



Survey on Transmission Control (TCP) Protocol for Wired and Wireless Networks

Range Gowda G J, P.G. Scholar, Department of CSE, NMAMIT, Nitte

Sharada U Shenoy, Associate Professor, Department of CSE, NMAMIT, Nitte

Sharmila Kumari M, Professor, Dept of CSE, PACE, Mangaluru

Abstract -A reliable, connection-oriented, full duplex, byte stream and transport layer protocol is known as Transmission Control Protocol. It was initially developed for wired networks and very efficient on wired networks. Many TCP variants are also used in wireless network and we considered wireless network due to some major advantages such as mobility, flexibility and cost. In this paper we presented literature survey of wired and wireless TCP and split based TCP protocols (such as ITCP, MTCP and METP). Split connection- means connection between fixed host and mobile host has to be divide into two different connections. One is between sender and base station and other between base station and receiver. We also presented comparison of split based TCP protocols with respect to performances.

Keywords—Wired and Wireless TCP; Split TCP protocols; ITCP, MTCP and METP.

I. INTRODUCTION

Transmission Control Protocol (TCP) is a connection oriented, point to point protocol and it is extensively used in internet. It encapsulates each block of client data with header and forms a segment. The connection consists of buffers, variables and a socket connection to a process in one host and similar in another host. A poor performance on wireless networks, when it is connected to internet. Hence it is known as wired-cum-wireless network environments. Users need reliable transmissions for internet access, email, data transfers and storage access. It is the very important reliable transport protocol on top of which all of these services run. LL protocol will have to ensure relatively reliable delivery of packets in wired networks. Delivery of packets is done by using an Automatic Repeat Request (ARQ) method.

Connection-oriented means while transmitting data in which the devices at end points use a preliminary protocol to establish an end to end connection before any data is sent.

Point to Point Protocol is a protocol for communication between two computers using a serial interface, PPP provides layer2 (data link layer) service.

WTCP it preserves the end to end semantics of transmission protocol. It is placed on a proxy in between two interactive nodes i.e base station or intermediate

gateway between source and destination. The base station or router is a transmitter and receiver for the mobile host and acts as a gateway to the internet for the host.

Gateway: it is a network interface to another network. Some of the important factors, which are plays a major role in performance of transport protocol in a network as follows.

- **Bandwidth:** the current generation of wireless LAN standards offer sufficient bandwidth. For example:- IEEE 802.11b standard offers raw bit rates of up to 11mb/s whereas HIPERLAN offers 20mb/s.
- **Long Round Trip Times:** Transmission over wireless network shows longer latency delays than wired network and it affects throughput.
- **Random Losses:** transmission losses are more in wireless medium. Transmission protocol was developed for wired network which has bit error rates on the order of 10^{-6} - 10^{-8} . In case of wireless media 10^{-3} - 10^{-1} that is very high bit error rate since we use that forward error correction method to reduce BER.
- **User Mobility:** users can move randomly and at the same time perfectly make use of network services without interceptions.
- **Short Flows:** a connection never manages to effectively use of available bandwidth.
- **Power Consumption:** the communication over a wireless channel consumes more power than CPU processing.

TCP in Wireless Network is presented in Section 2. In Section 3 Split Based Connection. Section 4 Indirect TCP. Mobile End TCP is presented in Section 5. Mobile TCP is presented in Section 6. Conclusion and future works are highlighted in Section 7.

II. TCP IN WIRELESS NETWORK

Multipath Fading means where the different forms of propagation are present in environment and signals received at receiver from transmitter through a different paths. The wireless network faces three major challenges which are described below.

- **Channel Errors:** occurs due to maximum bit error rate because of multipath fading and shadowing may cause errors in packets transmission leads to dropping of packets or acknowledgements. If it is could not get the reply within the RTO (retransmission timeout), the sender immediately reduces it cognition window to a packet and exponentially back off its RTO and retransmits the loss packets. Back off is an algorithm used to space out repeated retransmissions of the same block of data and it is part of network congestion avoidance therefore resulting in low TCP throughput
- **Mobility:** In wireless network handoffs occur due to user mobility and it may cause temporary disconnections that results packet loss and delay. Hence TCP needs to handle handoff.
- **Asymmetry:** As compared to base station, the mobile station has less power, processing capability and buffer space and also less and variable bandwidth.

For example: Ethernet bandwidth is 10mb/s where as bandwidth for 3G networks is about 2mb/s. Therefore wireless link is very likely to delay transmission of data.

III. SPLIT BASED CONNECTION

Several schemes are put forward to increase the TCP performance over wireless networks. In which split connection is one of the scheme i.e fixed host which is connected to wire network on one end and to the wireless network on the other end. Split connection protocols are used to establish connection between the fixed host and mobile host. It divides connections into two parts at base station. First is between sender and base station and second is between base station and receiver.

For example: fixed host will see failure of a base station as failure in the mobile host and it also requires the base station to have large buffers to buffer the packets sent for the mobile host. The pictorial representation split connection as shown below in Figure 1. It describes how to split a connection into two TCP connections such as wired and wireless part, wireless link are hidden from fixed host. Modifying the regular TCP protocol to improve the performance.

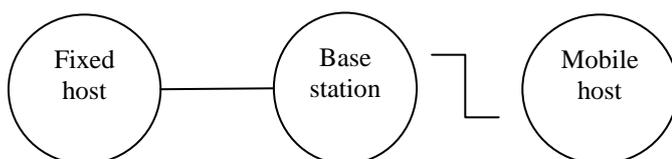


Figure 1. Split Connection

IV. INDIRECT-TCP

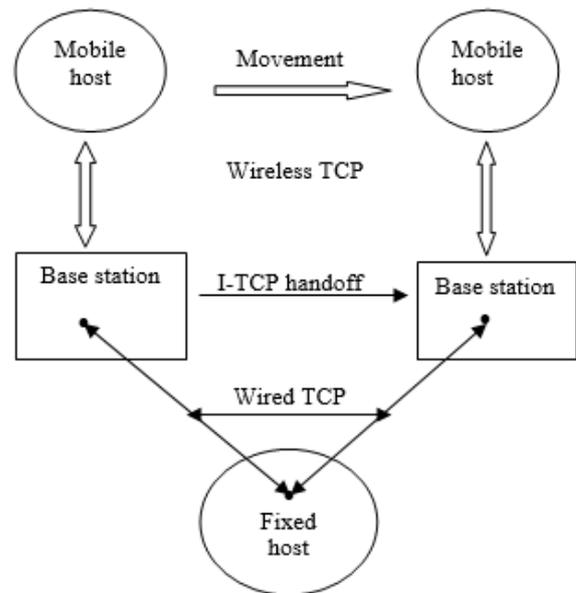


Figure 2. I-TCP Connection

The above figure describes how indirect TCP connection has been set up in the network.

When mobile node requests an indirect connection with a fixed host, the base station establishes wired connection with fixed host by using a socket with host's address and port number and other socket used to communicate with mobile host over wireless connection.

Packets sent to mobile host are first received at base station and buffered, and base station acknowledges the receipt of packets to fixed host before forwarding packets to the mobile host over wireless link. It performs better than standard TCP with respect to throughput only when disconnections are not longer. If they are many handoffs then overhead involved in connection, movement of mobile node between old and new base stations may be large and hence handoff latency will increase.

Pros:

1. Simple implementation.
2. Backward compatible to TCP fixed hosts unaware of mobile host.
3. Used to separate congestion and flow control of the wireless and wired link.
4. It can optimize fixed host and base station connection independently.

Cons:

1. Violation of End to End semantics.
2. Base station failure can cause connection loss and handoffs latency increases due to state transfer.
3. Lengthy disconnections are lead to buffer overflow.



- Unless optimized, extra copying of data at base station

V. MOBILE END TCP

This protocol hides the wireless link losses from the sender by replacing a protocol with smaller headers and it uses the link layer acknowledgements and retransmissions to rapidly regain the losses over wireless network. A mobile node does not do data forwarding only part of IP functionalities is shifted to the base station, which are handled by protocol at the base station and it acts as proxy transport protocol and keeps intact all the interfaces handled by TCP/IP stack. It uses sending and receiver buffer at base station and packets get dropped at receiver if the buffer is full such losses are avoided by periodic transmission of feedback packet by METP, it is to inform the sender of how much buffer memory is presently available then the sender will transfer only that much of data to the receiver, hence receiver buffer will not overflow.

When mobile host transmits the data to base station which places them in the sending buffer and then transmit the packets to destination. When a packet forwards to destination it will be received at the base station, the protocol will uses the receiving buffer to deliver the packet to destination and sends an acknowledgements to the source and receiving buffer is busy until the packets are delivered to destination.

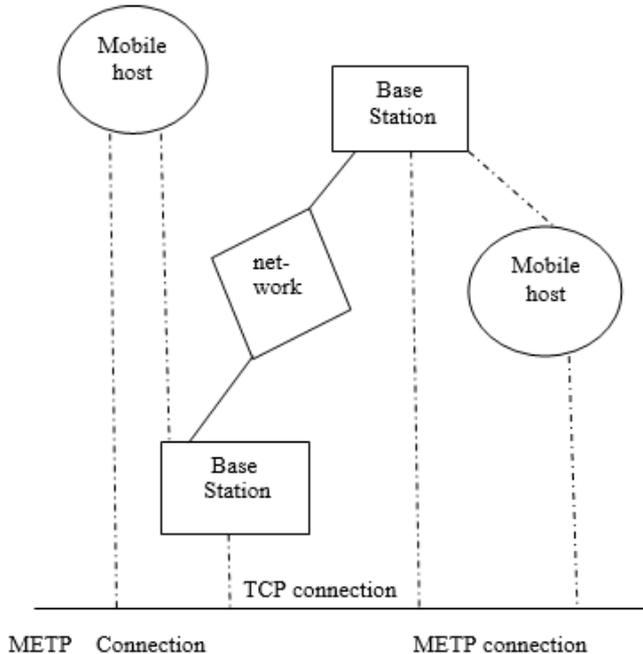


Figure 3. METP Framework

The above figure shows how mobile end transport protocol connection has been setup. The wireless link fails suddenly then also no problems on wire links. METP at the base station, still it is continues to receive data from fixed host but it can't forward any of the data to mobile node. Hence reduction in the buffer memory, this causes METP to send

acknowledgements with smaller window. The window size at sender reduces and inhibits data flow.

Later when the wireless node comes back then the window size will increases to the initial level. Since the sender does not identify packet drop and then no transmission. Hence no need to use exponential back off algorithm.

VI. MOBILE TCP

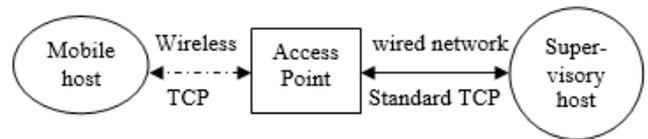


Figure 4. M-TCP

The above figure describes how mobile TCP looks like, its splits as I-TCP does, i.e first one is unmodified TCP fixed host network to supervisory host and other one is optimized TCP SH (supervisory host) to mobile host. It is special handling of lengthy or frequent disconnections. In case of SH, there is no caching and local retransmission. Monitors all packets, if disconnection is detected then it will perform two operations such as

- Sender window size value is set to zero.
- Sender immediately goes into persistent mode.

Pros:

- Maintains semantics.
- It supports disconnections and no buffer forwarding.
- Controls the unwanted retransmissions and slow start.

Cons:

- Loss on wireless link propagated into fixed network.
- Adapted TCP on wireless link.
- It is not a good idea for heavy traffic.

VII. CONCLUSION AND FUTURE WORK

In this paper we presented complete survey about split TCP connection and three different scheme (I-TCP, METP and M-TCP) which are used to improve TCP performance over wireless networks. According into survey, the I-TCP can optimize FH-BS connection and it differentiates flow and congestion control of the wireless and wired link but it fails to provide end to end semantics whereas Mobile TCP does. In case of heavy traffic, Mobile TCP performance is very poor. The Mobile End TP maintains sending and receiving buffer, therefore packets dropping is very less and it provide high throughput. These schemes are implemented on Mach 3/Unix. The future work is implement on NS2 (Network Simulator) and, analyze and compare with respect to performances and Also check for video files.



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