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RESEARCH ARTICLE

A Two Level Communication Analysis Approach for Effective Multipath Routing in MANET

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Abstract— ***In the recent years, the mobile communication is not limited only to voice transmission but it also includes the communication of different types of data such as video, text etc. The high quality video communication is still a challenge to provide the continuous and error free communication over the network. In this present work, a multipath video communication approach is suggested along with contention window analysis so that the effective communication will be performed. In this work, a hybrid route and frame analysis approach is suggested to perform the video communication over the multi-path. To attain the effective video communication, an analysis approach on two level next hop analysis to identify the congestion free communication node so that the effective transmission will be performed. This analysis will generate the different path based on the communication analysis on next hop. Another consideration of this work is the video data or frame anlaysis. These frames will be classified as the high quality and low quality data frames by performing the header analysis. This video frame analysis is defined as the frame prioritization approach in which, the high and low quality frames will be identified. The high quality frames will be send over the separate path whereas low quality frames will be transferred from other path. The presented work will be implemented in NS2 environment. The work is about to reduce the data loss and the communication delay so that effective throughput will be drawn.***

Keywords— ***Multipath, Video communication, Frame analysis, Route analysis, Next hop***

I. Introduction

The chapter mainly describes the basic terms related to presented work is given in detail. The basic terms discussed in the chapter are the Video Communication analysis and the relative parameters. The components of video communication are discussed such as bandwidth, security, transmission etc. The video networks are generally topology specific; because of this all the basic topologies are also discussed here. Later in the preceding sections of the paper, Multipath TCP is discussed along with its components and architecture. The benefits of the Multipath TCP network are also described here in following sections.

A. *Video Communication*

A video communication system consists of a transmitter which encodes a message into an video signal a channel which carries the signal to its destination, and a receiver, which reproduces the message from the received video signal. In video communication is a flexible, transparent communication made of very pure glass (silica) not much bigger than a human hair that acts as a waveguide or light pipe to transmit light between the two ends of the communication. Video fibers are widely used in communication-optic communications which permits transmission over longer distances and at higher bandwidths (data rates) than other forms of communication. Fibers are used instead of metal wires because signals travel along them with less loss and are also immune to electromagnetic interference.

B. *DATA TRANSMISSION TYPES*

Internet implements packet switching technology where all the packets are provided with IP addresses. The MTU size is 1500 bytes that carries all types of application data i.e. data; voice and video which is also termed as triple play technology. Certain problem in IP network are describe in later chapter however IP packet carrying data performance is efficient as compare to voice and video data. UDP and TCP protocols are mainly used for different data types while TCP provides connection oriented data transmission instead of UDP connectionless data transmission. Routing protocols running on different hops in an internet infrastructure performs destination address traversing by allowing shortest path towards IP destination address. Mainly it reduces performance if congestion happens at shortest path while TCP tries to make slow start to keep the link active, and due to some unutilized paths. Multipath TCP make use of label technology to limit these problems.

C. Multipath TCP

Multipath TCP is based on the concept of label switching: An independent and unique label is added to each data packet and this label is used to switch and route the packet through the network. The label is simple essentially a short hand version of the packet header information so network equipment can be optimized around processing the label and forwarding traffic. This concept has been around the data communications industry for years. X.25, Frame Relay, and ATM are examples of label switching technologies. Multipath TCP enables a single converged network to support both new and legacy services, creating an efficient migration path to an IP-based infrastructure. Multipath TCP operates over both legacy (DS3, SONET) and new infrastructure (10/100/1000/10G Ethernet) and networks (IP, ATM, Frame Relay, Ethernet, and TDM).Multipath TCP enables traffic engineering. Explicit traffic routing and engineering help squeeze more data into available bandwidth..Multi path TCP supports the delivery of services with Quality of Service (QoS) guarantees. Packets can be marked for high quality, enabling providers to maintain a specified low end-to-end latency for voice and video.Multipath TCP reduces router processing requirements, since routers simply forward packets based on fixed labels.Multipath TCP provides the appropriate level of security to make IP as secure as Frame Relay in the WAN, while reducing the need for encryption on public IP networks.

D. Difference between IP and Multipath TCP

It is important to understand the differences in the way Multipath TCP and IP routing forward data across a network. Traditional IP packet forwarding uses the IP destination address in the packet header to make an independent forwarding decision at each router in the network. These hop-by-hop decisions are based on network layer routing protocols, such as Open Shortest Path First (OPSF) or Border Gateway Protocol (BGP). These routing protocols are designed to find the shortest path through the network, and do not consider other factors, such as latency or traffic congestion. Multipath TCP creates a connection-based model overlaid onto the traditionally connectionless framework of IP routed networks. This connection-oriented architecture opens the door to a wealth of new possibilities for managing traffic on an IP network. Multipath TCP builds on IP, combining the intelligence of routing, which is fundamental to the operation of the Internet and today's IP networks, with the high performance of switching. Beyond its applicability to IP networking, Multipath TCP is being expanded for more general applications in the form of Generalized Multipath TCP (GMPLS), with applications in video and Time-Division Multiplexing (TDM) networks.

II. Related work

Multipath TCP is a technology used for optimizing traffic forwarding through a network. Though Multipath TCP can be applied in many different network environments, this discussion will focus primarily on Multipath TCP in IP packet networks, by far the most common application of Multipath TCP today.
Multipath TCP assigns labels to packets for transport across a network. The labels are contained in an Multipath TCP header inserted into the data packet (Figure 1).
These short, fixed-length labels carry the information that tells each switching node (router) how to process and forward the packets, from source to destination. They have significance only on a local node-to-node connection. As each node forwards the packet, it swaps the current label for the appropriate label to route the packet to the next node. This mechanism enables very-high-speed switching of the packets through the core Multipath TCP network.
Multipath TCP combines the best of both Layer 3 IP routing and Layer 2 switching. In fact, it is sometimes called a Layer 2-3 protocol. While routers require network-level intelligence to determine where to send traffic, switches only send data to the next hop, and so are inherently simpler, faster, and less costly. Multipath TCP relies on traditional IP routing protocols to advertise and establish the network topology. Multipath TCP is then overlaid on top of this topology. Multipath TCP predetermines the path data takes across a network and encodes that information into a label that the network routers understand. This is the connection-oriented approach. Since route planning occurs ahead of time and at the edge of the network (where the customer and service provider network meet), Multipath TCP-labeled data requires less router horsepower to traverse the core of the service provider's network.

A. Multipath TCP routing

Multipath TCP networks establish Label-Switched Paths (LSPs) for data crossing the network. An LSP is defined by a sequence of labels assigned to nodes on the packet path from source to destination. LSPs direct packets in one of two ways: hop-by-hop routing or explicit routing.

B. Hop-by-hop routing

In hop-by-hop routing, each Multipath TCP router independently selects the next hop for a given Forwarding Equivalency Class (FEC). A FEC describes a group of packets of the same type; all packets assigned to a FEC receive the same routing treatment. FECs can be based on an IP address route or the service requirements for a packet, such as low latency.

In the case of hop-by-hop routing, Multipath TCP uses the network topology information distributed by traditional Interior Gateway Protocols (IGPs) routing protocols such as OSPF or IS-IS. This process is similar to traditional routing in IP networks, and the LSPs follow the routes the IGPs dictate.

C. Explicit routing

In explicit routing, the entire list of nodes traversed by the LSP is specified in advance. The path specified could be optimal or not, but is based on the overall view of the network topology and, potentially, on additional constraints. This is called Constraint-Based Routing.

D. Label Information Base (LIB)

As the network is established and signalled, each Multipath TCP router builds a Label Information Base (LIB) table that specifies how to forward a packet. This table associates each label with its corresponding FEC and the outbound port to forward the packet to. This LIB is typically established in addition to the routing table and Forwarding Information Base (FIB) that traditional routers maintain.

E. Signalling and label distribution:

Connections are signalled and labels are distributed among nodes in an Multipath TCP network using one of several signalling protocols, including Label Distribution Protocol (LDP) and Resource reservation Protocol with Tunnelling Extensions (Improved Multipath TCP-TE). Alternatively, label assignment can be piggybacked onto existing IP routing protocols such as BGP. The most commonly used Multipath TCP signalling protocol is LDP. LDP defines a set of procedures used by Multipath TCP routers to exchange label and stream mapping information. It is used to establish LSPs, mapping routing information directly to Layer 2 switched paths. It is also commonly used to signal at the edge of the Multipath TCP network, the critical point where non-Multipath TCP traffic enters. Such signalling is required when establishing Multipath TCP VPNs, for example. Improved Multipath TCP-TE is also used for label distribution, most commonly in the core of networks that require traffic engineering and QoS. A set of extensions to the original Improved Multipath TCP protocol, Improved Multipath TCP-TE provides additional functionality beyond label distribution, such as explicit LSP routing, dynamic rerouting around network failures, pre-emption of LSPs, and loop detection. Improved Multipath TCP-TE can distribute traffic engineering parameters such as bandwidth reservations and QoS requirements. Multi-protocol extensions have been defined for BGP, enabling the protocol to also be used to distribute Multipath TCP labels. Multipath TCP labels are piggybacked onto the same BGP messages used to distribute the associated routes. Multipath TCP allows multiple labels (called a label stack) to be carried on a packet. Label stacking enables Multipath TCP nodes to differentiate between types of data flows, and to set up and distribute LSPs accordingly. A common use of label stacking is for establishing tunnels through Multipath TCP networks for VPN applications.

F. Multipath TCP Architecture

Multipath TCP architecture was easy in start but with unicast and multicast IP addresses the IP table lookup was complex and require more time than before. CPU capabilities for computing IP lookup table becomes limited and the bandwidth links were around 40 Gbps, which causes the link to be unused due to low processing speed or complex computations[7].
Network infrastructure for data communication is divided in to Control plane and Data plane. Control plane comprises of routing protocols, table, Signalling protocols etc. While Data plane forward packets between router and switches. Application specific ICs are built to perform data plane forwarding packets that enable IP packets as well as Label packets at identical data rate. In order to utilize the unused links or avoid congestion in the network can be done through implementing Multipath TCP technology.

III. Proposed work

Today data is not only communicated in textual form but also the communication data includes different kind of multimedia data. This media data includes the audio and video data. The video data is one of the most heavy data format communicated over the network. There is the requirement of some effective approach to perform the reliable video communication over the network. This communication is performed over the effective route over the network. In this work, an effective routing approach is defined for multimedia data communication. The presented work is divided in three main stages. The first stage is to divide the data in frames and to recognize these frames individually over the network. Once the frames are recognized, the network is to perform the analysis over the network to identify the effective route. In this work, a load analysis approach is defined to identify the effective node. In this chapter, the various aspects of the proposed work are shown.

A. PROBLEM DEFINITION

In the recent years, the mobile communication is not limited only to voice transmission but it also includes the communication of different types of data such as video, text etc. The high quality video communication is still a challenge to provide the continuous and error free communication over the network. In this present work, a multipath video communication approach is suggested along with contention window analysis so that the effective communication will be performed. In this work, a hybrid route and frame analysis approach is suggested to perform the video communication over the multi-path. To attain the effective video communication, an analysis approach on two level next hop analyses to identify the congestion free communication node so that the effective transmission will be performed. This analysis will generate the different path based on the communication analysis on next hop.

B. OBJECTIVE

1) The main objective of the work is to define a communication analysis and video frame analysis based hybrid approach for effective video communication over mobile network.
2) The objective of the work is to perform video communication over multi-path by perform two hop analysis.
3) The objective of the work is to generate multiple routes based on frame prioritization.
4) The objective of the work is to implement the work in NS2 environment.
5) The objective of the work is to analyze the work under different parameters.

C. Significance of Work

The significance of presented work is given here under
1) The presented work will perform the communication analysis based route selection so that the congestion free path will be identified that will reduce the data loss.

2) The presented work will perform a prior frame analysis and prioritization so that route selection at earlier stage will be performed.

D. Research design

In this present work, an effective multimedia data communication approach is suggested for mobile network. In this work, a multi-path video communication is suggested by performing a two vector analysis. The first level analysis is called the communication analysis. When the communication will be performed, two level next hop analysis will be performed under different parameters such as delay, communication rate etc. Based on these vectors, effective route will be identified.

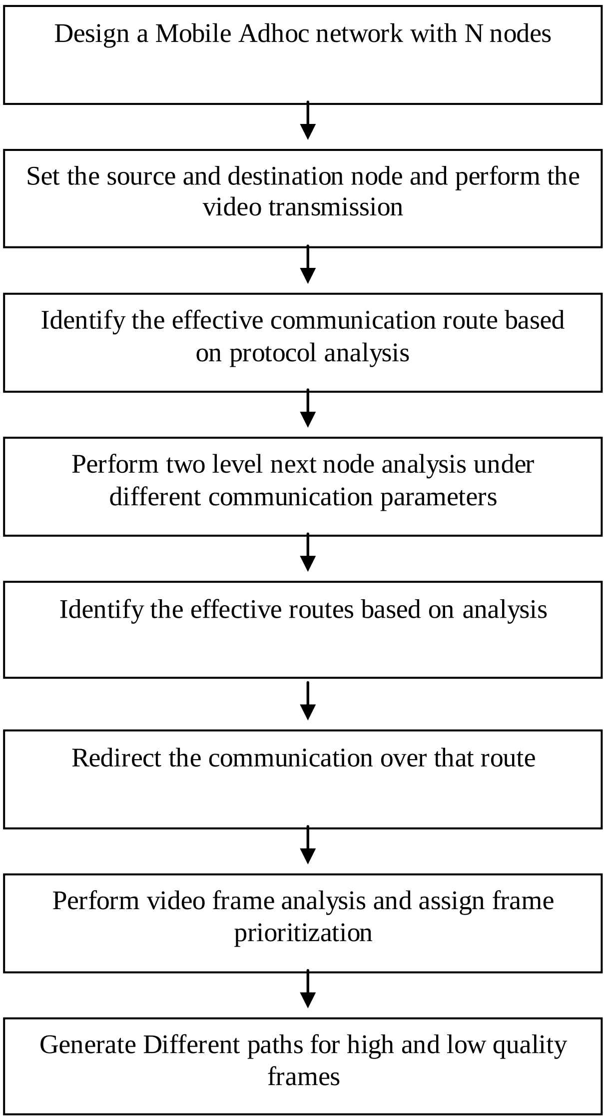

Figure 1

This approach will reduce the network congestion as well as provide the effective communication if some forwarding attack or the DOS attack is present on some intermediate nodes. The second level analysis will be performed for video frame analysis. Based on this analysis, the video frame prioritization will be done. The prioritization vectors will be based on the frame quality analysis. Based on this analysis, the frame prioritization will be obtained and it will help to identify the multiple-communication routes at the earlier stage. The work flow of presented work is shown here.

IV. Results

The thesis work mainly describes the limitations of Multipath TCP networks in transferring the voice packets compared to Multipath TCP Improved Multipath TCP networks. The possible outcomes are the simulation results obtained from NS2 which shows the performance parameters such as throughput, jitter, end-to-end delay, packets send and packets received for the both Multipath TCP and Multipath TCP Improved Multipath TCP networks. The simulation results also provide graphical comparison of the networks.

A. Simulation Results

Parameters	Values
Number of Nodes	30
Type of Topology	Random
Simulation Time	10 Sec
Packet Size	512
Protocol	AODV
MAC Protocol	802.11
Area	800x800
Type of Data	Video

Table I Simulation Parameter

Here table 1 is showing the simulation parameters for mobile network for video data communication. The network is defined with AODV protocol based communication. The simulation of the work is shown here under

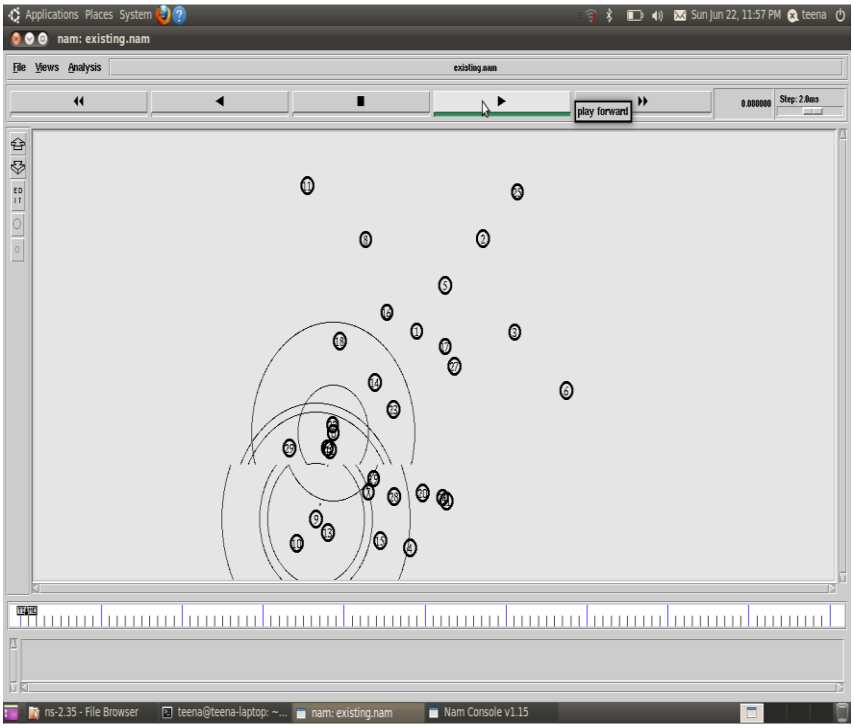

Figure 2: Design of Mobile Network

Here figure 2 is showing a mobile network with 30 Nodes. The nodes are placed at random location. Node 0 is the source node and the video data is communicated over the network. Node 9is here defined as the sink node to receive the video data. The video is communicated over the network through optimized route and the route reconfiguration is performed as the heavy traffic over the intermediate nodes found

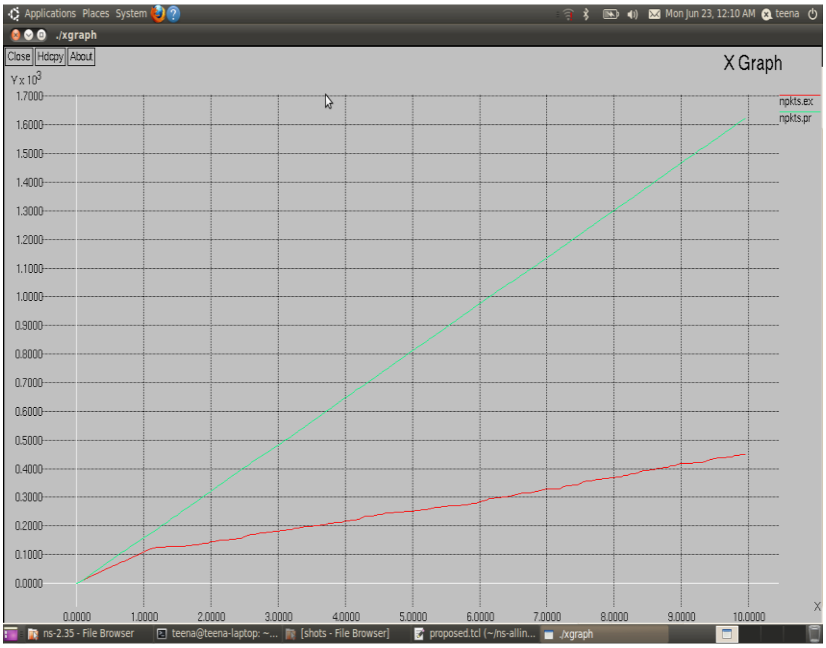

Figure 3: Packet Transmitted (Existing Vs. Proposed Approach)

The figure 3 is showing the graph to represent the number of packets transmitted over the network in case of existing and proposed approach. Here x-axis represents the simulation time and the y axis represents the number of packets transmitted over the network. The figure is showing as the congestion occur, the communication rate is decreased in case of existing approach whereas in case of proposed approach the packet communication is increasing continuously.

V. CONCLUSION

In this present work, a route reconfiguration scheme is suggested over the Multipath Mobile network as well as for the Improved Multipath network. To present the work, mobile network is defined for video data communication and to generate the effective communication route over the network. As the communication is perform over the network using existing Multipath Mobile network. It performed the route selection dynamically but given the data loss over the network when the bottle neck problem occurred. But in this present work, the Multipath Improved Multipath network to resolve the problem in case of heavy traffic over the network. Each node of the network is configured as a node as well as the monitor. This monitor node tracks its next as well the previous node for the communication. The Tracking is performed respective to the data loss and the data rate on the immediate neighbouring nodes. As the heavy load found, the load distribution is performed from that centralized node. The work will generate the multiple distributed paths to perform the communication. The obtained results show that the proposed load distribution and reconfiguration scheme has improved the network throughput and reduce the data loss over the network.

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