

Method of Reliable MPTCP

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Abstract— MPTCP(Multipath TCP)is transfer technology by multi path. It is for security, bandwidth and stability. It is use transfer by one path. If MPTCP is communicating on one path, it can be sent directly to another path when the problem occurs. It is used to ensure line stability.

If a problem occurs in the path, TCP will retransmit the packet in the same path. If one path has problem, problem is burstly, and in long time. So, one path has problem, it need other path for bypass. If only one packet is drop, it is not able to change path for bypass.

In trebled path, it need change path. It need not to retransmit packets. This only increases the burden on the network.

In this paper, we use dedicated path for retransmission path among multiple paths to enable efficient communication.

Keywords— MPTCP, Retransmission

I. INTRODUCTION

Currently, most mobile devices, including smartphones, have more than two network interfaces. In the existing TCP, even if the host A has two network interfaces, only one network interface can be used when communicating with the server B. Therefore, MPTCP uses one session by using communication of multiple paths.

A. MPTCP(MultiPath TCP)

Multi-path TCP (MPTCP) is a technology that is standardized by IETF in 2013. TCP protocol is extended to configure multiple TCP paths between a terminal and a TCP server, and simultaneously transmit and receive data to and from multiple paths. When heterogeneous networks such as LTE and WLAN are configured with multiple paths, it is possible to obtain a carrier aggregation effect between WLAN and LTE.[1]

The service server establishes one MPTCP session with the terminal using a number of subflows in cooperation with the MPTCP-capable terminal.

The UE and the TCP server can transmit and receive data through a plurality of connected MPTCP subflows, and the MPTCP performs signaling using an extension header of the TCP. Therefore, in LTE and WLAN networks, the traffic of

the MPTCP subflow is regarded as a single TCP session and normally relayed.

In the MPTCP structure, each subflow operates as one independent TCP session. Subflow provides independent TCP connection control and congestion control, and maintains the characteristics of TCP. It can be used even when passing through NAT, etc., and is considered as a standard so that universal compatibility can be maintained even through a TCP accelerator or a TCP proxy.

The upper MPTCP block performs connection control for multiple subflows, traffic distribution between subflows, retransmission processing, and packet sorting. Standardization is under way in relation to the congestion management method and the data distribution method when a large number of subflows are used. Basically, it is possible to operate multiple routes in the following way.

- MPTCP Full Mode: This mode can be used for aggregation between LTE / WLAN by transmitting / receiving data using all of multiple paths. There is no standardized method for efficiently distributing and congesting traffic between paths in a multipath environment with different propagation delay and bandwidth.

- MPTCP Backup Mode: Divide multiple paths into Primary and Backup, and use backup path only when primary path is unavailable. Apple's Siri service is using this method (Siri uses WLAN as Primary path and LTE / 3G as backup path).

- MPTCP Single Mode: Similar to MPTCP Backup mode, but in MPTCP Backup Mode, the backup path does not carry traffic and always maintains connection even in normal times. In the case of Single Mode, there is a difference in that the backup path is created when the primary path cannot be used.

Similar to MPTCP, the protocol that uses multipathing is Stream Control Transmission Protocol (SCTP). SCTP also has the advantage of being able to configure the multipath like Aggregation effect similar to MPTCP and to accommodate both TCP and UDP traffics, and is already included as a basic protocol in Linux.[2]

However, in case of SCTP, since NAPT function is not generally provided under NAT environment, which is a general network environment in which UE is used, MPTCP

has a considerable advantage over SCTP over TCP constituting individual paths in MPTCP.

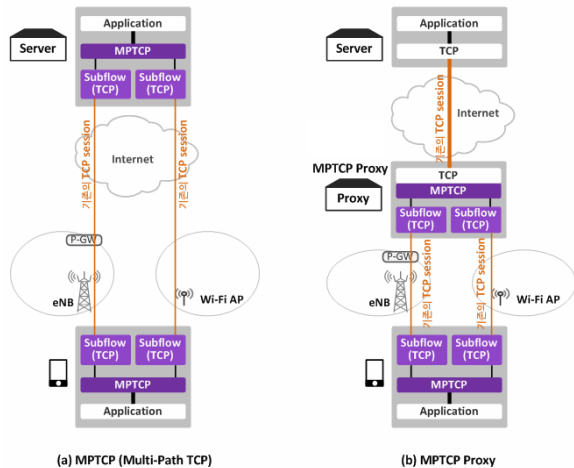


Figure 1. MPTCP

II. RELIABLE MPTCP

MPTCP (Multipath TCP) is a technique of transmitting / receiving by multipath. This technique is effective for increasing security and bandwidth, and for securing stability in case of dual transmission with multiple paths. In case of communication in one path, the path is used in order to secure the stability of the line, which can be sent directly to another path when a problem occurs.

However, if there is a problem in one path, it performs the retransmission of the erroneous packet in the corresponding path due to the nature of TCP. This keeps the problem in question for a long time when the path is in trouble.

In other words, if the line is a problem, it may occur due to the nature of the network hardware, and may have characteristics that are maintained for a considerably long time. Therefore, if the line is a problem, another bypass path must be secured immediately. It is impossible to know in advance whether one of the 100 packets is in error or the other 10 packets will be in error.

You are not able to bypass the route because one packet is dropped. In addition, it is meaningless to retransmit a dropped packet in the abnormal path while the packet is continuously dropping, and it only increases the burden on the network.

In this paper, this uses one path in MPTCP using multipath as the path for retransmission and signalling.

If problems continue to arise in the path where the problem occurs, do not use the path, or use the dedicated retransmission path as a normal path to increase network efficiency.

Reliable MPTCP is designed to maximize the stability of packet transmission, and the use of dedicated retransmission and signalling paths is made for stability.

Reliable MPTCP can be applied to networks in the military field where network stability is the most important, and networks in the medical field. Reliable MPTCP increases the

network bandwidth due to the simultaneous bandwidth use of MPTCP as the stability of the network bandwidth increases.

Assuming that three physical paths are used, two physical paths may be used for transmission of network data, and one physical path may be used for retransmission and signalling paths.

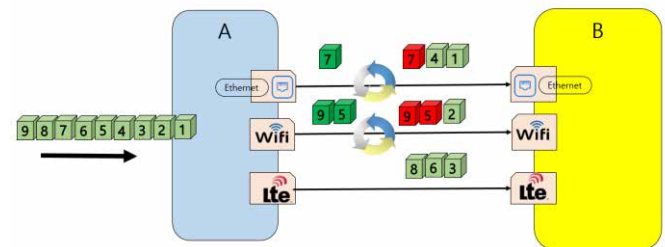


Figure 2. MPTCP Retransmission

In Figure 2, the existing MPTCP network service unit may send 1 to 9 packets when transmitting from A to B, sending the same packet per each path, or sending different amount according to the bandwidth according to the user's request. When a packet drops on the line, retransmission occurs on the line. When sending from A to B, error 7 occurs in the Ethernet line, and when Wifi 5,9 packet error occurs, the wrong packet is retransmitted in the corresponding path.

In case of sending from A to B, as shown in Figure. 2, 7th packet in Path 1 (Ethernet), and 6th and 8th packets in Path 2 (Wi-Fi) are recognized as an incorrect packet in B. Therefore, in Figure 3. B requests A to retransmit the wrong packet, and A retransmits packets 6, 7, and 8 to the path set to Emergency Path instead of Path 1 and Path 2.

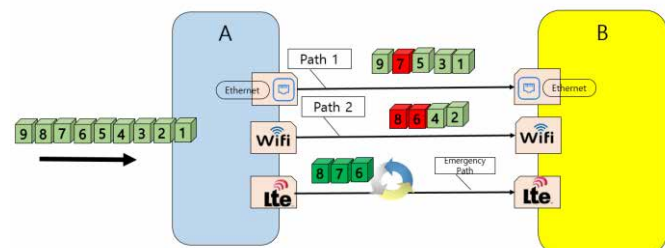


Figure 3. Reliable MPTCP Retransmission

A packet that is larger or smaller than the available bandwidth can be used when it is sent between A and B by MPTCP or SD-WAN[3] through this transmission. For example, when transmitting from A to B, assume that Path 1 (Ethernet) is 100Mbps, WiFi is 20Mbps, and LTE is 10Mbps. It is assumed that when retransmitting an erroneous packet, it has a 1/10 rate of retransmission. 100Mb is sent from A to B, and in MPTCP, several packets are sent in one packet. In the

SD-WAN, it is assumed that the data sent to one line is superimposed for stability.

Table 1. Retransmission Time

	MPTCP	SD-WAN	Reliable MPTCP
Content	100Mbps * 0.3+0.1 20Mbps * 1.5 + 1 10Mbps * 3	100Mbps * 1 20Mbps * 5 10Mbps * 10	100Mbps * 0.5 20Mbps * 2 10Mbps * 3
Time	3secs	10secs	5secs

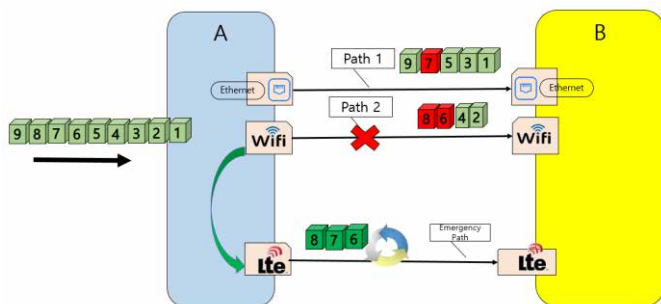


Figure 4. Abandonment of one path

In Fig 4, it is assumed that one packet drop occurs in Path 1 (Ethernet), a packet drop occurs after two packet drops in Path 2 (Wifi), and Path 2 is no longer used.

In this case, Packet drop continues and packets 2 are not correctly received through Path 2, and Path 2 is abandoned. If you abandon Path 2, the wrong packet is retransmitted through Emergency Path, and Path 1 and Emergency Path exist.

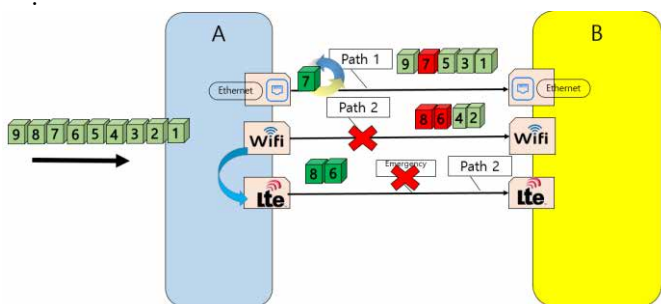


Figure 5. Path Change

In Fig 5, it is assumed that one packet drop occurs in Path 1 (Ethernet), a packet drop occurs after two packet drops in Path 2 (Wifi), and Path 2 is no longer used.

In this case, it is assumed that a packet drop occurs continuously and packets can not be properly received through Path 2, so that Emergency Path is changed to Path 2, and Reliable MPTCP is used as normal MPCTP. If you abandon Path 2, the Emergency Path changes its role to Path 2, retransmits the wrong packet corresponding to Path 2, and Path 1 and Path 2 exist.

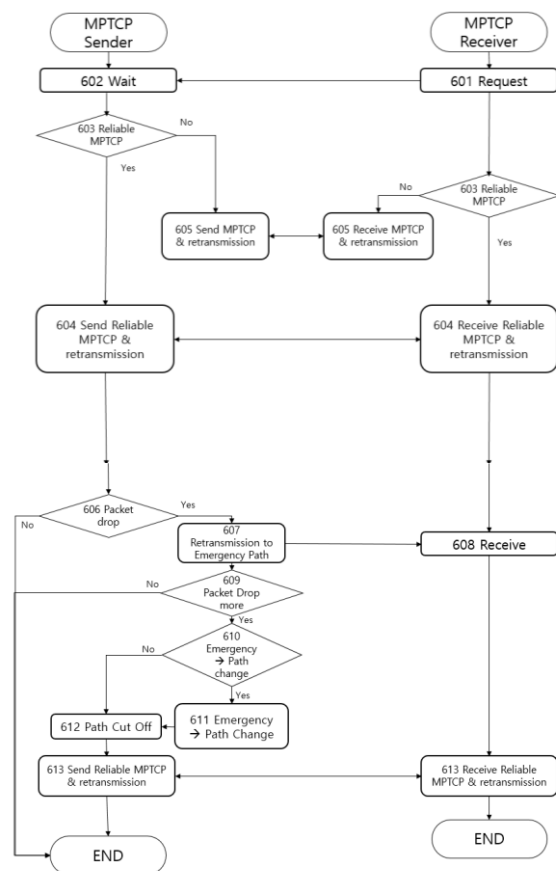


Figure 6. Flow Chart

Figure 6 is a flow chart, assuming that the transmit and MPTCP Sender, Receiver MPTCP receives the necessary protocol design. The MPTCP Receiver requests the communication from the MPTCP Sender (601). The MPTCP Sender is waiting (602) and receiving. It is noted that both Sender and Receiver are Reliable MPTCP of the present invention (603).

If desired a Reliable MPTCP, holding the path to the Emergency Path, it performs Reliable MPTCP (604). If Reliable MPTCP is not used, MPTCP will transmit the packet and if there is a wrong part, retransmission is performed (605). If the packet is to be dropped (606), retransmission is sent through Emergency Path (607) and the MPTCP Receiver is received (608). If packet drop occurs (609), the Emergency Path is changed to MPTCP Path. (610). If it is changed, the Emergency Path is changed to the MPTCP Path (611), and the Path is disconnected (612). If the Emergency Path is

maintained, the corresponding path is disconnected (612) and communication is performed.

III. CONCLUSIONS

Reliable MPTCP improves communication stability over existing MPTCP and offers faster resolution than SD-WAN's Duplicate communication.

When a wrong packet is transmitted due to a line problem, it is possible to solve the problem of bursting communication by sending a packet to an alternative path instead of sending a packet that is not transmitted to the corresponding line.

In other words, it is possible to increase the stability of communication by sending it to another line instead of trying to solve the problem with the problematic line.

This communication method is expected to be applicable to military communication and medical applications security is absolutely required.

research institute). Also, Her significant area of research interests includes the managed IP networking and trust connectivity between mobile and intranet-cloud.

ACKNOWLEDGMENT

This work was supported by by Institute for Information & communications Technology Promotion(IITP) grant funded by the Korea government(MSIP) (2017-0-00282, The Development of Adaptive Network Technology with Multi-Media Multi-Path), and 'The Cross-Ministry Giga KOREA Project' grant funded by the Korea government(MSIT) (GK17P0100, Development of Tele-Experience Service SW Platform based on Giga Media.)

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