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Video Transmission in Heterogeneous Network with Improved QoS

M. Edhayadharshini

Anna University Regional Office, Coimbatore
edhayasmvec@gmail.com

Alamelu

Pondhicherry Engineering College
alamelu306@gmail.com

Abstract: *Wireless communication systems that consist of cellular, WLAN and Wi-Max access networks simultaneously are termed as heterogeneous wireless networks. Heterogeneous networks connect computers and other devices with different protocols. In the existing system the Greedy Approach was used for video transmission in heterogeneous network. It minimizes the video quality distortion by scheduling the most valuable packets for transmission. But there is a loss occurs when large number of packets is transmitted. The proposed work considers Wi-Fi and Wi-Max in the heterogeneous network for transmission. In this process for multi-resolution video transmission to heterogeneous clients and for channel adaptation, Scalable video coding (SVC) is being developed in response to the need of robust video delivery for heterogeneous clients. The clients receive and decode different fractions of the video bit stream to obtain the desired resolutions and qualities. Multicast probe (MP) frame was initiated which contains the information of the video bit stream and the timer starts for the multicast response (MR) frame. Upon receiving the MP frame, if a client does not subscribe to the multicast group, the MP frame is simply ignored. Otherwise, an admitted client estimates the signal-to-noise ratio (SNR) and path loss of its wireless channel. The simulation results are performed using MATLAB.*

Keywords: GA; Wi-Fi; Wi-Max; SNR; SVC.

I. INTRODUCTION

Video is captured in analog form and it transmitted over network from many decades it is useful for communication and entertainment purpose. The wireless network the video has been transmitted efficiently through limited channel and transmission without loss. Heterogeneous network is a network which connecting different devices with different operating system or different protocol. Wireless Local Area Network which maintain the service of cellular network while switching the network. Heterogeneous Wireless Network (HWN) which is also called as Heterogeneous Network (HetNet). Wide Area Heterogeneous Network which use cells, Picocells, and femtocells which cover wide area through a wireless medium such as schools, office buildings, underground area etc from an open outdoor environment. Video format uses black and white or color information to make up video frame and it is recorded as per the video standard. WLAN which consists of high data rates, low mobility, short range. It support the standard such as NTSC, PAL, ATSC [1]. QoS (Quality of Service) which improved the service to the end to end users which improve the infrastructure, service by reducing the cost of the service. The main goal of the QoS is to provide the priority which includes delicate bandwidth and latency and it adds best effort to the existing users. QoS consists of four different views 1).Customers QoS requirements, 2).service provider offering of QoS, 3).QoS achieved or delivered, 4).Customer survey rating of QoS.

II. LITERATURE REVIEW

The energy and content aware video transmission which incorporates the energy limitation and Quality of Service (QoS) to the Mobile Terminals (MTs) for video streaming. MT has battery energy limitation by dropping some packets it determines the transmission power for the radio interfaces.

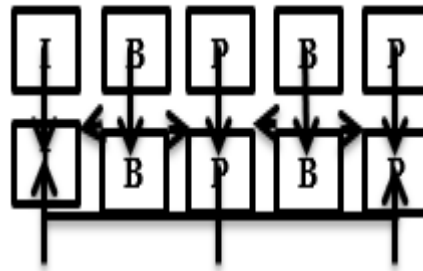


Fig 1.1 GOP structure with Frame dependences

Greedy Approach (GA) is used in order to schedule and optimize the power, it solves the problem by allocating power for each interface using its bandwidth, channel condition, and its energy constraints and it schedules the video packets by minimizing the video quality distortion [2]. Thus here different Knapsacks problems arise, items are packed in knapsacks and it classified with leaf and root items in Fig 1.1. Vertical Handover Strategies in the Heterogeneous network is a wireless network which allows the user to move between the heterogeneous network in multiple access interface for both real and non-real time services.

III. HETEROGENEOUS NETWORK VIDEO TRANSMISSION

In a heterogeneous network, the video transmitted simultaneously to a different network with improved quality.

A. Quality Of Service:

QoS is the Quality of service which provides better service for the existing user which reduce the upgrades of the network users in Fig 1.2. Its main objective is to provide for priority user which includes bandwidth, controlled jitter, and latency which allows the users to improve the service to the user

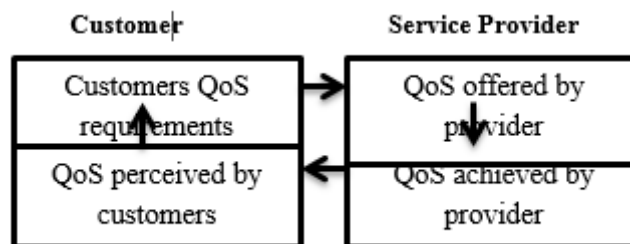


Fig 1.2 Four Viewpoints of QoS

B. Traffic Handling Mechanism:

The traffic was handled using its integrated services, differentiated services and through its parameters of QoS which govern the shape of the network traffic and its transmission was negotiated between the server and the client it was based on the parameters like bandwidth, throughput, delay, jitter, and loss. It considers the packet data rate, mean data rate, its transmission is based on priority it provides a way for a transport user thus higher priority user connections get serviced before the low priority ones.

C. QoS Techniques in WLAN:

WLAN network is useful for all parameters this may cause variation in bandwidth, latency in data delivery, jitter and error rates this prevailing in a WLAN network make QoS guarantees.

a. DCF with QoS enhancement:

DCF is Distributed Coordination Function its transmission followed by the WLAN devices is based on CSMA/CA. It does not base on Priority transmission for data, its all applications are irrespective of its quality has the same priority. The conventional DCF has been enhanced to overcome its limitation called Enhanced Distributed Channel Access (EDCA).

b. PCF with QoS enhancement:

PCF is a Point Coordination Function which is followed by the WLAN devices is based on polling which leads to minimal wastage; its data is transferred with small waits between frames. It has some limitations to be overcome was, traffic cannot be turned with different parameters. Devices are polled using a round-robin algorithm are dropped from the polling list which cannot accumulate a bunch of frames and deliver them together. In WLAN environment, the conventional PCF has been enhanced to overcome its limitation is called as Hybrid Coordinator Channel Access (HCCA).

d. Scalable Video Coding:

Scalable Video Coding (SVC) is developed to robust video delivery for heterogeneous clients it encodes videos into multiple layers. The broadcast nature of wireless medium which allows the transmission of video packet into multiple receivers. SVC bit stream is streamed to multiple heterogeneous clients which encode the videos and form into multiple layers. Clients receive the video and decode the bit stream in a fraction of seconds according to the desired qualities and resolutions [5]. By using the multicast architecture the client can deliver the quality videos to the multiple users. Through the wireless medium transmission there may be losses occur due to delay- sensitivity, high data rate, and unequal priority scalable video due to traffic poses occur in wireless transmission. In video peak to signal noise ratio (PSNR) the quality degradation occurs during transmission, thus PSNR values describe the quality description of a video.

D. Wireless Fidelity:

Wireless Fidelity (Wi-Fi) is an electronic device which allows the user to connect the device through a wireless medium using its microwaves in 2.4GHz to 5 GHz bands. Devices such as smartphones, TV, cameras, personal computers, digital devices etc. can connect through the wireless medium it access point was in the range up to 20 meters. Ethernet frame which the carrier wave transmit the data through the packets. Wi-Fi has two types of components such as wireless client station and AP, AP is used to connect the fixed and the wireless medium which acts as a bridge which is a cable modem, Digital Subscriber Line (DSL) which provides the internet in both wired and wireless medium [5].

IV. VIDEO TRANSMISSION MODEL

The video transmission model consists of different frames such as I, P and B-frames. I frame is an intra-frame which can also call as spatially coded frame all the information present is to reconstruct each block present in this is 8x8 discrete cosine transform resulting coefficient consists of few large and many small values [1]. P frame is an Inter-frame also called as the temporally coded frame is achieved using motion vectors its macroblocks consists of the 16x16 pixel area is recorded as two values as horizontal and vertical motion vectors. It consists of few common algorithms such as sequential search, logarithmic search, and hierarchical search. B frame is a general version of P frame it consists of both the past and future frame. Here the video sequence is encoded into bits each layer is encoded into a group of picture (GOP) in Fig 1.3. Transmission power allocation for each layer is dependent on channel allocation and bandwidth in order to achieve maximum data rate for the different radio interface.

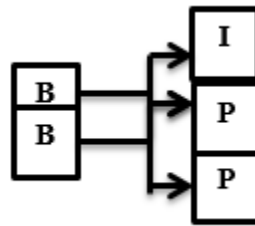


Fig 1.3 Illustration of Leaf and Root items using Base Layer

A. Greedy Algorithm:

Piecewise linearization approach is used in existing methods which is to solve the problem using cutting plane method it will reduce the complex present over MINLP (Mixed Integer Nonlinear Programming) to series of MIP (Mixed Integer Programming). The Greedy Approach (GA) is an algorithm which is to solve a global optimum problem, in many approaches it does not produce an optimum solution. Using GA algorithm which is forward to the neighboring node is closest to the destination, its node location can be determined by its physical location by ad-hoc networks [3]. Is a mathematical approach which has a set of k integers (a₁, a₂, a_k) is used to find a vector coefficients such that,

$$\sum_{i=1}^k c_i a_i = c. a = n \tag{1}$$

It is a simple algorithm to implement complex solutions to perform power allocation and packet scheduling to different radio interface is to MT battery energy limitation and minimize video quality distortion.

B. Simulation Parameters:

Multi Cast strategy (MCS) and Transmission Power together determine the energy consumption for each transmission and also determine the time duration for each source. If the transmission power is lower than the SNR value of the channel gets deteriorates and leads to higher loss rate in Table 1.1.

Table 1.1 Simulation Parameters

Parameter	Value
Frequency Band	5MHz OFDM
Modulation scheme	1/2 BPSK
No of BS	2
No of nodes	50
Simulation duration	20s
Requested data rate	50 Kbps
BS coverage	500m
Frame duration	20ms
MS speed	20 m/s

The PSNR value describes the quality of the video with its spatial-temporal resolution but for multi-resolution videos are not applicable [4]. As the SVC coding which expands it in three dimensions such as spatial, temporal and quality to many possible dependency combinations and also it determines the priority of the layer to be attached such that combination which produces the maximum video quality

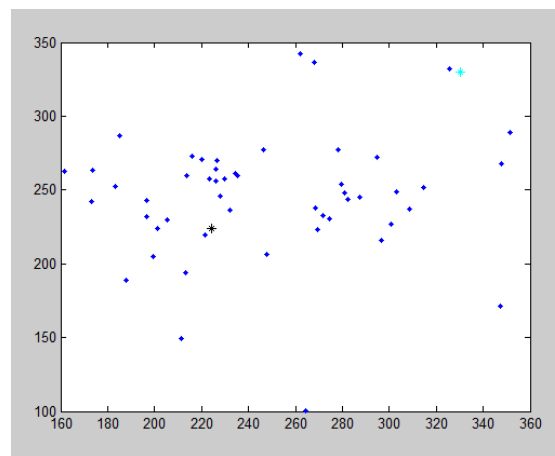


Fig 1.4 Network Setup

The node plotted for Wi-Fi and Wi-Max region which is shown in Fig 1.4. Here the black node which represents the Wi-Fi base station and the blue node is to Wi-Max base station. A heterogeneous network transfers simultaneously data to different devices by this drop age can be minimized by transferring over the single network [4].

C. Throughput and Packet Drop Ratio:

The cellular networks with wide coverage area and Wi-Fi hotspots with high throughput and energy and its base station which determines the channel according to the data which transfers long range.

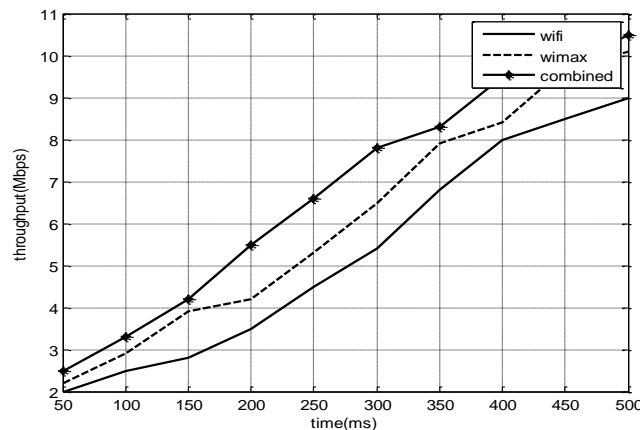


Fig 1.5 Graph of Throughput

In Wi-Max packet is the minimum for starting only is due to the high speed of Wi-Max PDR decreases. Opposite to it PDR is very large in Wi-Fi compared to Wi-Max, PDR comes in control at the end in Wi-Fi, and retransmission also occurs due to slow speed but PDR is more is shown in Fig 1.5.

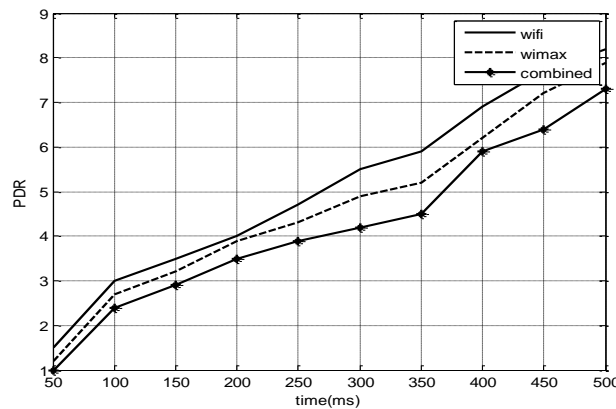


Fig 1.6 Graph of Packet Drop Ratio (PDR)

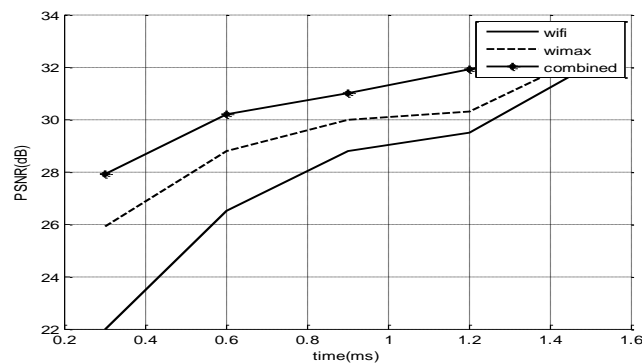


Fig 1.7 Peak Signal to Noise Ratio (PSNR)

The above fig shows the average PSNRs of all multicast clients under various channel access time at a fixed channel access for Wi-Fi, Wi-Max and all combined networks in above Fig 1.6 and 1.7.

D. Parameters Comparison:

The throughput value in Mbps is maximum in the case of heterogeneous networks is 18.3Mbps and drop ratio is 8.2 dB in Table 1.2.

Table 1.2 Comparison between Parameters

Parameters	Wi-Fi	Wi-Max	Combined Network
Throughput(Mbps)	9	10.1	10.5
Packet Drop Ratio	8.2	7.9	7.3
Peak Signal to Noise Ratio	32.1	32.5	32.9

CONCLUSION

Heterogeneous Network transmits the video sequence by considering the channel condition through a large number of video packets per GOP video sequence is encoded into a bit stream. In existing framework, the video packets are send using I, P and B-frames as leaf and root nodes but knapsack problem arises due to energy limitation. In order to support for long range transmission with better video quality and to increase the throughput and delay in a heterogeneous by simultaneous transmission using Wi-Fi and Wi-Max network. The process considers the Scalable Video Multicast bit stream can be streamed to multiple heterogeneous clients for different video resolutions. It determines the worst channel using SNR ratio and sends the most valuable packets and shown throughput, packet drop ratio using MATLAB.

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