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Integration between 3G Cellular and Wireless LAN Network

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***Abstract*— One of the prime objectives in future mobile communications is implementing seamless roaming between heterogeneous wireless networks. 3G Cellular network and Wireless LAN will complement each other to provide ubiquitous high speed wireless Internet connectivity to mobile users. Seamless means smooth transition from one network to another. The main criteria for seamless movement are hand off. With seamless roaming, the user will not perceive any delay on interruption of service. Even be aware of any change in the network and will not required interacting with the system to enable hand off.**

On the basis of inter-dependence between different wireless networks, there are two different ways of integration – one is Tight Coupling and another is Loose Coupling.

***Index Terms*— Qualnet, UMTS network, CBR, Different codecs.**

I. UMTS Network[2]

UMTS is an enhanced digital communication system that provides universal communication. This network is designed to support voice and data service to the mobile users. It provides coverage and high mobility support.

The basic UMTS architecture consists of three domains – User Equipment, UMTS Terrestrial Radio Access Network (UTRAN) and the Core Network. The UE consists of the equipment used by the user to access UMTS services. The UTRAN consist of one or more radio network subsystem. The radio network subsystem further has Node B connected to Radio Network Controller (RNC). Core Network consist of circuit switched network for providing voice and circuit switched services and packet switch network for providing packet based service. There is a Serving GPRS Support Node (SGSN) responsible for routing packets, mobility management and authentication.
This network also introduces a Gateway GPRS Support Node (GGSN) which acts as a gateway toward external network.

II. WLAN Network[5]

IEEE standard 802.11 a/b/g WLAN architecture consist of one or more BSS service which is called Access point and client devices.

WLAN provide high bandwidth capability. Data rate for 802.11 a is 11 Mbps where as 802.11 b support data rate 54 Mbps. Wireless users can access real time and Internet services virtually anytime anywhere. This services are mainly available in the hot spot like campus, hotel etc. The deployment cost is very low.

III. Benefit of Integrating UMTS and WLAN Network

The 3G Cellular system and Wireless LAN (WLAN) networks can be viewed as complement to each other . UMTS provides coverage and high mobility support. WLAN provides high data rate in hotspot areas. Therefore integration of UMTS and WLAN produce a new network that combines the advantages of both. In this way a new combination can be obtained which is much more complete in bandwidth and coverage. It will also be less costly.

IV. Simulation[1]

There are two different integrated UMTS-WLAN scenarios are studied. Loosely Coupled approach have been taken i.e. these different networks are connected through two different wireless subnets. In the first scenario, hot spots are deployed inside 3G cellular network coverage. In the second scenario, UMTS and WLAN networks are physically separated. The mobile Node (MN) moves from UMTS coverage area to the hot spot (WLAN) and back.

These two scenarios are designed in QualNet 4.5 simulator. In each case 25 mobile nodes were used. These nodes were made to move in a random fashion. The speed of the mobile node (MN) was between 10m/s to 25 m/s and the pause time was 30s. According to the Mobile Node (MN) UMTS network is the Home network while WLAN network is Foreign Network. The integration was done with the help of Mobile IP Protocol. Hand off is forced in two situation. First one is regular handoff which is automatically forced when the user moves out of coverage

range of a network. When it enters into the coverage area of a new network handoff must be initiated to maintain connection. Lower level layer attributes changes when the terminal enters into a new network. These changes are captured by information agent and sent to processing unit to initiate regular hand off. Here the simulation time was 300 second for my experimental data.

V. Solution

In the first scenario, the MN leaves the UMTS network altogether and register with Access Point of WLAN, then after sometime it leaves WLAN and comes back under UMTS. Here I want to present a global mobility management framework to support seamless roaming across heterogeneous wireless networks.

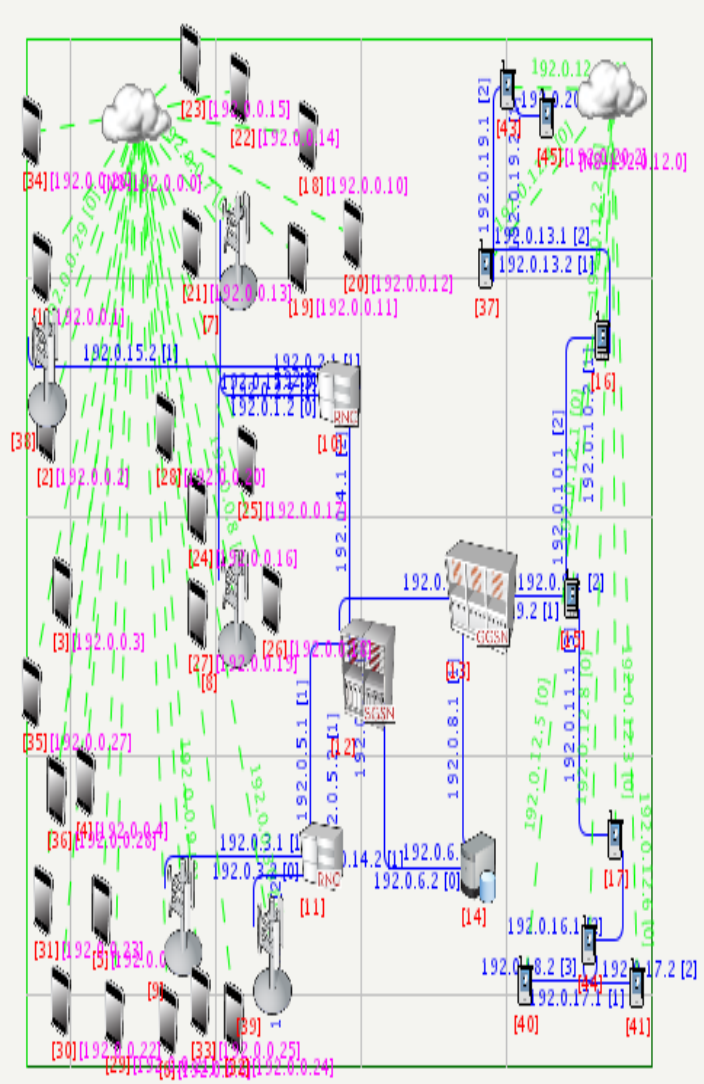


Figure.1: First Scenario of Integrated 3G Cellular & WLAN Network

In the second scenario, the hot spots were placed close to the Node B node of UMTS architecture. As the 802.11 provide greater bandwidth comparing to 3G cellular system, so when Mobile Node (MN) come close to hot spot, it tend to register with the WLAN.

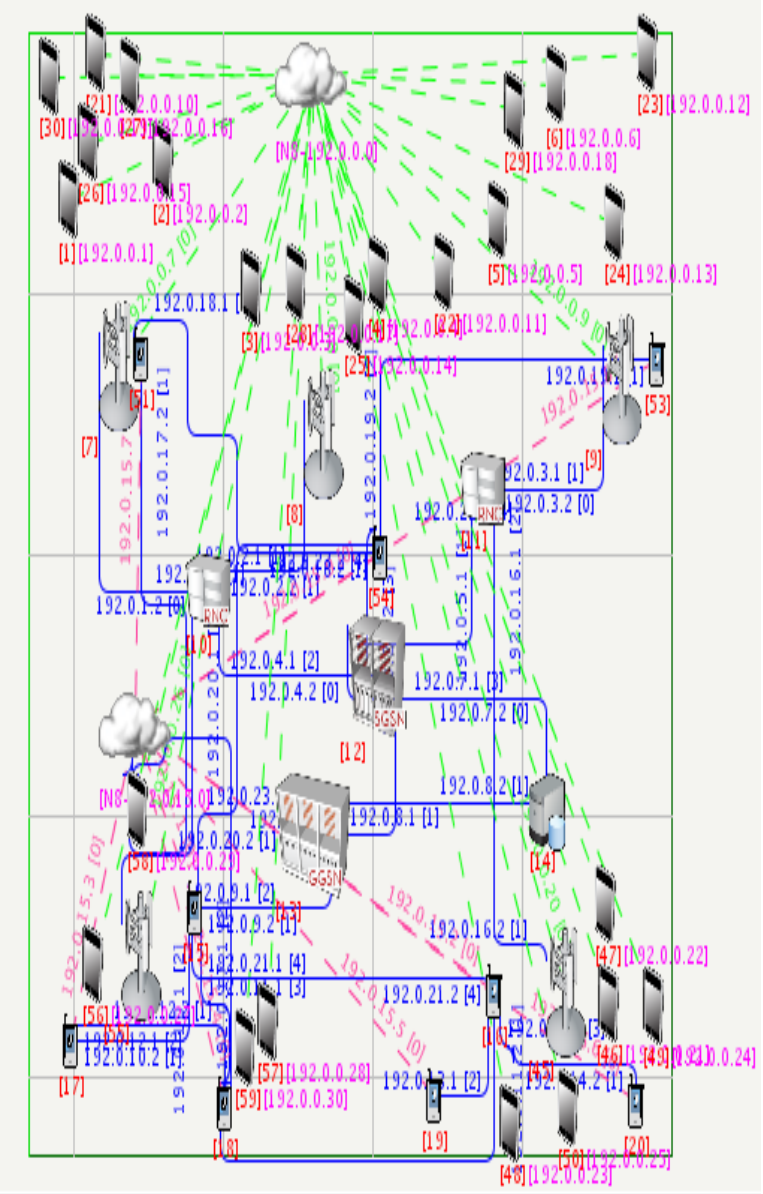


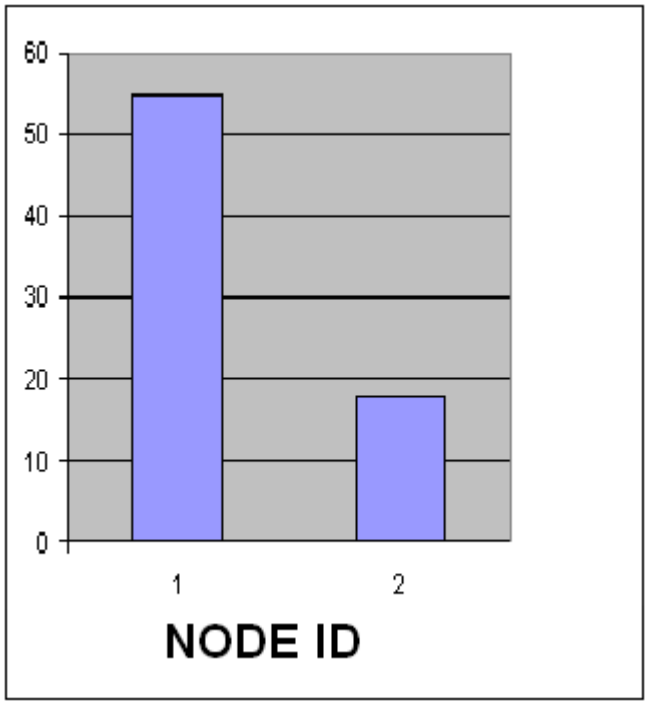
Figure. 2 : Second Scenario of Integrated 3G Cellular & WLAN Network

VI. Result

Throughput, Average Delay and rate of Packet Drop in each scenario have been measured and compared in QualNet 4.5 simulator then it concludes with remarks.

In the second scenario ,as the hotspots are deployed near to the Node B so when the mobile nodes moves from one region to another ,it can quickly register to another base station(Node B or Access Point). Comparing to the second Scenario , in the first scenario mobile nodes have to move much more distance to get registered with access point.

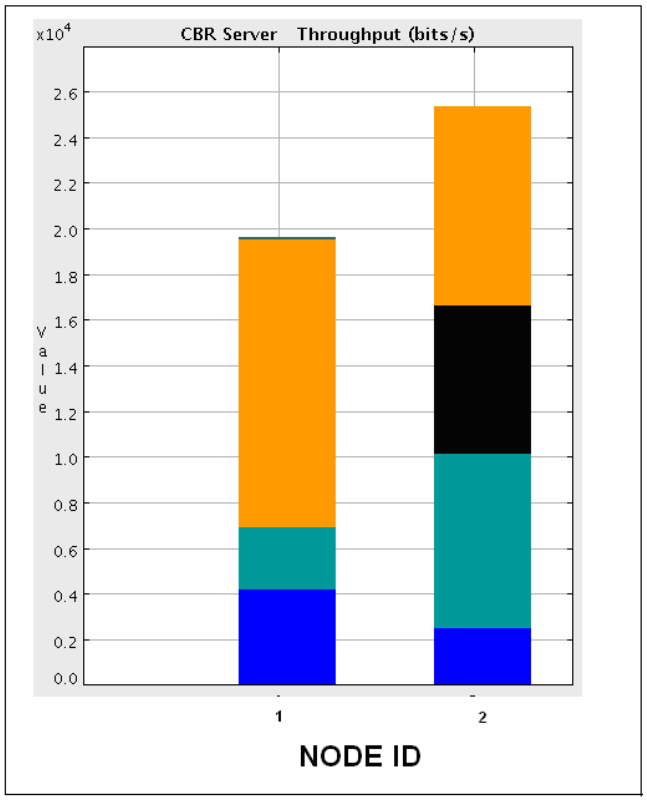
So the packet drop rate in the second scenario is less comparing to the first one. Rate of packet drop in two different scenario are plotted and compared here.



1 = First Scenario
2 = Second Scenario

Figure. 3: Rate of Packet Drop Comparison

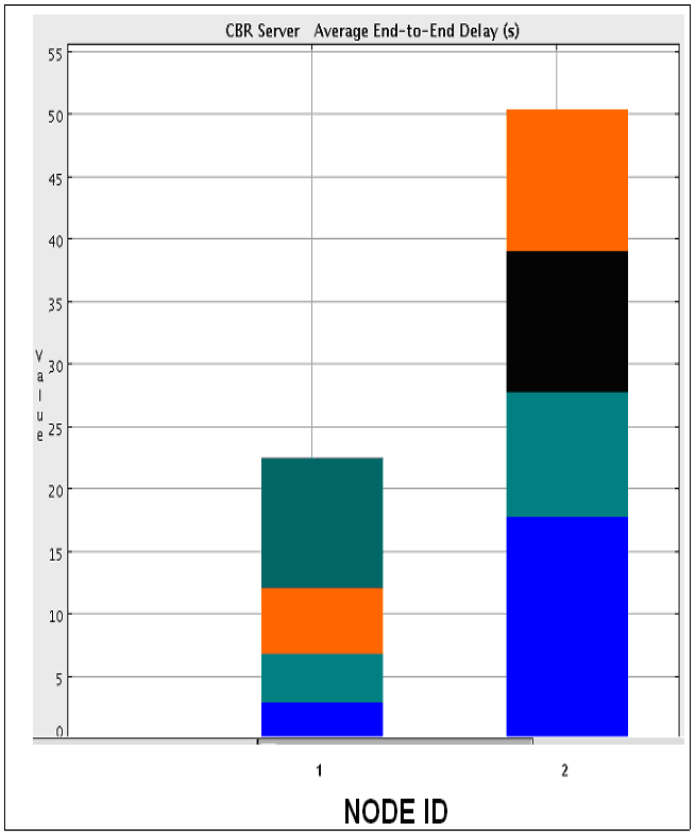
We can get better throughput performance in the second scenario than the first one.



1 = First Scenario
2 = Second Scenario

Figure. 4 : CBR server Throughput comparison of two network

In the second scenario as the mobile node rapidly changes their Base Station (Node B or Access Point) so the average delay is more comparing to the first scenario.



1 = First Scenario
2 = Second Scenario

Figure. 5 : CBR server End to End delay (in sec) comparison between two network

VII. Conclusion

In this work two different 3G cellular and WLAN integrated scenarios have been studied. From the result we can conclude that if the hotspots are deployed near the Node B of 3G cellular system then packet drop rate should be minimized and throughput is increased. Only drawback of this scenario is the average delay is increased which can be overcome if the mobile node register with access point more faster way. This work can reduce the registration delay. This simulation data and comparison is used to show an efficient mobility solution for handoff between UMTS and WLAN.

VIII. References

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