor and electronics industries well positioned in interference solutions in the Edge
- New job creation and pushing up research and innovation

## Team and roles



## Description of technical solutions

### New Memory technologies for AI applications

- Large-scale integration of new memories: PCM and OxRAM in 28nm FDSOI, SOT-MRAM in 40 nm, FeFET in 22nm FDSOI TFT memory (CEA/ST, imec, Fgh,)
- Explore new memories for Spiking neural networks and analog compute in-memory : ePCM Multi-value ST, FeFET in-memory compute neuromorphic crossbars (FhG), TFT for multi-timescale neurons (imec)

### AI Building Blocks and Tools

- Define and develop methods and tools for the design of AI/DL blocks
- AI/DL Architecture exploration
- Neural networks building blocks and algorithms
- Design of AI/DL foundation IPs

### Development of 5 ASICs and 1 Digital ANN ASIC Design

- ASIC 1.2: Mixed-signal SNN ASIC in 28 nm technology with PCM (SynSense, UZH, STG)
- ASIC 2.1: Digital ANN ASIC in in 28 nm FD-SOI technology with RRAM (CEA)
- ASIC 3.1: Mixed-signal ANN ASIC in 22nm FD-SOI with FeFETs (FHG, FAU)
- ASIC 3.2: Mixed-signal ANN ASIC in 28nm with RRAM (IFAG)
- Design of neuromorphic HW accelerator with SRAM and FeFETs (CSEM)

### Development of 3 Platforms and 1 Board

- Platform 1: STM32 hybrid neuromorphic platform (aiCTX, UZH, STG, CEA, TVES) for ASIC 1.2 and ASIC 2.1
- Platform 2: SNMC platform (IFAG) for ASIC 1.1
- Platform 3: Fraunhofer platform (FHG) for ASIC 3.1
- Board 1: ANMC board (IFAG) for ASIC 3.2

### Applications integration, validation and Evaluation

- 1 Digital Industry use case
- 2 Digital Farming use cases
- 5 Transport and Smart Mobility use cases
- 3 Healthcare use cases
- 2 Digital life use cases

## Other impact

- Enable Real-time applications
- Enable more « intelligent » and sustainable applications
- Reduce bandwidth as well as strongly energy consumption reduction
- Reduce cyber-security risks and secure the protection of personal data



ANDANTE



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Electronic Components and Systems for European Leadership

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