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Improving Throughput Over Multihomed Reactive Wireless Network

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ABSTRACT

The main objective of this paper is to implement a Reactive Wireless network using multihome technique for enhancing the throughput in a congestive environment. The conventional protocol TCP has been successful for the wireless network with straight forward approach by means of sequential order of data transfer on acknowledgment basis, which creates delay in packet delivery results degradation in throughput. In addition, TCP considers packet loss during vertical hand over transmission period as congestion result degradation of throughput and Reactive handoff method in TCP is not showing good performance. On the other hand, SCTP a reliable, message oriented, infrastructure based transport layer protocol, but incorporates a number of advanced and unique features that are not available in TCP. So SCTP is the better option due to the advanced features than that of TCP to increase throughput by applying SCTP Multihoming technique. Here, a novel method and architecture for throughput enhancement algorithm for reactive wireless network have been proposed. The results of proposed scheme have also been compared that indicates the 52% throughput enhancement over the TCP protocol for reactive approach which was 12% as compared with TCP protocol.

INTRODUCTION

Multimedia applications are aimed at creating additional network capacities to transfer voice and data simultaneously at rapid speed between static and movable nodes. Already number of different protocols has been proposed to support the concept of wireless mobility with the aim of increasing throughput.One such protocol is SCTP, a new transport layer protocol more suitable for applications that require additional performance and reliability due to its unique services such as multi-homing, multi-streaming, alleviate head-of-line blocking, and enhanced security features. Multihoming is one of the most important features in SCTP, which can be used by the data sender to send data to a receiver through the primary path and alternate secondary paths connecting two points. The two major new capabilities that are designed into SCTP are the support for multi-homed hosts and the support for multiple streams in a single SCTP association. The benefit of Multihoming is potentially greater survivability of the session in the case of network failures. The Multistreaming refers to the capability of SCTP to transmit several independent streams of chunks in parallel.

II. Motivation:

The following are the motivated factors behind this proposed work.

TCP considers packet losses during vertical hand over transmission period as congestion and as a result of degradation in throughput (Aftab, F., 2009). In the wireless environment some packets may loose while

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transferring the data from the sender to the receiver, which leads to the unordered data delivery of packets while reaching at the receiver end. There is only one path between sender and the receiver in TCP, if any packet loss retransmission of packets is not possible, also TCP does not have a Partial Reliable data transfer technique. SCTP is based on the TCP protocol, but incorporates a number of advanced and unique features that are not available in TCP. For end-to-end reliable communication, TCP has usually been used as a transport protocol with the restrictions in terms of continuous data transfer through sequential order (Hynes, M., L. Kilmartin, 2009). TCP provides reliable data transfer, but it transmits data in a sequence. However, some applications may need reliable data transfer, though not necessarily in a strict sequence. The strict sequence maintenance in TCP not only makes partial ordering of data impossible, it also causes unnecessary delay in the overall data delivery. Moreover, if a single packet is lost, delivery of subsequent packets is blocked until the lost TCP packet is delivered. This causes head-of-line (HOL) blocking.SCTP can manage multiple data streams in one association by using the multi-stream mechanism. The conventional transport protocol such as TCP and UDP easily suffer from frequent route failures and contention on the wireless channel minimizes the throughput (Natarajan, P., 2009). SCTP provides support for multihoming to improve reliability of associations to gain significant throughput improvement by simultaneously transferring new data across multiple paths to the receiver (Perotto, F., 2007).In order to improve the performance of the wireless network, it is a must to improve the throughput in the way of reducing packet loss due to path failure, delayed time due to the network coverage inconsistency. The main Objective of this paper is to improve the throughput of Wireless Network using SCTP in a Reactive manner by applying Multihoming technique, to send data to a receiver through multiple paths. The reactive approach is required to handle the situation and the adjustment of congestion window takes place in that receiver end. Reactive handoff method in TCP is not showing good performance (Budzisz, L., 2006).

III. Proposed network view:

The proposed multihomed wireless network is presented in Figure 1.

The proposed network has multiple primary and secondary paths through the interfaces 1 to 8.There are 4 interfaces available in the sender and the receiver side each. The multiple paths are created for improving data transfer rate and in the multistreaming environment, if one path fails, the other path can still deliver data without waiting for the existing transfercompletes.

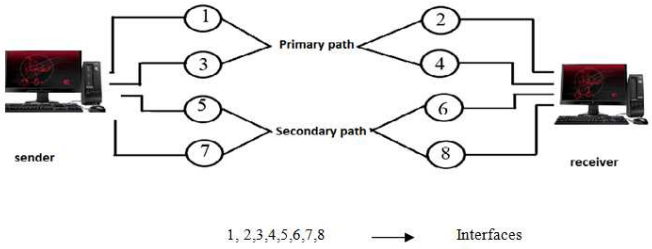

Fig. 1: Proposed System Architecture For Data Transfer In Sctp Protocol.

Consider the data is transferred between the sender and receiver using the interface 1 and 2, if any packet loss occurs to reach the interface 2, then the data transfer happens between interface 3 and interface 4 to reach the receiver destination. Before the occurrence of the handoff itself, the receiver node will send the data to the sender node that the hand off is going to occur, the congestion window in the sender node adjusted according to that hand off. The Reactive approach is calculated after the hand off.

3.1. Proposed throughput enhancement algotirhm for wireless reactive network:

A brief explanation of the proposed throughput enhancement algorithm for Wireless Reactive Network is illustrated below.

1. Handshaking process takes place between the interfaces from the sender side and the receiver end.
2. Select the interface on the sender and receiver node to send data.
3. Send a data chunk from one of the interfaces on the sender node to the receiver interface.
4. Sender node receives an acknowledgement on successful transmission.
5. If any data loss or path failure occurs,
6. The sender node discovers alternative path to transfer data.
7. Sender node gets an acknowledgement on successful transmission through the alternative path.

IV. Results and output:

The simulation is done in NS2.The data is transferred from the sender to receiver; some packets may lose due to some cases as discussed below.

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4.1. Malfunctioning of the interface on the Reactive approach:

Consider if any packet loss occurs during the data transfer between the sender and receiver using the interface1 and 2, while reaching the interface 2, then the interface 1 takes the secondary path to reach the receiver destination. After the occurrence of the handoff only, sender node can be informed that the hand off is going to occur, followed the congestion window of the sender node needs to be adjusted according to that hand off in the reactive manner.

4.2. Node-Out of coverage for the Reactive approach:

Node-out of coverage occurs; if the nodes are movable results the loss of packets. The sender determines the interface located near by path to send the message to the receiver. The Throughput estimation and the round trip time can be calculated for Reactive approach here as follows:

To calculate the round trip time (RTT)

$$RTT = \frac{\text{Receiver Buffer Size}}{\text{Maximum throughput of SCTP}}$$

Throughput = Number of packets reached in a given time.

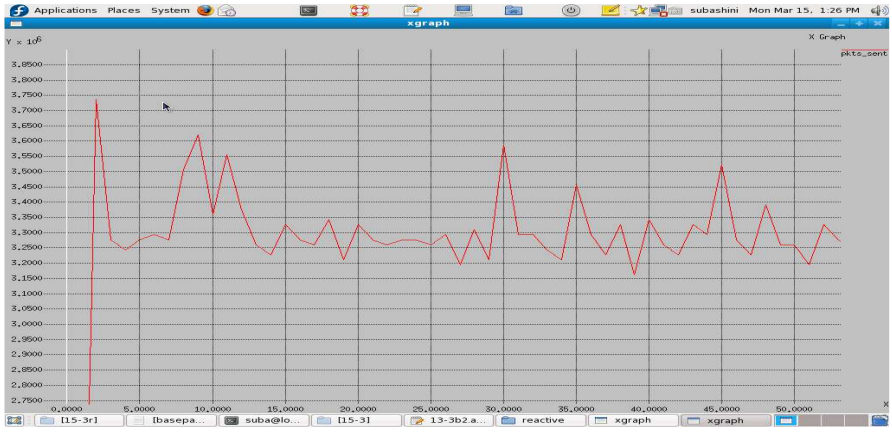

Fig. 2: Transmission time Vs packet drop for Reactive in SCTP.

The Figure 2 shows the Reactive approach for Transmission time and packet sent. Here the hand over time is taken as 11. From the figure it is known that, after the handoff there was some packet loss. In this Reactive approach the congestion window is adjusted after handoff accordingly so as to increase the throughput.

Calculation of throughput for Reactive approach:

Let the handover time be taken as 11.After handover the number of packets sent is going to be less. Number of packets dropped during handover time at 10seconds is high. Number of packets received (from given graph) = 4.52*10^3 kb/s. It is impossible and may be less than 22 % and Given high throughput 3000kb/s. So increase 4520-3200/3000 *100 % = 52.6%So the high throughput is achieved.

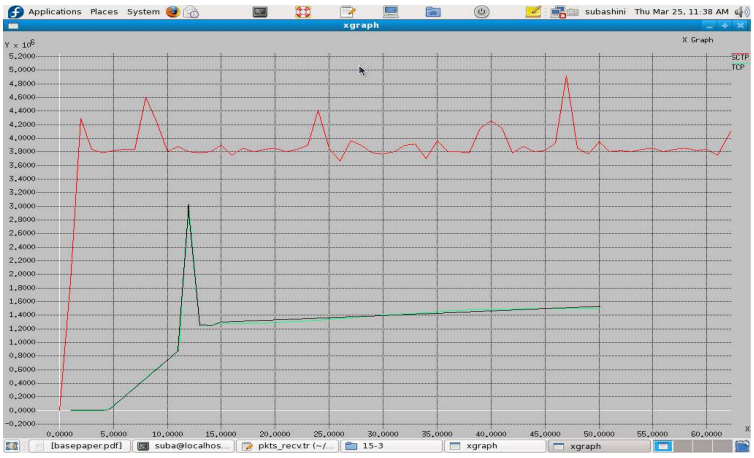

Fig. 3: Comparison between SCTP and TCP in a Reactive manner.

The Figure 3 illustrates the throughput comparison between SCTP and TCP in a Reactive manner. For the proposed wireless network using TCP, the throughput calculated is only 22%. But, using multihoming technique of SCTP, the throughput estimated is 38.6%. By this it is clear that the SCTP shows better throughput than TCP.

V. Conclusion:

Throughput enhancement algorithm for wireless reactive network has been proposed over the Wireless network by using the new generation protocol multihoming method of SCTP. The proposed method involves the echnique that if any malfunctioning of the interface happens, the packet takes an alternate interface to reach the destination and for coverage problem, the interface searches the nearest node to come into coverage area for the packets to be transferred. In addition, the window length may be adjusted depending upon the handoff situation created by the receiver once the data losses in reactive manner.The results of proposed scheme were also compared with TCP protocol. The results indicate the throughput enhancement over the TCP protocol for Reactive approach was 17% whereas throughput enhancement in SCTP is 45% as compared. Hence the throughput is greatly increased, which is evident from the results.In the future work, the number of paths may be increased a plenty, in Wireless Networks. The proposed algorithm also can be extended and performed in other networks like Adhoc network with different topology.

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