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Switching of Cloud Resources among IPTV Services for Better Utilization

Ravi Bhillu Jadhav[1], Nirmala Y Bariker[2]

Department of Computer Science & Engineering, Mangalore Institute of Technology and Engineering Mangalore, Karnataka, India

Assistant Professor-I, Dept. Of Computer Science & Engineering, Mangalore Institute of Technology and Engineering Mangalore, Karnataka, India

Abstract: ***Internet Protocol Television (IPTV) is a system through which Internet television services are delivered using the architecture and networking methods of the Internet Protocol Suite over a packet-switched network infrastructure, e.g., the Internet and broadband Internet access networks, instead of being delivered through traditional radio frequency broadcast, satellite signal, and cable television (CATV) formats. IPTV provides mainly three services: live TV, video on demand (VoD), and Interactive TV. IPTV services like Video on Demand (VoD) and Live broadcast TV require substantial bandwidth and compute resources to meet the real time requirements and to handle the very bursty resource requirements for each of these services. To meet the needs of the bursts of requests, each with a deadline constraint for both VoD and Live TV channel changes, we propose a resource provisioning framework that allows these services to co-exist on a common infrastructure by taking advantage of virtualization. To find the number of servers (VMs) that are required to serve these services based on the workload and shift the resources among different IPTV services to better utilize the deployed servers, to minimize the delay, and waiting time. In order to compute the amount of resources needed to support multiple services, without missing the dead line for any service a widely applicable supporting structure can be provided. We construct the problem as an optimization formulation that uses a generic cost function. This formulation gives the number of servers needed at different time instants to support the services. By taking the advantage of Virtualization strategy and Statistical multiplexing method the operators can gain greater cost savings.***

Keywords: IPTV, VoD, Live TV, VM, Interactive TV, Cloud Computing.

1. Introduction

As the demand for Internet-based applications grows around the world, Internet Protocol Television (IPTV) has been becoming very popular. With the recent advances in communication and computer technology, television has gone through many changes over the years. Nowadays IP based video delivery became more popular (IPTV) [6].

Internet protocol television is defined as a multimedia services such as television/video/audio/text/graphics/data delivered using the internet protocol suite over IP based networks managed to provide the required level of quality of service and experience, security, interactivity and reliability like- Internet, instead of being delivered through traditional satellite signal and cable TV formats. IPTV means delivering enhanced video applications over a managed or dedicated network via Internet Protocol. In IPTV service, this technology is used as that of Internet Services. In this service the TV channels are encoded in IP format and delivered to TV using a Smart Electrical Electronic Device. The IP TV Service also includes Video on Demand cloud services which are similar to watching Video CDs / DVDs using a VCD / DVD/CD player. Movies, different channels, Instructional Videos and other content shall be available to customers in the IP TV Services. This IPTV is through a broadband connection. IPTV is not video over the public Internet.

IPTV services can be classified into three main groups a) Live Television: with or without interactivity related to the current TV show, b) Interactive Television: TV shows can be forwarded, rewind, pause, play, etc and c) Video-On-Demand (VoD): browse a catalog of videos, not related to TV programming [5]. In IPTV, Live TV is typically Multicast from servers using IP Multicast; with one group per TV channel, there are typically several hundred Channels. The consumer's Set-Top Box "tunes" to a particular TV "channel" by joining the Multicast group for that channel. Video-on- Demand (VoD) is also supported by the service provider, with each request being served by a server using a unicast stream and the content is delivered at an accelerated rate. The play out buffer is filled quickly, and thus keeps switching latency small. Once the play out buffer is filled up to the play out point, the set top box reverts back to receiving the multicast stream [1] [2].

In our virtualized environment, ICC is managed by a set of VMs. The number of such VMs created would be driven by the predictor described above (note that a (small) number of VMs would typically be assigned to each distinct channel). Similarly, for the VoD service, we would configure a number of VMs based on the currently active VoD sessions, and would be adapted to meet user demand. When a physical server complex is shared for these services, it is desirable that we minimize the total number of VMs deployed (thereby the resources used) to satisfy all these requests [3].

In this paper, we aim a) to use a cloud computing infrastructure with virtualization to dynamically shift the resources among different IPTV services to better utilize the cloud resources, b) to minimize resource requirement for serving live TV and VoD request to deliver the content at the accelerated rate, and to minimize the waiting time and delay, c) to find the number of servers (virtual machine) that are required to serve the IPTV services at the same time.

2. Literature Survey

IPTV means delivering enhanced video applications over a managed or dedicated network via internet protocol. From an engineering perspective, IPTV places both the significant steady state and transient demands on network bandwidth. IPTV streaming techniques incur delays to stuff the play-out buffer, it is very important to minimize this latency for the betterment of viewers to switch or surf channels. In order to reduce this latency the technique so called, ICC (Instant Channel Change) was introduced by having a separate unicast assist channel for every viewer changing channels. Rather, a multicast-based approach using a secondary channel change stream was proposed in association with the multicast of the regular quality stream for the channel requested. The Instant Channel Change includes the Unicast Instant Channel Change Scheme and Multicast Instant Channel Change Scheme [1] [2]. The Unicast Instant Channel Change uses accelerated unicast streams to stuff the play-out buffer, thus reducing the wait at the STB[5] [6]. The Multicast Instant Channel Change is the secondary lower-bandwidth channel change stream that corresponds to each channel at the server. Servers in the VHO serve VoD using unicast, while Live TV is typically multicast from servers using IP Multicast. When users change channels while watching live TV, we need to provide additional functionality so that the channel change takes effect quickly. For each channel change, the user has to join the multicast group associated with the channel, and wait for enough data to be buffered before the video is displayed; this can take some time. Currently Live TV and VoD is served by a large number of servers grouped in a data center for serving individual channels, by doing so simply resources can be wasted, More waiting time, and More switching latency.

There are mainly three threads of related work, namely cloud computing, scheduling with deadline constraints, and optimization. Cloud computing has recently changed the landscape of Internet based computing, whereby a shared pool of configurable computing resources (networks, servers, storage) can be rapidly provisioned and released to support multiple services within the same infrastructure [7]. In preliminary work on this topic [4], we analyzed the maximum number of servers that are needed to service jobs with a strict deadline constraint. We also assume non-causal information (i.e., all deadlines are known a priori) of the jobs arriving at each instant. In this [5], considers the advancing scenario, this approach only requires a server complex that is sized to meet the requirements of the ICC load, which has no deadline flexibility, and we can almost completely mask the need for any additional servers for dealing with the VoD load. The content is delivered at an accelerated rate using a unicast stream from the server [8], [7]. There have been multiple efforts in the past to analytically estimate the resource requirements for serving arriving requests which have a delay constraint. These have been studied especially in the context of voice, including delivering VoIP packets, and have generally assumed the arrival process is Poisson [8]. We also show that for any server tuple with integer entries inside the server-capacity region, an earliest deadline first (EDF) strategy can be used to serve all requests without missing their deadlines. This is an extension of previous results in the literature where the number of server is fixed at all times [3].

3. Problem Definition

When users change channels while watching live TV, we need to provide additional functionality so that the channel change takes effect quickly. For each channel change, the user has to join the multicast group associated with the channel, and wait for enough data to be buffered before the video is displayed; this can take some time. Currently Live TV and VoD is served by a large number of servers grouped in a data center for serving individual channels, so simply resources can be wasted here, More waiting time, and More switching latency.

4. Methodology

IPTV services such as Live TV and VoD are delivered using the Internet. The combination of IPTV, VoIP and Internet access services is known as Triple play. The combination of triple and mobile voice services leads to quadruple, where these services are delivered by corporate LAN's and Business Networks. In this paper, a) We represent a Server as a Service Provider, called the VOD Server, fed by Multimedia Resources and handling the request that is incoming from the Remote User in which IPTV is constructed as described in a local media player, b) As the multimedia file is divided into "N" Number of packets from each sub-stream arrive at the VOD Server, they are stored in the Cloud for reassembly to reconstruct the full stream to the remote user. c) Portions of the stream that have been reconstructed from the VOD Server are then played back to the user as IPTV Services. In addition to providing a reassembly area, the VOD Server also enhances the user to absorb some variability's in available network bandwidth and network delay (VOD Server will enhance the Bandwidth as per the MM file request). d) This System provides a generalized framework for computing the amount of resources needed to support multiple services, without missing the deadline for any service. e) This System implements a simple mechanism for shifting the cloud resources among different IPTV services and delivers the content to the intended user.

Advantages: User easily buys the channel using Internet, Live TV Controller, the IPTV subscribers have a full control over the functionalities such as pause, play, rewind, forward, etc in the services like Video-on-Demand, the requested video channel and program is only sent to the viewer instead of broadcasting all channels (which saves the overall bandwidth), Ease of installation and operation, Competitive pricing.

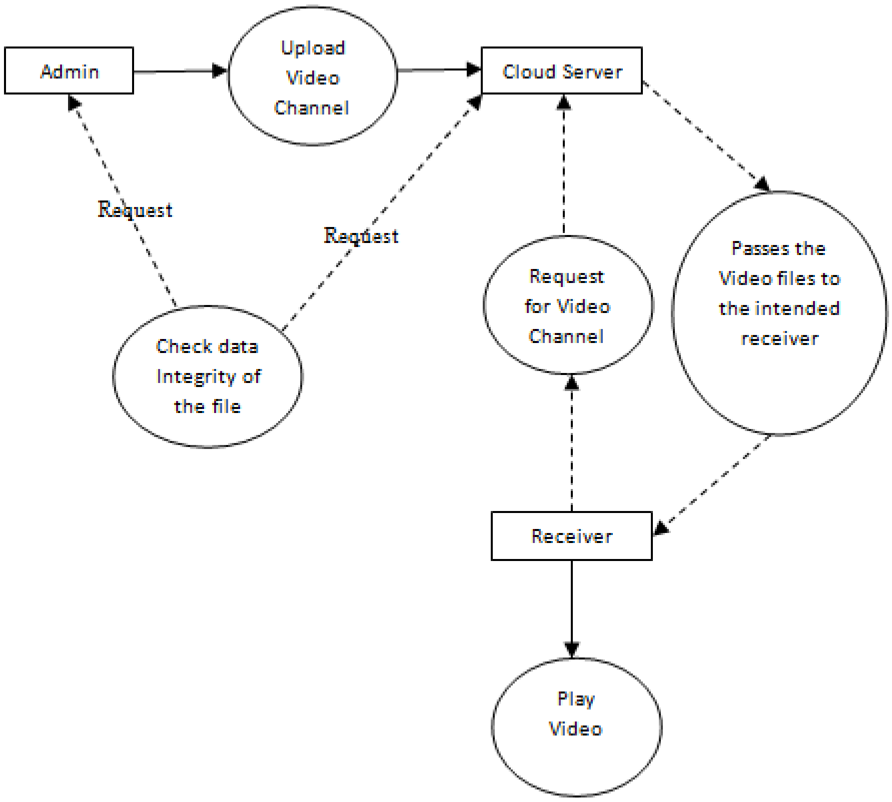


Figure1: Data flow diagram of the proposed system

4.1 Implementation

In this paper, four main modules are implemented:

1. Deadline Constraints and Scheduling- Each channel pack has some deadline constraints and scheduling. The deadline constraints provide the limited period of time to the channel pack. User using the channel packs within the period, suppose your channel period time is finished that time automatically you lose the channel pack, also Admin provides the alert message to user two days before in channel pack period using deadline constraints.

There are three types of constraints:
1) Flexible Constraint: This is a default type of constraint in project. It means that a task can start as soon as possible.
2) Semi-Flexible Constraint: A task must begin or end no later than the defined date.
3) Inflexible Constraint: A task must begin or end on a certain date.

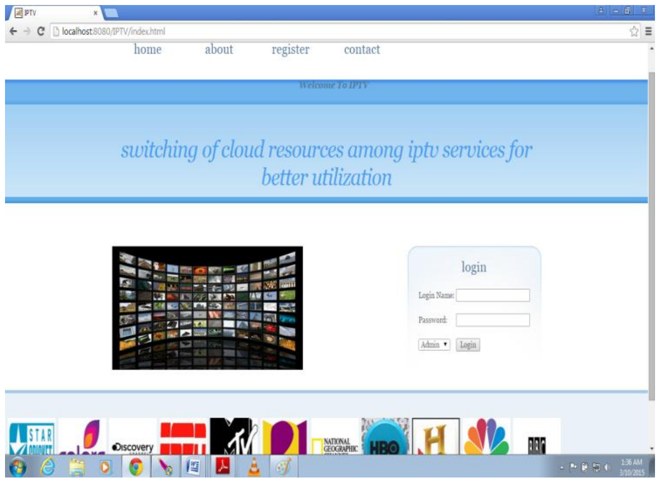
2. User Complaint- In this module we complaint about the channel i.e.; video clarity, sound clarity and so on, with the help of complaint box. Then the admin views the complaint then take action to that complaint. Finally users view that complaint status.

3. Optimization- In this module user selects the cheap and best channel pack. In this project optimization, there are three methods:

1) Linear Cost Function: In this cost function the cost is directly propositional to the total number of resources such that cost function increases as the number of servers increases.
2) Piecewise Linear Convex Cost Function: In this cost function at a particular number of servers the cost increases as the number of servers increases leads to linear cost function.
3) Exponential Cost Function: In this cost function the cost decreases as the number of server increases.

4. Multiple Services- The remote user can have multiple policies such as the services can take place simultaneously namely VoD and Live TV (whose service requirement is primarily to serve the ICC requests). Here Vod and Live TV are same but the services such as the channels will be different from both the TV Services. The user gets logged inn to Amazon Workspace (AWS) Cloud, which directs the user in to the Amazon workspace cloud.

5. Results and Discussion



The Welcome Page, where the User or Admin can login.

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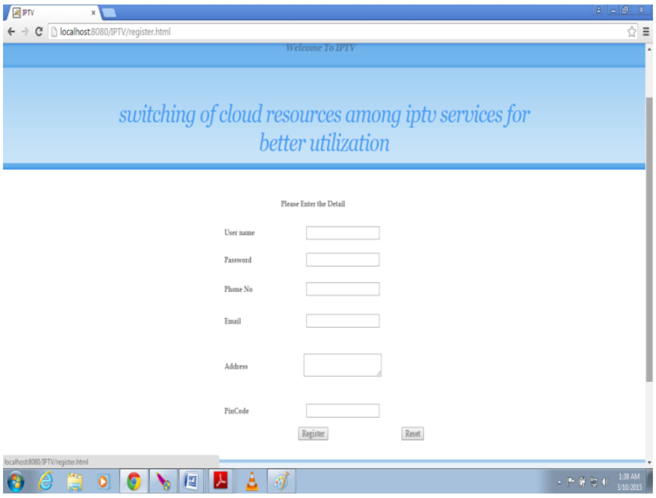
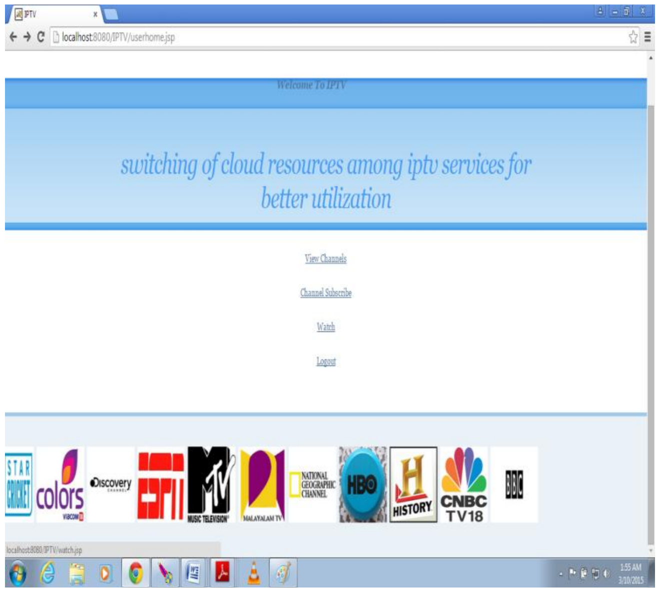
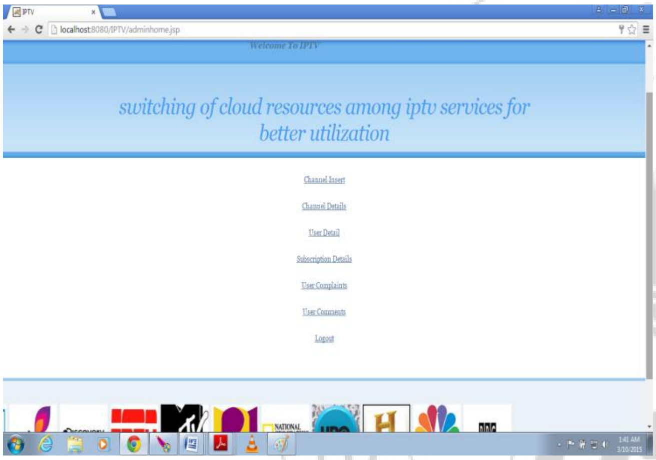


The New User Registration Page for the user to sign up for the service by providing his details. If the user is already registered then he/she can sign in by his/her username and password.



The user homepage, where user can view the available channels details, subscribe the channels of his/her interest, and then user authorized to watch the subscribed channels.

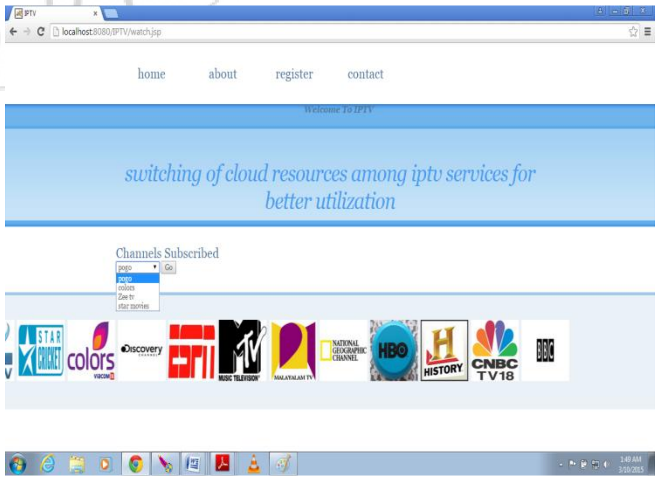


The admin authorized to insert the number of channels which can be viewed by customer. He can access the channel booking details of the particular users. He able to change the video files depends on the particular user complaints.

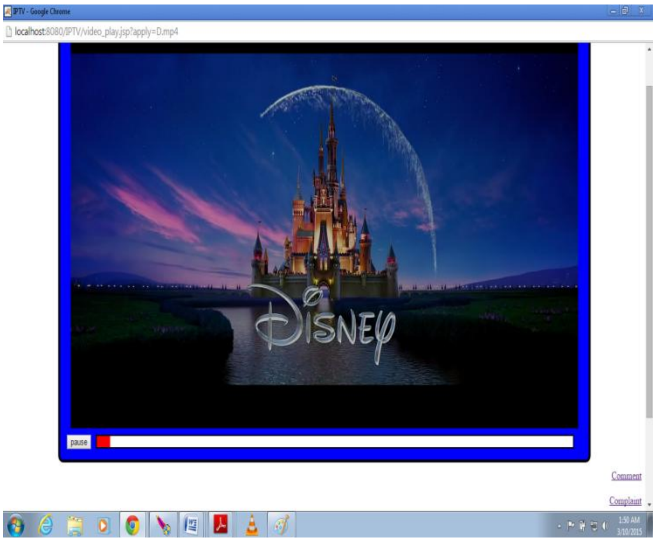
The channel subscribing packages for user cost optimization. The logged in user can buy his interested period channel pack, where each channel pack has different period and cost. The user can buy video files of his interested. Subscriber can save rs.50 for 6 months pack and rs.200 for 12 months pack.

Channel ID	Channel Name	About US	1 Month Package Cost	2 Month Package Cost	6 Month Package Cost	12 Month Package Cost
1	pogo	cartoon video	50	90	250	400
2	colors	funny interview	40	70	200	380
3	Zee tv	movie	50	90	250	400
4	star plus	good quality	60	100	300	600
5	star movies	video	30	50	140	280

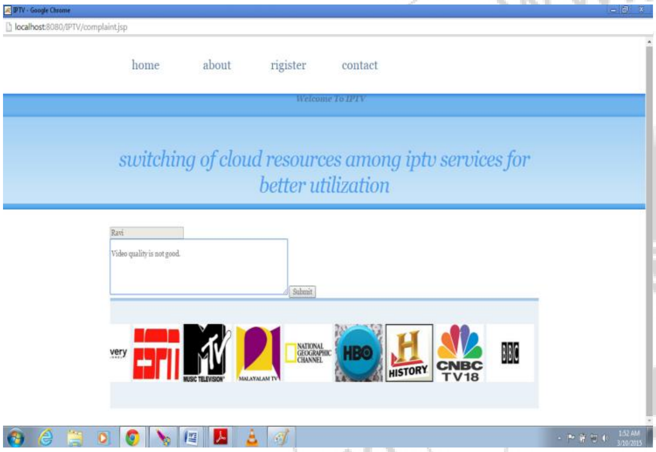
List of all the available channel.



A user can subscribe multiple channels of his/her interest and watch whichever he/she wants to watch.



Shows the window by which the user can view the selected channel. The user can watch the channels or video file, where he/she can also provide comments and complaints which can be viewed by the administrator later.



Shows the window that contains complaint box, where the user can post a complaint to the owner or admin.

6. Conclusion

In this paper, IPTV service operators will leverage a virtualized cloud infrastructure and mechanism for sharing server (Virtual Machine) among Video on Demand and Live TV to maximize utilization of deployed resources. This paper is also provided a generalized framework for computing the resources required to support multiple services with deadlines. The number of servers required to serve the IPTV service is optimized based on the viewers and server can be created when it is required to support multiple services as and when viewers are increased.

7. Future Scope

As a future work, we focus on scaling up the servers dynamically as and when it is required to support multiple services and providing the IPTV services through social networking to improve security and performance.

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Authors Profile

Ravi Bhillu Jadhav completed the bachelor's degree in Computer Science and Engineering from Basaveshwar Engineering College (Autonomous), Bagalkot under visvesvaraya technological University (VTU), Belgaum in 2013. Pursuing M.Tech in Computer Science and Engineering at Mangalore Institute of Technology and Engineering, Mangalore under VTU, Belgaum.

Nirmala Y Bariker completed bachelors and masters degree in Computer Science and Engineering. Currently working as Assistant Professor in Mangalore Institute of Technology, Mangalore. She has published 4 research papers in National and International conferences.