WELCOME TO YOUR METAVERSE-

AI AND AR-ENABLED NEXT GENERATION APPLICATIONS AND SERVICES

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OUTLINE

- About CTIF Global Capsule (CGC)
- Technology Trends
- Disruptive Technologies
  - AI
  - 6G enabling technologies
- Key Metaverse Elements
- Conclusions

ABOUT CGC

Basic and applied research in Technology and Multi Business Model Innovation through a global collaborative, cross-/interdisciplinary academic research and industry network

https://ctifglobalcapsule.org

6G technology, Healthcare & Entrepreneurship, AI and digitalisation of Business Models.

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HOW IS TECHNOLOGY CHANGING OUR WORLD

- From universal to metaversal communications

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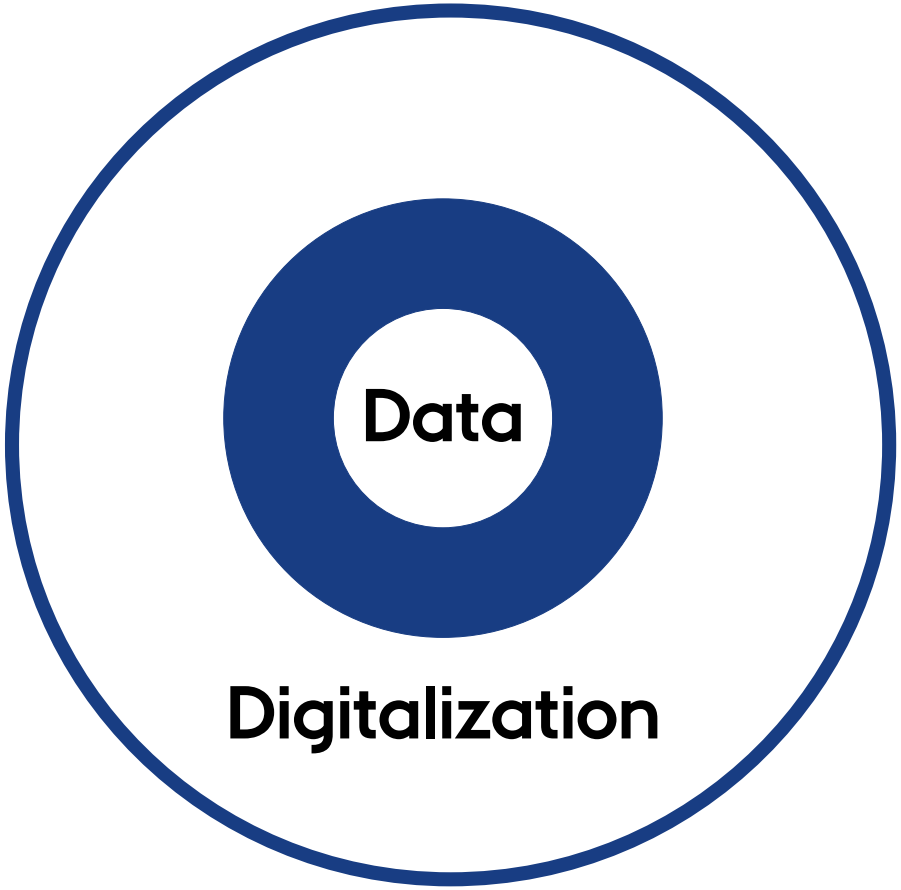
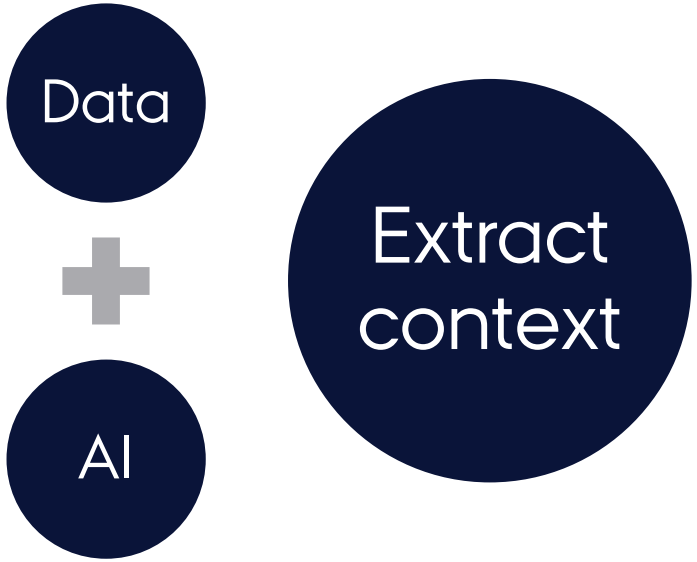
DISRUPTIVE TECHNOLOGIES

Artificial Intelligence (AI)-

- Better performance
- Cost-efficiency
- Increased number of services



ARTIFICIAL INTELLIGENCE (AI)



A solution is only as good as the data and how well it has been trained

WHAT HAS CHANGED?

- **Advanced services and applications**
  - Augmented, mixed, extended reality (AR, MR, XR)
  - High-fidelity and real time mobile hologram
  - Digital twins
- **New types of users**
  - Humans
  - Machines

- **New set of requirements**
  - Performance
  - Design
  - Trustworthiness

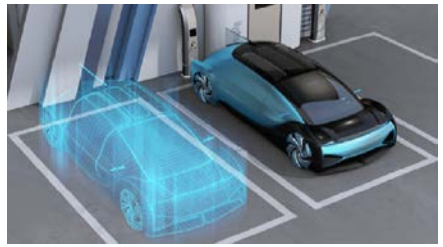
- **Key driving technologies**
  - Advanced sensors,
  - Artificial intelligence
  - Communication technologies

KEY METAVERSE ELEMENTS

- Truly immersive XR (Wireless capacity (0.44 Gps throughput compared to current 55.3 Gpbs for AR); User experienced data rate for XR streaming (0.9Gps throughput)

- High-fidelity mobile hologram

- Invisible-to-visible (digital avatar)



NETWORKING IN THE METAVERSE

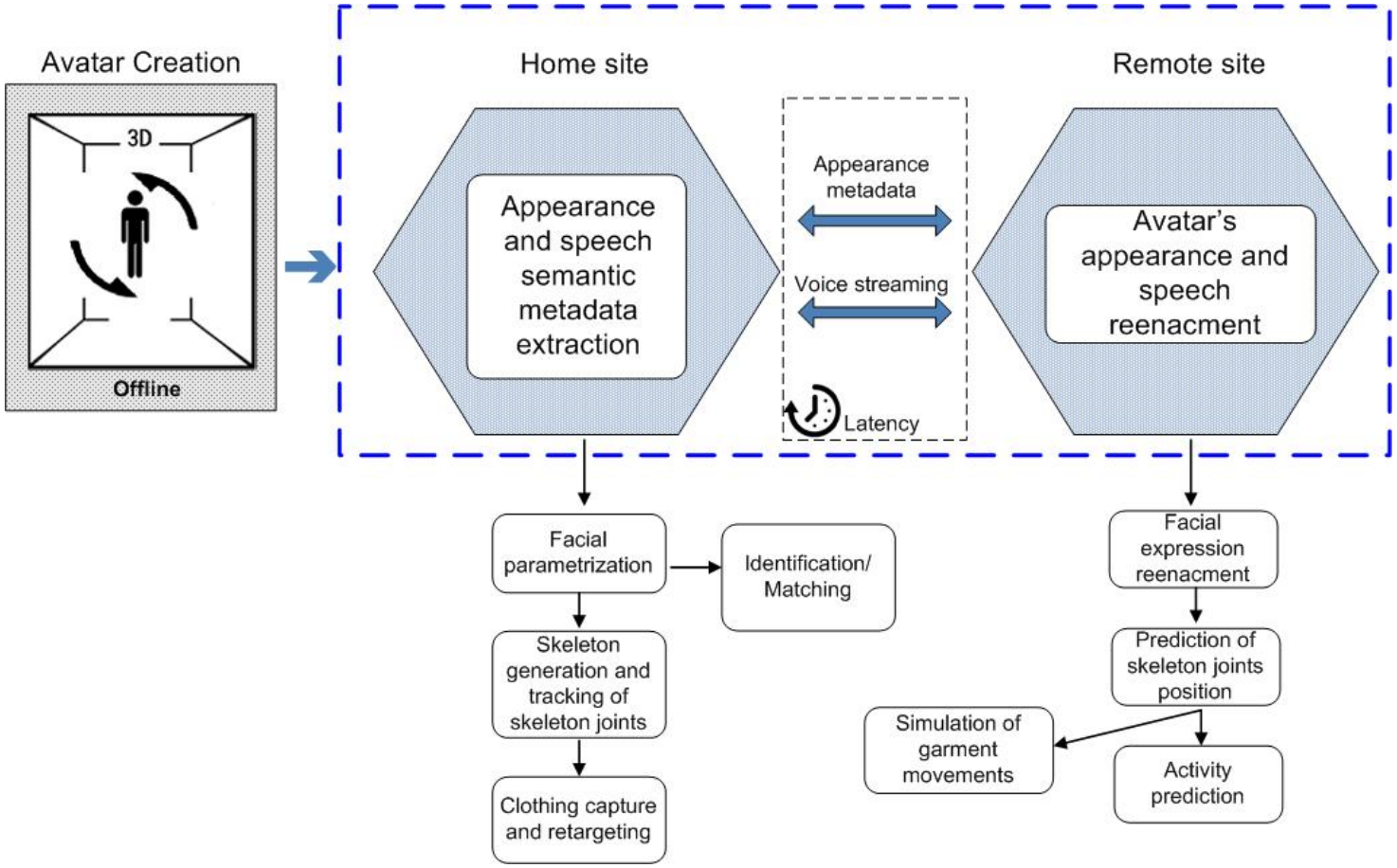
- Bandwidth:
  - Cloud-based data streaming
- Latency:
  - the hardest and slowest to fix of all network attributes
- Reliability

CAN WE GET THERE?

Typical Scenarios	Performance Requirements	Enabling Technologies	Design Principles	Applications
Further-enhanced mobile broadband (FeMBB)	• Peak data rate>1 Tb/s • User experienced data rate> 1 Gb/s • Area traffic capacity> 1Gps/sq.m • Spectrum efficiency 5-10x	THz communications Block-chain based spectrum sharing; SM-MIMO; VLC	Higher and unlicensed frequency bands; Richer spectrum resources; Strong security	Real-time holograms, full sensory digital reality; tactile applications
Long-distance and high-mobility communications (LDHMC)	• Mobility > 1000 km/h	Large-dimensional networks	Improve wireless coverage	Space travel; deep-sea communications
Ultra-massive machine-type communications (umMTC)	• Latency: 10-100μs • High connectivity density: 10^7 km/sq.m • Energy efficiency 10-100x	THz communications Block-chain based spectrum sharing; SM-MIMO; VLC; holographic beamforming; AI	Parallel data streams for higher spectral efficiency; High data transmission reliability; improved energy efficiency Strong security;	Internet of Everything; Smart city/Knowldege home
Extremely ultra-reliable and low-latency communications (eURLLC)	• Latency: 10-100μs • High connectivity density: 10^7 km/sq.m • Mobility > 1000 km/h	AI, SM-MIMO, quantum communications and computing	Autonomous and zero-touch networks; improved computer efficiency	Industrial IoT, fully autonomous driving
Extremely Low Power Communications (ELPC)	• High connectivity density: ⟦10⟧^7 km/sq.m • Energy efficiency 10-100x	Molecular communications and Internet of Nano Things	Nano-scale communications and connectivity	E-Health, nano-communications

HIGH-FIDELITY MOBILE HOLOGRAM

- real-time capture,
- transmission,
- 3D rendering techniques,
- extremely high data rate transmission



Conceptual architecture for a context-aware holographic communication system based on semantic knowledge extraction.

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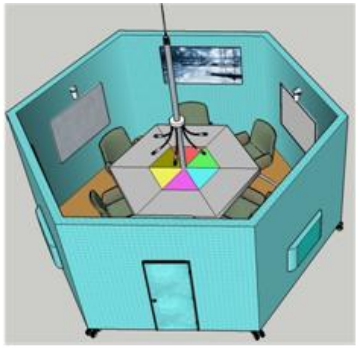
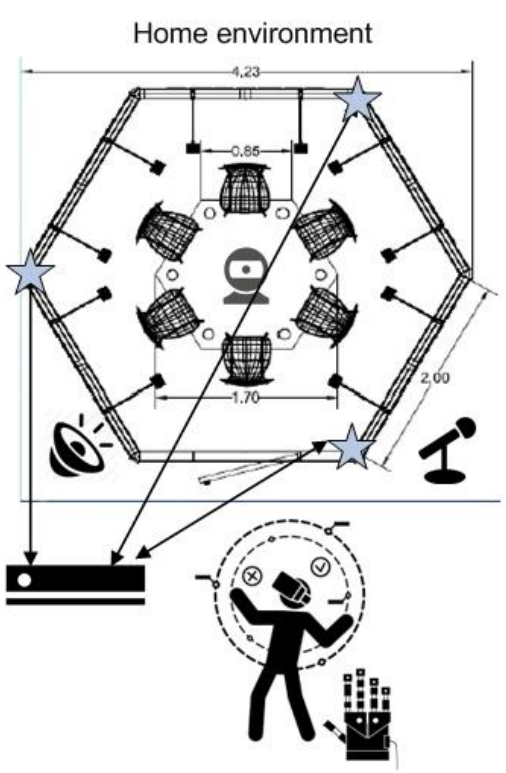
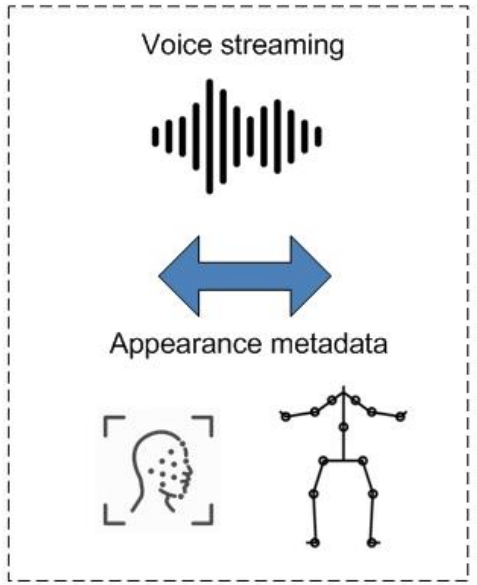
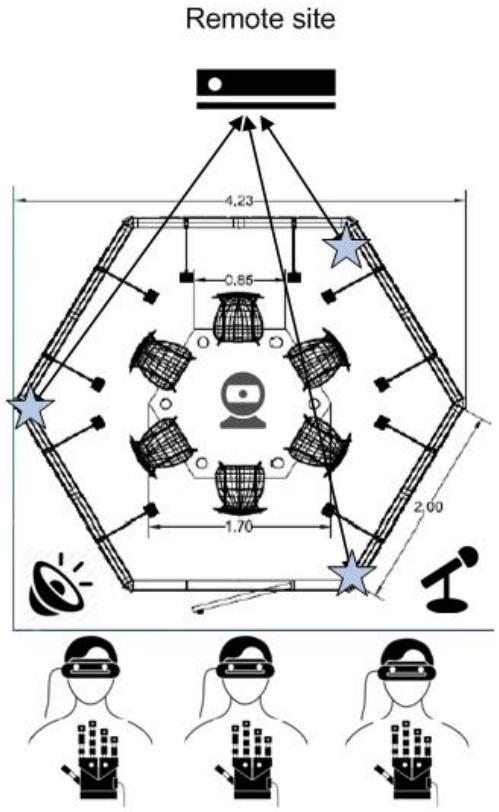
ENTERING THE METAVERSE

Conceptual model of the Bee-cube environment for holographic communication including all sensors deployment for two-way communication where participants from both locations wear VR/AR glasses and data is shared.









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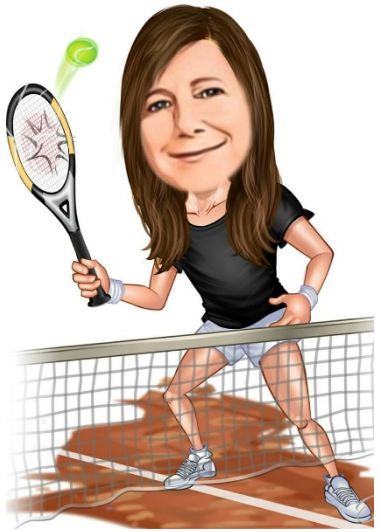
CONCLUSIONS

- The future ahead is a fully realized digital world
- Extreme connectivity is a main enabler and driver
- Seamless integration of different technologies, services, capabilities and products



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