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Mastering the Fundamentals

Operational and skillsets considerations for technological and networking evolution

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📅 Nov 25 – 29, 2024 🕗 08:00 AM
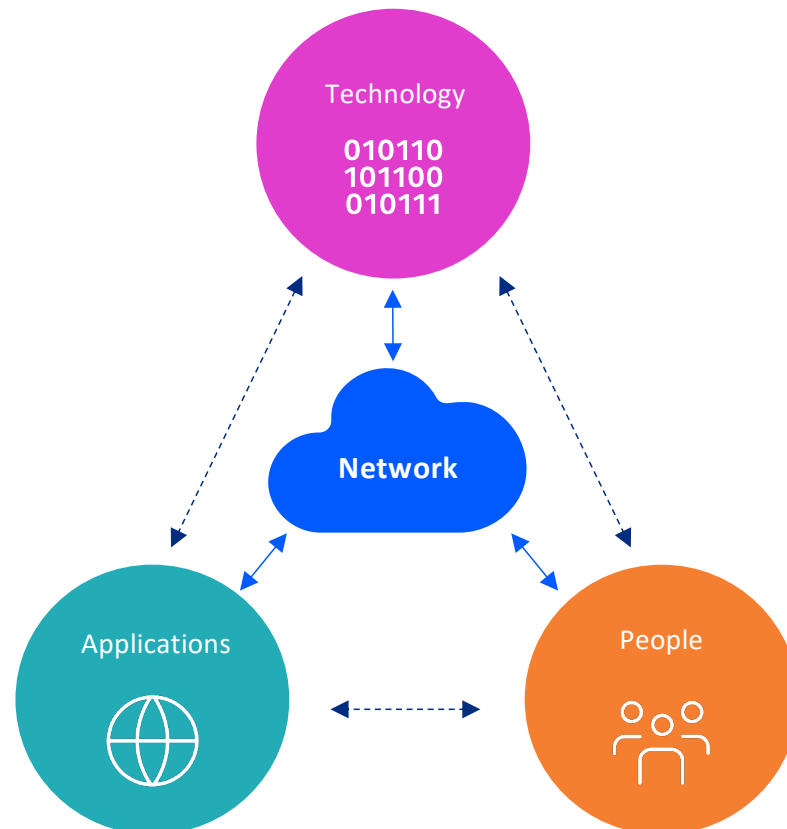
📍 Apia, Tuamasaga - Samoa

The forces driving networking

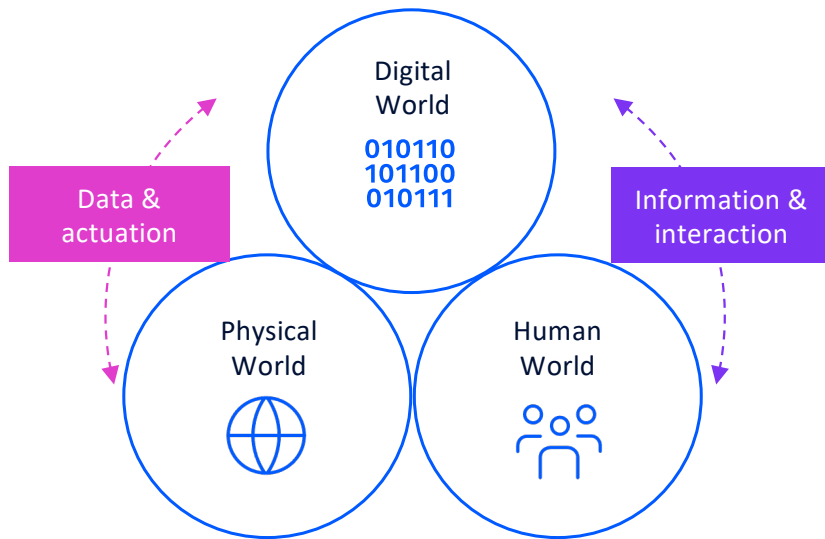## A complex push-pull between competing/co-operating elements

Motivating the evolution of networks that *sense, think & act...*

... with ubiquitous AI, driving the Power of n

Technology in 2030

Connecting the physical, digital and human worlds to meet the needs of 2030

Digital World
010110
101100
010111

Data & actuation

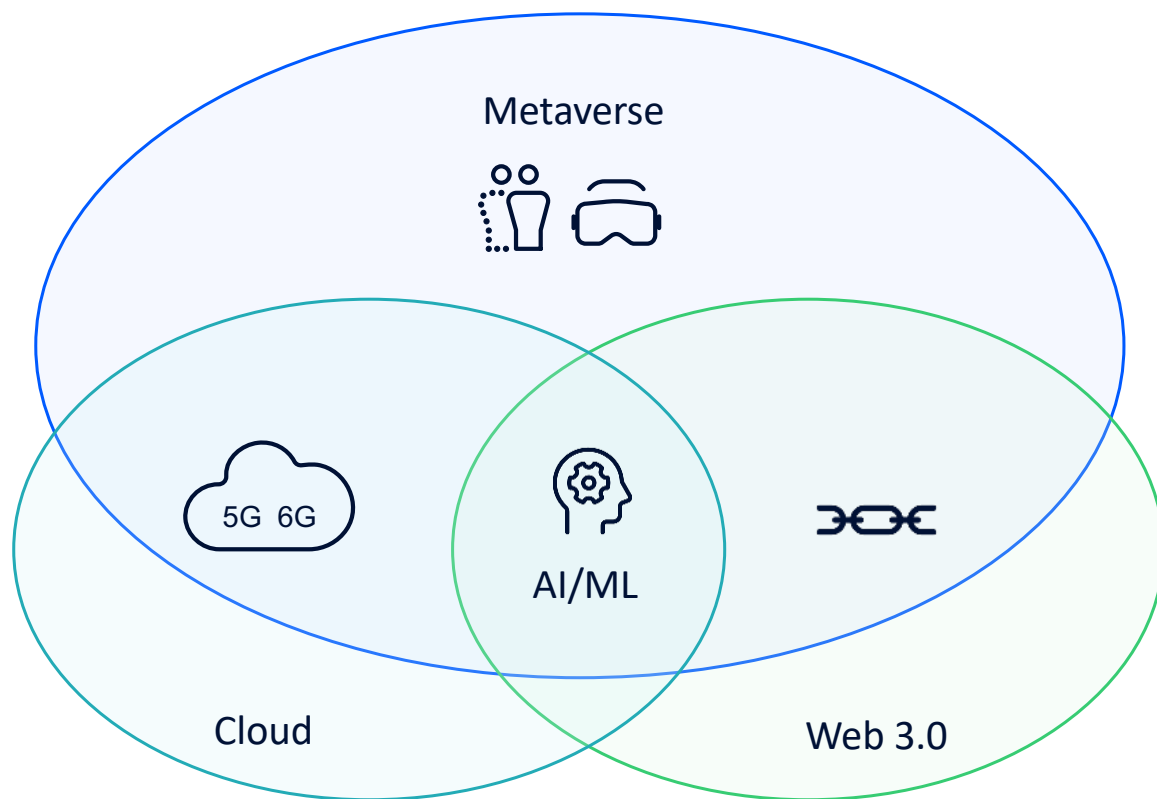Information & interaction

Physical World

Human World

Digital convergence continuously extends the scope of human possibilities

Technology themes shaping the world of 2030

AI is at the center of everything

Metaverse

5G 6G

AI/ML

Cloud

Web 3.0

Metaverse potential value creation
$5 trillion by 2030.[1]

Edge cloud computing opportunity
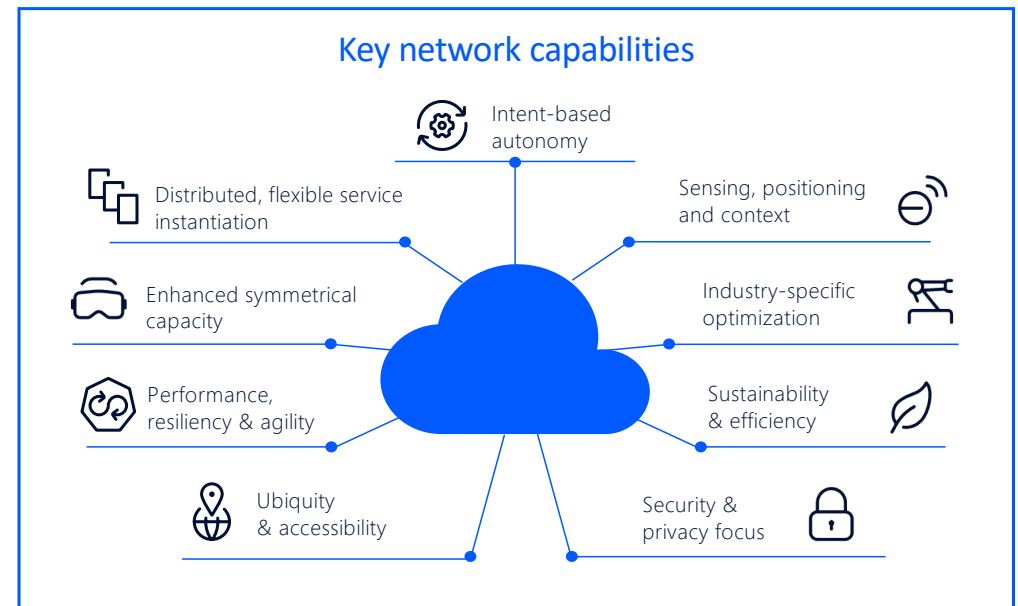**$445 billion** addressable revenue by 2030.[2]

Blockchain market worth **$508.1 billion** by 2030, with a 62.4% CAGR 2022-30.[3]

AI total market worth **$908.7 billion** by 2030, with a 35% CAGR 2022-30.[4]

1 McKinsey, February 2023.
2 STL Partners, December 2022.
3 GlobalData, December 2022.
4 GlobalData, June 2023.

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Meeting the challenges, and addressing the needs of 2030

Requires connectivity capabilities taken to the next level

Digital World

**010110
101100
010111**

Motivating the evolution of networks that *sense, think & act...*

… with ubiquitous AI, driving the Power of n

Network

Physical World

Human World

Key network capabilities

Intent-based autonomy

Distributed, flexible service instantiation

Sensing, positioning and context

Enhanced symmetrical capacity

Industry-specific optimization

Performance, resiliency & agility

Sustainability & efficiency

Ubiquity & accessibility

Security & privacy focus

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Network evolution & innovation

Areas of key focus

from Network Capabilities Exposure to
Support for New Business Opportunities & Models

from Closed-Loop Automation to
Fully Autonomous Networks

from Cloud Adoption to
Multi-Cloud Support

from QoS/QoE* Control to
Intent-Based Service Delivery and Orchestration

from Telco Cloud to
Network & Cloud Convergence

from Capacity-Richness to
Focused Capacity

from Low Energy Usage to
Energy-Optimized Design

from AI-Enhanced to
AI-Native

from Enhanced Security to
E2E Secure by Design

Intent-based autonomy

Distributed, flexible service instantiation

Sensing, positioning and context

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Industry-specific optimization

Performance, resiliency & agility

Sustainability & efficiency

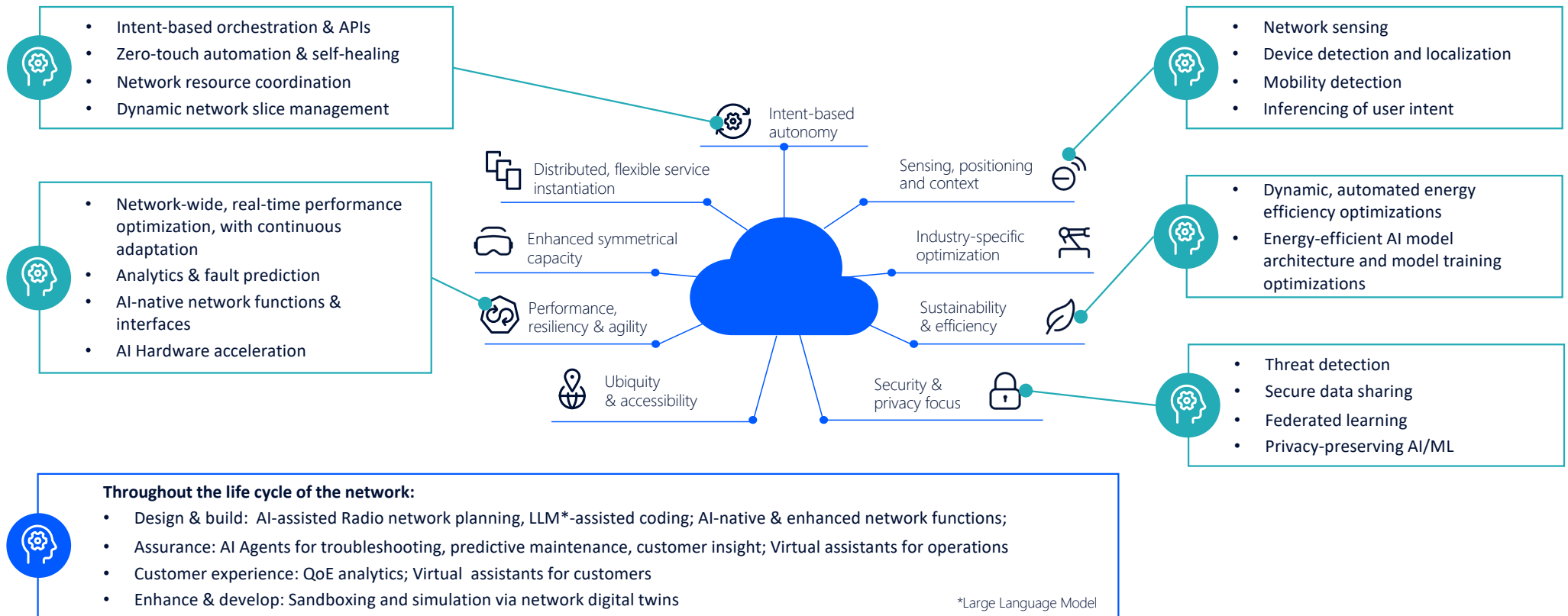Ubiquity & accessibility
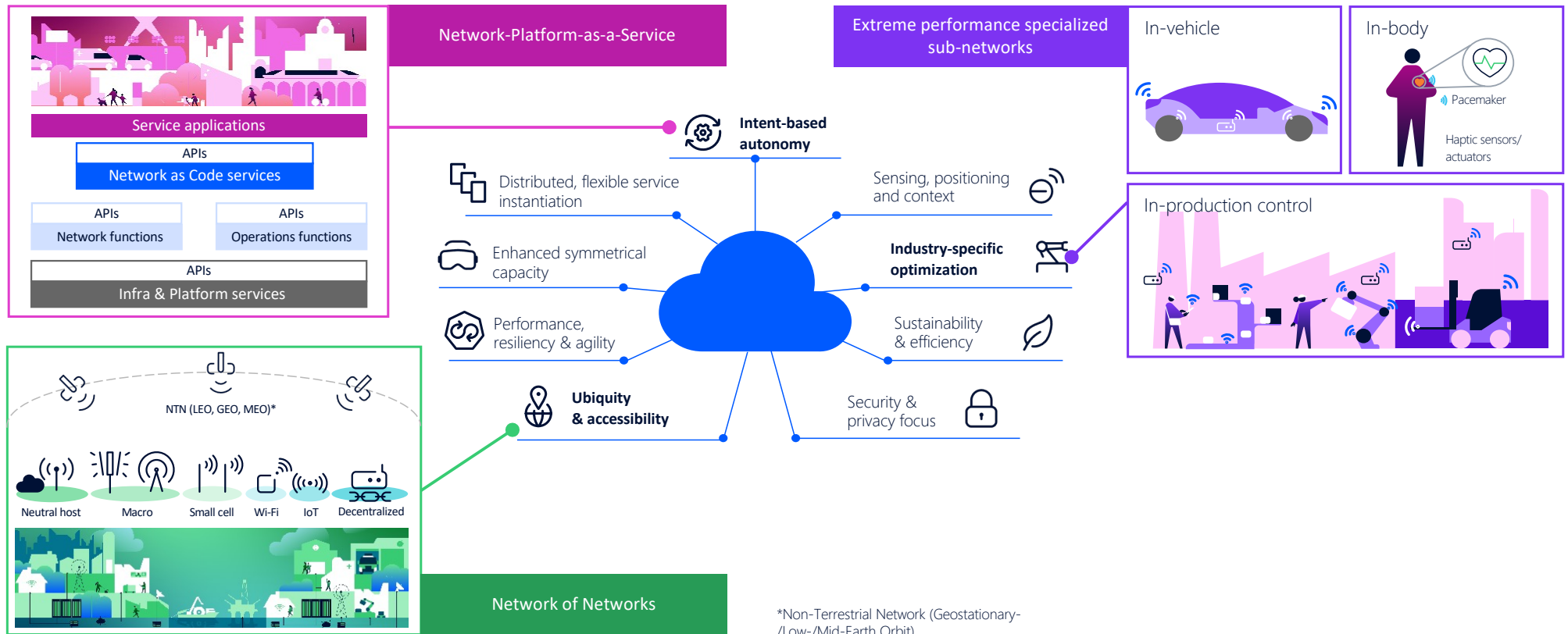
Security & privacy focus

*Quality of Service / Quality of Experience

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AI is integral to Network Evolution

Ubiquitous, Responsible AI unlocks the transformational potential of networks

- Intent-based orchestration & APIs
- Zero-touch automation & self-healing
- Network resource coordination
- Dynamic network slice management

- Network sensing
- Device detection and localization
- Mobility detection
- Inferencing of user intent

- Network-wide, real-time performance optimization, with continuous adaptation
- Analytics & fault prediction
- AI-native network functions & interfaces
- AI Hardware acceleration

- Dynamic, automated energy efficiency optimizations
- Energy-efficient AI model architecture and model training optimizations

- Threat detection
- Secure data sharing
- Federated learning
- Privacy-preserving AI/ML

Intent-based autonomy

Distributed, flexible service instantiation

Sensing, positioning and context

Enhanced symmetrical capacity

Industry-specific optimization

Performance, resiliency & agility

Sustainability & efficiency

Ubiquity & accessibility

Security & privacy focus

Throughout the life cycle of the network:
- Design & build: AI-assisted Radio network planning, LLM*-assisted coding; AI-native & enhanced network functions;
- Assurance: AI Agents for troubleshooting, predictive maintenance, customer insight; Virtual assistants for operations
- Customer experience: QoE analytics; Virtual assistants for customers
- Enhance & develop: Sandboxing and simulation via network digital twins

*Large Language Model

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Network Building

Network transformation requires new ways of creating and integrating networks

Network-Platform-as-a-Service

Service applications
APIs
Network as Code services
APIs — Network functions
APIs — Operations functions
APIs — Infra & Platform services

Extreme performance specialized sub-networks

In-vehicle

In-body
Pacemaker
Haptic sensors/actuators

In-production control

Intent-based autonomy

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NTN (LEO, GEO, MEO)*

Neutral host   Macro   Small cell   Wi-Fi   IoT   Decentralized

Network of Networks

*Non-Terrestrial Network (Geostationary-/Low-/Mid-Earth Orbit)

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Business ecosystem evolution

Leveraging new network capabilities and decentralized mechanisms

- **Rich, open solution ecosystem**, driven by **collaborative partnership** and **developer-led innovation & consumability**

- **Network capabilities** leveraged for solution innovation

- **Decentralized mechanisms** unlock **new business interactions** and increase **trustworthy value exchange**

- CSPs increase **focus on industrial, enterprise & B2B2C*** solutions for growth

- **Understanding & harnessing AI's potential** becomes essential to success

*Business-to-Business-to-Consumer

Collaborative Value Ecosystem

Metaverse

Industrial Solutions | Enterprise Solutions | Consumer Applications

Solution Developers / Solution Providers

Solution Enablement / Network Capability Exposure

Extreme-Performance Specialized Networks | Cognitive, Solution-Enhancing Network Capabilities

Ubiquitous Network of Networks

Network (-as-a-Service)

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Technology Vision 2030
Summary

Envisioning a world of 2030 driven by rapid and wide-ranging change, with innovation

- addressing new and heightened demands, and
- unlocking the potential of a vibrant, collaborative solution ecosystem

Digital World

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AI/ML

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Human World
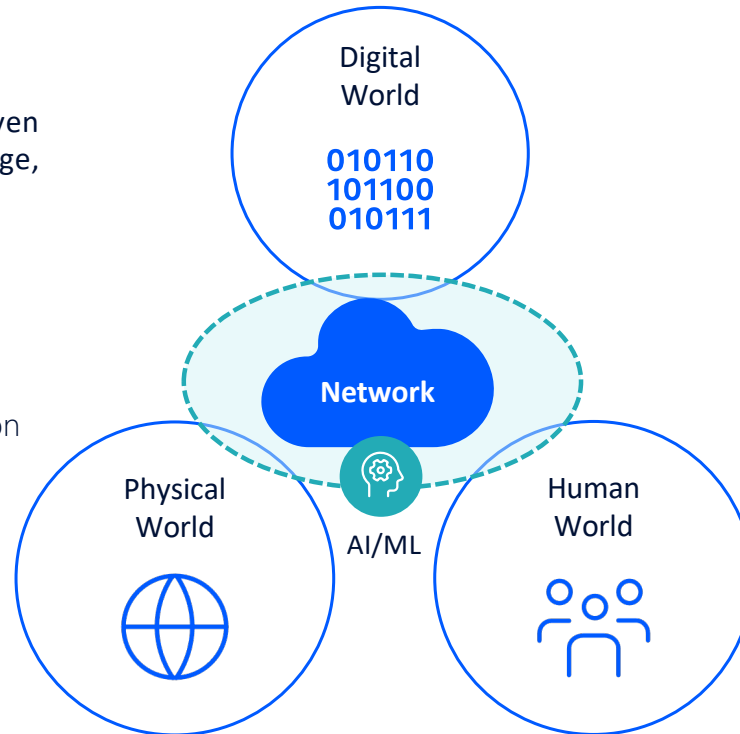
AI-enhanced **networks that sense, think and act** will be vital to this evolution - **connecting the human, physical and digital worlds**, to meet the needs and opportunities of 2030

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Thematic discussion: **metaverse**

Human Augmentation and Digital-Physical Fusion are the key concepts underpinning how we describe 'the metaverse'
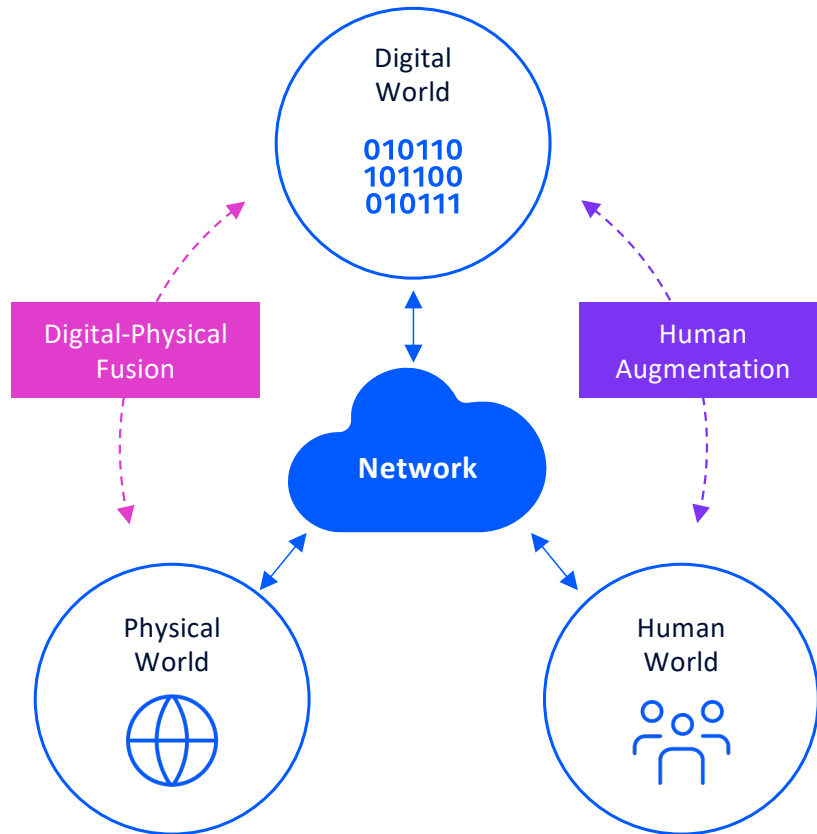
Human Augmentation

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

Evolves the digital world from being a source of two-dimensional experiences and information, to a focal point of immersive and productive interaction

Digital-Physical Fusion

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

Allows the physical world to be replicated, simulated and automated within the digital world - opening doors to a wealth of new possibilities for human benefit.

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Revenue opportunities will exhibit different growth dynamics

Industrial metaverse opportunities are already revealing traction

Industrial Metaverse (OT*-centric)

- XR-enabled workforces
- Digital twin enhanced production & condition monitoring

Enterprise Metaverse (IT*-centric)

- Immersive team collaboration
- Digital co-design
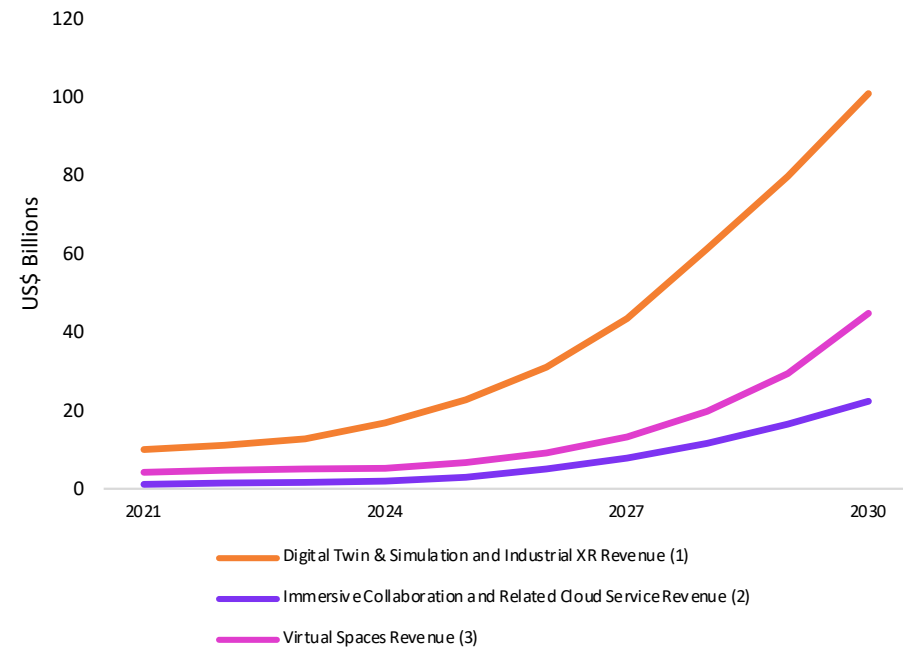- XR-based training & learning

Consumer Metaverse

- Immersive gaming
- XR-enhanced social & retail interaction
- Virtual tourism

* IT: Information Technology | OT: Operational Technology

Metaverse revenue forecast examples (global)

US$ Billions

— Digital Twin & Simulation and Industrial XR Revenue (1)

— Immersive Collaboration and Related Cloud Service Revenue (2)
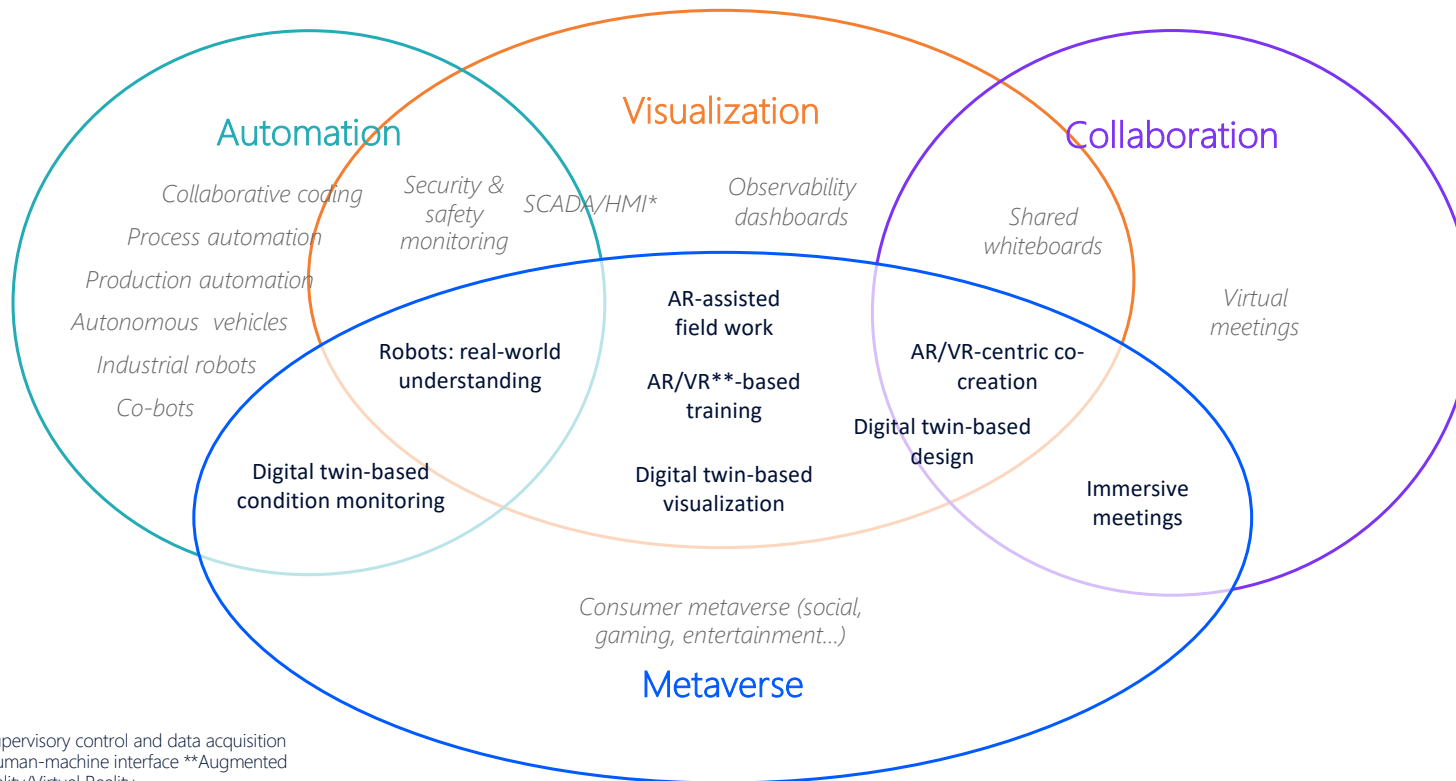
— Virtual Spaces Revenue (3)

1 ABI Research: The Future of Work, Augmented and Mixed Reality, Virtual Reality Market Data, November 2022
2 ABI Research: Enterprise Metaverse: Future of Work, March 2022
3 ABI Research: 2022 Consumer Metaverse Market Update, June 2022

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The metaverse extends business transformation potential

Examples, within established enterprise & industrial solution areas

Automation

Collaborative coding

Process automation

Production automation

Autonomous vehicles

Industrial robots

Co-bots

Security & safety monitoring

SCADA/HMI*

Visualization

Observability dashboards

Collaboration

Shared whiteboards

Virtual meetings

Robots: real-world understanding

AR-assisted field work

AR/VR**-based training

AR/VR-centric co-creation

Digital twin-based design

Digital twin-based condition monitoring

Digital twin-based visualization

Immersive meetings

Consumer metaverse (social, gaming, entertainment...)

Metaverse

*Supervisory control and data acquisition /Human-machine interface **Augmented Reality/Virtual Reality

Digital-Physical Fusion enables automation of real-world objects, systems and processes

Human Augmentation increases perception and understanding, through enhanced interaction & immersion

Key Enablers

- AI & ML

- Networks & Devices

- Data Management

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