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A Multi-Layer Data Routing on Multi-Hop Wireless Networks

[1]Mr.Ravishankar Kandasamy, [2]K.Bharathi, [3]S.V.Deepika, [4]S.Divya

[1]Assistant professor, Dept. of Electronics and Communication Engg., Paavai Engineering College, Namakkal, Tamilnadu, India
[2,3,4]UG Student, Dept. of Electronics and Communication Engg., Paavai Engineering College, Namakkal, Tamilnadu, India

***Abstract* - This paper deals with study of video streaming from a source to multiple receivers in wireless networks. This video is streaming with the help of intermediate users who forward the video to others. Two main challenges affect user satisfaction in the wireless network. The users usually have (i) different willingness to contribute (forwarding the video) (ii) different preference regarding the video quality. To overcome the challenges, we propose a framework based on a taxation mechanism in which the forwarding users, depending on their energy, are paid by their corresponding receivers. The video is layered such that the more video layers are received, the quality-of-experience (QoE) and the higher the price. Using a decentralized s coding scheme we define a user-specific utility function whose maximization determines the number of video layers a user wishes to receive. The utility function captures the users preferences including the importance of the video quality to her and her willingness to contribute. Our model supports the multicast transmission by which the receiver can use a common forwarder and share the cost. Simulation results show that the proposed model not only provides a higher QoE for the users and it is compared to the preference-agnostic models but also improves the network social-welfare.**

Keywords: Inter layer and Intra layer coding, source coding, Multi-layer video, Scalable video streaming and Video on demand.

I. INTRODUCTION

Wireless networks have been a crucial part of communication in the last few decades and enabling multimedia communication between people and devices from any location to share the information through the network. The commercial growth in the wireless networks was primarily in the late 1980s and 1990s. Early users of Wireless network primarily have been the Military, emergency services, law enforcement organization. Wireless networks are classified in two methods: Single hop and Multi hop communication networks. In multi hop communication, the video streaming is one way to deliver video and data over the internet. Using streaming technologies, delivers of audio and video over the internet can reach many millions of users using their Personal computers, PDAs, Mobile smartphones or other steaming devices. A streaming media player can be either an integral part of a browser, dedicated devices such as Apple TV, Roku player, iPod, etc. For streaming technology, UDP/IP(User Defined Protocol) is used which delivers the multi-layer flow as a sequence of small packets. The video streaming is compressed using a video codec such as H.264 or VP8.The audio streaming is compressed using an audio codec such as MP3, Vorbis or AAc.

The demand of portable devices such as phones, tab, and laptops are increasing. It demands for high definition video online with rise in video streaming. Wireless networks are inherently characterized by restricted high loss rates and high bandwidth, thus presenting a challenge for the efficient delivery of high video quality. Additionally, mobile devices can support a range of video resolution and qualities.

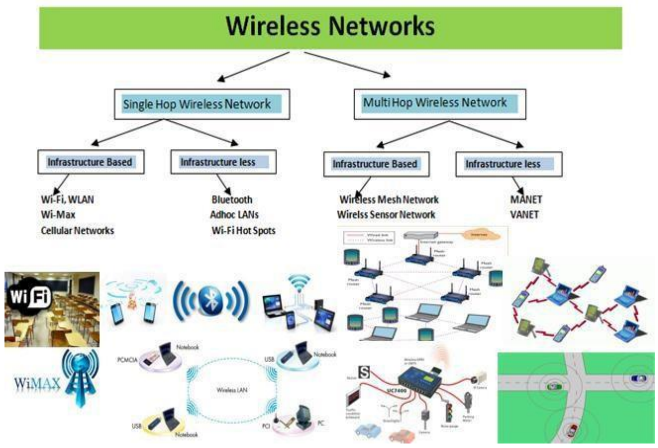

Figure 1: Classification of wireless network

In this project, we are interest in studying how to network coding can help in improving the performance of scalable video streaming over the wireless networks. We evaluate, the performance of based on generate scheme for multi-layer video traffic over a wireless network. The transmission over a lossy network may introduce a packet loss rate. Network

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coding scheme has shown its efficiency in such environment in the wireless networks.

II. LITERATURE SURVEY

Roger Immichet [1] "Towards aQoE-driven mechanism for improved H.265 video delivery" the main objective of the paper is improving video sequence with good quality of video streaming. The main drawback of this paper is error occurrence during the long distance transmission.

Hami [2] a promising approaches for video streaming over wireless by using video coding with network coding. This approach is video streaming over wireless, by using scalable video coding with network coding. The proposed solution is intended for one-hop wireless LAN network. PDR and end-to-end delay was calculated in order to evaluate the proposed approach against an original network coding approach. They explained how their approach is beneficial to video streaming; however they have provided very little information of how they have simulated such approach.

Sandeep Kaur [3] "Carrier Frequency Offset Estimation for OFDM Systems using Frequency-domain Techniques", the main objective of this paper is, for high speed mobile wireless communication is rapidly growing. Orthogonal frequency division multiplexing (OFDM) is a key element for achieving the high data capacity. The main drawback is effect of carrier frequency offset by Doppler shift.

A) System Architecture

We proposed a novel decentralized game theoretic algorithm for video streaming in wireless networks with one source to multiple receivers. We propose a joint incentive and taxation mechanism by which the nodes are contribute to the network and in return get paid by their respective receivers. Our design the video streams into the network by taking the preferences of individual users into account regarding their interest in high video quality and contribution to the network. Further, with our algorithm, the contributing nodes are not paid based on the energy they spend in the network for transmission of video layers to others but also based on the importance of their contribution for the remaining of the network. Every individual node that receives the video, including the source as the first node, distributes a so-called HELLO message in the network. This message contains the number of video layers and the corresponding VQM value of each and every individual layer. The game is child-driven, and after receiving the HELLO message, a node decides to the number of video layers she wants to receive and the corresponding PN for each layer.

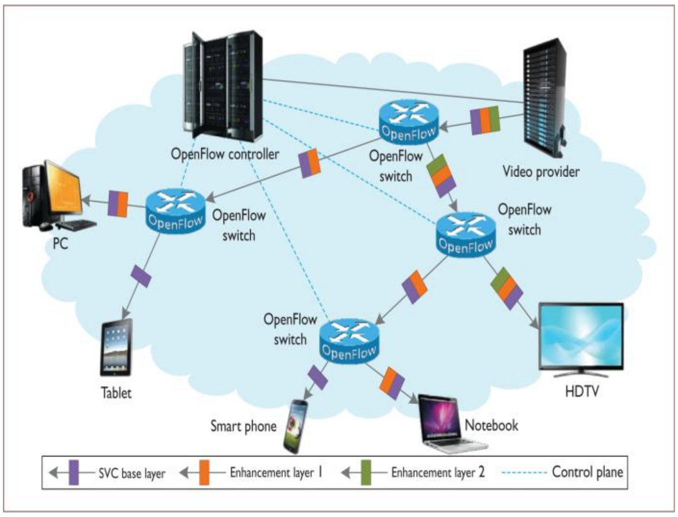

Figure 2: Flowchart for multi layer data routing

B) Content Placement

To studied the delivery cost minimization problem under a fixed topology by optimizing over content replication and routing. The investigated problem of maximizing the number of videos that can be simultaneously served by a collection of peers. Focused on minimizing the load imbalance of video servers while maximizing the system throughput. To label the problem of replica placement, client request routing, and multicast stream routing in media content distribution systems employing scalable streaming protocols. The authors formulated a simple optimization models for a variety of scalable protocols including hierarchical merging, patching, periodic broadcasts, and scheduled broadcasts. With the aid of additional constraints that must hold in the scalable delivery system solution, they showed that a variety of realistic scenarios can be solved exactly using available optimization software. They also showed that using the optimal conventional content distribution system for scalable delivery results in network costs. In our work, we use a class of network codes that enables fractional storage, which helps convert an NP-hard problem to a convex problem that can be solved exactly in a distributed manner. We also do not assume the topology is fixed, and instead also optimize over the topology selections. Our scheme does not require any prior knowledge of the video demand distribution.

C) Optimal Bandwidth Utilization

With regard to network resource utilization, solved a link bandwidth utilization problem assuming a tree structure with limited depth. An LP is formulated and under the expectation of symmetric link bandwidth, demand, and cache size, a simple limited greedy algorithm is designed to find a close-to-optimal solution. To introduce an LP-based heuristic to determine the number of video copies placed at customer

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home gateways. Both works assume a tree network structure. To minimize the load imbalance among servers subject to disk space and network bandwidth constraints. However, they only consider link capacity from servers. In contrast, our formulation allows the link capacity constraints that may exist anywhere in the network. To introduce a heuristic algorithm for VoD systems that reduces the bandwidth requirement. The transmission policy for peer-to-peer systems to efficiently deliver video data by exploiting the multicast capability of the network. They proposed a mathematical model to criticize the performance of their policies. However, the only consider upload bandwidth bottleneck. Our algorithm provides theoretical assurance of optimality.

D) Joint Intra–Layer and Inter–Layer Coding

In multi-rate multicast, network coding can be implemented within a layer (intra-layer coding) or across layers (inter-layer coding). Intra layer network coding is conceptually simpler than inter-layer network coding. Receivers are grouped into subsets that support the same rates. The rate of the base layer is selected such that it is platform by all multicast receivers, and a multicast network code for the base layer is formulated. The rate of the second layer is set such that, given the remaining capacity, it can be received by the bundle of receivers with the second lowest rate. Then a multicast network code for the second layer is designed and so on. Both algorithms first determine the max-flow (equivalent to the minimal cut) value to each receiver, using some well-known max-flow algorithm. To procreate the maximum layer constraints given by the max-flows of the receivers up coming the source, but they differ in how this is done. Decoding involves computationally excessive Gaussian elimination and storing data in its entirety before decoding is possible. Furthermore, both algorithms transport traffic on all upstream edges of the receivers, independent of whether they are needed for the multicast or not. This not only enforces lower layers on edges where higher layers could be transported but, more essentially, wastes capacity and thus may prohibit their use in networks where links are shared with other flows.

III. PROPOSED SYSTEM

In the proposed system, to study the video streaming with helpers in the case of multi-layer multi-videos and with the use of linear programming (LP).The problem of inter-layer NC is in general an NP-complete problem. Distributed approach to optimally utilize the helpers, it adapts the modulation in the requested videos .In contrast with the work to extend our solutions to consider the reliability of the links. In the DHT table whereby we create a track record of the data present the helper node this DHT table is maintained in sub server as and when the user request comes for a file the presence of data is checked in the sub server and there by forwarded to the respective helper node if the data is present in the helper node or else the data is sent from the main server. Network coding has been envisioned to increment throughput and deliver higher data rates than conventional source coding or no coding. Empirical evaluation of the proposed solution shows that all receivers can be given a rate equal to their max owns in all of the simulated instances. With the emergence of multimedia applications in business and entertainment, demand for real-time multipoint appliances such as multi-party gaming, videoconferencing and video on-demand services have expanded.

Multimedia data transfers typically contain large volumes of data, and hence redundant unicast transmission of the similar data to multiple receivers is likely to consume excessive network resources. The main solution to reduce the resource consumption is conventional unirate multicasting. However, if the receivers in same multicast session modify in their maximum flow rate from the source, unirate multicasting. In multirate multicasting where individual receiver rates depend on their max flow rates, is a preferred mode for distributing large content applications. One approach to achieve multirate multicasting is layered coding. Receivers subscribe to a layer cumulatively. If a receiver subscribes to layer and it also receives layers. The layers are incrementally combined at the receiver to provide progressive refinement. Rate control algorithms for multirate multicasting strive to make efficient use of the network resources.

IV. PERFORMANCE AND ALGORITHM

A) Game Theoretic Algorithm

This section, we propose a game theoretic framework for BT construction. We propose a non-cooperative game model for video in the network. The player of the game is all the nodes of the network except the source, i.e., the elements of the set P. Since we have a separate BT for the elements of the set P. since we have a separate BT for each of the layers, the player of the game for each layer are denoted by $p^{(l)} \subset p$.

B) Algorithm routing scheme

Step1: if there is at least one destination range n of S then
Step2: S conduct a transmission of source to destination
Step3: else
Step4: S conducts the following transmission with the same probability
Step5: transmission of source to relay
Step6: transmission of relay to destination
Step7: end if

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TABLE 1
Definition notation used through this paper

Notation	Definition
S	The source
D	The Destination
P	The set of all receiving nodes
Q	The set of all nodes in the network including the source, Q=P∪{S}
L	Total number of video layers

C) Algorithm: Transmission of source to destination

Step1: S randomly chooses a destination n its communication range
Step2: If the packet that the destination is requesting in its input queue of S then
Step3: S sends the packet to the destination from its input queue
Step4: else if the packet that the destination is requesting is in assistance-queue of S
Step5: Then S sends the packet to the destination from its assistance-queue
Step6: else
Step7: S keeps idle
Step8: end if

V. SIMULATION AND RESULT

In the following subsections, we present the simulation result of our study. We use ns-3 simulator to evaluate the performance of studied schemes. We evaluate muticast video transmission on a grid topology composed of 4×4nodes. The distance between nodes is set to 100m.we consider during this study two scalable bit streams generated using JSVM(Joint Scalable Video Model).The used scalable streams are encoded with two layer which corresponds to a quantization factor difference of 6 frame the base to enhancement quality layer. Table 1summarizes the simulation setup.

TABLE 2
Simulation Parameters

Parameter	Value
Number of nodes	20 nodes
Transmission range	150m
Node distance	100m
Simulation time	30 seconds
Channel bit rate	24Mbps
Maximum packet size	1500 bytes
Generation size	N=20 nodes

VI. CONCLUSION AND RESULT

In this paper, we propose a decentralized game-theoretic algorithm for joint video quality adaptation and overlay network creation in a multi-hop wireless network with one source and multiple receivers. To provide an incentive for the contributing users, the receiving users in this network pay their corresponding transmitting users via virtual currency. Further, to preserve the overlay network energy-efficiency, we design our algorithm based on a cost-sharing game. The cost of transmission in such a game is shared among the receiving users of a transmitter which not only reduces the cost of the receiving users but also helps in network energy efficiency by exploiting the multicast transmission.

Moreover, we propose a mechanism in our model which provides a higher reward for the users whose contribution has a higher impact on the video quality perceived by the others. In our model, we capture the preferences of the users concerning the video quality an individual user wishes to obtain and her preferred level of contribution to the network. With our algorithm, the users with higher willingness to contribute, regarding the energy they spend on delivering the video to others, are able to perceive a better video quality. In this work, our objective is to improve the social welfare and the quality-of-experience (QoE) of the users while preserving the network energy efficiency.

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