NOKIA

Enabling the Terahertz Metaverse

Communications and Sensing for the 6G era

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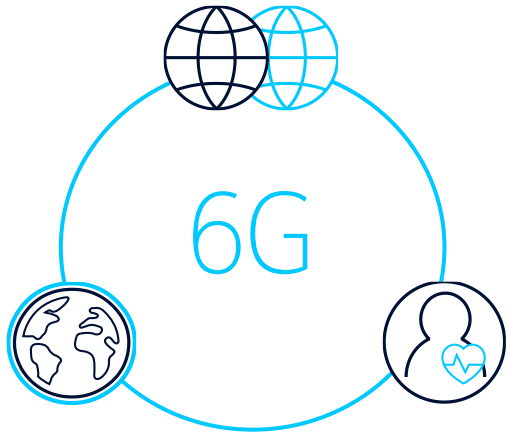
Developments and Challenges Enabling 6G THz Radio HW

EUCNC Panel 2022, May 10

Enabling the THz metaverse: Use cases and sectoral relevance



6G peak capacity and high precision sensing

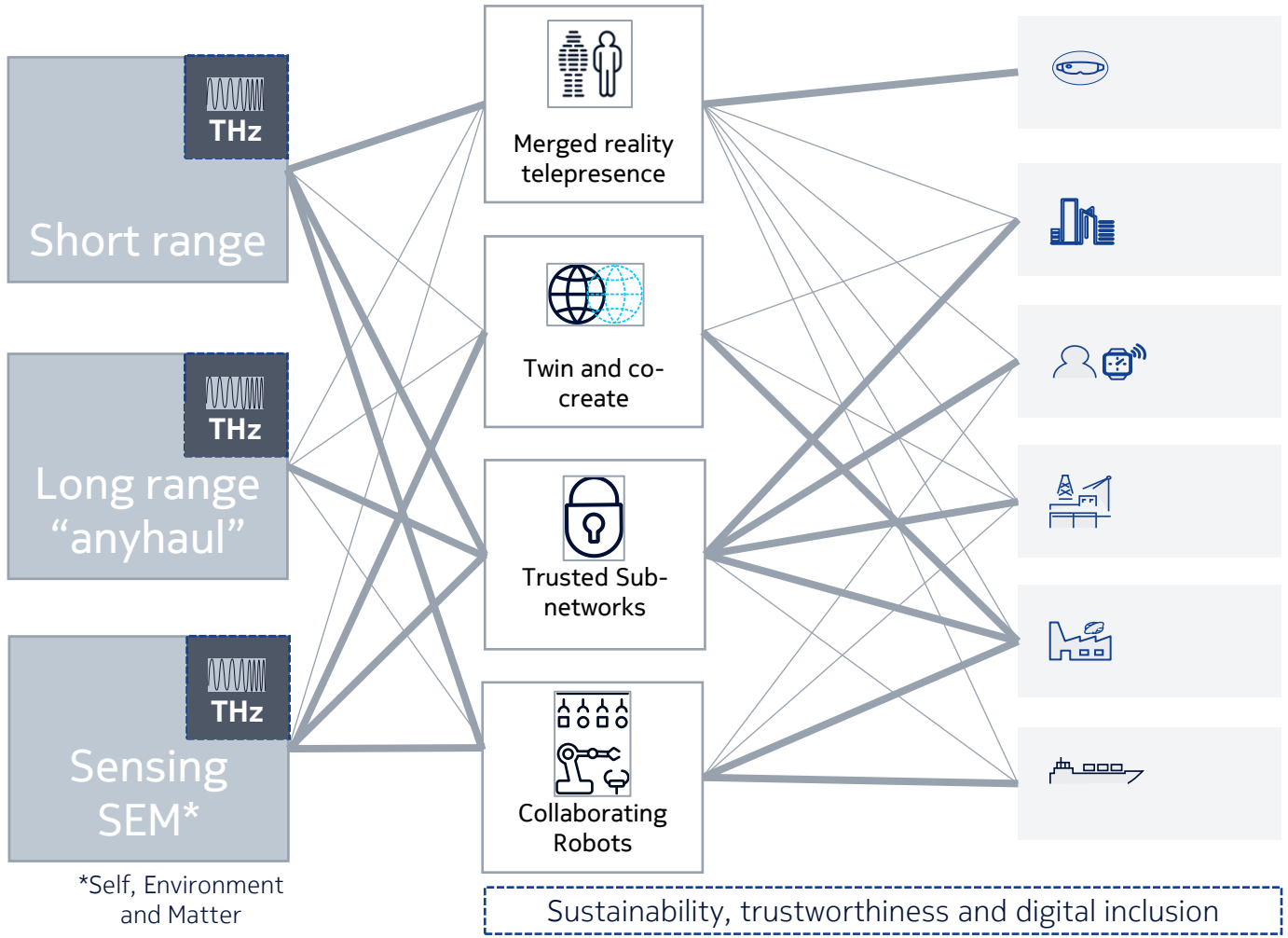
Carrier frequency:
100..300 GHz

Data rate:
>100 Gbps peak

Radio link range:
10..100 meters

Duplex method:
Time Division Duplexing (TDD)

THz



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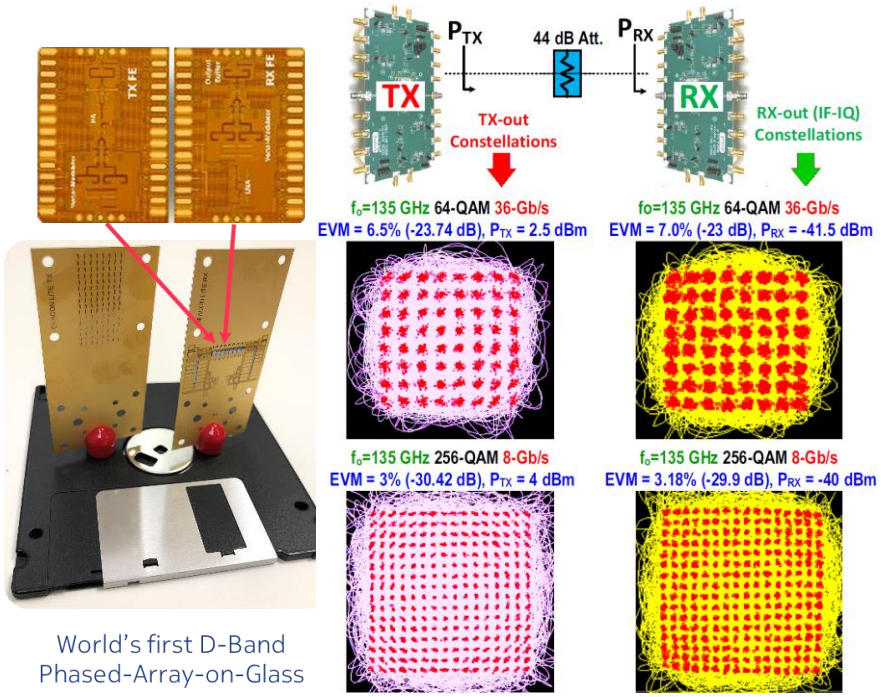
Six key areas for the 6G essential infrastructure

THz air interface for highest peak data rates

Efficiently providing ultra high bandwidth under challenging conditions

Advanced HW components



World's first D-Band Phased-Array-on-Glass

New PHY layer for THz

- **Low PAPR waveforms**
- **High gain antenna arrays**
- **Advanced beam forming for hybrid architectures**

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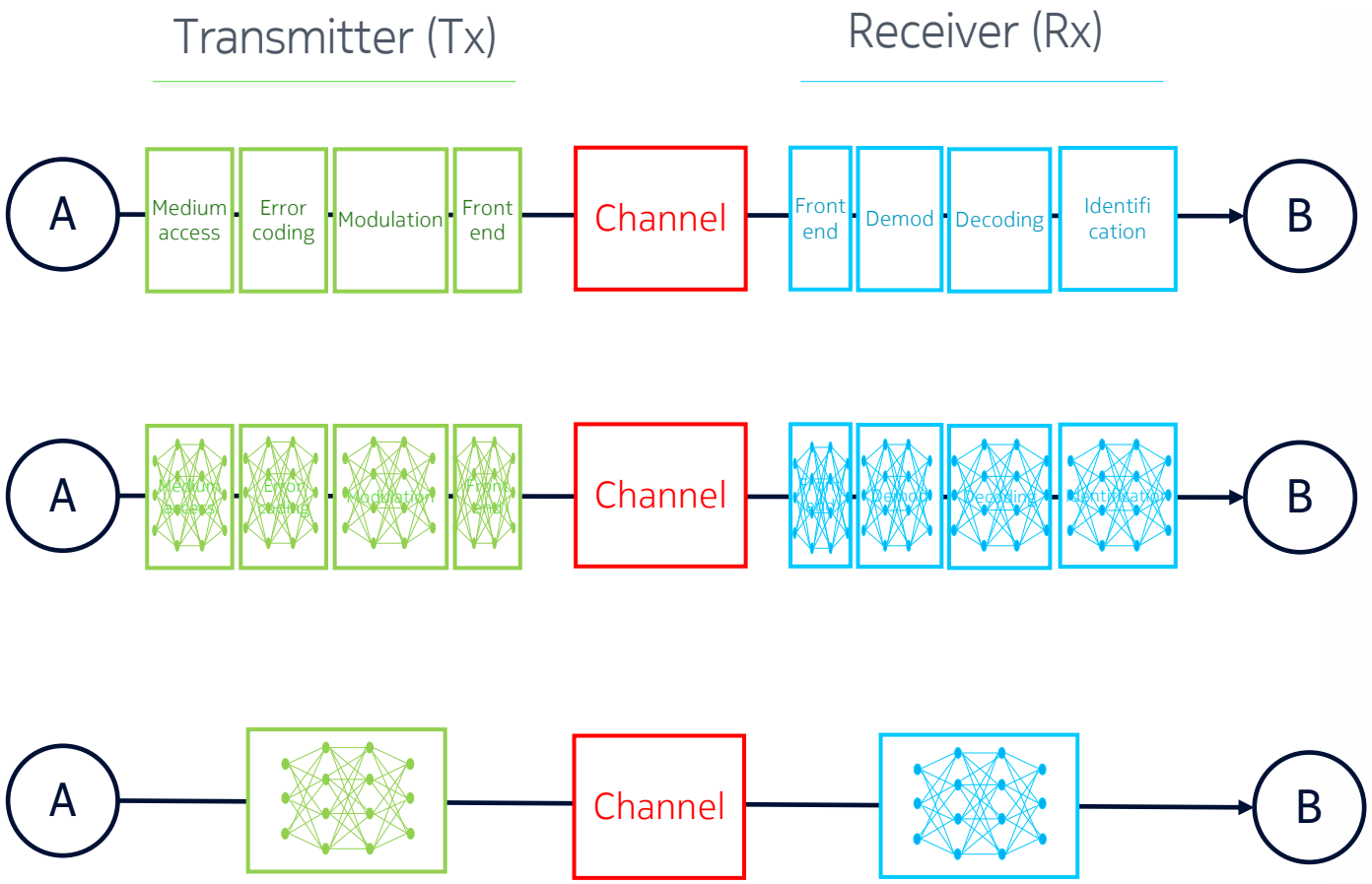
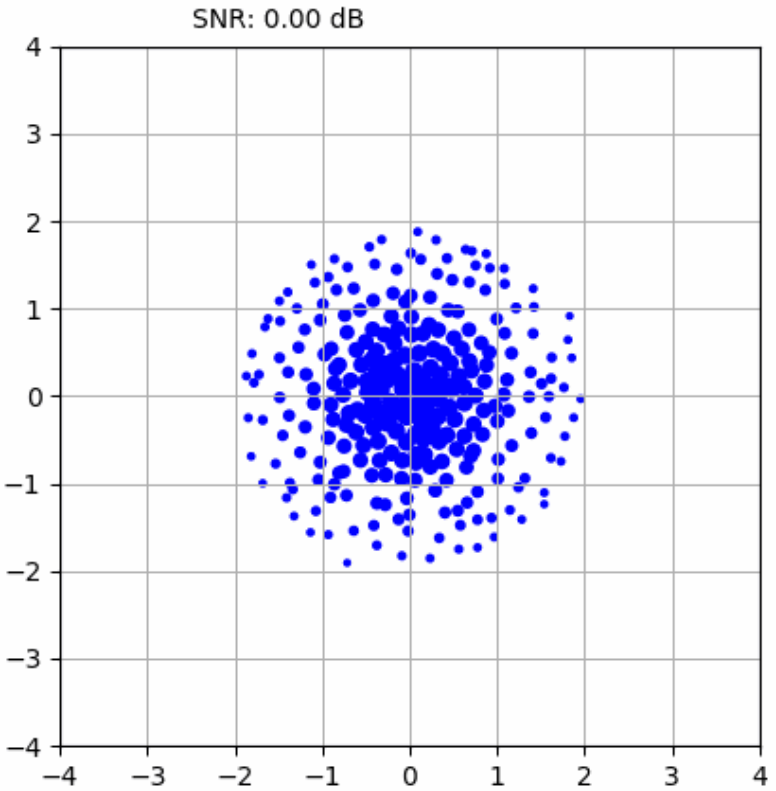
6G native AI/ML air interface





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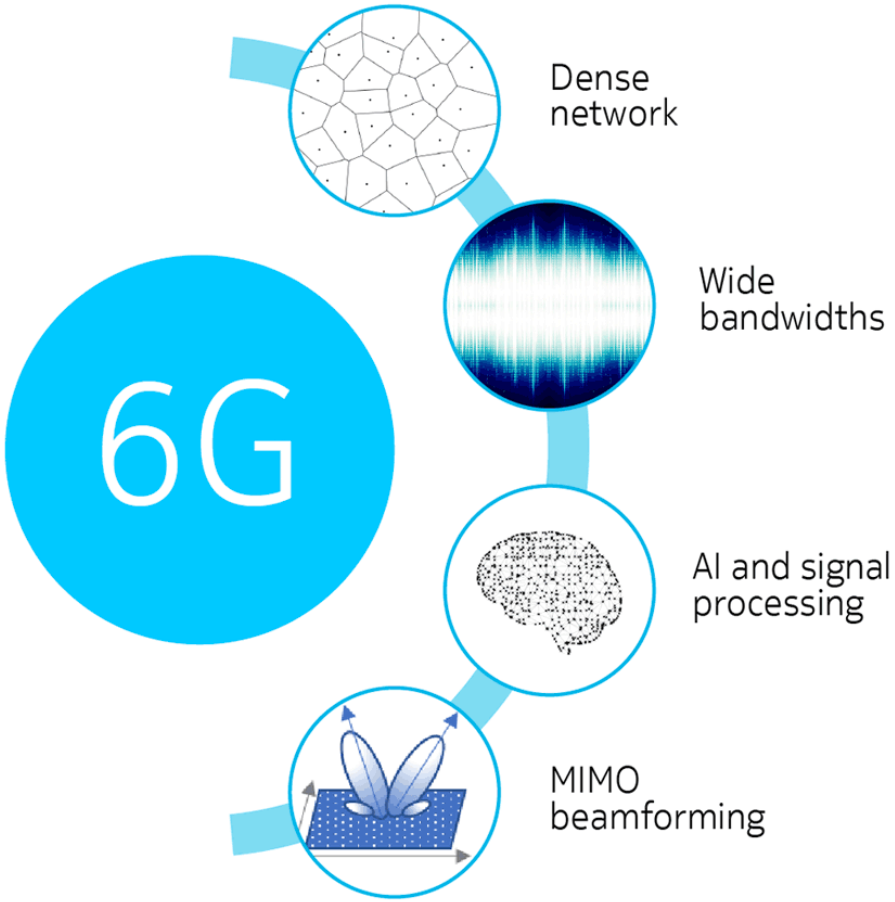
6G network with a 6th sense



- New waveforms and multiplexing
- Channel modeling for sensing
- Beam Sweeping and resource allocation
- Multi-band sensing
- High precision localization
- Object identification with AI/ML

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System level and HW: Objectives and Modelling

Objective

Air-interface and radio module design for bands in the 71 - 300 GHz range for both access and backhaul, addressing

- Architecture and system concept
- PHY design: BF/MIMO, waveform, numerology, beamforming, ADC optimization
- Energy efficiency and spectral efficiency
- Design for hardware limitations

- Proof-of-Concept
- Channel characterization, coverage analysis and spectral efficiency
- Design of HW TRX and phased array devices (RFICs)

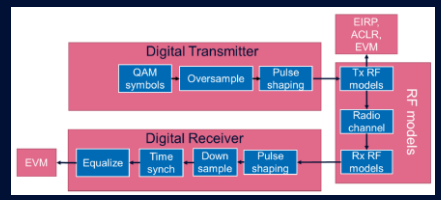
Signal Model

System

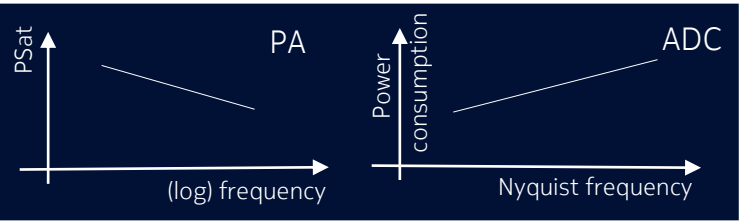
- Link range
- Waveform with RF non-linearity
- Waveform with large signal model

Digital-RF-digital

full wireless link

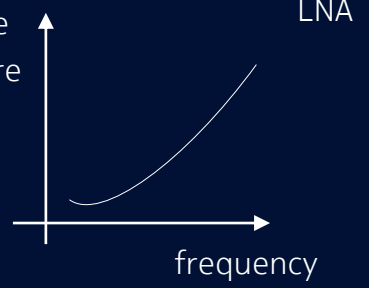


Power consumption



Phase noise and LNA noise figure

- 3GPP white noise
- RMS phase jitter white noise
- Colored phase noise



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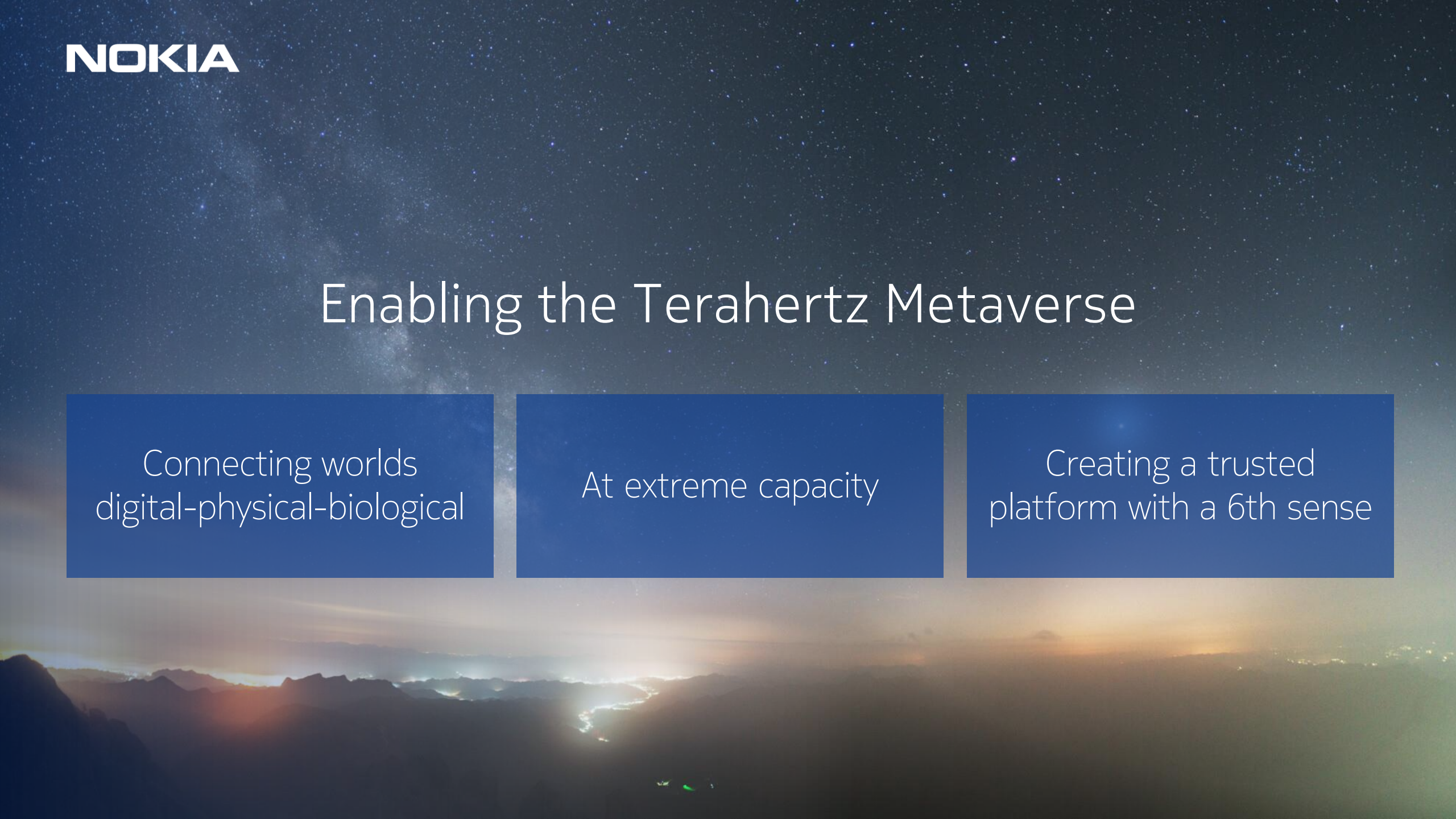
NOKIA
Enabling the Terahertz Metaverse
Connecting worlds digital-physical-biological
At extreme capacity
Creating a trusted platform with a 6th sense