Abstract—Mobility of the subscriber is an important attribute to the success of a telecommunication network.

With the advent of 5G networking which achieves high throughput rates by using heterogeneous nodes and frequent handovers, existing authentication and handover techniques should be revisited to securely and reliably perform handovers for LTE. By virtualizing the nodes through Network Functions Virtualization, the nodes can be treated as a homogenous node and can be controlled in unison. This greatly simplifies the handover procedure and increases the security of the user specific information. In this article, we present our scheme for secure authentication handover in 5G HetNets.

Index Terms—5G, HetNets, NFV, Handover

I. INTRODUCTION

The network is expected to be available all the time and its down time can bring a disastrous situation. Handover needs to be seamless and at the same time should ensure service continuity, network discovery and optimum selection and also power conservation of mobile devices. The standards revolve around 802.11, 802.16, CDMA, LTE, GPRS, EDGE etc. The diversity of the devices and the new 5G networks which combines heterogeneous nodes to increase throughput and it combines smaller networks to achieve this feat.

Handover is an essential process that must be envisioned ahead of time to provide quality communication service. Handover management with heterogeneous devices is discussed.

This heterogeneous paradigm with multi-tier protection in 5G is not most effective follows the usual evolution from present mobile applied sciences, but in addition satisfies the standards of new visitors, with small cells supplying very high throughput and underlying macro-cells delivering huge protection. As a consequence, community densification utilizing low-powered small cells is greatly regarded to be an imperative element toward low-priced excessive-capability 5G communications.

Together with some great benefits of 5G structure in Fig. 1, there additionally come a couple of predominant technical challenges. The huge deployment of small cells poses practical challenges in community administration, together with interference alignment, wide rework, and inconsistent mechanisms over heterogeneous networks (HetNets). Network administration and service provisioning are challenging on this multi-tier architecture to the accelerated number of base stations and complexity of network structure. Accordingly, new applied sciences are wanted to provide smart manage over HetNets for regular and amazing resource allocation as good as protection management.
information known as Authentication Vectors (AVs) for the needs of operating security-related functions including Identity Authentication, HMAC Authentication, AV Generation, Key Generation, SQN-synchronization and Encryption. After Identity authentication process, the server can invoke SHA-1 and Pseudo-Random Function (PRF) to derive essential key sets. As successfully completed WLAN authentication and SQN-synchronization process, the server immediately delivers MSK to neighboring node and Access Point (AP). Which lead to performance degradation, different type of handoff management techniques has been proposed by the researchers to improve the handoff process. *IEEE 802.21*

The IEEE 802.21 framework is intended to provide methods and procedures that facilitate handover between heterogeneous access networks. These handover procedures can make use of information gathered from both the mobile terminal and network infrastructure to satisfy user requirements. There are several factors that may determine the handover decision. Typically these include service continuity, application class, quality of service, network discovery and selection, security, power management and handover policy.

### III. NFV

The NFV initiative is intended to address the operational challenges and high costs of managing the closed and proprietary appliances presently deployed throughout telecom networks. By virtualizing and consolidating network functions traditionally implemented in dedicated hardware, using cloud technologies, network operators expect to achieve greater agility and accelerate new service deployments.

### IV. NFV vs SDN

NFV aims to reduce equipment costs and decrease time to market while attaining scalability, elasticity, and a strong ecosystem. Much like NFV, SDN accelerates innovation by breaking the bond between proprietary hardware and control/application software. Both architectures are optimized for the dynamic cloud environment at carrier scale.

![Figure 2 3GPP-WLAN heterogeneous mobile network.](image)

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### V. NFV NETWORK CHALLENGES

Major operators intend to leverage and adapt cloud technologies to implement NFV in the carrier environment. Among the network challenges that operators will need to overcome are:

- Fixed configurations. Today’s purpose-built hardware-based network appliances.
- Manually intensive management. Provisioning and configuration for network appliances are complex, manually intensive, and time-consuming tasks.
- Provisioning for virtual appliances (referred to in the NFV environment as virtualized network functions [VNFs]) must be automated to address the dynamic NFV environment. Such automation will reduce provisioning and configuration times along with manually induced configuration errors.
- Rapid growth of IP endpoints. Because of the virtualization of network appliances, the number of network endpoints in the NFV environment will increase far faster than for existing networks, potentially resulting in millions of endpoints for residential and mobile applications. This will increase the stress on existing network mechanisms such as Layer 2 VLANs, or necessitate additional complexity for bi-sectional bandwidth scaling such as SPB and TRILL.
- Network endpoint mobility. Physical appliances are typically provisioned once in their lifetime and stay fixed in the same network location. VNFs can be migrated readily to disparate physical servers, which may appear in different sub-networks or even physical locations, use different tunneling addresses, or even have different protocols that dictate how they will be reached. NFV breaks the traditional linkage between IP location and identity.
- Elasticity. In the NFV environment, VNFs are created, adjusted, and destroyed in real time on demand. Networks must be capable of being reconfigured rapidly to achieve the elasticity needed to optimize the pooled resources in the dynamic NFV environment.
- Multi-tenancy. Many of the NFV use cases are based on cloud-like “as a service” offerings whose viability hinges upon efficient multi-tenancy. Granular policy management is required that can be assigned to services and flow, but decoupled from the physical infrastructure.

**A. Advantages**

NFV infrastructure (NFVI) of another service provider. This approach can greatly expand a carrier’s reach in locations where it maintains no physical network assets.

- Real-time and dynamic handover. VNFs, VNF FGs, etc. must be automatically deployed and managed in the NFV infrastructure.
- Seamless control and provisioning of physical and virtual networking infrastructures.
- Carrier-grade scalability and robustness.
- Openness and interoperability. Like SDN, NFV envision an open environment where network elements and VNFs from multiple vendors interoperate and co-exist through open interfaces (i.e., OpenFlow) and APIs.
- NFV global reach and cross-administration. Connectivity that spans multiple administration domains and geographies is essential.
- Acceleration of innovation. The unique demands of NFV potentially necessitate in a massively complex forwarding
Handover policies are the crucial element that has greatest importance on flawless handover procedure. Thus it is important to define when specific handover procedures should occur. For example, if too low signal strength threshold value is chosen, probability of disconnections and unavailability of service is much higher. For handover in femtocell network it is even more important, therefore it is one of the most discussed topic where a lot of new decision criteria are proposed.

One of the most discussed policy is to differentiate static (or with low velocity) UEs from moving to avoid frequent handovers and the associated ping-pong effect. Typical femtocell coverage area is in order of tens of meters. When UE is moving, it stays in the range of selected FAP only for couple of seconds therefore for moving UE is handover to FAP completely unnecessary. It leads to waste of radio resource and has no advantage for macrocell. It would be more suitable, if during handover UE has to be in the range.

One of the proposed solution called prefetch-based fast handover [3] takes care of higher layer data for UE, which are sent to source cell and then forwarded to target cell and all of that have to go through public internet. Because of latency in public internet it results in longer time of handover procedures than it is necessary.

In proposed prefetch-based fast handover every serving cell identifies all neighbor cells and defines proximity region. Proximity region is important because serving gateway knows that handover will be to target cell from proximity region list. All cells in this list must be prepared for handover of every UE associated to all serving cells in proximity list. When handover occurs then these higher layer data are sent to all cells in proximity region list but only the target cell of handover sends them to UE. Other cells throw these data away after some time.

A completely different handover approach compared to classic handover in 2G or 3G networks is suggested in [8]. Basic idea is to use D2D (Device to Device) communication between UEs because D2D communication may happen in an area covered by multiple femtocells. Greatest advantage over using standard S1 interface between FAPs, which is through public internet, is in much lower latency. Author propose that every femtocell should have at least one associated UE creating TAN (Temporary Area Network) for communication between UEs. This TAN would be used for handover procedure.

When one UE (called first) will be leaving area of coverage of serving cell, this UE will send message using communication to other UE (called second) which is in same but is connected to another handshakes. This message contains request to send handover establishment for first UE to target cell that is serving second UE. Instead of using public internet, handover request will be sent using D2D communication.
In this paper, a hybrid handover technique is proposed as feature work based on the combination of NFV and SSHO with Multi-carrier handover techniques. The combination is expected to enhance the system performance in term of latency and outage probability. Also, it will be reduced the transmission overhead on the serving cell as expectation, which results in a balanced network traffic within the system cells.

The Physical frame structure that has been introduced in [7] is considered in our simulation. Based on that, the cell throughput can be calculated for every sub carriers at the UE side. Where, it is measured in every iteration time during all the simulation time and then taking the average over all the users that are simultaneously active in the cell.

The handover numbers in our simulation is investigated through all the simulation time to see in the effect of CA on LTE-Advanced standard during handover. It can be measured based on the following algorithm.

\[
\text{SINR}_a \text{ is the achieved SINR, } a \text{ is frequency reuse factor}
\]

\[
\text{if the No of served MS } \leq \text{ System Capacity}
\]

\[
\text{if SINR}_{\text{Served_eNB}(t,j)} \leq \text{ SINR\_threshold}
\]

\[
\text{Make Handoff from served to the Target eNBs}
\]

\[
\text{No\_FSHO}(j) = \text{No\_FSHO}(j) + 1;
\]

\[
\text{else}
\]

\[
\text{Keep communication with the served eNB; }\text{No\_FSHO}(j) = \text{No\_FSHO}(j) + 0;
\]

\[
\text{End else}
\]

\[
\text{Make Handoff from served to the Target eNBs}
\]

\[
\text{No\_FSHO}(j) = \text{No\_FSHO}(j) + 1;
\]

End

t refer to the simulation time. j refer to the user’s number.

IX. COMPARISON

With existing handovers the proposed system has fewer handovers and is done in a seamless fashion.

X. RESULTS

The existing handover technique that is utilized in LTE-Advanced system is known as HHO. HHO offers reduce architecture and handover procedure complexities. But on the other hand, there are several limitations when performing process, such as high latency, handover procedure unreliability, high outage probability and data lost. In this paper, a comprehensive overview of handover including handover techniques and features of the existing handover technique that are used in LTE/LTE-Advanced system are highlighted and discussed. Those handover techniques support seamless handover, but suffer from some flaws such as inter-cell interference coordination, interference mitigation technologies, latency, unreliability and some data lost during handover. Moreover, implementing FSHO based on CA has been investigated, which result in improve system performance in term of cell throughput in everywhere in the cell and user’s handover numbers much better than the system that has been implemented with one component carrier only (Non-CA).

A hybrid handover technique is proposed to address the shortcomings of the existing approaches. The hybrid handover scheme is based on the combination of difference and authentication with multi-carrier handover techniques. The combination is expected to enhance the system performance in term of latency, outage probability, interruption time and reliability during handover especially at cell boundary. Also, the combination is expected to reduce the transmission overhead on the serving cell, which balances the traffic load within the system cells in LTE-A context.

XI. CONCLUSION

Thus Network Function virtualization shows immense promise for intelligent handovers in LTE 5G HetNets.

REFERENCES


