



W3C Web & Networks Interest Group

TPAC 2024 IG Meeting

Sep 24 2024

Chairs:

Dan Druta (AT&T)
Song Xu (China Mobile)
Sudeep Divakaran (Intel)

Staff Contact:

Dominique Hazael-Massieux dom@w3.org

Welcome!

- Welcome to the TPAC 2024 W3C Web & Networks IG Meeting
- W3C meetings operate under the Principles and Procedures of our [Positive Work Environment at W3C: Code of Ethics and Professional Conduct](#)
- Patent Disclosures
Please see the [W3C Patent Policy](#)
- IRC Channel <https://irc.w3.org/?channels=#web-networks>
Channel: #web-networks

Agenda

- Introductions : 15min
- Web & Networks Overview : 15min
- Use Cases & Requirements : 45min
- Open Discussion : 45min

Web & Networks Interest Group Overview

The mission of the Web & Networks Interest Group is to explore solutions for web applications to leverage network information and capabilities, and edge compute to achieve better performance and better efficiency of network resource allocation, both on the device and network.

Key Topics in scope (from the charter):

- Client-Edge-Cloud Coordination and evolving next generation use-cases for edge computing, network usage patterns and challenges.
- Application hints to the network. Specifically, the group will focus on hints that can be used to optimize network resource allocation and performance achieve best web application and network performance. For instance:
- Network hints to device applications to enable migration of compute functions across the network between client, edge or cloud depending on user experience and compute requirements, and improved resource utilization.
- Evaluation of Privacy and Security risks of distributed compute-based solutions and evaluate related mitigation considerations using hardware and software support.

[Web & Networks Interest Group Charter \(w3.org\)](https://www.w3.org/charter/2021-web-networks/)

End Date: 31 December 2025

Focus areas

The group is currently focused on:

- The **role of Edge Computing offloading** for browsers and Web applications and study the privacy & security related challenges to enable it;
- The **role of network performance monitoring and prediction** for Web application optimizations;
- The role of **application hints and network metrics** that can enable sustainable and efficient networking solutions, without compromising user-experience.

Tasks

- Identify **opportunities** for network and application collaborations
- **Liaise and coordinate** with relevant networking standards organizations
- Collaborate with W3C Working and Interest Groups
- Share the latest developments in **networking standardization bodies**.
- Propose **incubation of new work**
- Represent **knowledge** about networking technologies
- Provide guidelines to **browser developers**
- Provide guidelines to web **application developers**

2019 to 2024: Progress So Far & Path Ahead

Workstreams	At the start 2019	2024 Emerging Use-Cases, Solutions & Applications	2024 Work seen in other W3C groups and external SDOs, Groups
Network Performance Monitoring and Prediction, Network & Application hints	<ul style="list-style-type: none">• NetInfo API• WebRTC API• Resource Timing API• Background Fetch	<ul style="list-style-type: none">• Mobile network quality prediction• Shaping Video Traffic based on Network quality• Cloud Gaming QoE under varying network conditions• Workload migration (e.g. AI inference models) based on Network latencies	<ul style="list-style-type: none">• IETF : Early work ongoing around Sconeprp Proposal• CTA-WAVE: Common Media Server Data (CMSD-Dynamic)
Edge Computing	<ul style="list-style-type: none">• Early data showing impact of network latency for ML/AI like use-cases	<ul style="list-style-type: none">• Cloud-Edge-Client Coordination use-cases• Edge Offload (Edge Workers)• Mobile operators MEC• Hybrid AI, Digital Twins for Smart Cities• CloudFlare Workers AI• Fastly Fastly Compute• Akamai EdgeWorker AI• Alibaba Edge Node Service/Alibaba Cloud• Amazon AWS Wavelength	<ul style="list-style-type: none">• ETSI MEC standards: Multi-Access Edge Computing• IPVM/IPFS (Everywhere Computer)• WinterCG: WASM Runtime API for Edge nodes• WASM on Client and Edge
Quality of Experience & Sustainable Networking	<ul style="list-style-type: none">• Factors that impact QoE	<ul style="list-style-type: none">• Low latency Cloud/Edge Gaming• Distributed Computing	<ul style="list-style-type: none">• New 6G use-cases discussed in 3GPP

Cloud Gaming

What is Cloud Gaming

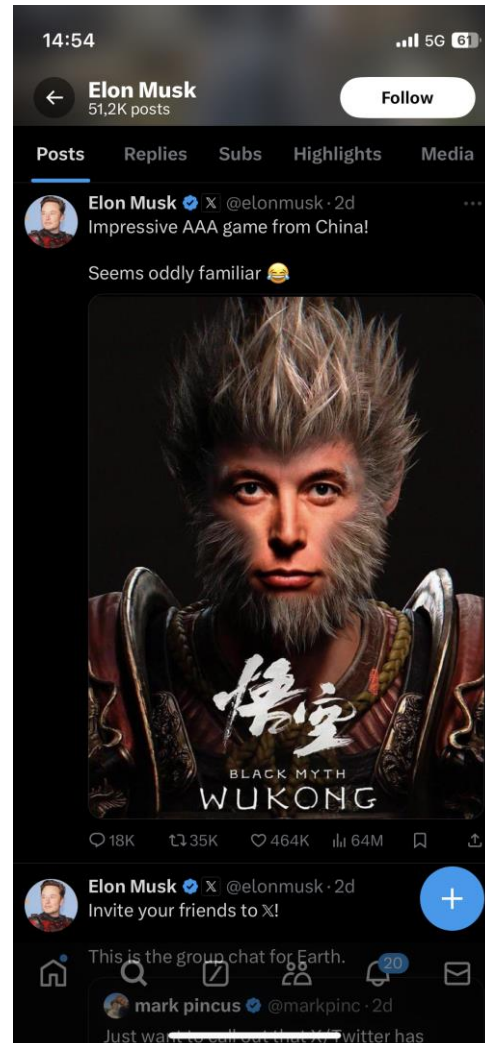
- **Cloud gaming**, sometimes called **gaming on demand** or **game streaming**, is a type of online gaming that runs video games on remote servers and streams the game's output (video, sound, etc) directly to a user's device, or more colloquially, playing a game remotely from a cloud. It contrasts with traditional means of gaming, wherein a game is run locally on a user's video game console, personal computer, or mobile device.
-- From Wikipedia

- **Advantages of Cloud Gaming**
 - **Accessibility** : Play on various devices without high-end hardware.
 - **Instant Play** : Start games instantly without downloads.
 - **Cost-Effective** : Save on expensive gaming rigs.
 - **Seamless Updates** : Automatic updates managed in the cloud.
 - **Cross-Platform Play** : Play with friends on different devices.



* pic from <https://t.co/2nU7e3xmYK>

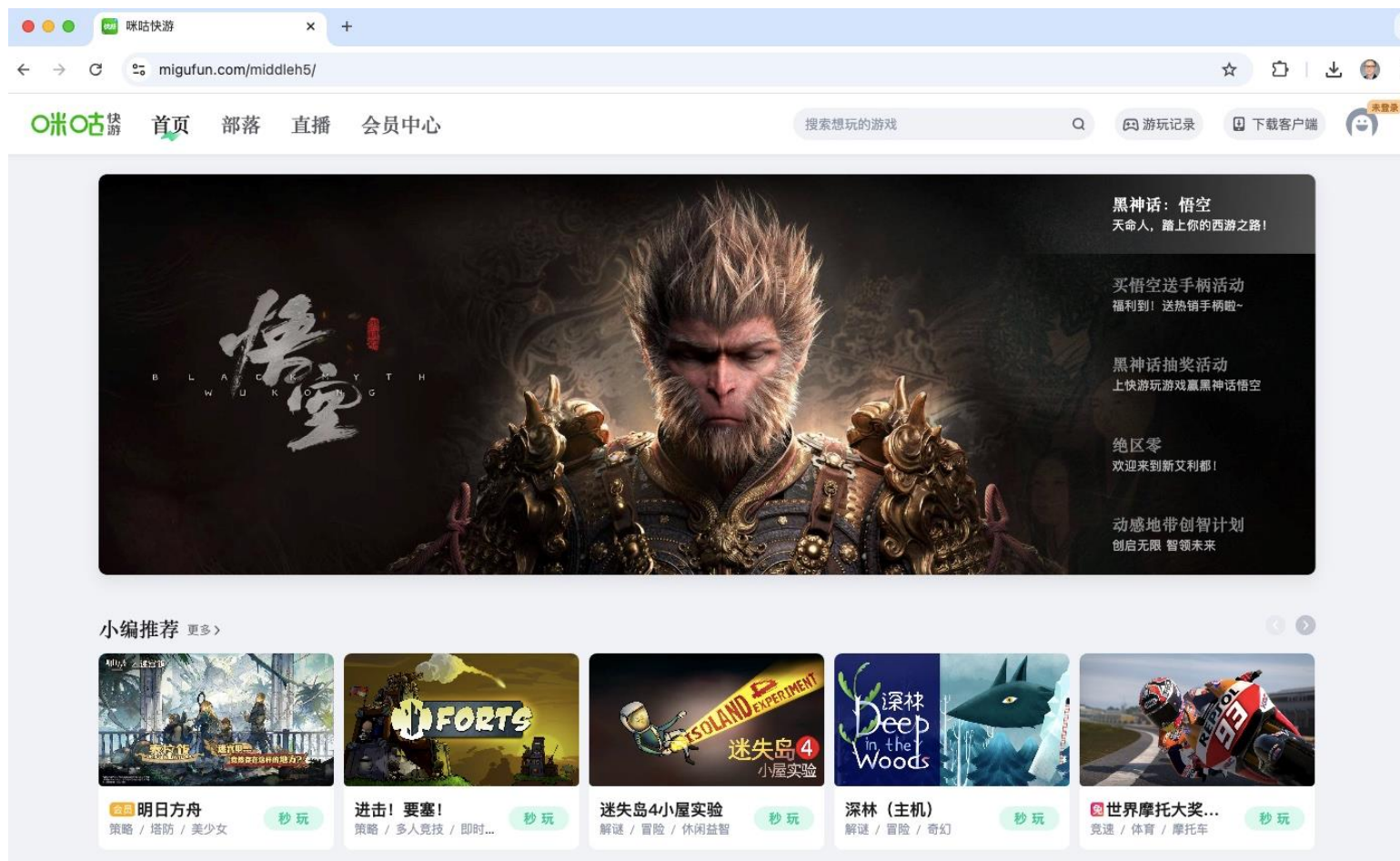
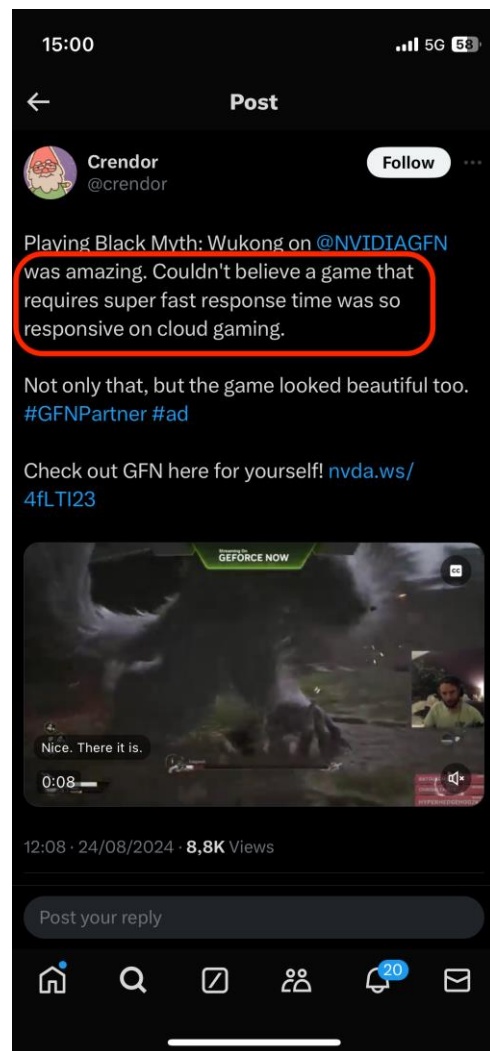
Black Myth: Wukong Phenomenon



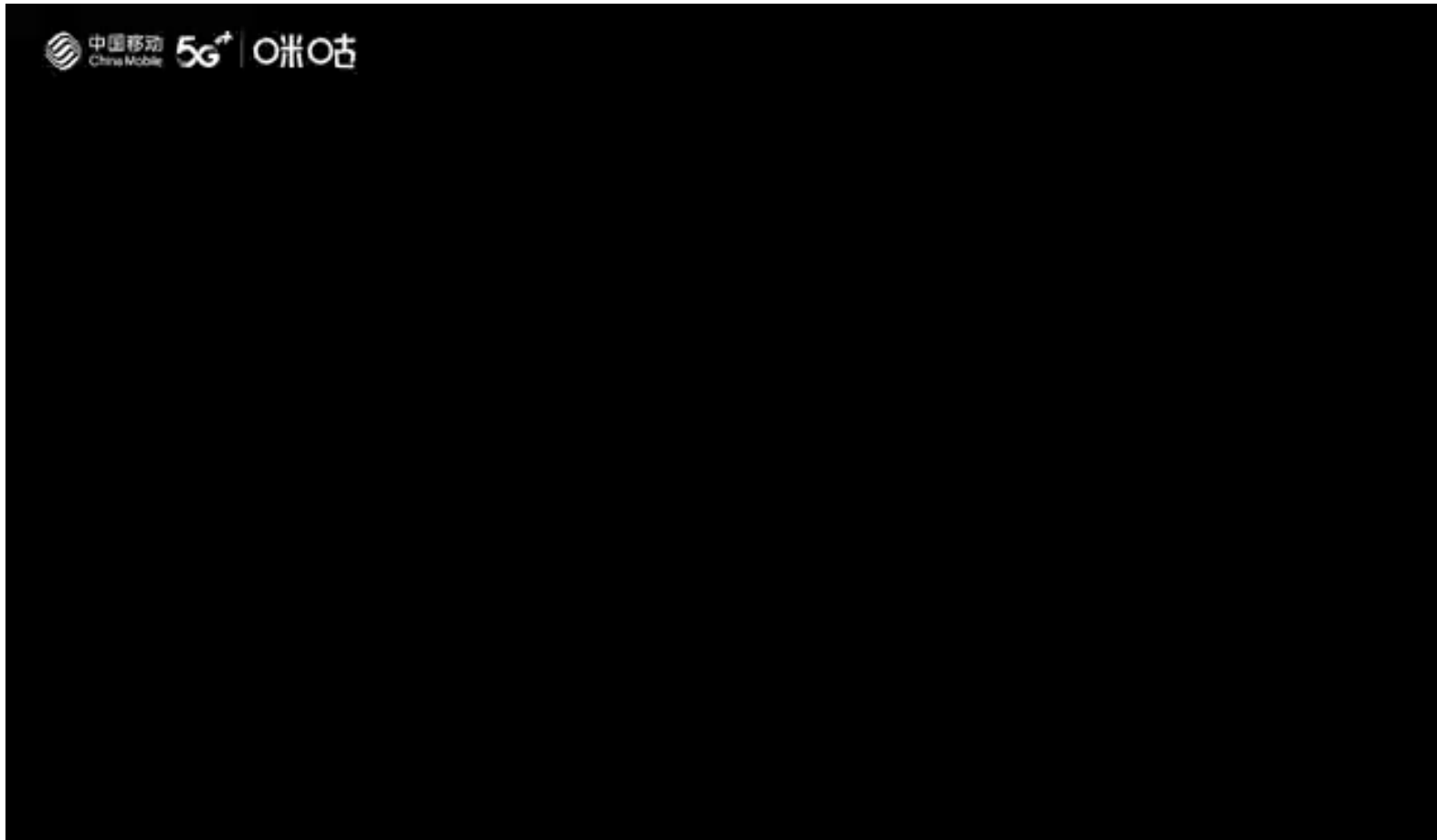
BLACK MYTH WUKONG							PC REQUIREMENTS		
	MINIMUM	RECOMMENDED	ULTRA	FULL RAY TRACING REQUIREMENTS					
				MINIMUM	RECOMMENDED	ULTRA			
GRAPHICS PRESET	Medium @1080P	High @1080P	Very High @4K	Medium @1080P Ray Tracing Low	Medium @1080P Ray Tracing Medium	High @4K Ray Tracing Very High			
PROCESSOR	Core i5-8400 Ryzen 5 1600	Core i7-9700 Ryzen 5 5500	Core i7-9700 Ryzen 5 5500	Core i5-9400 Ryzen 5 1600	Core i7-9700 Ryzen 5 5500	Core i7-9700 Ryzen 5 5500			
GPU	GeForce GTX 1060 RX 580	GeForce RTX 2060 Radeon RX 5700XT Arc A750	GeForce RTX 4070 RX 7800 XT	GeForce RTX 3060	GeForce RTX 4060	GeForce RTX 4080 SUPER			
VRAM	6GB	6GB	12GB	8GB	8GB	16GB			
SYSTEM RAM	16GB	16GB	32GB	16GB	16GB	32GB			
STORAGE	130GB HDD supported SSD Preferred	130GB SSD	130GB SSD	130GB SSD	130GB SSD	130GB SSD			
OS	Windows 10/11 64-bit	Windows 10/11 64-bit	Windows 10/11 64-bit	Windows 10/11 64-bit	Windows 10/11 64-bit	Windows 10/11 64-bit			

* pic from Reddit

Cloud Gaming for Black Myth: Wukong

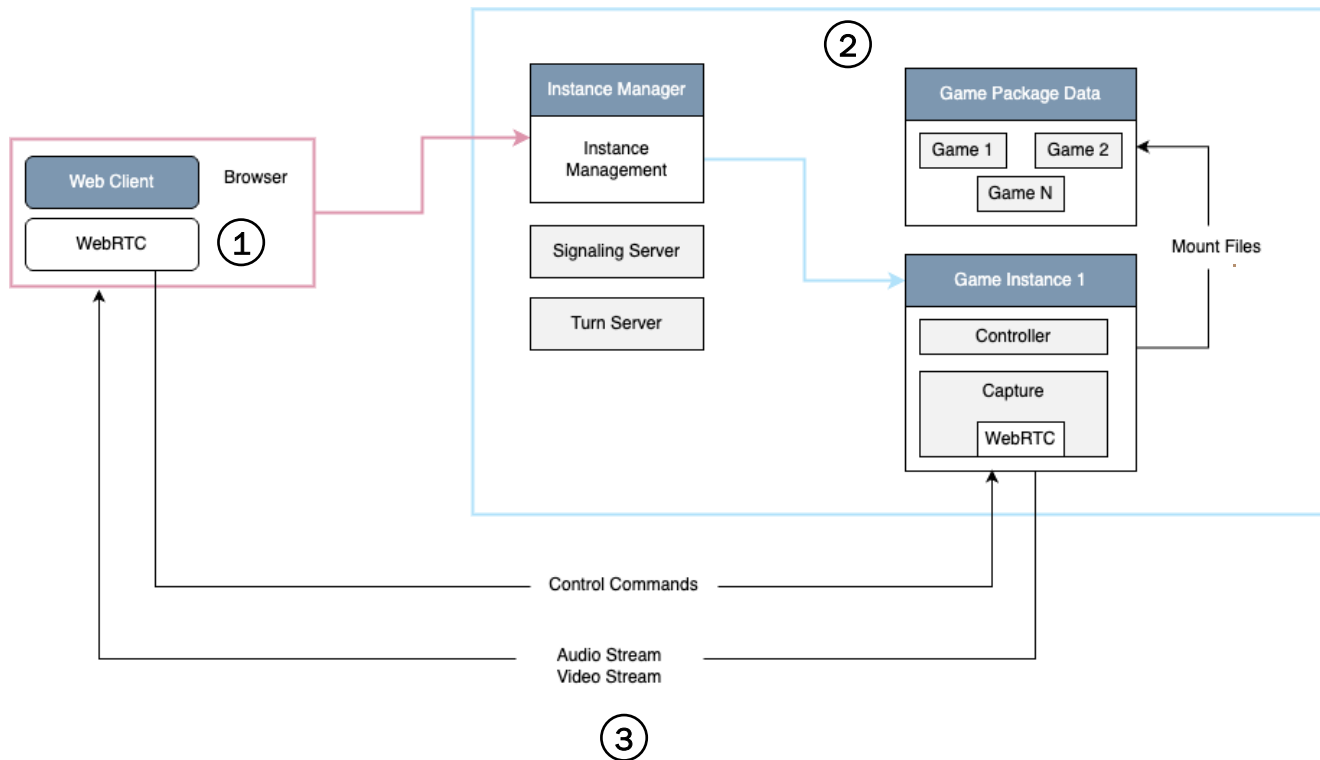


Cloud Gaming for Black Myth: Wukong



Cloud gaming video from China Mobile

Architecture for Cloud Gaming



- ① The player opens the web client, retrieves the configuration using the game ID, and requests an instance from the cloud gaming backen.
- ② The Instance Manager in the backend allocates an appropriate game instance based on network conditions and mounts the game package data. The web client then connects to the signaling server to obtain the WebRTC configuration necessary for communication.
- ③ After capturing the game graphics in the game instance, audio and video streams are transmitted to the client via WebRTC. Control commands are also sent through the WebRTC DataChannel.

Challenges for Cloud Gaming

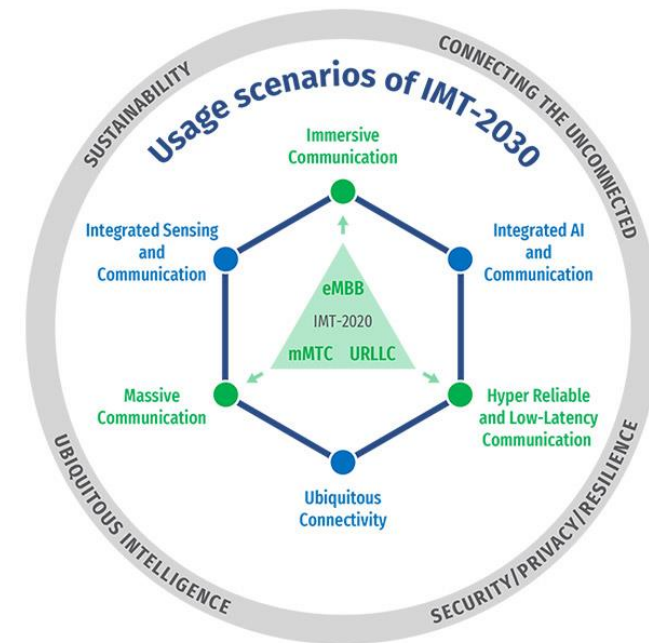
- **Input Lag and Latence:** Cloud gaming is not immune to input lag and latency issues. The time it takes for a player's input to be registered and reflected in the game can be affected by the distance between the player and the server, especially in fast-paced or competitive environments like first-person shooters and fighting games. **Algorithms like "Predictive input" could be used to help predict a player's next inputs**, which could overcome the impact of latency in cloud gaming applications.
- **Input Device Compatibility :** Not all input devices are created equal in the world of cloud gaming. There may be inconsistencies in performance and compatibility. Lag, miscommunication, or limited support for certain features (like haptic feedback) can frustrate players. **More feedback API could be developed to improve the immersive experience.**
- **Balance high-quality graphics with low latency:** Cloud gaming requires a substantial amount of data to be streamed in real-time. High-definition graphics and responsive gameplay translate to significant bandwidth consumption, often exceeding 10 Mbps for a quality experience. To smooth the user experience, **more compression algorithms like H.265 which support hardware acceleration could be developed and exposed to developers.**

Convergence of Immersive Web and 6G Technology

Shaping the Future of Immersive Digital Experiences

Overview of the Immersive Web and 6G Technology

- The Immersive Web WG is dedicated to bringing high-performance Virtual Reality (VR) and Augmented Reality (AR) (collectively known as XR) to the open Web via APIs to interact with XR devices and sensors in browsers.
- 6G is expected to deliver faster network speeds, lower latency, higher reliability, and broader coverage, providing the necessary technical support for immersive experiences.



Convergence of Immersive Web and 6G

- **Low Latency and High Bandwidth :** 6G is expected to dramatically increase mobile network speeds and performance, enabling smoother and more responsive immersive experiences in web environments. This will allow users to interact with virtual environments in real-time, virtually eliminating the sense of latency.
- **New Content Delivery Methods :** Leveraging the high-efficiency transmission capabilities of 6G, immersive web applications can support high-resolution 3D content delivery, as well as innovative applications such as real-time holographic projections and immersive video streaming.
- **Enhanced Device Connectivity :** 6G is anticipated to support a massive number of connected devices, enhancing the application of IoT within immersive experiences. Users will be able to interact with immersive web applications through various connected devices, such as wearables and smart home technologies.
- **Standardization and Interoperability :** The W3C working group is focused on developing standards to ensure interoperability across platforms and devices. Similarly, 6G will promote standardization between different networks and service providers, which is crucial for enhancing the accessibility and user experience of immersive web applications.

Immersive Communication in 6G Applications

- **Extended Reality (XR) in 6G:** 6G networks will support higher quality XR experiences, such as cloud-based XR and holographic communication.
- **Tactile Internet (TI) in 6G:** The low latency characteristic of 6G networks will make the Tactile Internet possible, enabling remote tactile interaction.
- **Holographic Communication in 6G:** Holographic communication will utilize the high bandwidth and low latency of 6G networks to provide real-time 3D image transmission and interaction.

Future Research Directions

- **Standardization and Interoperability of Immersive Web Experiences:** Future research could focus on the standardization of immersive Web experiences to ensure interoperability across different devices and platforms.
- **Innovation in 6G Network Architecture:** Research could explore innovations in 6G network architecture to support new services and applications.
- **Business Models and Ecosystems for Immersive Communication Services:** Future research could discuss the construction of business models and ecosystems for immersive communication services.



Thank you

