6GStart Online Event

5G Vertical User Workshop

The ETSI Approach to Research, Innovation, and New Technology Standards
(including, but not limited to, 6G)

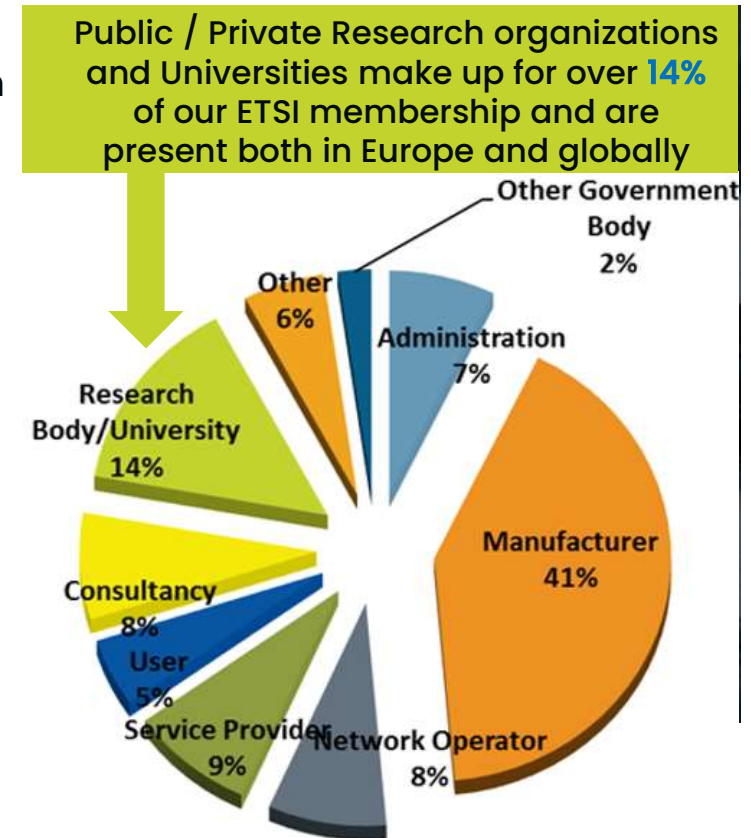**Source:** David Boswarthick:

ETSI Director NET (New Technologies)

Date: 20/04/2023

ETSI – Bringing people together...

- Independent, non-profit standards organization
- Officially recognized by the European Union to support EU regulation
- 35 year track record of technical excellence in the ICT sector
- Founding Partner of both **3GPP** (A GLOBAL INITIATIVE) and **oneM2M**

- Over 900 members from 61 countries over 5 continents,
- Diverse community: private companies, research and academia, governments, public bodies, societal stakeholders

- Over 130 technical groups holding more than 4 000 (e)-meetings per year

- Over 51 000 standards published to date, 2 400 annually
- All ETSI standards are available free of charge and may be downloaded from https://www.etsi.org/standards

Public / Private Research organizations and Universities make up for over 14% of our ETSI membership and are present both in Europe and globally

Pie chart:
- Other Government Body 2%
- Administration 7%
- Manufacturer 41%
- Network Operator 8%
- Service Provider 9%
- User 5%
- Consultancy 8%
- Research Body/University 14%
- Other 6%

Source: April 2023 edition of the ETSI Enjoy! magazine
https://www.etsi.org/newsroom/magazine

https://www.etsi.org/

ETSI Approach to Research and Innovation

- ETSI encourages a constant flow of research and innovation output into our standards work.

1. **ETSI Board RISE group:** Strong links between Researchers, Innovators & Standardization expertise in ETSI
   - Working with EU platforms (such as Horizon Europe, SNS JU, 6G-IA, NetworldEurope)
   - Working with national / EU / global research platforms & projects (e.g. HEXA-X / Next G Alliance /one6G / IOWN)
   - Outreach to universities and research labs worldwide

2. **ETSI Board TREND group:** Examines Future Technology Trends,
   - Produces the ETSI Technology Radar (ETR)

3. **ETSI NET (New Technology) Team:** responsible for
   - Build the tools and enablers for Research into Standards,
   - Track and capture Future Technology Evolutions,
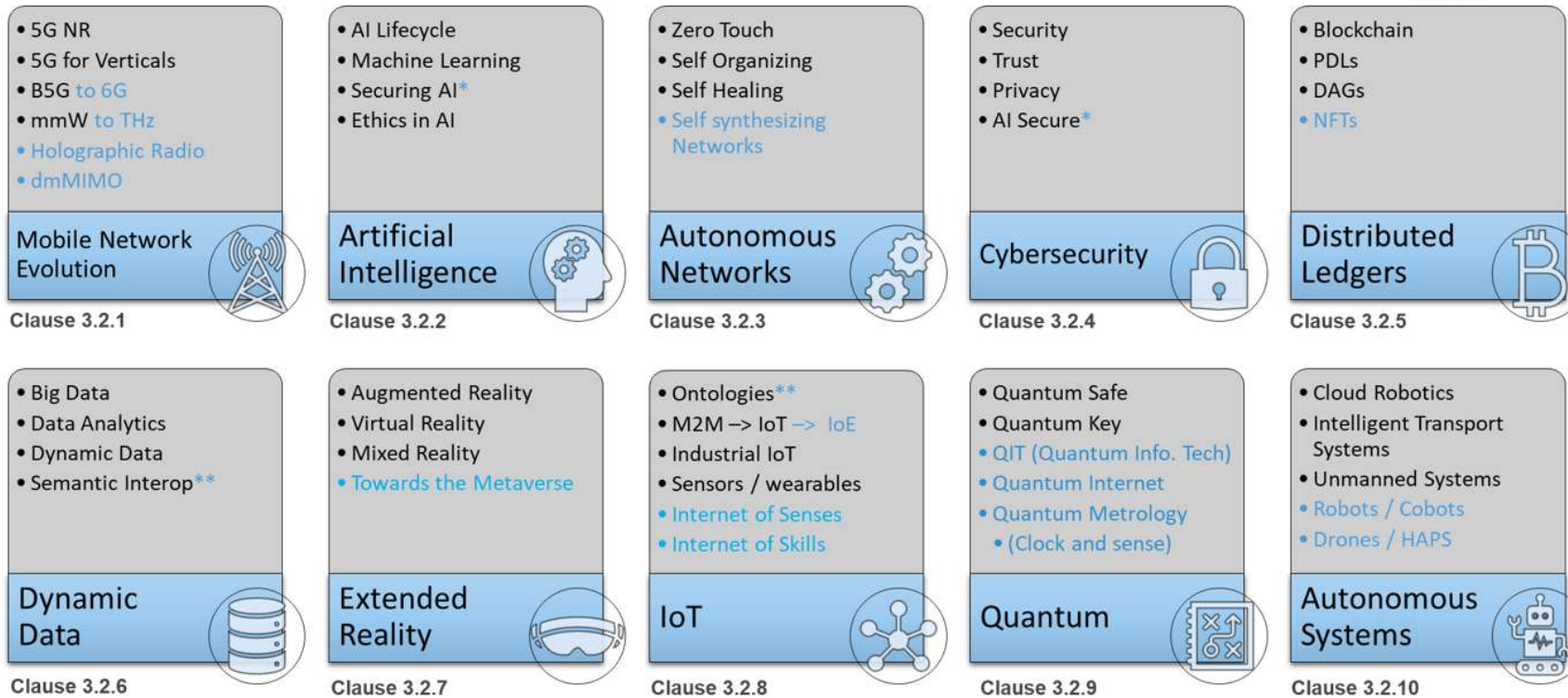   - Enable the creation of new technical groups, areas of work in ETSI
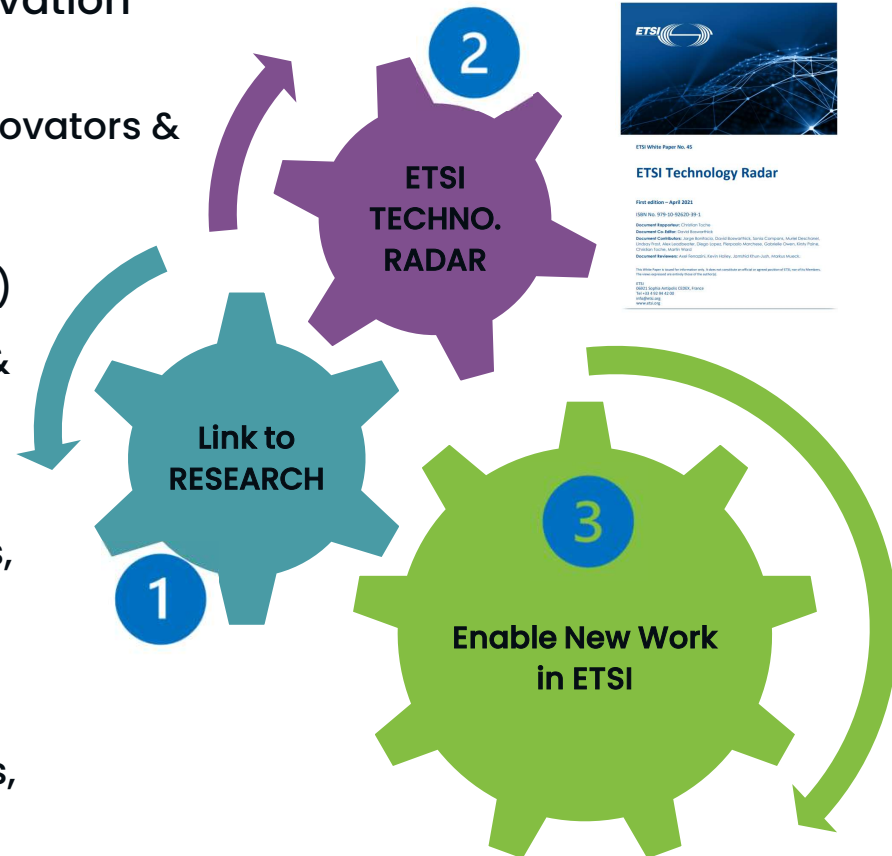
ETSI Technology Radar - Overview

- ETSI Technology Radar (ETR) tracks the major technology trends that are just on/over the horizon (approx. 0 –> 7 years). *Identifies potential for new standards work in ETSI.*

- ETR was first published in April 2021 and originally contained 10 broad Tech-Trends

Initial ETR TRENDs [2021]

• 5G NR • 5G for Verticals • B5G to 6G • mmW to THz • Holographic Radio • dmMIMO **Mobile Network Evolution** Clause 3.2.1	• AI Lifecycle • Machine Learning • Securing AI* • Ethics in AI **Artificial Intelligence** Clause 3.2.2	• Zero Touch • Self Organizing • Self Healing • Self synthesizing Networks **Autonomous Networks** Clause 3.2.3	• Security • Trust • Privacy • AI Secure* **Cybersecurity** Clause 3.2.4	• Blockchain • PDLs • DAGs • NFTs **Distributed Ledgers** Clause 3.2.5
• Big Data • Data Analytics • Dynamic Data • Semantic Interop** **Dynamic Data** Clause 3.2.6	• Augmented Reality • Virtual Reality • Mixed Reality • Towards the Metaverse **Extended Reality** Clause 3.2.7	• Ontologies** • M2M –> IoT –> IoE • Industrial IoT • Sensors / wearables • Internet of Senses • Internet of Skills **IoT** Clause 3.2.8	• Quantum Safe • Quantum Key • QIT (Quantum Info. Tech) • Quantum Internet • Quantum Metrology • (Clock and sense) **Quantum** Clause 3.2.9	• Cloud Robotics • Intelligent Transport Systems • Unmanned Systems • Robots / Cobots • Drones / HAPS **Autonomous Systems** Clause 3.2.10

5G Evolution
Artificial Intelligence
Autonomous Networks
Cybersecurity
Distributed Ledgers
Dynamic Data
Extended Reality
IoT
Quantum
Autonomous Systems

ETSI White Paper No. 45

ETSI Technology Radar

First edition – April 2021

ISBN No. 979-10-92620-39-1

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This White Paper is issued for information only. It does not constitute an official or agreed position of ETSI, nor of its Members. The views expressed are entirely those of the author(s).
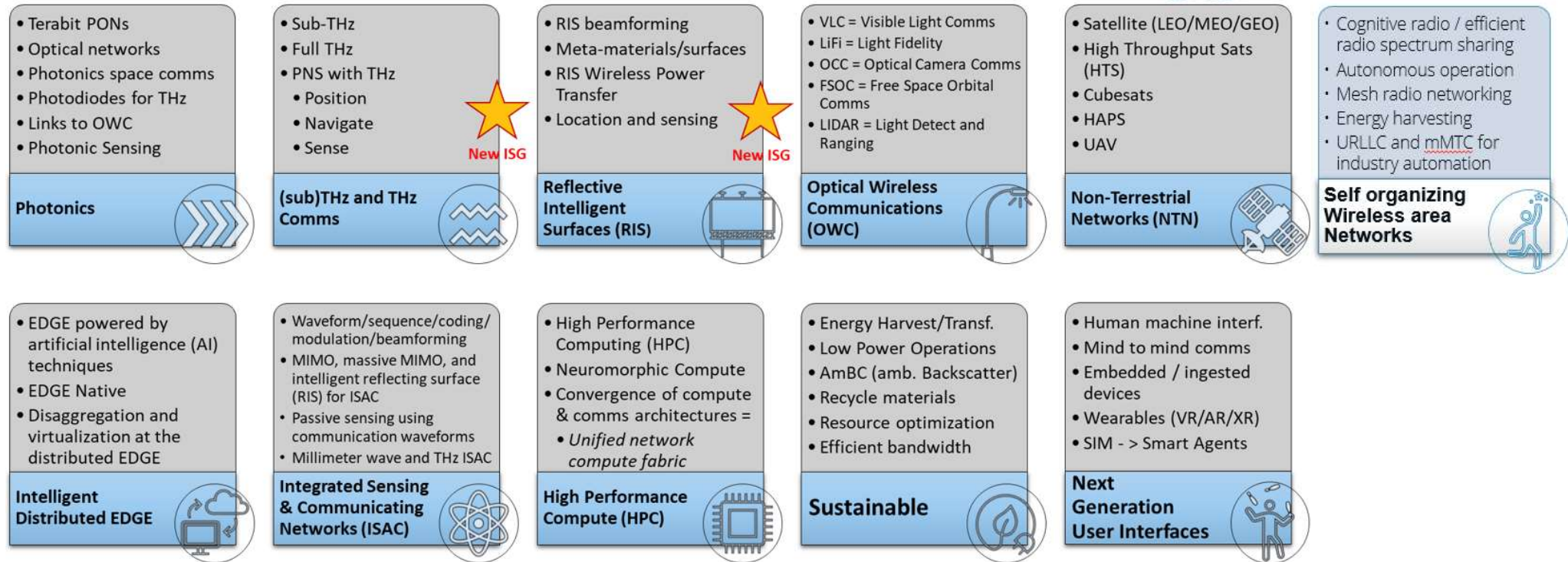
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ETSI Technology: Radar https://www.etsi.org/images/files/ETSIWhitePapers/etsi_wp45_ETSI_technology_radar.pdf

ETSI Technology Radar - Update

- ETSI Technology Radar (ETR) is in the process of being updated by BOARD_TREND

- Revision of the ETR planned for publication DECEMBER 2023, with ==11 additional== Technology Trends

New ETR TRENDs [2023]

Photonics
• Terabit PONs
• Optical networks
• Photonics space comms
• Photodiodes for THz
• Links to OWC
• Photonic Sensing
	(sub)THz and THz Comms
	• Sub-THz
	• Full THz
	• PNS with THz
	  • Position
	  • Navigate
	  • Sense
	New ISG
		Reflective Intelligent Surfaces (RIS)
		• RIS beamforming
		• Meta-materials/surfaces
		• RIS Wireless Power Transfer
		• Location and sensing
		New ISG
			Optical Wireless Communications (OWC)
			• VLC = Visible Light Comms
			• LiFi = Light Fidelity
			• OCC = Optical Camera Comms
			• FSOC = Free Space Orbital Comms
			• LIDAR = Light Detect and Ranging
				Non-Terrestrial Networks (NTN)
				• Satellite (LEO/MEO/GEO)
				• High Throughput Sats (HTS)
				• Cubesats
				• HAPS
				• UAV
					Self organizing Wireless area Networks
					• Cognitive radio / efficient radio spectrum sharing
					• Autonomous operation
					• Mesh radio networking
					• Energy harvesting
					• URLLC and mMTC for industry automation

Intelligent Distributed EDGE • EDGE powered by artificial intelligence (AI) techniques • EDGE Native • Disaggregation and virtualization at the distributed EDGE	**Integrated Sensing & Communicating Networks (ISAC)** • Waveform/sequence/coding/modulation/beamforming • MIMO, massive MIMO, and intelligent reflecting surface (RIS) for ISAC • Passive sensing using communication waveforms • Millimeter wave and THz ISAC	**High Performance Compute (HPC)** • High Performance Computing (HPC) • Neuromorphic Compute • Convergence of compute & comms architectures = • *Unified network compute fabric*	**Sustainable** • Energy Harvest/Transf. • Low Power Operations • AmBC (amb. Backscatter) • Recycle materials • Resource optimization • Efficient bandwidth	**Next Generation User Interfaces** • Human machine interf. • Mind to mind comms • Embedded / ingested devices • Wearables (VR/AR/XR) • SIM - > Smart Agents	

Topics emerging from early 6G research

Current assumption is the first 6G services *may* be deployed in **2030**, but of course expectations can & often do change due to global / market pressure
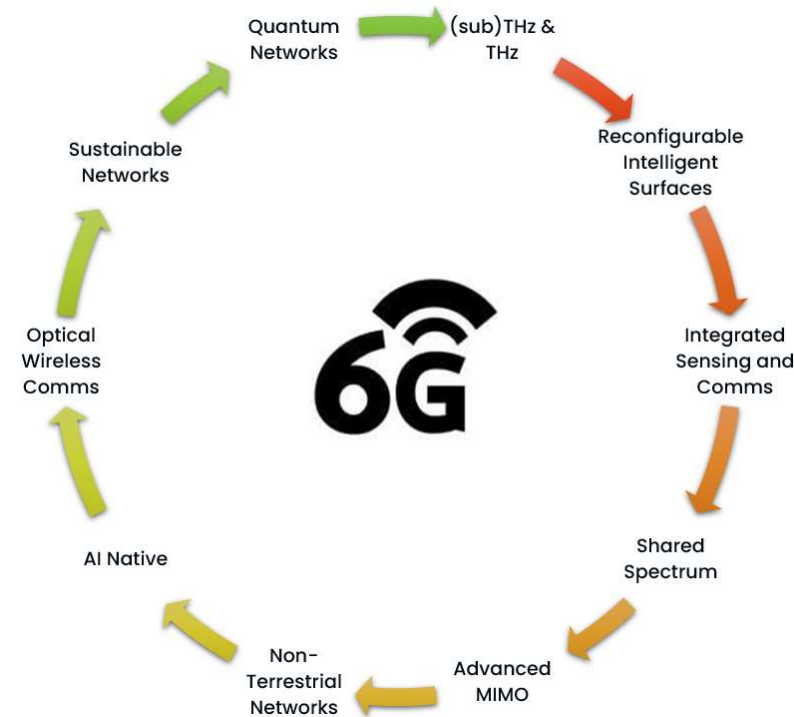
6G is currently only at the **Research** & **Vision** phase, and formal standards for 6G will follow later

We see already **many announcements** of national, regional, corporate 6G programmes and visions

Early sharing of 6G ROADMAPs & VISIONs between regional initiatives is essential in order to avoid 6G fragmentation/divergence of standards solutions

6G is expected to begin in 3GPP in Rel-20 (6G initial studies) and Rel-21 (6G service requirements), starting some time in the 2025 -> 2026 timeframe.

There are already some 'common identified' use cases, performance expectations and candidate 6G technologies.

Quantum Networks — (sub)THz & THz — Reconfigurable Intelligent Surfaces — Integrated Sensing and Comms — Shared Spectrum — Advanced MIMO — Non-Terrestrial Networks — AI Native — Optical Wireless Comms — Sustainable Networks

Candidate B5G / 6G Technologies

NOTE: These are simply *common* elements Extracted from *multiple* 6G vision papers.

6G, the **Window of Opportunity** (for pre-standards work)

ETSI

Source: B. Barani, DG Connect
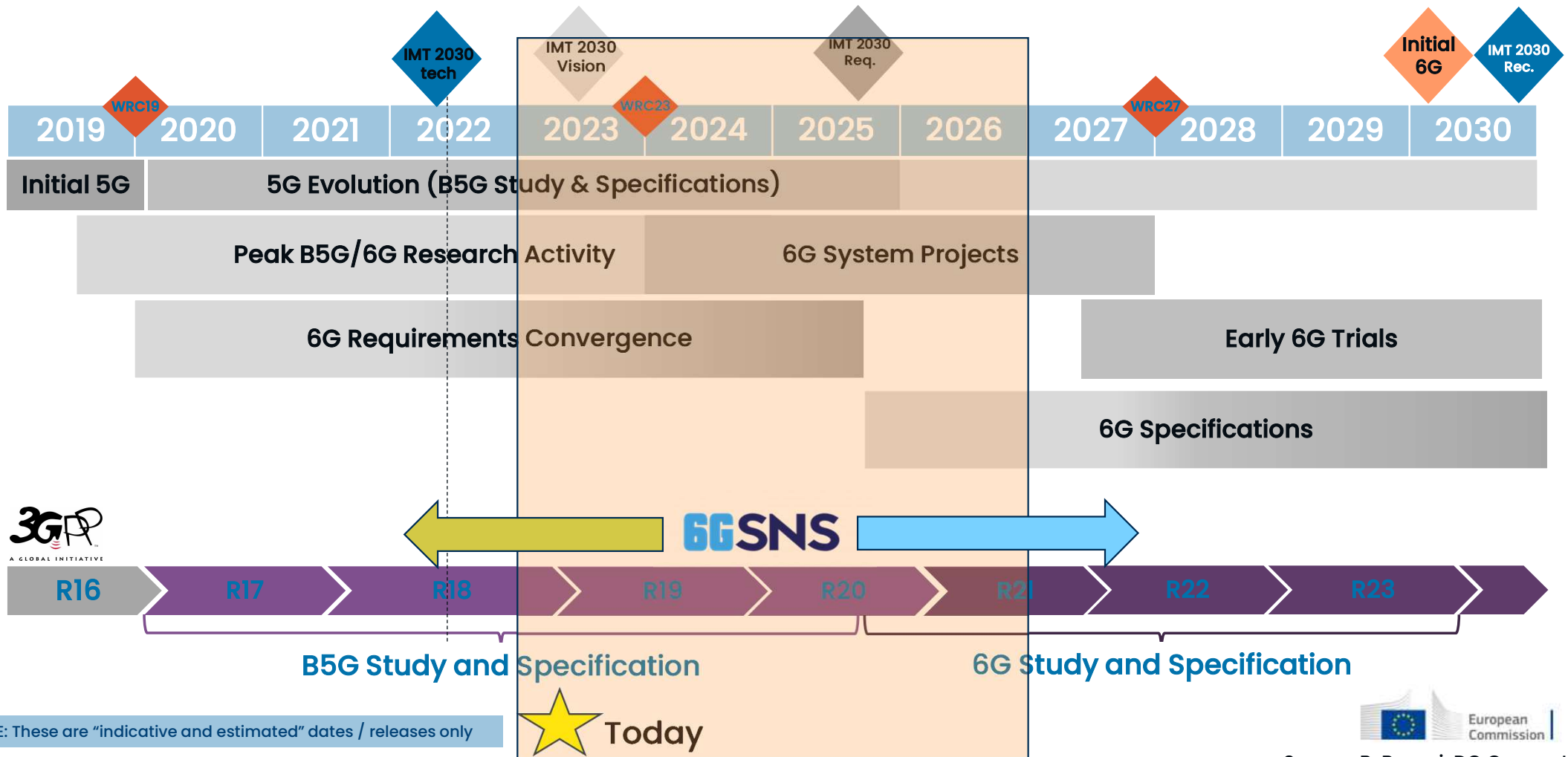
NOTE: These are "indicative and estimated" dates / releases only

# Potential 6G pre-standards Groups, What 'could' be next ?

ETSI is always considering potential new areas of work.

The topics identified in the ETSI Technology Radar (ETR) are a good starting point but not only.

ETSI is 100% member-driven and is interested in suggestions and contributions from our Member organizations (present & future) about potential new areas of work for 2023 and beyond.

Today, there is *no consensus of what the 6G technologies will include*, but they will be a mix of,

- *Evolutionary* technology developments, building on 5G evolutions

- and *Revolutionary* technology leaps, requiring a 'new' Generation
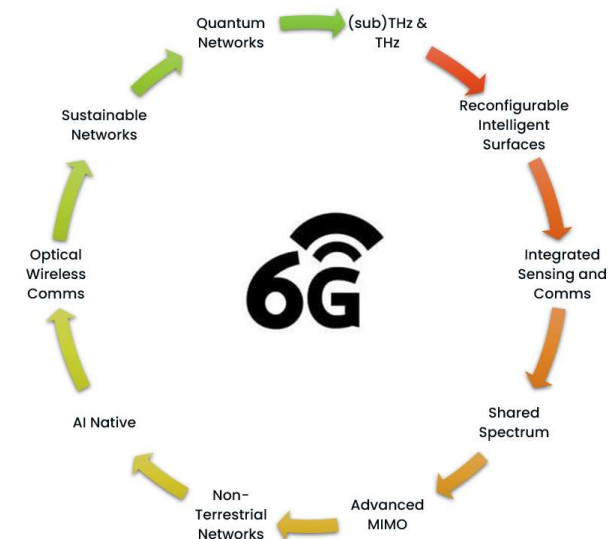
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