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AN ANTI-DISTORTION ROUTING SYSEM FOR VIDEO TRANSFER IN WIRELESS NETWORKS

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Abstract: Traditional routing metrics designed for wireless networks are application-agnostic. In this paper, we consider a wireless network where the application flows consist of video traffic. From a user perspective, reducing the level of video distortion is critical. Popular link-quality-based routing metrics do not account for dependence (in terms of congestion) across the links of a path; as a result, they can cause video flows to converge onto a few paths and, thus, cause high video distortion. To account for the evolution of the video frame loss process, we construct an analytical framework to, first, understand and, second, assess the impact of the wireless network on video distortion. The framework allows us to formulate a routing policy for minimizing distortion, based on which we design a protocol for routing video traffic. This protocol is efficient in reducing video distortion and minimizing the user experience degradation.

Index Terms—Protocol design, routing, video communications, video distortion minimization, wireless networks.

I.INTRODUCTION

Mobile Ad-hoc networks (MANETs) are composed by a set of independent mobile nodes which cooperates without any type of infrastructure[5], so the mobile nodes are free to move within a network which results in dynamic change of network topology. Other MANETs issues are limited bandwidth, lack of centralized monitoring, cooperative algorithms, limited physical security, energy constrained operations, etc. Ad-Hoc networks are categorized into two types of routing protocols, i.e. Table-driven routing protocols and On-demand routing protocols. Table-driven routing protocols are also known as pro-active routing protocols. These protocols attempt to maintain an updated routing table with routes to all known destination nodes in the network. This has the advantage of minimizing the delay during routes lookup and the disadvantage of these protocols is that it consumes a lot of network bandwidth. Whereas On-demand routing protocols only update the routing table in response to a routing request. This has the advantage of minimizing network traffic overhead and disadvantage of these protocols is increased delay[1]. Motivating application domains for such networks include data communication during emergency response in remote areas, or where a disaster (e.g., an earthquake) has fully or partially destroyed the existing infrastructure. Another application domain is battlefield communication. Given that an increasing amount of handheld devices now are capable of capturing and presenting video content, it is most likely that this will represent a significant percentage of the network traffic that in the future will be transmitted over MANETs. [3]. Video streaming in MANETs [1] is one of the most challenging issues. Video streaming in MANETs is mainly affected by these factors like node mobility,

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dynamic change in topology, multi path shadowing and fading, collusion, interference and many more. The dynamic change in topology causes periodic connectivity which results in large packet loss. Packet loss has the largest impact on the quality of the video. Video streaming in real time requires special techniques that can overcome the losses of packets in the unreliable networks [2]. Christo Ananth et al. [4] discussed about a system, In this proposal, a neural network approach is proposed for energy conservation routing in a wireless sensor network. Our designed neural network system has been successfully applied to our scheme of energy conservation. Neural network is applied to predict Most Significant Node and selecting the Group Head amongst the association of sensor nodes in the network. After having a precise prediction about Most Significant Node, we would like to expand our approach in future to different WSN power management techniques and observe the results. In this proposal, we used arbitrary data for our experiment purpose; it is also expected to generate a real time data for the experiment in future and also by using adhoc networks the energy level of the node can be maximized. The selection of Group Head is proposed using neural network with feed forward learning method. And the neural network found able to select a node amongst competing nodes as Group Head. In this paper, our project is that the user-perceived video quality can be significantly improved by accounting for ap- plication requirements, and specifically the video distortion experienced by a flow, end- to-end. Typically, the schemes used to encode a video clip can accommodate a certain number of packet losses per frame. However, if the number of lost packets in a frame exceeds a certain threshold, the frame cannot be decoded correctly. A frame loss will result in some amount of distortion. The value of distortion at a hop along the path from the source to the destination depends on the positions of the unrecoverable video frames (simply referred to as frames) in the GOP, at that hop. As one of our main contributions, we construct an analytical model to characterize the dynamic behavior of the process that describes the evolution of frame losses in the GOP (instead of just focusing on a network quality metric such as the packet-loss probability) as video is delivered on an end -to-end path. Specifically, with our model, we capture how the choice of path for an end-to -end flow affects the performance of a flow in terms of video distortion. Our model is built based on a multilayer approach as shown in Fig. 1. The packet-loss probability on a link is mapped to the probability of a frame loss in the GOP. The frame-loss probability is then directly associated with the video distortion metric. By using the above mapping from the network-specific property (i.e., packet-loss probability) to the application-specific quality metric (i.e., video distortion), we pose the problem of routing as an optimization problem where the objective is to find the path from the source to the destination that minimizes the end-to-end distortion.

Video encoding standards, like MPEG-4 [1] or H.264/AVC [2], define groups of I-, P- , and B-type frames that provide different levels of encoding and, thus, protection against transmission losses. In particular, the different levels of encoding refer to: 1) either information encoded independently, in the case of I-frames, or 2) encoding relative to the information encoded within other frames, as is the case for P- and B- frames. This Group of Pictures (GOP) allows for the mapping of frame losses into a distortion metric

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that can be used to assess the application-level performance of video transmissions.

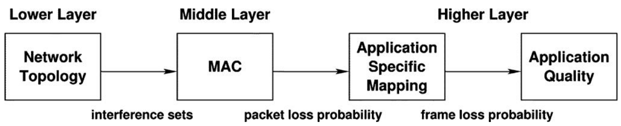

Fig. 1. Multilayer approach.

2. Related Work

The Potential Compressed Sensing [3] has been investigates for Video Streaming in Wireless Multimedia Sensor Networks. The Rate Control scheme is designed in order to Maximize the received video quality and to prevent the Network congestion while maintaining fairness between multiple video transmissions at the Receiver Side. Video Distortion is represented through Analytical and Empirical Models and at the Physical Layer based on the estimated channel quality the video Encoding rate and channel coding rate can be estimated. In order to avoid Congestion while maintaining fairness in the Domain of video quality rather than data rate the End-To-End Data rate is regulated [7],[8],[9]. In paper [5] [6] a new rate allocation algorithm is designed for Transform Domain Wyner-Ziv Video Coding (WZVC) without Feedback. Its objective is to design Intra-Frame Encoding and Complex Inter-Frame Decoding that is based on the Slepian-Wolf And Wyner-Ziv Distributed Source Coding Theorems. To allocate oroper Number of bits to Each Frame, Most Existing Wyner-Ziv Video Coding Solutions need a Feedback Channel (FC) at the Decoder. However, in many Video Coding Applications,The FC is not allowed. Moreover, the FC will introduce Latency and also the increase of Decoder complexity because several iterative decoding operations may be needed to decode the data to achieve target Video Quality. The Algorithm predicts the Number of bits for each Wyner-Ziv frame at the encoder as a Function of the Coding mode and the Quantization Parameters. Such Predictions will not significantly increase the complexity at the encoder. However, the prediction will be able to properly select the best mode and Quantization Parameter For encoding each Wyner-Ziv frame. Experimental Results show that the Algorithms is able to achieve good encoder rate allocation while still maintains consistent coding efficiency. Comparing To The WZVC[7] Coder With FC, this New WZVC Coder Without FC Induces only a small loss in Rate-Distortion Performance. The performance of video streaming over a multihop IEEE 802.11 wireless network is studied in [12], and a two-dimensional Markov chain model is proposed. The model is used not only for performance evaluation, but also as a guide for deploying video streaming services with end-to-end quality-of-service (QoS) provisioning. Finally, a recursion model is derived in [13] to relate the average transmission distortion across successive P-frames. None of these efforts considers the impact of routing on video distortion.

There have also been studies on the performance of video transmissions over 4G wireless networks that have been de-signed to support high QoS formultimediaapplications. In[14], an assessment of the recently defined video coding scheme (H.264/SVC) is performed over mobile WiMAX. Metrics such as the PSNR and the MOS are used to represent the quality of experience perceived by the end-user. The results show that the performance is sensitive to the different encoding options in the protocols and responds differently to the loss of data in the network. Again, these are single-link wireless networks, and routing is not a factor.

Cross-layer optimization and QoS routing is not new. An extensive body of research exists on routing algorithms for wireless ad hoc and mesh networks [15]. Furthermore, the survey in [16] provides various ways of classifying QoS routing schemes based on protocol evaluation metrics (transport/ap-plication, network- and MAC-layer metrics). However, none of the routing schemes presented in these surveys takes into account performance metrics defined for an application and specifically for video transfers. Even when a QoS routing is defined as application-aware, the applications need to specify throughput and delay constraints. This is in contrast to our approach, where an application-related performance metric, namely the video distortion, is directly incorporated into the route selection mechanism.Prior work on routing for video communications focuses on Multiple Description Coding (MDC). In [17] and [18], multi-path routing schemes are considered to improve the quality of video transfer. In [17], an extension to the Dynamic Source Routing is proposed to support multipath video communica-tions. The basic idea is to use the information collected at the destination node to compute nearly disjoint paths. In contrast with our approach, no analysis is provided in [17], and the evaluation of the scheme is based solely on simulations.A rate-distortion model is defined and used in an optimization problem where theobjectiveistominimizetheoverallvideodistortionbyprop-erly selecting routing paths. Due to the complexity of the opti-mizationproblem,agenetic-algorithm-basedheuristicapproach is used to compute the routes. Although the approach in [19] and [20] takes into account the distortion of the video, it does so using MDC. Our approach differs not only on the way we model video distortion, but also on the fact that we focus on LC, which is more popular in applications today.

3. SYSTEM ANALYSIS

3.1 Existing System:

- Different approaches exist in handling such an encoding and transmission. The Multiple Description Coding (MDC) technique fragments the initial video clip into a number of sub-streams called descriptions.
- Standards like the MPEG-4 and the H.264/AVC provide guidelines on how a video clip should be encoded for a transmission over a communication system based on layered coding. Typically, the initial video clip is separated into a sequence of frames of different importance with respect to quality and, hence, different levels of encoding.
- In another existing model, an analytical framework is developed to model the effects of wireless channel fading on video distortion.
- In other existing model, the authors examine the effects of packet-loss patterns and specifically the length of error bursts on the distortion of compressed video.

3.1.1 Disadvantages of Existing System:

From a user perspective, maintaining a good quality of the transferred video is critical.

- The video quality is affected by: 1) the distortion due to compression at the source, and 2) the distortion due to both wireless channel induced errors and interference.
- The model is, however, only valid for single-hop communication.

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- The existing model is used not only for performance evaluation, but also as a guide for deploying video streaming services with end-to-end quality-of-service (QoS) provisioning.

3.2 Proposed System:

- In this paper, our thesis is that the user-perceived video quality can be significantly improved by accounting for application requirements, and specifically the video distortion experienced by a flow, end-to-end. Typically, the schemes used to encode a video clip can accommodate a certain number of packet losses per frame. However, if the number of lost packets in a frame exceeds a certain threshold, the frame cannot be decoded correctly.
- A frame loss will result in some amount of distortion. The value of distortion at a hop along the path from the source to the destination depends on the positions of the unrecoverable video frames (simply referred to as frames) in the GOP, at that hop.
- As one of our main contributions, we construct an analytical model to characterize the dynamic behavior of the process that describes the evolution of frame losses in the GOP (instead of just focusing on a network quality metric such as the packet-loss probability) as video is delivered on an end-to-end path.
  - Specifically, with our model, we capture how the choice of path for an end-to-end flow affects the performance of a flow in terms of video distortion. Our model is built based on a multilayer approach.

Advantages of Proposed System:

- Our solution to the problem is based on a dynamic programming approach that effectively captures the evolution of the frame-loss process.
- Minimize routing distortion.
- Since the loss of the longer I-frames that carry fine-grained information affects the distortion metric more, our approach ensures that these frames are carried on the paths that experience the least congestion; the latter frames in a GOP are sent out on relatively more congested paths.
- Our routing scheme is optimized for transferring video clips on wireless networks with minimum video distortion.

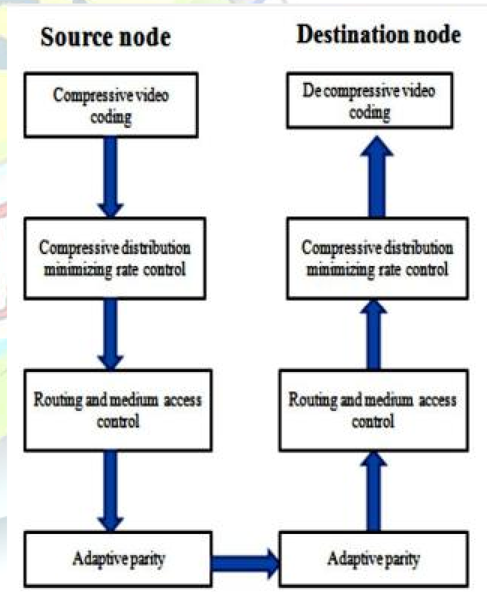

Fig 2 : Architecture

3.3 Proposed solution

3.3.1 Compressed Video Transmission

Sender selects the Compressed File that needs to be send to the receiver based on the Temporal Correlation at Low complexity. Here the Sender Node browse the Video File that already in the Compressed Format in-Order to reduce the size of the file so that file can be Sent to the Network effectively.

3.3.2 Video-On-Demand

The Compressed Video File is splitting in to 'N' Number of packets based on the Video-On-Demand. The packets are forwarded to the Buffer. The Packets Perform the action based on FIFO Queue. The First Packet added to the Queue is the first packet to be removed. So that the Video File can be received in FIFO order at the Receiver Side. The FIFO Receives Raw Video Data, buffers the raw capture Video Data at a rate, and transfers the raw capture Video data to the High Speed Memory. The Host FIFO Receives display Video Data from a remote source, Buffers the Display Video Data, and Transfers the input display Video data to the High Speed Memory. The PB FIFO reads capture Video Data and Display Video Data, During The PB Service, from the High Speed Memory to Provide an Input Queue for Video Compression and Video Decompression. The Display FIFO Receives, during the Display Service, Display Video Data from The High Speed Memory, and Buffers the Display Video data to Provide the Display Video Data at a Display Rate for the Host.

3.3.3 Video Encoder

Key Establishment in Sensor Networks is a Challenging Problem because Asymmetric Key Cryptosystems are Unsuitable for use in Resource Constrained Sensor Nodes and also the Nodes could be physically compromised by an Attacker. For Each and Every Splitted Packet a Unique ID can be assigned. So that the Video File can be Send Effectively to the Receiver. There are three types of General Key Agreement Schemes.1.Trusted-Serverscheme.2.Self-Enfourcing Scheme.3.Key Pre-Distribution Scheme. In this paper Key Pre-Distribution Scheme is Used. In Key Pre-Distribution Scheme the Information of the Secret Key is Distributed among all the Sensor Nodes prior to deployment. If we know the nodes that are in the same Neighborhood before Deployment, the Keys can be decided a priori.In this Paper we are concentrating on RSA Cryptographic Technique. Here in this Technique Key Generation is one of the important part, where we need to Generate both Public Key and Private Key. The Sender will be Encrypting the Packet with Receiver's Public Key And Receiver will be Decrypting using his own Private Key.

3.3.3.1 RSA Algorithm

RSA is an Algorithm Used or Public Key Cryptography.

Step 1: Select Random Prime Numbers P And Q, and Check That P != Q

Step 2 : Compute Modulus N = Pq

Step 3: Compute $\Phi(N) = \Phi(P)\Phi(Q) = (P - 1)(Q - 1)$

Step 4: Select Public Exponent E, Such That $1 < E < \Phi(N)$ And $Gcd (E, \Phi(N)) = 1$

Step 5: Compute Private Exponent D = E-1 (Mod Φ (N))

Step 6: Public Key Is {N, E},

Private Key Is D

Encryption: C = Me mod N,

Decryption: M = Cd mod N

Digital Signature: S = H(M)D mod N,

Verification: M' = Se mod N, If M' = H(M) Signature Is Correct. H Is A Publicly Known Hash Function.

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3.3.4 Minimum Distortion Routing Module:

This system is interested in applying redundancy to satisfy application specified reliability and timeliness requirements for wireless netwoks. Moreover, it aims to determine the optimal redundancy level that could satisfy QoS requirements while prolonging the lifetime of the WSN. Specifically, it develops the notion of "path" and "source" level redundancy. When given QoS requirements of a query, we identify optimal path and source redundancy such that not only QoS requirements are satisfied, but also the packet loss is minimized. We develop Minimum Distortion Routing (MDR)algorithm based on hop-by-hop data delivery to achieve the desired level of redundancy and to eliminate energy expended for maintaining routing paths in the WN.

In essence, the MDR routing policy distributes the video frames across multiple paths and in particular minimizes the interference experienced by the frames that are at the beginning of a GOP (to minimize distortion). The I-frames are longer than other frames. Their loss impacts distortion more, and thus these are transmitted on relatively interference-free paths. The higher protection rendered to I-frames is the key contributing factor in decreasing the distortion with MDR.

3.3.5 Load-Balancing:

Interflow packet order is natively preserved be setting slicing threshold to the delay upper bound at.Any two packets in the same flow slice cannot be disordered as they are dispatched to the same switching path where processing is guaranteed; and two packets in the same flow but different flow slices will be in order at departure, as the earlier packet will have depart from before the latter packet arrives. Due to the fewer number of active flow slices, the only additional overhead in, the hash table, can be kept rather small, and placed on-chip to provide ultrafast access speed. This table size depends only on system line rate and will stay unchanged even if scales to more than thousand external ports, thus guarantees system scalability.

4. Results

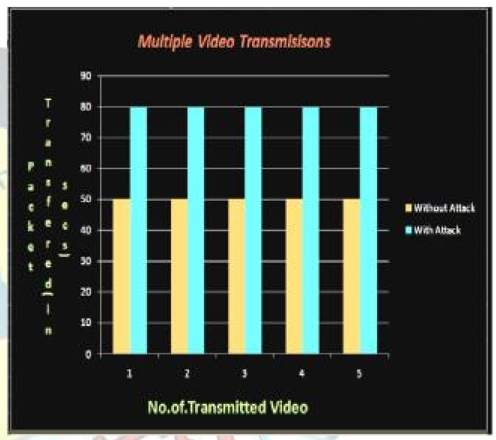

Fig. 3 Video Streaming Compression Results

5. Conclusion

In this paper we addressed the problem of packets dropped at an intermediate node or final node. Where the attacker is a part of the Network who is aware of Network secrets and also the implementation details. In order to Overcome the problem of dropped Packets we develop Adaptive Rate Control Scheme that Reconfigure the dropped Packets. We Analyze the Security of our schemes and through simulation we can achieve the higher throughput by Re-sequencing the dropped Packets.

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