AI & Telecommunications

Innovation with Purpose

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At Nokia Bell Labs we solve problems that address real human needs through the power of human intellect

As Nokia's award-winning industrial research lab, we innovate with purpose, pursuing responsible, sustainable technologies that will have a demonstrable impact on society.

An unrivalled track record of driving innovation for ~ 100 years that changes the way we live, work and communicate

Transistors

Information Theory

Solar cells

Laser/fiber optics

Satellite communications

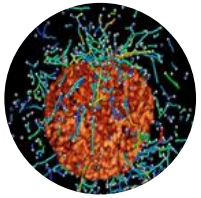
Charge-coupled devices

Unix/C/C++

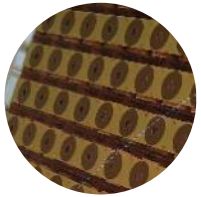
Coherent optics

Cellular communications

Neural networks



Super-resolution microscopy



MIMO

Technology Vision 2030 provides a clear and definitive view of the metaverse opportunities

Metaverse enablers

Human Augmentation

Extensions that enable people to interact with and within the digital world

Digital-Physical Fusion

Dynamic, connected representations of real-world things in the digital world

Metaverse opportunity areas

Consumer Metaverse

Enterprise Metaverse

(IT*-centric)

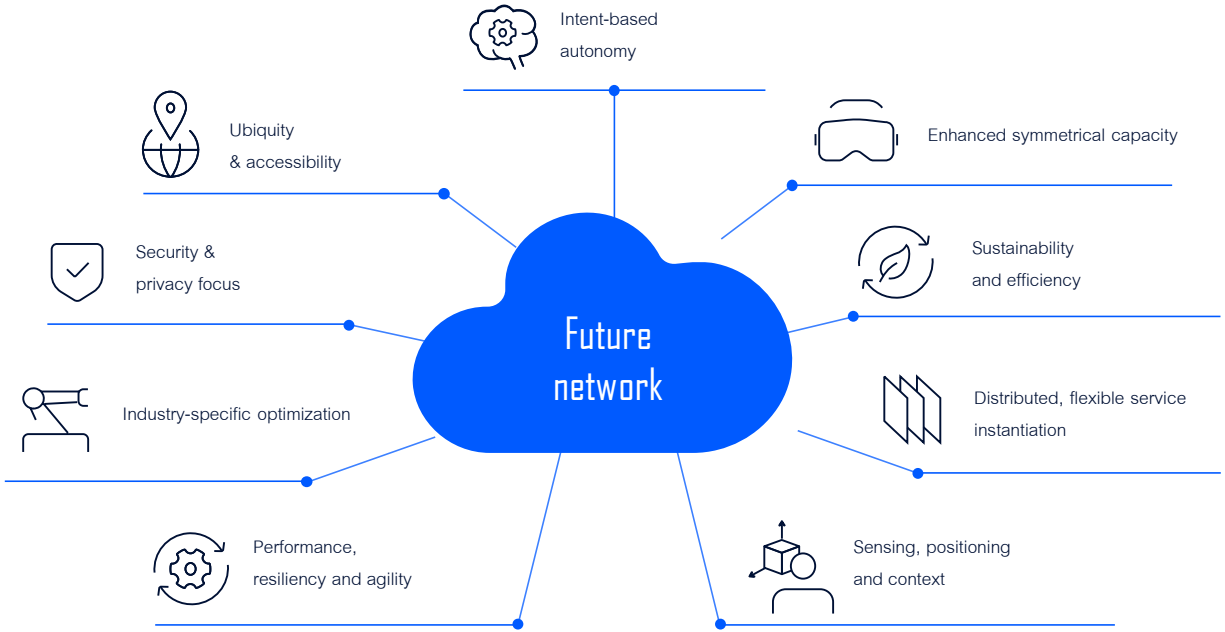
Industrial Metaverse

(OT*-centric)

* IT: Information Technology * OT: Operational Technology

The network will be key to realizing these opportunities

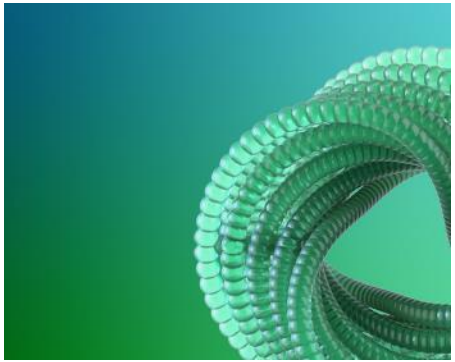
… requiring transformed capabilities and versatile integrations



Focusing our research on innovations to transform the way we live our lives

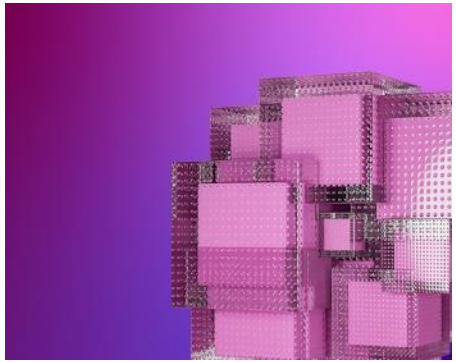
Network Fundamentals

Redefining what trusted networks can do



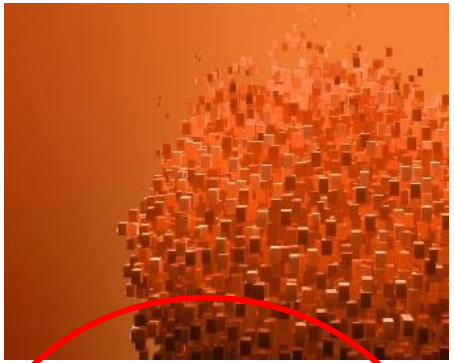
Automation

Augmenting our daily lives in an intuitive way



Semiconductors and Devices

Unleashing the power of sustainable future systems



AI and Software Systems

Making technology both accessible and responsible

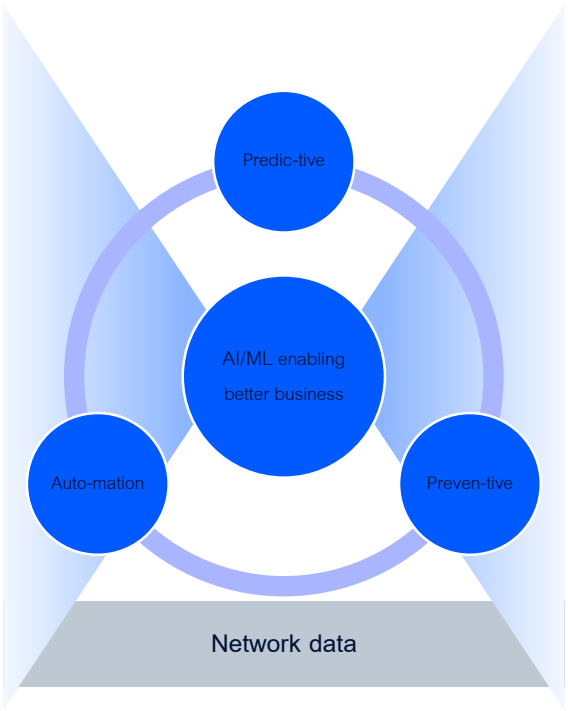
AI/ML will unlock new opportunities

Overcoming complexity by leveraging mobile network data

- Operational complexity
  50-fold increase
- Densification increase
  Millimeter waves
- Configuration parameters
  >2,000 parameters
- Management and monitoring
  Billions of data points
- Increase of CAPEX and OPEX
  BTS power and cooling
- Spectrum assets
  BTS managed independently

Humanly **impossible to configure**

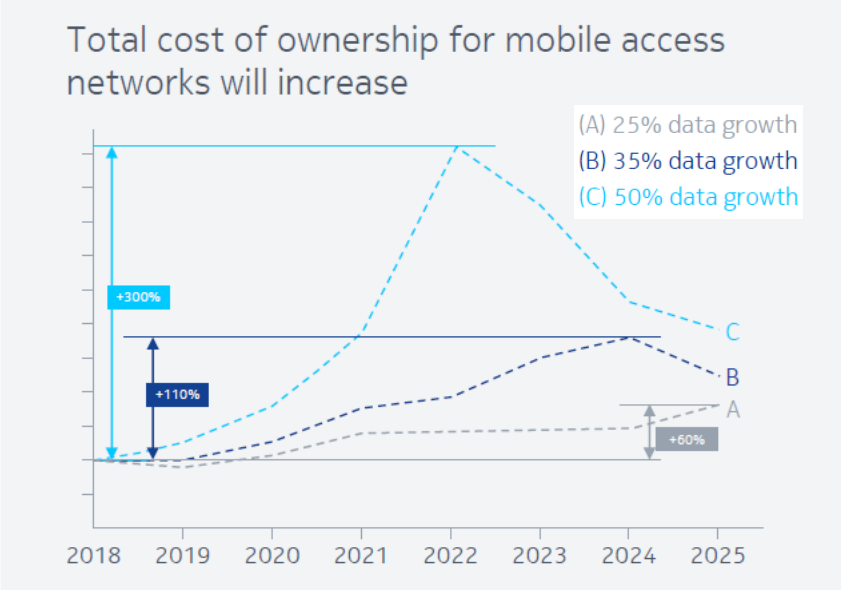
Rule-based software systems are **complex to scale**



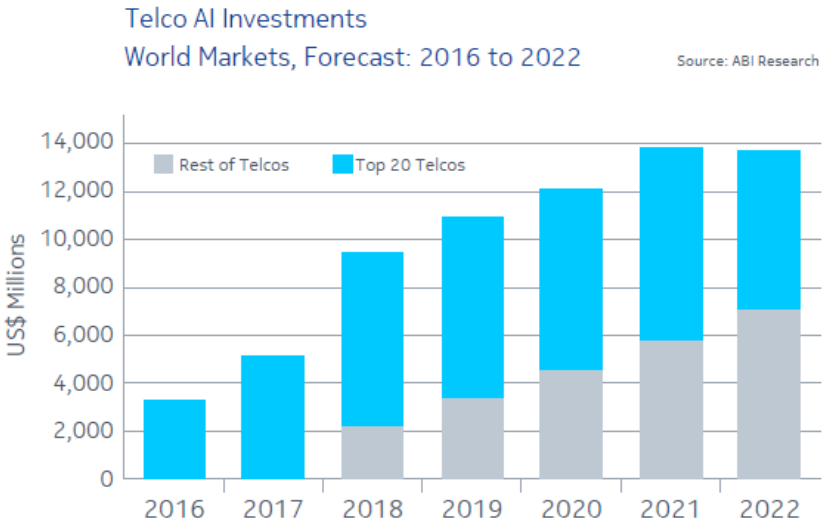
- Operational efficiency
- Network performance
- New revenue streams
- Customer experience
- Business agility
- Edge Cloud intelligence

AI and Telecommunications

Why Artificial Intelligence?



Source: McKinsey & Company

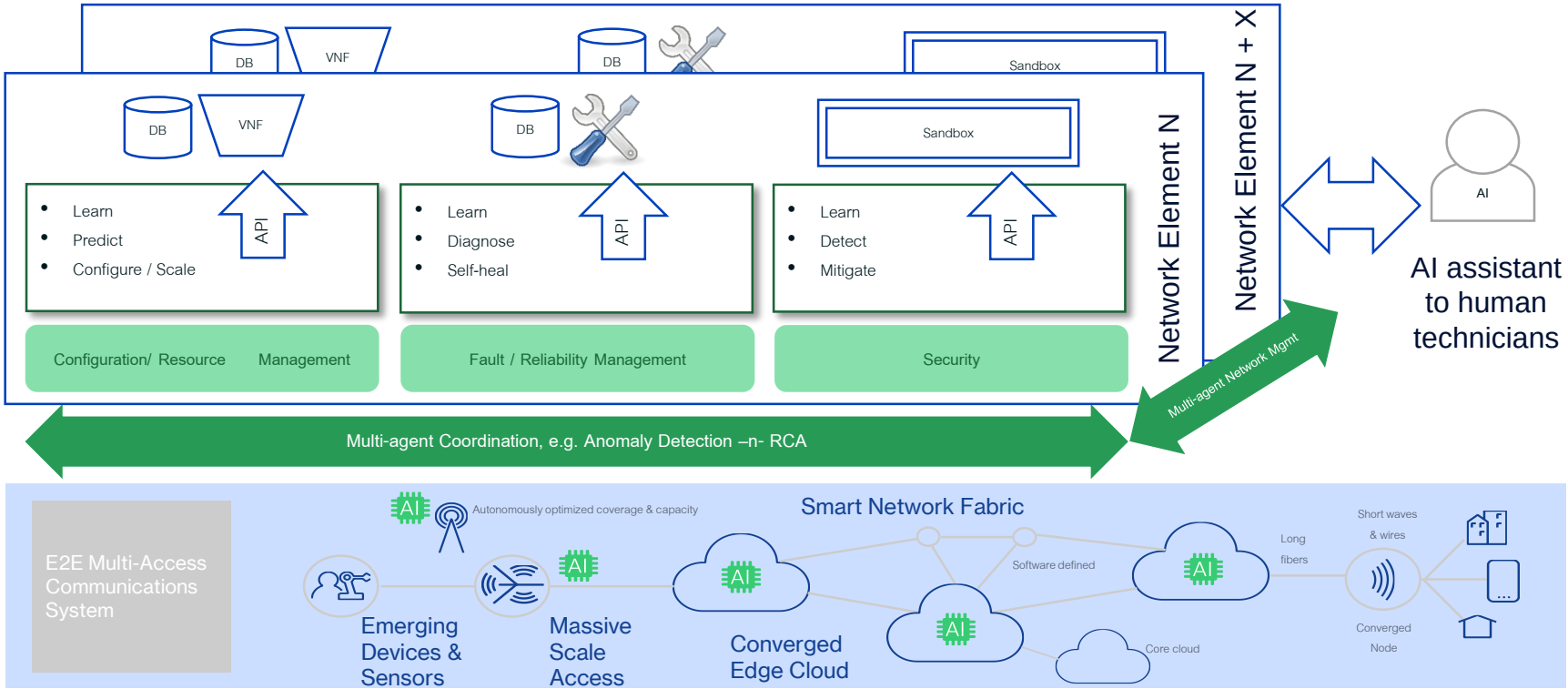


Dramatic increase in technical complexity and/or costs

Automation and Artificial Intelligence - not optional

AI and Telecommunications

Subsystems and functional areas: operations



AI and Telecommunications

Subsystems and functional areas: real-time optimization

- Self-Organization
- Capacity Management
- Parameter Optimization
- Performance Management
- Energy Savings

OPTIMIZE via AI-enabled

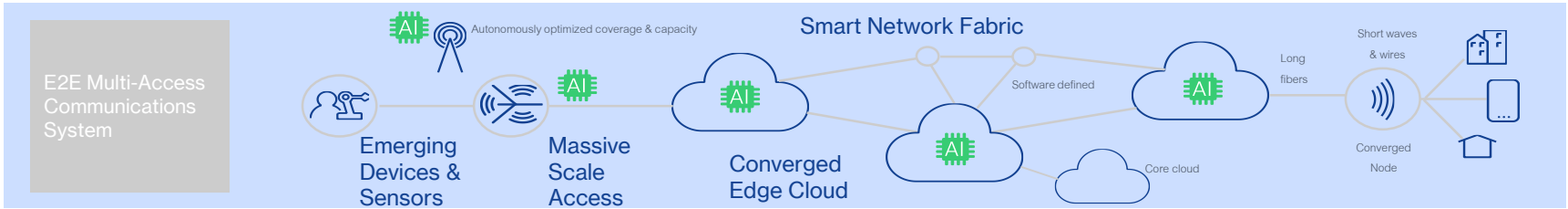
- Spectrum sharing
- Smart carrier aggregation
- MaMIMO beam pattern selection – tilt, azimuth, vertical/ horizontal width
- Handover decisions
- Parameter tuning
- Load prediction and balancing
- VoLTE optimization, CSFB
- WAN path selection

ACTIONS triggered from AI

- Optimized beam combinations for signaling and common channels - # beams, periodicity, pattern
- Minimized inter-cell interference, optimized neighbor relationships
- Batch latency-insensitive transmissions
- De-activate power amplifiers, transmissions during low traffic periods

GOALS achieved through continuous, real-time AI-enabled re-tuning

- Maximize usage of least amount of resources
- Maximize QoS/QoE per subscriber including throughput
- Minimize manual intervention



AI and Telecommunications

Subsystems and functional areas: subscriber

Subscriber Acquisition & Retention

- Subscriber insights
- Churn prediction
- Application and content recommendations
- Service personalization
- New feature identification
- Zero-Touch automated new customer enrollment, existing customer modification workflows

Customer Experience Management

- Telecom-focused (i.e. context and semantics) AI assistant to subscribers
  - General inquiries
  - Device provisioning
  - Equipment troubleshooting
- Find best fit support team for issue

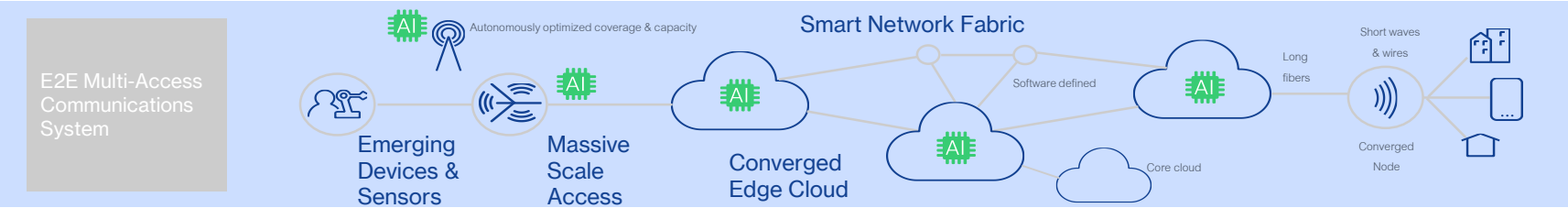
Contact Center

Subscriber Applications

Context-Aware Apps | Chatbots | Video Surveillance

Trans-lation Services | Personal Assistant | And more…

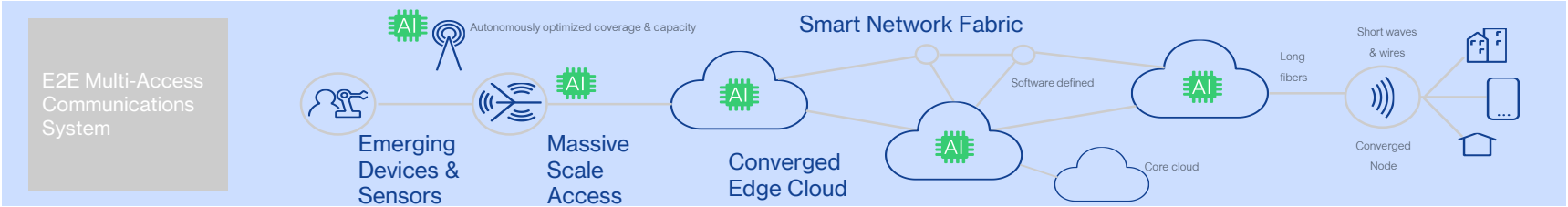
APIs



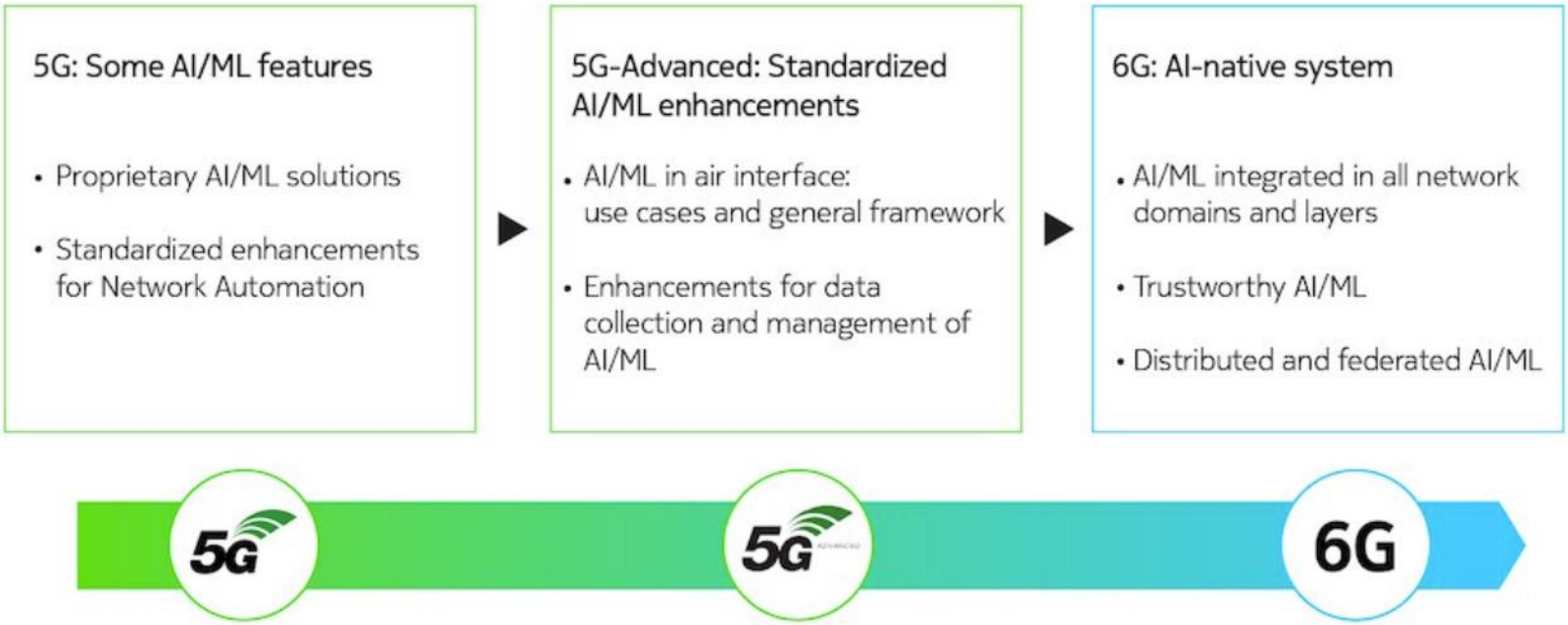
AI and Telecommunications

Subsystems and functional areas: vendor

Research & Development	Customers & Contracts	Continuing Education
• Automated model selection, hyperparameters tuning, feature engineering • AutoML, AutoKeras, code re-use recommendation engines, transfer learning • AI tools to find defects and security holes in code early	• RFx response tools • Executive approval workflow process • AI assistant to human technicians for troubleshooting	• AI-enabled hands-on exercises • Personalized education • Education recommendations • New product training



Towards an AI native network



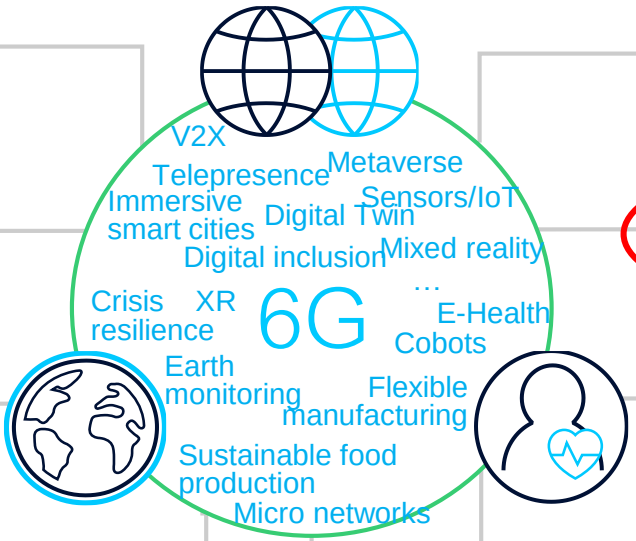
6G System Architecture
Drivers and Principles

New applications trends, e.g., requiring increased application awareness and adaptive QoS/QoE

New technology trends, e.g., joint communication and sensing

Architecture to suit ultra-dense and macro deployments

Privacy, Security, Trust and Resiliency. Quantum safe design. Ensure full protection for UE and network



Sustainability as integral part of 6G architecture design

Native AI/ML support

Cognitive Network and autonomous management for cognitive NFs

Leverage full potential of Service Based Architecture (SBA)

Radio Network disaggregation


NOKIA