Survey Paper On Bandwidth Estimation For Video Streaming

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Abstract—Video streaming is a household term now-a-days and it is widely gaining a lot of popularity among mobile users. A wide variety of mobile devices,such as smart phones and tablets, are equipped with multiple wireless network interfaces. A lot of videos are streamed over the Internet according to users preferences but the question is how to efficiently and cost-effectively improve video streaming quality. In order to maintain high video streaming quality while reducing the wireless service cost,various approaches such as improving band with using adaptive algorithms are devised. In it,the optimal video streaming process with WIFI is done using bandwidth estimation and manipulation.Existing systems consider the quality of service (QoS) requirements for video traffic, such as the start up latency, playback fluency, average playback quality, playback smoothness and wireless service cost. Existing systems based on different survey's include various bandwidth estimation tools such as Spruce,Pathload,PathChirp etc.These bandwidth estimation tools are based upon scenarios of probe gap model and probe rate model.these tools help to determine the available bandwidth based on the transmission of packets between sender and receiver the streaming quality is deduced and then the video streaming quality is adjusted according to that bandwidth as per user's choice.
The rate adaptation decision is made at the client side. For each segment, the client can request the appropriate quality version based on its screen resolution, current available bandwidth, and buffer occupancy status. We can let the client request different parts of one segment over different links.

The main contributions is based upon threefolds. First, formulate the video streaming process over multiple links as an MDP problem. To achieve smooth and high quality video streaming, we define several actions and reward functions for each state, thus calculating the estimated bandwidth. Second, to propose an algorithm to perform bandwidth manipulation, this will take several future steps into consideration to avoid playback interruption and achieve better smoothness and quality. Last, we implement a realistic test bed using an Android phone and Scalable Video Coding (SVC) encoded videos to evaluate the performance. [3]

II. VIDEO STREAMING SYSTEM

keywords: Bandwith estimation, Bandwith manipulation, Adaptive algorithm, Video streaming.

I. INTRODUCTION

VIDEO streaming is gaining popularity among mobile users recently. Considering that the mobile devices have limited computational capacity and energy supply, and the wireless channels are highly dynamic, it is very challenging to provide high quality video streaming services for mobile users consistently.

High resilience to bandwidth variation and easy deployment are both important requirements for video streaming applications. Currently, progressive download, one of the most popular and widely deployed streaming techniques, buffers a large amount of video data to absorb the variations of bandwidth. Meanwhile, as video data are transmitted over HTTP protocols, the video streaming service can be deployed on any web server. However, the video quality version can only be manually selected by users and such decision can be error-prone. Since the smart phones only have limited storage space, it is impractical to maintain a very large buffer size.

To overcome the above disadvantages of progressive download bandwidth estimation and manipulation is done.

Considering how to utilize multiple wireless access networks together for video streaming, e.g., WiFi, and/or Bluetooth simultaneously. Here, as an example, Bluetooth and WiFi access networks are considered as it does not have end-toend control over cellular links, and it can be extended when other types of wireless access networks or more than two wireless access networks are used. Since a wireless channel may suffer from time-varying fading, shadowing, interference and congestion, the available bandwidth of a wireless link may vary all the time. In addition, different smart-phones or tablets may have different screen size and resolution. Taking these two aspects into consideration, the server should store several copies of video with different quality. The videos are encoded into a base layer and several enhancement layers, and chopped into segments and each segment can be played with a fixed duration.[1]

A pull-based algorithm is required for video streaming, as shown in Fig. 1. After initialization, the client will request the video information which includes video resolutions, bitrates and qualities from the server through both the WiFi and link. The rate adaptation agent will request a video segment of appropriate quality version based on the current queue length and estimated available bandwidth. Once the request decision is made, HTTP requests over WiFi will be issued to download the video segment. This process will continue until the completion of downloading the last segment or the termination of the video streaming by the user. [1]
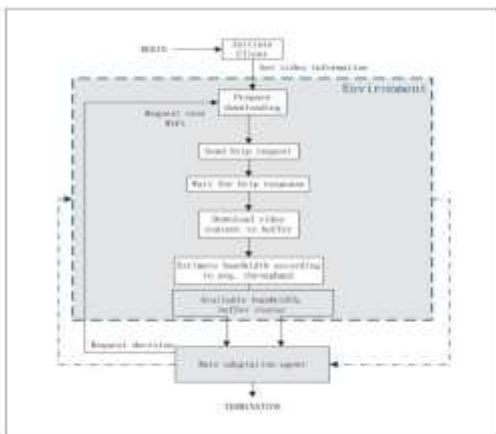

Fig. 1. Video Streaming System [3]

III. BANDWIDTH ESTIMATION

Streaming video over the Internet requires us to deal with bandwidth and delay that vary over time. Many video streaming applications address this problem by adapting the quality of scalable video. Scalable video encoding allows us to play a single video stream at full quality when network conditions allow, and to degrade gracefully when network resources are insufficient. However, scalable video encoding is only part of the solution for adaptive video distribution. Another critical component is an adaptive streaming mechanism for detecting the network conditions and choosing the appropriate scalable video components to send in order to achieve the best possible video quality given those network conditions. Bandwidth Estimation of the network channel could be an solution. [3]

A. Metrics

1) *Capacity:* Capacity of the medium can be defined as maximum achievable amount of data which can be sent over a link in the channel or end-to-end path between the source and sink. In case of 802.11, link-layer technologies do not work with same transmission rate. The maximum capacity relies upon the size of the network, traffic models and the local radio interaction which are never constant. The achievable capacity is always less than the raw medium capacity. Due to the fixed overheads introduced by the protocols at different layers, such as protocol header and control packets, the maximum achievable throughput are always much less than the raw medium capacity.

2) *Bandwidth:* The term bandwidth can be defined as the maximal quantity of data that can be sent out along a channel in a period of time. It is also defined as the data rate that can be sent through a network link or a network path over a time period. The term throughput, on other hand, relates to volume of data sent through in one direction over a link in the channel divided by the time taken for its transmission. Thu the value of throughput is never constant but varies over time.

3)   Available Bandwidth: Available bandwidth is another important metric which can be defined as maximal throughput that can be sent between two nodes without affecting current flow in the network. The available bandwidth in network is the time varying metric that relies not only on capacity of the link but also on amount of traffic. Calculating the available bandwidth is always essential before performing the admission control, flow control or QoS routing based on bandwidth constraint.

4)   Bulk Transfer Capacity: The Bulk-Transfer-Capacity (BTC) is defined as the maximal throughput attainable by a single TCP connection. The connection should carry out all TCP congestion control algorithms. Available bandwidth and BTC are basically different metrics. The BTC relies on how the TCP flows shares bandwidth among them, whereas the available bandwidth estimates the additional bandwidth that a path can provide before its link gets saturated.

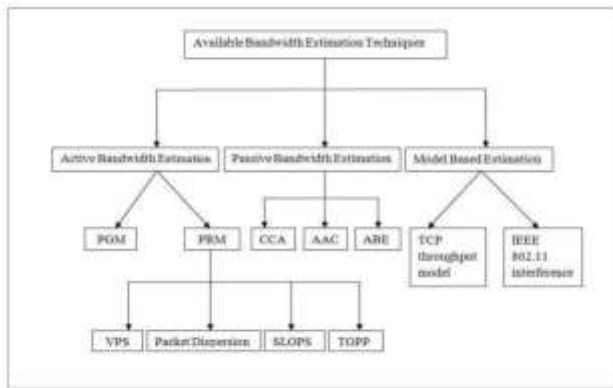## IV. TYPES OF BANDWIDTH ESTIMATION TECHNIQUES

Fig. 2. Bandwidth Estimation Techniques [1]

Number of works has been done in the area of estimating the available bandwidth. However there is still no clear consensus in terms of accuracy on the way of precisely measuring the available bandwidth in mobile ad hoc networks. The available bandwidth estimation technique can be categorized into three broad types such as Active bandwidth estimation; Passive based estimation and Mathematical model based estimation as shown in figure 2.

5) Active Bandwidth Estimation Techniques: The active estimation method has two types such as probe rate model (PRM) and probe gap model (PGM). PRM consists of three types of probing such as packet dispersion method, variable packet size probing method, and self loading probe. In PGM the available bandwidth is estimated based on the time interval between two successive probing packets at the receiver.

A.   Probe Rate Model (PRM) : Probe rate model is based on probe rate between the sender and receiver to estimate the amount of available bandwidth.

B.   Probe Gap Model (PGM) : Probe gap model is same as packet train probing method. However, PGM calculates the available bandwidth instead of the path capacity. Here the concept is estimating the available bandwidth with the time interval between two probe packets at the receiver. And the key assumption is that queue is not empty between the probing packet pair and the capacity at the high traffic link is known and constant.

Thus in active bandwidth estimation techniques probing packets at different rates are used to measure the bandwidth available in the network. These probe packets will cause additional traffic overhead in the wireless network which affects the performance of ongoing flows.

6) Passive Bandwidth Estimation Techniques: With the problems and drawbacks of the active bandwidth estimation techniques in wireless scenarios the research shifted towards the passive methods for estimating available bandwidth. The sensing based approaches are more suitable to wireless networks since it does not cause extra traffic. Here nodes utilize the 802.11 MAC physical carrier sensing or virtual carrier sensing to identify the channel idle and busy time. The MAC identifies the channel as idle when below given criteria holds true:

• Network Allocation Vector (NAV) is less than or equal to the current clock time.

• Receiving state is idle.

• Sending state is idle.

The passive bandwidth estimation method uses carrier sensing mechanism to estimate the available bandwidth. Hence there is no extra traffic overhead as introduced in active techniques. But the issues related to the external factors such as noise, interference, lack of synchronization etc., are leading to underestimation of available bandwidth in this method.

7) Model Based Bandwidth Estimation Techniques: In addition to the above approaches, the available bandwidth can also be obtained based on the model-based approaches. This method helps in providing the quantitative analysis of the protocols, helping us to predict the result set if the network parameters are changed. This is not possible with the either active or passive estimation approach. There have been few analytical models proposed in late which models around the operation of DCF in ad hoc networks each with their own set of assumptions.

V.   CONCLUSION

In this paper, the study of various methods for estimating available bandwidth were presented. The available bandwidth estimation schemes and QoS solutions have real progress in accuracy terms however each of the techniques discussed has its own set of drawbacks. No clear consensus has been reached which gives the accurate value of the available bandwidth in the dynamic environment. From the above study we infer that the probing based methods are suitable for wired than wireless environments. The model based techniques works well in the environment having a stable network topology and the passive scheme is suitable for wireless environment with low overhead.

VI. ACKNOWLEDGMENT

VII. REFERENCES

[1] Janani J, O.S Gnanaprakasi, Dr. P. Varalakshmi , A Survey on Available Bandwidth Estimation in Mobile Ad hoc Networks, www.ijaret.org ISSN 2320-6802 ICIRET2014

[2]Mingzhe Li, Mark Claypool and Robert Kinicki WBest: a Bandwidth Estimation Tool for Wireless Networks IEEE, pp. 374 -381, 2008.

[3]Min Xing, Siyuan Xiang, Member, and Lin Cai, IEEE, A Real-Time Adaptive Algorithm for Video Streaming over Multiple Wireless Access Networks , IEEE JOURNAL ON SELECTED AREAS IN COMMUNICATIONS, VOL. 32, NO. 4, APRIL 201

[4] Tony Sun, Guang Yang, Ling-Jyh Chen, M. Y. Sanadidi, and Mario Gerla, A measurement study of path capacity in 802.11b based wireless networks, Workshop on Wireless Traffic Measurement Model., pp. 3137, 2005.

[5]Karthick Lakshminarayanan, Venkata N. Padmanabhan, and Jitendra Padhye, Bandwidth estimation in broadband access networks, ACM SIGCOMM conference on Internet Measurement, pp. 314321, 2004.

[6]Zhenhui Yuan, H Venkataraman, G Muntean., iBE: A novel bandwidth estimation algorithm for multimedia services over IEEE 802.11 wireless networks, IEEE International Conference on Multimedia Mobile Networks Services, pp. 6980, 2009.

[7]Yang Y, Kravets R, Contention aware admission control for ad hoc networks. IEEE Transactions on Mobile Computing, vol 4, issue 4, pp 36377, 2005.

[8]De Renesse R, Friderikos V, Aghvami H, Cross-layer cooperation for accurate admission control decisions in mobile ad hoc networks. IET Communications, vol 1 , issue 4, pp 577586, 2007.

[9]Sarr C, Chaudet C, Chelius G, Lassous IG. Bandwidth estimation for IEEE 802.11- based ad hoc networks. IEEE Transactions on Mobile Computing; vol 7, issue 10, pp 12281241, 2008.

[10]Ronghui Hou , Sikai Qu Hongfei Zeng ; King-Shan Lui ;Jiandong Li Coding and interference aware path bandwidth estimation in multi-hop wireless networks. IEEE proceedings of GLOBECOM; pp. 15, 2011.

[11]Feng Chen, Hongqiang Zhai, Fang Yuguang,

Available bandwidth in multirate and multihop wireless ad hoc networks. IEEE Journal on Selected Areas in Communications; vol 28, issue 3, pp 299 307, 2010.

[12]Prasad R, Dovrolis C, Murray M, Claffy K,. Network, Bandwidth Estimation: Metrics, Measurement Techniques, and Tools, IEEE Network, vol 17, issue 6 , pp 27-35, 2003.

[13]Charles Blake, Douglas S. J. De Couto, Hu Imm Lee, Jinyang Li, Robert Morris, Capacity of Ad Hoc Networks, International conference on Mobile Computing and Networking, ACM, 2001.

[14]Constantinos Dovrolis, Manish Jain, End-to-End Available Bandwidth: Measurement Methodology, Dynamics, and Relation with TCP Throughput, IEEE Transactions in Networking, pp 295-308, 2003.

[15]C.Chaudet and I.G. Lasssous, BRuIT-Bandwidth Reservation under Interference Influence, European Wireless,2002