VIDEO STREAMING OVER HETEROGENEOUS WIRELESS NETWORK –A SURVEY

K.Lavanya[1], Dr.R.Kanthavel[2],
1. Research Scholar, Velammal Engineering College, Chennai
2. Principal, V V College of Engineering, Thirunelveli
lavanya201180@gmail.com
kanthavel2005@gmail.com

***Abstract*—**. Video streaming has become a dominant Internet traffic due to the increased deployment of mobile devices. Delivering a high quality video stream through a heterogeneous wireless network has more challenging aspects because of the asymmetrical nature of the network and the stringent QoS requirements of the video applications. In a heterogeneous network, bandwidth availability is a highly varying parameter. The rate at which the packet is lost, increases with varying bandwidth. In order to provide a reliable transfer of video information, a variance of the transport protocol can be a better solution. This paper analyses the challenges for efficient video streaming over a heterogeneous wireless network over various transport layer solutions.

Keywords— Heterogeneous wireless network (HWN), video streaming.

I. HETEROGENEOUS NETWORK

The mobile video streaming has started dominating the internet due to the excessive growth of mobile applications.(*e.g.*,Youtube, online gaming, live sports program, *etc*.) during the past few years. The latest market survey of Cisco company [3] reports that video streaming accounts for 60% of the mobile data traffic over the Internet in 2016 and will exceed 78% by the year 2021. In parallel, global mobile data will increase 7-fold from 2016 to 2021. This tremendous growth exerts heavy loads on the capacity-limited wireless platforms.

Some of the limitations of the video frames transmission over wireless network include (i) high energy efficiency schemes lacks to provide high quality real-time video streaming.(ii)Algorithms used to deliver multiple video streams are not considering the time-varying channel status and (iii)No solution is given for mobile video delivery in wireless networks to reduce the packet delay and consumption of bandwidth. The exploitation of multiple connections can be a suitable solution for video streaming in heterogeneous networks.

The availability of various wireless access options like 3G cellular mobile networks, WIMAX(IEEE 802.16), WiFi (IEEE 802.11) etc, have made the wireless environment c in nature .The features of these access technologies may differ in many aspects and these differences make the wireless environment asymmetrical in nature.

Network	Coverage	Data Rates	Mobility
Satellite (B-GAN)	World	Max. 144 kb/s	High
GSM/GPRS	Aprox. 35 Km	9.6 kb/s up to 144 kb/s	High
UMTS	20 Km	up to 2 Mb/s	High
HIPERLAN 2	70 up to 300 m	25 Mb/s	Medium/high
IEEE 802.11a	50 up to 300 m	54 Mb/s	Medium/high
Bluetooth	10 m	Max. 700 kb/s	Very low

Table.1 Features of various wireless access networks

As the user demand and quality of service (QoS) requirements increase at a faster rate and the available wireless resources remain limited deploying multiple points of access becomes more essential.These multiple wireless access technologies can be used concurrently by a mobile device and this makes the environment heterogeneous in nature. If a multi homed mobile device has more than one radio access options, to get better service the connection can be switched from one to another. The exploitation of multiple interfaces is capable of increasing the bandwidth.

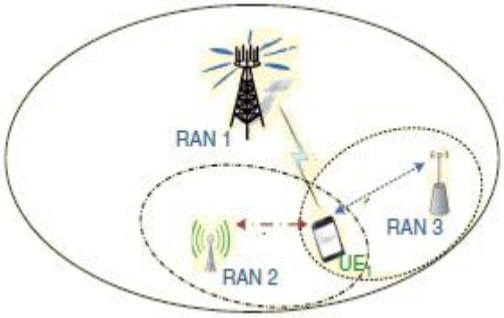

Fig.2 A multi-homed network

The use of multiple interfaces simultaneously opens new way of addressing some of the limitations of wireless media and can enable other new and interesting possibilities
1.. Bandwidth Aggregation. Bandwidth offered by the multiple interfaces can be aggregated to improve quality or support demanding applications that need high bandwidth.
2. Mobility Support. The delay incurred for handover can be reduced when an alternate communication link is always kept alive.
3. Reliability. For applications requiring strict reliability guarantees, some or all packets can be duplicated/encoded and sent on the multiple paths.
4. Resource Sharing. In an ad hoc network of nodes connected via their local interfaces (LAN—802.11 or Bluetooth), a subset of nodes may have wide area (WAN) connections. 5. Data-Control Plane Separation. Similarly, the WAN interfaces in an ad hoc/sensor network can also be used for out of band control communication (via an infrastructure proxy) to aid distributed ad hoc protocols such as routing.

Challenges faced by heterogeneous networks

- To predetermine the theoretical capacity of the network
- Interoperability of the different wireless radio access technologies
- Vertical Hand off
- Mobility of the user device

- Quality of Services (QoS) offered by different networks
- Interference between the radio signals

II.VIDEO STREAMING

Video streaming applications have tight latency constraints, and data arriving too late is essentially useless.Typical applications include mobile internet access, mobile video conferencing, streaming video/audio, distance learning, e-commerce, entertainment, etc. Efficient media compression creates interdependence between packet and codecs, so packet losses and late arrivals of video data can be detrimental. When combined with the inherent

nature of network environments and transport protocol behavior, effective multimedia delivery presents many challenges.

Video frames should be played between 24-30 frames per second to create the illusion of motion. Video compression algorithms carry out both intra and inter-frame compression, which have temporal dependencies The variability in encoded bits per second leads to Variable Bit Rate (VBR) video.

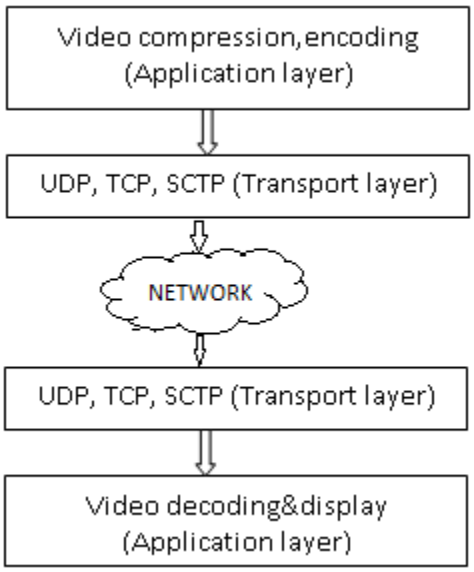

Fig.3 Video streaming process

The VBR encoded video is then transmitted into the Internet. Since the Internet does not provide a constant, guaranteed bandwidth for the video stream, the network can only support the video bitrate on a best-effort basis. If the network bandwidth is not sufficient to support the video bitrate, then the decoder at the client-end starts to consume the video data at a greater rate than at which new data is being received from the network. The decoder eventually runs out of video data to decode, which results in a screen freeze (video stalls or rebuffering events). Applications run on top of transport protocols and real time multimedia applications ideally trust the transport layer to minimize induced delays and deliver data with an appropriate degree of reliability and timeliness. This paper surveys popular transport layer solution in video streaming such as User Datagram Protocol(UDP) and Transmission Control Protocol(TCP).

III.USER DATAGRAM PROTOCOL

Most of the IP-based real-time multimedia services deploys user datagram protocol (UDP) as their layer transport protocol .The transmission delay is minimum in UDP, which makes it attractive to time constraint applications. The UDP packet format is very simple, comprising of a header and payload. UDP receives message from the application layer attaches the source and destination port number and passes the block to the Internet layer. The IP protocol encapsulates the received block into a single datagram and this datagram is delivered to the destination with a best effort service. The peer UDP at the receiver accepts the datagram and handover that to the appropriate application process through the destination

port number stored in the received block.UDP which is being used for video streaming in most of the cases, does not establish an end to end connection between the source and the destination. It exploits the datagram approach to forward packets. In this case, the source need not wait for the acknowledgement from the receiver and therefore without the knowledge of the data received or lost ,the source continuously transmits the data, thus providing an unreliable data transfer. UDP uses cyclic redundancy check (CRC) to verify the correctness of packets. If an error is detected, the packet is declared lost and discarded. At the receiving host, packets are either perfect or completely lost. The wireless networks are characterized as low-bandwidth and unreliable, where of packet losses are mostly due to both channel failure and network congestion. Depending on the environment, transmission speed and the load of the network, packet loss can be random. UDP does not perform any error recovery to reconstruct the lost packet, streaming video over wireless networks can yield unpredictable degradation and poor quality. UDP fails to adopt to the properties of the wireless network, where a channel error only partially corrupts a packet .It discards a packet containing a small fraction of corrupted data including error-free data within the packet.

IV.TRANSMISSION CONTROL PROTOCOL

Transmission Control Protocol(TCP) is a connection oriented protocol, which retains the connection between the two communicating end nodes till the completion of data transfer between them. It provides a reliable transmission with effective flow control and error control protocols. The reliable transfer of data is guaranteed by the positive acknowledgement returned by the client after receiving the information successfully. If this acknowledgement does not reach the server within the expected round trip time(RTT),the server concludes that the segment is lost and the same segment will be retransmitted .For retransmitting segments, the waiting time will be increased in order to cope with the congestion if any, in the network.TCP is mainly aiming at accurate data delivery rather than on time delivery. However, this reliability comes at the expense of variable delay as senders wait for acknowledgments (ACK) and retransmit lost data. This behavior of TCP makes it not suitable for certain applications such as video/audio streaming which has a tight constraint over time delay. In such applications, even a small time delay will affect the quality of the video/audio information received. In a mobile environment, Packet loss are often due to Bit errors due to wireless channel failure, Handovers and Possibly congestion. Delay is very long as the round-trip time can be very long and variable and due to the link level retransmission TCP was originally designed for fixed end-systems and networks.TCP assumes packet loss is due to Congestion in the network and Packet reordering. TCP's mechanisms do not respond well to packet loss due to bit errors or handoffs as the case of mobile systems.TCP assumes congestion if packets are dropped which is not true in wireless networks where packet loss is

mainly due to transmission errors In mobile environment the performance of an unchanged TCP degrades severely which in turn degrades the quality of the video information transferred.

V.CONCLUSION

Based on the survey made ,an alternate transport layer solution can be identified with certain objectives .The video data transfer needs to be more reliable. The out of sequence packet delivery to the client due to packet loss and receiver buffer block must be elimainated.

The transmission efficiency of scalable videos is to be improved. The path switching overhead in multipath mobile environment should be eliminated. Finally, the high definition video should be transmitted successfully in a multi-homed network.

REFERENCES

[1]. Scott Pudlewski and Tommasomelodia*,"A tutorial on encoding and wireless transmission of compressively sampled videos "*, IEEE communications surveys & tutorials, vol. 15, no. 2, second quarter 2013

[2]. S. Pdlewski and T. Melodia, *"Cooperating to stream compressively sampled videos,"* in proc. IEEE int. conf. commun. (icc), Budapest, Hungary, Jun' 2013.

[3]. Nikolaos M. Freris ,Cheng-Hsin Hsu, Jatinder Pal Singh , *"Distortion-Aware scalable video streamingto multinetwork clients*" IEEE/ACM transactions on networking, vol. 21, no. 2, April 2013

[4].S. Pudlewski and T. Melodia, "*Compressive video streaming: design and rate-energy-distortion analysis,"* IEEE trans. multimedia, vol. 15, no. 8, pp. 2072–2086, Dec. 2013.

[5].G. Papa Georgiou, S. Singh, Krishnamurthy, R.Govindan, and T. Porta, *"Distortion-resilient routing for video flows in wireless multi-hop networks,"* in proc. IEEE int. conf. networking Protocols (icnp), Austin, tx, USA, Nov. 2012, pp. 1–10.

[6]. James Nightingale, Qi Wang and Christos Grecos, *"Removing path-switching cost in video delivery over multiple paths in mobile networks "*,IEEE transactions on consumer electronics, vol. 58, no. 1, February 2012

[7]. ChangQiaoXu, Enda Fallon, Yuansongqiao, Lujiezhong, and Gabriel-Miro Muntean, *"Performance Evaluation of multimedia content distribution over multi-homed wireless networks,"* IEEE transactions on broadcasting, vol. 57, no. 2, June 2011

[8]. SangchunHan, Hyunchuljoo,Dongju Lee, and HwangjunSong*,"An end-to-end virtual path construction system for stable live video streaming over heterogeneous wireless networks,"*IEEE journal on selected areas in communications, vol. 29, no. 5, May 2011.

[9]. Xiaoqing Zhu,PiyushAgrawal, Jatinder Pal Singh*,",Tansualpcan and Bernd Girod ,"Distributed rate allocation policies for multihomed video streaming over heterogeneous access networks*",IEEE transactions on multimedia, vol. 11, no. 4, June 2009.

[10]. Schierl, T.; Ellge, C.; Ganger, K.; Stockhammer, T.; Wiegand, T., *"Multi source streaming for robust video transmission in mobile ad-hoc networks"*, in image processing, 2006 IEEE international conference on , vol., no., pp.1669-1672, 8-11 Oct. 2006

[11]. Jyh-horngwul; Ho-Cheng lien; Chen-PeyHuang; Yi-Haurshiau; Whey-FoneTsai, *"An efficienct way for sharing real-time data and the application of remote network video system,*" in cellular Neural networks and their applications, 2005 ,9th international workshop on , vol., no., pp.308-310, 28-30 May 2005

[12]. Gustafsson, E.; Karlsson, G., *"A literature survey on traffic dispersion,*" in *Network, IEEE* , vol.11,no.2,pp.28-36,Mar/Apr,1997.