Current status of Cloud Gaming
by
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Agenda

- What is Cloud Gaming
- What are the differences from the normal video streaming
- Current Standardization Activities - W3C WebRTC WG
- macOS/iOS Topics
What is Cloud Gaming?

No need for new consoles, a computer upgrade - all you need is streaming capable devices and cloud gaming services.

Image from: A game attention model for efficient bit rate allocation in cloud gaming

Take a trip to the Forgotten Realms with your Chromebook and GeForce NOW
What is Cloud Gaming?

**Click to Pixel Latency** is one of the major performance indices in the Cloud gaming and it is recommended to be under 150 ms.
What is Cloud Gaming? - 120fps processing timeline

- Frame to Frame: 5.1ms
- Packet Retransmission: 10.7ms

1. 2023-09-29T00:02:37.514869Z WARNING chrome[6644:38]: [rtp_video_stream_receiver2.cc(557)] Packet Info:
2. 2023-09-29T00:02:37.514933Z WARNING chrome[6644:38]: [rtp_video_stream_receiver2.cc(558)] SeqNum: 12926
3. 2023-09-29T00:02:37.514981Z WARNING chrome[6644:38]: [rtp_video_stream_receiver2.cc(561)] TimeStamp: 2985840
4. 2023-09-29T00:02:37.514998Z WARNING chrome[6644:38]: [rtp_video_stream_receiver2.cc(562)] Receive Time: 92605925 us
5. 2023-09-29T00:02:37.514516Z WARNING chrome[6644:38]: [rtp_video_stream_receiver2.cc(557)] Packet Info:
6. 2023-09-29T00:02:37.514549Z WARNING chrome[6644:38]: [rtp_video_stream_receiver2.cc(558)] SeqNum: 12928
7. 2023-09-29T00:02:37.514567Z WARNING chrome[6644:38]: [rtp_video_stream_receiver2.cc(561)] TimeStamp: 2986560
8. 2023-09-29T00:02:37.514587Z WARNING chrome[6644:38]: [rtp_video_stream_receiver2.cc(562)] Receive Time: 92616493 us
9. 2023-09-29T00:02:37.514808Z WARNING chrome[6644:38]: [rtp_video_stream_receiver2.cc(557)] Packet Info:
10. 2023-09-29T00:02:37.514831Z WARNING chrome[6644:38]: [rtp_video_stream_receiver2.cc(558)] SeqNum: 12929
11. 2023-09-29T00:02:37.514848Z WARNING chrome[6644:38]: [rtp_video_stream_receiver2.cc(561)] TimeStamp: 2986560
12. 2023-09-29T00:02:37.514862Z WARNING chrome[6644:38]: [rtp_video_stream_receiver2.cc(562)] Receive Time: 92616798 us
13. 2023-09-29T00:02:37.514920Z WARNING chrome[6644:38]: [rtp_video_stream_receiver2.cc(557)] Packet Info:
14. 2023-09-29T00:02:37.514946Z WARNING chrome[6644:38]: [rtp_video_stream_receiver2.cc(558)] SeqNum: 12930
15. 2023-09-29T00:02:37.514964Z WARNING chrome[6644:38]: [rtp_video_stream_receiver2.cc(561)] TimeStamp: 29866560
16. 2023-09-29T00:02:37.514980Z WARNING chrome[6644:38]: [rtp_video_stream_receiver2.cc(562)] Receive Time: 92621981 us
17. 2023-09-29T00:02:37.515035Z WARNING chrome[6644:38]: [rtp_video_stream_receiver2.cc(557)] Packet Info:
18. 2023-09-29T00:02:37.515061Z WARNING chrome[6644:38]: [rtp_video_stream_receiver2.cc(558)] SeqNum: 12931
19. 2023-09-29T00:02:37.515089Z WARNING chrome[6644:38]: [rtp_video_stream_receiver2.cc(561)] TimeStamp: 29866560
20. 2023-09-29T00:02:37.515103Z WARNING chrome[6644:38]: [rtp_video_stream_receiver2.cc(562)] Receive Time: 92622180 us
21. 2023-09-29T00:02:37.515162Z WARNING chrome[6644:38]: [rtp_video_stream_receiver2.cc(557)] Packet Info:
22. 2023-09-29T00:02:37.515188Z WARNING chrome[6644:38]: [rtp_video_stream_receiver2.cc(558)] SeqNum: 12932
23. 2023-09-29T00:02:37.515206Z WARNING chrome[6644:38]: [rtp_video_stream_receiver2.cc(561)] TimeStamp: 29866560
24. 2023-09-29T00:02:37.515223Z WARNING chrome[6644:38]: [rtp_video_stream_receiver2.cc(562)] Receive Time: 92622218 us
What is Cloud Gaming? - Demo
What are the differences from the normal video streaming

- **Ultra Low latency**
  - Desirable C2P latency is < 120ms
  - > 170 ms makes first person shooter games unplayable
- **Consistent latency**
  - Critical for player adaptability
- **Video Content**
  - High motion complexity during active gameplay
  - Text, HUD overlays
  - Devil is in the details - Crisp horizons, maps
- **QoS**
  - Video loss is highly undesirable
  - Garbled video with fast recovery better than video freeze
- **And more**
  - Display Vsync control
  - Unaccelerated, high event rate mouse events
  - …
Current Standardization Activities - W3C WebRTC WG

- **W3C PR#118** Quality Improvements on lossy network condition
  - Faster Video Recovery
    - [b/15192](http://example.com/b15192) Non keyframe based recovery through Dependency Descriptor
    - Implementing Sender Receiver Synchronization Loss notification - RPSI/LNTF ([RPSI Discussion](http://example.com/rpsi-discussion))
  - Consistent Latency
    - Configurable Transport Wide Collision Control Feedback interval
    - [b/15535](http://example.com/b15535) Increases accuracy of jitter buffer adaptation
      - Set the actual data instead of assumptions: 60fps or 10ms render delay
macOS/iOS Topics

- WebRTC Release Cycle
  - AS-IS: Bi-Annual, need to do individual update (b/262881)
- Higher Resolution (4K) Support
  - AS-IS: HEVC is behind a flag (b/242921)
- User Inputs (GamePad, Keyboard and Mouse)
  - Pointer Lock support on iOS (b/216621)
  - Keyboard Lock support (i/182)
  - Haptic support on iOS (b/263022)