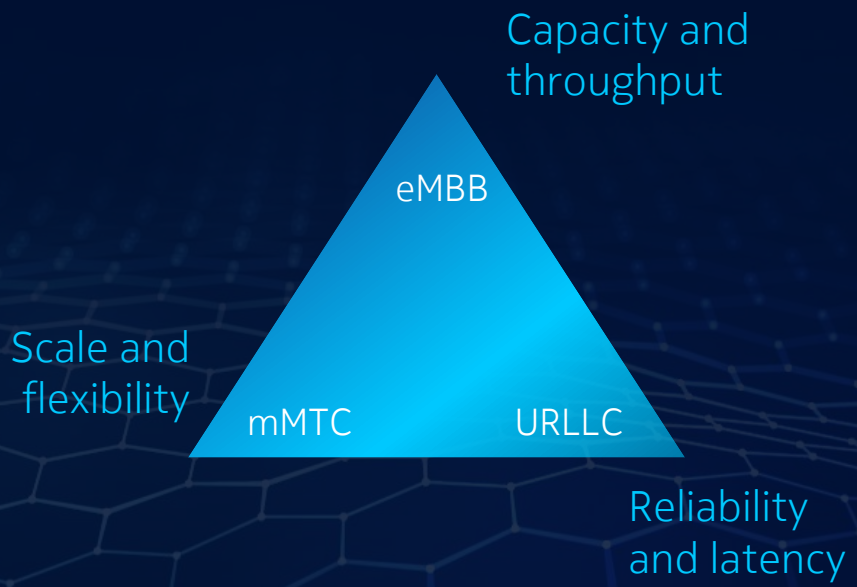
Shaping future 6G network

Hannu Flinck, Nokia

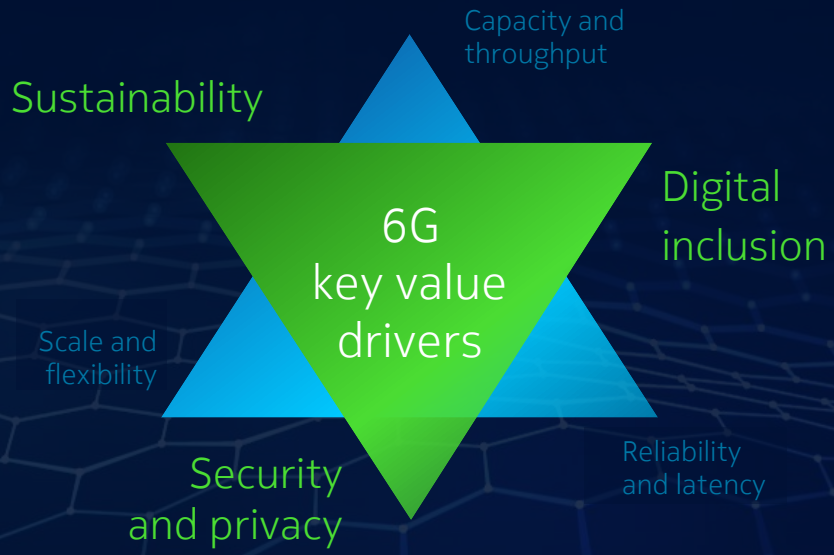
Wireless system design principles

From 2G to 5G



Wireless system design principles

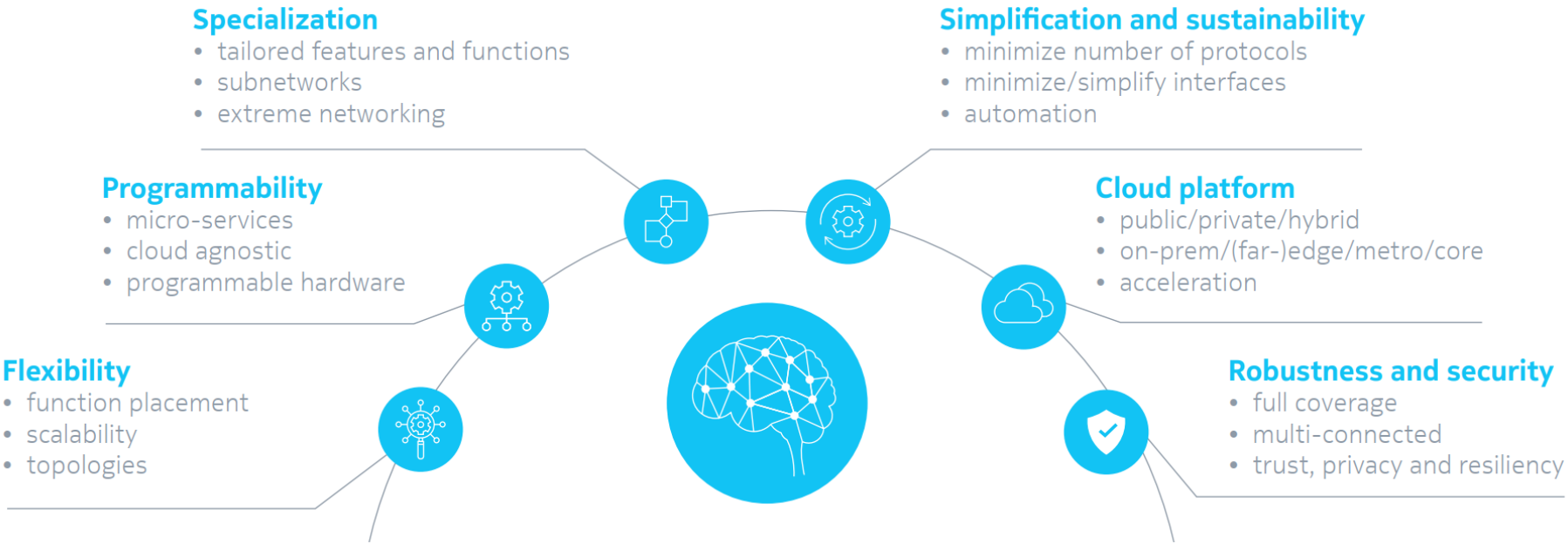
In 6G: Adding three key value drivers



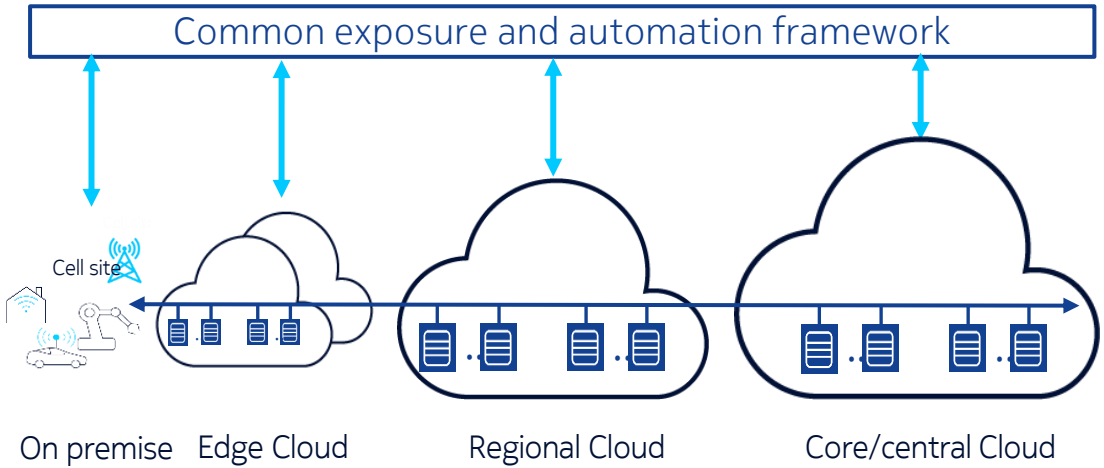
What to expect from 6G?

Critical dimensions	Capacity and throughput • 20xtraffic • 100 Gps peak rates • 1 Gbps where needed	Scalability and flexibility • Global coverage • 10 million devices/Sq Km • Platform and services approach	Reliability and latency • 0.1 ms – 1 ms • Nine 9s • Nanosecond synchronization level
6G Value drivers	Sustainability • Zero-carbon-footprint networks and 6G for a sustainable future	Digital inclusion • Global connectivity will be a basic human right	Security and privacy • Evolve networks towards fully trustworthy and resilient systems

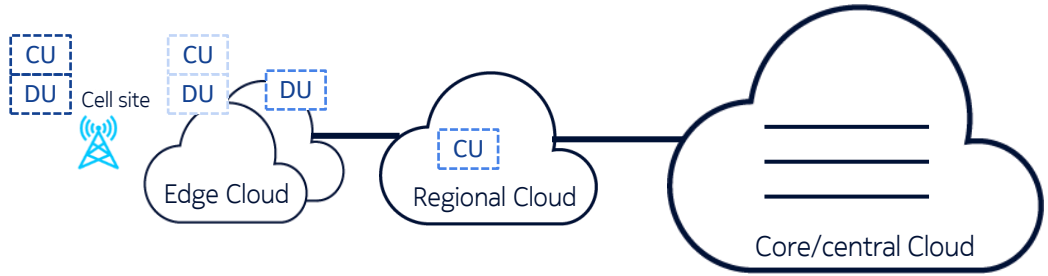
6G System Architecture: Goals and challenges

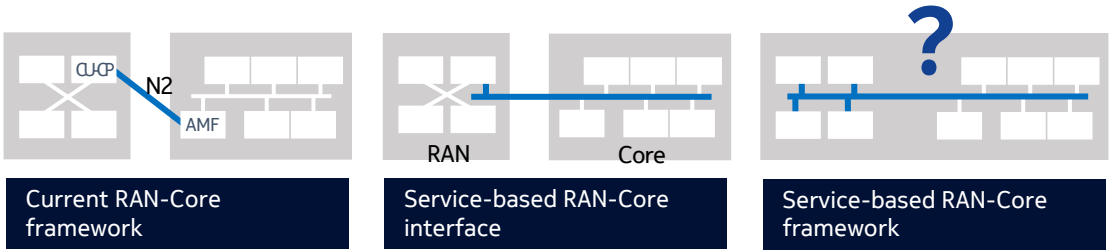


Fully cloud native architecture

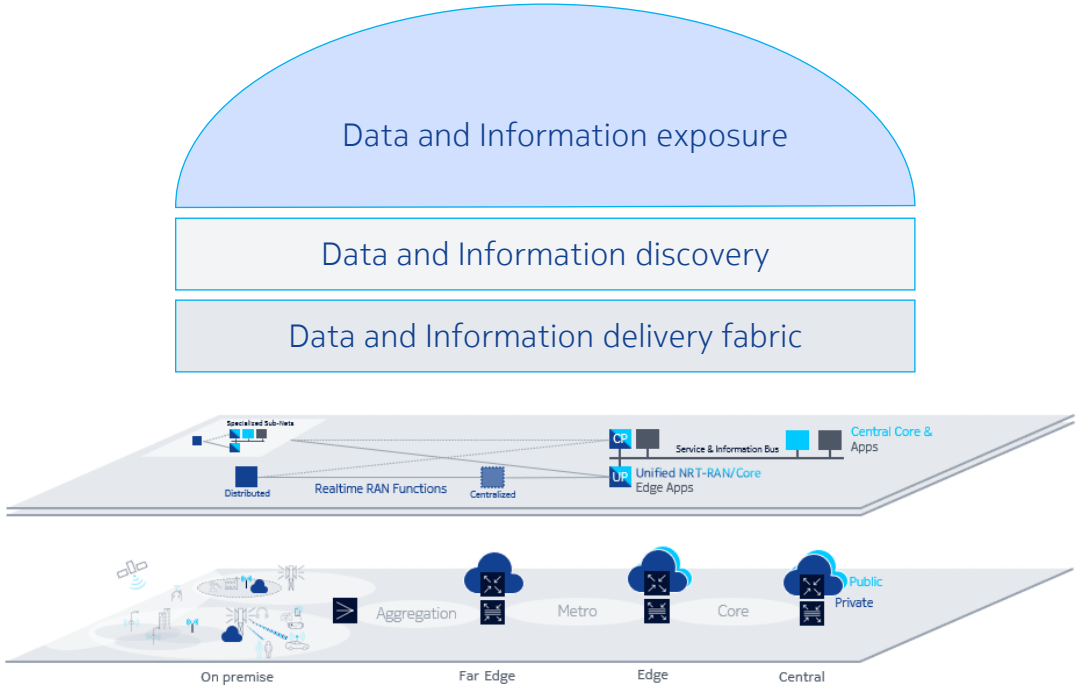


System architecture (r)evolution



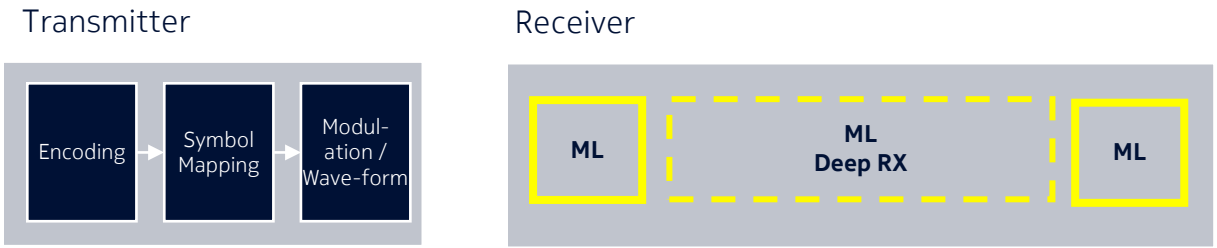


Data and Information framework



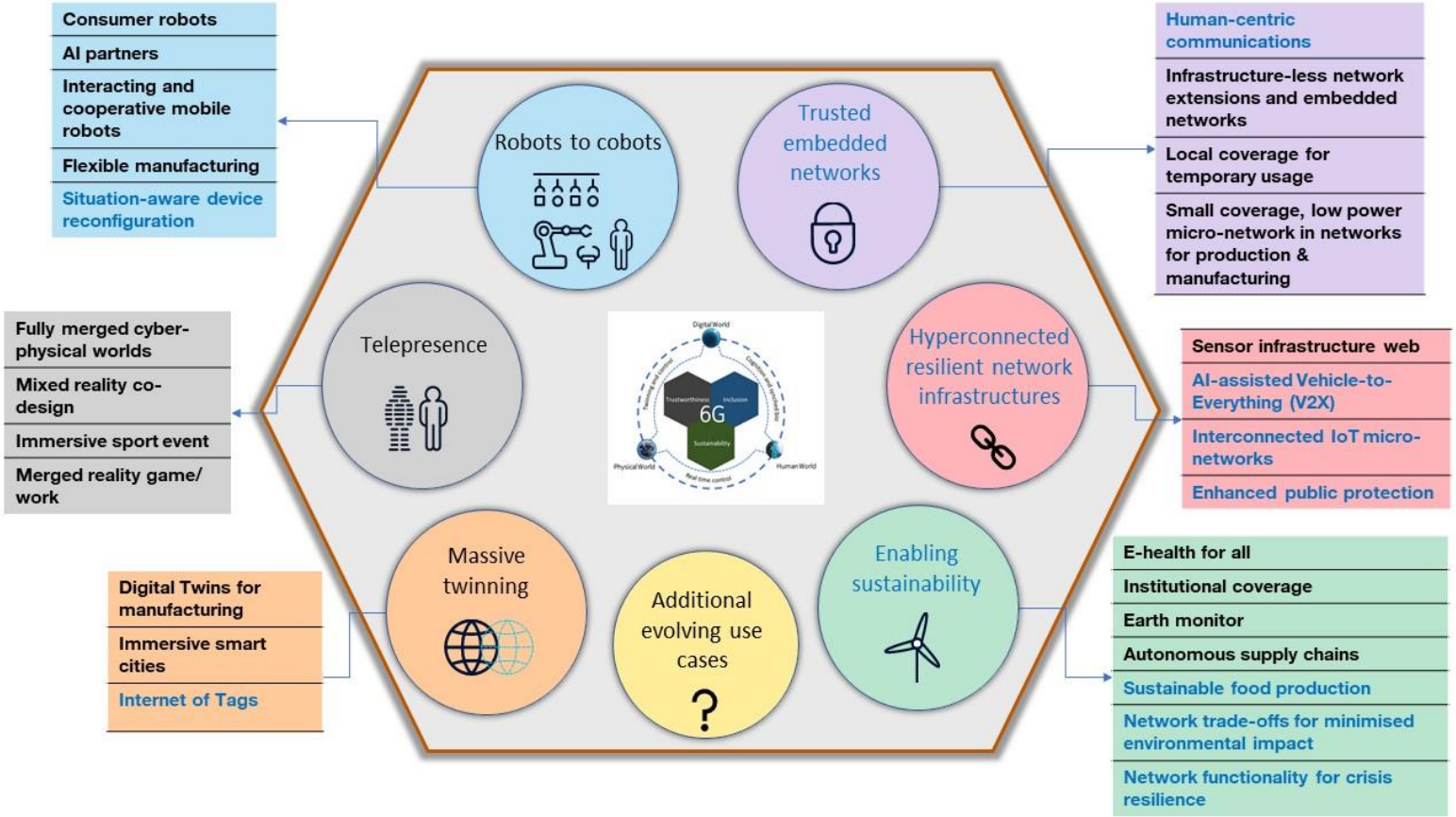
6G AI native air interface

- 5G-Advanced phase 2: ML replaces multiple processing blocks



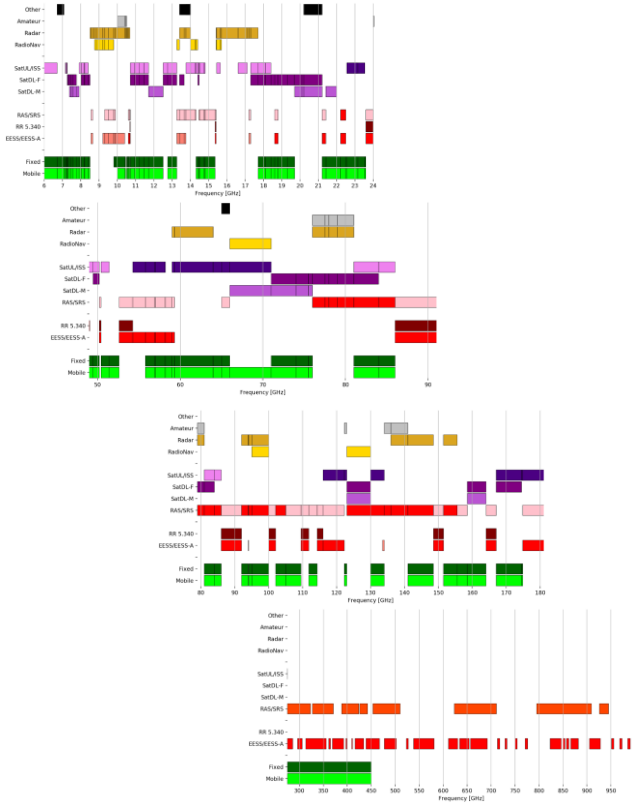
- 6G ML designs part of the PHY itself

Hexa-X EU project has identified services and use cases for 6G: clustered into 6 families



Spectrum evolution aspects: Improve spectrum utilization & extend current spectrum boundaries

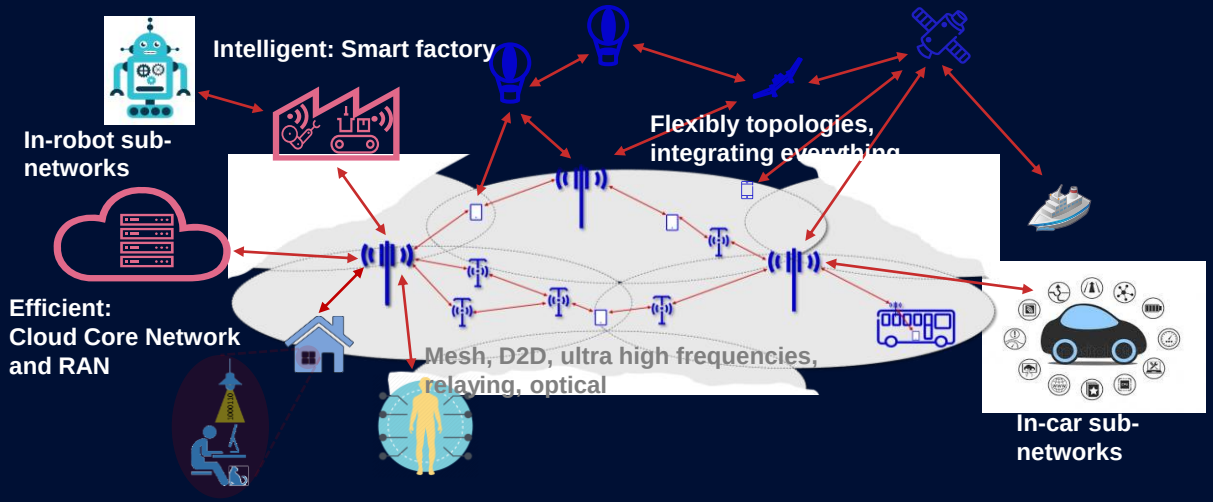
- Sub-THz spectrum will be utilized with combinations of bands: low, mid, and mmw ranges to optimize wireless link characteristics and cooperatively provide the full set of service requirements
- Spectrum under 6 GHz pivotal for wide area radio coverages
- Possible usage of spectrum in 7-24 GHz range; currently not available for mobile communications to be exploited by proper design of sharing methods with current users
- Improved intelligent spectrum access systems, in particular in newly available spectrum resources in higher bands, to dynamically assign frequency resources to authorised subsystems on both time and geographical basis while preventing interference issues
- Extending spectrum utilization
  - Improving the usage of available spectrum in the different frequency bands identified for IMT
  - New coordination mechanisms and techniques for local spectrum use
  - Improving assumptions and models to better fit more realistic scenarios



An overview of spectrum allocations in several ranges between 6 GHz and 1,000 GHz

Hexa-X Architectural enablers for 6G

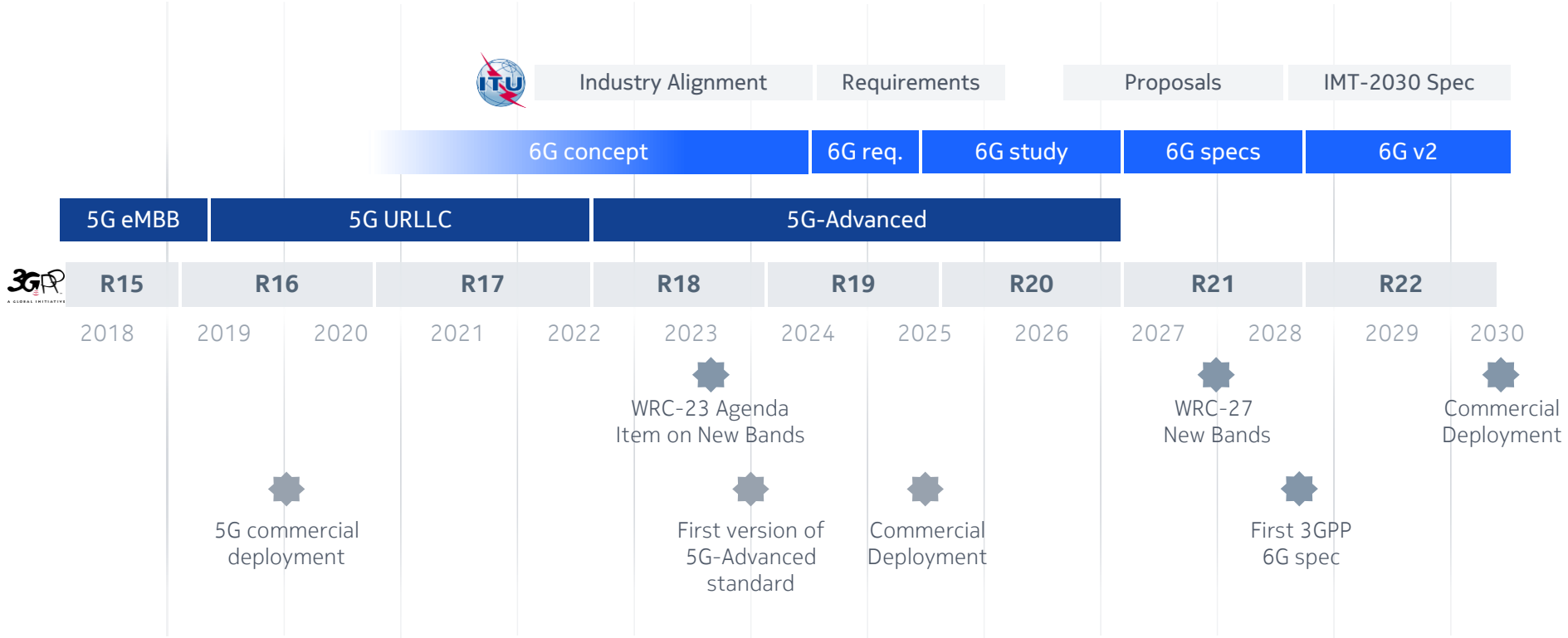
- **Main objectives** are to develop:
  - Technical enablers for **AI integration and network programmability**
  - Architectural components that support a new **flexible network design**
  - **Streamlined and redesigned architecture** for a cloud-native RAN and CN



Hexa-X standardization activities

- ITU-R IMT2030 Vision work
  - Use case justifying the AI/ML applicability,
  - To the use of Sub THz radio.
- 3GPP contributions about the energy efficiency and analytics to support AI/ML
- NGMN to use case and their analysis
- GSMA E2E Network Slicing Architecture

Nokia's view on 6G timeline



NOKIA Bell Labs