6G the next technology horizon

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Big Trends

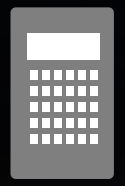
Connected Society

Connected Everything

Connected Intelligence

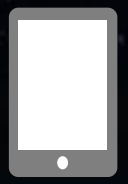
Big Shifts (Every 20 Years)

1G



Sub 1GHz

2G 3G



Sub 3GHz

4G 5G

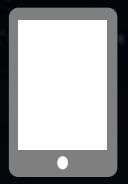
mmWave

6G 7G

Sub THz

Big Shifts (Market Reality)

1G 2G | 3G 4G | 5G 6G | 7G ····



Sub 1GHz | Sub 3GHz | mmWave | Sub THz

Big Technologies

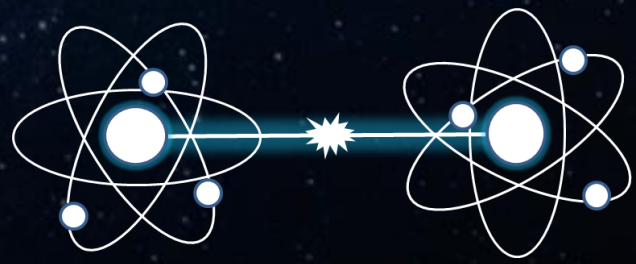
ML

1-5 Years

VLEO

5-10 Years

QPU



10-20 Years

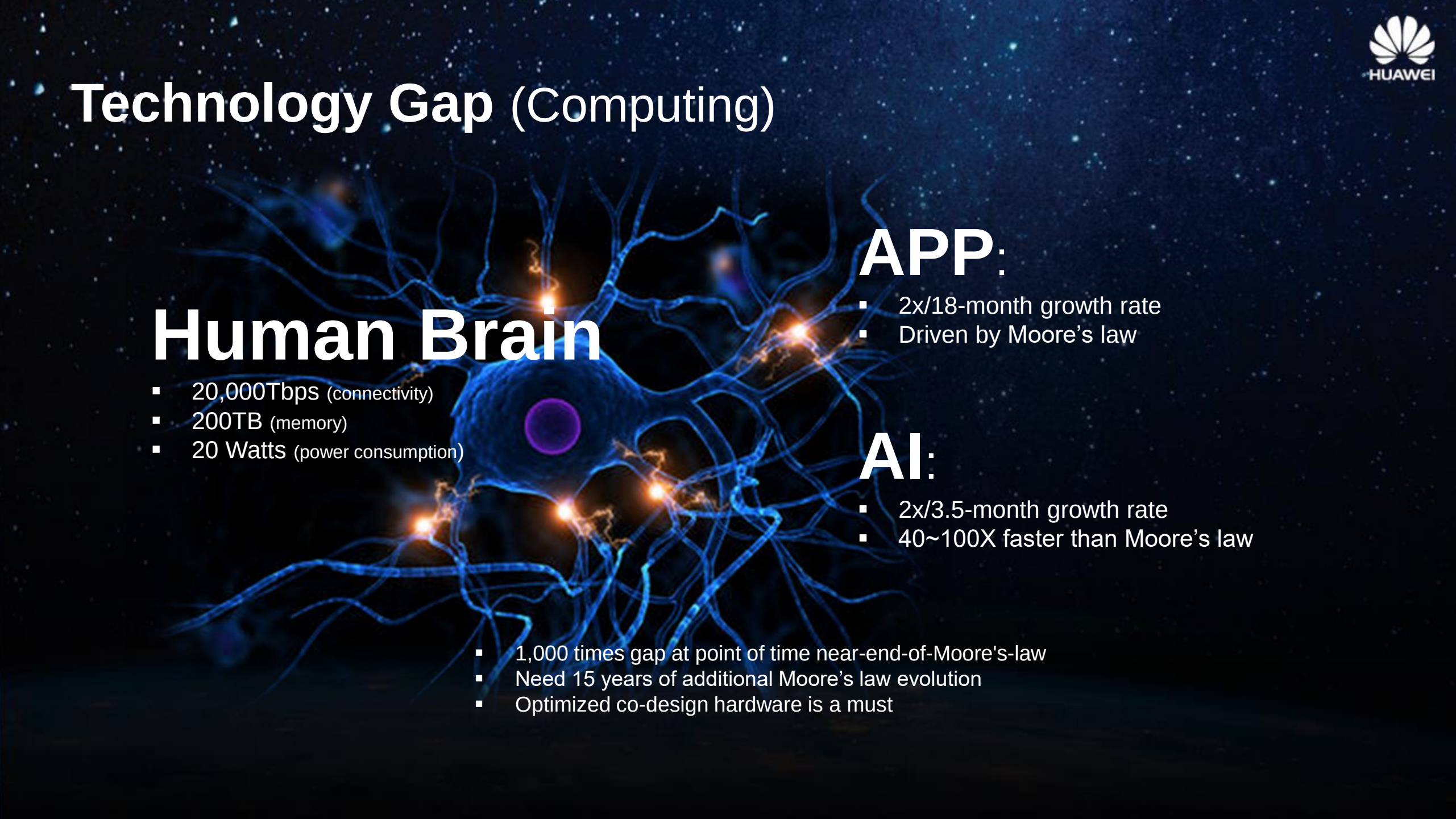
Big Goal: 6G

From

To

- Mobile to Enable Proliferation of AI
- Network to Augment of ML

Technology Gap (Computing)



Human Brain

- 20,000Tbps (connectivity)
- 200TB (memory)
- 20 Watts (power consumption)

APP:

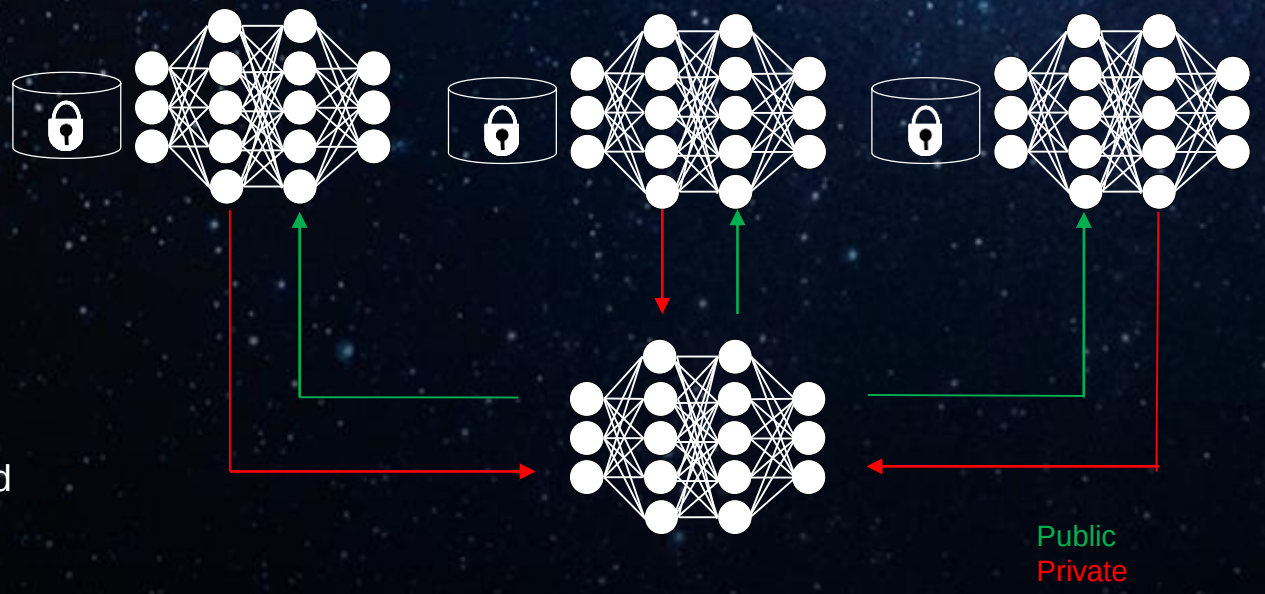
- 2x/18-month growth rate
- Driven by Moore’s law

AI:

- 2x/3.5-month growth rate
- 40~100X faster than Moore’s law

- 1,000 times gap at point of time near-end-of-Moore's-law
- Need 15 years of additional Moore’s law evolution
- Optimized co-design hardware is a must

Technology Gap (Network Architecture)



More data for ML

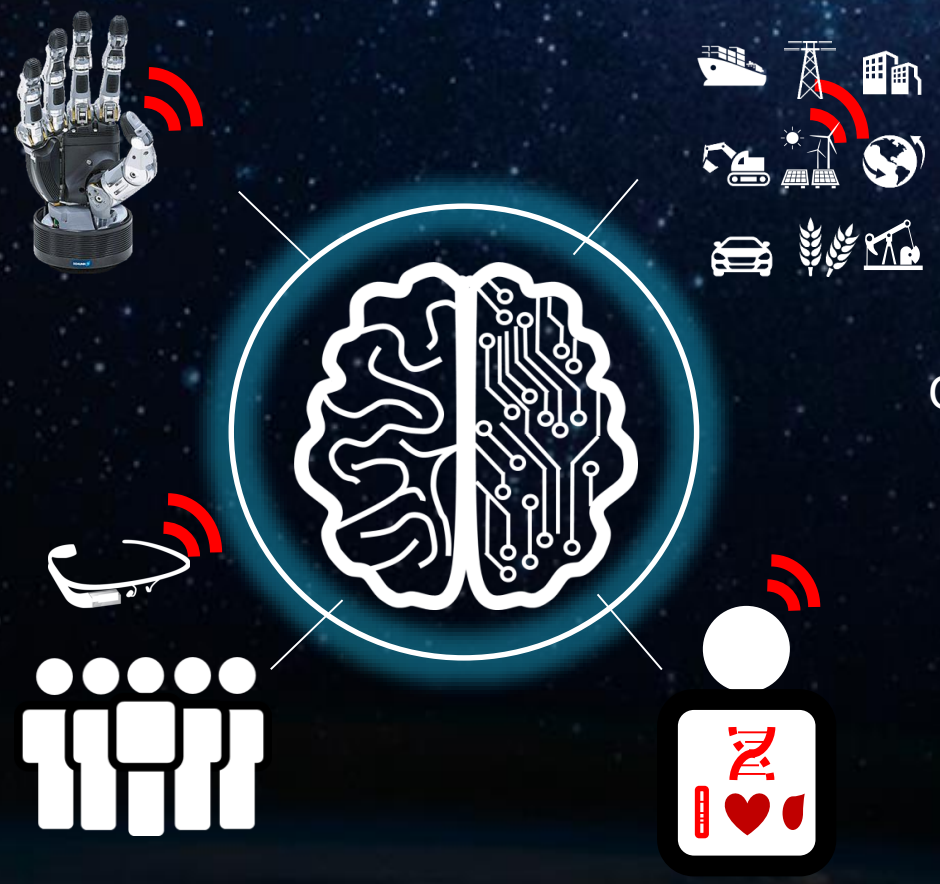
- Physical world to digital world
- Sensing and collect data
- 10s of million times
- Real time learn from/with machines

Collaborative ML

- Data split, model split
- Distributed AI
- Leverage computing
- Local governance of data

- Shift from Downlink-Centric Radio to Uplink-Centric Radio
- Shift from Core Network to Deep-Edge
- Shift from Cloudification to Machine Learning

New Value Chain



Many-universe yet unification of

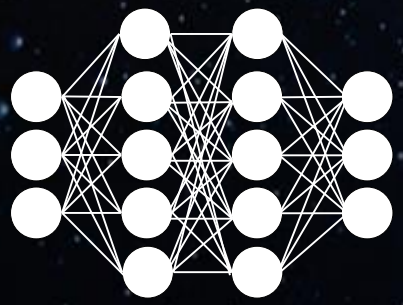
- Digital and Physical world
- Digital and Biology world
- Digital and Societal world

Global technology yet local sovereignty

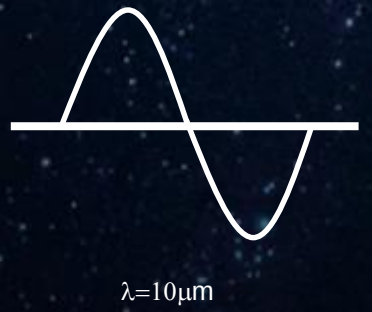
- Tailored, not proprietary
- A new life style at global scale
- Meet humanity challenges
- Climate change, pandemic

Open Platform and Open Ecosystem

New Technology Quantum Leap



- Beyond DNN
- New Wireless Radio Interface

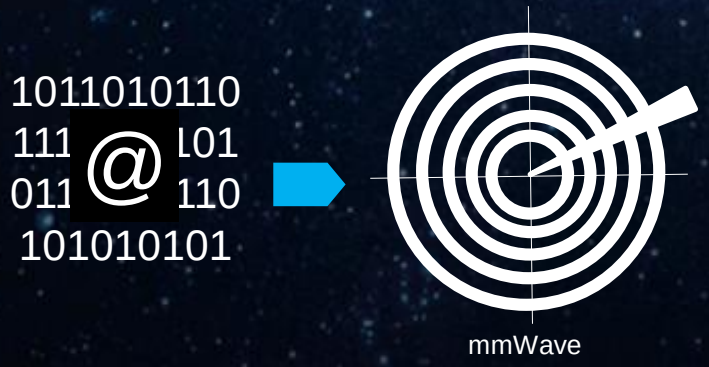


- Digital world to physical world: X-Reality
- Real time physical world ensing

- Ubiquitous coverage
- Global low latency

Major Re-architect

Cloud Centric → AI Native



Information Centric → Network as Sensors

Security Centric → Trust and Secure

6G Key Requirements

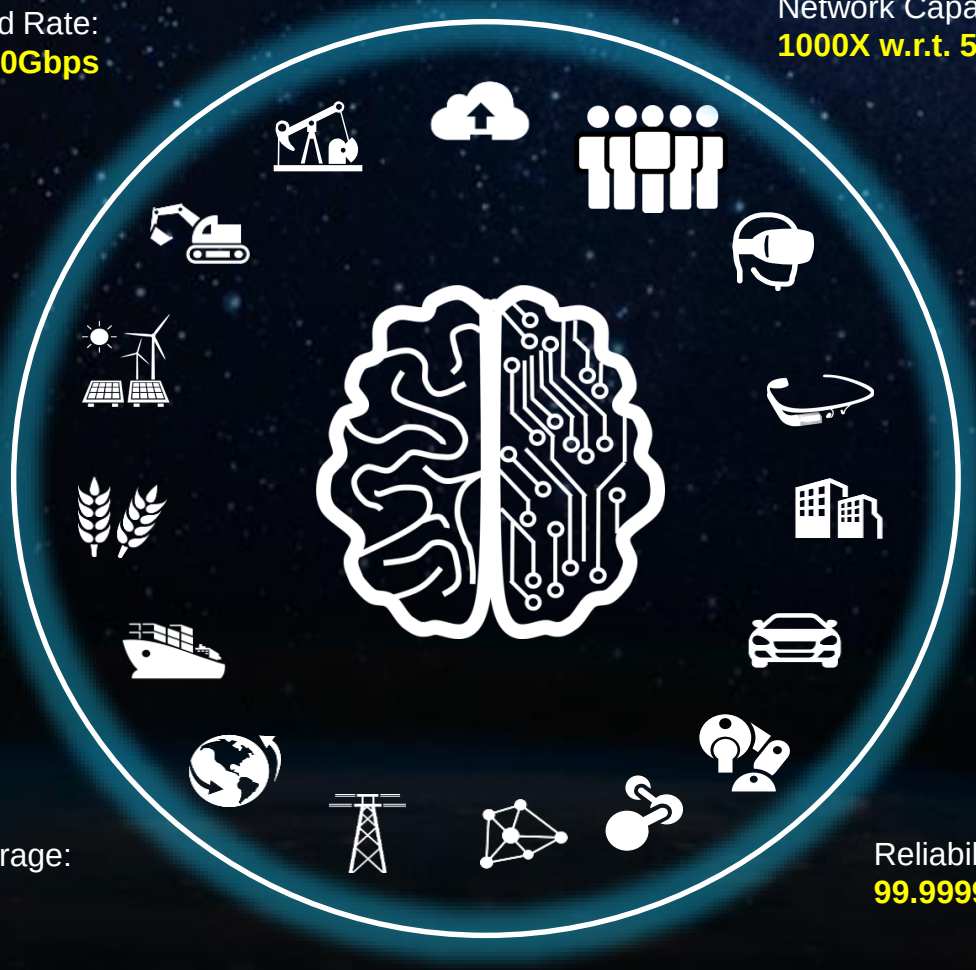
Peak Rate:
1Tbps

Guaranteed Rate:
10-100Gbps

Network Capacity:
1000X w.r.t. 5G

Energy Efficiency
10X w.r.t. 5G

Air Interface Latency:
0.1ms



Sensing Battery Life:
20 Years

Position Accuracy:
50cm outdoor, 1cm indoor

Device Density:
10millions/km^2

Air Interface Jitter:
+/-0.1ns

Network Coverage:
167dB

Reliability:
99.99999%

6G Human Communications

Smartphone

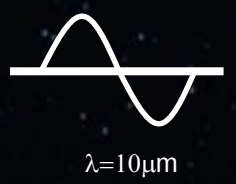
Wearable

5-10 Years

Cyborg

10-20 Years

6G Machine Communications



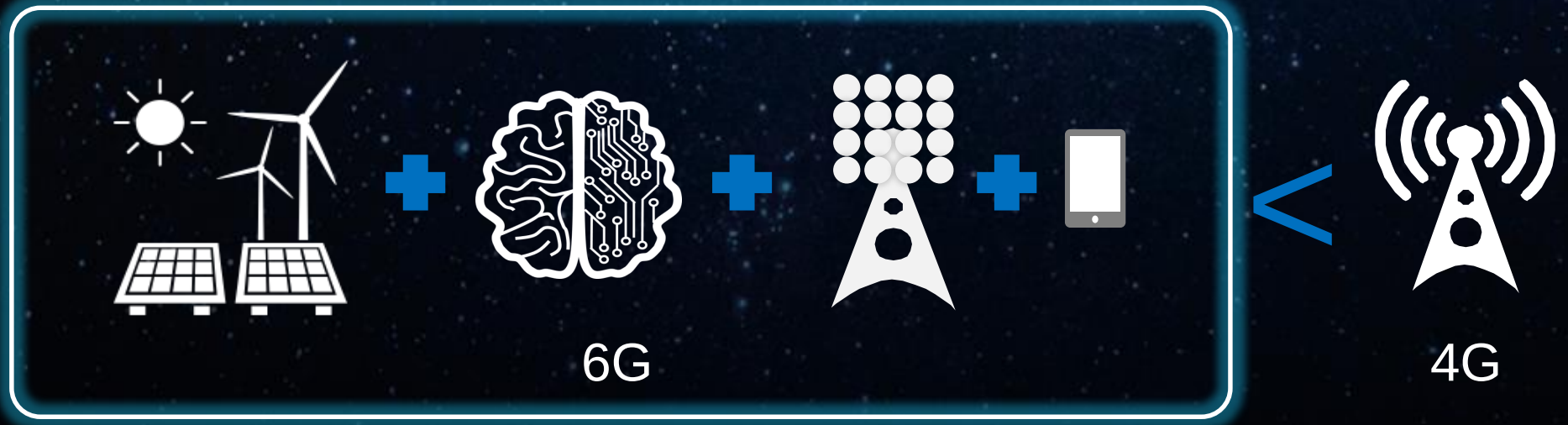
Sensing
&
Learning

Deep Edge

Inference
&
Tactile

6G Challenges: Energy Efficiency & Sustainability

- Open-Source-Edge:10X



- 40% power for electronics in 2030, 20% power for ICT by 2025
- Training a single AI model can emit as much carbon as 5 cars in their lifetime

6G Challenges: Spectrum

6GHz,10GHz

28GHz, 39GHz, 66GHz, 71GHz

39GHz, 50GHz

252GHz-275GHz—(23GHz)
275GHz-296GHz—(21GHz)
306GHz-313GHz—(7GHz)
318GHz-333GHz—(15GHz)
356GHz-450GHz—(94GHz)

6G Challenges: NTN Integration

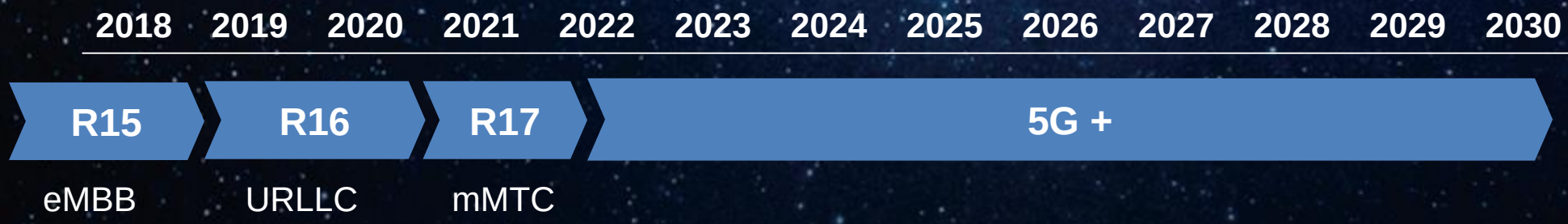
The 6G NTN System:

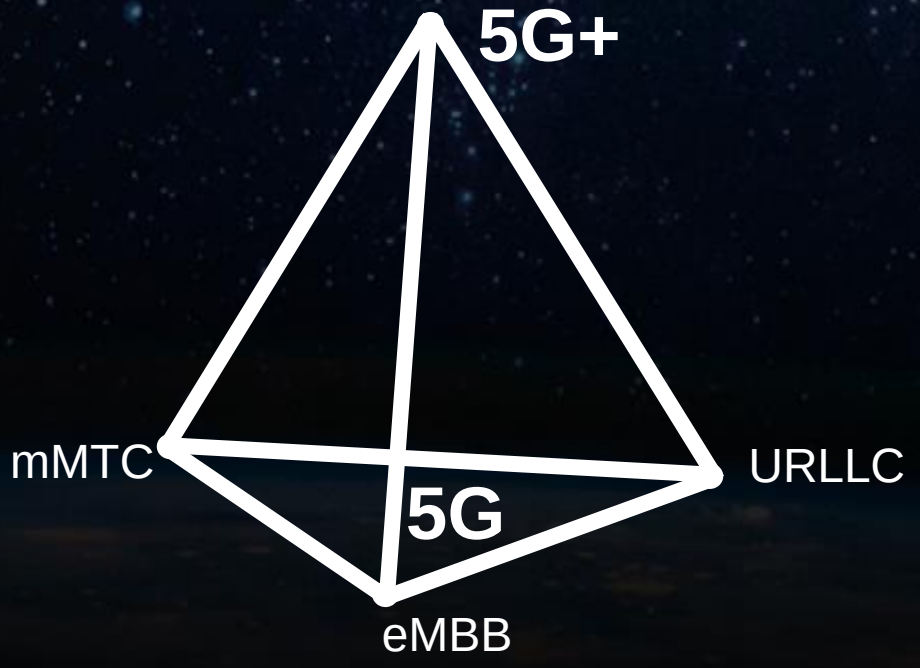
- Constellation available capacity: 12 Pbps
- Each Satellite Capacity : 1.5 Tbps
- Coverage Area: 607,000 km^2
- System uniform Coverage: 5Gbps/km^2
- The Peak Throughput: 18Gbps/km^2
- Per Beam Throughput: 50Mbps /km^2

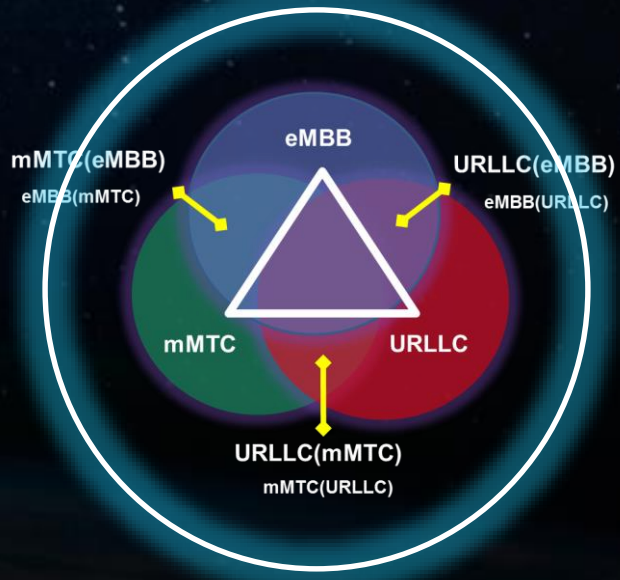
The 6G NTN Service:

- Global Extreme Low Latency Links:
- 40Mbps to Pad devices
- Autonomous driving for global coverage
- Remote sensing and precision positions
- New Digital Infrastructure for un-connected (Africa)

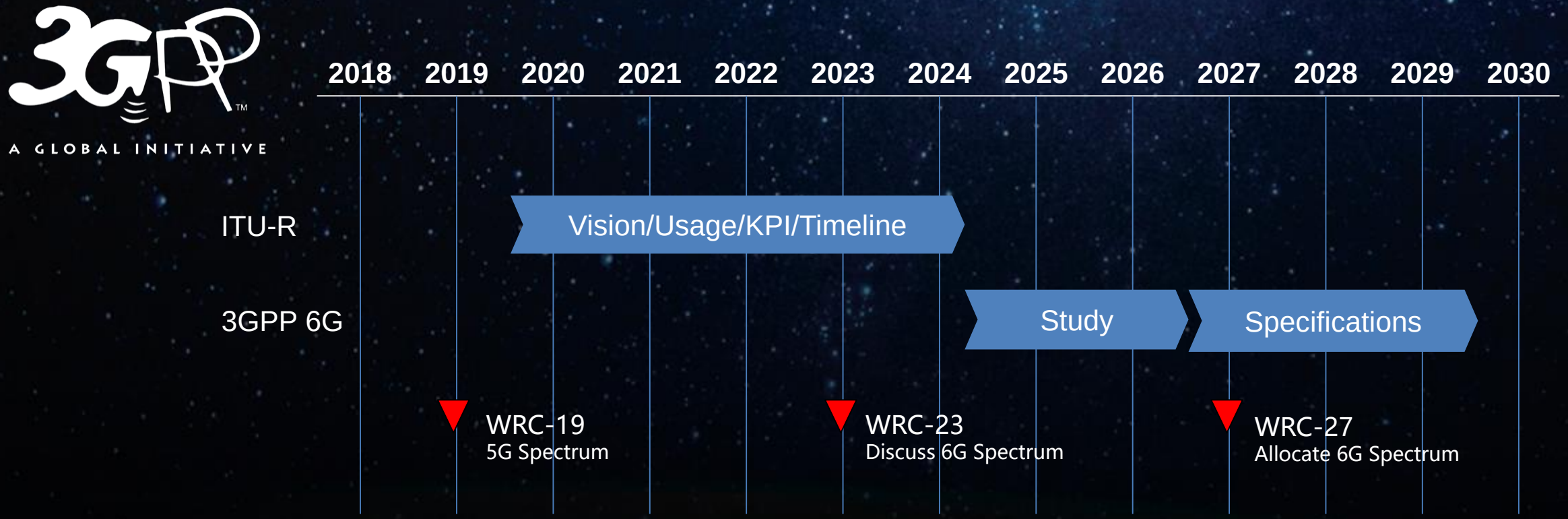
5G and Evolution







6G and Timeline



Horizon Europe

THE NEXT EU RESEARCH & INNOVATION PROGRAMME (2021–2027)

Thank You.