Resource Optimization for Cloud-Based IPTV Services by Intelligent Time-Shifting of Service Delivery Through Virtualization.

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***Abstract* –Internet Protocol Television (IPTV) is the delivery of the programming by video stream encoded as a series of IP packets. To make the best or most effective use of cloud resources in a real-time IPTV services can be a challenge. To reduce the provider's cost of real-time IPTV services, a virtualized IPTV architecture is used with the intelligent time shifting of service delivery. IPTV is bundled with other services like Video on Demand, Voice over IP or digital phone, and Web access, collectively referred to as Triple Play. To effectively multiplex these services differences in deadlines associated with LiveTv versus Video-on-Demand is used.**

A generalized framework is proposed that allows Triple Play services to co-exist on a common infrastructure without missing a deadline by taking the advantage of virtualization. Multiple forms for cost function are considered to reflect the different pricing options, this gives the number of servers needed at different time instant to support these services.

***Keywords* – LiveTv, Video On Demand, Set Top Box, Statistical Multiplexing.**

I. INTRODUCTION

IPTV has become a high-benefit service for the operators by adding multimedia content delivery (TV, Video & Audio) over their own network but not Video over the public Internet. One hop before the client they include a Set Top Box to give interactive and customized services that add aggregated value to the service like Targeted advertisement, Live program watching and Network PVR (offline TV programs).IPTV is bundled with other services like Video on Demand, Voice over IP or digital phone, and Web access, collectively referred to as Triple Play. From the service provider point of perspective, IPTV encompasses processing and secure delivery of video content over an IP based networking infrastructure. The type of service providers involved in deploying IPTV services range from cable and satellite TV carriers to the large telephone companies and private network operators in different part of the world.

In IPTV, LiveTv uses a IPMulticast protocol to serve the users. In Video on Demand request is served by the server using unicast stream. When user changes the channel while watching the LiveTv , additional functionality is needed to serve the user without much waiting time. In IPTV, there is both steady state and transient traffic demand [1].Transient bandwidth demand come from clients switching channels. This transient and highly bursty traffic demand can be significant in terms of both bandwidth and server I/O capacity. In the existing system this demand is served by the large group of servers present in the datacenter for serving individual channels that have to be scaled as the number of user's increases. As the demand is transient and typically only lasts several seconds possibly up to a couple of minutes, majority of the servers dedicated to LiveTv sit idle outside the burst period. The user has to pay for the server resources which are idle.

To better utilize the deployed servers differences in deadlines associated with LiveTv verses Video on Demand is taken to effectively multiplex services. There is a large peak to average ratio for LiveTv ICC. The real time aspect of entertainment content requires us to provision resources to handle peak demand. Moreover, the ICC demand is very peaky, using resources only for a very short period of time. VoD on the other hand has a relatively steady load and imposes delay bounds. Since there is storage at set top boxes (STBs), by properly speeding up the delivery prior to the burst ICC load, the delay constraints for the VoD can be relaxed for a period of time. The opportunity is to explore how these services may coexist on the same server complex. By causing one service (VoD) to reduce its resource requirements temporarily to help support a sudden influx of requests from another (LiveTV ICC) service. This can be achieved by preloading VoD content into the STB buffer by speeding up its delivery just before we expect an influx of ICC requests. This gives us the opportunity to then delay VoD delivery during the time LiveTV ICC requests peak. This is shown in Fig. 1

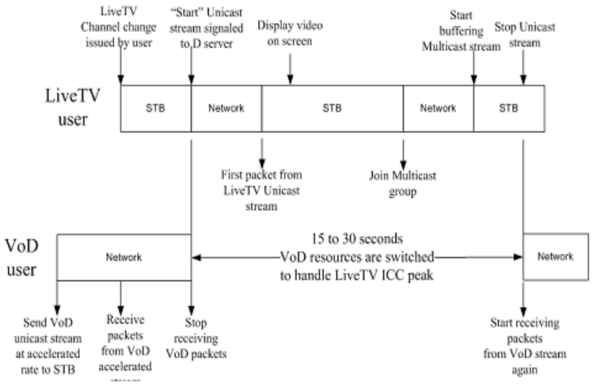

Fig. 1 LiveTv ICC and VoD packet Buffering Timeline

II. RELATED WORK

Cloud computing, deadline constraints, and optimization are three threads related to this paper. Shared pool of configurable computing resources like networks, servers, storage can be rapidly provisioned and released in the real time applications like IPTV using cloud computing platform based on the user needs. cloud infrastructure supports content delivery applications due to its nature of supporting content delivery applications. IPTV services like LiveTv and VoD uses the dedicated servers[2] . cloud infrastructure is used to operate the different services like LiveTv and VoD by carefully rebalancing the resources of different services.

To serve the arrival of requests without missing any deadline certain strategies are studied[3][4].Earliest Deadline First is used to serve the user request without missing any deadline. For a given set of processors ,incoming jobs for different services are assigned different priorities such that each job finishes by a deadline.Each of the different services send request for a chunks with a different deadline.EDF is a optimal strategy if a number of processors are fixed.

Optimization theory is a mathematical technique for determining the most profitable or least disadvantageous choice out of a set of alternatives. By knowing the arrival patters of LiveTv and VoD with their deadlines dynamic optimization is used to reduce the cost of the services. User is given the chance to select the different cost function selection by the optimization.

III. ARCHITECHTURE

In this Section the detailed working system architecture of the proposed system is shown.

IPTV operators receive digital satellite channels by satellite antenna and digital terrestrial Services by UHF antenna. The channels are routed to the transmission center's signal Converter equipment, which converts the television content to an IP network-compatible Format and transmits it into homes via operators' broadband backbone and access Networks. In homes, IPTV services are received by an IP STB whose software and updates are managed by a configuration server located in the transmission centre.

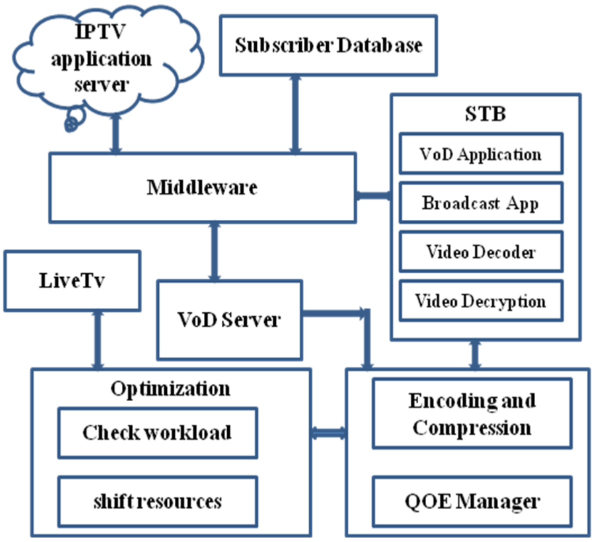

Figure 2.Architecture

IV. METHODOLOGY

IPTV is package that includes different services like LiveTv, VoD, VoIP. To effectively use the cloud resources intelligent time shifting of service delivery is used. Provider can't determine when the user will change the channel while watching the LiveTv. In traditional television delivery, simultaneously the programming is broadcasted and available program signals, flows downstream so that viewer select which program the viewer want to watch. IPTV, by contrast sends only one program at a time .content is stored in the service provider network. the program which customer selects is only sent to the home. In VoD the stored videos are served to the customer. ICC is very bursty with a large peak to average ratio but VoD possess relatively steady steady load and imposes "not so stringent" delay bounds. If LiveTv gets more requests in particular time ,the VoD resources are used to serve the users using the cloud virtualization.

Framework-IPTV delivers multiple real time services like VoD, LiveTv and sometimes network based DVR, where every service deadline are different from each other. means LiveTv has a deadline which has slightly different deadline from the VoD. In this section, we analyze the amount of resources required when multiple real time services with deadlines are deployed in a cloud infrastructure. In the context of voice, including delivering VoIP packets assumes arrival process as Poisson[5].In this paper analysis extends that for any general arrival process consider multiple services with different deadlines. The optimized framework computes number of servers needed at different time instants based on the different workload associated with different IPTV services. Optimized framework goal is to reduce the cost of service provider by initially knowing the number of servers required and also impact of relaxing the deadline constraint on optimal cost. Paper also concentrates on the benefit of multiplexing the different services in a same platform.

Formulation- Let $r_j(i)$ denote the number of class requests arriving at time instant i,i belongs to {1,2,…T},j belongs to {1,2,..K},where k denotes the number of service classes. Every class j request has a deadline d_j, which means that class-j request arriving at time instant imust be served at time no later than min{i+ d_j,T}.If there is only one service class as a special case then the subscripts are dropped, so that the number of requests at time i is denoted r(i) and the deadline is d.If there are s_i service classes then the cost of providing the service over the interval $1 \leq i \leq T$ is denoted by $C(s_1,s_2..s_T)$. The framework goal is to reduce the $C(s_1,s_2..s_T)$ over this time interval without missing any deadline.

V. COST FUNCTIONS

This section considers various cost functions[7] to evaluate the efficient use of server resources and study the impact of cost function to reduce the cost of real time services.

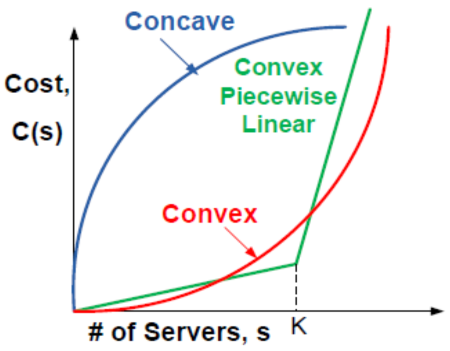

Figure 3.Cost Functions.

In the section user select the cheap and best channel pack. In this project ,optimization contains three methods.

Linear Cost Function-Cost function in which the graph of total costs versus a single cost driver forms a straight line within the relevant range[8].

Piecewise Linear Convex Cost Function- Scheduling of the incoming requests which uses yi server Resources a time i. Suppose that application serve min (yi,K) of the requests and drop the remaining then cost of using server's yi at time i is given by total number of requests + c times the number of dropped requests. Earliest deadline
first strategy minimizes the number of dropped requests and hence the optimal strategy for the cost is as follows. Suppose that when earliest deadline first as the strategy with K as the number of servers, ˆsi be the number of requests served in time i and ˜si is the number of requests dropped (Note that ˜si = 0 if ˆsi < K.). Then si = ˆsi + ˜si is an optimal solution.

Exponential Cost Function-This is a convex optimization problem with integer constraints, and is thus NP hard problem in general. This provide an achievable solution based on convex primal-dual method.

VI. CONCLUSION

Using Instant Channel Change and VoD delivery as examples optimized framework shows that IPTV service providers can leverage a virtualized cloud infrastructure and intelligent time-shifting of load to better utilize deployed resources and by taking the advantage of the difference in workloads of IPTV services to schedule them appropriately on virtualized infrastructures. By anticipating the LiveTV ICC bursts that occur every half hour we can speed up delivery of VoD content before these bursts by pre filling the set top box buffer. This helps to dynamically reposition the VoD servers to accommodate ICC bursts that typically last for a very short time. This paper provided generalized framework for computing the amount of resources needed to support multiple services with deadlines.

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