Researching Different Problem Topics on Twitch

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What is Twitch?

- Video Streaming platform with the main focus around game streaming.
- Interactive chat room that logged in users can message in.
- Streamers/Twitch generates revenue by displaying advertisements or alternatively users can subscribe for ad free viewing.

Feinberg, *hoplite solo leaderboard climbing.* (Nov. 2023). Accessed: Nov. 30, 2023. [Streaming video]. Available: https://www.twitch.tv/feinberg

Twitch as a Multimedia Application

- No buffering / virtually **no** buffering during playback is very important + high quality!

- Users want to the livestream to feel as real-time as possible. Application must minimize delay

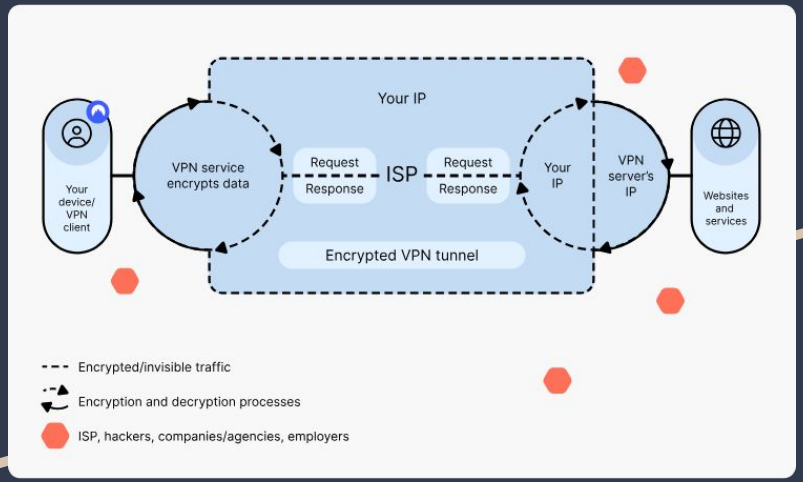
These requirements mean that the application requires a minimum bandwidth and has an upper bound on end-to-end delay

Problem Topics Researched

- Stuttering of video on mobile devices with a VPN
- Twitch’s “Low latency mode” causing buffering even with high speed internet
- Problems with high refresh rate streaming (>60FPS)

Stuttering of Video on Mobile Devices with a VPN (Virtual Private Network)

Stuttering of video on mobile devices with a VPN



NordVPN, “What Is A VPN? Virtual Private Network Explained | NordVPN,” nordvpn.com, Oct. 21, 2015. https://nordvpn.com/what-is-a-vpn/

Couple of main issues with VPNS:

- Higher overhead: packet encryption
- Additional servers: packets need to travel to the VPN server (larger distance travelled)
- This is good for keeping data secure but can cause problems on MM applications

VPN Server Issues

- High server load can increase/decrease latency, which can lead to buffering

- Different VPN companies have different VPN servers, some may not be suitable for streaming live video.

“How VPNs affect Internet speed | Cloudflare,” Cloudflare. Available: https://www.cloudflare.com/learning/access-management/vpn-speed/

Twitch users using LTE networks

- Article by Putri, A. Anhar, et al. shows that Twitch has highest index score when analyzing the data using TIPHON standards. (Compared to other live streaming platforms such as YouTube.)

- Received a high index score on ‘throughput’ category, but in some cases high throughput is not a good thing: limited data plans

- Overall, Twitch does a good job with optimizing LTE performance

RA, Anhar Anhar, Aguinaldo Al Nazen, A. Setiawan, and Dede Abdul Kholik, “Analysis of LTE Network Quality of Service on Streaming Application,” International Journal of Electrical, Energy and Power System Engineering, vol. 6, no. 2, pp. 151–155, Jun. 2023, doi: https://doi.org/10.31258/ijeepse.6.2.151-155.

Stuttering of video on mobile devices with a VPN

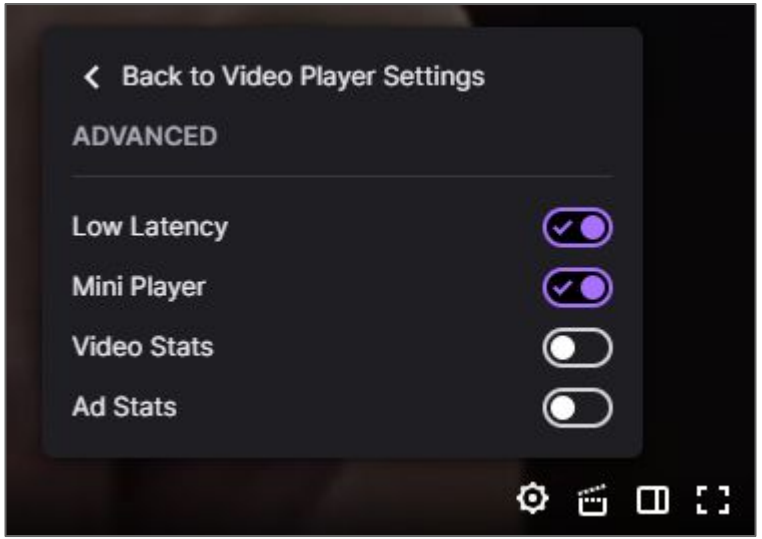
Conclusions:

- Many potential points of failure within the VPN that can cause issues with video streaming:
  - VPN Server
  - Higher end-to-end delay
- Probably not a problem with LTE network as Twitch received a high score by the study done
  - Potential compatibility issue with specific VPN + LTE combination

Twitch’s “Low latency mode” causing buffering even with high speed internet

What is Low Latency mode?

- Lowest possible delay between when the broadcaster streams the video to user receiving the video
- Can cause increased buffering if the users internet connection is unstable
- What about when the user has a good connection/consistent connection but still buffers?



Twitch's Distribution of Content

- Twitch distributes streams to servers depending on popularity
  - Will even recommend them to viewers

- Problem with Asia Servers:
  - "clients were redirected to NA due to poor local interconnectivity with Twitch's Autonomous System"

J. Deng, G. Tyson, F. Cuadrado, and S. Uhlig, "Internet Scale User-Generated Live Video Streaming: The Twitch Case," Passive and Active Measurement, pp. 60–71, 2017, doi: https://doi.org/10.1007/978-3-319-54328-4_5.

Twitch’s “Low latency mode” causing buffering even with high speed internet

Conclusions:

- Unpopular streams may experience increased buffering due to lack of hosts available to receive content from
  - Less servers with content can cause issues with delivery
- Depending on region, such as in Asia servers, users will occasionally be redirected to North American servers
  - A potential solution will probably require an infrastructure change, due the nature of Twitch AS

Problems with High Refresh Rate Streaming (>60FPS)

Twitch’s Guidelines

- Twitch only officially supports streaming of up to 1920x1080p 60 FPS (Frames per Second) @ 6000 KB/S
    - If you try to stream at a higher bitrate, the stream will be unresponsive

- **BUT!** Higher FPS streams WORK! You can set your live streaming program to stream at 120FPS and users will be able to see
    - Higher FPS is beneficial because it brings a new level of immersiveness to the stream.

Problems that arise with high refresh streaming

- More work on user end
  - More frames is more work for the decoder
  - Those with worse hardware or no dedicated GPU (hardware decoder) may experience issues

- Bitrate upper bound
  - Per frame quality can be worse as there are double the frames represented by the same amount of bits

High refresh rate streaming

Conclusions for high refresh rate streaming:

- Smoother visuals for those that it does work for
- Problematic for those with worse hardware (particularly those with no dedicated GPU that cannot hardware decode)
- Ultimately not worth it for streamer as it may cause their stream to be inaccessible

References

[1] NordVPN, “What Is A VPN? Virtual Private Network Explained | NordVPN,” nordvpn.com, Oct. 21, 2015. https://nordvpn.com/what-is-a-vpn/

[2] “How VPNs affect Internet speed | Cloudflare,” Cloudflare. Available: https://www.cloudflare.com/learning/access-management/vpn-speed/

[3] RA, Anhar Anhar, Aguinaldo Al Nazen, A. Setiawan, and Dede Abdul Kholik, “Analysis of LTE Network Quality of Service on Streaming Application,” International Journal of Electrical, Energy and Power System Engineering, vol. 6, no. 2, pp. 151–155, Jun. 2023, doi: https://doi.org/10.31258/ijeepse.6.2.151-155.

[4] J. Deng, G. Tyson, F. Cuadrado, and S. Uhlig, “Internet Scale User-Generated Live Video Streaming: The Twitch Case,” Passive and Active Measurement, pp. 60–71, 2017, doi: https://doi.org/10.1007/978-3-319-54328-4_5.

[5] “Twitch Help Portal,” help.twitch.tv. https://help.twitch.tv/s/article/broadcasting-guidelines?language=en_US (accessed Dec. 01, 2023)

Thank you!