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A Study on Current Challenging Issues and Optimal Methods for Video Streaming over Heterogenous Wireless Network

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Abstract: In the past few years, video streaming in a heterogenous wireless network is one of the striking feature among mobile users. In real time implementation, it involves very huge amount of data and a significant aspect of bandwidth for diverse kinds of network that dominate with multiple interface capability. In this paper, analysis of various techniques and studies on issues of video streaming and optimal solution for these issues of a heterogenous wireless network has been presented by focusing different standards of video streaming such as multi-user streaming, rate allocation, link delay and bandwidth aggregation.The careful observation and quality-aware multi-paths philosophies are the fundamental principles to make good decisions without debarment on each path.The important factor of the heterogeneous radio network is the bandwidth aggregation which increases the consistency and throughput.LBTA excels in getting provisions of Peak Signal to Noise Ratio (PSNR) and improves Video PSNR average ratio compared to other schemes like D-EMS, SEMS and EDPF.

Keywords: Heterogeneous Wireless Network, Video streaming, multiuser, link delay.

I. INTRODUCTION

The existing wireless cellular network has largely resulted in a homogeneous mode. These homogeneous networks have base stations(BS) and clients with modular technical characteristics along with their profiles. In the homogeneous network, compatibility can be achieved only when each base station is balanced properly and planned carefully. But this homogeneous network is more complicated, less flexibility and costly for video streaming. So, the mentioned drawbacks can be overcome in a heterogeneous network, where base stations have improved interfaces for concurrent usage by increasing spectral efficiency. A heterogeneous network is made up of Wi-fi, E-Utran, WiMAX etc called Radio Access Network(RAN) technologies. These multiple interfaces are capable to increase bandwidth, adopts latest deployment model, less cost effective to deliver the data to the destination. A new problem such as delay owing to presumptive packet recording [1] is due to uncertainty paths properties. The careful observation and quality-aware multi-paths philosophies are the fundamental principles to make good decisions without debarment on each path [2]. A streaming scenario is designed by high-speed heuristic-based algorithm capable to adapt packet rate and a channel bandwidth of server [3].

The parallel processing mechanism provides various throughputs by increasing the possibilities for video streaming in a multiuser environment. Limited bandwidth and data delay in multiuser data transfer must be handled carefully by using some mechanism to synchronize at the receiving end [4]. Severe confusions affect performance level if the video streaming issues are not resolved[5][6]. Quality-aware multipath schemes must be adopted and properly utilized by the heterogeneous network to overcome complicated process such as video streaming in a multiuser environment [7]. In random channels, error correction technique plays an important role in maintaining a quality of the video during streaming in a wireless network [8]. For the application such as live telecast and video conferences, the network must be able to support fast traffic for video data transfer. [9]

II. VIDEO STREAMING CHALLENGING ISSUES

The following are the challenging issues for video streaming over a heterogeneous wireless network.

a. Network uncertainty
b. Rate allocation
c. Loss-Tolerant Bandwidth Aggregation

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d. Data Delivery
e. Video Packet selection and scheduling
f. Multiple users

*Network uncertainty***:**

The main purpose of any network is to provide reliable communication which plays a crucial role. In radio communication technology, there is a huge demand for the promptly moved clients(MC) able to connect to multiple connections at the same time but not to the same type of network. Moved clients should acquire necessary features of various wireless technologies to achieve better Quality of Service [10]in order to assist users requirements. Based on network conditions intellect designs helps in making a number of a feasible decision. Fuzzy logic tools can be applied to the different network conditions.

Rate Allocation:

In the mutual wireless network, multiple video streaming sessions are carried separately along with cautious rate allocation. To avoid network congestion and by utilizing the network resources in a well-organized manner. A Jamming distortion optimization scheme was introduced within multiple video streams. During encoding, if the allocated rates are decreased then it trails to higher video distortion. At the application layer, the link state monitor of MAC layer and video rate controller must be permitted to exchange information with cross-layering.

Loss-Tolerant Bandwidth Aggregation:

The important factor of the heterogeneous radio network is the bandwidth aggregation which increases the consistency and throughput. To overcome the burst loss failure heterogenous wireless network bandwidth aggregation methodology was examined to handle the path diversity of network and to decrease consecutive packet loss. This examination was carried out based on Gilbert loss [11] design and unbroken structure Markova time chain designs. LBTA excels in getting provisions of Peak Signal to Noise Ratio (PSNR) and improves Video PSNR average ratio compared to other schemes like D-EMS, SEMS and EDPF.

Data Delivery:

For FTP data transfer it makes use of solution called SCTP to achieve quality aware concurrent multipath transfer real-time video delivery in a heterogeneous radio network. Message behaviour ability at every path is repeatedly inspected and determined by the CMT-QA to select deserved path by formulating liberated data procedures. Data transfer rate and data sharing are managed during transmission on every path separately by using various progression mechanisms which is a part of CMT-QA. Redundant retransmissions as well as minimizing reallocation delay can be moderated by this above-said method.

Video Packet Selection & Scheduling:

Multipath streaming is an inevitable condition for delivering good quality of video packet and scheduling. During distribution time, the mutual selection of network path and video packet to be broadcasted to be integrated into the streaming procedures. Simple streaming representation was introduced by considering video packet consequences and dependencies as a function of streaming approach, timing analysis must be done to achieve excellence for a controlled payback delay at a receiver side [12]. Based on a predominant problem of video concept model, the server can precisely predict the state of the network to be derived. For this reason, load balancing principles along with fast heuristic-based algorithm are combined for analysis.

Multiple Users:

The upcoming trend in the wireless network is to provide a good Quality of Service(QoS)[13][14]. In multiple user video streaming, the problem of QoS is taken into consideration more than multiple wireless heterogonous networks to influence on cross-layer design with a distributed framework. Both dynamic movement adaption and source coding techniques are taken as QoS parameters under the homebound resource availability. For framing video, Available Bitrate(ABR) and Round-Trip Time (RTT) are the two principal parameters [9].

III. OPTIMAL SOLUTIONS

The various optimal solutions available are:

a. Optimal Data Rate control for video stream Transmission over wireless network
b. OFDMA optimal resource allocation to support multimedia traffic in wireless network
c. Packet transmit permission for real-time traffic

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Optimal Data Rate control for video stream Transmission over wireless network

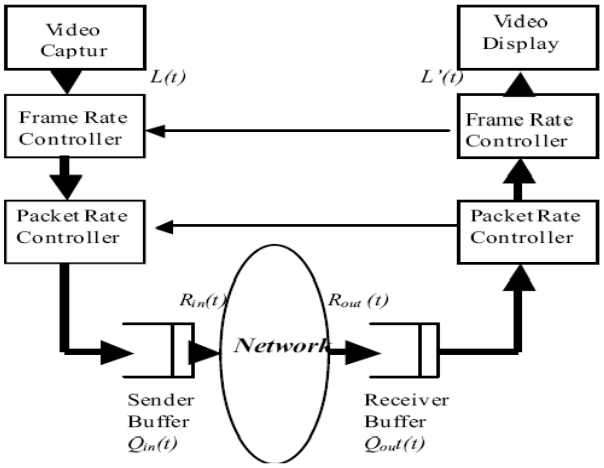

Fig. 1 Video Stream Transmission Model.

Rin(t) and Rout(t) are the incoming and outgoing transmission rates from and to the transmission network[15].

$$Rout(t+T)=Rin(t)-w(t) \quad ---(1)$$

Is the relationship between Rin(t) and Rout(t). where,

Notations	**Description**
T	Network delay of data packet transmission
Qmax	Allocated client buffer size
W(t)	Packet loss rate
Q(t)	Client buffer packet size
L(t)	Display rate
E(t)	Variation between Qmax and Qin(t)

Table 1. Notations used in expression.

Packets to be transmitted dynamically/automatically based on the buffer size of the packet and display rate, instead of transmission at a fixed rate. To achieve the optimal transmission rate Linear Quadratic(LQ) tracker is used which minimizes the bandwidth allocation and maximize the buffer utilization [16][17].

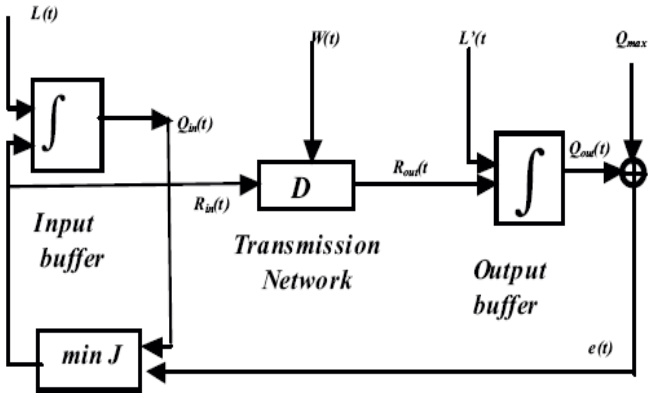

Fig. 2 Simulation Model.

The optimal numerical values for the video is given below in the table.

Video Format Coding Frame Size	Motion JPEG
	320*240
Frame Rate	30fps
Color Depth	3byte(Full Color)
Average Compression Rate	1/15
Video Scene	Star wars
Average Playback Rate	3.68 Mbps
Observed Packet Error Rate	0 ~ 30%
Network Speed	11 Mbps
Max. Buffer Size at client	1 Mbps
Weight functions m	0.1, 0.3, 1.0

Table 2. The Numerical values of Video source.

OFDMA Optimal resource allocation to support multimedia traffic in wireless network

In a cellular wireless network, Orthogonal Frequency Division Multiple Access (OFDMA) supports various demands of multimedia traffic system capacity on various fold can be increased by using OFDMA coding techniques and adaptive modulation methods. Two-stage rate Adaptive (TSRA) algorithm is proposed to encounter dynamic bandwidth requirement in the downlink in an efficient manner [18]. To support dynamic resource requirement of a multimedia traffic, Bandwidth Adaptation(BWA) algorithm and Adaptive Modulation techniques are employed by TSRA algorithm, to deal with real-time variable bit rates BWA is invoked dynamically.

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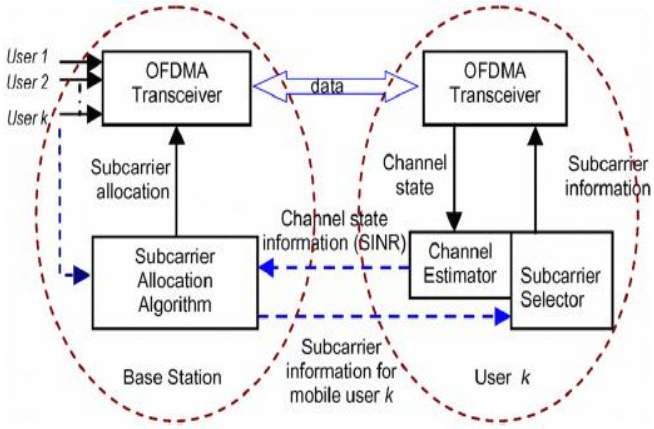

Fig. 3 Downlink OFDMA System Model.

Fig 3. Shows the transceiver system model of OFDMA. The input data stream has been fragmented into N parallel data streams by the transceiver system. This system is also known as Discrete Simulation Modulation scheme because a large number of evenly spaced subcarriers are modulated instead of single carriers [19].*Packet transmit permission for real time traffic:*

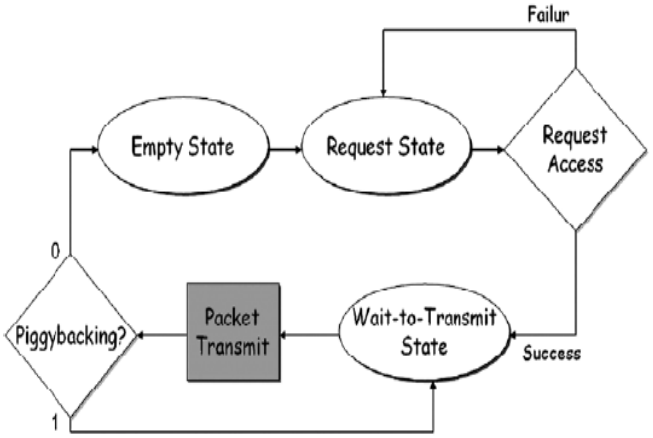

Fig. 4 State transition diagram of real time systems.

Packet transmission policy is one of the important factors of traffic control is a wireless network because it is served to decide whether a new connection to be accepted or not by the network [20][21]. One of the three states of the real-time station are

1. Empty
2. Request
3. Wait to transmit

Empty state is the state where the station buffer size is empty. During empty state, if the packets are entered into a station, it is called Request state[22][23][24]. The station sends the requests and stays in request state till it is served via request access by the Access Point(AP)[25][26][27].

The following are the tasks performed by the Access Point

1. The buffer of the voice sources is scanned as per priority order by the Access point.
2. One token from the token buffer is removed when a token is found and re-polls.
3. When the station receives a poll, packets are transmitted at specific intervals.
4. Next token is generated by the Access point for voice source.
5. Access point continues to scan for a token buffer if no tokens found.
6. If there are no token found by an Access point in token buffer, then Access Point does not which stations have packets to transfer.

IV. CONCLUSION

Heterogenous wireless Network has influenced with a lot of research possibilities at diverse sections of wireless communication specifically in video streaming. In this paper, we have tried to address several challenging issues and various methods of optimal solution to overcome these issues. Heterogenous network is to provide communication which makes a striking impact on its users. Here, we also have presented channel allocation concept for downlink and about OFDMA designed for shaping the simulation process.OFDMAsupports various demands of multimedia traffic system capacity on various fold can be increased by using OFDMA coding techniques and adaptive modulation methods.

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