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Performance Of Integrated Heterogeneous Network (WLAN-SGSN AND WLAN-GGSN)

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Abstract: To facilitate end user with high bandwidth data services different architectures has been proposed. Previous studies shows loose coupling has worst performance i.e. connecting WLAN to IP backbone directly. For high bandwidth application tight coupling integration of UMTS-WLAN is the efficient way, there are two way to form tight coupling i.e. connecting WLAN with either SGSN or GGSN. Both the technique is far better than loose coupling. Architecture for WLAN-SGSN and WLAN-GGSN are developed and analyzed. The simulated result on OPNET Modeler 14.0 reveals for high bandwidth data services, integration of WLAN-GGSN is best as it has minimum packet lose, better response time and goods QoS (Quality of Service)**.**

Keywords: WLAN-UMTS, WLAN-GGSN, WLAN-SGSN, Tight Coupling, Loose Coupling.

I. INTRODUCTION

For high bandwidth data application and services, present 3G network is not ideal as the data rate is low (2MBPS) and its high cost restrict the high bandwidth application. To above restriction development of good heterogeneous network is on high demand, which not only provide high data rate but also low cost. Today mobile networking is not only restricted to real time voice calling, demand of end user has increased. They want real time video calling to high speed downloading of high bandwidth data. User becomes restless if downloading of page more time. UMTS can provide data access with mobility and covers wide area but can only support medium data rate and also is not suitable for indoor or densely populated areas i.e hotspots. Other side WLAN provides high data to the user in its vicinity at low cost and gives access to indoor and dense geographic area user. The growing demand has lead to integrate these two networks to form heterogeneous network. Therefore integration of these two networks (WLAN-UMTS) will offer the wireless users best service at hotspot areas where high bandwidth data application are in demand. There will be no drop in the current session while moving from UMTS region to WLAN or vice versa, as ongoing session could be served by WLAN and UMTS respectively in mobility. For the best utilization of heterogeneous network the connection of WLAN with UMTS has to be definite with proper link. For the same we have compared WLAN-SGSN and WLAN-GGSN and through proposed architecture it's found that WLAN-GGSN should be used for better quality of service. Further, the paper is organized as follows: Firstly introduction to application and WLAN efficiency, Brief introduction to loose and tight coupling. Second proposed architecture of WLAN-SGSN and WLAN-GGSN is described briefly. The simulation environment built on the OPNET Modeler 14.0 and next results are described with simulation graph and finally the conclusion has been drawn.

II. APPLICATION

Different application has different bandwidth requirement and so the processing time is different as well. Keeping application point of view we can decide which network to use. The first challenge is to improve the response time in tight coupling. For this the interface of WLAN should be to support connection for switches, gateways, and station node at selectable rates. Also, the mobile node must have two transceivers; one for WLAN interface and one for UMTS interface. The mobile device must be advance enough to judge the bandwidth requirement of application. So, the cost could be less and QoS could be better.

FTP and Web application response times were taken as they are two different QoS profiles. Both response times were measured in seconds, and a smaller value is considered better. FTP download response time is defined as the time that elapses between a clients sending a "get" request and receiving the entire file. It is measured as the time when a client sends a request to server to the time it's received. The FTP download response time included the time required to transmit the entire file—it is dependent on the file size. This time included the signaling delay for connection setup. As FTP download response time is used to demonstrate how the WLAN-SGSN system differs from the WLAN-GGSN.

HTTP (Web page) response time was defined as the time required retrieving an entire HTML page with all of its online objects. Similar to the FTP response time, the web page response time was measured from the time a client browser application sent the request to the web server and ends when the client received the entire HTML page. Both application delay performance measures were used to demonstrate the benefit of shifting data users to the WLAN access network in terms of reduced application delays.

A. WLAN

Our work involves the study the QoS of WLAN and how it works for high bandwidth application. The simple architecture of WLAN is implemented on OPNET Modeler 14.0. An area of 100x100 meters is considered and uniform mobility of is given to end user.

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Fig 1. WLAN Scenario

The simulation ran for 1 minute, the application which considered was video conferencing. When the session got established the graph showed very good throughput, as the user was in the coverage area of source but there was exponential drop in the throughput after 20sec. So over the definite interval the QoS was good but due to mobility of user drop become more. Therefore to serve our purpose of high bandwidth application can be used by integrating WLAN with existing UMTS network.

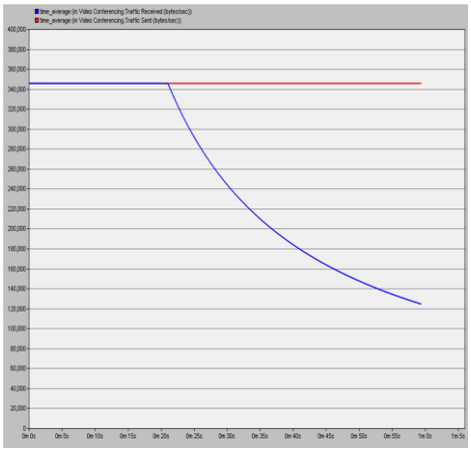

Fig 2. Throughput of WLAN

B. Loose Coupling

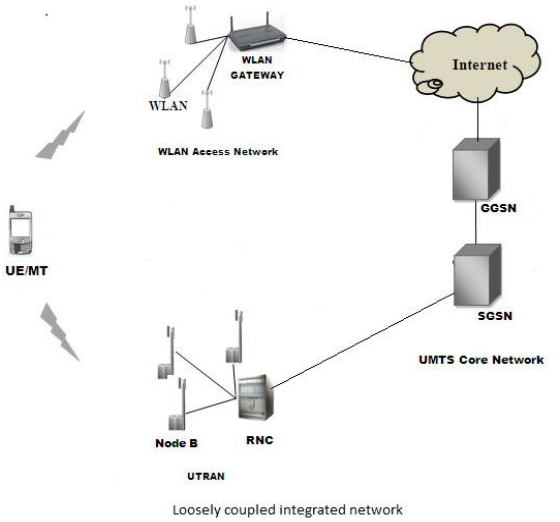

Fig 3. Loose Coupling

C. Tight Coupling

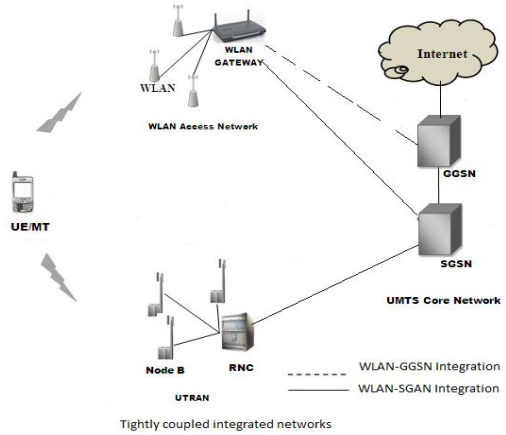

Fig 4. Tight Coupling

In the loose coupling technique, WLAN and UMTS are assembled and interconnected to each other independently. In this architecture WLAN is connected to UMTS network over Internet Protocol (IP) and mobility management and billing of WLAN are done by Internet Protocol (IP). WLAN gateways are used for billing and authentication. In this an UMTS server is used which is connected to the Internet.

In Tight coupling Architecture Gateway GPRS (GGSN) is directly connected to the internet via PPP link depending on its data rates used according and Serving GPRS (SGSN) is connected to Radio Network Controller (RNC) via PPP links. In this WLAN architecture can be added to either SGSN or GGSN, though GGSN gives a better performance like real time and internet services. For uniformity the links kept same for both scenarios WLAN-SGSN and WLAN-GGSN.

III. SIMULATION AND PERFORMANCE ANALYSIS

Our purposed technique and architecture was implemented in OPNET Modeler 14.0. We have taken world topology and the simulation ran for period of six minutes.

A. Network design

Our simulated network has three major components which are Internet backbone, UMTS network, WLAN network. UMTS network has GGSN, SGSN, RNC (Radio Network Controller), Node_B_0 and UE (User Equipment). WLAN has Node_0 (Router) and mobile nodes. Real world scenario is considered and WLAN is deployed in hotspot region. For connection we have used ATM OC-3 link (date rate of 155 MBPS) between Node _b_0 and RNC, RNC and SGSN, GGSN and Node_0 (For WLAN-GGSN Integration), SGSN and Node_0 (For WLAN-SGSN Integration). PPP DS-1 link (data rate of 1.5MBPS) between GGSN and router _2. PPP DS-3 link (data rate of 44MBPS) between SGSN and GGSN, Internet and router.

For router and server 10BASE_T link is used. We have design two scenario one for WLAN-SGSN and another for

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WLAN–GGSN. The architecture could be seen in Fig 5 and Fig 6 respectively.

SIMULATION SPECIFICATIONS

WLAN	UMTS
Data rate of 11 mbps.	Data rate of 2mbps.
Simulation of 6 minute.	World topology and simulation of 6 minutes.
By configuring application profile we added parameters ftp and http.	By configuring application profile we added parameters ftp and http.
In Nodes(mobile and fixed) we changed the WLAN parameters , transmit power to 0.005W and packet threshold to -95	Mobile (UE) is deployed independently in the coverage area, transmit power is 0.005W

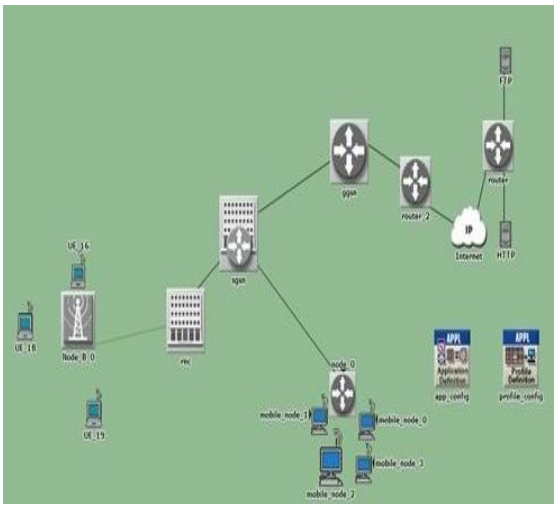

Fig 5. WLAN-SGSN Integration

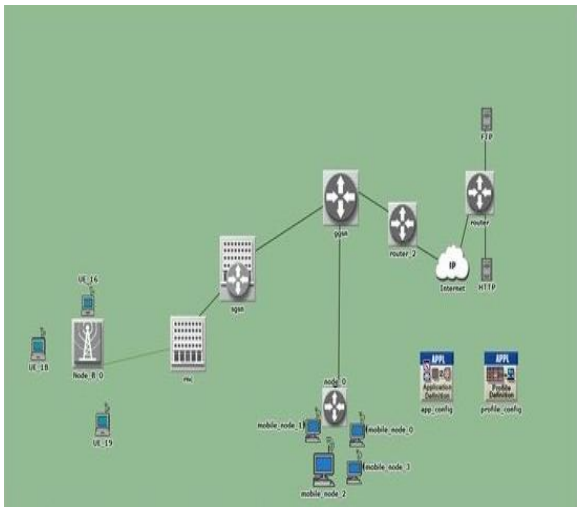

Fig 6. WLAN-GGSN Integration

B. Simulated result

The simulation analyzed for HTTP object response time, HTTP Page response time, FTP Download response time and Upload response time. Also, as mentioned earlier the response time which takes less time is consider better.

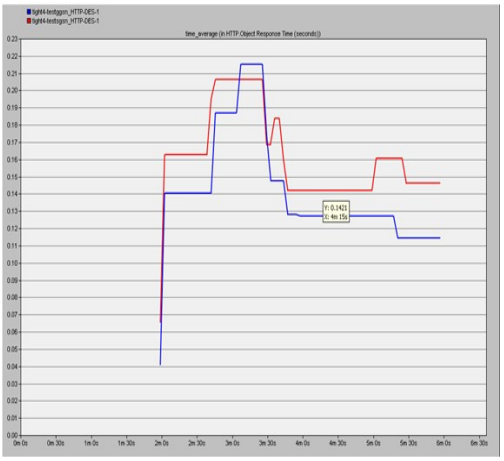

Fig 7. HTTP Object response time

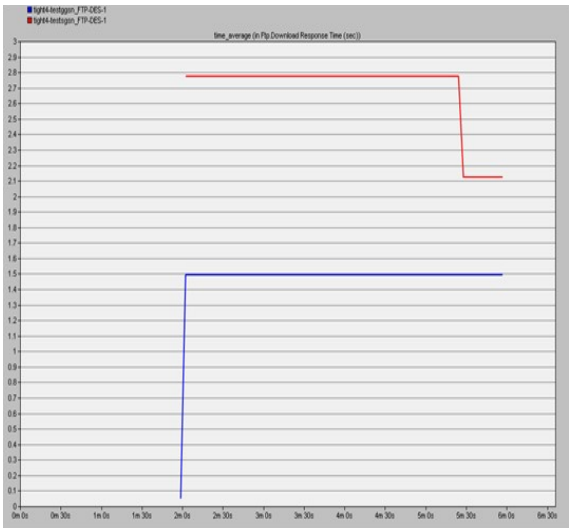

Fig 8. HTTP Page response time

From Fig 7 and Fig 8 of HTTP response time we analyzed that after the session is established, initially the result was high for both WLAN-SGSN and WLAN-GGSN but as the simulation goes rapid response is observed. The response of GGSN-WLAN is more rapid. In other words GGSN took less time in compare with SGSN. Though for small period the graph of GGSN was high but the overall response time performance of WLAN-GGSN is better than WLAN-SGSN.

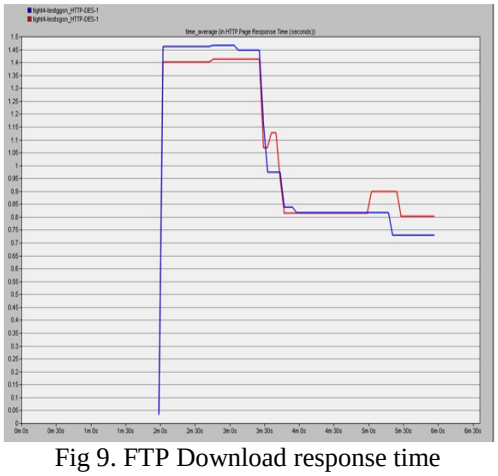

Fig 9. FTP Download response time

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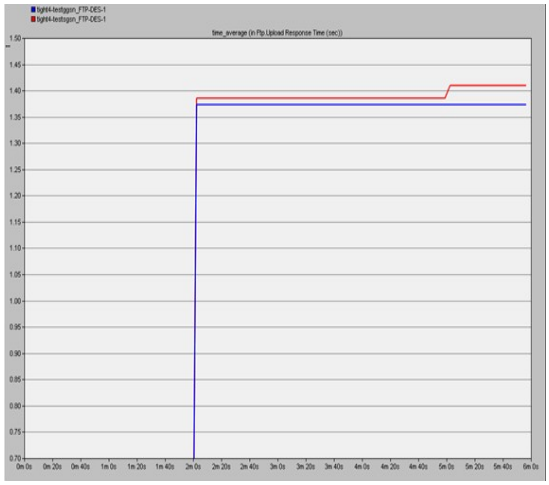

Fig 10. FTP Upload response time

From Fig 9 of FTP Download response time it was analyzed that initially response time for both integrated scenario was high but it was more for WLAN-SGSN. Also, during the entire simulation WLAN-GGSN has less response time. In other words WLAN-GGSN was better than WLAN-SGSN.

From Fig 10 of Upload response time, we analyzed that after the session is established; initially the result was high for both WLAN-SGSN and WLAN-GGSN but as the simulation goes response of WLAN-GGSN improves.

C. Response time (seconds) for user applications in WLAN-SGSN & WLAN-GGSN networks

Table 1

HTTP	WLAN-SGSN	WLAN-GGSN
Object Response Time	0.160	0.140
Page Response Time	1.041	1.036

Table 2

FTP	WLAN-SGSN	WLAN-GGSN
Download Response Time	2.686	1.472
Upload Response Time	1.370	1.3535

IV. CONCLUSION

We have designed and analyzed the two scenario of integration i.e. WLAN-SGSN and WLAN-GGSN. For simulation we have used OPNET Modeler 14.0. Our study shows the response time of HTTP and FTP. It is seen for both the scenario (WLAN-SGSN and WLAN-GGSN) that initially the network took more time to negotiate with server and for the same reason we got early delay for both scenario. We have studied the graph and analyzed that for integration of UMTS and WLAN, WLAN-GGSN technique should be followed. By studying Table 1 for HTTP we concluded that response time for WLAN-GGSN is less than WLAN-SGSN. Also, from Table 2 for FTP we have seen that again response time for WLAN-GGSN is less than WLAN-SGSN.

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REFERENCES

[1] Safdar Rizvi, Asif Aziz, N.M. Saad, Nasrullah Armi & Mohd Zuki Yusoff , "Tight Coupling Internetworking Between UMTS and WLAN: Challenges, Design Architectures and Simulation Analysis", International Journal of Computer Networks (IJCN), Volume 3, No.2, 2011.

[2] S. NandaKumar, Praveen Kumar S, Nagendran N.S, "Performance of UMTS Interworking with WLAN to Provide Consistent Services", International Journal of Information and Communication Technology Research Vol., No. 1, May 2011.

[3] Theodore S Rappaport, "—Wireless Communications Principles and practices, 2nd edition.

[4] W. Song, W. Zhuang, A. Saleh. "Interworking of 3G cellular networks and wireless LANs", International Journal of Wireless and Mobile Computing, Vol. 2, Issue. 4, pp.237-247, 2007.

[5] Wei Song, Hai Jiang, Weihua Zhuang, "Performance analysis of the WLAN first scheme in cellular/WLAN interworking". IEEE Trans Wireless Communication. 6(5), 1932–1952 (2007)

[6] Tracy L. Mann , "A Network System Level Simulator for Investigating the Interworking of Wireless LAN and 3G Mobile Systems**",** 2003.

[7] S.Tsao and C.C. Lin. "Design and evaluation of UMTS-WLAN interworking strategies". Proceedings of Vehicular Technology Conference. 2002.

[8] LaMaire, R.O., "Wireless LANs and Mobile Networking: Standards and Future Directions, IEEE Communications Magazine, Vol. 34, No. 8, pp. 86–94 Aug. 1996,.

[9] Syed Amjad Iqbal , Muhammad Ahmad, "Performance Evaluation of Vertical Handover between UMTS AND WLAN".