

# An Overview on European Research towards THz Communications

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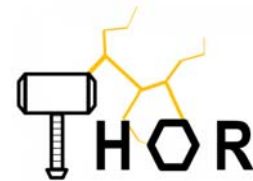
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Presentation via webconference to the

Terahertz System Application Promotion Council Meeting of Japan, 25.3.19

# ICT beyond 5G Cluster



[WORTECS](#)



# ICT Beyond 5G Cluster

Emerging from ICT-07-2019 “Networking Research Beyond 5G”

Collective promotion of **topics and activities** for the cluster projects:

- THz Communication (technologies and protocols)
  - mmW Communication (100GHz +)
  - Visible Light Communication
- Next Generation Forward-Error-Correction



terapod

Terahertz based  
ultra high bandwidth  
wireless networks  
for beyond 5G

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www.terapod-project.eu

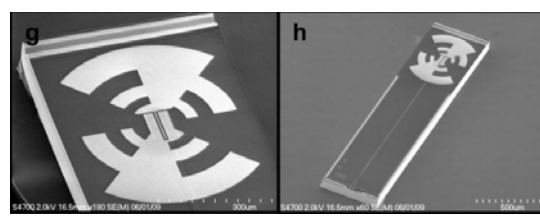
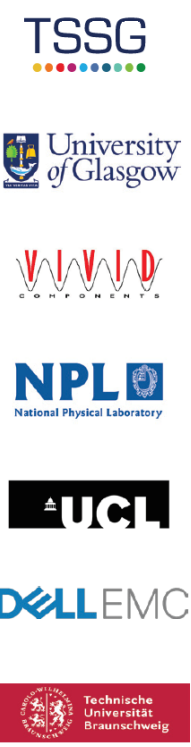
Project Coordinator:

**Dr. Alan Davy**

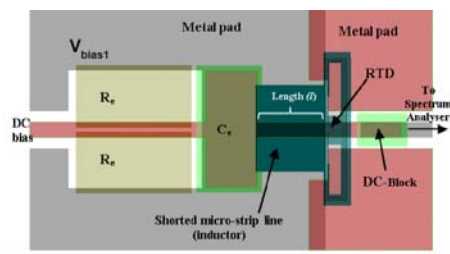
TSSG, Waterford institute of Technology

**TERAPOD Objectives**

- Advance the Technology Readiness Level of THz communication devices and systems
- Demonstrate a Fully integrated 'early adopter' **Data Centre** THz communication system.
- Progress Regulation of THz band and Standardization of THz communication protocols and metrology techniques.
- Promote THz communications systems science through Dissemination activities.

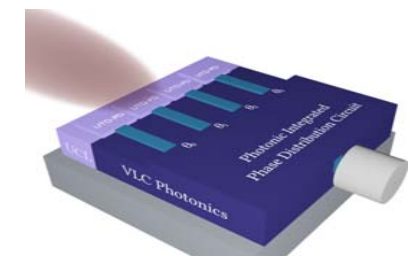


UTC-PDs



RTDs

Photonic Phase Array





# DREAM

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**Project Title:** D-band Radio solution Enabling up to 100Gb/s reconfigurable Approach for Meshed beyond 5G network

**Project Duration:** September 2017 – August 2020

## Project Goals:

The H2020 DREAM project is aimed at exploitation of the **D-band (130-174.8 GHz) spectrum, with beam steering** functionality, to enable wireless links with data rate **exceeding current backhaul solutions by at least a 10x**, thus bringing wireless systems to the speed of optical systems.

***[www.h2020-dream.eu](http://www.h2020-dream.eu)***

**Partners:** VTT (coordinator), Nokia, STM, III-V Lab, CEIT, University of Pavia, ERZIA



# Enabling Practical Wireless Tb/s Communications with Next Generation Channel Coding

- EPIC Project Objectives:
  - ◆ Design and implementation of **next generation Forward-Error-Correction (FEC)** for wireless Tb/s technology and **Beyond-5G systems**
  - ◆ Advancement of **state-of-the-art channel codes** and **channel coding technology** for wireless ultra-high throughput communications
  - ◆ **Holistic design approach** that considers code design, decoding algorithms and efficient implementation on advanced silicon technologies in a cross-layer approach
  - ◆ Validation and demonstration of new FEC technology and corresponding implementations as **virtual silicon tape-out** using realistic use cases
  - ◆ Provide **scientific excellence and contributions** to wireless industry in the domain of B5G standardization and technology development

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European Commission

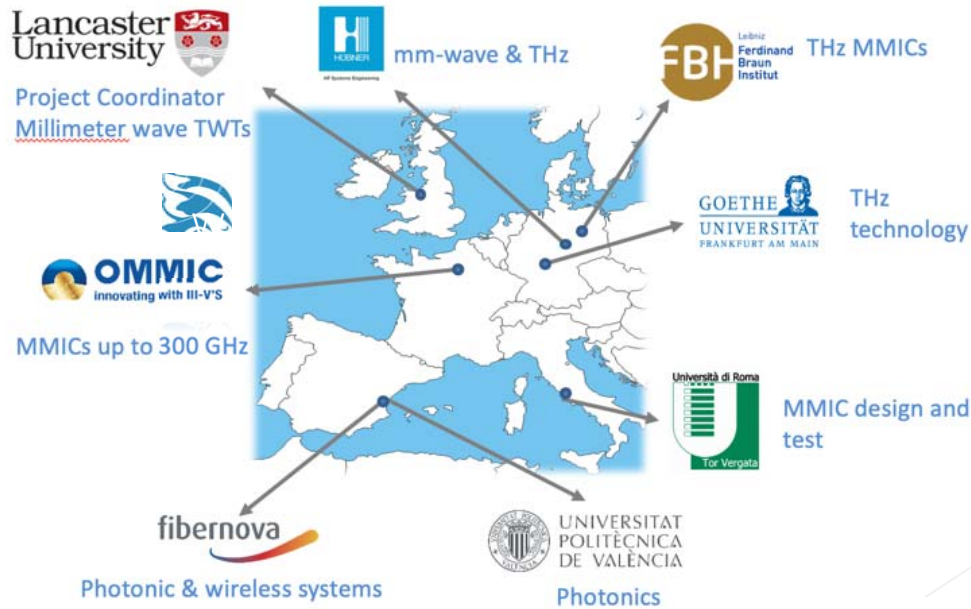
Horizon 2020  
European Union funding  
for Research & Innovation

Coordinator  
Claudio Paoloni  
Lancaster University  
UK

# ULTRAWAVE

“Ultra capacity wireless layer beyond 100 GHz based on millimeter wave Traveling Wave Tubes”

Budget €2.9 M  
1<sup>st</sup> September 2017

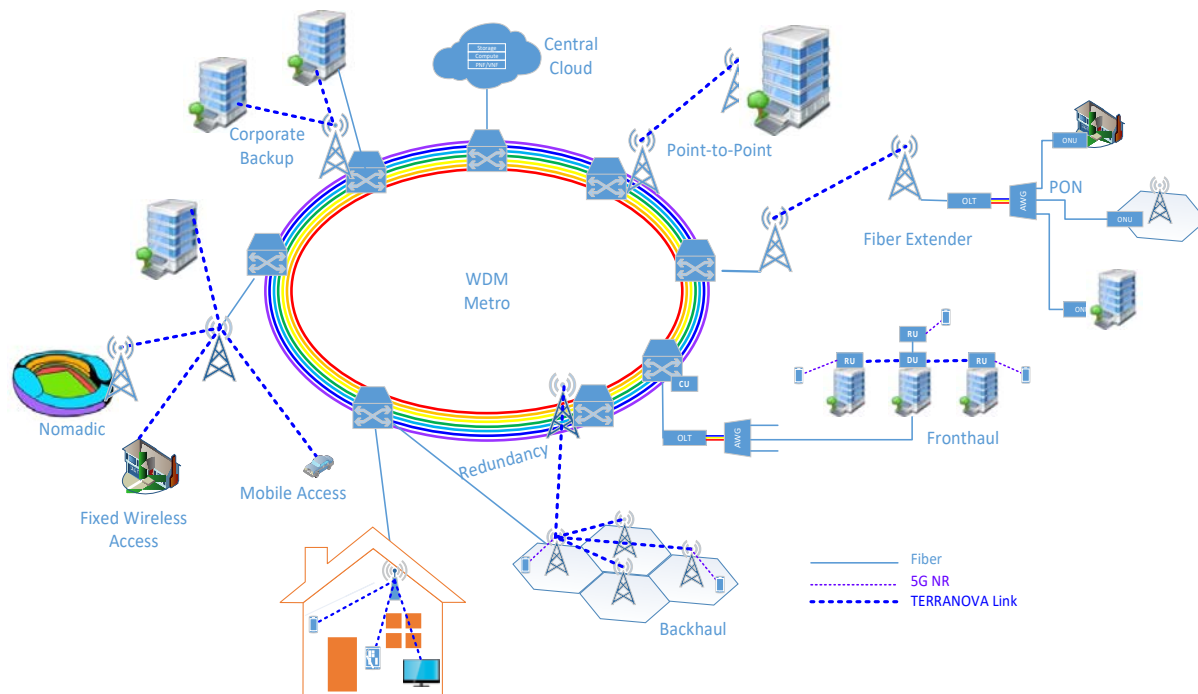


ULTRAWAVE aims to produce ultracapacity layers with more than 100 Gb/s/km<sup>2</sup> of area capacity by combining area sectors in Point to multipoint at D-band (141 – 148.5) connected by high capacity links at G-band (275 – 300 GHz), enabled by novel traveling wave tubes and MMIC chipset.

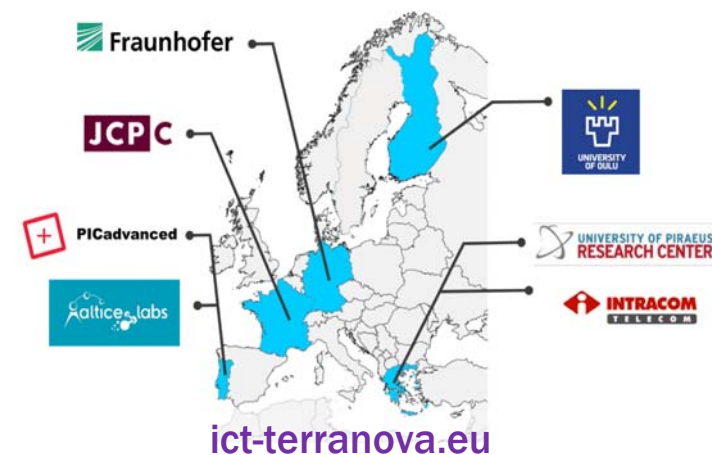
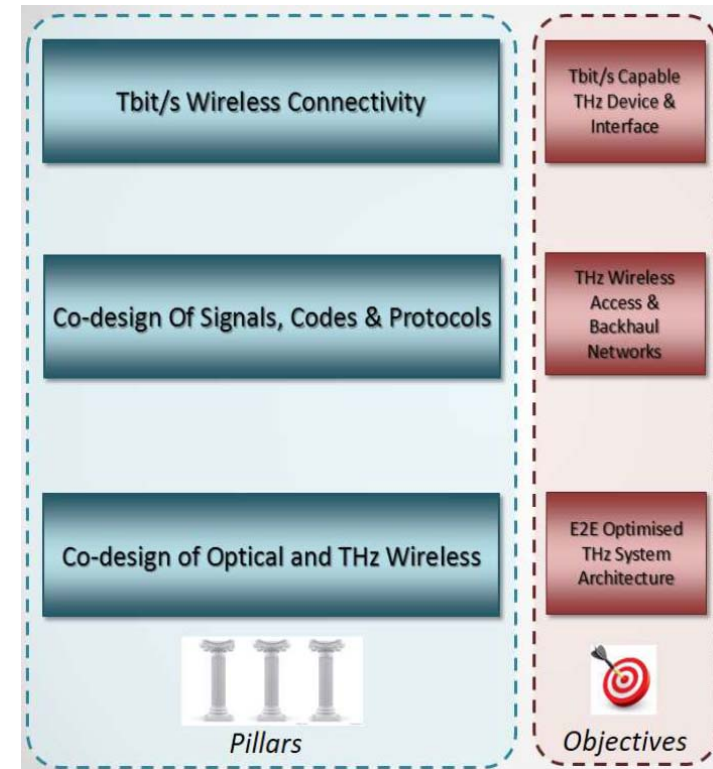
[www.ultrawave2020.eu](http://www.ultrawave2020.eu)  
@ultrawave2020



# Tbps Wireless Connectivity by THz innovative technologies to deliver Optical NW QoE in SB5G



- ✓ Baseband signal processing for the complete optical and wireless link
- ✓ THz wireless frontends and their integration with photonic components
- ✓ THz network information theory framework and channel & interference models
- ✓ Higher order modulation schemes and pencil beamforming antenna arrays
- ✓ MAC protocols, caching techniques and multiple access schemes





# WORTECS

## Wireless Optical/Radio Tera-bit Communications

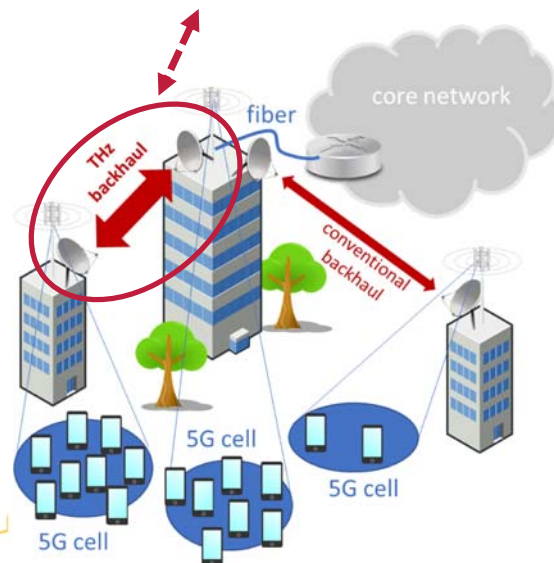
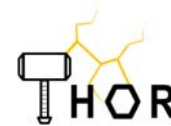
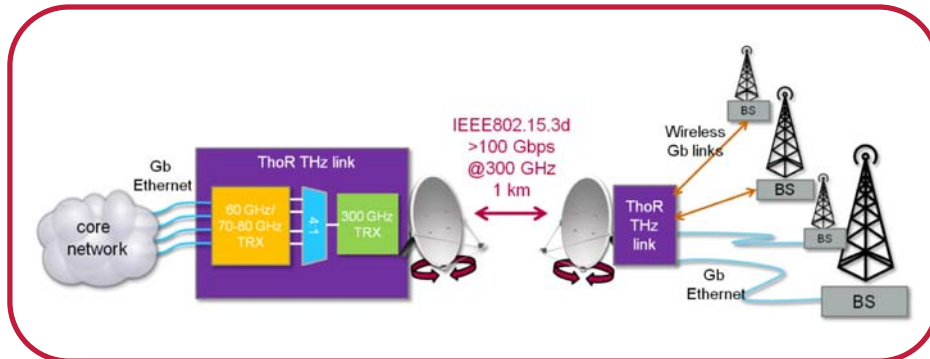


- ❑ Duration: September 2017 – August 2020
- ❑ Objectives:
  - Development of a system able to deliver ultra-high throughput (up to Tbps) meeting low latency and positioning requirements
    - Radio mmWave prototype links operating above 90 GHz able to deliver extremely high capacity and low latency
    - Optical wireless communication systems offering multi-Gbps up to Tbps in indoor spaces
  - Development of innovative network coordination systems in order to deliver Tbps data rates, with low latency, in a multi Wireless Access Technologies (WAT) environment
  - Demonstration of the ultra-high data rate prototype for virtual reality use-case
  - Provide inputs to standardization bodies (e.g. IEEE 802.11, IEEE 802.15.7 and 3GPP) where and when relevant



# H2020-EU-Japan-Project ThoR

THz end-to-end wireless systems supporting ultra-high data Rate applications



Participants	Country
<b>Companies</b>	
Deutsche Telekom AG	Germany
NEC Corporation	Japan
Siklu Communication Ltd.	Israel
Vivid Components Ltd.	UK
HRCP	Japan
<b>R&amp;D</b>	
Fraunhofer IAF	Germany
University of Lille / IEMN Laboratory	France
<b>Universities</b>	
TUBraunschweig ( <b>Coordinator, EU</b> )	Germany
Chiba Institute of Technology	Japan
Gifu University	Japan
University of Stuttgart	Germany
Waseda University ( <b>Coord., Japan</b> )	Japan

Project duration 1.7.18-30.6.21



# CLUSTER Activities in 2019

- IEEE EUCNC 2019 Workshop Beyond 5G
- INFOCOM 2019 UBTCN Workshop
- IRmmW-THz 2019 B5G Special Session
- IEEE 5G World Forum 2019

# Communication



[www.h2020-dream.eu](http://www.h2020-dream.eu)



[www.ict-Terranova.eu](http://www.ict-Terranova.eu)



[www.epic-h2020.eu](http://www.epic-h2020.eu)

@Epic760150



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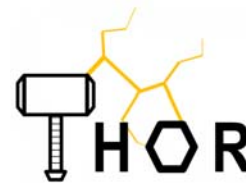
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ULTRAWAVE\*



[www.ThorProject.eu](http://www.ThorProject.eu)



[WORTECS](http://www.wortecs.eu)

[wortecs.eurestools.eu](http://wortecs.eurestools.eu)

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# ICT beyond 5G Cluster

