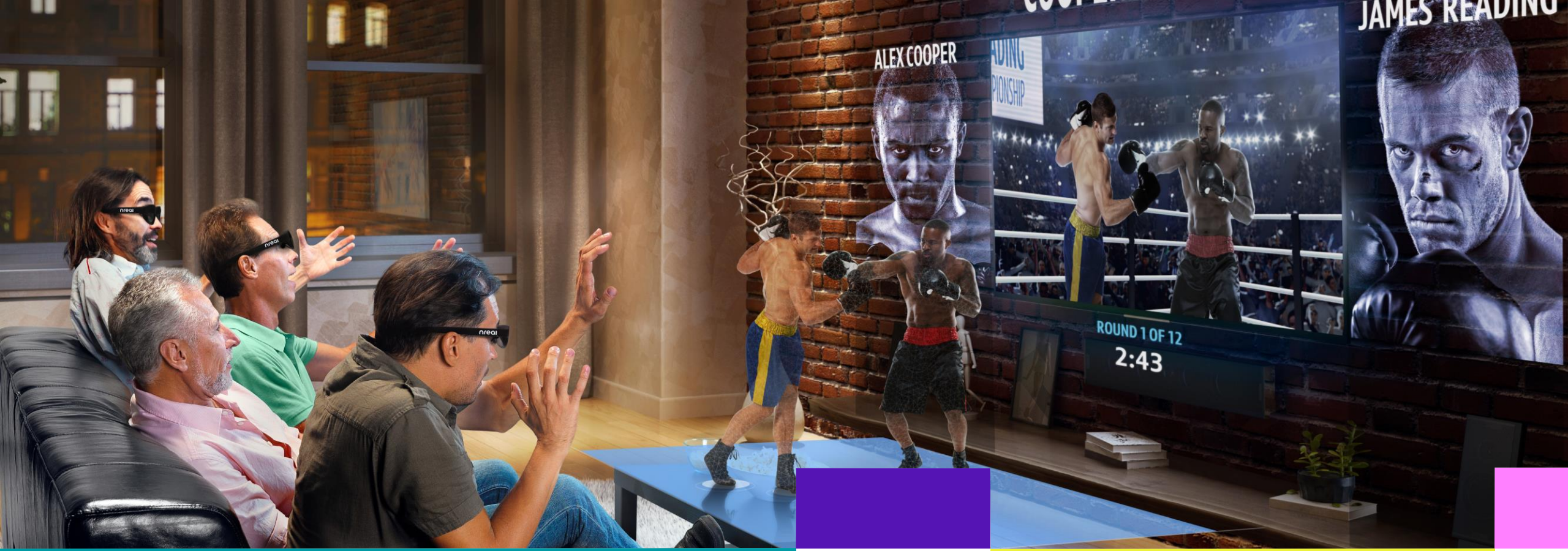


Metaverse

Use Case Requirements and Enablers

Andy Gower, BT Applied Research

TechUK 11th January 2023

BT Group

Metaverse Capabilities

The Metaverse has the potential to revolutionise the way we connect, live, work, learn, create, and play.

To become the foundation of our digitally enhanced lives the Metaverse will need to be…

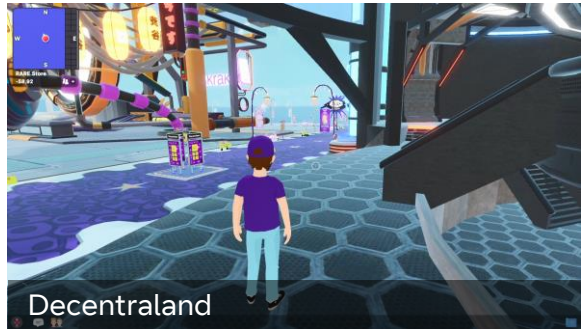
- Persistent and always on
- Multisensory real-time experiences
- Blends the virtual digital and real-world
- Capable of hosting any size of audience
- Spans across an infinite number of platforms
- Offers access to the broadest range of experiences
- Content created by a wide range of contributors
- Single user identity used across all experiences
- Fully functioning digital economy
- Digital assets are owned and are cross-platform
- Decentralised platform supporting interoperability


Fortnite


Meta Horizon Worlds

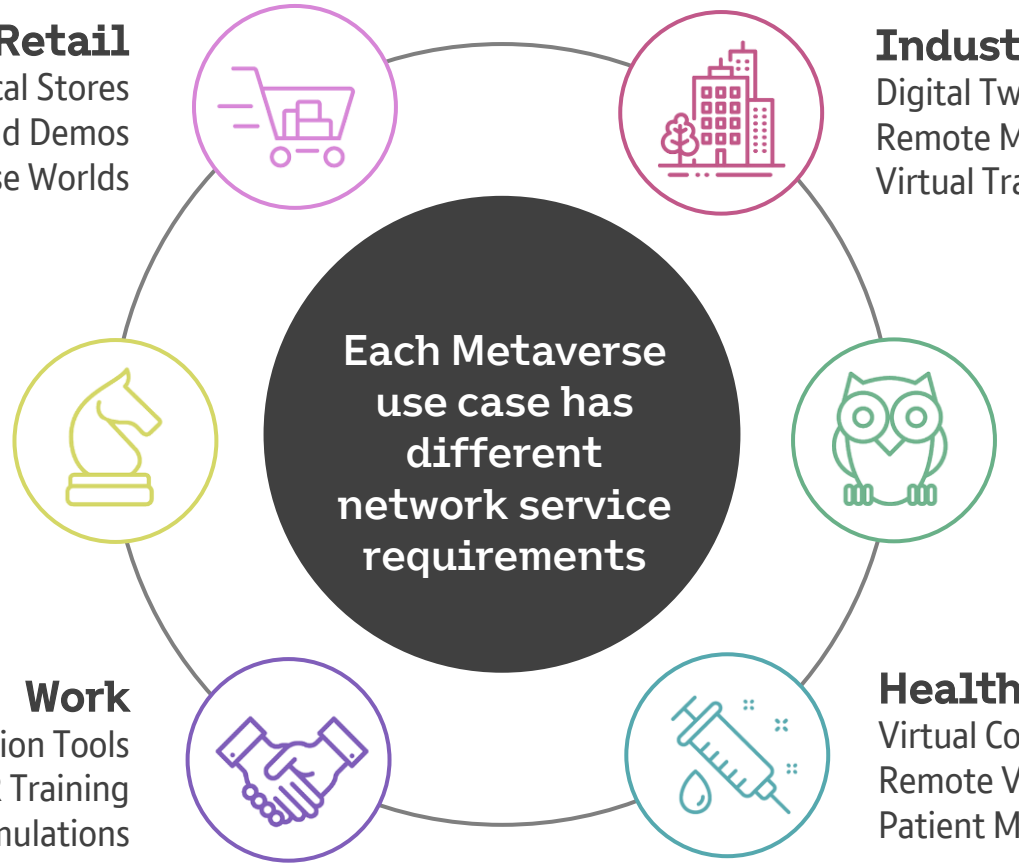

Roblox


Microsoft MESH


Decentraland


Nvidia Omniverse

Metaverse Use Cases



Retail
Virtual Store & AR Physical Stores
AR Product Placement and Demos
Virtual Products for Metaverse Worlds

Industry
Digital Twin Simulations
Remote Monitoring via Digital Twin
Virtual Training

Entertainment
AR & VR Immersive Games
Virtual Concerts & Events
Personalised Virtual Billboards

Education
Virtual Classrooms & Lectures
AR and VR Study Trips
Volumetric Video Teachers

Work
Remote Virtual Collaboration Tools
VR and AR Training
Digital Twin Simulations

Healthcare
Virtual Consultations
Remote VR Surgery
Patient Monitoring via Digital Twin

Metaverse Value Chain

Experience	Games, Social, Sports, Shopping, Theatre, Music, Work, Learning, etc.
Interface	VR AR headsets, phones, tablets, PCs, games consoles, haptic gloves, etc.
Discovery	Search, Curated Guides, Social Networks, Content Stores, Guides and Ad Networks.
Creators	Content creators using tools and platforms to make and monetise content and experiences.
Engines	Real-time 3D engines such as Unity and Unreal, Geo-Spatial Anchors, Cloud Rendering, etc.
Decentralised	Distributed Ecosystems, Edge Compute, Microservices, Blockchain, and NFTs.
Infrastructure	Teleco networks, cloud computing, 5G, WiFi 6, Cloud, CPUs, GPUs, etc.

Cloud-rendered Metaverse XR over 5G

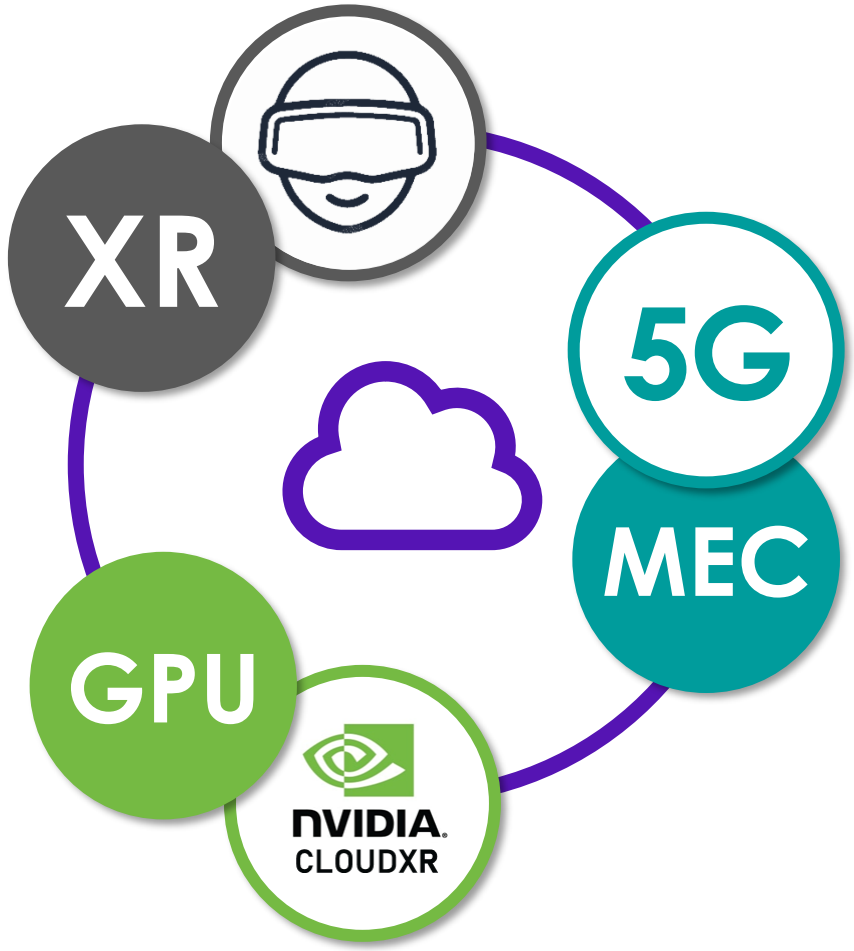
Delivering higher quality XR Metaverse experiences by off-loading graphics processing to the cloud with delivery over low-latency 5G.

5G Connectivity

- Higher speeds = Ultra-high resolution content
- Lower latency = Better Quality of Experience (Motion to Photon)
- Larger capacity = Many simultaneous connected experiences
- MEC (Multi-Access Edge Compute) accessible over 5G and FTTP

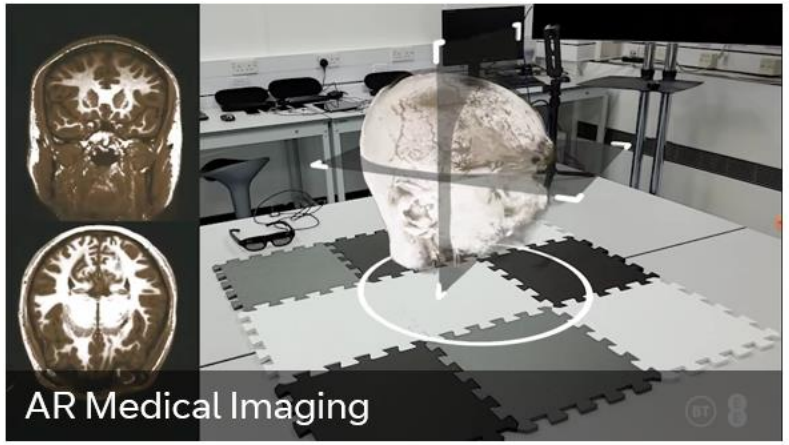
Cloud-GPU Processing

- Better quality = Ray Traced Lighting, Atmospheric Effects
- Higher fidelity = Less optimisation needed for ingress
- Faster Start-up = Streamed delivery, no waiting for downloads
- Extended Battery = Reduced client side processing
- Consistent QoE = Stable bitrate regardless of content



5G Edge-XR Developed Prototypes

Six prototype XR experiences rendered on Cloud-GPU and delivered over 5G developed within 5G Edge-XR



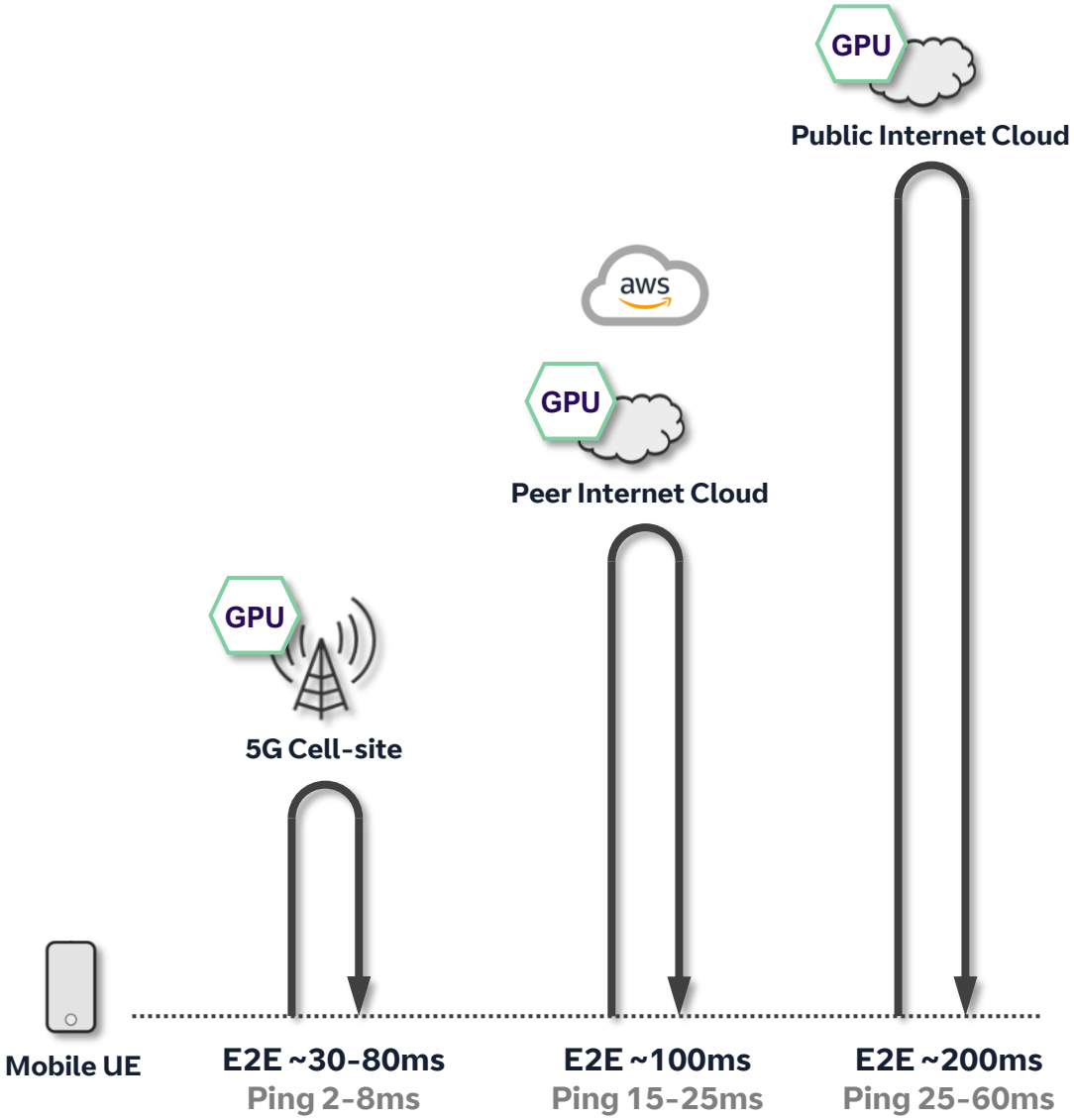
Cloud Rendering Network Latency

The logical and physical location of the GPU affects the end-to-end latency and QoE.

The challenge is to minimise the ‘motion to photon’ latency… the delay between the position and orientation information being sent from the client device to it receiving an updated frame of video from the GPU platform.

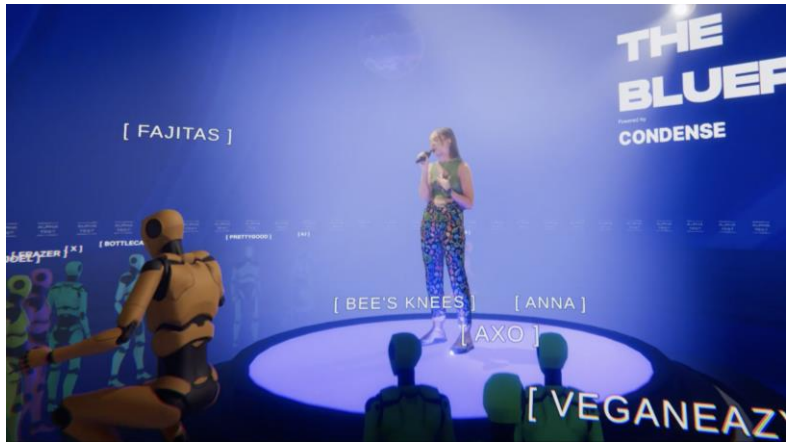
30ms is considered to be the ideal maximum latency, with lower latency preferred.

By siting the GPU closer to the point of presentation the end-to-end delay can be reduced to provide a more responsive user experience.



Metaverse Drivers & Requirements

Consumer

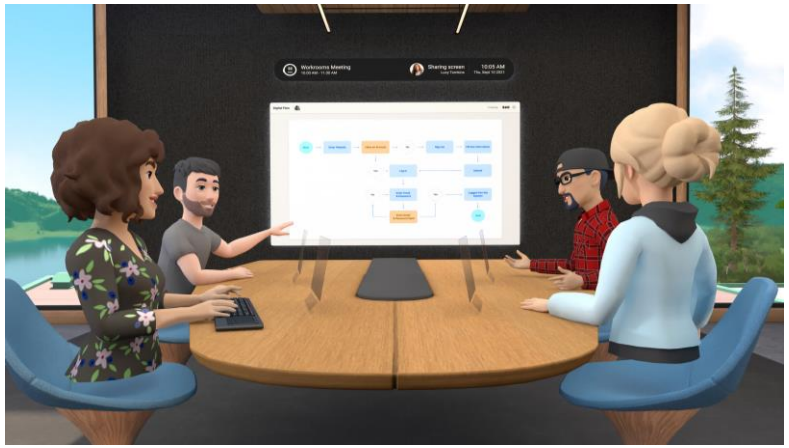


Mass Entainment VR Events

Public 5G and Home WiFi 6
Consumer VR Headsets and Phones
Low Quality Volumetric, 30K 15fps
Client Rendered Presentation

HD @ 30fps = 20-40Mbps
4K @ 120fps = 50-100Mbps

Enterprise



Teams VR Remote Collaboration

Public 5G and WiFi 6
PC, Phones and VR Headsets
Med Quality Volumetric, 100K 60fps
Hybrid Cloud Rendered Presentation

HD @ 60fps = 30-50Mbps
4K @ 120fps = 100-200Mbps

Industry

AR & VR Digital Twin Simulations

Private 5G and WiFi 6E
Enterprise AR/VR Headsets
High Quality Digital Twins, 12M 90fps
Cloud Rendered Presentation

+HD @ 90fps = 40-80Mbps
+4K @ 120fps = 200-400Mbps

Thank you