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Project: IEEE P802.15 Working Group for Wireless Speciality Networks (WSN)

Submission Title: Overview on the Horizon Europe 6G SNS Project TIMES

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Re: n/a

Abstract: This document provides information on the Horizon Europe 6G SNS Project TIMES (THz Industrial Mesh Networks in Smart Sensing and Propagation Environments)

Purpose: Information of IEEE 802.15 SC THz

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TIMES

THz Industrial Mesh Networks in Smart Sensing and Propagation Environments

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IEEE 802.15 SC THz

Atlanta, March 13, 2023



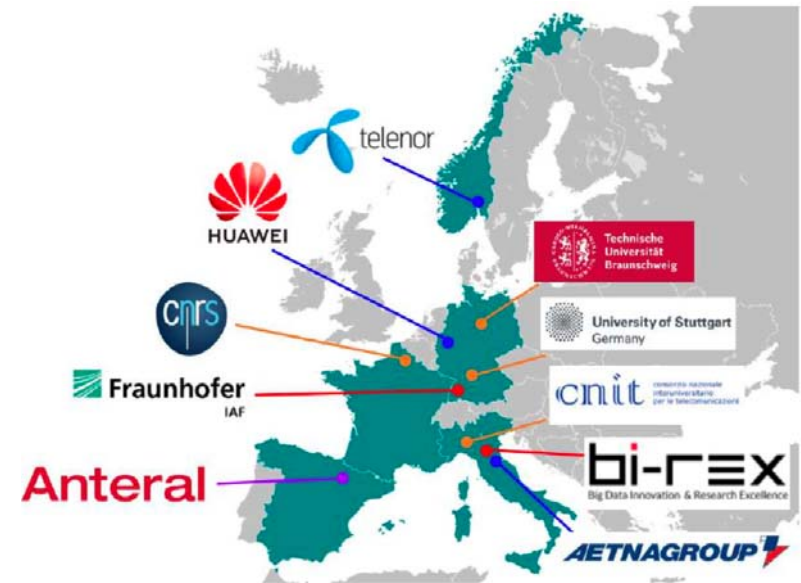
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Funding Framework

- A total of 35 Research and Innovation (R&I) projects have been selected following the evaluation of proposals submitted under the first call of the EU's Smart Networks and Services Joint Undertaking (SNS JU).
- TIMES is one of those funded projects in Stream-B, see <https://smart-networks.europa.eu/stream-b-research-for-revolutionary-technology-advancement-towards-6g/>
- Project run-time: 1 January 2023 – 31 December 2025

Project Overview

- Project Website: www.times6g.eu (available soon)
 - <https://wilab.cnit.it/times/> (temporary)
- SNS-2022-STREAM: B-01-02
- Consortium - 10 Partners (5 EU countries):
 - **Coordinator:** CNIT (IT).
 - **Academics:** TU Braunschweig (GE), CNRS (FR), USTUTT (GE)
 - **Research institutes:** FRAUNHOFER (GE), BIREX (IT)
 - **Industries:** HUAWEI (GE), TELENOR (NO), AETNA (IT)
 - **SMEs:** ANTERAL (ES)
- Verticals: Manufacturing (I4.0, I5.0), Healthcare, Automotive



Project vision and pillars

- TIMES long-term vision:
 - Smart radio ecosystem in complex scenarios offering similar performance as wired networks.

- Pillars:



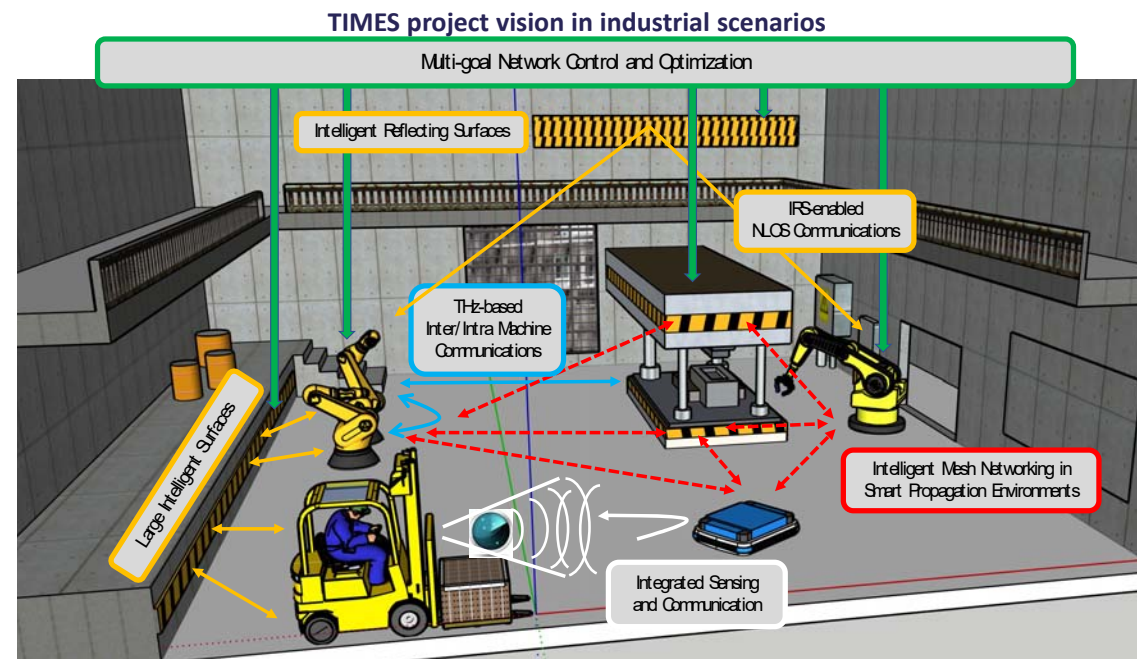
Exploiting ultra-wide bandwidth and sensing-friendly characteristics of **THz communications** as wired networks.



Deploying intelligent mesh THz networks in smart propagation environments.



Enabling high-definition **integrated communications and sensing at THz.**



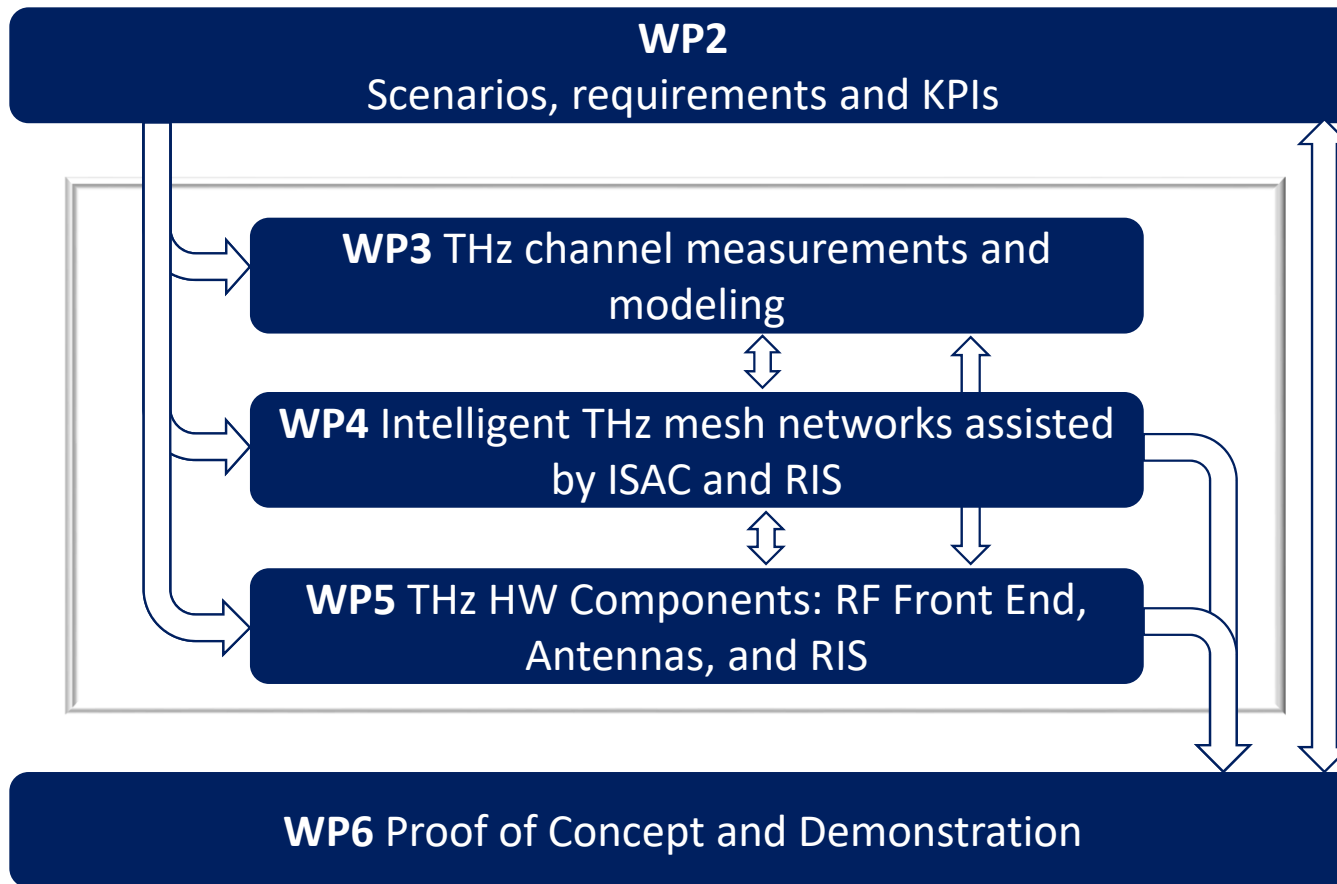
Main Innovations

	Identification of potential use cases Definition of KPIs
THz communications	Intra-device/machine and inter-device/machine THz channel measurements and modelling EM exposure characterization Ultra-Massive MIMO, fast beamforming, electromagnetic signal processing 250-300 GHz highly integrated THz RF front-ends
Intelligent Mesh Networking in Smart Propagation environments	Mesh topology with active/passive devices Efficient and reliable transmission over multiple THz links 300 GHz RIS made of metamaterials
Integrated sensing and communications	Enable see-around-the-corner functionality with RISs Enhanced localization functionalities through near-field THz propagation conditions
Proof-of-concept	Integration of THz RF front-ends, antennas, RISs Multiple THz links between static and mobile devices through direct/reflected paths

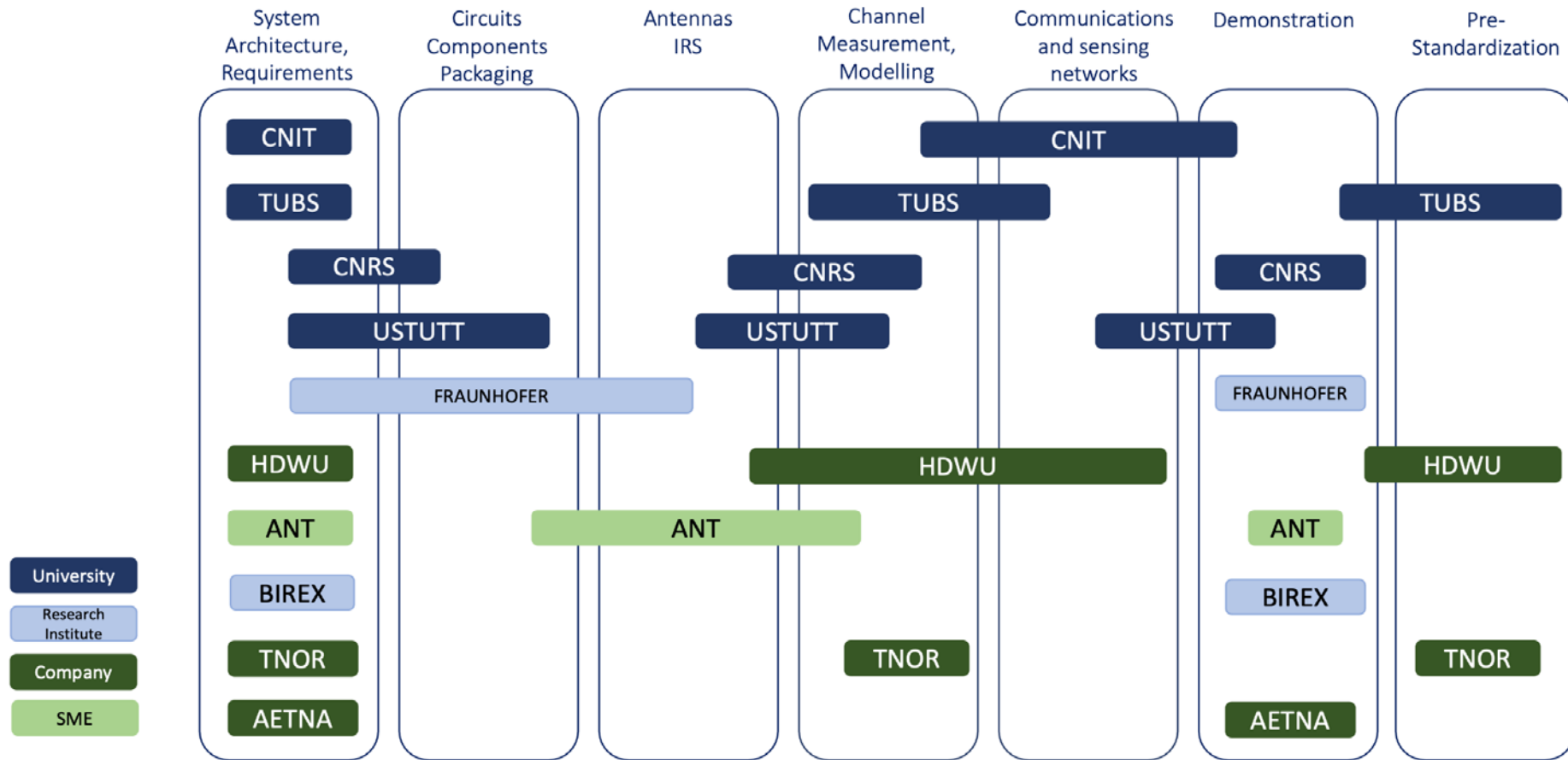
Key objectives

- Focused on 8 objectives
 1. Definition of **use cases/requirements** for future industrial applications
 2. Derivation of **new THz channel models** based on measurements in industrial scenarios
 3. Design of novel **THz solutions** at the **PHY/MAC layers**
 4. Design/implementation of **THz front-ends, antennas, and IRSs**
 5. Design of a **multi-goal mesh-based RAN** composed of active and passive (RIS) nodes
 6. Design of **integrated sensing and communications functionalities/waveforms**
 7. Realization and validation of a **PoC in real industrial environments**

Project Implementation



Expertise of Partners in TIMES

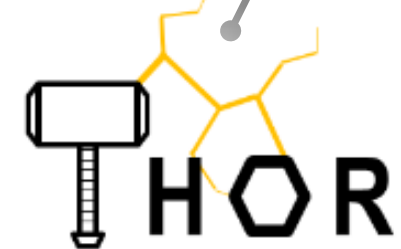


Previous Experience: an example

Thor project <https://thorproject.eu>

- Joint EU-Japan Project
- TUBS, USTUTT, CNRS, FRAUNHOFER
- Successful PoC of a 2 x 20 Gbps bidirectional 300 GHz link over 160 m

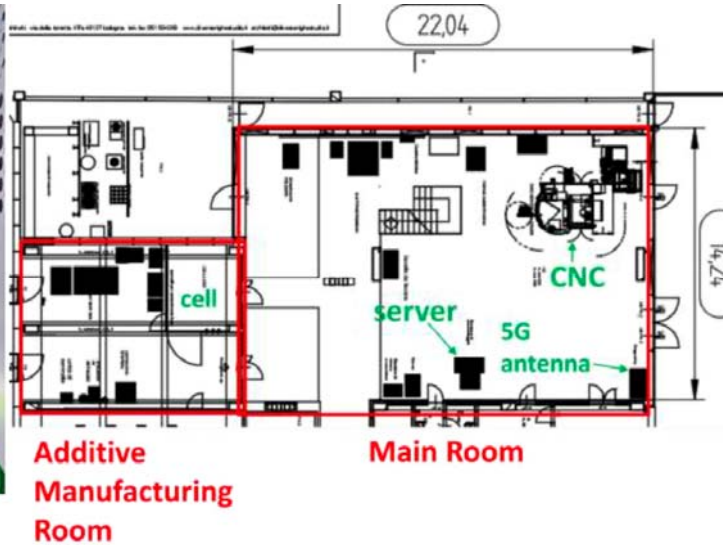
Channel ID	Maximum performance		IEEE802.15.3d			
	-	-	44	54	25	26
$f_{IF,center}$ / GHz	79.1	79.25	85.7	79.1	84.6	84.6
$f_{RF,center}$ / GHz	301.2	304.25	302.4	300.2	305.6	307.8
Bandwidth / GHz	8.64	1.35	4.32	8.64	2.16	2.16
Data Rate / Gbit/s	32	8	9.6	25.6	9.6	11.2
Modulation Scheme	32-QAM	256-QAM	8-PSK	16-QAM	64-QAM	128-QAM
Constellation						
EVM / dB	-23.6	-30.8	-20.9	-21.4	-27.1	-30.5
SNR / dB	19.6	26.3	20.6	19	23.5	25.6



PoC: BIREX Pilot Plant

Advanced production line

- test new technologies for industrial processes
- thematic areas: additive manufacturing, robotics, Big Data and IoT.
- covered by a dedicated 27 GHz private 5G network.



Mobile Wagon



Mobile Rack

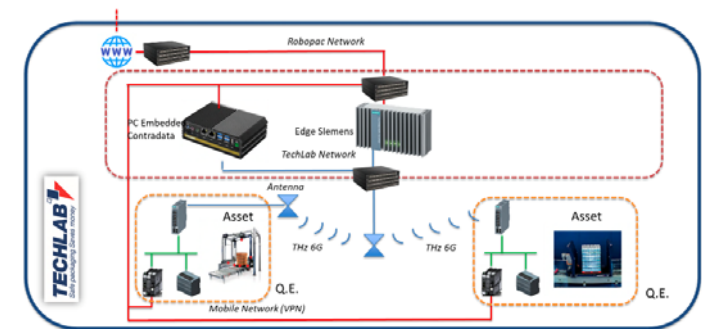


PoC: AETNA Techlab

- Large area with packaging machines and test equipments
 - To demonstrate TIMES solutions in automated packaging
 - To connect the PLCs with the edge network



AETNA Company Profile



Standardization activities

Project activities / technologies that may lead to standardization:

- Industrial simulation scenarios and KPIs
- THz channel measurements/modelling in industrial scenarios
- Technology enablers for industrial THz communications

Potential targeted standardization bodies / groups:

- **ETSI ISG THz 5** founding members: TUBS (ISG THz Chair), HUAWEI, TELENOR, CNRS, FRAUNHOFER
- ETSI ISG RIS
- IEEE 802 SC THz
- COST-INTERACT
- **one6G** 4 founding members: CNIT, TUBS, HUAWEI, TELENOR
- 3GPP

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