

The Architecture of Multi Media Multi Path System

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Abstract— The defense network uses a strategic network, a tactical network, etc., and these networks are operated in isolation from the Internet. In addition to wired and wireless networks, it also uses diverse and complex private networks such as walkie-talkie networks, military telephone networks, and military satellite networks. In particular, because the defense network must ensure the survivability of the network, even if the network is managed by the army itself and the military support facilities are well, the network can be restored by the emergency backup operation should be possible.

In this paper, we investigate the technology trends and technology to guarantee the survivability, stability and security of wired and wireless networks in various defense networks using various media, and develop a multi - media multi - path adaptive network technology.

Keywords— *mptcp, multi homing*

I. INTRODUCTION

The technologies for interworking and merging technologies between LTE and Wi-Fi include merging between LTE and Wi-Fi using 3GPP-based LTE network infrastructure and MPTCP based on IETF standard in which non-3GPP- (Multi-Path TCP) based method.

Since 3GPP-based merge technology should use LTE-based network infrastructure, technology development is being conducted by telecommunication network operator with LTE infrastructure. Therefore, development of IETF based MPTCP technology that independently merges with LTE network can be easily achieved without changing or adding existing application servers and systems.

Multipath TCP (MPTCP) [1] is a major modification to TCP that can use multiple paths simultaneously as a transport connection. Multipath TCP can solve the problems that affect TCP.

This paper discusses Multipath TCP technology and 3GPP-based technologies and proposes a high-reliability and intelligent networking system that can cope with real-time situations by utilizing all idle communication infrastructure

resources in dynamic mission-centered network environment that guarantees survival and security by using this technology.

II. RELATED WORK

The technologies for interworking and merging technologies between LTE and Wi-Fi include merging between LTE and Wi-Fi using 3GPP-based LTE network infrastructure and MPTCP based on IETF standard in which non-3GPP- (Multi-Path TCP) based method [2].

(1) 3GPP-based (merging between LTE and Wi-Fi using LTE network infrastructure)

The 3GPP standard proposes the following three techniques.

- Evolved PDN Gateway (ePDG): This is a method defined by 3GPP Rel-8, which is the start of LTE standard. It is a structure in which a terminal directly connects with LTE network infrastructure and connects LTE core network via Wi-Fi access network.

- TWAG (Trusted WLAN Access Gateway): Since ePDG is defined in Rel-8 as defined in 3GPP Rel-11, "terminal dependency" has emerged as a serious obstacle to service. Therefore, A structure that combines WLAN and LTE infrastructure to combine WLAN and LTE to eliminate dependency

- IP Flow Mobility (IPOM): Direct S2c interface between the terminal and the DSMIPv6 Home Agent (included in the P-GW or configured as a separate node) via ePDG or TWAG network in a materialized way such as TWAG (SaMOG) in 3GPP Rel- And a structure for providing a carrier aggregation effect between WLAN and LTE by using WLAN and LTE as data paths at the same time

(2) MPTCP (Multi-Path TCP) in IETF

KT, Korea's leading telecommunication network operator, demonstrated LTE-H, the LTE-WiFi Link Aggregation (LTE-WiFi Link Aggregation) technology between LTE and Wi-Fi in MWC 2015 and demonstrated speeds of over 600Mbps with LTE-H technology. Unlike LTE-A (CA) merging a plurality of LTE carriers, LTE-H is a link aggregation technology that combines LTE and Wi-Fi, which are different RAT (radio access technology), it is a technology that can receive at the sum of available transmission speeds of each network.

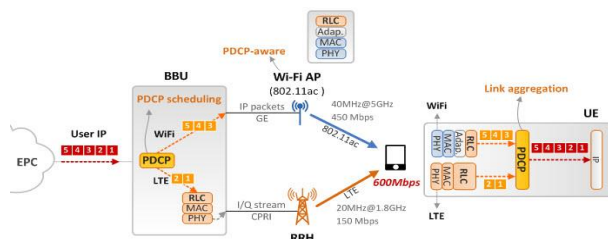


Figure.1 LTE-H link aggregation method in KT

In addition, KT understands the use of specific frequencies and adopts Listen Before Talk (LBT), a frequency selection technology that uses frequencies that are not being used by other systems, enabling LTE-U technology has been developed, and the company has acquired technology to increase the LTE speed while utilizing the existing WiFi network that KT currently owns, and provides download speeds of up to 450Mbps by combining broadband LTE 150Mbps and WiFi frequency 300Mbps.

LG U + demonstrated LTE-U, a technology that can broaden the LTE frequency band by utilizing existing WiFi frequency band as LTE frequency. It bundles 20MHz width of 5.8GHz band and 2.6GHz wideband LTE 20MHz width of WiFi frequency, and downloads total 40MHz. It succeeded in achieving the maximum speed of 300Mbps. Unlike WiFi + LTE technology that physically bundles WiFi and LTE base station signals, LTE + LTE bundling technology, which uses WiFi frequency band body as LTE, is different from other companies.

As a foreign company, Apple applied for MPTCP function using iOS 7 with LTE and WiFi for US mobile phone maker, and applied it to Siri, a voice recognition secretary service of iOS 7, and improved throughput differently from domestic service providers. It is used for the purpose of providing continuous connectivity. Google has also developed MPTCP module, which consists of Connection Manager to manage the connection and Network Daemon to set the path automatically when using 3G and WiFi based MPTCP, and to develop various applications using MPTCP.

III. MPTCP PROTOCOL

MPTCP (Multipath TCP) protocol is a protocol that allows one TCP connection to be distributed over multiple paths. This protocol makes it possible to maximize the utilization of resources of multiple transmission paths and to increase the reliability of data transmission through multipath. MPTCP is standardized as an experimental standard by IETF RFC6824[3].

In MPTCP, a TCP flow is divided into a plurality of subflows. Each subflow has its own TCP sequence and a separate sequence number for each subflow, thereby restoring the original TCP flow based on the sequence. Also, when a specific subflow path is disconnected, data can be normally transferred through another subflow path. MPTCP guarantees backward compatibility with existing TCP, so it can be applied without changing the application infrastructure applied to existing TCP. Therefore, it can be operated on the

middle box (NAT, Firewall, Proxy) existing on the route, and all existing TCP applications using the common TCP API can be used without modification[4].

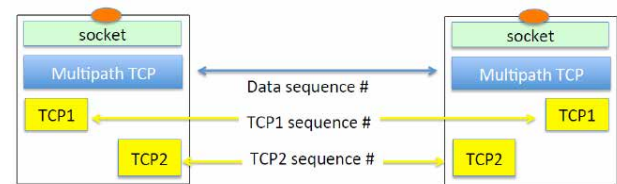


Figure 2. MPTCP Protocol

IV. MULTI-MEDIA MULTI-PATH SYSTEM

In a dynamic mission-critical network environment that requires absolute connection survivability and security, such as a disaster network or a defense network, high-reliability and hassle-free networking technology capable of handling real-time situations utilizing all idle communication infrastructure resources is required. For this purpose, Multi-Media Multi-Path system (MMMP system) uses various communication media to recognize the bandwidth situation and increase performance and efficiency by distributed data transmission. The goal is to acquire a user-tailored network technology that transmits data and to distribute data to a variety of media, thereby securing the technology to prevent information deception on the entire data content even when a medium occurs or is stolen.

Figure 3 shows the technical concept of MMMP system to provide connectivity survivability, high performance, network optimization and security.

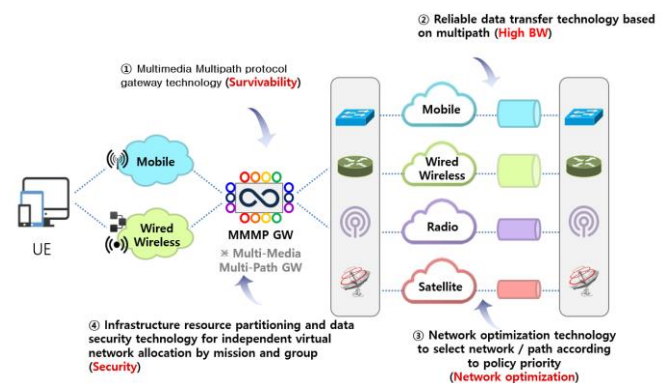


Figure.3 MMMP System

The main technology of MMMP system is "Multimedia multipath protocol matching gateway technology" which enables integrated utilization of available infrastructure resources, "Multipath-based reliable data transmission technology" based on automatic detection of idle communication infrastructure resources, "Network Optimization Technology" for selecting a network, and "Infrastructure Resource Partitioning and Data Security Technology" for real-time allocation of independent virtual networks per mission / group.

(1) Multimedia Multipath protocol gateway technology

It is able to collect the state of Ethernet, TDM, WiFi, M / W, LTE and satellite communication infrastructures which are various communication infrastructures used in the military. Infrastructure resources and communication means available in the zone can be used at the same time, and data survivability can be enhanced by utilizing the commercial network of the mobile device. It can acquire adaptive networking technology that provides performance, efficiency, security, availability, survivability and service optimization using all leased lines and commercial wired and wireless networks available through the development of multi-media multi-path protocol matching gateway technology. New business creation is possible.

(2) Reliable data transfer technology based on multipath

It aims to develop reliable networking technology that utilizes all dedicated and commercial wired and wireless networks available in a dynamic mission-critical network environment with data transmission technology that supports high availability and high reliability by utilizing multi-media multipath simultaneously. It consists of integrated routing protocol technology for integrated distributed delivery and highly reliable data transmission technology based on dynamic automatic switching. It is a technology that distributes network load by recognizing dynamic change of various network states in All-IP-based integrated network and enables high-speed and high-reliability data transmission by using limited bandwidth and cost. The technology that utilizes the simultaneous multi-media network can improve the availability of the entire network. It can automatically substitute low-cost wireless resources in areas where high-priced LTE resources are lacking and can be utilized for large-capacity wireless data transmission services is.

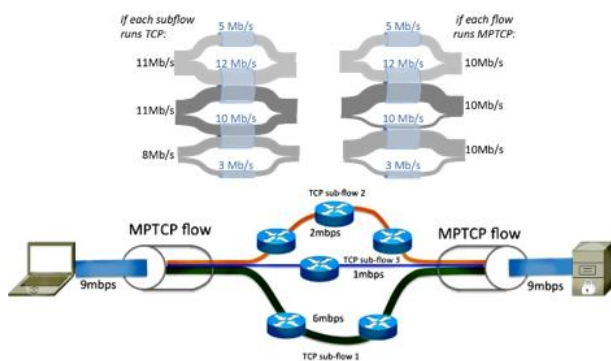


Figure.4 Multipath Transmission Network based transmission technology

(3) Network optimization technology to select network / path according to policy priority

It is an adaptive communication technology that satisfies the minimum common specification among heterogeneous end-to-end heterogeneous networks that can communicate even if the transmission node transmits without selecting a network. In this structure, it is a connection priority management technology that assists the optimal network connection considering the bandwidth, delay, cost, and security

characteristics of individual networks in a mixed network structure. And it is possible to improve the survivability of the network through communication of the minimum common specification.

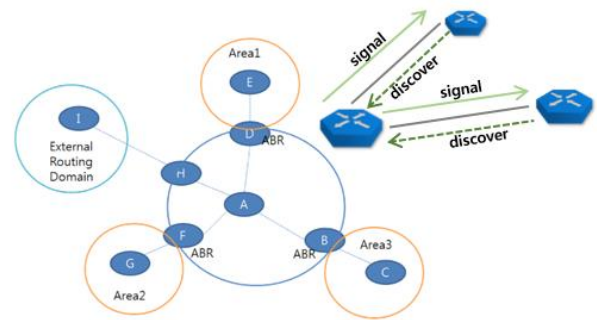


Figure.5 Network optimization technology

(4) Infrastructure resource partitioning and data security technology for independent virtual network allocation by mission and group

Separate virtual infrastructure resource partitioning technology based on user's mission and group by using virtual networking and network-based data protection technology for perimeter protection based on white list accessible only by defined user and secure data transmission And white list-based access management technology, equipment manufacturer's proprietary protocol neutralization technology to prevent information deception, and multi-dimensional array based data waring and recovery technology.

The development of this technology enables risk management and infrastructure resource management for each mission group, and it can provide multidimensional data confidentiality and network security. Since the virtual network is created using the existing network, it is possible to reduce the cost of building a separate network, and it is possible to build a customized security solution according to various security levels.

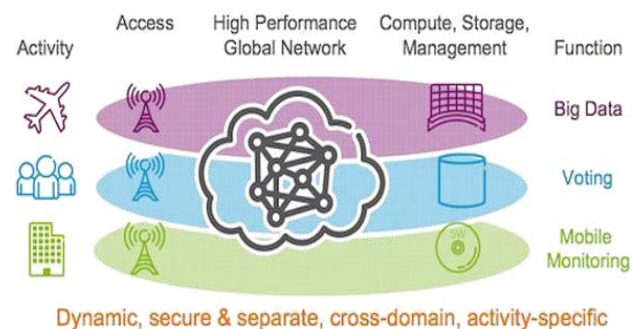


Figure.6 Infrastructure resource partitioning and data security technology

V. THE ARCHITECTURE OF MMMP SYSTEM

Figure 7 shows the structure of the MMMP system. The MMMP system consists of three subsystems such as an MMMP manager, an MMMP gateway, and an MMMP agent.

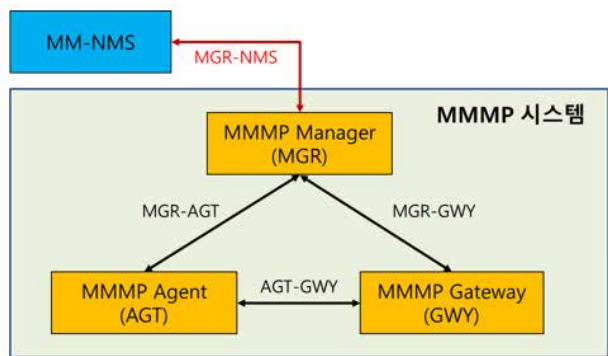


Figure.7 MMMP system structure

(1) MMMP Manager Subsystem

The MMMP manager subsystem performs device authentication, authorization and registration management for efficient communication between MMMP agent and MMMP gateway, and manages connection topology information. In order to provide efficient policy, it collects media resource information of each media in the multimedia network, collects status and resources (BW) status of each interface of MMMP gateway, selects a multimedia path according to service policy, Function.

(2) MMMP Agent Subsystem

The MMMP agent subsystem refers to the terminal used by the user to use the MMMP service, and provides functions such as multi-factor based multi-authentication and IPsec VPN tunneling for authentication with the MMMP manager, and provides multi-media multi- Route data transfer function, and sequence ordering function for data reassembly.

(3) MMMP Gateway Subsystem

The MMMP Gateway Subsystem is a device that supports the merging of multi-modal wireless networks such as LTE, WiFi, microwave, and satellite, and the bypassing of traffic. MMMP Agent subsystem and MMMP Gateway subsystem should provide MPTCP Network Stack to support merge transmission and seamless mobility. The MMMP Agent subsystem has a proxy function for selectively diverting the service flow to the MMMP Gateway subsystem. The MMMP Gateway subsystem exchanges requests with the service application server, and has a proxy function for performing communication.

The MMMP Gateway subsystem should be able to achieve the following effects by improving the rate of service merging transmission through multi-media wireless network and using network load balancing.

- Multimedia network merging transmission function increases data communication speed
- Provide uninterrupted service base by providing simultaneous use of multimedia network

- Enhance network efficiency by providing load balancing function using multimedia network
- Minimize service delay or reconnection time due to switching of multimedia network

VI. SERVICE SCENARIO OF MMMP SYSTEM

The MMMP authentication application installed in the subscriber terminal requests the MMMP manager subsystem (policy server) to acquire a policy for the terminal (e.g., a list of MP-GW IPs to be accessed). The terminal generates an MPTCP session with the MMMP Gateway subsystem and explicitly redirects the traffic to the MMMP Gateway subsystem. The MMMP Gateway subsystem creates a normal TCP session with the destination server and maps the traffic that the user terminal delivers through the MPTCP session to a normal TCP session to the server.

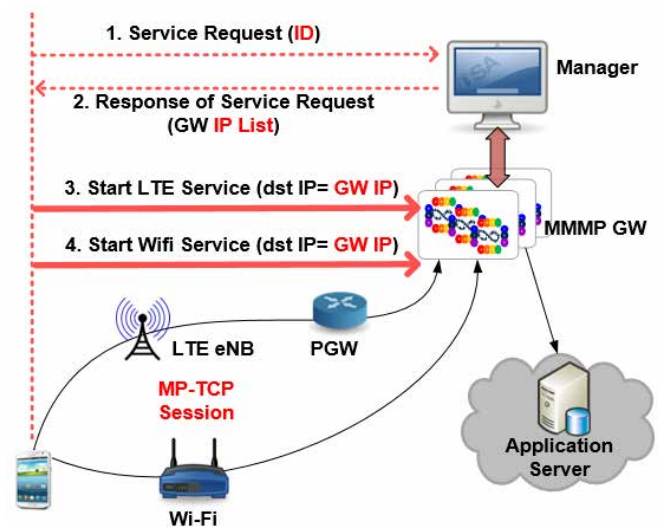


Figure.8 Scenario of MMMP system

The uplink traffic of the user terminal moves to the MMMP Gateway subsystem and then to the application server. Likewise, downlink traffic from the application server also moves to the MMMP Gateway subsystem first and then to the user terminal.

VII. CONCLUSION

This paper describes a study on MMMP system based on MP-TCP with adaptive networking technology that provides performance, efficiency, security, availability, survivability and service optimization using all available private and commercial wired and wireless networks. With the development of this technology, it is possible to increase the performance and efficiency and increase the load by distributing the situation of the bandwidth and data distribution by using various communication media, and it is possible to distribute the load (cost, speed and safety Etc.) media can be selected and transmitted, thus securing customized network technology. In addition, it is possible to acquire the technology to prevent the information

deodorization against the whole data contents even if one medium is deodorized by distributed transmission to various kinds of media. In particular, it is expected that not only the communication capacity but also the reliability improvement through multi-path utilization can be expected by using the technology in the defense network. In addition to the application to the defense network, since the applicable technology can be applied to the commercial communication network, It is possible to sense the improvement of communication quality from the viewpoint of the user.

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