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Inter-Streaming Web Application

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ABSTRACT

Video on demand using network streaming applications has grown into a multi-billion dollar industry in last 10 years. Research in the field of media streaming protocols have been at the centre of computer network these days. Many streaming protocols have been developed for the same, one of the most effective of them being Real Time Messaging Protocol (RTMP).Different streaming servers have been tested commercially for better performance, Nginx is popular choice in the industry currently.

Keywords: RTMP, Nginx, Media Streaming, Web Server, Commercial ,Computer Networks, Socket Programming, JW Player

1 INTRODUCTION

One of the biggest companies in the field of online media streaming, Netflix, provides Video-on-Demand to millions of users on a daily basis. Netflix uses the Nginx server to host and stream all its media content. The aim of this project was to create a secure VOD service similar to Netflix, having user-modifiable different quality streams and restricted access to content by user authentication. There exist a number of protocols for real-time messaging via network sockets; this is constantly evolving to satisfy growing user demands.

2 WEB TOOLS

2.1 Nginx server

Nginx, like Apache2, is an open-source HTTP server and reverse proxy that can host media content for streaming over network. It is one of the popular tools used in the industry as it provides high performance, is very stable, has a rich set of features, is easily configurable and causes low load on resources.

Nginx can address the C10K problem, i.e. 10 thousand users connected to the server simultaneously. Instead of using threads, it relies a scalable event-driven architecture to handle clients' requests. Nginx is used by many popular media sites like Netflix, Pinterest, Hulu, WordPress, GitHub, SoundCloud, etc.

2.2 JW Player

Currently, there is no support in HTML5 for playing RTMP streams. These streams can be accessed either by media players (like VLC Media Player) that can access and play out network streams, or by embedding these streams in webpages using Flash players like Flowplayer or JW Player. No significant advantages or disadvantages of using any particular Flash player with respect to load on streaming application were stated. JW Player was used because of the ease of embedding RTMP streams in HTML5 and a smooth, user-friendly interface having the required features like full-screen mode, volume control, video seeking, etc.

2.3 Scalyr

A free trial academic version of real-time analytical tool Scalyr was used. It was used to analyze the System, Process as well as Web Server logs simultaneously. The Web Server analysis includes metrics like Request Rate, Response Bandwidth, Response Size, Response Time, etc. The System metrics include CPU Load, Disk Usage, Memory Usage, Disk Request Latency, etc. Linux Processes Metrics include Thread analytics, as well as Disk Bandwidth.

2.4 MySQL, Apache2 and PHP

MySQL Server and Javascript were used on the server side to store the clients' database for authentication and restricting access to different media content hosted on the server. PHP was used for maintaining secure sessions on the client side. Apache2 Server was used for handling the HTTP requests.

3 WEBAPP

3.1 Features

1. Need to register first for accessing the application.
2. Two types of accounts were offered;
i) Premium having access to both HD and SD streams of series he has access to; ii) Normal having SD stream access only.
3. Two animated web series, each having 6 different streams in SD and HD type were used as a video content.
4. Series Access were admin provided.
5. Switching from one series to another or one stream type to another (provided access) is possible.
6. All video of a given series of certain type can be easily switched via single click on images depicting episodes in toggle.

4 ANALYSIS

Multiple clients were simulated by using the streaming service on a number of machines. The number of clients was increased as shown in Table 1 after every 5-6 minutes, starting at 9:15 am. All these clients were made to stream the videos in high quality so as to test the limits of the server's performance.

It was found that the server's Upload Speed increased approximately linearly with the number of active clients for a small number of these. However, as this number grew, there was significant degradation in the server's performance as the Upload Rate fell

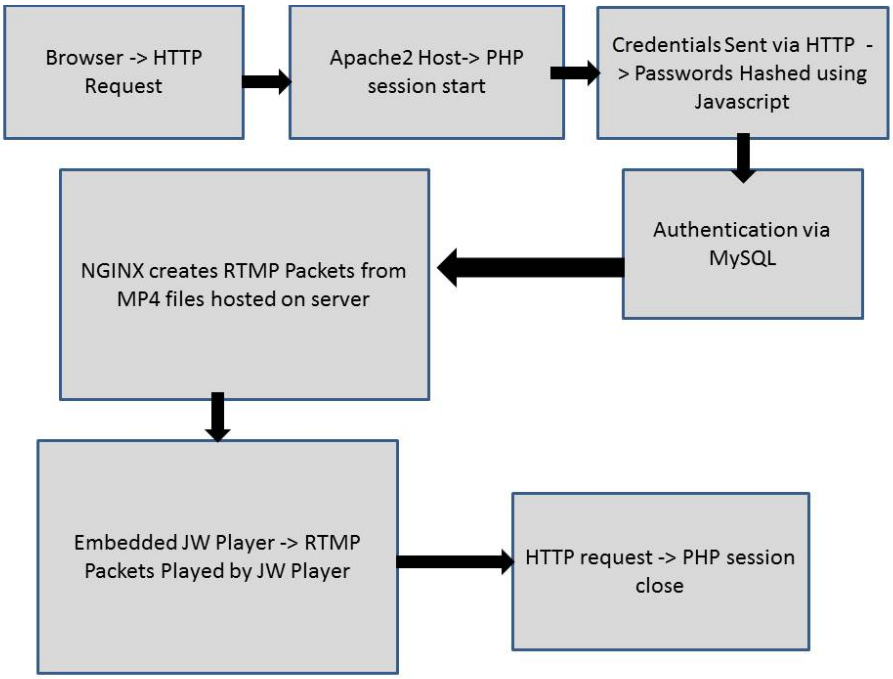
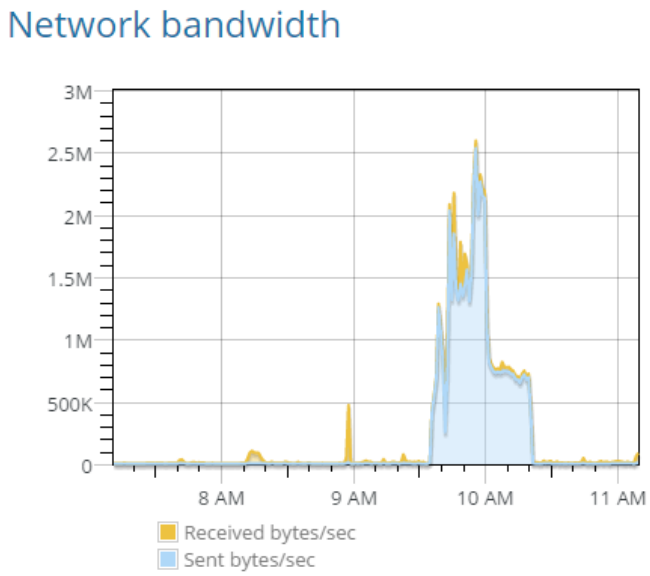


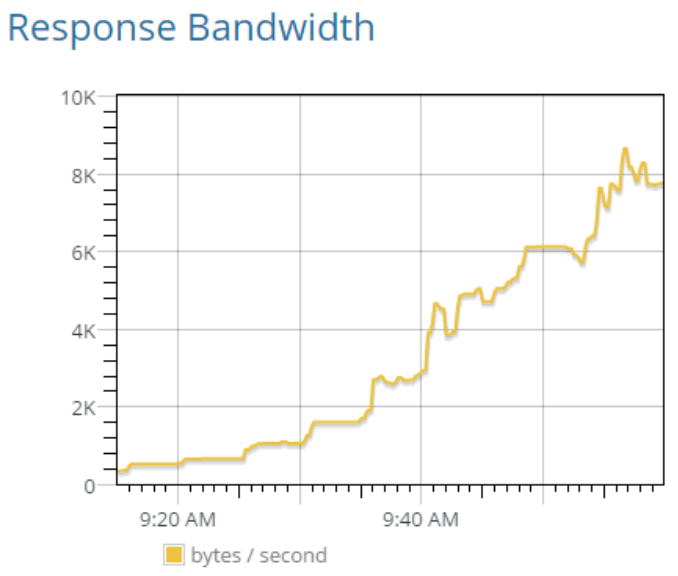
Fig. 1. Application Flow Diagram

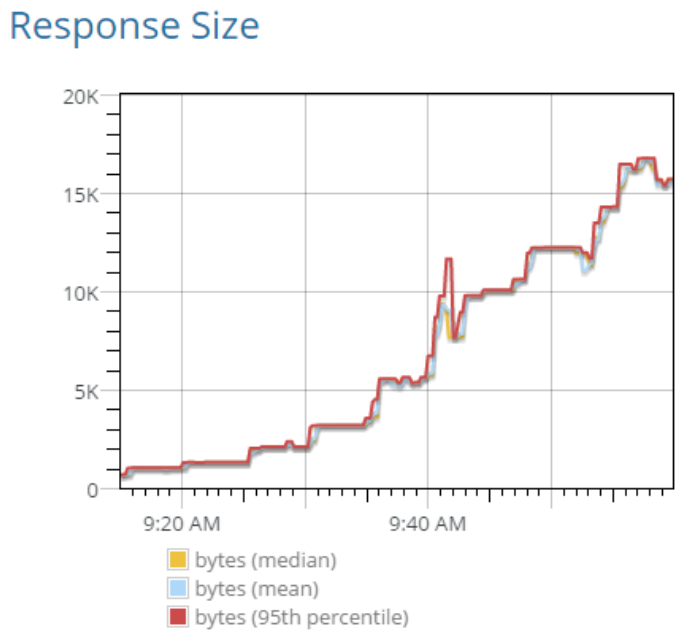


much below the expected linear growth. It was noted that at more than 40 active clients, there were significant delays in the streams, especially in newly-connected clients due to buffering (of the order of a few seconds).

5 RESULTS AND CONCLUSIONS

After creating the Web Application as described earlier, the analysis of server's Upload Rate showed that there was a significant amount of degradation in server performance (i.e. longer delays, response times, etc.) when the number of active clients grew exponentially. The Upload Rate to serve high quality (718px576p video with bitrate 551 Kbps) was approximately 23 Mbps for 32 active clients.

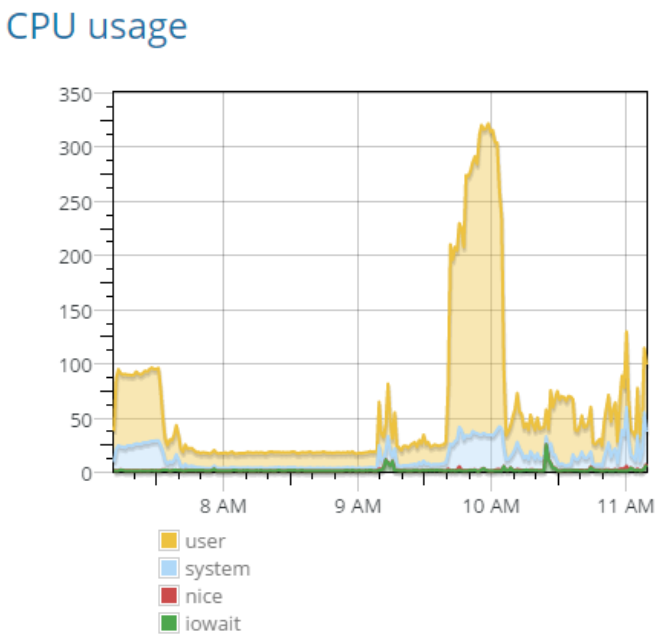


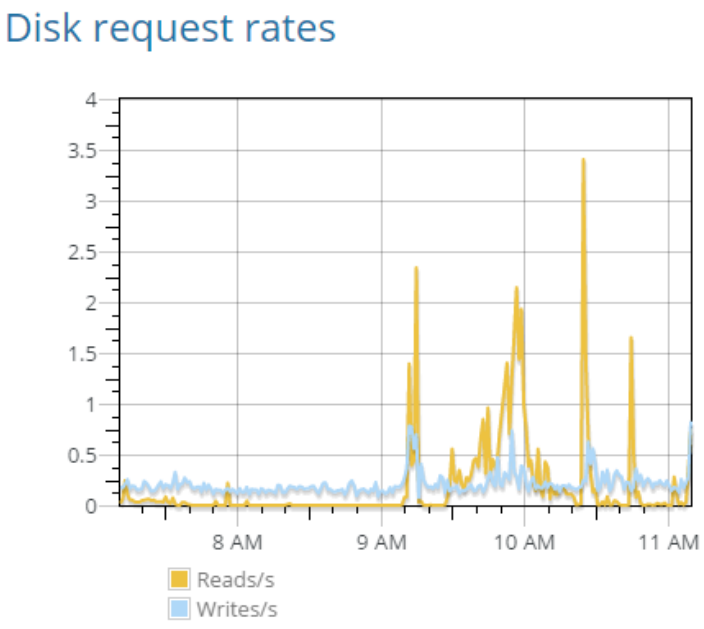


If a commercial provider like Netflix follows this client-server architecture and serves similar quality video to 32,000 clients simultaneously, the total upload speed for its servers would have to be atleast 23 Gbps. However, it must be kept in mind that the number of active users may increase to much higher values for certain durations of time, and contemporary videos are created and streamed online mostly in HDTV formats, i.e. 720p and 1080p, for which the bandwidth recommended by Netflix is 5 Mbps per user.

6 FURTHER SCOPE

As further work on this project, the videos can be hosted on multiple servers and the connections to these determined by a random function. There is also scope to improve the user interface of the web application, by using features like on-the-go quality change as in Youtube videos. Also, due to limitations on the memory and bandwidth on the server used in this project, it would be interesting

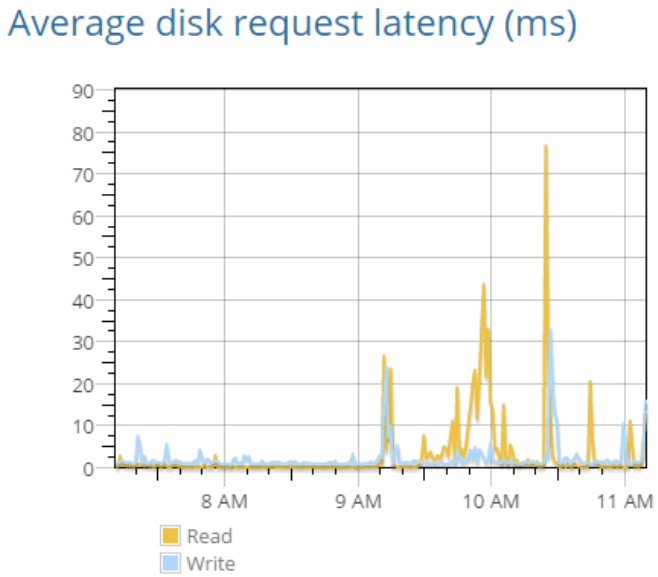




to scale it up to study full-fledged commercial-level streaming traffic.

7 REFERENCES

- Nginx-RTMP Module [https://github.com/arut/nginx-rtmp-module]
- Nginx Configuration [https://www.leaseweb.com/labs/2013/11/streaming-video-demand-nginx-rtmp-module/]



No. of Active Clients	Upload Rate (Mbps)
1	0.7
2	1.3
4	2.3
8	4.8
16	12
32	22.5
40	27
48	36
52	32

Table 1. Server Performance based on number of active clients.

- Computer Networking, A Top-Down Approach. Kurose, Ross.
- CSS for WebApp [https://w3layouts.com/batman-login-form-template/]
- PHP-MySQL Login Script [http://www.wikihow.com/Create-a-Secure-Login-Script-in-PHP-and-MySQL]
- JW Player [http://www.jwplayer.com/]
- NGINX Wikis documentation [https://www.nginx.com/resources/wiki/]
- Server Log Monitoring Tool Scalyr [https://www.scalyr.com/]
- Internet Connection Speed Recommendations - Netflix