

Trend Analysis of ultra-low latency RTC and ultra-low latency streaming

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Date: July 14, 2027.



Application Evolution of RTC and Live Streaming

Traditional applications

VoD:

1080P~4K @30fps, X seconds latency

RTC: Video conference/Video Call

720P~1080P@30fps, ~200ms latency

Conventional Live streaming:

1080P~4K@30fps. X seconds latency.



VoD



Live streaming



RTC

Emerging applications

RTC: Cloud desktop, Cloud mobile phone, Cloud gaming, Remote control (Industrial Machine Remote Control, Remote Fault Monitoring).

1080P~4K @30fps~60fps, **50-100ms latency**

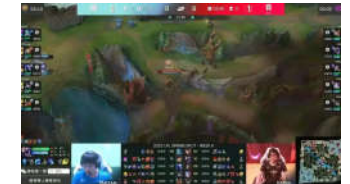
Live streaming: E-commerce Live Streaming, Multi-Host Co-Broadcasting, Digital Human Live Streaming, Outdoor Mobile Live Streaming.

1080P~4K@30fps, **sub-second latency.**

(China's live e-commerce market exceeded 6 trillion RMB in 2025, with a year-on-year growth of 20%[1])



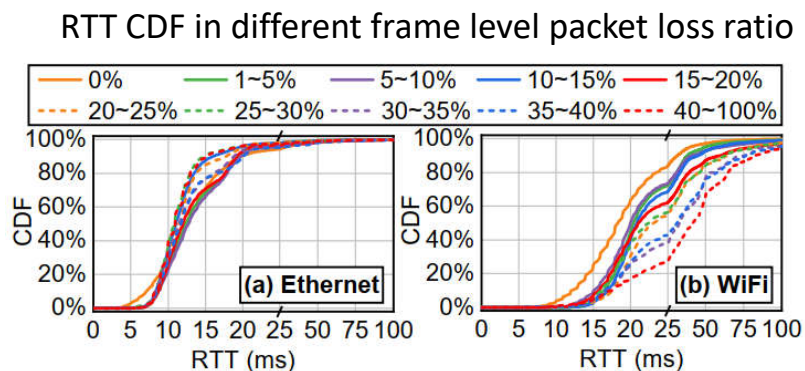
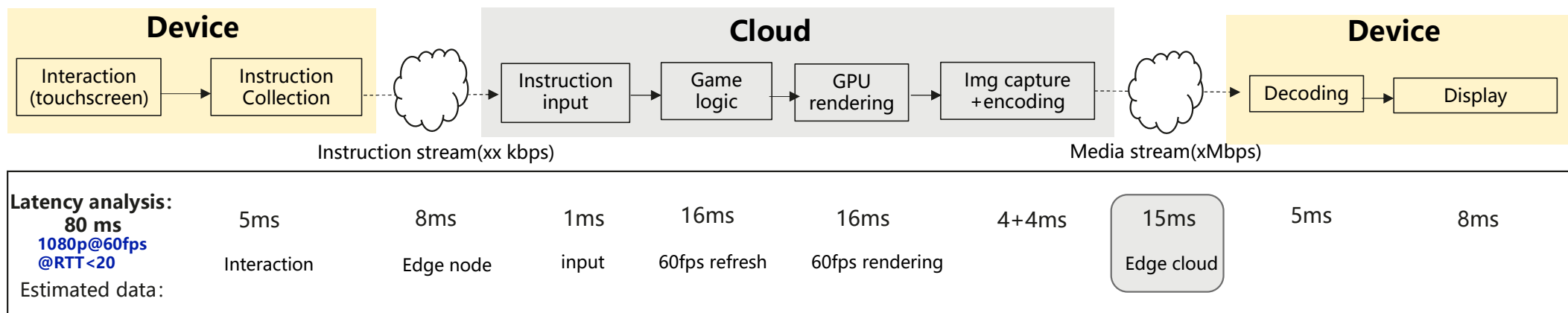
RTC



Live streaming

[1] iResearch: White Paper on Digital Human Live E-commerce 2026

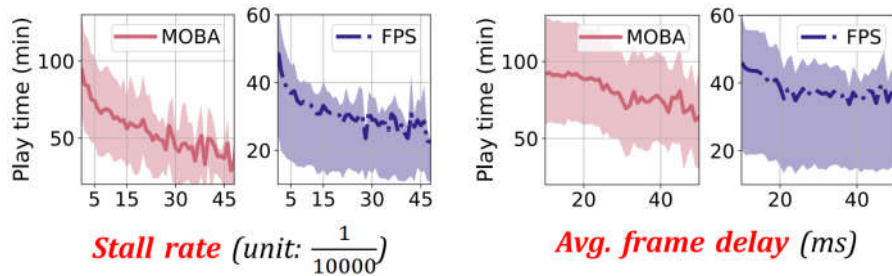
RTC - Typical RTC Architecture & Key Challenges (Cloud Gaming Use Case)



Ethernet and Wi-Fi: 5% and 10% RTT > 50ms, respectively.[1]

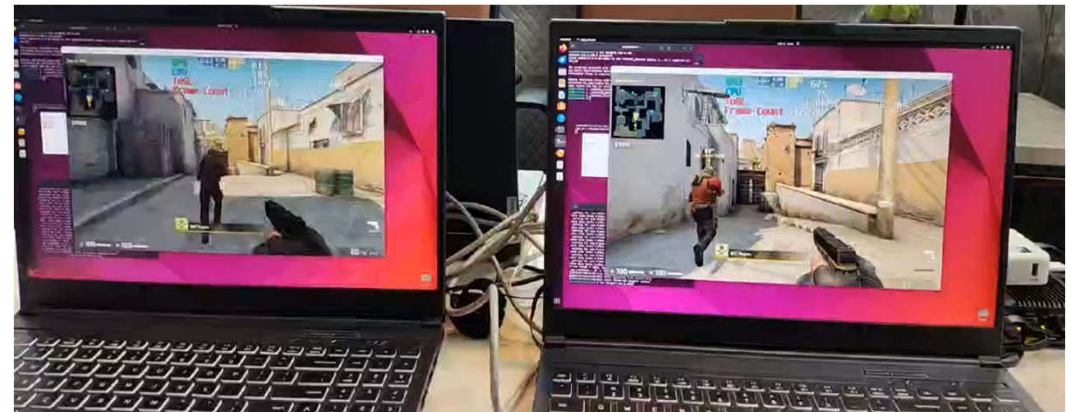
- Core feature of mainstream RTC services: heavy real-time human-computer interaction
- Long-tail network anomalies frequently occur, triggering excessive frame delay and severe jitter, significantly impairing user experience..
- Problem: Network transmission brings unstable latency, which greatly affects user experience

RTC - Degradation Effect of Network Fluctuations on RTC Services



[1] Wang, Shibo, et al. "Pudica: Toward {Near-Zero} Queuing Delay in Congestion Control for Cloud Gaming." (NSDI 2024).

- Frame stalling or latency spikes directly degrade user experience and reduce user retention[1] duration
- Requirement: **consistent low latency**, low frame freezing, and high image quality.

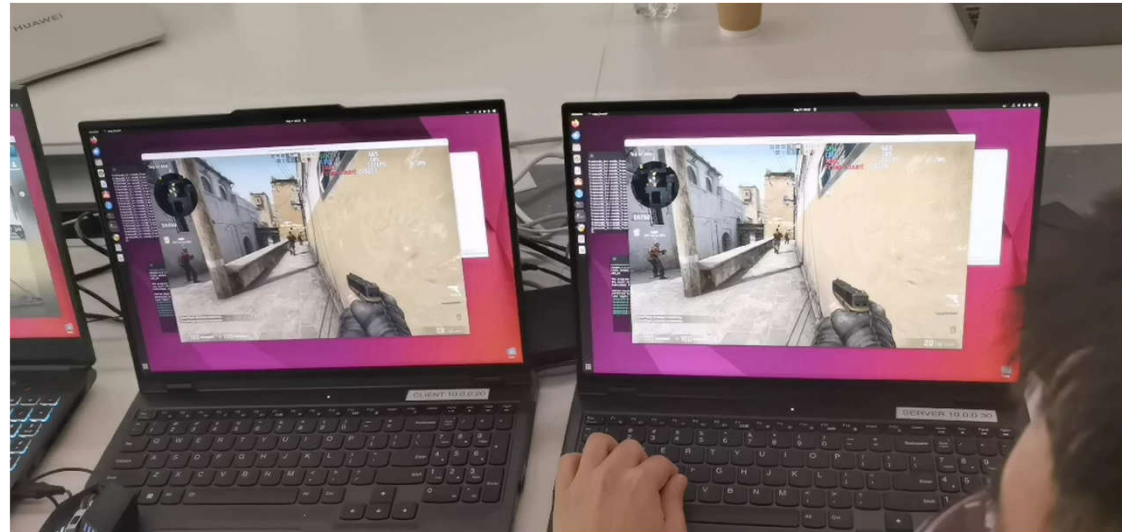


- Variable RTT jitter and random packet loss make it impossible to guarantee on-time delivery of all media packets under lossy transmission links
- Decoders must support video reconstruction with incomplete received data.

RTC - Performance Gains of Our Optimized RTC Solution

- **Benefits:** Based on partial-information video decoding, delivering drastically smoother playback under packet loss.
- **Limitations:** Sacrifices visual quality, Raises transcoding computation overhead on both sender and receiver ends.

Effect of the proposed prototype



Receiver with 10% random packet loss.

Sender

Send/Receive Latency (per-frame)

— proposed
— original



RTC - RTC Service Requirements for AI Consumer Terminals



Human-Oriented Receivers

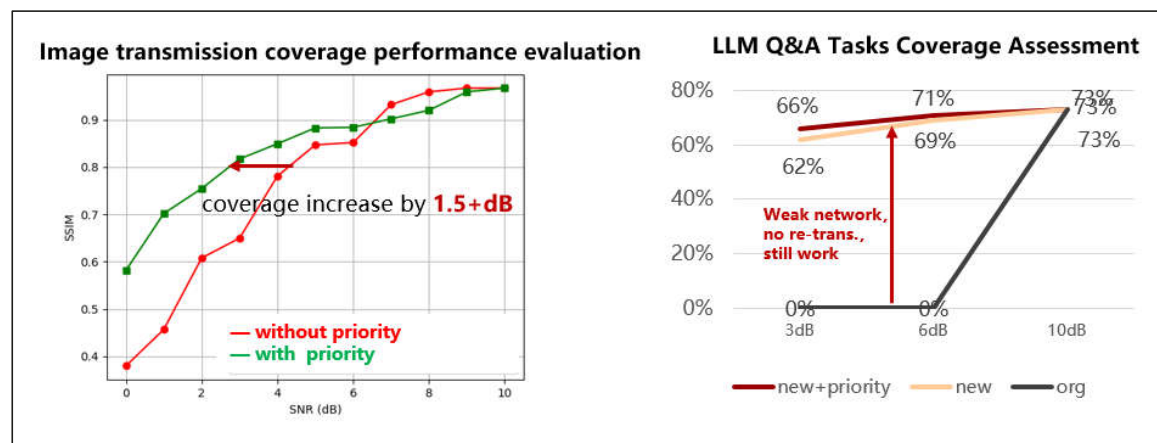
- Quality: High definition, ultra-low latency, smooth playback
- Network: Indoor fixed access, stable network

Multimodal Large Language Model (MMLM / AI Agent) Receivers

- Quality : Prioritize low latency over human subjective visual quality; complete key feature information suffices for AI computing tasks
- Network : Outdoor mobile scenarios with frequent movement

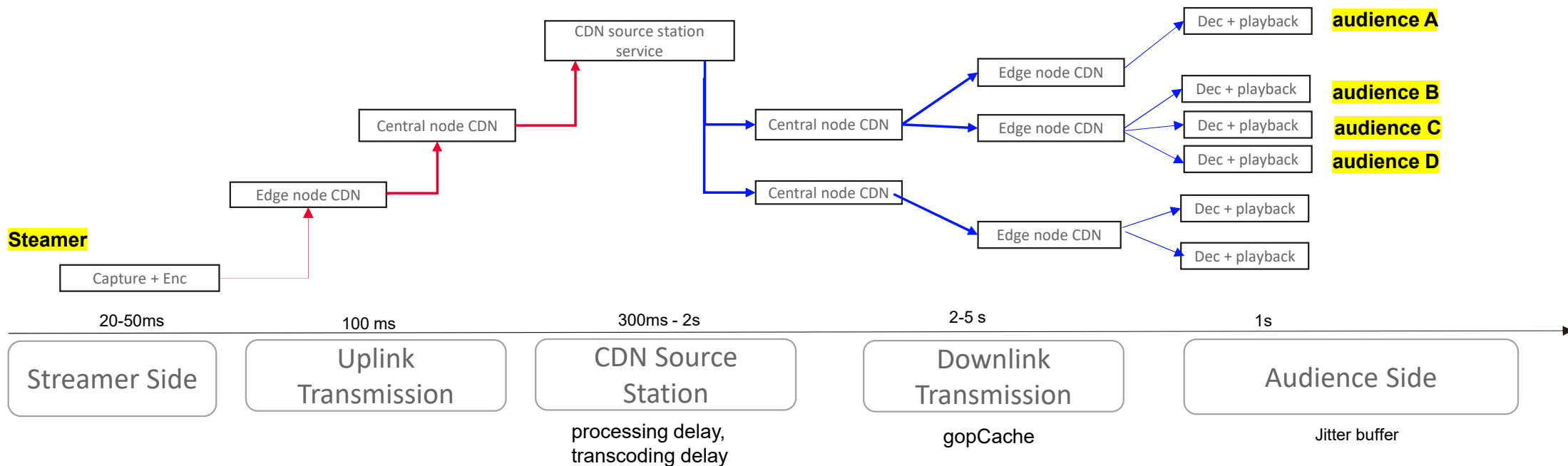
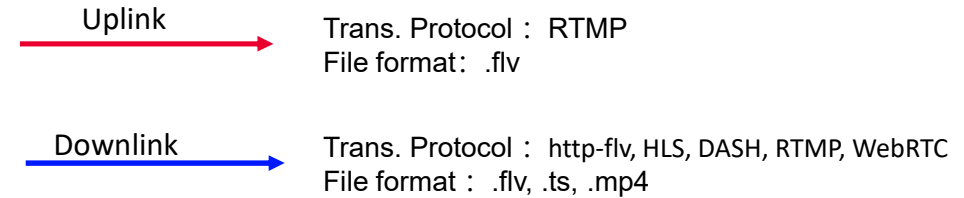
Advantages of Lossy Transmission & Priority Scheduling

- MMLM algorithms are robust to moderate video quality degradation without sacrificing task accuracy.
- Cooperative transmission with media priority scheduling delivers three core benefits
 - ✓ Expands service coverage range
 - ✓ Improves concurrent user capacity
 - ✓ Maintains stable service performance under weak networks



Streaming - End-to-End Pipeline of Conventional Live Streaming

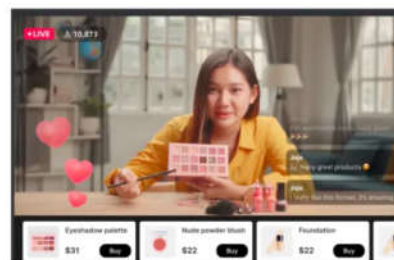
- To support massive concurrent distribution and control overall bandwidth costs, sacrifice end-to-end latency.
- Acceptable for low-interaction scenarios. (news broadcasting, general sports live streaming) (3–5 s latency).



Streaming - New Industry Trends for Next-Generation Live Streaming

- **Mandatory Sub-Second Low Latency** : Beyond high definition and smoothness, sub-second Low latency(200-800ms) and audio-video synchronization, become core requirements, to elevates **commercial conversion rates**.
- **Diversified Creator/Streamer Ecosystem** : Beyond top-tier streamers, mid-tier and long-tail streamers grow rapidly, requiring cost-effective lightweight streaming solutions
- **Mass Outdoor Mobile Live Scenarios** : Comprehensive weak-network adaptation capabilities are required to address mobile outdoor pain points: frequent network switching, high packet loss, low-end device computing limitations.

E-commerce



"first-comment-to-get" flash sale

Higher latency → Miss the deal



Entertainment



Get spoilers from chat board

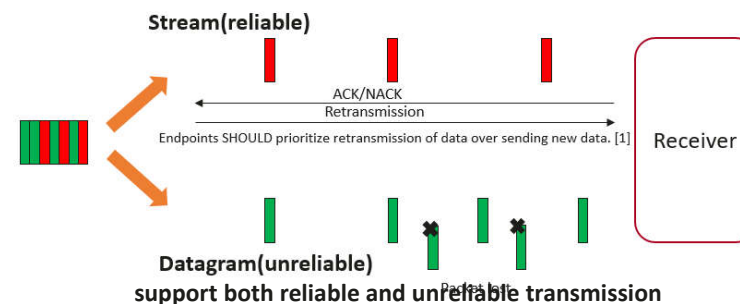
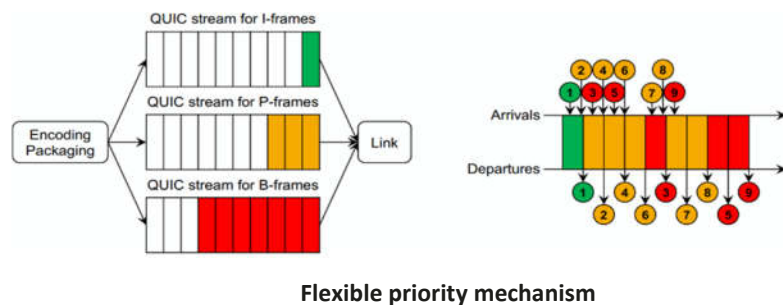
Frustrated



https://mp.weixin.qq.com/s/69ej_Yor2KmbDk1oBn8-A

A standard: IETF MoQ (Media over Quic), unify RTC and live streaming

low latency, and for larger scale distribution



Streaming - Latency Effect, For Different Application Scenarios

Source Video

Interactive live
E-commerce live streaming

Fast live
General entertainment live

CDN live
Low-interaction broadcast

源视频

互动直播

延时: 400-800ms

极速直播

延时: 1.5-2s

CDN 直播

延时 >3s



声网

<https://www.shengwang.cn/>

Streaming - AI Is Rebuilding The Live Streaming Pipeline

Capture/
content generation

Encoder and
transmission

CDN

Transmission and
decoder

Display/Analysis

- **Content generation:** AIGC content, digital human, AI short drama production;
- **Production & Editing :** One-click automatic video creation; AI completes 80%–100% of editing workflows;

- AI based smart **Content Audit & Moderation**
- **Intelligent Advertising Insertion ;**
- **AI editing/produce:** video clip/live photo/image; of key moment, produce to social media with AI text;

AI Consumption Terminals:

- AI Agent
- MMLM
- intelligent robots
- Claw



iResearch: White Paper on Digital Human Live E-commerce 2026



Summary: Suggestions To Technology And Standard

- **Adapt to New Business Demands**

- > Beyond traditional media services, continuously track market evolution and emerging technical requirements, especially **ultra-low-latency RTC and sub-second low-latency live streaming**.
- > Optimize end-to-end system architecture comprehensively to **balance four core indicators: low latency, smooth playback, high visual quality, and low deployment cost**.

- **AI For and For AI : Pay Attention To The Change Brought By AI**

- > **AI For** : AI reshapes the full media workflow, encapsulation and transmission protocols need to adapt AI
 - Like: semantic/prompt with video bitstream for AI tool; actions or semantic action based content segmentation; etc.
- > **For AI**: Media receivers are no longer limited to human users, the service quality should satisfy the AI task
 - Like: **Prioritize low latency over visual smoothness for AI tasks**; Expand media description (e.g., semantic included MPD files) to improve AI task efficiency

Thank you.

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