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IMT ATLANTIQUE
RENNES CAMPUS

PRESENTATION TAF IOT AND RENNES CAMPUS
- SEPTEMBER 8, 2025

WELCOME IN RENNES

Land 20,000 m^2 , 5000m^2 offices

New building since 2021

100 student apartments

15 minutes from downtown!

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OUTSIDE TAF IN RENNES?

Language courses
Partnership with CentraleSupélec and INSA Rennes

Sports courses
Partnership with CentraleSupélec

Various training courses on campus:
Specialized Master in CyberSecurity

Master of Sciences AEIoT

Engineer specializing in IT, networks and telecommunications (apprenticeship)

APART FROM SCOLARITY IN RENNES?

39 student associations at CentraleSupélec + 6 at IMT Atlantique - Campus de Rennes

- **Twinning since the start of the 2019 academic year**
  Talk about it with the 2A present this week!

Alpha brochure :
https://www.imt-atlantique.fr/fr/documents/plaquette-alpha

CentraleSupélec list :
https://www.rez-rennes.supelec.fr

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+

CentraleSupélec

Brittany's cultural capital

Rue de la soif

Marché des Lices: Europe's largest market (and its famous Galette saucisse!)

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WHICH TAFS PROPOSED

What TAFs are on offer?

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Advanced themes (from the start of the 2019 academic year)

TAF "Digital platforms: technologies and markets".

- Issues related to network technologies and cloud computing, as well as the regulatory and legal aspects associated with them
- Skills to meet the challenges posed by the heterogeneity and complexity of networks, emerging technologies such as SDN and 5G, and new needs such as IoT support.

TAF "Internet of Things and 5G"

- Issues of network communication, information representation and processing, development of services for the Internet of Things
- Skills for understanding and analyzing all the elements in the Internet of Things chain / understanding the social issues involved in their actions

TAF "Digital security and trust / Cyber security

- Skills for acquiring the scientific and technical background needed to meet the market needs of the cyber security sector
- Cyber professions linked to product or system development, operations or Cyber R&D

A COHERENT PATH

- **3 complementary TAFS**
- **Designed to create coherent career paths**
- **At the crossroads of identified business needs**
  - Cyber + IoT
  - PNum + CYBER
  - IOT + PNum

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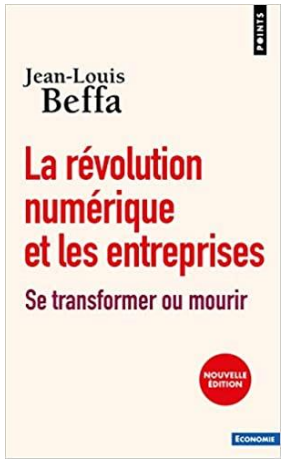
INTERNET OF THINGS AND 5G+ FOR INDUSTRY 4.0

LAURENT TOUTAIN
XAVIER LAGRANGE

Source : https://lejournal.cnrs.fr/articles/les-defis-de-linternet-des-objets

- **At the dawn of the 2020 decade, an economic and social Big Bang is about to happen [...] Connected devices will form a gigantic network of physical data and information that will need to be organized and optimized to give rise to services benefiting all individuals, whatever their standard of living, territory or basic needs."** J.L. Le Moan, *2G, 3G, 4G, 5G, ZéroG, le réseau mondial de connexion des objets va changer le monde,* Editions débat publics, 2020



- **"The Internet of Things functions as an essential irrigation channel for Big Data, ensuring the massification of data and the intelligence to be drawn from it."** JL Beffa, *La révolution numérique et les entreprises, Se transformer ou mourir*, Seuil, May 2018.

At-a-Glance

Internet of Things

Connected Means Informed

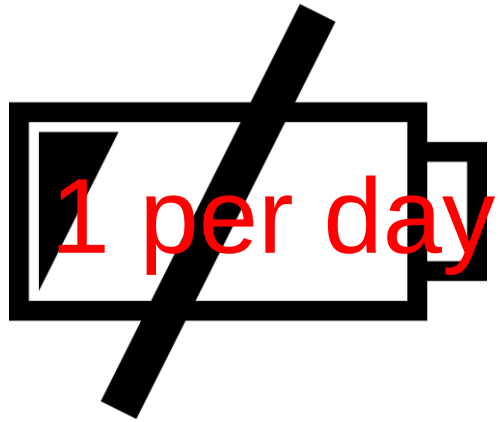
According to Cisco, 500 billion devices are expected to be connected to the Internet by 2030. Each device includes sensors that collect data, interact with the environment, and communicate over a network. The Internet of Things (IoT) is the network of these connected devices. These smart, connected devices generate data that IoT applications use to aggregate, analyze, and deliver insight, which helps drive more informed decisions and actions.

The IoT is a critical part of business strategies going forward. Based on an IDC study of 2300 executives in 15 countries, 48 percent of those surveyed have already deployed IoT solutions, and 58 percent said that the IoT is strategic to their business strategy (Figure 1).

2030

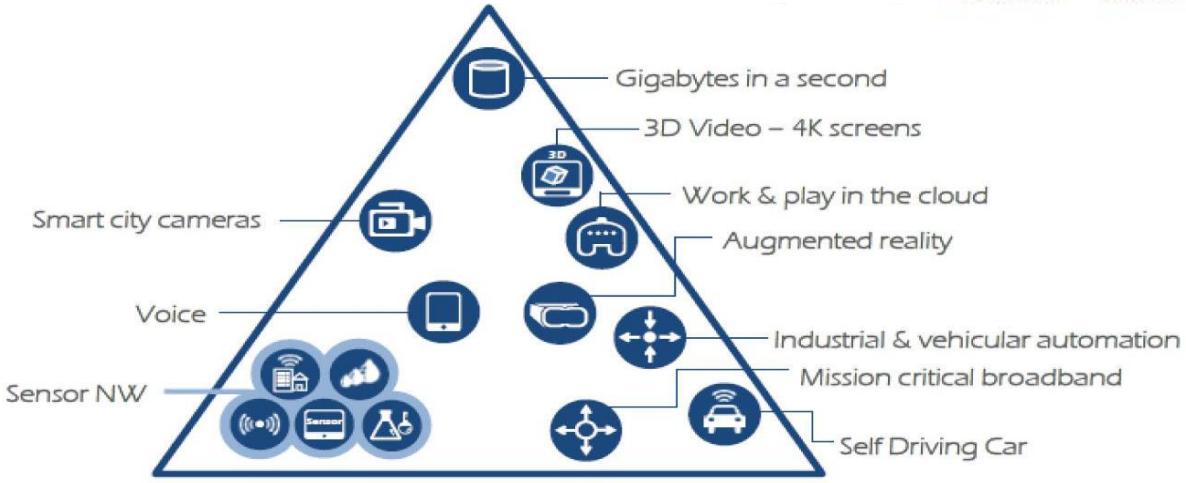
60 devices

240 devices



FEATURES OF 5G AND 5G+ EVOLUTIONS

- **Complex, adaptable and highly configurable system for a wide variety of applications (TAF IoT)**
- **Advanced transmission technologies (TAF STAR)**
  - MIMO, Massive MIMO, Distributed MIMO, etc.
  - Extended frequency range: up to THz (6G)
- **Massive transition to software**
  - Virtualization of functions (TAF PNUM)
    - NFV (OpenStack, Kubernetes), Slicing , Auto-configuration, Auto-repair
  - Software-defined radio (Cloud RAN)
- **Diversity (private vs. public networks) (TAF IoT)**
  - Quality of service requirements (IoT vs. Virtual Reality)
  - Applications and sectors (Industry 4.0, transport, environment, energy, health, agriculture)
  - Marketing methods
- **Imperatives**
  - Health safety
  - IT security
  - Energy efficiency



Source: based on Report on 5G and mobile communications networks, Report by the French Academy of Sciences, July 12, 2021

WHAT COULD BE 6G?

- Ultra-High Data Rates: Expected to reach terabits per second, enabling instant data transfer.
- Ultra-Low Latency: Near-zero latency for real-time applications like remote surgery and autonomous systems.
- Global Connectivity: Seamless coverage, including remote and underserved areas, using advanced satellite and terrestrial networks.
- **AI by design**: AI-driven networks for optimized performance, predictive maintenance, and personalized services.
- Sustainability: Energy-efficient infrastructure and green technologies to reduce environmental impact.
- Advanced Security: Quantum encryption and AI-based threat detection for robust cybersecurity.

THE CHALLENGES OF 5G+ AND THE INTERNET OF THINGS

- **Technical challenges**
  - Network capable of managing thousands of objects
  - Highly configurable and adaptable network
  - Constraints on objects in terms of energy, computing power, real time and data flow characteristics
  - Interface between elaborate information systems and rudimentary objects
  - System and data security
- **Economic issues**
  - New business models
  - Influence on the corporate organizational chain
- **Societal issues**
  - Sobriety in energy and resource use
  - Privacy (Law)

CMA PROJECT : IMTFOR5G+

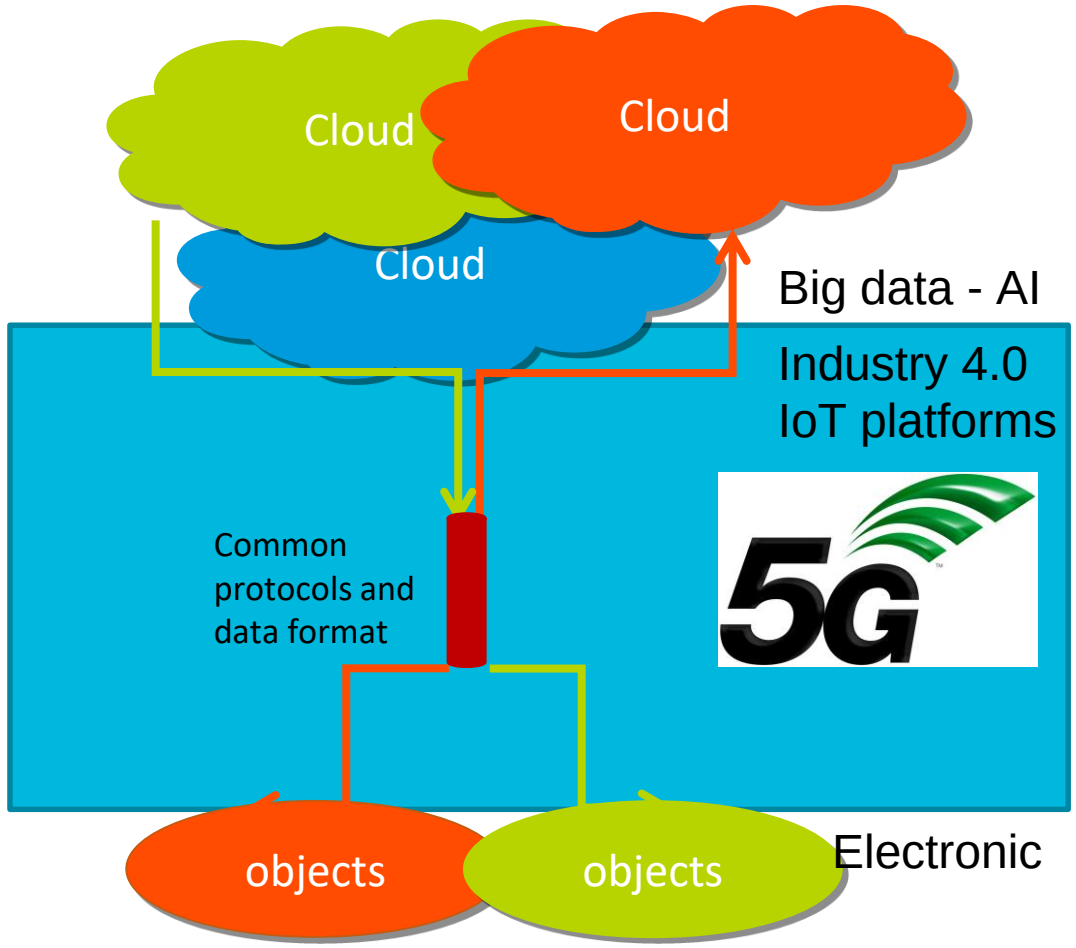
- **France 2030 Recovery Plan**
  - Presidential objective: Digital Sovereignty lever
  - National Acceleration Strategy (SNA)
    - SNA 11: 5G and future telecommunications technologies and networks
    - SNA 12: Cloud
    - SNA 13: AI
    - SNA 27: Digital greening
  - Lever Competencies Transversality
    - SNA 16: Education and digital technologies
    - SNA 28: Attractiveness
- **Future Skills and Professions Projects (CMA)**
  - IMTFor5G+
  - End 2028: 3,400 people trained in IF, 5,400 in FC, 60,000 people sensitized
  - Organization of a virtual, physical and digital training space
    - offering customized hybrid training paths
    - based on pedagogical technology platforms

A WIDE RANGE OF APPLICATIONS

OBJECTIVES OF TAF IOT AND 5G

- **Objective**
  - To train engineers capable of mastering the **potentials**, **challenges** and **constraints** involved in networking equipment with very different characteristics and for a variety of applications.
- **At the end of the TAF, students will be able to**
  - analyze the constraints specific to a service or application and determine the appropriate network solutions
  - specify and develop new protocols and architectures based on the expression of service constraints
  - perceive the complexity of the societal changes brought about by the Internet of Things, and master the levers for action.

INTEROPERABILITY - MASS DEPLOYMENT



Benefits

- Interconnection
- Service deployment
- Management devices, network, users
- Durability

TEACHING UNITS

- **Core courses**
  - A - New Socio-Economic Models and Digital Law
  - B - Information Transport Protocols
  - C - Communications and networks for the IoT
- **UE Prerequisites (to be taken only if no basic knowledge of networks)**
  - D - Network basics
- **UE Electives**
  - D - Operating systems (TAF cybersecurity)
  - D - Introduction to 4G-5G cellular networks
  - E - Artificial intelligence for embedded systems
- **IoT Path**
  - F – 5G private networks
  - G – Long-Range Radio access networks
  - H - Smart Cities and Intelligent Transportation System

B2 TEACHING UNITS (APRIL-JUNE FOR MASTERS AND SOME TRANSFER STUDENTS)

- 5G and Evolutions
- Standardization
- Smart Grid

FALL SEMESTER OVERVIEW, TAF IOT

- **Focus on scientific UE**

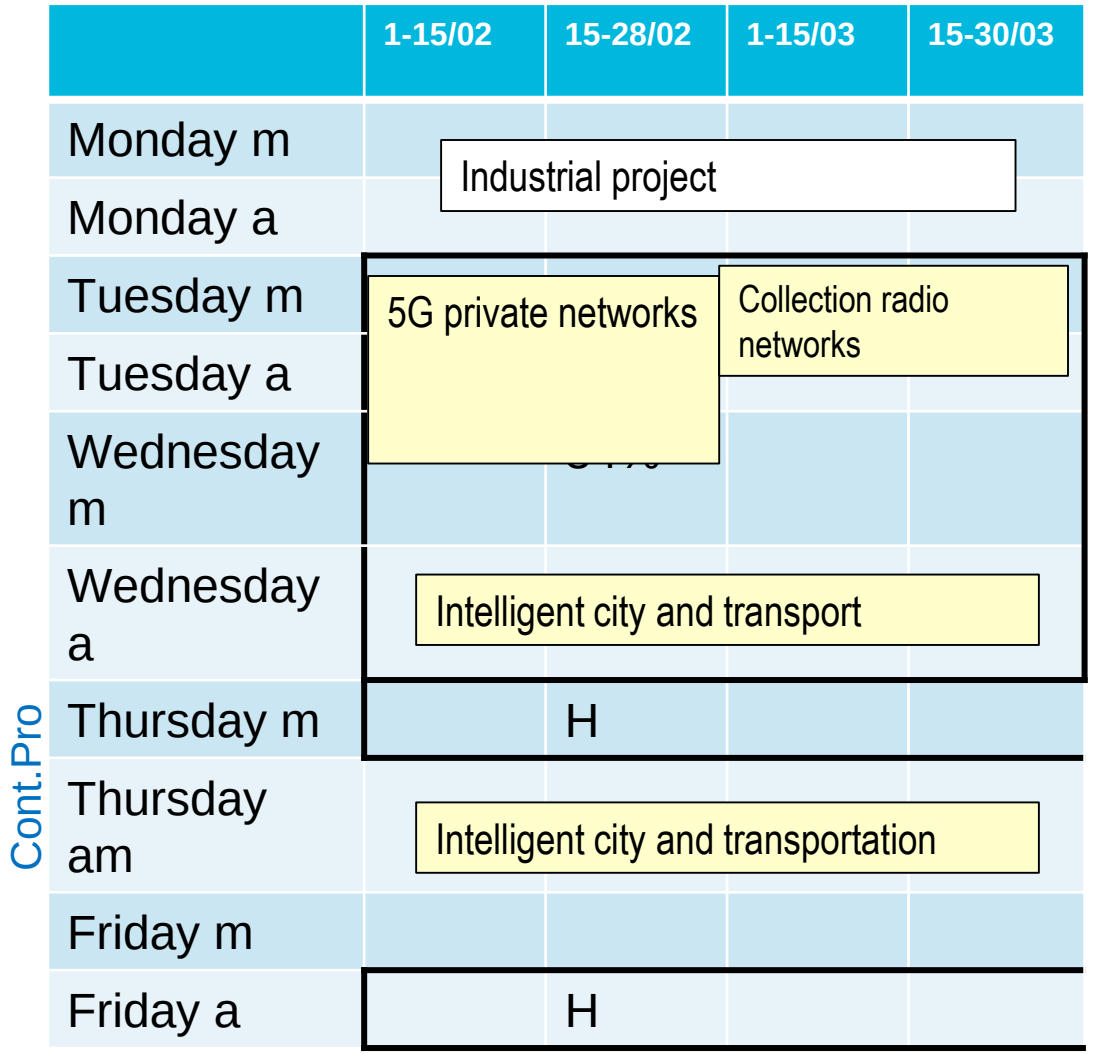
2 weeks

	1-15/10	15-30/10	1-15/11	15-30/11	1-15/12	15-30/12	1-15/01
Monday m		Industrial project					
Monday a							
Tuesday m		IoT communications and networks	Information transport protocols				
Tuesday a							
Wednesday m			New business models and digital and law				
Wednesday a							
Thursday m							
Thursday am	Network fundamentals or 4G-5G networks or Operating systems						
Friday m							
Friday a	82%						

Artificial intelligence for embedded systems

Contract Pro

WINTER BIMESTER OVERVIEW, TAF IOT

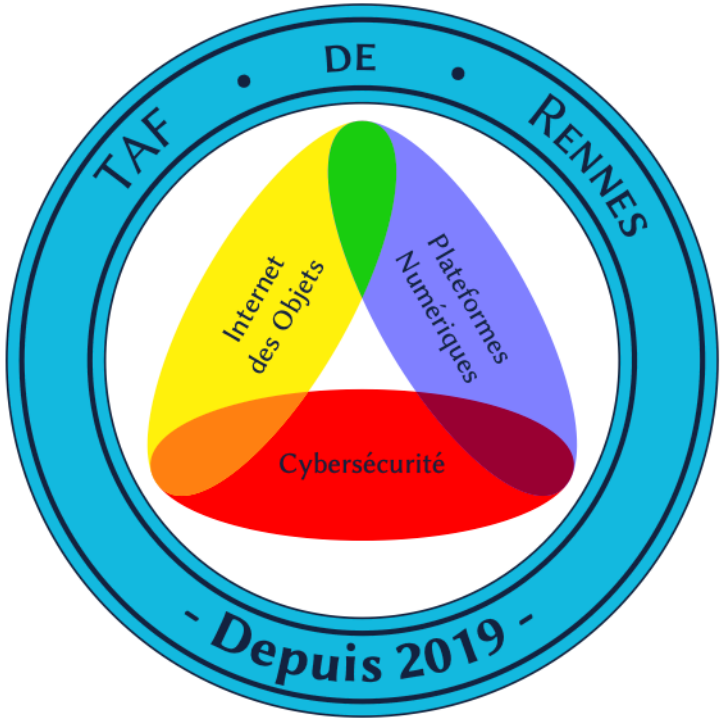


One TAF = 8 UE
- 3 core subjects (bright yellow)
- 3 elective UE (pale yellow)
- 2 free UE (see other TAFs, depending on compatibility of timetable)

POSSIBLE OCCUPATIONS

- **Possible jobs**
  - Chief IoT officer
  - Network and services architect
  - Consultancy
  - Design and development engineer
- **Target companies :**
  - Telecom operators
  - Utility companies (energy, transport, logistics, etc.)
  - Local authorities (smart cities)
  - Healthcare, home automation and retail companies
  - Equipment manufacturers (telecoms, automotive, energy, etc.)
  - Consulting and engineering firms
  - Regulatory bodies

- **Any questions?**

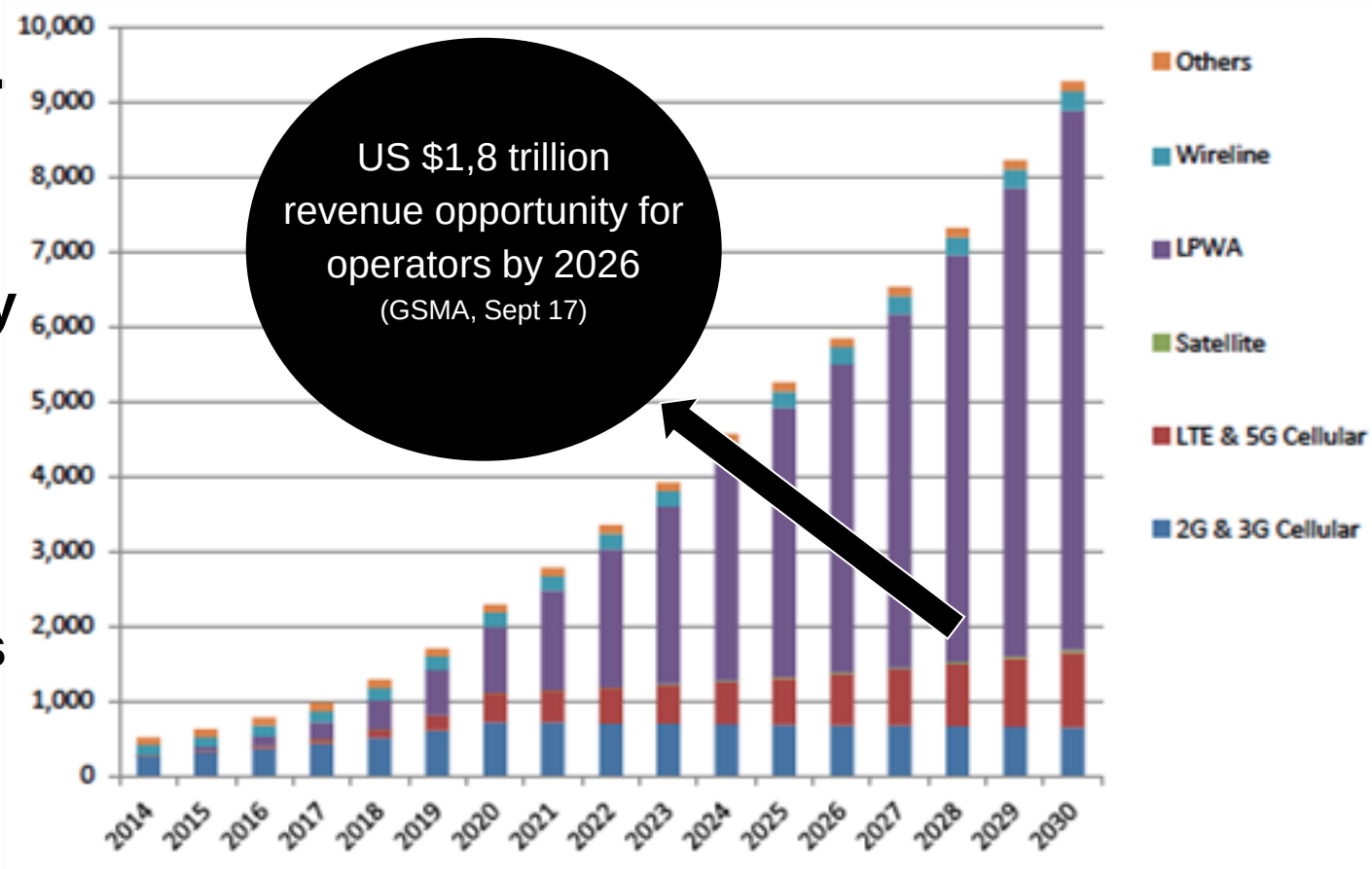


IMT ATLANTIQUE'S RENNES CAMPUS

- **A well-developed eco-system**
  - Start-ups (Acklio, Yogoko, etc.)
  - SMEs (Broadpeak, Ensensys, etc.)
  - Major corporations (Orange, Technicolor, etc.)
- **A teaching team committed to pedagogical innovation**
  - Moocs: "Understanding 4G", "Exploring 5G", "digital manufacturing", etc.
- **Dynamic research teams (IRISA), Adopnet, OCIF**
- **Student life**
  student life
  developed

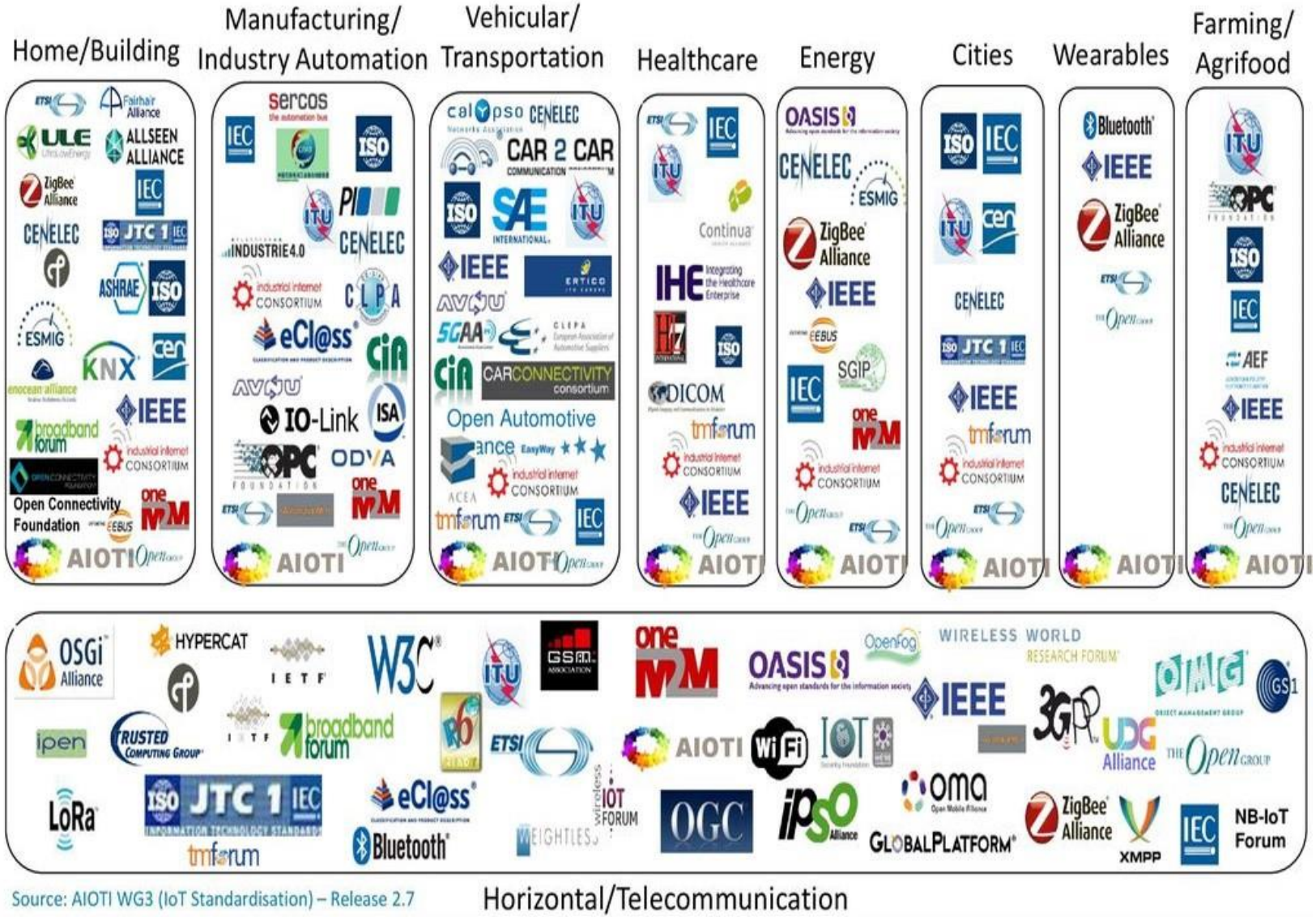
THE IOT MARKET

- **A growth supported by *Low-Power Wide-Area Network* (LPWAN) technologies**



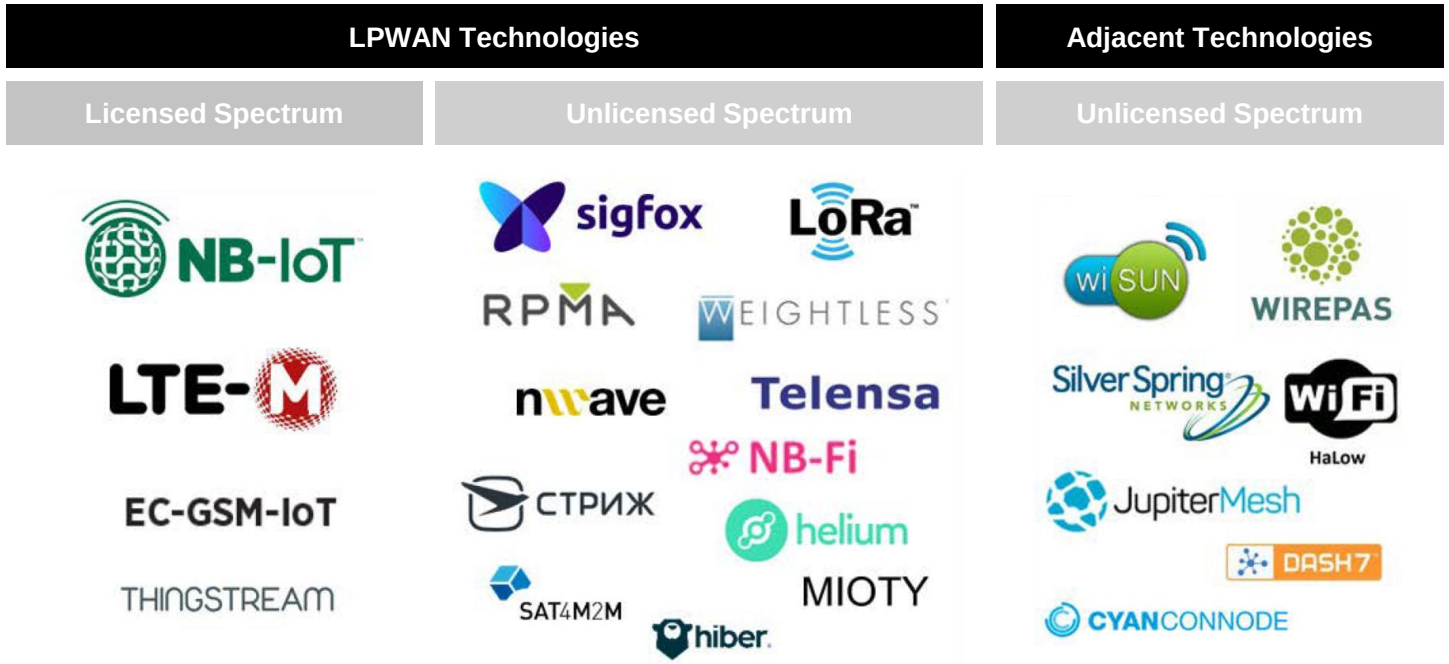
"The LPWA Networks Ecosystem: 2015 - 2030", Source: SNS

INTERNET OF THINGS APPLICATION DOMAINS AND STANDARDIZATION/SPECIFICATION



Source: AIOTI WG3 (IoT Standardisation) – Release 2.7

- **Low-power, long-range network technologies (LPWAN)**



- 3 antennas
- Covering 3 000 km^2 area

- 1 to 3 GPS coordinates per day
- 3 years of autonomy
- Prototype cost: ~ 50€

COPERNIC

BAYARD RANGE

Detect stolen water and track usage of your fire hydrant

COPERNIC is an add-on module installed on fire hydrant that tracks the use of the fire hydrant in real time. Using Sigfox wireless communication, the operator gets an instant alert by email or sms in the event of the fire hydrant being opened and the module tracks suspicious water drawing. Working 24/7, the operator gets an overall estimate of water consumption from the fire hydrant network to improve the network efficiency.