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A Framework to Avoid Video Distortion in Wireless Multihop Networks

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Abstract: Traditional routing metrics designed for wireless networks are application-agnostic. In this paper, we consider a wireless network wherever the application flows consist of video traffic. From a user perspective, reducing the level of video distortion is important. we ask the question "Should the routing policies modification if the end-to-end video distortion is to be minimized?" popular link-quality-based routing metrics (such as ETX) 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 some paths and, thus, cause high video distortion. To account for the evolution of the video frame loss method, we construct an analytical framework to, first, perceive and, second, assess the impact of the wireless network on video distortion. The framework permits USA to formulate a routing policy for minimizing distortion, supported which we design a protocol for routing video traffic. We discover via simulations and test bed experiments that our protocol is efficient in reducing video distortion and minimizing the user experience degradation.

Keywords: MPEG, Multiple Descriptions Coding (MDC), Expected Transmission Count Metric (ETX).

I. INTRODUCTION

Video traffic has become a problem nowadays due to the increase in the use of wireless networks. Maintaining a good quality of video is very important. The video quality is affected by: 1) the distortion due to compression at the source and 2) distortion due to both wireless channel induced errors and interference. Groups like I, P and Btype frames provide different levels of encoding. In I frame information is encoded independently, in P and B frames information is encoded relative to information encoded within other frame. Video quality can be improved by accounting for application requirements. The schemes used to encode a video clip can accommodate a certain number of packet losses per frame. If the number of lost packets exceeds a threshold value then the frame cannot be decoded correctly. Thus, resulting a distortion. The value of distortion depends on position of unrecoverable video frames in the GOP (Group of Pictures). So, we construct an analytical model to view the behaviour of the process that describes the evolution of frame losses in the GOP. Using this we capture how the choice of path for an end-to-end flow affect the performance of a flow in terms of video distortion. Our model is built based on a multilayer on 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 and the frame loss probability is then directly associated with the video distortion Metric.

Using the above mapping from the network specific property to the application-specific quality metric, we indicate the problem of routing as an optimization problem where we can find the path from the source to the destination that can minimizes the end-to-end distortion. The solution for this problem is based on a dynamic programming approach that effectively captures the evolution of the frame –loss. After this we design a practical routing protocol, based on the above solution, to minimize routing distortion.

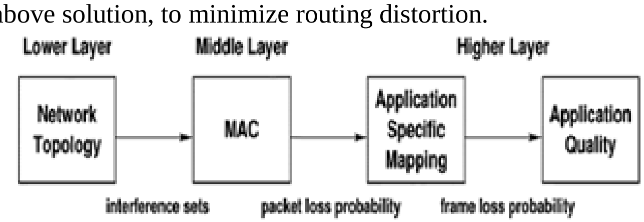

Fig.1. Multilayer approach.

A. Types of Networks

Organizations of different structures, sizes, and budgets need different types of networks. Networks can be divided into one of two categories:

- peer-to-peer
- server-based networks

Peer-to-Peer Network: A peer-to-peer network has no dedicated servers; instead, a number of workstations are connected together for the purpose of sharing information or devices. Peer-to-peer networks are designed to satisfy the networking needs of home networks or of small companies that do not want to spend a lot of money on a dedicated server but still want to have the capability to share information or devices like in school, college, cyber café.

Server-Based Networks: In server-based network data files that will be used by all of the users are stored on the one server. With a server-based network, the network server stores a list of users who might use network resources and usually holds the resources still. This will help by giving you a central purpose to set up permissions on the information files, and it will give you a central point from which to back up all of the information just in case data loss should occur.

II. LITERATURE SURVEY

A. Overview of the H.264/AVC Video Coding Standard

AUTHORS: Wiegand, G. J. Sullivan, G. Bjontegaard, and A. Luthra

H.264/AVC is newest video coding standard of the ITU-T Video coding specialists group and the ISO/IEC moving picture specialists group. The most goals of the H.264/AVC standardization effort are enhanced compression performance and provision of a "network-friendly" video representation addressing "conversational" (video telephony) and "no conversational"(storage, broadcast, or streaming) applications. H.264/AVC has achieved a significant improvement in rate-distortion potency relative to existing standards. This article provides an overview of the technical features of H.264/AVC, describes profiles and applications for the quality, and outlines the history of the standardization process.

B. A High Throughput Path Metric For Multi-Hop Wireless Routing

AUTHORS: D. S. J. D. Couto, D. Aguayo, J. Bicket, and R. Morris

This paper presents the expected transmission count metric (ETX), which finds high-throughput paths on multi-hop wireless networks. ETX minimizes the expected total number of packet transmissions (including retransmissions) needed to with success deliver a packet to the ultimate destination. The ETX metric incorporates the effects of link loss ratios, asymmetry in the loss ratios between the two directions of every link, and interference among the successive links of a path. In contrast, the minimum hop-count metric chooses arbitrarily among the various ways of constant minimum length, regardless of the often giant differences in throughput among those paths, and ignoring the possibility that a longer path might supply higher throughput. This paper describes the design and implementation of ETX as a metric for the DSDV and DSR routing protocols, further as modifications to DSDV and DSR which permit them to use ETX. Measurements taken from a 29-node 802.11b test-bed demonstrate the poor performance of minimum hop-count, illustrate the causes of that poor performance, and ensure that ETX improves performance. For long ways the throughput improvement is often a factor of two or a lot of, suggesting that ETX can become more useful as networks grow larger and paths become longer.

C. Packet Loss Resilient Transmission of MPEG Video Over The Internet

AUTHORS: J. M. Boyce

A method is proposed to protect MPEG video quality from packet loss for real-time transmission over the internet. Because MPEG uses inter-frame coding, comparatively tiny packet loss rates in ip transmission can dramatically reduce the standard of the received MPEG video. Within the proposed high-priority protection (HiPP) method, the MPEG video stream is split into high- and low-priority partitions, using a technique the same as MPEG-2 data partitioning. Overhead resilient data for the MPEG video stream is created by applying forward error correction coding to solely the high-priority portion of the video stream. The high- and low-priority information and resilient data is sent over a single channel, using a packetization technique that maximizes resistance to burst losses, while minimizing delay and overhead. Because the projected method has low delay and doesn't need re-transmission, it is well suited for interactive and multicast applications. Simulations were performed comparing the improvement in video quality using the Hippo technique, using experimental internet packet loss traces with loss rates in the range of 0–8.5%. Overhead resiliency data rates of 0.33, 12.5%, 25%, and 37.5% were studied, with completely different compositions of the overhead information for the 25th and 37.5% overhead rates, in a shot to find the “best” composition of the overhead information. In the presence of packet loss, the received video quality, as measured by PSNR and the Negsob measure, was considerably improved once the HiPP methodology was applied.

D. Layered Coded Vs. Multiple Description Coded Video Over Error-Prone Networks

AUTHORS: Y.-C. Lee, J. Kim, Y. Altunbasak, and R. M. Mersereau

Layered (LC) and multiple descriptions coding (MDC) have been proposed as supply coding techniques that area unit robust to channel errors for video transmission. LC and MDC have similar characteristics: they each generate multiple sub-bit streams, and it's permissible to drop some portion of the information from the sub-bit streams during transmission for each method. However, they are entirely different in the sense that the sub-bit streams for LC have different levels of importance whereas all sub-bit streams for MDC are equally vital. Since these two encoding techniques have similar properties, some performance comparisons between LC and MDC have recently been reported. However, these studies are still not conclusive because many scenarios haven't been carefully considered. Furthermore, they need been performed in numerous environments. in this paper, we further investigate the error-resilience capabilities of those two encoding techniques through extensive experimentation. Although a number of our conclusions agree with those within the literature, we believe that this paper provides the most comprehensive performance comparison yet between LC and MDC.

III. EXISTING SYSTEM

- Different approaches exist in handling such an encoding and transmission. The Multiple Description coding (MDC) technique fragments the initial video clip into form of sub-streams called descriptions.
- Standards just like the MPEG-4 and the H.264/AVC give guidelines on how a video clip ought to 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 various

importance with respect to quality and, hence, completely different levels of coding.

- In another existing model, an analytical framework is developed to model the consequences 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.

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 thanks to compression at the source, and 2) the distortion thanks to each wireless channel induced errors and interference.
- The model is, however, solely valid for single-hop communication.
- The existing model is employed not just for performance evaluation, however also as a guide for deploying video streaming services with end-to-end quality-of-service (QoS) provisioning.

IV. PROPOSED SYSTEM

- In this paper, our thesis is that the user-perceived video quality will be considerably improved by accounting for application desires, and specifically the video distortion experienced by a flow, end-to-end. Typically, the schemes used to write in code a video clip will accommodate a selected range of packet losses per frame. However, if the number of lost packets in a frame exceeds a certain threshold, the frame cannot be decoded properly.
- A frame loss can result in some amount of distortion. the worth 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) within the GOP, at that hop.
- As one of our main contributions, we construct an analytical model to characterize the dynamic behavior of the method that describes the evolution of frame losses among the GOP (instead of simply specializing in a network quality metric like the packet-loss probability) as video is delivered on an end-to-end path. Specifically, with our model, we capture however the choice of path for an end-to-end flow affects the performance of a flow in terms of video distortion. Our model is made supported a multilayer approach.

Advantages of Proposed System:

- Our solution to the matter 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.

V. MODULES

- Model Formulation
- Video Distortion Model
- Video Distortion Dynamics
- Optimal Routing Policy

A. Model Formulation

Our analytical model couples the functionality of the physical and mac layers of the network with the application layer for a video clip that's sent from a source to a destination node. The model for the lower layers computes the packet-loss probability through a set of equations that characterize multiuser interference, physical path conditions, and traffic rates between source–destination pairs in the network. This packet-loss probability is then input to a second model to compute the frame-loss probability and, from that, the corresponding distortion. The worth of the distortion at a hop along the trail from the source to the destination node depends on the position of the primary unrecoverable frame the GOP.

B. Video Distortion Model

Our analysis is based on the model for video transmission distortion. The distortion is broken down into source distortion and wireless transmission distortion over a single hop. Instead of focusing on a single hop, we significantly extend the analysis by developing a model that captures the evolution of the transmission distortion along the links of a route from the source node to the destination node. Assuming that the packet losses in different frames in the GOP are freelance events (likely if the fading patterns modification in between), the transition probabilities for the process, can be computed.

C. Video Distortion Dynamics

The value of the distortion at hop along the path from the source to the destination node depends on the position of the first unrecoverable frame in the GOP. The value 0 indicates that the first (I-frame) is lost, and therefore the whole GOP is unrecoverable. A value between 1 and denotes that the corresponding P-frame is the first frame in the GOP that cannot be decoded correctly, and the value indicates that no frame has been lost thus far, yielding a distortion. The dynamics of the process and therefore of the video distortion depend on the process.

D. Optimal Routing Policy

- In this module, our objective is to find the path that yields the minimum video transmission distortion between any source and destination. By using the analysis presented, we pose the problem as a stochastic optimal control problem where the control is the selection of the next node to be visited at each intermediate node from the source to the destination.
- In essence, the MDR routing policy distributes the video frames (and the packets contained therein) 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 alternative frames. Their loss impacts distortion a lot of, and therefore these are transmitted on comparatively interference-free paths. the higher protection rendered to I-frames is the key causative factor in decreasing the distortion with MDR.

VI. SCREEN SHOTS

Screen shots of this paper is as shown in bellow Figs.2 and 3.

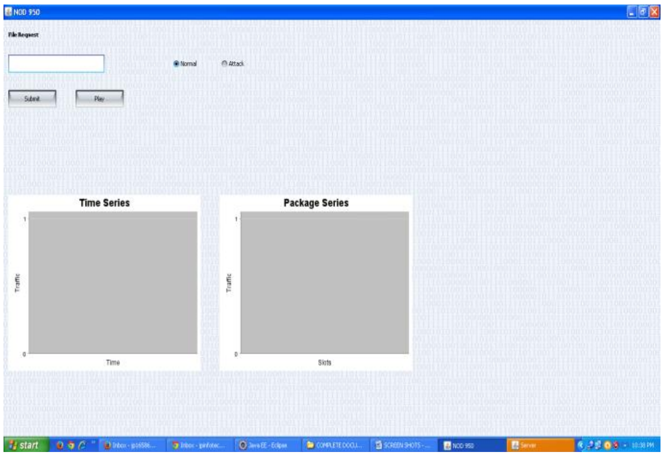

Fig.2.

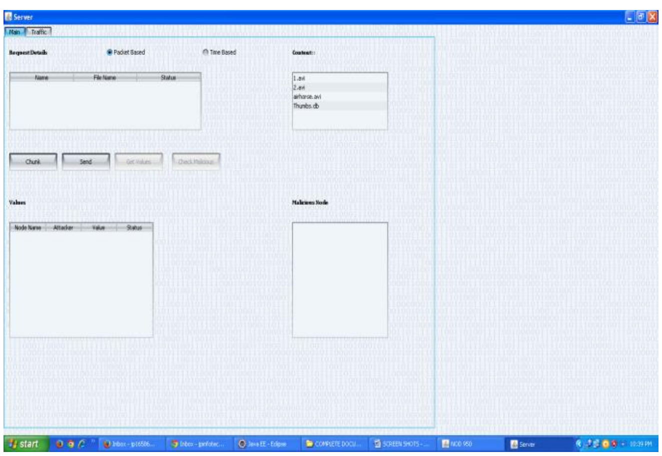

Fig.3.

VII. CONCLUSION

In this paper, we argue that a routing policy that is application- aware is likely to provide benefits in terms of user-perceived performance. Specifically, we consider a network that primarily carries video flows. We seek to understand the impact of routing on the end-to-end distortion of video flows. Toward this, we construct an analytical model that ties video distortion to the underlying packet-loss probabilities. Using this model, we find the optimal route (in terms of distortion) between a source and a destination node using a dynamic programming approach. Unlike traditional metrics such as ETX, our approach takes into account correlation across packet losses that influence video distortion. Based on our approach, we design a sensible routing scheme that we tend to then evaluate via extensive simulations and test bed experiments. Our simulation study shows that the distortion (in terms of PSNR) is decreased by 200th compared to ETX-based routing. Moreover, the user experience degradation due to increased traffic load in the network is kept to a minimum.

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