Performance Analysis of Advanced FMIPv6 for Handover Schemes in VANET

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Abstract— Vehicular Ad-hoc Network (VANET) is a rising technology. The vehicle in the network uses the wireless medium to interconnect with other vehicles in their radio range. A heterogeneous wireless network (HWN) which is hybrid network of cellular network (having access routers (AR) and Internet Service Providers (ISP) for providing interaction and internet services to the VANET) and VANET. Internet Engineering Task force (IETF) given MIPv4/v6 (Mobile Internet Protocol -version4/6) and FMIPv6 (Fast) as mobility and handover management methods which is standard protocol. An improvement of FMIPv6, a handover management method using concept of tunnelling is simulated in VANET. NS2 is the simulating tool for evaluating performance of advanced FMIPv6 against standard FMIPv6 by seeing the parameters like Tunnelling Performance, Handover Latency, Packet Loss, Signalling Overhead Ratio, Service Disturbance Time, and Network Time.

Key words: Vanet, Handover, Tunneling, Fmipv6, Disturbance, Network Time

I. INTRODUCTION

Vehicular Adhoc Network (VANET) is a different type of Mobile Adhoc Network (MANET) having the interaction among vehicles without reliant upon any organization and configuration effort and is becoming common for inter vehicular interaction. An example is Fleet communication System which is a radio communication technology for adhoc network among node. It depends on ULTRA TDD. [1] For attaining multihop communication, as an alternative to ULTRA TDD, the schemes reduce the effect of network disturbance through media independent handover (MIH) which facilitates the mobility which in VANETs, vehicles can improve short connections to the Internet by using wireless access points (AP). A important part of the connection time is the time required for obtaining an IP address via dynamic host configuration protocol (DHCP). The vehicles can use broadband wireless technology for intelligent interaction for V2V and V2I communication.

[3-5] the handover among different types of networks like wireless Local Area Network (WLAN) and cellular networks is used with IP based network. [6] We have the following standard protocols that act on different layers of internet architecture:

- Mobile IP (base MIP or MIPv4 or MIPv6- at layer 3 (network layer of internet architecture) [7-8]
- FMIPv6 (Fast) [9]
- HMIPv6 (Hierarchical) [10-11]

- PMIPv6 (Proxy) [12]
- TCPmigrate, mSCTP, SIP [13]

The plan of the paper is as follows. Related work and literature survey of various handover techniques have been given in section II. Section III focuses on FMIPv6 (existing) and its progression using tunneling. In section IV simulator and simulation setup with VANET scenario is discussed. There are simulated results and discussion i.e. comparison of advanced FMIPv6 is done with standard FMIPv6 by taking various parameters like handover latency, tunneling performance etc discussed in section V. Finally, concluding remarks are given in section VI.

II. RELATED WORK

There are various models adopted for implementing the handoff and handling the mobility in the network. The advanced handover method of FMIPv6 by using Media Independent Handover (MIH) services was described in [14]. A NEMO (Network Mobility) protocol was planned for VANETs which is labeled in [15]. The Global Mobility Management (GMM) was planned for handover in VANET [16].

In [17], SIGMA (Seamless IP Diversity Based Generalized Mobility Architecture), which works both for IPv6 and IPv4, is planned. The concept used here is to keep fastness the old path though establishing a new track for seamless handover.

In [18], MMIPv6, a communication protocol is planned which assimilates multihop IPv6 based vehicle into the internet. Mobile IPv6 (MIPv6) cannot be used for backup multihop. VANET as it always desired a direct link layer connection among mobile node and gateway. In [20], Virtual Mobile Anchor Point (VMAP) is planned as one of the routers located among MN and actual MAP. The handover latency is reduced however analysing with HMIPv6.

In [21], a new algorithm based on Enhanced Access Routers (EAR) is planned for implementing better handover procedure than FMIPv6 hence it is EAR-FMIPv6. This EAR implements the handoff instead of router and it will configure the mobile Care of Address (CoA) and drives the BU message.

In [22], an advanced FMIPv6 is planned using Media Independent Handover (MIH) facility which allows an optimized handoff by growing the probability of its operation in predictive mode. It is achieve by using initiation handoff link. Event indication is used in it which supports in forwarding the packet to new access router without waiting for the message of attachment from FMIPv6. The access router discovery is condensed with the help of MIH [23-24].

In [25-26], the schemes reduce the effect of duplicate address detection (DAD). MIH describes a
network function of the network entity called MIH-F for communicating upper and lower layer through Service Access Point (SAP).

In [27], a handover scheme is planned for supporting multimedia services in Vehicular Wireless Network and Vehicular Intelligent Transportation System (V-WINET/VITS).

In [28], a hierarchical mobility management arrangement is planned by utilizing the concept of VMAP for reduction the signalling traffic for updating the location. The concept of virtual layer is introduced.

In [29], Simple Mobility Management Protocol (SMMP) is planned which deliver global seamless handover not only among homogeneous networks but also among heterogeneous wireless networks which is not delivered by MMIPv6 and its enhanced versions.

In [30], there is a proposal of a Leader-based arrangement which needs the Duplicate Address Detection (DAD) when a node changes its leader in the real-time applications in VANETs.

III. HANDOVER MANAGEMENT TECHNIQUE (ADVANCED FMIPv6)

Mobile IPv6 offer the internet connectivity to the mobile node (vehicle as mobile router-MR) when moving from one Access Router to other, this procedure is called handover. During handover, there is a session during which the mobile node is not capable to send or receive packets because of link-switching delay and IP protocol operations. There is a delinquent of "handover latency" as a result of standard Mobile IPv6 methods (movement detection, new Care-of Address configuration, and Binding Update).

The packet loss and handover latency problem of MIPv6 reductions the Quality of Service (QoS) for multimedia service application and is resolved by Fast MIPv6 (FMIPv6) [9]. FMIPv6 has two handover styles: first implements handover (predictive mode) afterward complete establishment of the tunnel among access routers (ARs) and second is reactive mode (gear's the handover)

A VANET Situation is taken in which the vehicles are stirring on road and vehicle can act as mobile routers which are having the ability of internet connectivity through access routers (AR) of Internet service providers (ISP). The advances FMIPv6 protocol arises when an MN [assume each node (Vehicle) as Mobile Router (MR)] directs a message (Router Solicitation for Proxy Advertisement - RSolPr) to its access router or to its ISP when the procedure of handover is about to happen i.e. when this specific is in the range of two access routers. There is a movement of vehicles from one network to another network.

The mobile routers (MR) are linked with the access routers (AR) and access routers have the facilities of Internet Services providers (ISP) which need their own home agents (HA) connecting through correspondent node. When the handover is taking place (MR1), MR1 (undergoing handover method) has to use MR2 (which still in AR1-ISP1) for internet connectivity until handover method is not completed in AR2 (ISP-2). A new CoA (Care of Address) is configured to AR2 for MR1 and after the registration, MR1 starts getting packet from AR2.

After fruitful tunneling among MR2-HA1 (AR1), the second tunneling among MR1-HA2 (AR2) takes place. After the achievement of tunneling process, now MR1 decide whether to stay in AR1 or start using the facilities of AR2.

IV. SIMULATION SETUP

NS-2 (Network Simulator) is the simulating tool which is used for the simulation of advanced FMIPv6 by seeing the numerous parameters. NS-2 is an open-source discrete event network simulator that cares both wired and wireless networks, including many MANET routing protocols and an implementation of the IEEE 802.11 MAC layer.

[31] The Vehicles moves at maximum speed of 40-120 Kmph. Other particulars of the simulation area are specified in the following table:

Table 1 gives the simulation period and range of values.

<table>
<thead>
<tr>
<th>Simulation Parameters</th>
<th>Range of Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simulation Area</td>
<td>1600(x) * 1000(y)</td>
</tr>
<tr>
<td>Antenna</td>
<td>Omni directional</td>
</tr>
<tr>
<td>MAC Type</td>
<td>Mac/802_11</td>
</tr>
<tr>
<td>Total No of nodes(Vehicles)</td>
<td>65-75</td>
</tr>
<tr>
<td>Number of Vehicles(Node)</td>
<td>65-75</td>
</tr>
<tr>
<td>Simulation Time</td>
<td>12.0</td>
</tr>
<tr>
<td>Preamble Length</td>
<td>144 bit</td>
</tr>
<tr>
<td>PreambleDataRate</td>
<td>1Mbps</td>
</tr>
</tbody>
</table>

Table 1: Simulation parameters

V. SIMULATION RESULT AND DISCUSSION

For analysing the performance of the advanced FMIPv6 with admiration to the standard FMIPv6, the diverse parameters like Handover latency, Packet Loss, Performance Comparison using tunneling, Service disturbance time, Network Lifetime, Signalling overhead ratio restrained against time (ms, 100/10) where time parameter can be considered as time taken among mobile vehicle and its interaction with access router or ISP. The simulation results and the performance evaluation are as follows:

A. Packet Loss:

The packet loss through the handover of mobile router (vehicle) is less for the planned arrangement as compared to the standard FMIPv6 as shown by the Figure 1. As the time increases, packet loss is not increasing exponentially in the strategic scheme. The number of messages required for the handover is less in case of tunneling mechanism as
associate to the signalling messages used for handover in FMIPv6.

**B. Handover Latency:**
Handover latency of a mobile network is describes as the whole handover time from one access router to other access router and from the Figure 2, the handover latency of planned scheme is a smaller amount as compared to the FMIPv6.

**C. Service Disturbance Time**
The service disturbance time during handover can be describes as the time among the receptions of last packet from previous access router until the first packet is expected from next access router via tunnelling among them. Figure 3 depict that service disturbance time for the planned scheme is less as compared to FMIPv6.

Fig. 1: Packet Loss

Fig. 2: Handover Latency

Fig. 3: Service Disturbance time
D. Network Lifetime

The network lifetime of the planned scheme and standard FMIPv6 is publicized in the following fig (Figure 4):

![Network Lifetime](image)

Fig. 4: Network Lifetime

E. Signalling Overhead:

Signalling overhead includes the number of signalling messages swapped to manage handover process effectively and Figure 5 demonstrate that the signalling overhead of FMIPv6 is higher than standards FMIPv6.

![Signalling Overhead](image)

Fig. 5: Signalling Overhead

F. Performance Comparison using tunnelling

The comparison of the tunnelling in the planned scheme and FMIPv6 is work as follows i.e. the number of packets mandatory for handover process in the planned scheme is less as compared to the number of packets needed for handover in standard FMIPv6 in Figure 6.

![Performance comparison using Tunnelling](image)

Fig. 6: Performance comparison using tunnelling
VI. CONCLUSION AND FUTURE SCOPE

The mobility and handover organization of vehicles in VANET is a broad part of research. There are various standard rules for these techniques when each node is having the internet connectivity. Handover latency, signallling overhead, performance comparison using tunnelling, packet loss, service disturbance time, network lifetime are the parameter used for analysing the simulated result of advanced FMIPv6 as compared to the standard FMIPv6 using NS-2 simulator. There is a decrease in the handover latency, packet loss, signallling overhead, number of packets required for handover and service disturbance time. Network lifetime is also calculated.

There is a necessity of evaluating this method in a more realistic scenario and applying them to actual wireless situation. There is a need of refining these schemes keeping in mind high speed of node, frequently changing topology and large number of vehicles in city situations or in highway situations.

REFERENCES


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