6G and Metaverse: A perspective

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Sheeba Kumari M, PhD
Tejas Networks
Bangalore
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

- 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
6G for Metaverse

6G

Metaverse
Metaverse: Features and Needs

### Key Features
- Ubiquitous access to all multi-verses
- Light weight and accessible XR devices

### Needs
- Consistent Coverage and Capacity
- Mobility Support
- Seamless Handover
- Low latency and Reliable Communication
- Access to edge/remote cloud
- Longer battery life

### XR Device: Tasks
- Sensor Data Acquisition
- Localization
- Point-Cloud Data
- Spatial Mapping
- Map Optimization
- Object Detection
- Object Tracking

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5G/6G Split Computing

On-device processing, access to rich content

5G/6G

On-device processing augmented by edge cloud

@Qualcomm

Split Computing

Stand-alone device

Split computing device
## Metaverse: KPIs and Technology Focus

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

6G KPIs

6G key technologies and their roles for the Metaverse

@B Siniarski et.al
6G : KPIs and Technology Focus

6G Use cases

@free6gtraining
Metaverse for 6G: A Use Case

6G

Metaverse
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
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

Thank You