

6G and Metaverse: A perspective

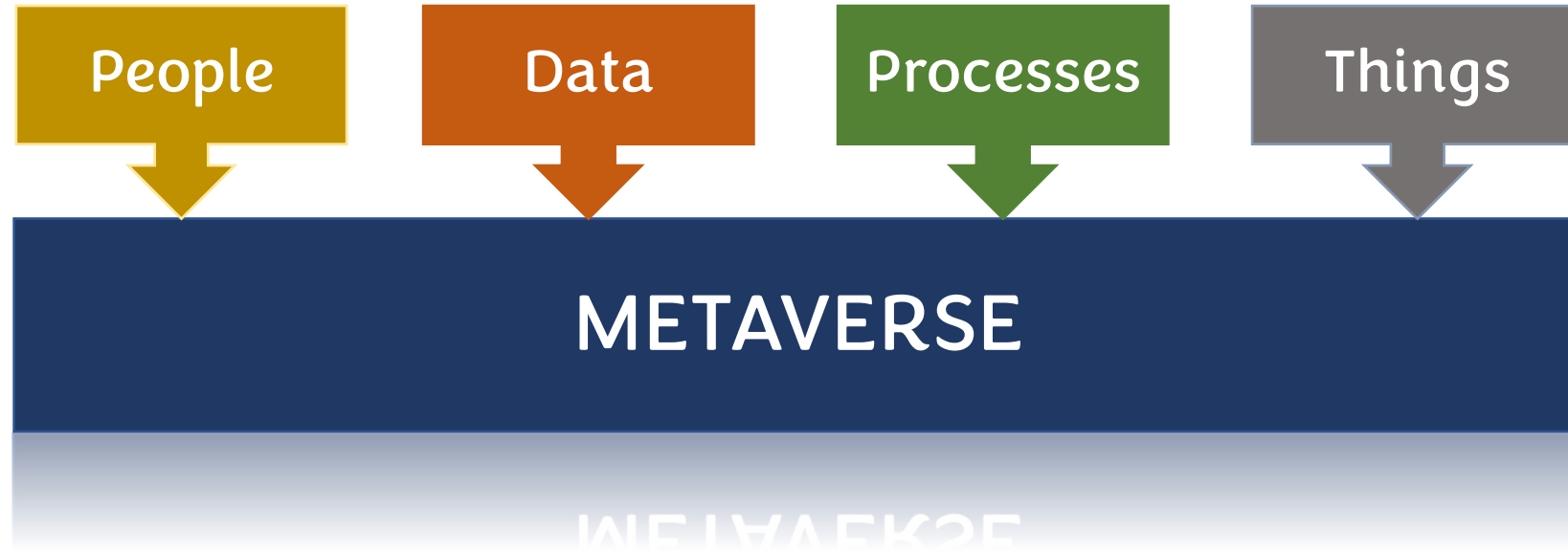
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Overview

- What is / Why the Metaverse ?
- Metaverse Ecosystem
- 6G for Metaverse
 - Metaverse: Features and Needs
 - Metaverse: KPIs and Technology Focus
 - 6G: KPIs and Technology Focus
- Metaverse for 6G
 - Enabling 6G Systems with Metaverse
- Conclusion

What is/Why the Metaverse ?

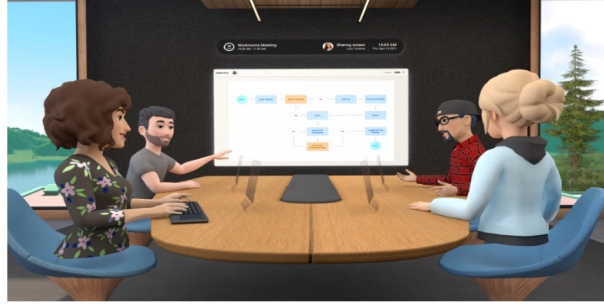


- Networked connections more relevant and valuable than ever before
- Information into actions creating new capabilities and immersive experiences
- Economic opportunity for businesses, individuals, and countries

Metaverse Ecosystem



@META



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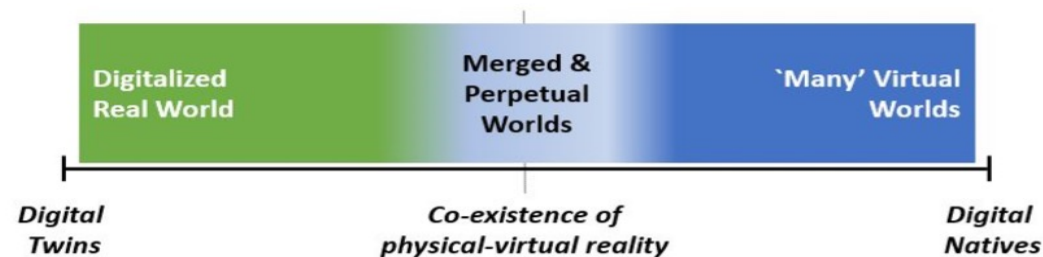


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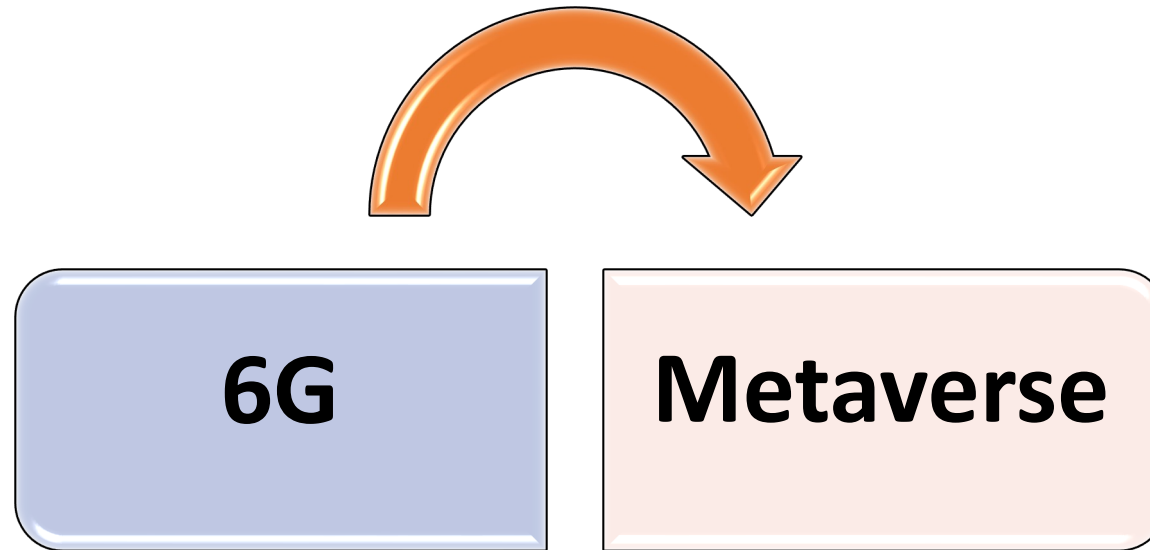
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- Ever present spatial internet
- Offers complete digitized experience – physical and virtual worlds
- Various degrees of integration between physical and digital
- Experienced multiple transformations
 - Text-based interactive games – Virtual open worlds – MMOGs – Immersive virtual environments



@Lik-Hang Lee et.al

6G for Metaverse

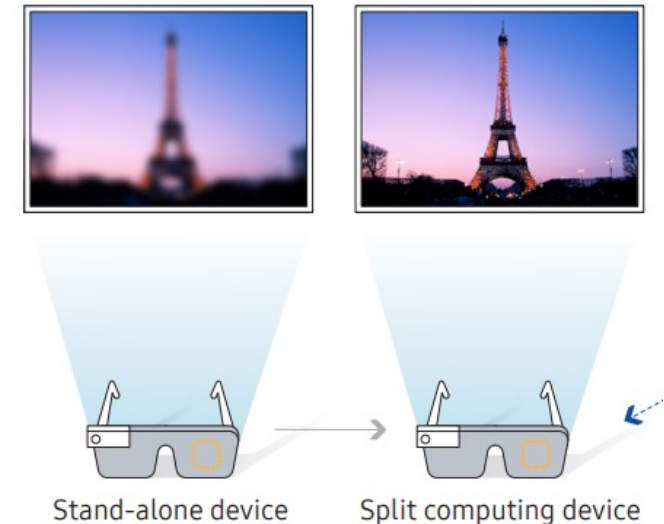
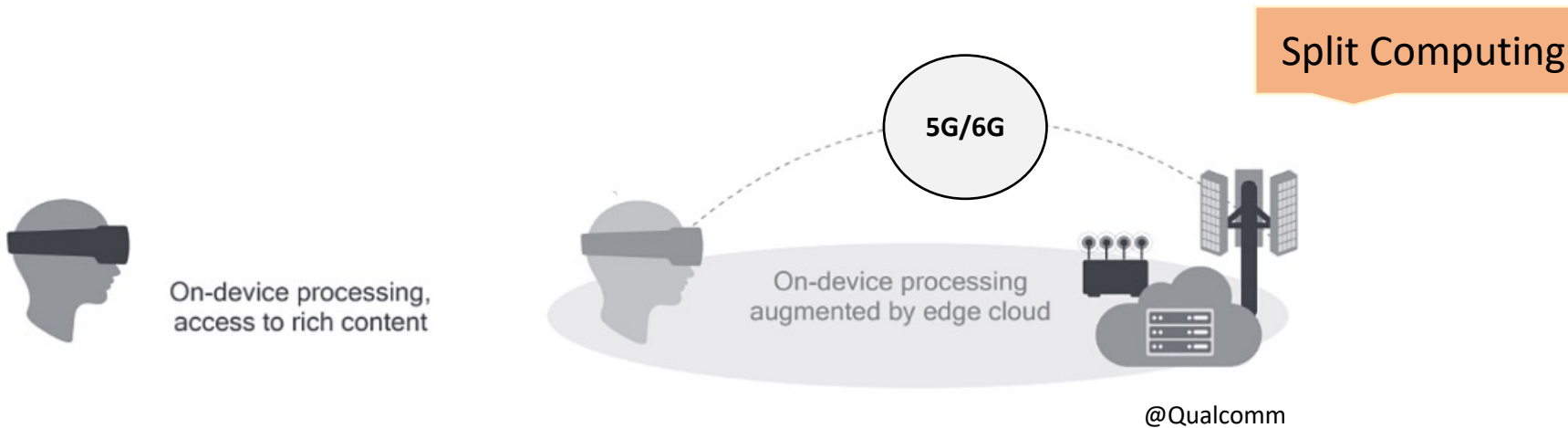


Metaverse: Features and Needs

Key Features	Needs
Ubiquitous access to all multi-verses	<ul style="list-style-type: none"> • Consistent Coverage and Capacity • Mobility Support • Seamless Handover
Light weight and accessible XR devices	<ul style="list-style-type: none"> • • •

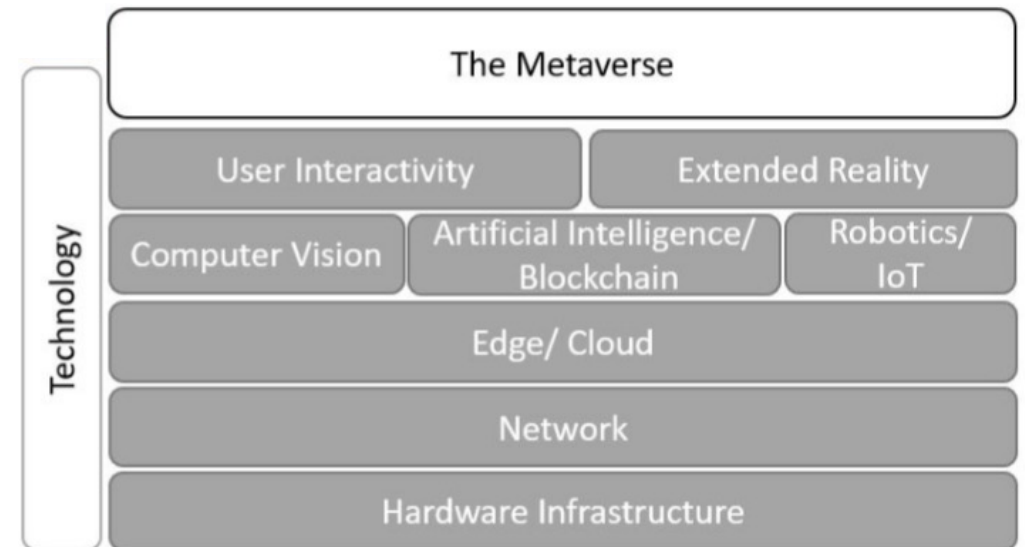
XR Device: Tasks

- Sensor Data Acquisition
- Localization
- Point-Cloud Data
- Spatial Mapping
- Map Optimization
- Object Detection
- Object Tracking

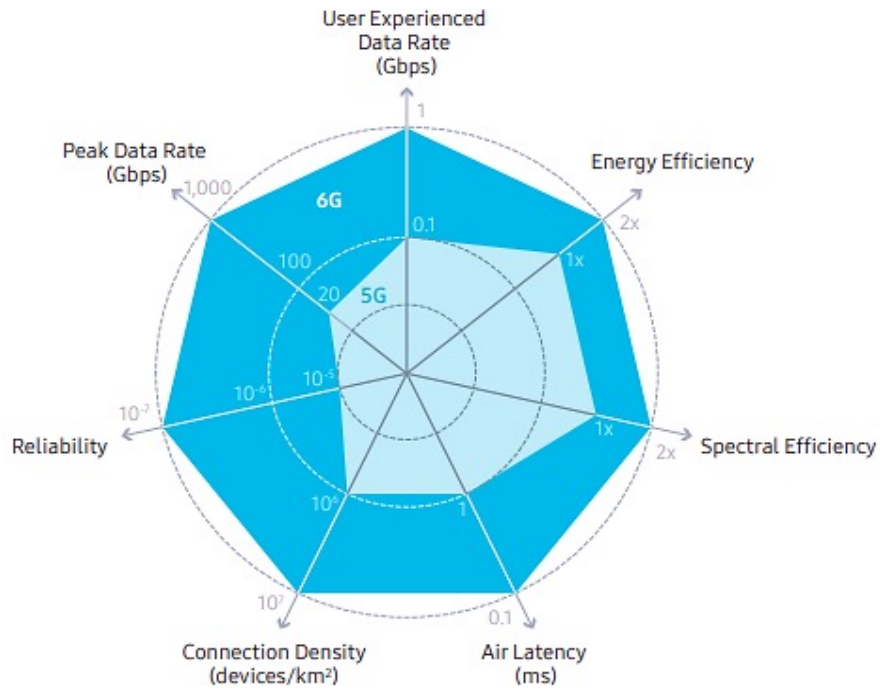


Metaverse: KPIs and Technology Focus

Type of interaction / use case	Network KPI requirement	Fair-experience	Comfortable-experience	Ideal-experience
Weak-interaction Users select view and location, but do not interact with entities in the virtual environment.	Bitrate	≥ 40 Mbit/s	≥ 90 Mbit/s	≥ 290 Mbit/s
	Recommended network RTT	≤ 20 ms	≤ 20 ms	≤ 20 ms
	Packet loss requirement	$\leq 9e-5$	$\leq 1.7e-5$	$\leq 1.7e-6$
Strong-interaction Users can interact with virtual environments through interactive devices. The virtual space displayed needs to respond to interactions in real time.	Bitrate	≥ 40 Mbit/s	≥ 90 Mbit/s	≥ 400 Mbit/s
	Recommended network RTT	≤ 20 ms	≤ 15 ms	≤ 8 ms
	Packet loss requirement	$\leq 1e-5$	$\leq 1e-5$	$\leq 1e-6$

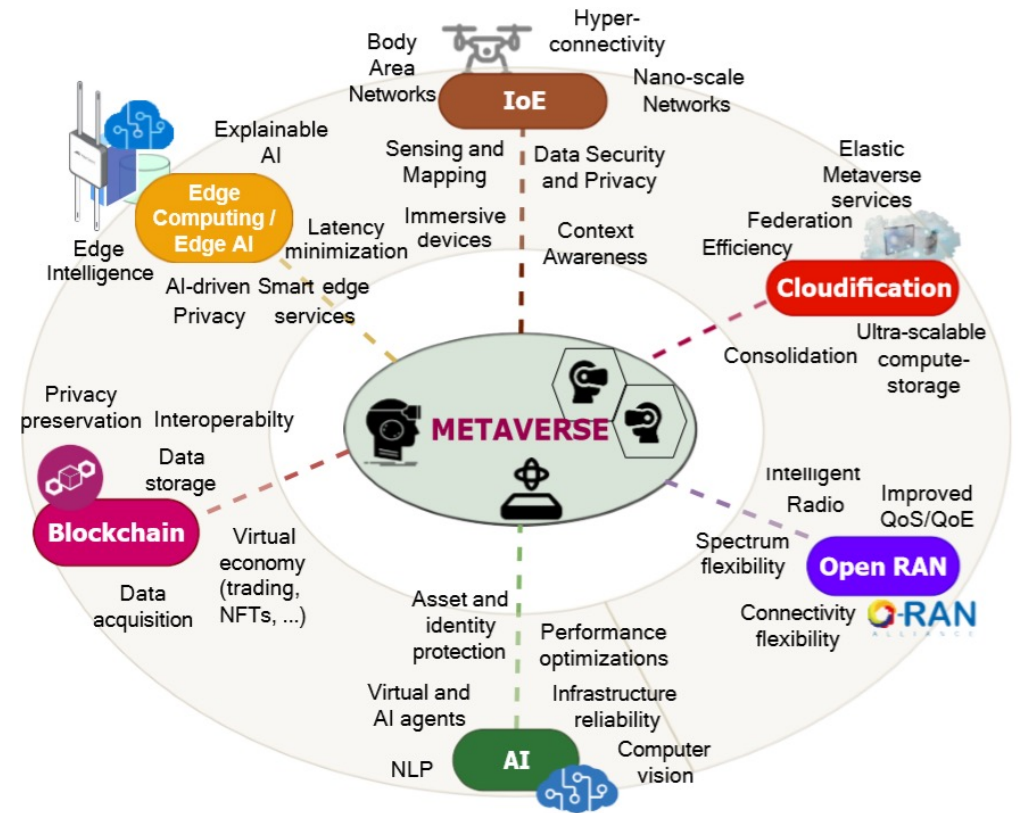


6G : KPIs and Technology Focus



@Samsung 6G Vision

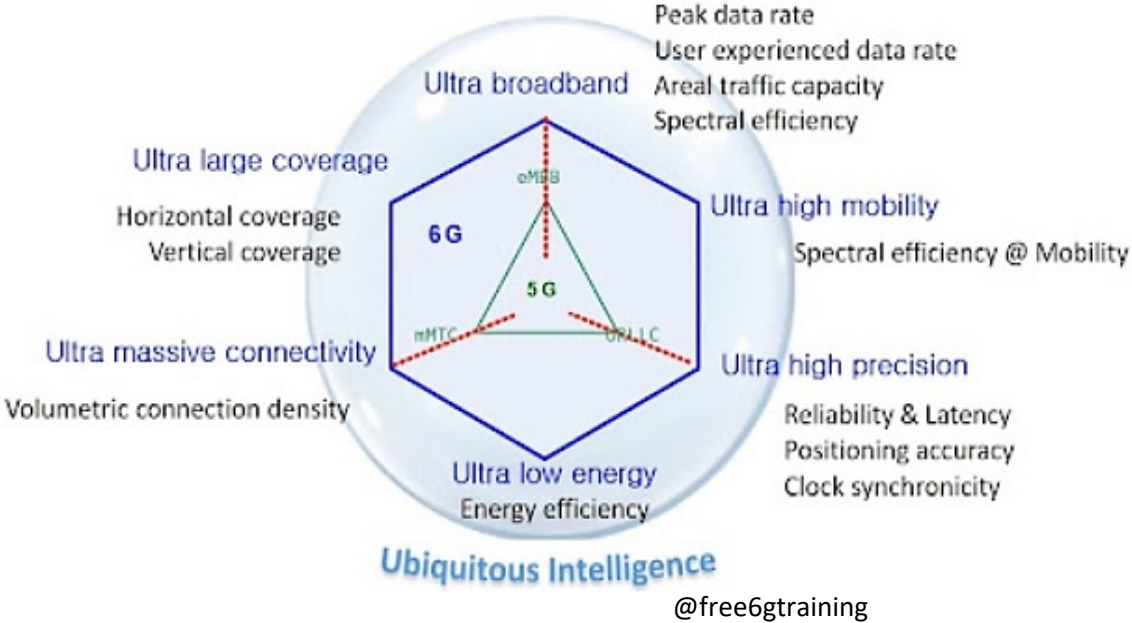
6G KPIs



6G key technologies and their roles for the Metaverse

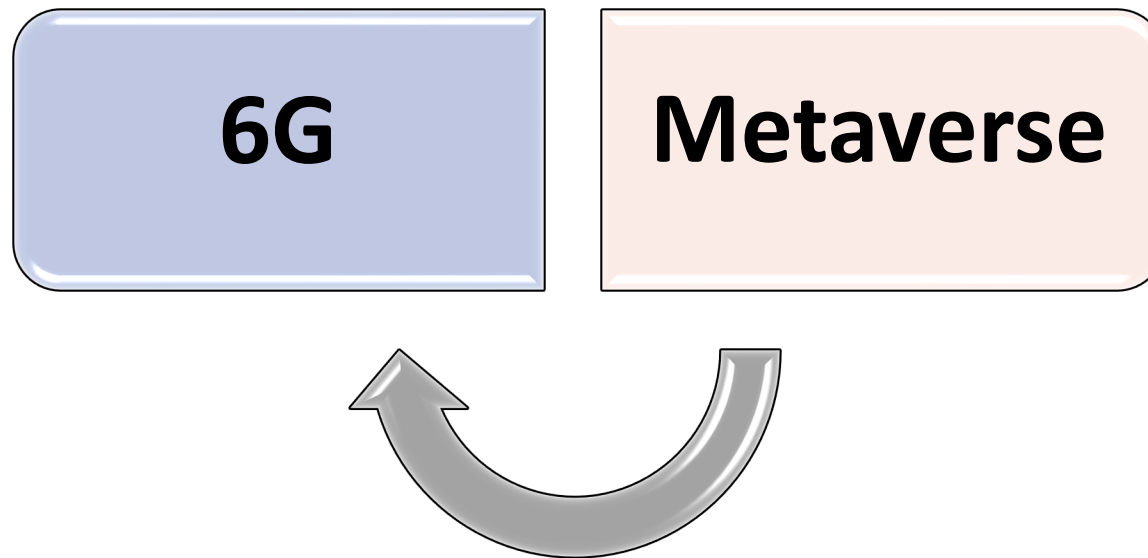
@B Siniarski et.al

6G : KPIs and Technology Focus



6G Use cases

Metaverse for 6G : A Use Case



Enabling 6G Systems with Metaverse

Why

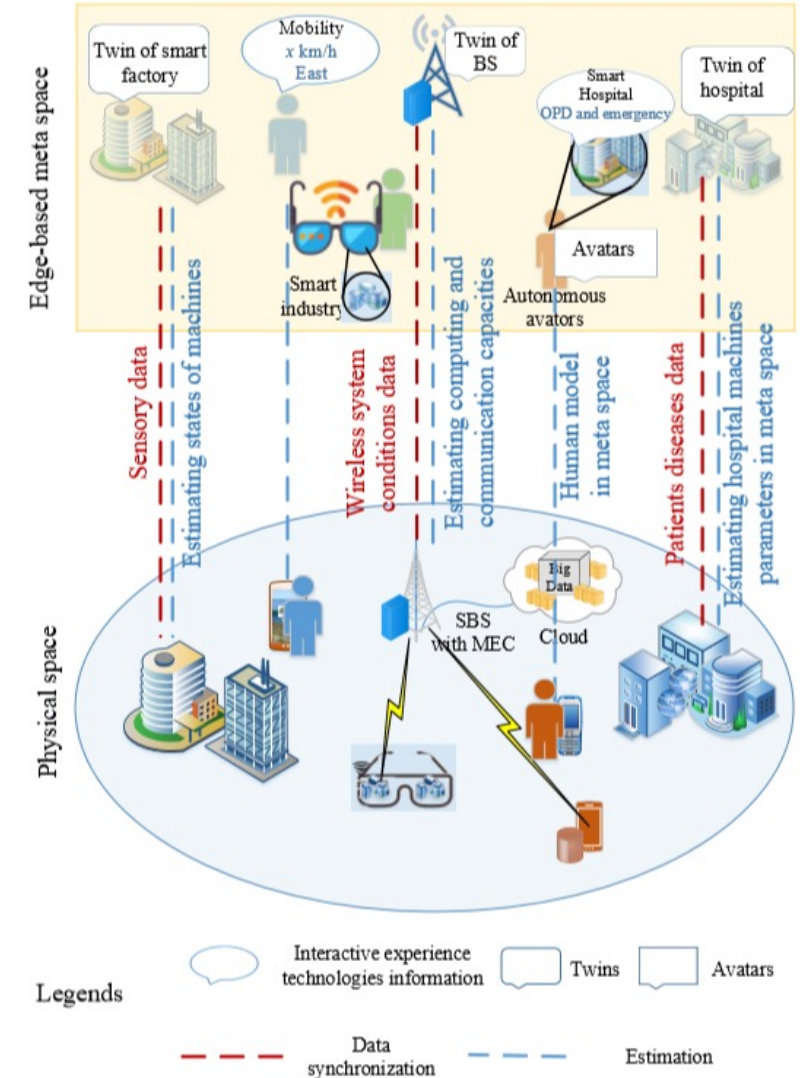
- 6G evolving with new challenges and features
 - Applications based on diverse requirements and user-defined characteristics
- Virtual representation capability of metaverse can be used to assist wireless applications

How

- Digital twinning to create virtual wireless 6G system
- Inclusion of realistic effects, static entities
- Creation of Avatars and content creation by digital natives

What for

- Offline Analysis: aids in the design and deployment
- Online Control: for run-time control



Metaverse based 6G wireless system

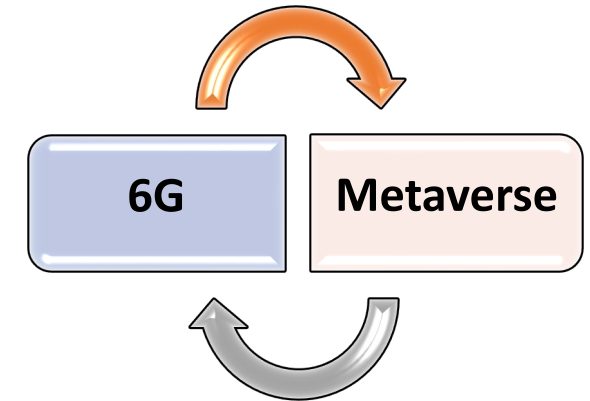
Conclusion

6G technologies will contribute largely to enable the metaverse

Virtual open space of the metaverse will enable 6G development through key enablers

Points to Ponder:

- Avatar Liability, Immortality
- Content creation censorship
- Social Acceptability
- Security, Privacy
- Trust, Accountability



Need for achieving a balance between virtuality and reality, while transcending to virtuality-reality continuum..

References

1. Bartłomiej Siniarski et al., "Need 6G for the Metaverse Realization", IEEE Access, 2022.
2. Lee, Lik-Hang et al. "All One Needs to Know about Metaverse: A Complete Survey on Technological Singularity, Virtual Ecosystem, and Research Agenda." ArXiv abs/2110.05352, 2021.
3. Khan, Latif U., et al. "Metaverse for Wireless Systems: Architecture, Advances, Standardization, and Open Challenges." arXiv preprint arXiv:2301.11441, 2023.

Thank You

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