International Journal of Engineering and Advanced Technology (IJEAT)
ISSN: 2249-8958 (Online), Volume-8 Issue-6, August 2019

# Video Transmission In Wireless Multihop Networks

**L.Jenila, R.Aroul Canessane**

***Abstract:*** ***Multi hop wireless networks are being deployed in many video streaming applications because they have several potential features for next generation wireless communications. Though optimal encoding techniques offers significant quality retention in video transmission still it is insufficient to overcome the challenges ahead over wireless network transmission. In order to support wide range video communications in an efficient way certain Quality of service has to be retained in multi hop wireless network. To address this issue, this paper investigates several encoding and routing protocols video delivery over multi hop wireless networks. Specifically, we first investigate several encoding framework for videos and wireless data transmission over WMNs through individual paths; we then investigate the challenges ahead to formulate resistant routing model for least possible video quality dictions which incorporate channel status as well as the encoder properties over video characteristics. In this framework, routing techniques which can maximally used to achieve good video traffic with improved system performance. However, video streaming also have very stringent delay requirements, which makes it difficult to find optimal routes with the least possible distortions. To address this problem, we investigate several enhanced version of packet scheduling techniques for video communications over multi path multi hob multi user wireless network environment.***

***Index terms:*** ***Video communications, multi-hop wireless network, routing, video traffic analyses etc.***

## I INTRODUCTION

Due to the recent advancements that emerged in 5G telecommunications [1-2], video based applications are playing significant roles and the demands also increased to maximize the video transmission quality and regulate the video traffic, which always requires unique optimization techniques. Though the video transmission quality metrics are proved to be unique to an individual's still these transmission qualities are unstable and linear changes may happen in wireless networks that will degrade the overall performance. The current video traffic analyzes has shifted from video-centric to application-centric. Multi-hop routing is a promising paradigm to facilitate end-to-end frame loss alongside with transmission delay since each individual path will result with different level of distortions. Much encoding architecture has been proposed for video transmission, but the Routing Framework that can resist the video distortions is currently emerged and it has been widely investigated in many research works.

An important issues that arises while supporting multi-user video over wireless networks are as follows; (1) select the path which can optimize the end-to-end delay with maximized packet delivery (2) routing protocols that can reduce payload congestions which can utilize the traffic less network resources (3) to formulate routing according to the frame losses along each path in networks and select appropriate one which can minimize the video distortions.

In general video encoding standards are widely preferred such as MPEG-4 [2] or H.264/AVC [3] to reduce the video distortions that arises due to transmission losses

Many works have been [5-6] published to reduce the distortions over video transmissions. Though encoded information's increases the video quality in many ways still performance degradations will happen due to the variations that arises over end-to-end quality metrics for each individual's path. Depends on applications and tolerable video distortions at the destination side over multi-hob networks quality of service can be improved only through dynamic programming approach due to following issues:

*1) Heterogeneity:*

Video transmission over in wireless multi-hop networks should exploit both peer-to-peer packet loss probabilities of each path and the tolerable resistant of any particular applications over distortions.

*2) Delivery rate:*

It is essential to meet minimum QoS requirements for each video class, while maximizing rate of transmission by optimizing end-to end path delay using appropriate routing protocols.

*Resource assignment:*

In multi hop networks each node has multiple video interfaces; to support multiple users with improved system capacity. So it is essential that the routing protocol should distribute video traffic crosswise the disparate paths in accordance to: 1) the tolerable distortion level and 2) frame losses (as discussed in Section 2).

In general the primary objective of any of these encoding techniques is to minimize the distortion level due to the data compression and the routing techniques is to minimize the channel losses due to data transmissions both are subject to the bit-rate constraint.

**Revised Manuscript Received on August 30, 2019.**
*Correspondence Author
**L.Jenila*,** Research Scholar, Department of Computer Science and Engineering, Sathyabama Institute of Science and Technology (Tamil Nadu), India. E-mail: jenilacse@gmail.com
**Dr. R.Aroul Canessane,** Professor, Department of Computer Science and Engineering, Sathyabama Institute of Science and Technology (Tamil Nadu), India. E-mail: aroulcanessane@gmail.com

## II. VIDEO DISTORTION AND TRAFFIC ANALYZES

### *A. Encoding methods*

Video encoding for wireless applications [7-8] has been used widely used widely used for the transmission of standard definition (SD) and high definition (HD) videos. It is preferred for following requirements (1) to improve coding efficiency to accomplish multi mode video transmission over channels (2) to upgrade the quality of services of video transmission over wireless data transmissions (3) extending the range of environments and applications with video streaming (4) to ensure the trade off measures between payload rate and achievable quality metrics to improve the network capacity and user rate. Here information's are encoded independently for each frame (I-frame) or relative information's (B and P-frames) are considered. This multi modal frame allows exploiting frame losses into a distortion metric. Depends on required application-level performance and mode of video transmissions links these frames can be used accordingly to assess the path loss.

In method [9] used video quality estimation with some reference video sequence to improve the which is related to human perception using video quality metric (VQM) scores rather than bit-error rate that has least correlative measures with the achievable visual quality .

In [10] rate-distortion (RD) model is proposed which is monitored the potential error propagation and video characteristics, network conditions. And appropriate distortion map is generated according to the potential error-propagated over each frame. Her channel distortion is modeled using Lagarangian parameter.

The hash function based used distributed video coding (DVC) is also prominently in many video transmission which is largely depends on used motion-compensation and prediction techniques. In [11] low complexity encoding is used which is formulated based on scalable Wyner-Ziv video coding model. Here both prediction and temporal correlative measures were used with the aspects of the high compression performance. In other view, particular encoder model can be made in several ways one can't prefer at early stage. But vulnerabilities are predicted, the remedies can be made quite easily in all these methods.

In recent years High Efficiency Video Coding (HEVC) [12] is emerged and outperformed H.264/Advanced Video Coding (AVC) standard. HEVC adopts unique block partitioning schemes which exploits various texture characteristics very well and incorporate several supervised data mining process [13] to improve the system performance.

### *B. Wireless Multi hop Networks*

In recent years, many scheduling and routing methods have been proposed [14-16] to regulate the video traffic over wireless multi-hop networks

*Distributed network architecture.*

In order to support wide range of videos and regulate the video traffic to avoid network congestions both data rate and routing end-to-end path for each video streams are changed dynamically based on network traffic over the chosen path and routing efficiency. In [17] cross-layer design is proposed where the channel information's are exchanged according to boost the network capacity. In [18] Multi-hop hierarchical routing protocol is accomplished to formulate Video traffic over Wireless Multimedia Sensor Networks (WMSNs). Here path links are selected based on network congestions and energy level associated with each node.

In [19] in order to validate the potential merits of scheduling schemes both its ability to enhance quality of service and escalate the transmission delay without using advanced video coding techniques are analyzed. On the other side several works has been published to regulate the resource utilization rate. Heuristic – integrated network architecture with appropriate link-controlled routing tree algorithm is used [20] to enable multiple user gateways with improved network throughput rate.

*Channel-aware distortion driven network*

In [21] general distortion model is constructed according to the network congestion mechanism and tolerable level of distortion for that particular video stream.

In [22] involves with dynamic programming (DP) framework which utilize attributes such as Channel, Deadline, and Distortion heuristically for scheduling process. And these combinations of real-valued vectors are validated over H.264/MPEG-4 AVC coded videos.

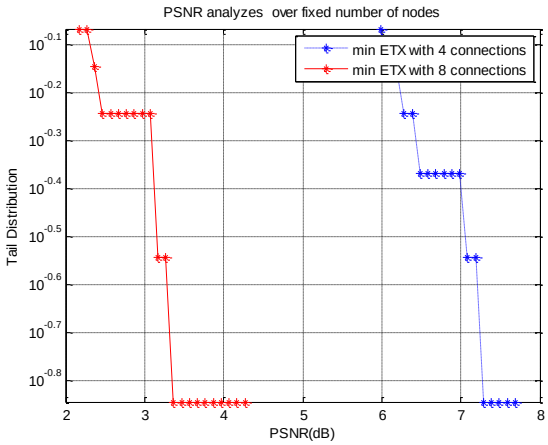


**Figure 1 : Tail distribution analyzes over fixed number of nodes**

In [23] scalable video streaming model is derived which supports video transmissions over heterogeneous access networks for more than one client webbing and the possibility tradeoff between perceived accuracy in terms of quality over complexity level is proved.

In general deterministic packet scheduling widely preferred over haphazard packet scheduling in sequence to synchronize the distortion level inside the bounded limits. Though several heuristic network routing models have been proposed to incorporate all above feature metrics, still they cannot meet demands in the following criteria: (i) To formulate the evolution of the video loss process over end-to-end transmissions (ii) to formulate the collision of the wireless network on video distortion.

*Retrieval Number: F9349088619/19©BEIESP*
*DOI: 10.35940/ijeat.F9349.088619*
*Journal Website: www.ijeat.org*



*Published By:*
*Blue Eyes Intelligence Engineering and Sciences Publication (BEIESP)*

This paper investigates the approaches that deal with routing policy for lease possible distortion and correlative measures of packet losses that greatly influence video distortion.

## III. DISTORTION-RESISTANT ROUTING FRAMEWORK & RESULTS

The necessity of a unique set of QoS parameters (packet loss, perceived quality) for each wireless video streaming application gives rises intrinsic time-varying routing topological changes which provides optimal solutions to these stringent QoS requirements. Moreover the effect of the packet loss is not directly related video quality since positions of each frames has direct impact on the perceived video distortion. In our recent survey we can conclude that routing protocols for video traffic always tend to add QoS metrics as prominent novelty, while encoding standing schemes typically involves for better video quality which is relate to frame losses. To exploit both properties and to get their relative strengths, combinations of the above are jointly consider proposed in many recent works.

**TABLE I. Analysis of video traffic over multi hop network**

| Author | Methodology used | Merits |
|---|---|---|
| Goudarzi et al.,[24] | Optimal rate allocation | Here video flow is multiplexed over different path as traffic sub-stream which increase the perceived video quality |
| Wu, Dalei, et al.,[25] | Quality-driven cross-layer optimization framework | Here both routing path selection and video coding are jointly optimized thereby reducing distortion level with given delay constraint. |
| Gomes, Rafael Lopes, et al., [26] | Optimized Link State Routing protocol | Here fuzzy system is used to evaluate link quality metrics, such as Expected Transmission Count (ETX) and Minimum Delay (MD) with achievable QoS. |
| De Felice et al.,[27] | Distributed Beaconless routing protocol | Multi-hop, multi-path, and dynamic routing protocol is used to evaluate live video streaming in VANETs. |
| Wu, Jiyan, et al.,[28] | Concurrent Multipath Transfer model | Here per-path channel status estimation -congestion control - rate allocation- retransmission over loss is jointly considered. |
| Usman, Muhammad, et al.,[29] | Light-weight Error Concealment technique | To regulate the data-rate with improved QoS Scalable High efficiency Video Coding (SHVC) is applied at each multimedia sensor nodes. |

**TABLE II. Analysis of routing transformations made for video transmissions**

| Author | Transformation type | Merits |
|---|---|---|
| Mao, Shiwen, et al.,[30] | Genetic algorithms (GAs) is used complex cross-layer driven optimization | Optimal multipath routing results lower bound distortion. |
| Kandris, Dionisis, et al., [31] | Energy efficient routing paths are selected | Analytical distortion prediction model enables minimal video distortion due to any type of error pattern. |
| Ehsan, Samina, and Bechir Hamdaoui [32] | Optimal energy and application-specific QoS aware routing | Multi-channel routing brings great potentials for handling high bandwidth data. |
| Mezher et al.,[33] | Multimedia multi metric map-aware routing protocol | It can manage fast video transmissions in VANETs to enable fast warning of the incident. |

Hybrid combined approach is proposed in Usman, Muhammad, et al.,[29] to interpret the issue of video quality distortions due to packet loss when considering high data rate data transmissions. An analysis in [34] showed the efficiency of topology-based routing protocols for least possible frame loss ratio and PSNR over VANET test bed.

In [35] field-based routing protocol is investigated which accomplished routing potent driven by a variable field type evaluated by Poisson's equation. This routing style considers congestion degree in sequence to improve throughput rate and optimize peer-to-peer transmission delay with deliberate video quality.

## VI. CONCLUSION

This paper presents an extensive survey on various routing techniques and its metrics over video transmission in multi hop wireless network etc. This paper investigates several routing techniques for video transmissions based on wireless network. We begin our study with the encoding framework for video traffic analyzes perspective. We further identify that the strict distortion level requirement for video transmissions is the major limitations that hindering the overall system performance.

## REFERENCES

1. Stockhammer, Thomas, and Miska M. Hannuksela. "H. 264/AVC video for wireless transmission." IEEE Wireless communications 12.4 (2005): 6-13.
2. Hsu, Chi-Yuan, Antonio Ortega, and Masoud Khansari. "Rate control for robust video transmission over burst-error wireless channels." IEEE Journal on selected areas in communications17.5 (1999): 756-773.
3. Stuhlmuller, Klaus, et al. "Analysis of video transmission over lossy channels." IEEE Journal on Selected Areas in communications 18.6 (2000): 1012-1032.
4. Khan, Asiya, et al. "Quality of experience-driven adaptation scheme for video applications over wireless networks." IET communications 4.11 (2010): 1337-1347.
5. Paulikas, Sarunas. "Estimation of video quality of H. 264/AVC video streaming." Eurocon 2013. IEEE, 2013.
6. Zhang, Yuan, et al. "Error resilience video coding in H. 264 encoder with potential distortion tracking." 2004 International Conference on Image Processing, 2004. ICIP'04.. Vol. 1. IEEE, 2004.
7. Deligiannis, Nikos, et al. "Wyner-Ziv video coding for wireless lightweight multimedia applications." EURASIP Journal on Wireless Communications and Networking 2012.1 (2012): 106.
8. Sullivan, Gary J., et al. "Overview of the high efficiency video coding (HEVC) standard." IEEE Transactions on circuits and systems for video technology 22.12 (2012): 1649-1668.
9. Díaz-Honrubia, Antonio Jesús, et al. "Adaptive fast quadtree level decision algorithm for H. 264 to HEVC video transcoding." IEEE Transactions on Circuits and Systems for Video Technology 26.1 (2016): 154-168.
10. Park, Soohong, and Seong-Ho Jeong. "Mobile IPTV: approaches, challenges, standards, and QoS support." IEEE Internet Computing 13.3 (2009): 23-31.
11. Chen, Bo-Wei, et al. "QoE-enabled big video streaming for large-scale heterogeneous clients and networks in smart cities." IEEE Access 4 (2016): 97-107.
12. Tu, Wanqing. "Efficient resource utilization for multi-flow wireless multicasting transmissions." IEEE journal on selected areas in communications 30.7 (2012): 1246-1258.
13. Zhang, Qian, and Ya-Qin Zhang. "Cross-layer design for QoS support in multihop wireless networks." Proceedings of the IEEE 96.1 (2008): 64-76.

14. Rosário, Denis, et al. "A hierarchical multi-hop multimedia routing protocol for wireless multimedia sensor networks." Network protocols and algorithms 4.2 (2012).
15. Zhou, Liang, Haohong Wang, and Mohsen Guizani. "How mobility impacts video streaming over multi-hop wireless networks?." IEEE Transactions on Communications 60.7 (2012): 2017-2028.
16. Tu, Wanqing, et al. "Resource-aware video multicasting via access gateways in wireless mesh networks." IEEE Transactions on Mobile Computing 11.6 (2012): 881-895.
17. Zhou, Liang, et al. "Distributed scheduling scheme for video streaming over multi-channel multi-radio multi-hop wireless networks." IEEE Journal on Selected Areas in Communications 28.3 (2010): 409-419.
18. Dua, Aditya, et al. "Channel, deadline, and distortion (CD 2) aware scheduling for video streams over wireless." IEEE Transactions on Wireless Communications 9.3 (2010): 1001-1011.
19. Freris, Nikolaos M., et al. "Distortion-aware scalable video streaming to multinetwork clients." IEEE/ACM Transactions on Networking (TON) 21.2 (2013): 469-481.
20. Wu, Dalei, et al. "Application-centric routing for video streaming over multihop wireless networks." IEEE transactions on circuits and systems for video technology 20.12 (2010): 1721-1734.
21. Gomes, Rafael Lopes, et al. "Using fuzzy link cost and dynamic choice of link quality metrics to achieve QoS and QoE in wireless mesh networks." Journal of Network and Computer Applications 34.2 (2011): 506-516.
22. De Felice, Mario, et al. "A distributed beaconless routing protocol for real-time video dissemination in multimedia VANETs." Computer communications 58 (2015): 40-52.
23. Wu, Jiyan, et al. "Distortion-aware concurrent multipath transfer for mobile video streaming in heterogeneous wireless networks." IEEE Transactions on Mobile Computing 14.4 (2015): 688-701.
24. Usman, Muhammad, et al. "A joint framework for QoS and QoE for video transmission over wireless multimedia sensor networks." IEEE Transactions on Mobile Computing 17.4 (2018): 746-759.
25. Kandris, Dionisis, et al. "Energy efficient and perceived QoS aware video routing over wireless multimedia sensor networks." Ad Hoc Networks 9.4 (2011): 591-607.
26. Ehsan, Samina, and Bechir Hamdaoui. "A survey on energy-efficient routing techniques with QoS assurances for wireless multimedia sensor networks." IEEE Communications Surveys & Tutorials 14.2 (2012): 265-278.
27. Mezher, Ahmad Mohamad, and Mónica Aguilar Igartua. "Multimedia Multimetric Map-aware Routing protocol to send video-reporting messages over VANETs in smart cities." IEEE Transactions on Vehicular Technology 66.12 (2017): 10611-10625.
28. Xu, Shouzhi, et al. "QoS evaluation of VANET routing protocols." Journal of Networks 8.1 (2013): 132.
29. Mei-Hsuan Lu, Pter Steenkiste, Tsuhan Chen, "Oppurtunistic Retransmission in WLANs", Mobile Computing IEEE Transactions on, vol.11, no.12, pp.1953-1969,2012.
30. George Papageorgiou, Membr, IEEE, ACM, Shailendra Singh, Srikanth V. Krishnamurthy, Fellow, IEEE, Ramesh Govindan, Fellow, IEEE, and Tom La Porta, Fellow, IEEE, "A Distortion-Resistant Routing Framework for Video Traffic in Wireless Multihop Networks", IEEE/ACM Transactions on Networking, vol.23, no.2, 2015.
31. Mahdi Mousavi, Anja Klein, "Decentralized Video Streaming in Multi-hop Wireless Networks: Incentive Mechanism and Energy Efficiency", IEEE Access PP(99):1-1, 2019
32. Afsane Zahmatkesh, Thomas Kunz,"Software defined multihop wirreless networks:Promises and challenges", IEEE Transactions on Journal of Communications and Networks, vol.19, no.6, 2017.
33. Sumit Singh, Upamanyu Madhow, Elizabeth M. Belding, "Shaping Throughput Profiles in Multihop Wireless Networks: A Resource-Biasing Approach', IEEE Transactions on Mobile Computing, vol.11, no.3, 2012.
34. Long Hai, Jie Wang, Ping Wang, Hongyu Wang, Tingting Yang, "High-Throughput Network Coding Aware Routing in Time-Varying Multihop Networks", IEEE Transactions on Vehicular Technology, vol.66, no.7, 2017.