Secure Handover Scheme For Traffic Optimization Based on DSDV Protocol

S.Indhu[1], R.Mohanapriya[2], S.Thiruvasagam[3]
[1]Dept of Electronics and Communication
[2]Assistant Professor, Dept of Electronics and Communication
[1, 2, 3] Paavai Engineering College, Namakkal

Abstract- *Mobile communication industry is growing rapidly with the increasing demand of users in the field of communication. For better communication, there are various networks such as Wi-Fi, which allows the user to stay on always connected and also provide seamless connectivity to the internet. But Wi-Fi has some limitations as its range is limited. Then WiMAX based on IEEE standards and LTE standardized by 3GPP, are two competing technologies, very technically similar which provides the speed of Wi-Fi. Thus by combining these three networks, a new wireless solution is created, which provide seamless roaming and better connectivity for mobile users. By using NS-3 tool, Handoff latency, End to end delay, Power consumption, Ping pong effect, Packet loss, and Network load, Bandwidth and coverage for mobile users are analyzed. In this we use DSDV protocol, to access the performance of the inter system handover between Wi-Fi, WiMAX and LTE networks. The proposed scheme reduces traffic and increases the quality of communication.*

Keywords- Wi-Fi network, WiMAX network, LTE network, Vertical Handover, DSDV protocol.

I. INTRODUCTION

In the present time, key to provide mobile users with required QoS will be seamless handoff between homogenous or heterogeneous wireless access networks. Also the continuation of user application should not be compromised. Generally handover bring up the process of transferring an active call or data session from one cell in a cellular network to another. There are many reasons to perform handover between three cellular networks, and the most important reason is to deliver uninterrupted service to a user [12, 13]. There are some rules to initialize the handoff and it can be divided into two types:

1) Horizontal handoff – In this process the handoff occurs between the two cells having the same access technology or among the homogenous base stations. In this process there is no connection break between the two cells [11, 14].
2) Vertical handoff – In this process the handoff occur between the two cells having different technologies or when a node moves between various wireless access networks. In this case the access technologies as well as IP address change because as the node move from one network to another the technology also changes. But change of network interface and IP address are main concern of this process. In the Figure 1, a vertical handover occur among AP1 and BS1 [12,15].

In this paper, three major wireless access technologies-Wi-Fi wireless network, WiMAX mobile communication system and LTE are selected as our research subject. Section 2 describes the method used. Section 3 describes the result and analysis. Section 4 deals with conclusion. Section 5 describes acknowledgement.

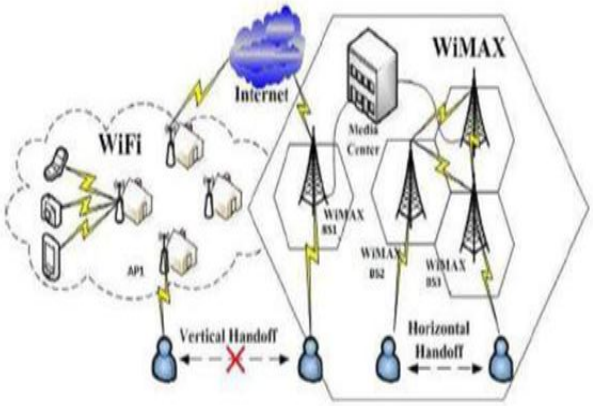

Figure 1 Vertical and Horizontal Handover

A. Wi-Fi (Wireless Fidelity*):*

Wi-Fi describes the underlying technology of Wireless Local Area Network (WLAN) and it is based on the specification of IEEE 802.11. Initially its use is limited to mobile devices but as the performance increases at present it is also used for several other services, such as VoIP phone and Internet access. The 802.11n Wi-Fi standard can provide the speed up to 108 mbps. Wi-Fi has a limited range and the actual distance depend upon the several factors. Generally the range can be 150-300 feet and 1000 feet for outdoor[1].

Technically Wi-Fi setup can contain Access point and clients. Since Wi-Fi communicate in the air so there are chances that collision may occur. But like most of the radio packet it trey to avoid collision rather than collision detection [2].

B. WiMAX:

The IEEE 802.16 standard which famously known as WiMAX approved in June 2004. This is comparatively new and also provides better speed and coverage area than Wi-Fi. With the use of WiMAX we can easily achieve the speed up to 70 mbps and the coverage area of 48 kilometer. WiMAX has the capability to provide higher data rates, better coverage area, efficient bandwidth and minimum interference. As it provides long distance communication with better speed it is considered as an alternative to DSL and cable [3].

WiMAX technology is more secure as it uses 3DES and AES encryption technology and also less susceptible to interference. Technically WiMAX uses the similar approach which is used in cell phones. In this approach two channels are used known as uplink and downlink to transfer the data from base station to user and from user to base station respectively.

C. LTE:

Long Term Evolution (LTE) is a 4G wireless broadband technology developed by the Third Generation Partnership Project (3GPP), an industry trade group. 3GPP engineers named the technology "Long Term Evolution" because it represents the next step (4G) in a progression from GSM, a 2G standard, to UMTS, the 3G technologies based upon GSM. LTE bring significantly increased peak data rates, with the potential for 100 Mbps downstream and 30 Mbps upstream, reduced latency, scalable bandwidth capacity, and backwards compatibility with existing GSM and UMTS technology. Future developments to could produce peak throughput on the order of 300 Mbps.

Handover Procedure

Handover is the process of maintaining a mobile user's active connection as it moves within the network. When a user moves from one cell to other, maintaining good quality of signal is a very important aspect which includes deciding the correct handover time, the correct handover decision, packet losses, latency, signaling traffic overhead, security and increased system loads [4].

Frequent handovers can put a large burden on the base station and can also lead to an inefficient utilization of network resources. This unnecessary handover is called ping-pong effect where a mobile device is handed over from one cell to other cell several times within a period of few milliseconds [5]. Therefore, handover decision criterion should always lead to minimization of these unnecessary handovers.

A. Handover Process:

Handover is the process of changing the channel associated with the current connection while a call is in progress. It is often initiated either by crossing a cell boundary or by deterioration in quality of the signal in the current channel. The complete handover procedure is divided into following three phases [6]:

B. Handover Initiation :

It deals with collecting all the information, related to network and the mobile device, required to identify the need for handover. For a network, information such as bandwidth available, QoS provided by network, bit error rate, current traffic load, Received Signal Strength (RSS) is collected. For the mobile device, its velocity, battery life and access mode is required.

C. Handover Decision:

Based on the various parameters chosen for handover, one best network is selected out of various possibilities. Decision may be taken based on a single parameter like RSS or a combination of two or more parameters from RSS, velocity, available bandwidth, access mode and battery life etc. The decision can be taken by network, the mobile or the network in assistance with mobile.

D. Handover execution:

In this phase the connectivity to the target cell is established. The radio link to the old cell is deleted and a radio link to the new cell is set up.

Reasons of Handover:

Telecommunication reasons for conducting handoff can vary. Here we have mentioned some of these cases.

- When the cellular phone is moving away from the area covered by the serving BS, the device eventually goes outside the range of the serving BS. So in order to avoid call termination, the call needs to be transferred to an area covered by another BS [7].

- When the signal strength is not enough to maintain a proper call at the edge of a serving cell, the call needs to be transferred to another cell [8].
- When the capacity for connecting new calls of a cell in a BS becomes full or more traffic is pending, capacity must be made available for users who can only be connected on that cell. Therefore, the existing calls or the new calls from a phone that is located in an area that is overlapped by both cells can be transferred from the first cell to the second cell [7] [8].
- In non-CDMA networks several phones use different cells but the same channel. As a channel is being used by several phones, disturbing co-channel interference comes from another phone. Therefore, in order to avoid interference, the call is transferred to a different channel in the same cell or to a different channel in another cell [7].
- In vertical handoff, a faster network is occasionally available. So the phone changes its network to the cheaper one [8].

III DSDV PROTOCOL IN NS-3

Destination-Sequenced Distance-Vector Routing (DSDV) is a table-driven routing protocol for ad hoc mobile networks based on the Bellman–Ford algorithm. The main contribution of the algorithm was to solve the routing loop problem. Each entry in the routing table hold a sequence number, the sequence numbers are generally even if a link is present; else, an odd number is used. The number is generated by the destination, and the emitter needs to send out the next update with this number. Routing information is presented between nodes by sending full dumps infrequently and smaller incremental updates more frequently.

DSDV module in ns-3

This section describes our implementation of DSDV, which has been included in ns-3.10 stable release[9]. The main components of the DSDV implementation are routing update mechanisms, route table creation and route maintenance. DSDV maintains valid routes and flushes out invalid routes based on the periodic update interval. We implemented an optional packet buffering mechanism that was not part of the initial DSDV design[10]. This feature is implemented for testing the performance of the protocol with and without packet buffering and also to provide users with more options. All the attributes used in this implementation are listed in Table 1. The details of the classes implemented are explained next.

Attribute	Defaults	Summary
Periodic Update Interval	15s	Time interval between exchange of full routing tables among nodes
Enable WST	True	Enables Weighted Settling Time for the updates before advertisement
Settling Time	6s	Minimum time duration an update is stored before transmission
Weighted Factor	0.875	Weighted factor for the settling time if Enable WST is true
Enable Buffering	True	Enables buffering of data packets if no route to destination is available
Max Queue Len	100	Maximum number of packets that can be queued
Max Queue Time	30s	Maximum time duration for which packets can be queued
Max Queued Packets Per Dst	5	Maximum number of packets that can be buffered per destination
Hold times	3	Number of times Periodic Update Interval to purge a route
Enable Route Aggregation	False	Enables aggregation of DSDV updates over a period of time R
Route Aggregation Time	1s	Time over which DSDV updates are aggregated

Table 1. DSDV attributes and default values.

Class Interaction

We implemented the DSDV routing protocol ns3::dsdv::RoutingProtocol in ns-3 by extending from the abstract base class ns3::Ipv4RoutingProtocol. The ns3::dsdv::DsdvHeader is extended from ns3::Header. We have also declared ns3::dsdv::RoutingTableEntry to store the updates of a node and ns3::dsdv::RoutingTable to store all these entries in a table. Similarly, we have declared the ns3::dsdv::QueueEntry class to store a packet and ns3::dsdv::RequestQueue to store all the queued entries. The main class that glues all these together is the ns3::dsdv::RoutingProtocol class.

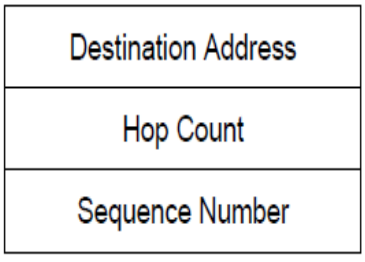

Figure 2 DSDV message header

Header

The DSDV message header (DsdvHeader) is 32 bits wide with the total header size of 12 bytes as shown in Figure 2. The fields in the DSDV header are the node's IP address, the number of hops required to reach that node, and its last

known sequence number. The latter two are 32-bits long in our implementation to provide word alignment and allow simulation of very large networks, even though the ns-2 implementation used 16-bit fields. Note that unlike AODV and OLSR, there is no DSDV RFC to guide standards compliance.

Routing Table

The structure of the DSDV Routing Table is implemented as follows. Each entry carry out by the Routing Table. Entry class corresponds to a node in the network and the entry is mapped to that node's IP address. Every entry stores the following attributes of a node: its IP address, interface address, a pointer to its ns-3 net device, last known sequence number of the node, hop-count to reach the node, timestamp of the last update received for the node, and the settling time for that node. Also, we maintain a boolean value that species whether the entry for this node has changed since the last periodic update. This helps filter DSDV updates that are broadcasted through the trigger update mechanism.

The Routing Table class has methods to add, delete, update, look up, and print entries. DSDV maintains two routing tables: a permanent routing table and an advertising routing table. These tables store the permanent stable routes and the recently received routes respectively. The recently received routes might be unstable; therefore, when the node identifies a route to be stable, it advertises that route and moves it to the permanent routing table.

IV. RESULT AND DISCUSSION

The handover between WiMAX, Wi-Fi and LTE is evaluated with the use of DSDV protocol. There are various parameters that have been affected during the handover but the connectivity of the node is not affected. Figure 3 shows about the hand over failure rate in these three networks.

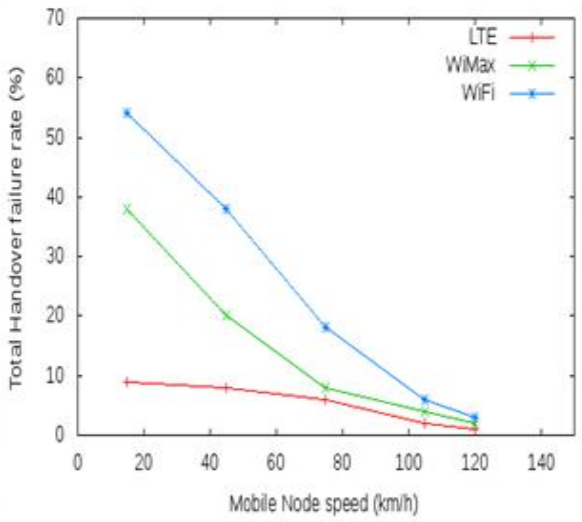

Figure 3 Handover failure rate

Future work

In future, the handover failure is over come and analyze some parameters which reduces traffic in communication

REFERENCES

[1] Malak," Battery Based Vertical Handover between WiMAX and WLAN Technologies" 978-1-4244- 5118-011©2011 IEEE.

[2] Miss.Minal J.Patil, Prof.S.S.Patil, "Simula tion Based Analysis of Vertical Handover Between Wi-Fi and WiMAX Network s using NS2", International Journal of Engineering Trends and Technology (IJETT) – Volume 1 1 Numbers 9-May2014.

[3] Gurpartap Singh*, Garima Saini," Development of Vertical Handover (VHO) Protocol Based on MIH (IEEE 802.21 standard) In UMTS-WIMAX Heterogeneous Network" International Journal of Scientific Research Engineering & Technology (IJSRET) Volume 1 Issue2 pp 027-034 May 2012.

[4] A. Singhrova, N. Prakash," Vertical handoff decision algorithm for improved quality of service in heterogeneous wireless networks", IET Communications, vol. 62, pp. 211-223,2012.

[5] G. P. Pollini,"Trends in Handover Design." IEEE Commun. Mag., vol. 34:pp. 82-90, 1996.

[6] K.Sethom, Ben Reguiga, F. Mhiri, R.Bouallegue," Handoff Management in Green FEMTOCELL Network",International Journal of Computer Applications, vol. 27,pp. 1-7,2011.

[7] Pooja, B., Bijender M., "Analysis of Handover in Wimax for Ubiquitous connectivity", International Journal of

Computational Engineering Research, ISSN: 2250–3005, Vol. 2, July-August 2012.

[8] Makelainen, A., "Analysis of Handoff Performance in Mobile WiMAX," pp.12-68, 2007.

[9] Dsdv code review. http://codereview.appspot.com/1668042, June 2010.

[10] C. E. Perkins and P. Bhagwat. Highly Dynamic Destination-Sequenced Distance-Vector Routing (DSDV) for Mobile Computers. In Proceedings of the ACM Conference on Communications Architectures,Protocols and Applications (SIGCOMM), pages 234{244, 1994.

[11] Bathich Ammar A. ; Dani Baba Mohd ; Ibrahim Muhammad, " IEEE 802.21 based vertical handover in Wi-Fi and WiMAX networks ",IEEE page(s):140 - 144 , 18-20 March 2012.

[12] Asmae, Nourddine, Mouhammed, Driss, "HANDOFF BETWEEN WiMAX AND WiFi NETWORKS" 978-1-4673-2679-7/12/$31.00 ©2012 IEEE.

[13] Ankur Sain, Preeti Bhalla," Vertical Handover between Wi-Fi and WiMAX" , International Journal of Advanced Research in Computer Science and Software Engineering Volume 3 , Issue 6 , June 2013.

[14] Rashid A. Saeed, Hafizal Mohamad ; Borhanuddin Mohd. Ali ; Mazlan Abbas," WiFi/WiMAX Heterogeneous Seamless Handover " , IEEE page 169 – 174, date 23-26 Nov. 2008.

[15] Ammar A. Bathich , Mohd Dani Baba , Muhammad Ibrahim," IEEE 802.21 Based Vertical Handover in Wi-Fi and WiMAX Networks", 978-1- 4673-1686-612/$26.00 ©2012 IEEE.