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# Mobility operation in the 5G Network between colorful Access Networks

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***Abstract*—** The 5G network, which aims to manipulate in 2020, is secerning in terms of data transmission speed, quiescence, and capacity of outstations on the network compared with the 4G network. One of the major design generalities for the 5G network is to accommodate colorful multiple access networks with the core network, and to give flawless mobility service. In this paper, we present the conception of Multiple Access Protocol Data Unit( MAPDU) session to control large data transmission in 5G network, and propose a dynamic anchoring mobility operation between different access networks.

***Keywords—dynamic anchoring, mobility management, 5G network***

## 1. INTRODUCTION

The 5G network, which aims to manipulate in 2020, differs from the 4G network in terms of data transmission speed, quiescence, and capacity of outstations on the network. In addition, the 5G network is anticipated to play a part not only as an structure for mobile communication services, but also as a base for future diligence

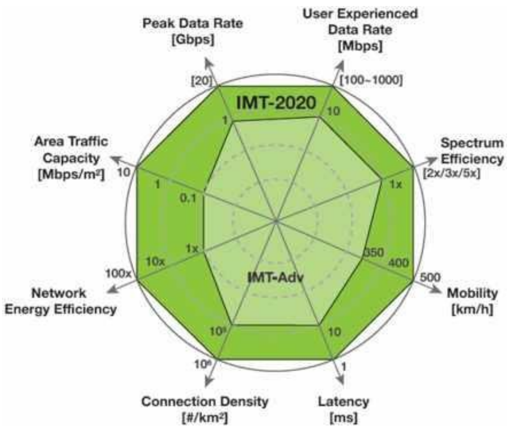



Fig. 1. Enhancement of key capabilities from 4G to 5G

The 5G network aims to achieve data rates of over to 20 Gbps, which is 20 times faster than the 4G network with a outside of 1 Gbps( 2). still, the factual data transmission speed that 5G mobile service druggies can witness is aimed at 100 Mbps. This raises enterprises about whether it'll be possible to handle contents that bear large quantities of data, similar as virtual reality or holograms. To break this problem, one of the major design generalities for the 5G network is to accommodate colorful multiple access networks with the core network. This allows druggies to enjoy immersive contents that they hadn't preliminarily endured through the 5G network. For this purpose, there's a need for a control system able of transmitting a large quantum of data by contemporaneously using colorful kinds of access networks constituting the 5G network( 6).

Another of the main design generalities for 5G network is to have a distributed control structure to help centralization of data business. The 4G network has a hierarchical structure in which several S- GWs are connected to a P- GW where an IP address is anchored and several base stations are connected to the S- GW. thus, in order to use the Internet service, the data business is concentrated in the P- GW, performing in hamstrung data paths. In the 5G network, the GW that anchoring the IP address is distributed close to the access networks to support a large quantum of data business. In order to support similar distributed structure, mobility control for data business between anchoring GWs is needed. While the stoner terminal moves in the 5G network and coincidently attaches to the 3GPP and the Non3GPP Access networks, and when the data packet transmitted to the 3GPP Access network is path switched to theNon-3GPP Access network, there may arise a problem that order of the packets isn't guaranteed because of the transmission detention difference on the paths in the colorful access networks.

In this paper, we present the conception of Mama- PDU( Multi Access PDU) session to control large data transmission in 5G network, and propose mobility control system to guarantee nonstop data transmission between multiple access networks. The remainder of this paper is organized as follows. In Section 2, affiliated exploration trends on mobility control are explained. Section 3 describes the structure of 5G network, which is being formalized in 3GPP. In Section 4, a dynamic anchoring mobility operation with the End Marker is presented to insure flawless data transmission between 5G and WiFi access networks

## 2. RELATED WORKS

In the 4G network as in the figure 2, 3 realities similar as the Serving Gateway( S- GW), the Packet Data Network Gateway( P- GW), and the Mobility operation reality( MME), manage mobility functions. The point of the 4G network, in which all the business generated by the outstation is transmitted to the central P- GW due to mobility operation and billing, causes hamstrung business paths. In addition, 4G network doesn't give mobility control between the anchoring GWs. Since there isn't a unified mobility operation between colorful access networks and LTE access and WiFi access networks operate independently( 3).

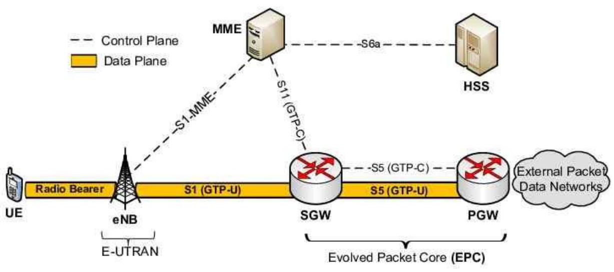
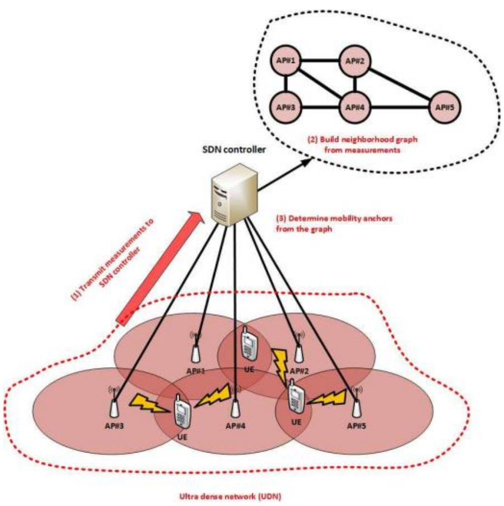



Fig. 2. 4G Network Architecture

The 5G network being formalized in 3GPP provides the conception of Demand on Mobility. The mobility characteristic and the mobility position are classified according to the types of the terminal, similar as a detector in a stationary state or a vehicle under operation, thereby minimizing the paging signaling between the UE and the core network. As the UE moves through a lot of stoner Aeroplane Functions( UPFs), the problem about Session and Service Continuity( SSC) has been considered. Indeed though three ways are defined to break the problem, but procedures for furnishing mobility operation in colorful access networks aren't defined in detail yet.




`Fig. 3. Overall steps of centrality based SDN- DMM

Proposes an optimization of the handover interruption time in the SDN grounded distributed mobility operation( DMM). The idea of this paper is to use centrality for ranking the bumps of the network. The bumps with the loftiest centrality are named as mobility anchors for the data and control aeroplane of the stoner outstations of the network. But, since this offer is grounded on SDN regulator, the 5G network armature in 3GPP isn't reflected.

Proposes a network armature that employs MMEs as a logical function in the mobile network. These MMEs perform UE operation autonomously in a distributed manner as independent distributed MME( ADMME). The main thing is to propose a new network armature that solves problems in the ADMME selection system while retaining its advantages. still, this offer is still grounded on 4G network and adds an reality to manage mobility in the RAN.

Analyzes stoner and control aeroplane quiescence, handover prosecution time, and content of functional LTE networks. This paper explains that the LTE handover prosecution time conditions and observed performance are analogous. Since the connected mobility use cases are targeting safety and effectiveness bear zero service interruption time, it suggests that the 5G design must use new mobility styles similar as makebefore- break andmulti-cell-connectivity.

## 3. 5G NETWORK ARCHITECTURE

A. Design Principles

The 5G network armature has been defined in 3GPP to support data connectivity service. The 5G network armature uses service- grounded relations between Control Plane Network Functions where linked. Some crucial principles and conception are as follows

-Separate the stoner Aeroplane( UP) functions from the Control Aeroplane( CP) functions, allowing independent scalability, elaboration and flexible deployments.

- Minimize dependences between the Access Network( AN) and the Core Network( CN). The armature is defined with a gathered core network with a common AN- CN interface which integrates different Access Types(e.g. 3GPP access andnon-3GPP access).

- Modularize the function design(e.g. to enable flexible and effective network slicing).

- Support concurrent access to original and centralized services. stoner Aeroplane functions can be stationed near to the Access Network to support low quiescence services and access to original data networks.

B. Architecture Reference Model

The 5G network armature as in the figure 4 consists of the following network functions( NF).

- Access and Mobility operation Function( AMF) AMF provides functionalities similar as Termination of RAN CP NAS, Registration/ Reachability/ Mobility operation, Access Authentication/ Authorization

- Session operation Function( SMF) SMF provides functionalities similar as session operation, UE IP address allocation, control of UPF, termination of SM corridor of NAS dispatches.

-stoner Aeroplane Function( UPF) UPF provides functionalities similar as Anchor point for mobility, Packet routing & forwarding, QoS handling

- Authentication Garçon Function( AUSF)

-operation Function( AF)

- Data Network( DN)e.g. Internet access, 3rd party services, driver services

- Network Slice Selection Function( NSSF)

- Policy Control Function( PCF)

- Unified Data Management( UDM)

- stoner outfit( UE)

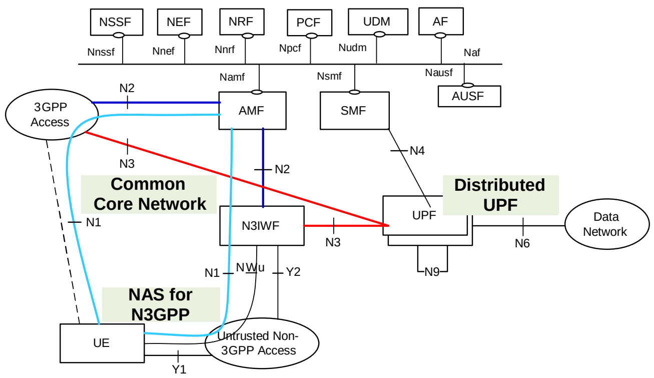



Fig. 4. 5G Network Architecture

## 4. MOBILITY MANAGEMENT IN THE 5G NETWOK

In order to break the problem of the mobility operation in the 4G network, dynamic anchoring mobility control, in which the anchoring GW for managing the IP address of the UE is changed as the UE moves, is being introduced in the 5G network( 5).

In this section, we consider a 5G network where a UE can use 5G access and WiFi access contemporaneously as shown in Fig 5. We propose a mobility operation grounded on dynamic anchoring with the End Marker that guarantees the durability of sessions when the UE moves between colorful access networks belonging to different anchoring GWs. To do this, the UE must be suitable to control the Mama- PDU session, and the 5G core network must supportinter-GW Handover discovery of multi RATs and mobility operation for on- going PDU sessions.

### A. Support for MA- PDU Session-

The 5G Network supports a PDU( Protocol Data Unit) Connectivity Service i.e. a service that provides exchange of PDUs between a UE and a data network linked by a DNN( Data Network Name). The PDU Connectivity Service is supported via PDU Sessions that are established upon request from the UE( 5).

A Mama- PDU( Multi Access PDU) is a type of PDU session that allows operation to shoot admit business either over 3GPP access, ornon-3GPP access, or both accesses contemporaneously. A Mama- PDU session comprises of a PDU session over 3GPP access and a PDU session overnon-3GPP access, or vice versa. Each of the PDU sessions may have its own set of UPFs, but both PDU sessions partake a common PDU session anchor( PSA). A Mama- PDU session is created by speeding together two separate PDU sessions, which are established over different accesses.

### B. UE Architecture for MA- PDU Session-

During MA- PDU Session Establishment procedure, the SMF sends the IP address to the UE via SM NAS signalling. To control the Mama- PDU session and theInter-GW Handover function, the UE supports Logical Interface( LIF) to acclimatize given IP address to inner IP addresses for multi access interfaces independently. Figure 7 shows the armature of a UE with a LIF to support multiple inner IP addresses for colorful access types.

The LIFs in the link subcaste of the UE may have different inner IP addresses, and each LIF is created one by one whenever a sub PDU session is created. The Mama- PDU session is generated through NAS signaling between the UECB( stoner Equipment Control Block), which processes the NAS dispatches at the UE, and the AMF. The UECB transmits the IP address, which is allocated at the time of Mama- PDU session creation, and the UPF information to the LICB( Logical Interface Control Block) which manages the logical interface. The LICB generates the LIF using the corresponding information, and sets up the routing table for mapping the business of each sub PDU session to the corresponding LIF.

The LIF generation and business control procedures in the UE, when the UE performs theinter-GW handover( HO), are as follows.

Previous to the handover of the UE, an IP# 1 address is allocated to the LIF# 1 according to the NAS procedure, and the IP address of the source UPF is set as the dereliction anchoring gateway in the routing table of the UE.

According to the routing policy of the UE kernel, the operation of the UE transmits and receives data using the IP# 1 address. After the UE performsinter-GW handover, it changes the On- going Session from the source UPF to the target UPF according to the NAS procedure, and the target UPF and the target base station( BS) establish a lair for recycling the business of the On- going Session. The operation of the UE transmits and receives the data using the being IP# 1 address

**C. Support for Dynamic Anchoring Handover**

While the UE moves between different access networks in the 5G network, theinter-GW( between anchoring UPFs) mobility operation grounded on Dynamic Anchoring, which guarantees the packet transmission order through the End Marker exchange, is as follows.

When there's a session created in the source UPF, the mobility control procedure of the on- going session is different depending on whether there's an Xn interface(inter-base stations interface) between the source BS and the targetBS. However, a forwarding lair is created between the source BS and the target BS, If there's an Xninterface. However, an circular forwarding lair is created between the source BS and the target BS, If there's no Xn interface. The circular forwarding lair is formed from the source BS to the target BS through the source UPF and the target UPF.

1)Inter-GW Handover procedure for On- going Session with Xn Interface

The Xn groundedInter-GW Handover procedure for on-going session is shown inFig. 8 left side. Source 5G- BS determines handover to target WiFI- BS through dimension control. However, a Handover Prepare procedure is performed through the Xn interface, and a forwarding lair between the source 5G- BS and the target WiFi- BS is created, If there's an Xn interface between the BSs.

The target WiFi- BS buffers packets entered from the forwarding lair until a Handover Confirm communication is entered from the UE. The target WiFi- BS sends the N2 Path Switch Request communication to the AMF, and the AMF sends the corresponding communication to the SMF.

The SMF selects a new target UPF of the UE with reference to the ID of the target WiFi- BS. The SMF generates anInter-GW lair for handover of an on- going session by transferring a session creation and session change dispatches to the target UPF and the source UPF.

The source UPF sends an End Marker to the source 5G- BS at the time of the path change to shoot the packet to the target UPF. The target WiFi- BS first transmits the packet entered through the forwarding lair to the UE until it receives the End Marker. The target WiFi- BS buffers the packet entered through theInter-GW lair until it receives the End Marker, and transmits it to the UE after entering the End Marker.

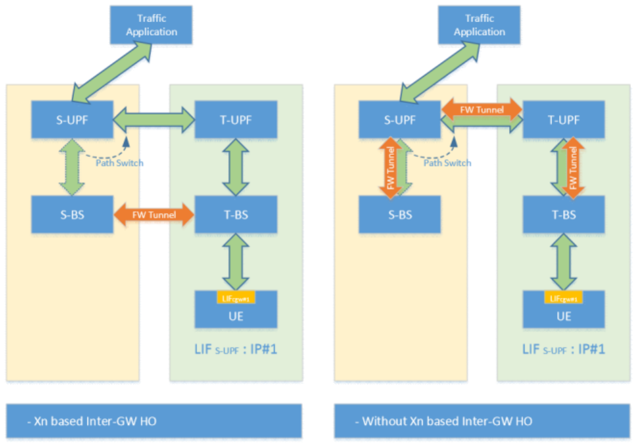



Fig. 5. Inter-GW Handover procedure for On-going Session

2)Inter-GW Handover procedure for On- going Session without Xn Interface

Theinter-GW Handover procedure in the absence of an Xn interface between different access BSs is shown inFig. 8 right side. The source 5G- BS determines the handover to the target WiFi- BS through the dimension control and notifies the target WiFi- BS of the handover medication procedure through AMF and SMF.

The SMF generates an circular forwarding lair through the source 5G- BS- source UPF- target UPF- target WiFi- BS.

Until the UE completes the L2 handover, the packets entered by the source 5G- BS are encouraged to the target WiFi- BS through the circular forwarding lair.

When the L2 handover of the UE is completed, the target WiFi- BS sends a Handover Notify communication to the AMF, and the AMF sends a Handover Complete communication to the SMF through the N11 interface. AMF creates anInter-GW lair to further the packet from the source UPF to the target UPF.

In the path switching step, the source UPF transmits the End Marker to the source 5G- BS. The target WiFi- BS transmits the packet entered through the forwarding lair to the UE until it receives the End Marker. The target WiFi- BS buffers the data packets entered through theInter-GW lair until it receives the End Marker, and transmits the softened data packets to the UE after entering the End Marker.

The Source UPF buffers stoner data business after the Path Switch without transmitting it to theNon-3GPP access network in order to guarantee the order of business packets. The source UPF transmits the last stoner business transmitted to the 3GPP access network with an end marker.

The 3GPP access network transmits the stoner business, which transmitted from the source anchoring UPF to the UE with the end marker. also, it sends the End Marker to the target anchoring UPF. This guarantees the packet transmission order.

3) Optimizing Paths for New Sessions

After the handover procedure for the on- going session is completed, a new PDU session of the moved UE is created by assigning a new IP address to the changed anchoring UPF. The SMF sends an N11 Acknowledgement communication during a handover procedure for an on- going session which notifies an suggestion for requesting the creation of a new session. The UE starts a new session creation procedure via changed anchoring UPF. Through this procedure, the new session is routed through new UPF, which is the optimal path, without going through the being source anchor UPF.

## 5. CONCLUSION

The 5G network accommodates colorful access networks similar as 5G, WiFi, and Fixed interfaces under the single control medium in the 5G core network, and attempts to break the vexation of service interruption when UEs move between multiple access networks.

In this paper, we propose a dynamic anchoring mobility operation with the End Marker to guarantee the transmission order of packets when a UE moves in colorful access networks in 5G network. Through the proposed mobility operation, the 5G network provides the optimal network terrain for furnishing a more effective and flawless communication service to druggies

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