

High Throughput, Privacy and Security for Handover in 5g Networks Using Software-Defined Networking

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ABSTRACT:-Being a faster technology, 5G provides applications with highly social and economic value, leading to a 'highly connected society' in which internet will play an important role in people's lives. We deploy cell development with spreading coverage through co-existing heterogeneous networks a prominent feasible solution for 5G mobile networks. However, this multi-layer architecture along with demanding latency requirements in 5G brings new challenges in security provisioning due to the frequent handovers and user authentications in 5G small cells. In this proposed idea, we instigate SDN into 5G as a platform to enable efficient latency achieving, authentication hand over and privacy protection. Our objective is to get low latency, less delay, simplify authentication handover by global management of 5G Networks through sharing of user dependent security context information among related access points. In this heterogeneous network we consider both macro and micro access points. We demonstrate that SDN-enabled latency reduction and security solutions are highly organized through its centralized control capability, which is essential for low latency and secured 5G communications.

KEYWORDS: 5G Networks, Heterogeneous Networks, SDN, Latency, location awareness and security

I. INTRODUCTION

With the quick development of mobile internet applications such as high-quality real time wireless video streaming, social networking etc., the demands for high speed data transmission has been growing drastically. The total worldwide mobile traffic of 351 exa-byte in 2025 represents a 174% increase compared with 2020. Currently, the cellular networks including the 1G, 2G, 3G and 4G are far from satisfying the significant traffic increments and the high energy efficiency by using the base station (BS) power to overcome losses, which in turn causes interference to other users. The 5G system deployed initially in 2020 is expected to allot 1000 times higher wireless area capacity and can save 90% of energy consumed per service compared with the current 4G(LTE) system. More than 1Tbit/s/km² area is covered dense urban environments, 10 times longer battery life time of connected devices, and end-to-end (E2E) latency can be reduced by 5 times in 5G systems. The current 5G air interface and spectrum should be merged together with the long term evolution (LTE) and WiFi to provide high-rate coverage and a consistent user experience. To achieve these, 5G systems use advanced radio access technologies and its internet protocol (IP) open internet network architectures should be developed smoothly from 4G systems. The current breakthroughs in the base-band and radio frequency (RF) are required to allow computationally intensive and adjust to new air interfaces in 5G systems. A notable and advanced base-band computation is required to meet the intricate requirements of new solutions. The new developments in the integrated-access node and heterogeneous networks are enforced to allow the ultra-compact radio nodes to work efficiently. The plug-and-play function becomes important to commercial deployments, in which the accessible spectral resources should be allotted and the corresponding parameters should be self-organized. The programmed air interface technologies should be consistently integrated into the 5G radio access network architecture. The cloud computing based radio access framework would provide on-demand resource processing, storage and high network capacity wherever needed.

As the association of the mobile industry, says that the GSMA will play an important role in shaping the planned, commercial and regulative development of the 5G ecosystem. This will include areas such as the definition of roaming and annex in 5G, and the identification and alignment of suitable spectrum bands. Once a standard solution of 5G is reached, the GSMA will function with its members to identify and develop commercially viable 5G applications.

Two definitions of 5G:

1) A service which views 5G as a combination of 2G, 3G, 4G(LTE), Wi-fi and other innovations providing far greater coverage, high reliability and security.

2) 5G is defined as a significant change in data speed and order of extent reduction in end-to-end latency.

The technical requirements that constrain a true generational shift are sub-1ms latency and less than 1 Gbps, downlink speed, and only services that need at least one of these would be considered and use 5G. Achieving sub-1ms latency is a highly an exciting challenge. Moreover in 5G delivering 1ms latency over large network will be challenging task. If this were to happen, some 5G services may not be possible and the second definition of 5G would become less clear. This paper looks at the challenges that must overcome to deliver 1ms latency.

Meanwhile, 4G will continue to develop and evolve Technologies such as Het-Nets, etc., are already being deployed by operators and support in the developments of 5G.

Future 5G networks will become heterogeneous with small cell deployment & overlay coverage, owing to the poor signal propagation feature at extremely high frequencies, as shown in Fig. 1. Cellular/mobile networks operating at low frequencies (e.g., 2G, 3G, LTE) could offer wide area coverage capability, mobility support, privacy and control, while small cells operating at high frequencies guarantee high data transmission and reception rates in the area of spectral and energy efficiency.

In 5G, follows the progression from existing cellular technologies, by satisfying the requirements of increased data traffic, providing very high throughput using micro cells and underlying macro cells providing large-scale coverage. To achieve increased capacity with low cost 5G networking communication, small cells can be utilized. In spite-of that, density of the 5G network can be increased by using these low power small cells(crucial element)

II. LITERATURE SURVEY

"A QoS Oriented Vertical Handoff Scheme for WiMAX/WLAN Overlay Networks" Dong Ma, Maode Ma, 2012."

In this paper, an analysis of important issues for the inter-working of Mobile WiMAX and WLAN networks. A tightly coupled inter-working architecture is discussed in paper. Further, a consistent and proactive vertical hand-off scheme is designed based on the architecture which aims to provide the best quality of service for users. Both the performance of applications and network settings are considered in the hand-off process.

"Optimization of Vertical Handover Decision Processes for Fourth Generation Heterogeneous Wireless Networks" Xiaohuan Y, 2010.

This thesis presents a vertical hand over decision (VHD) scheme for improving the efficiency of vertical hand over processes in the 4G heterogeneous wireless networks. In this survey author review the recent bandwidth estimation of heterogeneous networks literature focusing on hidden techniques and procedures as well as open source bandwidth measurement tools.

III. SOFTWARE DEFINED NETWORKING-BASED 5G SYSTEM

Software-defined networking is considered as a radical new network structure to centralize network management, and enable transformations through network programming ability in considering the needs of emerging applications. The separation of control plane and data plane by considering control logic from the hidden switches and routers to the main SDN controller in the control plane is the main feature of SDN. In 5G, the networks are controlled globally with the help SDN controller. SDN switches are used to follow data forwarding instructions from the controller. This SDN controller is simply a program which will be running on a server and it can be used in any remote data center.

On top of the controller application modules are implemented in-order to define the behavior of the SDN switches and APs. The base stations, switches and AP's are provided with SDN protocols that support Software Defined Networking. An external application programming interface is toused to achieve the above said facility. protocols like Open Flow is used for data control whereas Simple Network Management Protocol is used for device controlling.

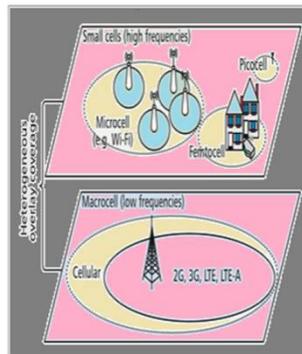


Figure 1. 3G heterogeneous network structure with densified small cells

An highly flexible and global connection, more faster routing and network management is provided by SDN based 5G network structure. Users can the access network services anywhere, anytime regardless of the network type (e.g., Wi-Fi, 3G, LTE, LTE-A) as long as these networks belong to the same network or there are agreements between operators. A proper authentication and privacy and security protection are also feasible by using this SDN based network.

In this paper, we explore SDN as a optimistic platform to introduce intelligence into 5G and address the security challenges. In particular, we explore SDN-based 5G network provide minimized redundant authentication and hand-over.

In 5G, the hand-over authentication is highly controlled avoiding unnecessary procedures. The mobile users are shared with highly secured information. This network chooses many routing paths to transmit information simulataneously. More efficient security provisioning is achieved in 5G based system. This shared security data reduces handover complexity. Its privacy protection in different network routing paths during data transmission is checked in order to provide guaranteed communication and privacy protection.

IV. AUTHENTICATION AND 5G CHALLENGES

Our existing mobile cellular communications systems currently use forms of full duplex communication, these use different range of frequencies for transmit and receive data and voice signals, FDD - frequency division duplex method, or different times for transmission and reception method, TDD - time division duplex. Advanced 5G full duplex scheme being developed and that allows simultaneous transmission and reception on the same channel at the same time.

- Base station model
- Relay station model
- Subscriber station model
- A typical LTE system consists of three types of network elements: the base station (BS), the subscriber station (enodeb), MME , gateway and its interfaces.
- There are three types of relaying nodes we are considering in our project:
 - RSs—the standardized fixed relays
 - femto cell/pico cell BS's the fixed femtocell/pico cell BS's with wireless relay functions, where these fBSs/pBSs can relay signals over the air from the SS's to the 4G BS, or vice versa.

Network selection

The selection of network is based on types of networks we selected for our communication purpose. Here we selected two types of access points for our communication, one is macro access points and another one is micro access points. We consider micro access point as wifi and micro base station and macro access point as LTE advanced communication. We select our network based on heterogeneous communication system. Our modified and proposed idea select network based on low latency and defined highly security based on our software defined system as in our centralised networking system

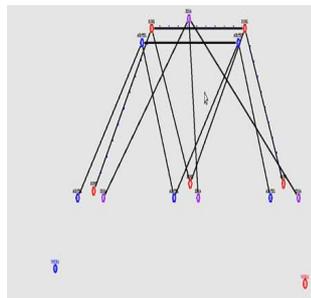


Fig 2:Network Selection

Vertical handoff

If node and BS detects fading signal then signal handoff will taken into account Normally handoff is done in same network node mean then we are calling that handoff as horizontal handoff In this model, we are implementing the handoff in different network such as macro base station and micro station. This type of handoff is called as vertical handoff .Our extended 5g advancement the same channel is used for both the direction so the fading or its propagation characters remain the same; this reduces the air interface timings.

- In general, handoff is taken into account when the node notice signal fading.
- In our proposed model we are implementing the handoff, not only in signal

Fading

- When the no of user increased or delay is increased, handoff will be taken into account
 - Due to this type of handoff, we can improve our network quality

Channel fading occurs mainly because of macro or micro user moves from one station to other station if the user is stationary then almost no time variations of the channel occur. The average fade duration specify how long the signal waste time below the threshold. Due to fading there should be delay normally our proposed scheme reduce the time delay by implementing the concept of full duplex single frequency.

Network security

For multi hop (nth hop) connectivity using ECEHP (Elliptic curve encrypted Hybrid protocol), the cell-edge RS broadcasts its public key, ECEHP global parameters, BS-ID, and system parameters in the DCD (Downlink channel Decryption) broadcast message. The MS/BS that wishes to join with access BS starts the ranging and connectivity process. After the initial connectivity, if the newly connected node in BS, then the super ordinate BS will share the public key of the BS and the corresponding global parameters. The new BS will associate with the BS by sending its public key to the BS. Hence, the multi hop RS can send its traffic over the tunnel mode.

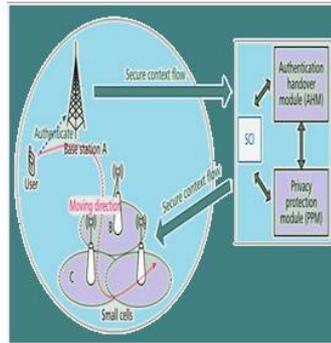


Fig:3 Secure context flow

The 5G SDN controller shares the user’s SCI (secure context information) to next cell AP’s along the predicted route is just like a authentic establishment from a previous AP before hand-over. The future cell AP’s finishes the authentication with the user promptly and begin to monitor the user’s service according to the SCI. If trace of the user is found, the risk of getting impersonated is significant, if not entirely minimized. The risk of service disruption in previous networks will be present, if the connection between AP’s and the authentication server is broken.

Under alike network conditions, however, our mechanism will not lose global network connectivity because another AP is programmed to monitor the user, which can help the controller retrieve the necessary information according to the pre-contributed SCI. Thus, the SDN-enabled security hand-over possesses high levels of tolerance to network failures. We have tested out project and path discovery module by following screen shot, which worked perfectly.

Application Considered – Voice calls

In this case, we are considering that both users are looking for the voice communication. For voice communication, the main thing considered here is better connectivity through the network region, instead of looking cost of the service, bandwidth, etc. As per the parameter values of the different kind of networks considering macro or micro base stations to provide the better connected network according to the distance function value. So, both the users are connected with the heterogeneous process of voice communication that is shown.

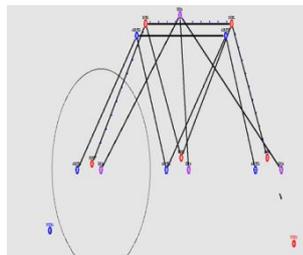


Fig 4 Secured communication

Whenever node is moving from one place to another place that time hand-off will be occurs due to coverage problem.

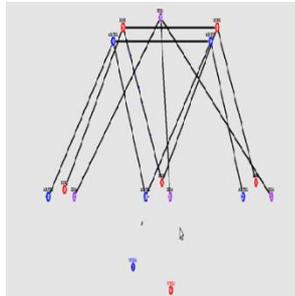


Fig 5. Node is moved inside another base station, so handoff has been done

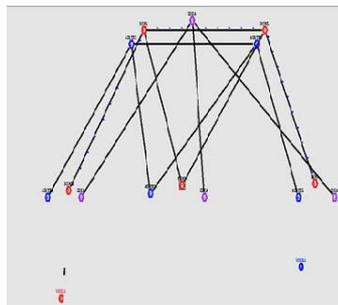
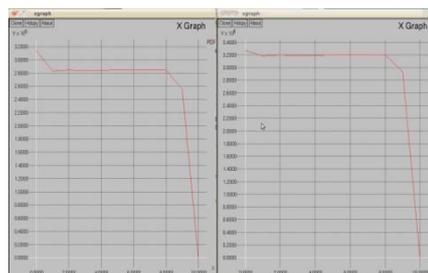


Fig 6In above fig user moved to another base station region so here handoff time and connectivity latency reduction

V. PERFORMANCE ANALYSIS

Throughput and packet delivery ratio:



From this graph we can see the packet delivery function is high for VHO with Micro BS network compare than Macro VHO operation.

VI. CONCLUSION & FUTURE WORK

We have introduced a SDN protocol with security control technique for 5G systems with marginal modifications to the prototype. All other method maintains the less Security compare than our model due to SDN communication, and in our method the throughput level is maintained but some over head is increased due to withdrawal message sharing or key sharing and improvement in latency also made high.

The multi-tier micro to macro accesspoints handover architecture and low latency accuracy, challenges emerge in security provisioning and privacy protection in 5G networks. 5G network low latency and security handover needs to be fast, with low complexity due to the reduced cell size and stringent latency constraint. In this proposed ideas we

identify current challenges on obtaining low latency, authentication handover and privacy protection in 5G. To address these challenges, we implement our work SDN-enabled authentication handover and privacy protection through sharing of user low latency specific security context information among related access points. The SDN enabled solution not only provides a re-configurable network management platform, but also simplifies authentication handover in accomplishing reduced latency. The performance of our work has been demonstrated through numerical simulations and examples. Security performance under different attacks, low latency achieving between two links, and effective use of secured information, could be explored for SDN-enabled 5G security mechanisms. We did our project as the prototype implementation model with throughput and overhead and Security with the relay link and access link checking process. Due to our less academic duration we have not tested with more result like different data rates, bandwidth availability and as like in real time 100's of nodes with mobile relay functionality and number of antenna variation.

In our future work, to improve the more reliability we will test with bandwidth variations with different data rate for each user and we will try to reduce the overhead in the place of power control.

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