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PERFORMANCE INVESTIGATION OF WIRELESS INTEGRATED NETWORKS FOR RURAL AREA

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Abstract: Wireless technology having an important role in the field of communications and allows users to connect at anywhere and anytime. The users enjoy the features of 3G networks such as more connectivity and IEEE 802.11 Wireless LAN has its own advantages in terms of low cost and its widespread use. In order to get the best services of both technologies, the idea of integrating UMTS with Wireless Local Area Network (WLAN) came into existence. The integrated UMTS-WLAN network can be capable of providing ubiquitous connectivity and high data rate to the end user. The work in this paper presets the performance of the wireless integrated network for the rural environment. The combined effect of the packet loss and mobility has been analyzed for the wireless integrated networks. The proposed architecture analyzes the performance of integrated UMTS-WLAN with outdoor to indoor and pedestrian path loss model for the rural environment under varying network conditions.

I. INTRODUCTION

The wireless communication is providing the endless serviced to the user and integration of the technology raises the expectation of the user in terms of Quality of Service support. WLAN provides low mobility, low bandwidth, high data rate at a low cost for limited area and UMTS is a third generation mobile cellular network based on Global System for Mobile communication(GSM), developed and maintained by 3GPP (Third Generation Partnership Project). It supports data rate up to 2 Mbps and provides a global roaming standard. UMTS consist of UTRAN (UMTS Terrestrial Radio Access Network), core network and user equipment.

II. LITERATURE SURVEY

Maarouf et al compared the open and loose coupling integration schemes; further enhance the handover solution and analyzed that loose coupling provided better result than open coupling. [1]. Transport layer protocol Stream Control Transmission Protocol (SCTP) works on dynamic address configuration and multihoping capability and provide the

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handoff between UMTS and WLAN. Integrated WLAN and UMTS architecture focused on the issues such as network architectures, integrated architectures, mobility management and QoS support [2, 3]. The performance of proposed architecture of UMTS and WLAN can be evaluated with the help of Generic Routing Encapsulation (GRE) [4, 5]. The proposed architecture of IP-based 2G-3G network analyzed that the performance of the tightly coupled GGSN is better than the tight coupled SGSN- WLAN method in terms of handoff [6]. A 3GPP SIP- IMS model used to regenerate the lost packet during the vertical handover process. A SIP based IMS model used to provide uninterrupted services to the end user [7]. The performance of WiMAX analyzed in terms of different path loss models such as Ericsson, okumura, Hata model, Cost-231, Erceg, Walfish, Ecc-33, Lee and free space path loss models and provides high throughput and wide coverage to a large number of users. The path loss values compared in terms of the power outage probability, WiMAX cell coverage area and link budget [8].This paper presents the performance evaluation of integrated UMTS-WLAN for mobile and fixed nodes under the outdoor to indoor and pedestrian path loss model for FTP, Video Conferencing and Voice traffic.

III. INTEGRATION SCHEMES

Integrated architecture having benefit to both end users and service providers and provide full quality of service support. The integration of WLAN and UMTS network increases the coverage area and bandwidth and wide coverage [9-11]. There are three different method of integration are [12]:

A) Tight Coupling: Tightly coupled architecture works on a single core network and integration of UMTS and WLAN is done either SGSN or GGSN level. Tight coupling is more complex than other coupled architecture.

B) Loose coupling: Different networks are connected independently with the internet backbone through gateway router and allow independent deployment, operations of the network.

C) Open coupling: In open coupling scheme, dissimilar networks are working independently and use separate authentication mechanism. The open coupling can be used for billing system.

Table: 1. Design Parameters for Wireless Integrated Network

Parameters	**UMTS-WLAN Network**	
Integration Scheme	Loose Coupled	Loose Coupled
Node Type	Mobile	Fixed
Environment	Rural area	Rural area
Traffic class	Weibull	Weibull

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IV. SIMULATED WIRELESS INTERGATED UMTS-WLAN NETWORK

The wireless integrated UMTS-WLAN network has been simulated in OPNET Modeler 14.5 to analyze the combined effect of outdoor to indoor and pedestrian environment path loss model & mobility. Table 1 presents the various design parameters for the simulation of UMTS and WLAN. The network is integrated with the help of loose coupling scheme and the traffic has been generated through Weibull function. The network has been designed for the rural areas and the performance of the integrated network has been analyzed for outdoor to indoor & pedestrian path loss model. The simulation scenarios for integrated UMTS-WLAN for mobile and fixed nodes have been shown in Figure 1 and Figure 2.

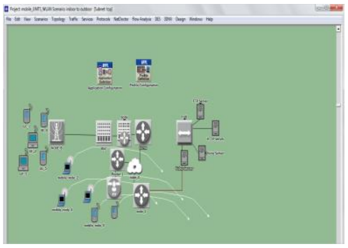

Figure 1: Simulation scenario for mobile nodes under UMTS-WLAN Network

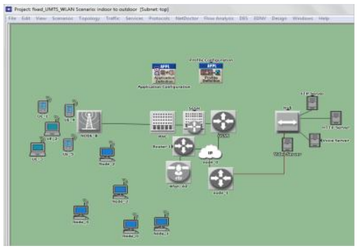

Figure 2: Simulation scenario for fixed nodes under UMTS-WLAN Network

V. SIMULATION RESULTS AND DISCUSSION

The integrated UMTS/WLAN network has been designed for fixed and mobile nodes under pervasive environment for various network conditions such as path loss and mobility. The performance of integrated UMTS/WLAN network has been analyzed in terms of delay, data dropped and throughput, FTP, Video Conferencing and voice traffic received for both fixed and mobile nodes. The simulation results for the fixed integrated UMTS-WLAN design are presented in Figure 3 to Figure 9. The results in Figure 10 to Figure 16 present the performance the mobile integrated network.

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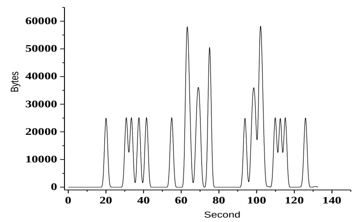

Figure 3: FTP in integrated UMTS_WLAN for fixed nodes

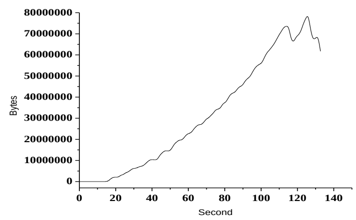

Figure 4: Video Conferencing in integrated UMTS_WLAN for fixed nodes

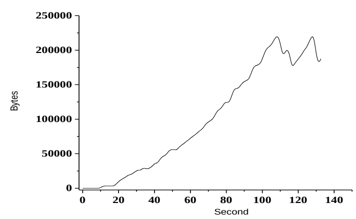

Figure 5: Voice in integrated UMTS_WLAN for fixed nodes

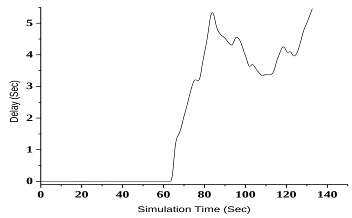

Figure 6: Delay of integrated UMTS_WLAN for fixed nodes

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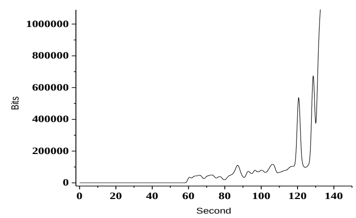

Figure 7: data dropped of WLAN in integrated UMTS_WLAN for fixed nodes

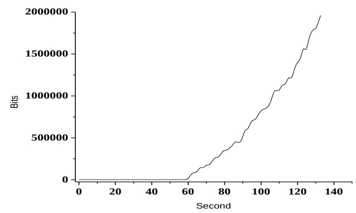

Figure 8: Load in integrated UMTS_WLAN for fixed nodes

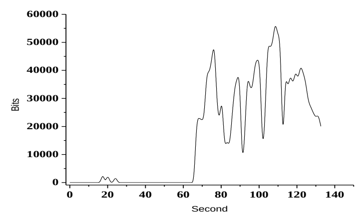

Figure 9: Throughput of integrated UMTS_WLAN for fixed nodes

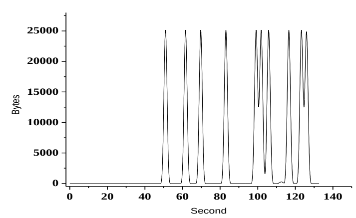

Figure 10: FTP in integrated UMTS_WLAN for mobile nodes

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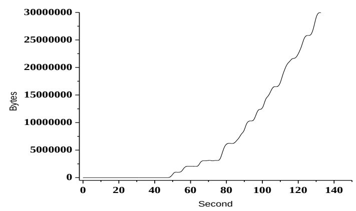

Figure 11: Video Conferencing in integrated UMTS_WLAN mobile nodes

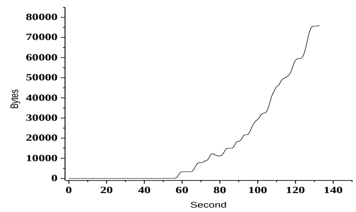

Figure 12: Voice in integrated UMTS_WLAN for mobile nodes

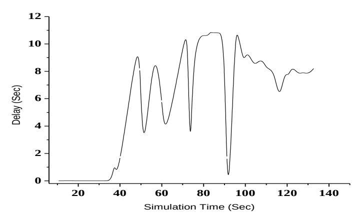

Figure 13: Delay of integrated UMTS_WLAN mobile nodes

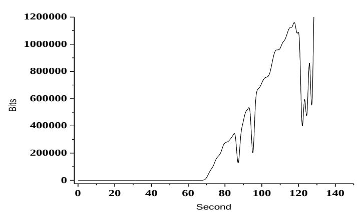

Figure 14: Data dropped of WLAN in integrated UMTS_WLAN for mobile nodes

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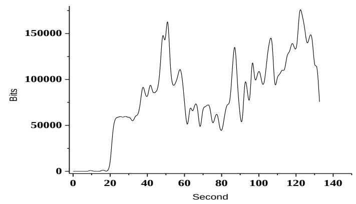

Figure 15: Load of integrated UMTS_WLAN for mobile nodes

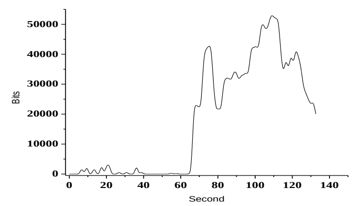

Figure 16: Throughput of integrated UMTS_WLAN for mobile nodes

The simulations for integrated UMTS-WLAN under mobile and fixed nodes have been performed in a rural environment with outdoor to indoor and pedestrian path loss model with different network parameters. The Figure 3 to Figure 5 presents the FTP, video conferencing and voice traffic of the fixed integration scheme. Figure 6 and Figure 9 depict the delay, data drop, load and throughput under integrated UMTS-WLAN scheme for fixed nodes. The Figure 10 to Figure 12 presents the FTP, video conferencing and voice traffic of the mobile integration scheme and Figure 13 to Figure 16 represent the delay, data drop, load and throughput mobile nodes in integrated UMTS-WLAN scheme. As the simulations moves from fixed to mobile integration scheme of UMTS-WLAN network, the degradations has been observed in the results of integrated UMTS-WLAN network due to the pervasive environment of mobility and path loss. The amount of delay and dropped data for WLAN has been increased in mobile integrated scheme as shown in Figure 13 and Figure 14 as compared to the fixed integration scheme of UMTS-WLAN network. The decrease in the throughput of the network can be observed in Figure 16 in mobile integration scheme. The result in Figure 13 shows increment in the amount of delay for UMTS-WLAN network during mobile integration scheme as compared to the fixed integration scheme as presented in Figure 6.

VI. CONCLUSION AND FUTURE SCOPE

The work in the present paper analyzed the performance of the integration schemes of WLAN/UMTS networks under pervasive environment of mobility and path loss. It was observed from the performance analysis of UMTS/WLAN network for fixed and mobile integration system that the fixed integration scheme worked well as compared to mobile integrated system for rural environment. The performance of the mobile scheme degraded due to the combined effect of the mobility & path loss. But both fixed and mobile integrated network worked well as compared to the single network, because it

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provided the satisfactory throughput to the end users. In future, the work can be extended to the integration of the 2G and 4G network.

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