Management and Analysis Case for IPTV Services

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Abstract—The future IPTV supported networks require new methods and models in the network monitoring, analysis and management. Our visualization and control software was previously used in 3/4G networks, but in this study we analyze its usability in IPTV networks. Especially one use case, concerning measurements of TV viewers ratings, is presented. Based on the results, the software seems to be a promising solution also for IPTV managers.

I. INTRODUCTION

The development of broadband user access networks has enabled a huge growth of different kinds of Internet services and applications. Increased bandwidth in customers side makes it now possible to offer diverse bandwidth demanding services, like network gaming, digital IPTV and Video on Demand. Multicasting is one interesting mechanism to handle the transmission of the bandwidth craving services to the customers. In this survey we concentrate especially in multicast IPTV-service. Our previous studies have been concentrating on maintaining the QoS of multicast [1] and on the authentication process of the IPTV networks [2].

Providing the IPTV service to the customers takes usually place in particular content providing network. The basic model of the content providing network is presented in figure 1. Content providing network can be seen as an outline that consists of the different elements in broadband content providing process. These elements are different network devices (e.g. servers, routers, client side equipments) and different network actors (e.g. content providers, network service providers and customers). Content providers take care of the content production and they usually manage their own content servers, like IPTV-servers. Networks service providers are responsible for providing the network infrastructure needed for the transmission. This infrastructure usually consists of service providers edge devices, core network and users edge devices. Network service providers also handle the management of the networks. This outline allows the users access networks to be heterogeneous, users access network solution can be for example ADSL2+ or Wireless LAN.

Providing broadband IPTV service highlights a need for strict management in many levels. This sets requirements for all responsible actors in content providing network. IPTV-service is very bandwidth craving, so there is need for bandwidth utilization monitoring. There can be pay-channels, so there must be a solution for the accounting and billing etc.

In this study we concentrate on IPTV service management solutions needed by content and network service providers.

Network service providers are responsible for offering the proper network service for all clients. To be successful in this task, it is necessary to manage the whole network and be sure that all nodes are correctly installed and configured. The key words in network management are network analysis and visualization. One essential part of network analysis is monitoring the critical parameters in particular network nodes and links, like core and edge routers. These parameters usually deal with the bandwidth utilization and throughput matters in particular links. Every link and node may have intended rates of bandwidth utilization, so by proper analysis it is possible to find out if the state of the network element was acceptable. One common way to handle the monitoring is to gather the requisite information by SNMP-polling.

Efficient exploitation of the network analysis demands that the analysis data is easily available. Real time network visualization is the most illustrative way to report the present state of examined network element. In this survey we will present a case study of network analysis and visualization used in multicast IPTV service. Our test case takes place in xDSL client access networks.

The rest of this paper is organized as follows. Chapter 2 explains the basic framework and guidelines behind our case study. In chapter 3 we introduce our own network analysis and visualization tool and different purposes of it. In chapter 4 we explain the case study concerning TV ratings analysis.
II. IP-TV INFORMATION FROM NETWORK ELEMENTS

Providing multicast IPTV service highlights many important network and service management trouble domains from service providers point of view. “A trouble domain expression” here can mean a horizontally similar property that can be measured in same terms from different kinds of elements (etc. End-to-End delay) or vertically similar property or domain that can be summed in fuzzy terms from several different domain quality metrics into a single quality metric for a geographical area or logical area (etc. IP domain). This is area where the network service provider and content service provider may sometimes have slightly different interests. Content provider is interested in popularity and revenue of provided IPTV-service. Network service provider has to concentrate on optimization of the whole network configuration and capacity. However, most of the interests are common. QoS parameters like packet loss and throughput are very important for both content providers and network operators. Many of these issues relating to network management may also be dependent of each other. Trouble domains in our case studies’ point of view are presented in Figure 2. In next sub-chapters we will list the most important IPTV-information parameters. We will also describe the basic guidelines how they can be measured.

A. Capacity of the Networks

Network capacity is the most important object of analysis from network service providers point of view. Lack of network capacity affects on all other performance parameters in content providing network. Continual real time analysis of crucial links helps networks service operators to prepare for possible bottlenecks and too heavy loaded links. Capacity of the network can be analyzed by polling the counters of the crucial links.

B. TV Channel Ratings

IPTV service providers are interested in issues which interacts directly or implicitly with their possibilities to gain profit. The most important direct factors are TV-ratings for different IPTV-channels or channel packages. In multicast IPTV environment TV ratings can be seen as the content provider needs to know exactly how many receivers for example some particular TV program has had. They also want to know whether the ratings are gaining or decreasing. When operating in multicast IPTV environment, the most useful way to get the exact TV-ratings information is to gather the IGMP information from the users edge nodes. This can be done by using SNMP-polling messages. TV-ratings are very high category indicator about the functionality of the service providing network and it may be affected by almost all other indicators in content providing network.

C. Availability

Common availability in our case means basically the customers ability to receive the IPTV-stream. If the customer was not able the receive the stream, there is couple of basic errors that might have happened. The most common ones are problems either in some network link or in IPTV servers. Issues relating to service accessibility are crucial for both content provider and network service provider. Network service provider is responsible on the network connections and gets paid for that. Content provider wants as many receivers as possible and every moment when the service is not available for certain group means financial loss.

If IPTV-service is not accessible, one possible reason is problem in physical link. Link may be down due some misconfiguration or some random errors. The status of each interface on each network element should be polled constantly or SNMP traps could also be used to get alarm immediately after a problem arises.

Functionality of the IPTV servers are crucial for availability of the IPTV service. When the server is down, it means that no one is able to receive the service. Analysis of the servers status may consists of two basic parts. First it is necessary to know whether the servers network connections are up and running, which task can be done by pinging. If ping test replied it and problems still remains, the IPTV server functionality itself may be down. This can be checked from IPTV servers edge device, whether the IPTV stream arrived or not.

D. Quality of Service

QoS issues are one of the most important aspects of network management and analysis in IPTV service. Service like IPTV is extremely vulnerable for problems in quality of service parameters. If the requirements that has set for QoS parameter are not fulfilled, it affects immediately the quality of the IPTV stream. Measurement and analysis of QoS parameters can also be based on SNMP-polling. Network management entity polls the intended nodes and links to get the required counter values. Based on these values it calculates an analysis and summary of all intended QoS parameters. Quality of service related management is crucial for content provider while their clients have paid for certain level of service.

Packet loss ratio can be outlined by doing comparisons of packets sent by source link and received at destination link in certain period of time. Calculation of jitter is based on the intervals in which consecutive packets arrives at the receiver.
VizTool is a visualization, analysis, and regulation software, originally developed for controlling the 3/4G networks. It’s usage has been analyzed earlier by authors in [3]. It has been however developed in such a way, that it can be used to visualize any kind of networks. In this study, SNMP is used as an interface towards the network. An example screenshot on the main screen of the VizTool is presented in Figure 3. The screen shows a geographical network view, where the cities are analyzed based on the network inside them.

VizTool is based on a distributed framework, as can be seen in Figure 4. The visualization server is running somewhere in the network and several data collectors are putting their data to the database of the visualization server. Users with different privileges and roles can then use thin Java clients to connect to the server and see the state of the network. The privileges and roles define what is visible for each user. Network operators can provide e.g. to their customers a special view about their resources. This view could be a part of the network or part part of the counters and trouble domains. This way, the network operators can provide a unique view for each actor.

The computational needs and efficiency of the software have been analyzed in our previous studies. The conclusion of them however is that our hierarchical database and polling system is the most efficient in large networks and actually this kind of hierarchy is the only possibility when the number of nodes increases.

The VizTool visualization software gives us a variety of features and the most important ones of them are listed below:

- Realtime and non-realtime history views
- Possibility to draw graphs on any of the measured or analyzed counters
- Hierarchical analysis system, that gives immediate feedback on problems
- Scalability

IV. USE CASE - TV CHANNEL RATINGS

Currently the television channel ratings are collected in various ways. The traditional method are the written diaries from the sample group. A more modern way is to install portable devices on the sample people and collect the information using them. The recent methods are very good, but the results are anyway just statistical averages and not always accurate.

IPTV architecture enables a way to collect more accurate and realtime television channel ratings. The content providers and network operators may get a realtime view on amount of viewers on each channel. It is up to the network operator to choose who can see these statistics and what can be seen on them. The matter of confidence is also critical on this case, because obviously the operator can not get statistics if the viewers deny it.

In Viztool, there can be multiple views on the database, and then e.g. broadcasting companies could only have view for watching statistics about their channels. Another view could be for the network operator, who could see the trouble states from the network, to be able to react to the problems quickly. This is depicted in Figure 5. There are two client machines for the actors and server machine that contains the actual data. The two actors can then get the data describing their views from the same database.

The ratings may be gathered from several places, based on the network equipments currently available. In our test network, the data is gathered from the DSLAM with SNMP protocol. The memberships for each multicast group are summed and overall ratings can be seen. In our software, the results can also be analyzed further, e.g. by grouping the results by element. Then the analysis could result if one area of city watched more on channel A and another area channel B.

This kind of information would be very useful for the broadcasting companies to control the commercials. In Figure 7 is the chart about the ratings presented. The chart can be viewed in realtime mode, where user can see the actual watchers for each channel. The non realtime mode is used for checking the ratings in e.g. a certain hour of day.

A more detailed screenshot of the network operator’s view is presented in Figure 6. There can be seen the different elements of the network and their current state indicated as colors, analyzed based on the counters. This kind of view gives the operator possibility to locate the problem element and then
zoom to the element and locate the problem inside the element, e.g. in certain interface or encoder.

The Figure 7 on its behalf, shows the view for the content provider. The figure is screenshot from realtime view of the channel ratings. There are different lines for each channel of the particular broadcasting company.

V. CONCLUSIONS

This paper introduced few examples on what should be taken into account when planning IPTV network management. The QoS, capacity and ratings are the essential domains of interests in this kind of environment. Our visualization software seems to be good solution for this kind of problem field and we will continue on developing it towards this usage. We will continue our studies with more detailed tests on the QoS issues and the analysis in heterogeneous access networks.

REFERENCES