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QOS ENSURANCE IN CLOUD

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Abstract: As the technology has drifted from distributed computing to cloud computing in order to provide better access and storage to services and data respectively, the cloud faces many challenges and among which the major concern is QoS. QoS concerns the rate of transmission, error rates, and the other characteristics that can be measured, improved and to some extent ensured in advance. The major concern of QOS is continuous transmittal of high bandwidth video and multimedia information which is focused in the paper. As the users grow, so do their demands. The users need a service without any interruption and of high quality. In multimedia transmission, the users demand services without delay and buffering. Users are consuming video-on-demand increasingly rather than sticking to watch content as per the broadcasted schedule. To ensure the same, a high speed transmission of multimedia is to be guaranteed by the service provider as per the user demands. As the user doesn't will to watch the pre-framed multimedia content, the service provider thus provides an on demand video service to such users and the users can watch the content anytime they wish. For this purpose the content to be watched by the users is cached by the service provider which provides an on demand multimedia service to the user.

Key Words: Video-on-Demand, Cloud Computing, Buffer Management, Cloud Caching, Queuing.

1. INTRODUCTION

To provide an on demand video services to the users YouTube, Netflix and Hulu have succeeded widely using different business models, including freemium or monthly subscription according to the users consumption. This has triggered the content owners, cable, broadcast networks and video service providers to innovate a new way to provide glitch free streaming of video data. [3]

On an average, consumers watch 45 minutes of streamed video per day [1]. At the higher end data rate of 5Mb/s2 (e.g., Netflix, full HD), this translates to 50 GB/month of downloaded videos. In terms of time spent, these numbers work out to 22.3 hours per month, representing 23% of the 100 hours per month (3.3 hours per day) consumers spend looking at video-related content. By 2018, this percentage is expected to increase two times, and will likely reach half of all video viewership hours.

The users nowadays are becoming acquainted to watch the data that they want to watch not the broadcasted, scheduled video data [12]. In addition to this, the users are expecting from cloud service providers to allow them to do so whenever, wherever and on whatever device they want to. As these demands by the users are increasing enormously, the cloud service providers have started to differentiate their services by providing more and more of the content to an extent they can provide. The service providers are not limiting these services to TVs only, but offering services on mobile phones, PCs, gaming consoles, tablets.

To meet the requirements of the users for providing video on demand services along with demanded features by the users, service providers are drifting from the current broadcast approach

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to a different IT like environment [2]. Service providers and the network architects need to change their current network infrastructure and data delivery mechanisms in order to meet those new demands by the users. Video on demand services don't only require creation and simultaneously delivery of large independent data streams but tailored insertion of incarnated advertising[15]. Video service providers avoid attrition to maximum extent and QOS issues, and maximize profitability.

Buffering leads to abrasion. According to Conviva's 2014 Viewer Experience Report, even an increase of just 1% in buffering will lead viewers to watch online video content for an average 11 minutes less than experiences where they don't have these glitches. For live sports, average viewing time drops from over 40 minutes to under 1 minute if they're forced to endure buffering problems. Needless to say, experiences like this could lead to dramatic drop-offs in data usage, which in turn will decrease advertising opportunities and greatly increase the likelihood of cancellations and/or switching over to providers who don't suffer from these issues. Video service providers and ad networks [9], will need to develop systems that allow advertisers to deliver timely, targeted ads to the viewers of their content and insert them on the fly. One of the critical differentiators between broadcast and video on demand is that advertisers want to be able to target their ads more precisely, as they typically can with web sites [3]. This is good for ad networks, content delivery networks and video service providers because they can typically charge more for targeted ads. These increased prices can be justified by knowing much more about the social demographic and psychographic profiles of viewers, as well as when and where they consume each piece of content. The challenge is that inserting more individualized ads puts even greater strains on the network infrastructure, creating more network latency challenges, resulting in unwanted video buffering events for viewers.

2. LITERATURE SURVEY

The world's first livestreaming event was introduced by a Seattle based startup company which was named as Progressive Networks. By using a Cutting edge technology, thousands of its subscribers viewed a live radio broadcast of a baseball game between the Seattle Mariners and the New York Yankees streamed on ESPN sports zone on 5th September 1995. After a few years, the name of the company was changed to Real Networks and before it would catch itself perplexed, an acerb technological and legal war with Microsoft took upon for the domination of a brand new technology market-media streaming. Microsoft emerged from this war with Real Networks as a winner but was then unable to subsidize the victory. Another Redmond-based US company dissipated away its advantage. Macromedia which was later acquired by Adobe Systems slowly crumbled Window Media's market share in mid 2000s due to the launch of their Flash player which was getting increasingly popular. The Flash ruffled the streaming media industry by seamlessly merging with interactivity, web 2.0 and media streaming for the first time. With the evolution of the new era in media streaming, some old problems like bandwidth and buffering issues still remained there.

The majority of the Internet traffic was based on HTTP and for the delivery of popular content to huge audiences CDNs were being used enormously by mid 2000s, to keep up with the demand of increasing users, the streaming media with its mélange of recovery protocols which were mostly based on UDP(less popular) found itself struggling. In 2007, a company named Move Networks introduced a technology and a service that would change the industry once again, it was an HTTP based on adaptive streaming. It gave the concept of moving Networks which used the dominant HTTP protocol to deliver media in little file chunks while the player application was utilized to monitor the download aspects and request chunks of different size (quality) in response to the fluctuating network conditions instead of responding on the proprietary streaming protocols and leaving the users at the clemency of the internet bandwidth Gods. This technology had walloping impact as it allowed far distribution of the media to be streamed and used CDNs widely and cached for the efficiency, at the same time eliminated the connectivity and buffering issues for the users.

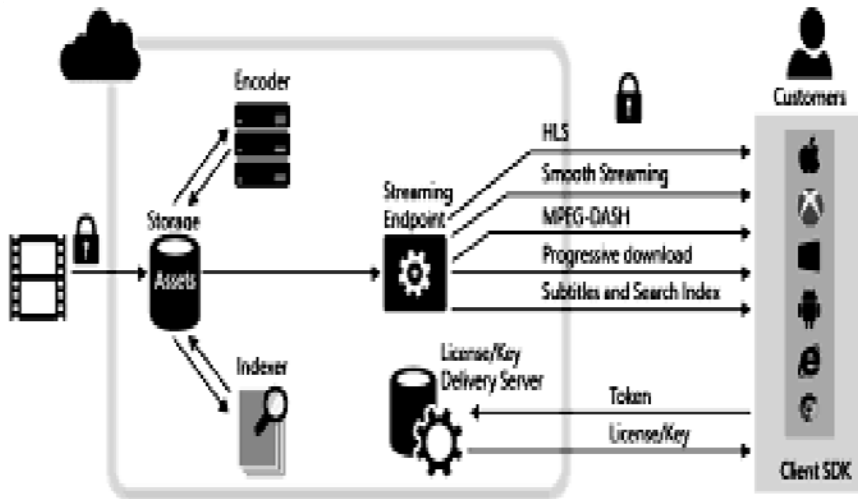

Figure 1: On Demand Video Streaming

3. METHODOLOGY:

Videos are to be shared seamlessly without buffering. There are several ways to stream the cloud content, some of them are using JW Player, OSMF (Open source Media Framework) and iOS device streaming. There are many cloud service providers, like Brightcove.com, DailyMotion – dmcloud.net, Rackspace.com, Metacdn.com, Duracloud.org, Akamai.com and Wowza.com etc.

NetFlix: Connecting the iPad, iPhone, Laptop and desktop to the Netflix account facilitates watching TV instantly over Internet [4]. Netflix totally revolutionized the DVD rental space when it was introduced more than a decade ago. It is one of the most visible subscription streaming service and also one of the largest streaming content libraries which captivates subscribers by millions.

Hulu: Hulu is an American online company and online video service that proposes a collection of Television shows, subscription services and movies [4]. The subscribers can watch the episodes in HD from Fox, ABC and NBC the day after they are broadcasted on the channel using Internet-connected TVs, game consoles smart phones, set-top boxes, and Internet-connected devices. Hulu videos are currently offered only to users in the United States and its overseas territories. Hulu presents video in Flash Video format.

4. SOLUTION TO THE BUFFERING

In order to avoid the hitches [8] and video sputtering issues that are typical symptoms of buffering, CDNs and video service providers need to rethink their data center architectures and edge technologies that can minimize potential delays most cost effectively [1]. One of the best ways to achieve this is through the concept of cloud caching

The basic idea behind caching the cloud is to get the video and advertising where it needs to be, before it's actually required. Content can be cached, either for network relief or for convenience, at various layers of the delivery network, from the network edge to set-top boxes sitting at the consumer's premise, user's demand downloading and streaming video content on any device [5], making this capability a business clamant for video service providers. The challenge is to provide a consistent quality viewing experience even during peak hours when networks are typically more congested. Using predictive analysis based on customer preferences provides an opportunity for network operators to pre-cache personalized video content to the customer device and could provide the ultimate video experience regardless of the network conditions [14]. For this, HDDs are to be replaced by flash drives. Flash offers tailored-speed access to data, making it ideally suited for applications such as sorting, finding, playing, pausing, and moving through digital video content. In the data centers dedicated to video applications, the speed and reliability of storage are important to enable a stable, high performance environment. The important Input/output Operations per second metric determines how quickly storage devices can get access to and read the data they need to create the hundreds to thousands of video streams being requested simultaneously. Video streaming applications require enormous numbers of reads and writes and not all types of storage [10]. To maintain reliability, CDNs and video service providers need to utilize specialized types of high endurance flash storage with high Program/Erase cycle capability, in order to ensure long-term, error-free operation.

At the user's house, to make the experience of watching video on-demand content completely hitch-free comes from using flash based storage solutions for both convenience and network relief. To avoid waiting for content to load during periods of high network congestion, video service providers can pre-fetch [12], during the afternoon, a program that the user expects to watch during peak evening consumption hours, and store the program in a high-speed, high endurance local flash cache.

5. BUFFERMANAGEMENT:

Depending upon the level of congestion in the network [6], the Cisco routers store packets in a few different locations.

Tx-ring – Transmit ring or queue.

Interface buffers- public or private pools.

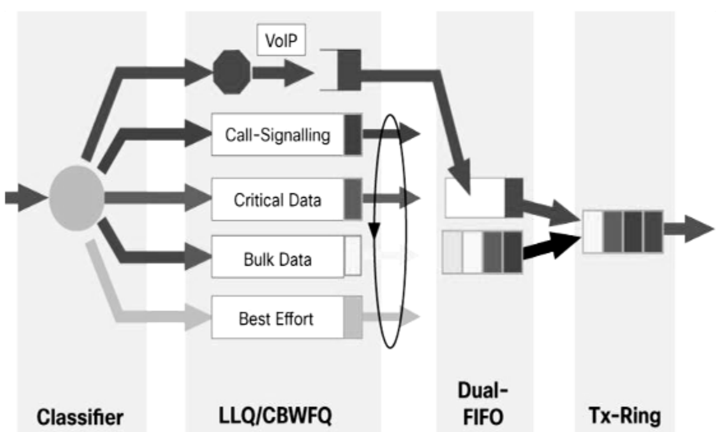

Figure 2: Buffer Management

The packet is stored in the ingress buffer for its processing as the packet enters the router. The packet is still accounted on ingress interface when sent to the egress for its processing. If the packet has exceeded the 1K buffers on the physical ports, memory is taken from the public pool [6].

Packets can be stored at two possible locations as offered by the public pools of the mid-range routing series:

Fast Switching buffers (F/S)

Normal pool buffers.

These buffers differ in size and access speed.

F/S buffers, 1664 bytes (total 1536, permanent 1536):

1024 in free list (256 min, 2048 max allowed)

512 hits, 0 misses, 0 trims, 0 created

0 failures (0 no memory)

512 max cache size, 0 in cache

0 hits in cache, 0 misses in cache.

Normal pool buffers, 1676 bytes (total 3840, permanent 3840):

3840 in free list (128 min, 4096 max allowed)

0 hits, 0 misses, 0 trims, 0 created

0 failures (0 no memory)

When the depth of the private buffers is reached, the public buffers (public particle pools) are used.

The F/S buffer can provide memory for 2048 packets .The soft limit is governed by the configured amount of fast switching buffers < buffers fast switching permanent x >.

The normal buffers provide a maximum packet memory of 4096 packets (256 packets in the cache and 3840 packets in the permanent memory)[6].

The ISR G1 and G2 platforms differ when using public buffer pools. The ISR G1 always uses the normal buffer pool. In IOS versions up to IOS 15.2T, the ISR G2 uses the Fast Switching buffer (F/S), beyond this release the normal pool buffers are used (CSCtq27141, CSCtw65356). This modification provides a larger backup pool that is usable for complex Quality of Service (QoS) configurations.

The public buffers are partially in cache, ready for use after the physical port is oversubscribed. At this point, if the router has filled up both the private and the cache public buffers, the router will request more public buffers from I/O memory. The upper value of physical I/O memory is governed by the amount of RAM on the platform.

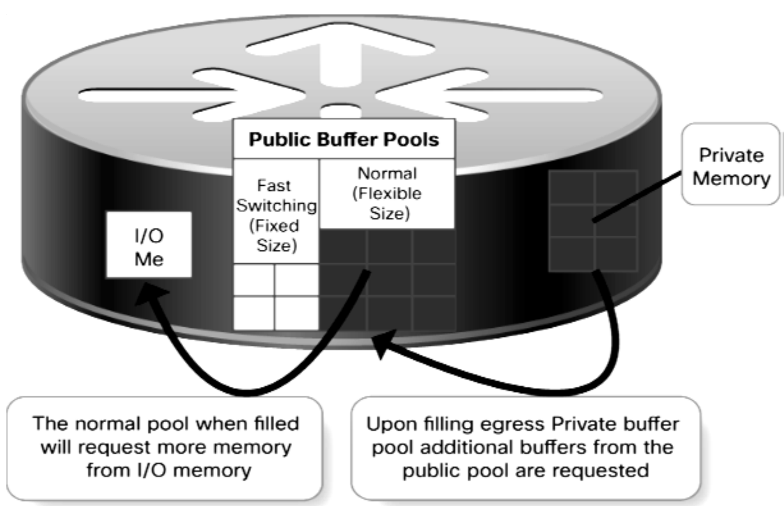

Figure 3: Buffer Pools

5.1 HQF Architectural Integration

Physical buffering is used in Hierarchical Queueing Framework. The amount of buffer that the physical interface can use is governed by the hold-queue parameter. The per class buffering threshold is limited by per class queue limit configuration.

Packet loss will occur if these values with the physical hardware limits are not aligned. The packet is then placed in the final FIFO queue after its processing by HQF, the Tx ring [6].

The TX-Ring provides a final queue for the physical FIFO prior to transmit onto the wire.

When congestion occurs at the egress interface i.e. the TX-Ring is full, the CBWFQ queues begin to buffer traffic based on their per class queue-limit allocations. Ideally, these queues will reach their full capacity, then will beg into tail drop additional traffic in excess of the queue-limit configured. If however the router configuration for queue limit exceeds the physical hold-queue limit, or the hold-queue exceeds the available buffering capabilities (private pools + public pools + additional I/O MEM RAM), traffic will be dropped prior to reaching the full buffer size configured.

Default Settings and Configuration Parameters

The current structure of buffering on the ISR platform is as follows:

1. Each physical interface is allocated 1000 packets of buffer (hold-queue).
2. Each newly instantiated class is allocated 64 packets of buffer (queue-limit).
3. The Tx-Ring is allocated 128/256 Packets of buffer (tx-ring-limit).
4. Upon consumption of physical buffers, interfaces request buffer allocation from the F/S buffer in I/O memory.

6 ADVANTAGES OF ON DEMAND VIDEO STREAMING:

- Hitch free video streaming.
- A computing platform distributed in large-scale data center [7].
- A search system that ranks lists of the top videos.
- Reusability and extensibility of the framework component.
- Provides private Storage space for each user and every Provider[15].
- Process of Detection video spammers and promoters is easy.
- Process of Detection video spammers and promoters is easy.
- Streaming of data whenever, wherever and on whatever device as per users wish [11].

7. FUTURE CONCERNS AND SCOPE:

There are still many challenges in on demand video streaming of data which need to be taken care of. One of the major issue is to maintain the local cache at every users end. The data to be streamed by the user is pre-fetched in the local cache at the users end in the flash drive.

There are enormous number of users and this creates and overhead in maintaining the caches at every users end, which is to be maintained by the service provider more efficiently.

Another issue is that the search engines for on demand video streaming should be made more efficient to provide faster and demanded services by the user.

8. CONCLUSION

The overview, benefits and future scope on demand video streaming and ensurance of QoS is summarized in this paper. On demand video streaming enables the users to stream video data which they want to see anytime they want to, wherever they want to and on whatever device they want to, rather than waiting for the videos to be broadcasted as per the schedule. This provides a flexibility in streaming of glitch-free data [8] to the users by pre-fetching the demanded data on the local cache of the user.

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