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Interface and Traffic Handover Mechanism in Multi-homed Mobile IP Node

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Abstract: ***Network Mobility is a relatively new networking concept aimed at improving the reliability and scalability of data communications within vehicles moving at high speed. The growing use of IP devices in portable applications has created the demand for mobility support for entire networks of IP devices. Users are expected to be connected to the internet from anywhere at any time this facilities will provide to own user to more than mobile devices, there are several mobile devices such as mobile phone, laptop and PDA and other type, all these devices could have multiple network interfaces, these interfaces enable mobile devices to maintain ongoing communication while its moving from one point to another.***

Keywords: Mobile IP, IETF, Network Mobility, Network Simulator (NS2), Multi-homed node, Interface selection mechanism, Throughput, Delay, Jitter.

I. INTRODUCTION

The rapid development of the area of communication as well as mobile devices, which increasing the number of nodes connected to the internet. The rapid development of wireless technologies enables the users to communicate while on the move. Where increasing the popularity wireless networks as well as devices are used such as Mobile devices, Laptops, PDAs and other portable. Although, all this development in the area of mobile telecommunication is still making efforts to improve services through mobile telecommunication, which enables the users to access network resources from anywhere and at any time.

Mobile IP is an open standard, defined by the Internet Engineering Task Force (IETF) RFC 2002 that allows users to keep the same IP address, stay connected, and maintain ongoing applications while roaming between IP networks. Mobile IP is scalable for the Internet because it is based on IP—any media that can support IP can support Mobile IP [1]. Ipv4 suppose uniquely attachment to internet therefore, IP address of node will be uniquely identifies in order to receive datagrams, otherwise, will not receive datagrams [2].

The rest of this paper is organized as follows. In section II give an overview of the Mobile IP protocol. Section III Introduction to Multi-Homing. Section IV gives an aim and Objectives of this paper. Section V discusses the different simulation scenarios in NS2 and their results. Section VI. Conclusion of the paper.

II. INTRODUCTION TO MOBILE IP PROTOCOL

In the literature [3] there are several entities are work in the scenario of mobile IP, Mobile Host (MH) support IP address, Home Agent (HA) and Foreign Agent (FA). Where the home agent is a router on the network that the mobile host connects to it, also Foreign Agent is a router on the network since the mobile host connects to it after move away from its HA and visit FA. Any devices support IP can support Mobile IP [4].

In the current internet status, a host can be established session with wireless link but it cannot maintain its established session during moving, therefore, Internet Engineering Task Force (IETF) try to solve this problem by designed Mobile IP, since in this design the host can maintain its existing session with the internet when it changes its attachment point to the internet, where the Mobile IP support the mobility to the internet. There are two version of Mobile IP designed by the IETF, first one, Mobile Internet Protocol version4 (Mobile IPv4), second, Mobile Internet Protocol version6 (Mobile IPv6). Mobile IPv6 support two addresses to identify the mobile node on the network, first one, is called permanent IP address obtain from Home Agent, second, identify the mobile node's current location (Foreign Agent) [5].

When mobile node change its network this means moves from home agent (HA) to foreign network (FN), therefore, it sends its Care of Address (COA) to HA by using FN this new home called the foreign agent (FA), after that any packet will send to mobile node from any corresponding node (CN), HA will receives the packet then forward it to mobile node's temporary address (COA) located in FN, thus, the process continue each time when the mobile node moves among networks, it inform home agent about its new location, where it gets a new temporary address from new network, HM will stop tunneling the packets when the mobile node back home, Mobile IP protocol always track the location of Mobile node to deliver the packets if it change the its location by moving from network to another [6] [7] [8].

III. INTRODUCTION TO MULTI-HOMING

The concept of multi-homing has two aspects: first one static multi-homing and second mobile multi-homing. Where, this adjective typically used to describe customers.

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The static multi-homing is such as companies, campus, While, mobile multi-homing is such as mobile node, mobile network (train, aircraft, and car, etc). The multi-homing increases the reliability of the internet connection for an IP network. Multi-homed that is means each nodes or networks connect to the internet by multiple interfaces, these interfaces may be associated with several Internet Service Provider (ISP), which may be different access technologies to provide internet to nodes or networks, therefore, nodes and network has more than one interfaces to connect to different ISPs or the nodes and networks has more than one interfaces to connect with same ISP. Furthermore, when the host has several IPv6 addresses to choose between them it is said multi-home. Our discussion will be Multi-homing mechanism to support mobility. Continue connectivity can be provided by multiple interfaced IPv6. The mobile networks can accesses to internet through multiple interfaces [9].

Multi-homing must be applied at Network Mobility (NEMO) and Mobile IP Node; this is to give NEMO and Mobile IP Node reliability and constant connection to the internet, because the wireless link is not for all time stable. Therefore, by using Multi-homing that will improve connectivity of node and network [10].

Mobile IP enables hosts to move between networks with maintained connectivity. Therefore, hosts can register multiple Care-of-Address (COA) that result the wireless network connectivity enhanced. Multi-homing can support the load-balanced between Care-of-Addresses. When the sender wants to send packets to multi-homed MIP, in this case the network protocol use the best path to the destination, the Mobile host has multiple interfaces to the internet. Therefore, multi-homed MIP can be considered any-cast approach. Best available destination used that support best service required, this mechanism used by IPv6 in any-cast address [11].

These technologies enable devices to be connected everywhere and at any time.

IV. AIMS AND OBJECTIVES

The aims of this paper are to compare different routing protocols in the wireless networks and how it deals with the multi-homed host handovers. We explore the possibility that intelligent control of Boundary Gateway Protocol (BGP) routes, coupled with Internet Service Provider (ISP) multi-homing can provide competitive end-to-end performance and reliability, using extensive measurements of paths between nodes in a large content distribution network, we compare the relative benefits of overlay routing and multi-homing route control.

This paper requires defining a mechanism to allow the mobile multi-homed node, or even a fixed multi-homed node to simultaneously use several interfaces. Multiple interfaces cannot yet be used simultaneously; nor can they be switched without breaking ongoing connection, this paper will explore the benefits and issues of having multiple access interfaces when mobile nodes and networks employ layer 3 mobility protocols of internet protocol to access the internet while changing their points of attachment to the internet.

Moreover, the paper will define a mechanism to show how to move the traffic from one interface to another according to the interface selection mechanism. Network connection should be placed in the best possible interface, variety of mobility management protocols supporting handovers between interfaces have been proposed, some of these protocols move all traffic from one interface to another at once, while some protocols allow simultaneous communication over different interfaces.

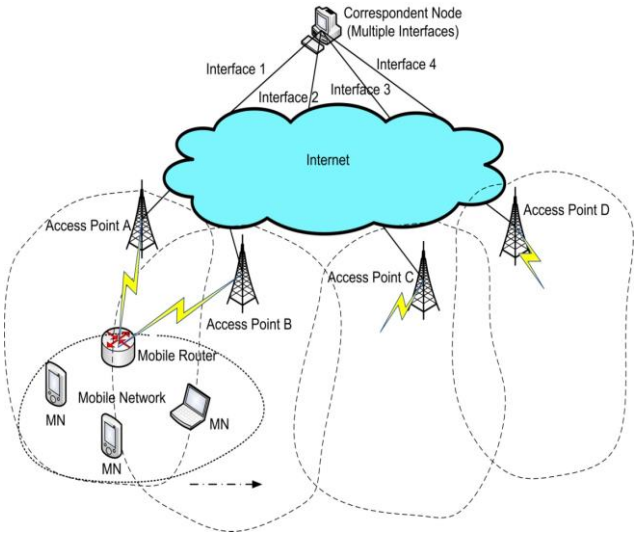

Fig.1. Scenario of Mobile Network

V. SIMULATION SCENARIOS

We use NS2 simulator program in all scenarios.

The mobile network connected to the first access point A, and then it moves away from access point A towards access point B, in this case disconnects from access point A and establishes connection with access point B. After specific time period the mobile network begging in moves towards access point C, that means disconnect from access point B and connected with access point C. Also after specific time period disconnect from access point C and connected with Access point D, the mobile network connects to all access points in sequence from the first one until the last, in other words, the mobile network (destination) is moving with a slow speed between the access points, facing several handovers. In addition to the Correspondent Node (CN) has multiple interface, therefore, in this scenario the CN selects suitable interface to send the traffic with respect to the moving of mobile network, that means when the mobile network does handover from one access point to another also CN does selected of interface from one interface to another respect to the current mobile network's access point. For the purpose of comparison between the results, we have conducted simulation in two cases first, when the Correspondent Node (CN) has multiple interfaces and this is mentioned it above, second, when the CN has single interface, in this case the CN does not any interface selection between interfaces due to it has single interface, thus CN will still used same interface while mobile network does handover between access points. Therefore, the results which obtain from these two cases will compare between them to study better performance of this scenario such as (packets throughput, delay, and jitter).Following the results and figures which we obtain from this scenario and clarification of each figure:

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Case1: The correspondent node (CN) has multiple interfaces.

The CN does interface selection between them with respect to the mobile network moving.

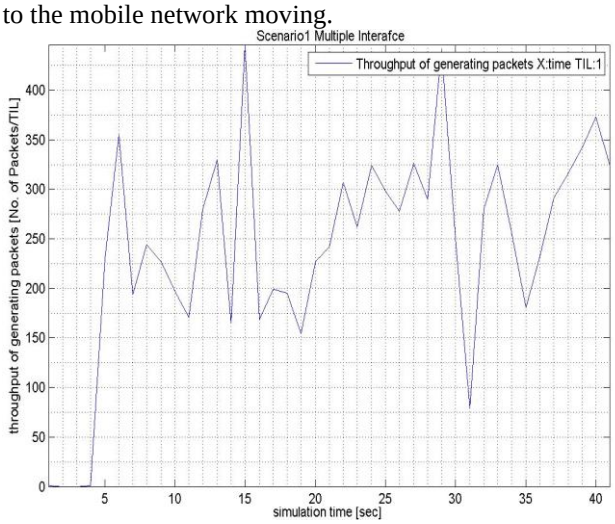

Fig. 2. Throughput of generating packets (Multiple interfaces).

The figure 2 above illustrate the throughput of generating packets at CN, the CN sent these packets to the mobile node inside the mobile network. The simulation time is specified, since the mobile network still connected to the access point A (0-10) second, then at second 10 it does handover from access point A to B, so on every 5 second the mobile network does handover from access point to another until at 25 second the mobile network return to the access point A by does handover from D to A. In the same time the CN does interface selection among its interfaces with respect to the movement of mobile network. We can see that in figure above the throughput of packets in this case (multiple interfaces) is high; moreover there is some fluctuation due to handover of mobile network and interface selection of CN among its interfaces.

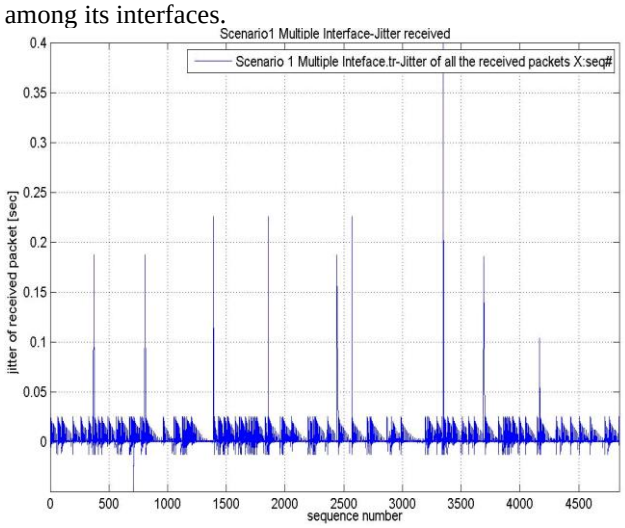

Fig. 3. Jitter of all received packets (multiple interfaces).

Jitter is defined as variation in the delay of received packets. The correspondent node sent the packets in a continuous stream with constant packets spaced, where the packets spaced evenly apart. There are some factors that affect the regularity of the packets spaced such as network congestion, improper queuing, configuration errors due to these factors steady stream can become lumpy and the spaced between packets can vary instead of remaining constant. In the figure (3) above we can see that the jitter of received packets at the mobile node, since there are some large jitter values happened.

Case 2: The CN has single interface connected to the internet. The CN still used this interface to send the packets to the mobile node while mobile network moved.

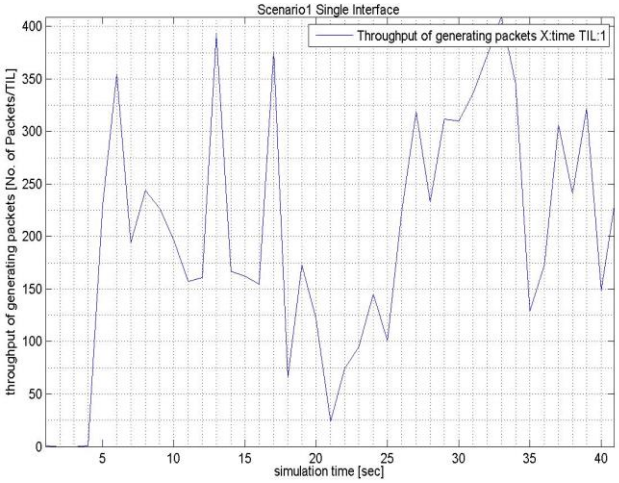

Fig. 4. Throughput of generating packets (Single Interface).

The figure 4 illustrates the throughput of packets that sent by the CN to the mobile node inside the mobile network, in this case the CN has single interface, therefore it does not interface selection. We can see the dropping of the throughput especially at the simulation time between (16-25) secs, due to handover of mobile network while CN has single interface.

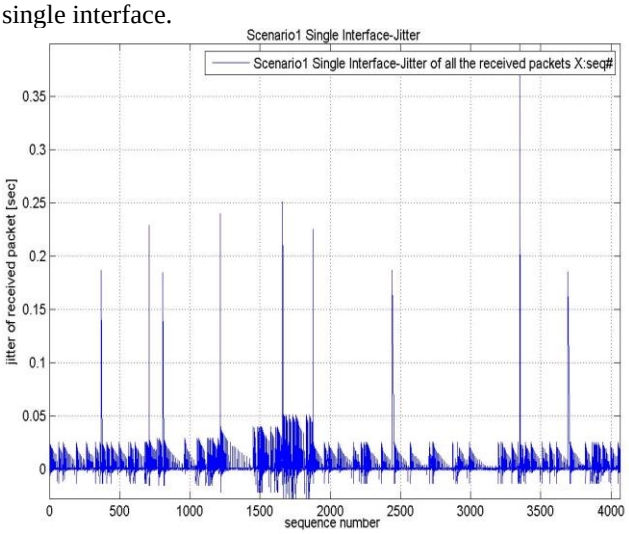

Fig. 5. Jitter of all received packets (Single Interface).

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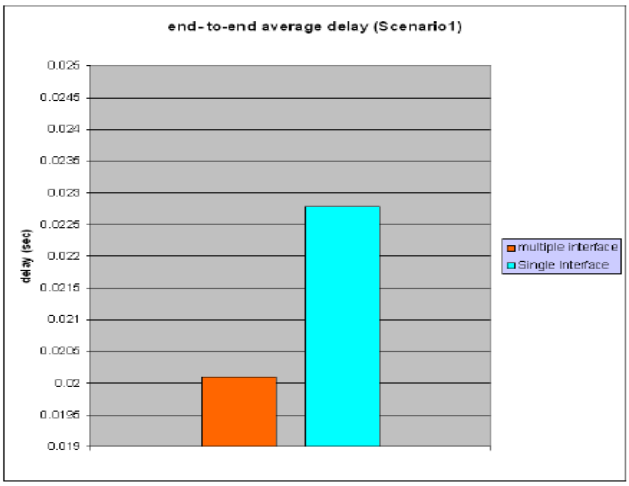

Fig. 6. Comparison of end-to-end average delay between multiple and single interface.

The delay is very important when evaluation the system, therefore, in the figure 6 above the comparison of end-to-end average delay between case1 (multiple interfaces) and case2 (single interface), since there is different in delay between two cases, multiple interfaces has low delay due to the CN dose interface selection from one interface to another respect to the moving of mobile network, where the mobile network moves away from its current access to the new access point and establish link with this new access point. The CN dose interface selection to choose short and better path to the mobile network. While the delay of the case2 (single interface) is high due to the mobile network has become far from the CN. Therefore, the packets take more time to reach the mobile node inside mobile network. Therefore, the multiple interfaces are better performance compare of single interface.

VI. CONCLUSION

The multi-homed Networks/Hosts (Mobile and fixed) shows an increasing interests, to this end, this paper defines an interface selection mechanism for a Multi-homed Network/Host. The mechanism allows the Multi-homed device to select the right interface during the communication time, in order to keep the communication going and reduce the overall delay, simulation jitter and increase the overall throughput of sending and receiving packets.

The mechanism reduces the number of lost packets, as the traffic is moved from one interface to another according to the link availability and the communication requirement. The simulation result shows a great improvement in terms of the overall end-to-end delay, the simulation jitter and the throughput of generation packets particularly during handover, where the destination is assumed to be a Mobile Node moving around different coverage areas.

The defined mechanism managed to handle different scenarios; on the first hand, the destination (MN) is moving with a slow speed between the access points, facing several handovers, i.e. the CN should choose the right interface to keep the communication going with minimum cost. On the other hand, the destination is moving in a high speed, where the MN is facing a faster handovers in such a way that the MN might handover to a new access point before successfully send traffic to the CN, at this point the CN needs to switch to different interfaces faster than the first case in order to keep the communication going and reducing the packet losses and reducing the overall costs of the communication.

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