# 6G –
# The Intelligent Network Platform of 2030

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# What is 6G?

# 6G

## Driving forces

↕

Use cases

↕

Capabilities

↕

Technology

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### Some drivers for future technology evolution
Outside in perspective

| Application demands | Trustworthiness | Sustain'able world | Simplified life |
|---|---|---|---|
| extended and new services requiring extreme connectivity performance | trusted communication and computing for industry and society relying on critical information | communication and networking as part of and enabler for sustainable development | communication and massive use of AI across systems for optimal assistance and efficiency |

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## Outside in perspective

**Application demands**

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**Trustworthiness**

trusted communication and computing for industry and society relying on critical information

**Sustainable world**

communication and networking as part of and enabler for sustainable development

**Simplified life**

communication and massive use of AI across systems for optimal assistance and efficiency

# 6G

Driving forces

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## Use cases

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## Some drivers for future technology evolution
### Outside in perspective

Applic...

extende...
service...
extreme...
perform...

## Moving in a cyber-physical continuum

**Programmable digital representation of the physical world**

**Digital world**

*Connected intelligent machines*

*Internet of senses*

*Digitalized & programmable physical world*

**Physical world**

**The physical world of sensing, action, and experience**

# Moving in a cyber-physical continuum

**Programmable digital representation of the physical world**

The network platform provides intelligence, ever-present connectivity, and full synchronization in a cyber-physical continuum

*Cyber-physical continuum*

Digital world

*Connected intelligent machines*

*Internet of senses*

*Digitalized & programmable physical world*

Physical world

*Connected sustainable world*
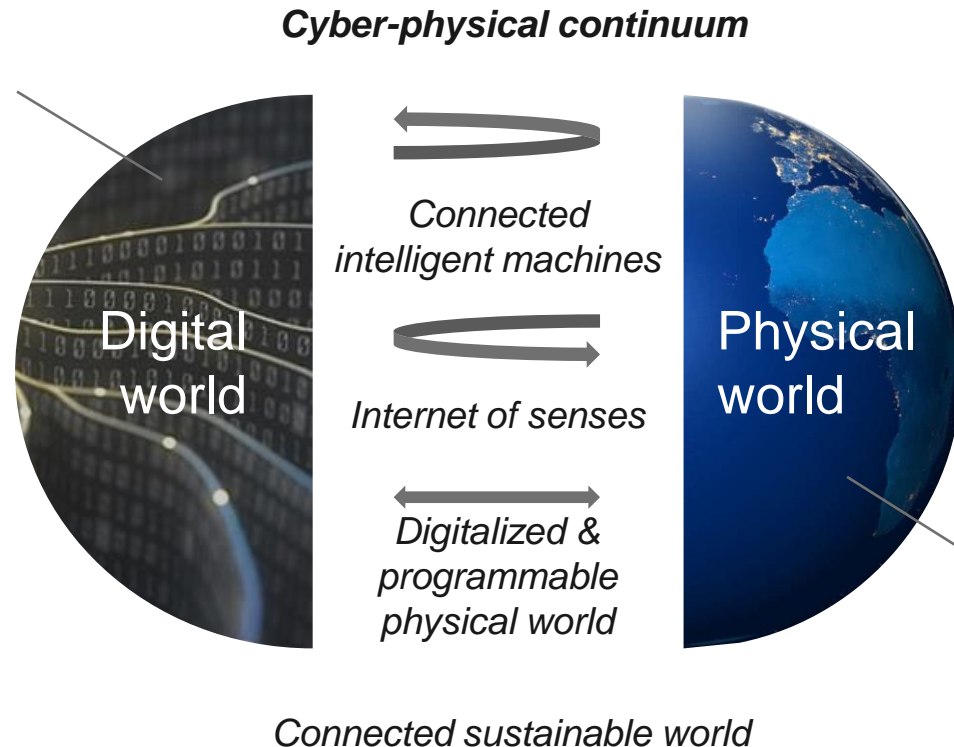
Vast amounts of sensors embedded in physical world send data to update the digital representation in real time

Actuators in the real world carry out functions that is programmed in the digital representation

**The physical world of sensing, action, and experience**

# 6G

Driving forces

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### Moving in a cyber-physical continuum

Applic
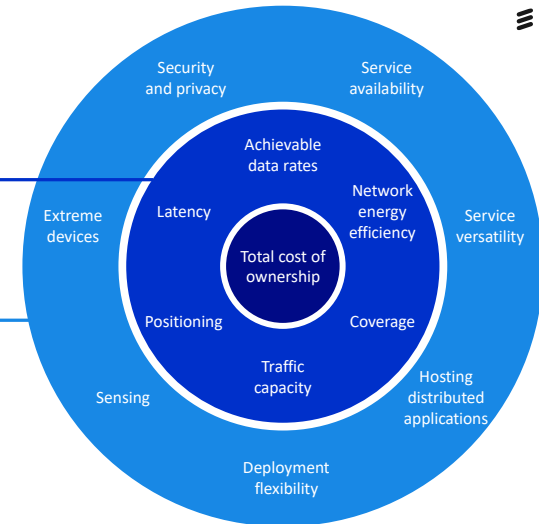
extende
service
extreme
perform

**Program
represen
physical**

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### Capabilities

"Classical" capabilities still important

New capabilities for emerging use cases

Total cost of ownership

Security and privacy · Service availability · Achievable data rates · Network energy efficiency · Service versatility · Extreme devices · Latency · Total cost of ownership · Coverage · Positioning · Traffic capacity · Hosting distributed applications · Sensing · Deployment flexibility

# Capabilities

"Classical" capabilities still important

New capabilities for emerging use cases

Cost efficient and sustainable



Security and privacy

Service availability

Achievable data rates

Network energy efficiency

Latency

Extreme devices

Service versatility

Cost efficient & sustainable

Positioning

Coverage

Traffic capacity

Sensing

Dependable compute

Deployment flexibility

# 6G



Driving forces

↕

Use cases

↕

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↕

**Technology**

Some drivers for future technology evolution
Outside in perspective

Moving in a cyber-physical continuum

Capabilities

Technology

Limitless connectivity | Trustworthy Systems | Cognitive network | Network compute fabric

# Technology

## Limitless connectivity

| Limitless connectivity |
| --- |
| Network adaptability |
| End-to-end functions |
| Extreme performance |
| Embedded devices everywhere |

## Trustworthy Systems

| Trustworthy systems |
| --- |
| Security assurance |
| Service availability |
| Solutions built on conf. computing |
| Secure identities & protocols |

## Cognitive network

| Cognitive network |
| --- |
| Data-driven operations |
| Distributed intelligence |
| Continuous learning |
| Intent-based management |
| Explainable & trustworthy AI |
| Cognitive system |

## Network compute fabric

| Network compute fabric |
| --- |
| Unified telco-IT ecosystem |
| Unified execution environment |
| Unified data infrastructure |
| Unified application management |

# Intelligent Network Platform

**Applications**

Real-time Gaming

Comms/Productivity for Enterprise
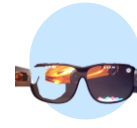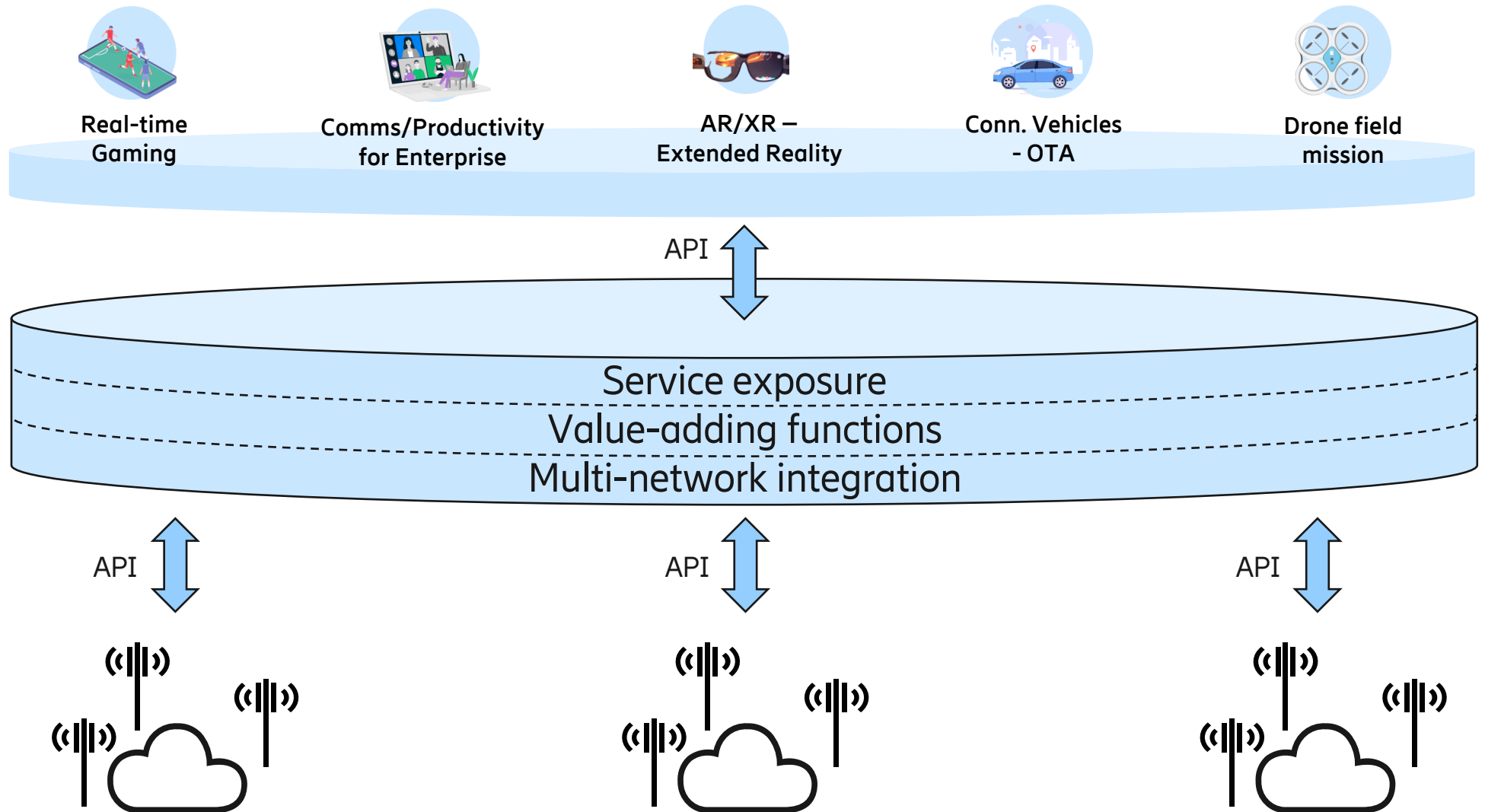
AR/XR – Extended Reality
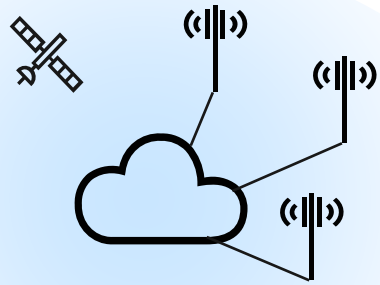
Conn. Vehicles - OTA

Drone field mission

**Developer ecosystem**

API

**Intelligent Network Platform**

Service exposure

Value-adding functions

Multi-network integration

API

API

API

**CSP network**

# Some examples of technology components

Cloud-native

Spectrum compatibility

6G spectrum range

1 GHz    3 GHz    10 GHz    30 GHz    100 GHz    300 GHz

Spectrum

AI
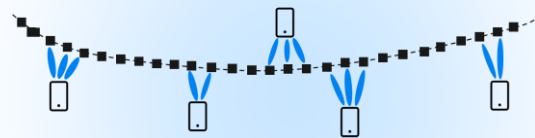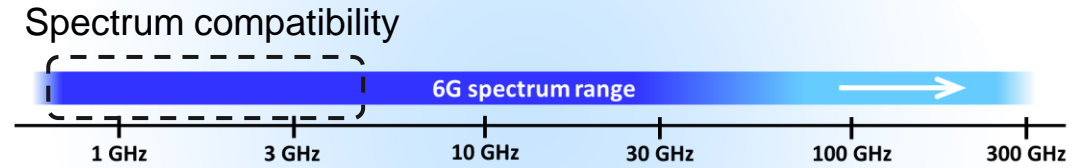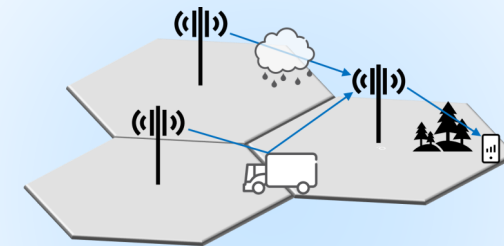
Joint communication and sensing
"6G makes sense"

D-MIMO

"Zero energy" devices

…and many more!

# Network Adaptability (examples)

**Cloud-native**

## Network architecture optimized for cloud

- Based on a common cloud platform and IT tools

- Fully service-based

- Having enhanced functional separation

- Enabling optimization and simplification
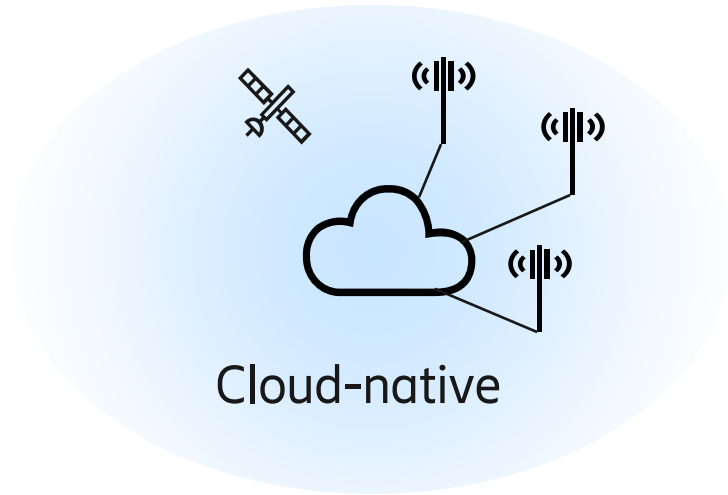
## Flexible and dynamic networks

- Integration of new types of access nodes

- Versatile programmable transport for cost effective densification

- Addressing needs from enterprises and verticals

## Programmable devices and network

- Adjust to new deployments and use cases

- Faster TTM for new services and features, more devops like
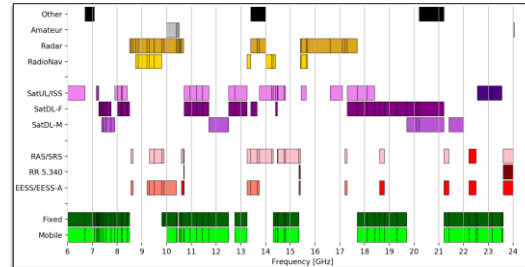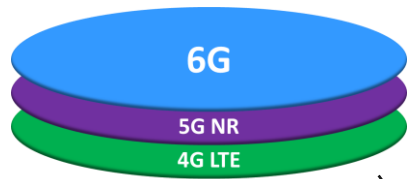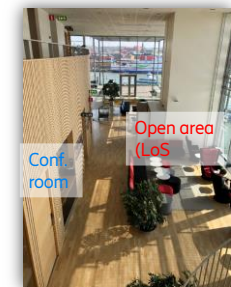
- Dynamically deployable AI/ML agents
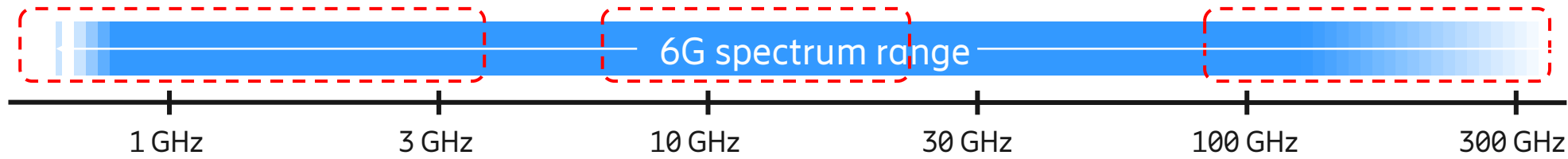
AI

# Spectrum

- Wide range – from sub-GHz to sub-THz


Coexistence with other services

Spectrum compatibility needed      7 – 24 GHz      "sub-THz" – specific scenarios only

6G spectrum range

1 GHz    3 GHz    10 GHz    30 GHz    100 GHz    300 GHz

# "Zero-energy" devices

- Devices harvesting ambient energy (solar, temperature, vibrations, RF, …)
  - *"No need to change battery"*
  - *Enabling sustainable asset trackers, sensors for mass deployment, …*

- Much more extreme than today's low-power/ low-capability devices – *not* an incremental enhancement of NB-IoT/LTE-M

- Design challenges – very small amounts of energy available, complete redesign of the air interface needed
  - PHY; waveform suitable for Rx/Tx device imperfections, crystal oscillators likely not feasible
  - Mobility; current mobility mechanisms cannot be afforded from an energy perspective
  - Security; power-efficient security mechanisms are needed
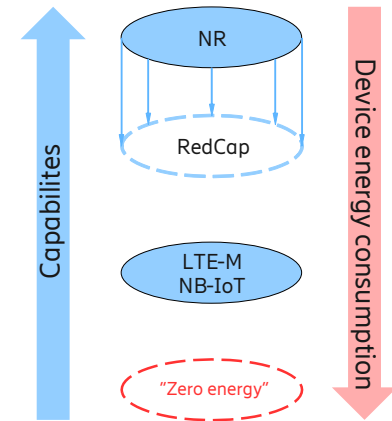
# "6G makes sense"

Sensing functionality as an *integrated* part of the communication network

- Reuse the communication spectrum for sensing
- Reuse the communication infra-structure for sensing
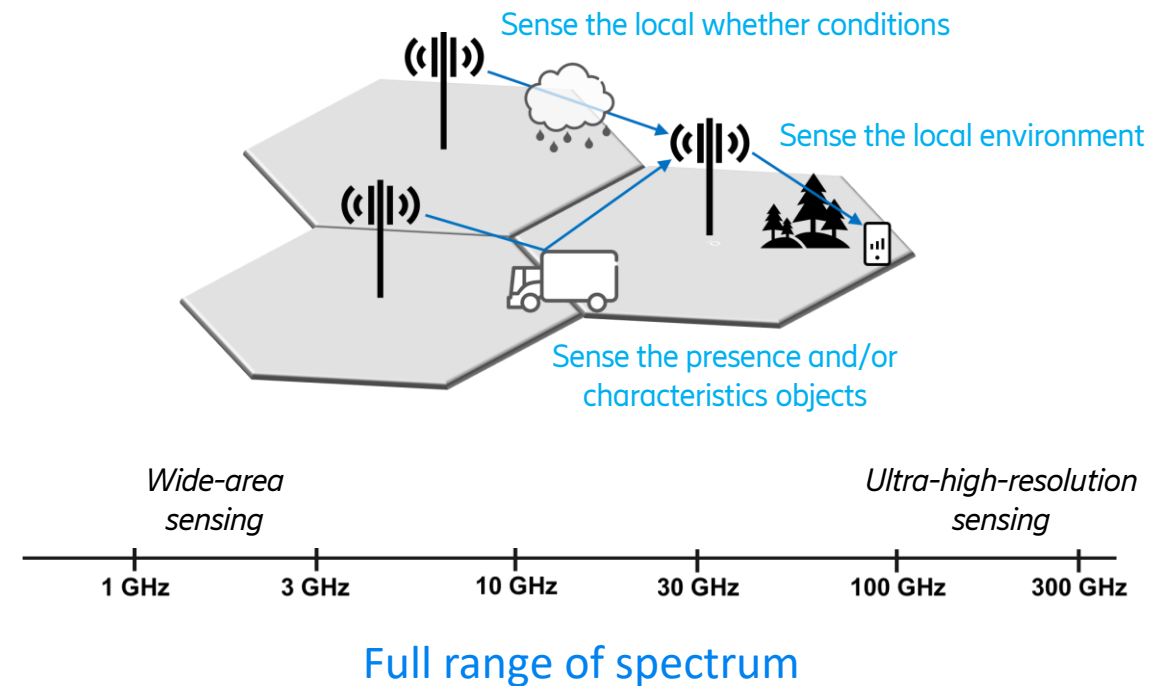
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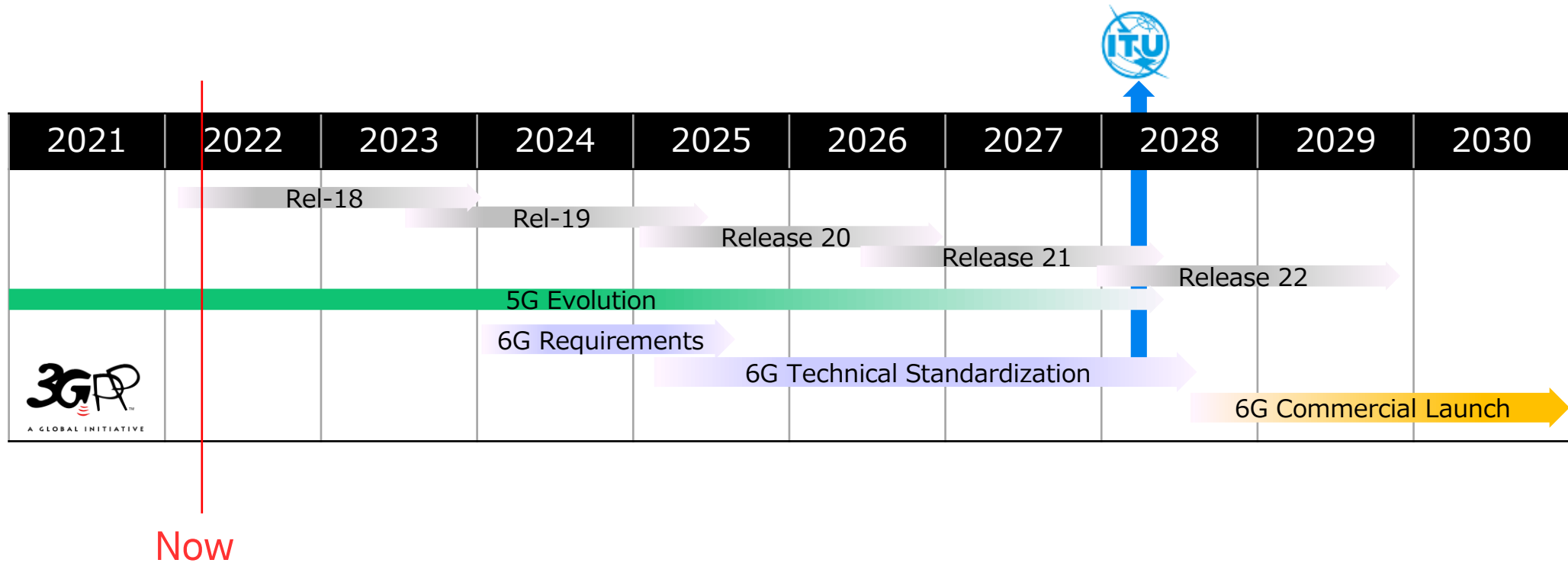Low-cost introduction of sensing functionality

Benefit from huge number of co-operative network nodes

Externally to enable new/enhanced services
Internally to enhance the network performance



Sense the local whether conditions

Sense the local environment

Sense the presence and/or characteristics objects

Wide-area sensing

Ultra-high-resolution sensing

| | 1 GHz | 3 GHz | 10 GHz | 30 GHz | 100 GHz | 300 GHz |

Full range of spectrum

# Timeline

# Summary

- 6G is the overall solution around 2030 –
  *a trusted platform delivering ever-present intelligent communication including connectivity, data, and compute*

- New capabilities for new use cases

- Wide range of radio-access technologies considered