AN ANALYSIS OF MOBILITY AND SEAMLESS HANDOFF MANAGEMENT AND PROPOSING A NEW ALGORITHM TO IMPROVE DELAY PERFORMANCE

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ABSTRACT

In this paper we are presenting an analysis of mobility and seamless handoff management and proposing a new algorithm to improve delay performance. A heterogeneous wireless network (HWN) which is hybrid network of cellular network (having access routers (AR) and Internet Service Providers (ISP) for providing communication and internet services to the VANET) and VANET. Internet Engineering Task force (IETF) purposed MIPv4/v6 (Mobile Internet Protocol -version4/6) and FMIPv6 (Fast) as mobility and handover management techniques which are standard protocols. An enhancement of FMIPv6, a handover management technique using concept of tunnelling is simulated in a VANET scenario. NS2 is the simulating tool for analysing performance of advanced FMIPv6 against standard FMIPv6 by considering the parameters like Tunnelling Performance, Handover Latency, Packet Loss, Signalling Overhead Ratio, Service Disruption Time, and Network Time.

Keyword: - *Tunnelling, Handover Latency, Packet Loss, FMIPv6, VANET, MIPv4/v6.*

1. INTRODUCTION

Vehicular Networks are a stylish, comfort and dynamic network of the Intelligent Transportation Systems (ITS) [2]. Vehicles reveal with each other via Inter-Vehicle Communication (IVC) as well as with roadside base stations. A VANET is a technology that uses moving cars as nodes in a network to create a mobile network, enables communication between moving vehicles and the road side units (RSU's) [1]. VANET is the special type of MANET, so the routing Protocols and IEEE standards used in MANET are also applied in VANET Environment [3][4].FIMPv6 depends upon the network predation which is very difficult to obtain accurate result for a fast moving mobile node. In FIMPv6, when a mobile node receive a link layer triggers, several message will exchange among mobile node. New AR and old AR cannot exchange message properly due to the very high speed of the mobile node. To address this problem early binding fast handoff (EBFH) was proposed. In this schema, mobile node detects the new network by monitoring router advertisement and initiate early binding update with its current access router. EBFH increase the reliability with cost of high overhead. To reduce the amount of signaling overhead hierarchical mobile IPv6 (HMIPv6) was proposed. In HIMPv6, a mobile node has two care of address (CoA). First MIPv6 COA and second is regional CoA (RCoA). RCoA is similar to home address If the mobile nodes moves across subnet but within the same MAP domain. The mobile node only registers MIPv6 CoA to the new MAP while RCoA does not change. A simple extension to MIPv6, FMIPv6 is combined with HMIPv6 (IFHMIPv6) based on IEEE802.16e [5]. Upper layer solution: To avoid the change of current architecture, mobile stream control transmission protocol

(MSCTP) [6] at transport layer was proposed. Due to multi homing feature of the VANETs mobile node MSCTP can be used for internet mobility support without changing the internet architecture. However, due to large overhead and mobility this is not suitable for upper layer in vehicular network. Cross layer solution: the performance of mobility management can be increase by effectively exchange information within layers. FMIPv6 is a cross layer design which exchange information between link layer and physical layer. In [7,8], a new cross layer design for fast IPv6 was proposed. In this information exchange between IP layer and MAC layer which improve performance of FMIPv6 in IEEE802.16e environment.

2. PERFORMANCE ANALYSIS OF ADVANCED FMIPV6 FOR HANDOVER MANAGEMENT IN VANET

Vehicular Adhoc Network (VANET) is a special type of Mobile Adhoc Network (MANET) having the communication among vehicles without depending upon any infrastructure and configuration effort and is becoming popular for inter-vehicular communication. An example is Fleet communication System which is a radio communication technology for adhoc network among vehicles. It depends on ULTRA TDD. [11] For achieving multihop communication, instead of using IP addresses, a location based adhoc routing protocol is used for packet forwarding [12].

The heterogeneous wireless network, integrates the characteristic of the cellular network and Vehicular Ad-Hoc network. It is assumed that each Vehicular Node (VN) equips with the Mobile Router (MR) and cellular interface and Ad-Hoc interface. In VANETs, vehicles can gain short connections to the Internet by using wireless access points (AP). A significant part of the connection time is the time required for acquiring an IP address via dynamic host configuration protocol (DHCP).The vehicles can use broadband wireless technology for intelligent interaction for V2V and V2I communication.[13-14] The handover between different types of networks like wireless Local Area Network (WLAN) and cellular networks are used with IP based network. [15] They act at different layers of internet architecture and we have the following standard protocols:

- 1 Mobile IP (base MIP or MIPv4 or MIPv6- at layer 3 (network layer of internet architecture) [16-17]
- FMIPv6 (Fast) [18]
- HMIPv6 (Hierarchical) [19-20]
- PMIPv6 (Proxy) [21]
- TCP migrate, mSCTP, SIP [22]

3. LITERATURE SURVEY

Mobile server knows that mobile host had already moved to the cell of another mobile server using IETF's IP mobility Support [9]. To implement, we selected Aglet as a mobile agent platform after analyzing different mobile agent platforms such as Aglets, Grasshopper, and Voyager etc [10].

There are many models adopted for performing the handoff and managing the mobility in the network. The advanced handover procedure of FMIPv6 by using Media Independent Handover (MIH) services was explained in [23]. A NEMO (Network Mobility) protocol was proposed for VANETs which is described in [24]. The Global Mobility Management (GMM) was proposed for handover in VANET. [25]

In [26], SIGMA (Seamless IP Diversity Based Generalized Mobility Architecture), which works both for IPv6 and IPv4, is proposed. The concept here used is to keep remember the old path while establishing a new path for seamless handover.

In [27], MMIP6, a communication protocol is proposed which integrates multihop IPv6 based vehicle into the internet. Mobile IPv6 (MIPv6) cannot be used for supporting multihop. VANET as it always needed a direct link layer connection between mobile node and gateway. [28]

In [28], Virtual Mobile Anchor Point (VMAP) is proposed as one of the routers located between MN and actual MAP. The handover latency is reduced while analysing with HMIPv6.

In [29], a new algorithm based on Enhanced Access Routers (EAR) is proposed for performing better handover process than FMIPv6 hence it is EAR-FMIPv6. This EAR performs the handoff instead of router and it will configure the mobile Care of Address (CoA) and sends the BU message.

In [30], an advanced FMIPv6 is proposed using Media Independent Handover (MIH) services which allow an optimized handoff by increasing the probability of its operation in predictive mode. It is done by using initiation handoff link. Event indication is used in it which helps in forwarding the packet to new access router without waiting for the announcement of attachment from FMIPv6. The access router discovery is reduced with the help of MIH [31-32].

In [33-34], the schemes reduce the effect of duplicate address detection (DAD). MIH defines a network function of the network entity called MIH-F for communicating upper and lower layer through Service Access Point (SAP).

In [35], a handover scheme is purposed for supporting multimedia services in Vehicular Wireless Network and Vehicular Intelligent Transportation System (V-WINET /VITS).

In [36], a hierarchical mobility management scheme is purposed by utilizing the concept of VMAP for reduction the signalling traffic for updating the location. The concept of virtual layer is introduced.

In [37], Simple Mobility Management Protocol (SMMP) is purposed which provide global seamless handover not only between homogeneous networks but also among heterogeneous wireless networks which is not provided by MMIPv6 and its enhanced versions.

In [38], there is a proposal of a Leader-based scheme which needs the Duplicate Address Detection (DAD) when a vehicle changes its leader in the real-time applications in VANETs.

4. NEED OF PROPOSED WORK

Nowadays, everything is moving towards the infrastructure less wireless environment to bring the smartness of the society. In this situation, it is necessary to bring the smart technologies in the ad-hoc network environment. As vehicular traffic is a foremost problem in modern cities and on highway. Huge amount of time and resources are wasted while traveling due to traffic congestion. VANET is providing comfort and safety for passengers. Moreover, various transactions like information on accident, road condition, petrol bank details, menu in the restaurant, and discount sales can be provided to the drivers and passengers. The speed and time in which the message is sent and received plays an essential part in the Intelligent Transport System (ITS). For this the VANET requires efficient and reliable methods for data communication, gathering and retrieving information for seamless handoff in VANET.

Mobile IPv6 provide the internet connectivity to the mobile node (vehicle as mobile router-MR) when moving from one Access Router to another, this process is called handover. During handover, there is a period during which the mobile node is unable to send or receive packets because of link-switching delay and IP protocol operations. There is a problem of "handover latency". The packet loss and handover latency problem of MIPv6 decreases the Quality of Service (QoS) for multimedia service application.

In VANET, for better and dynamic data communication, a fault tolerance handoff mechanism plays an important role in the handover process between the vehicular nodes during the vehicles are running on the road then mobile agent plays a important role in retrieving the information during the handoff process. A method for fault tolerance information retrieval is required in VANET while traffic is moving with random speeds for random time intervals.

We need to review the fast handoff schemes proposed to improve the different procedures involved in the handoff process. Till now, not much work has been done on the fast handoff for VANET. How to combine the different handoff approaches and reduce handoff latency remains an open research issue and needs more. The mobility and handover management of vehicles in VANET is a broad area of research.

5. WORKING OF PROPOSED MECHNISM

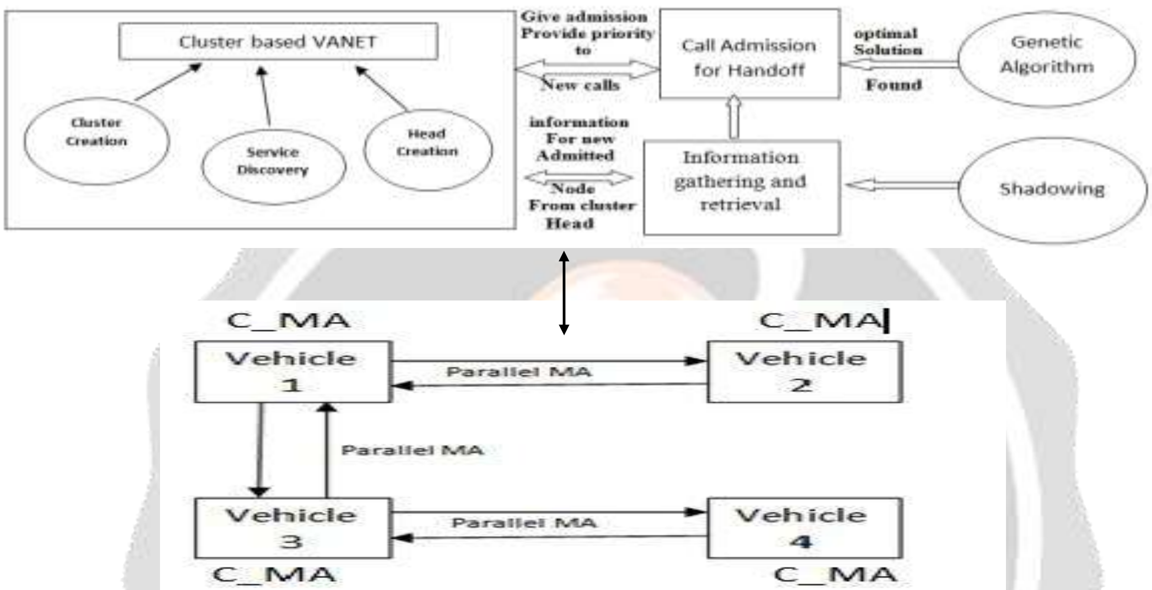

Fig-1: Cluster Based VANET Handoff Mechanism with Special Mobile Agents

In [37], VANET parallel mobile agent architecture is used to perform the better transmission of mobile agents, the client initiates multiple MAs, each of which visits a number of nodes in VANET. The MAs then return to the client and collect their results to complete the task. When the traffic load in VANET is heavy, many researchers believe that (Call Admission Control) CAC [38] aims handoff calls have to be given more preference than new calls, since users are much more sensitive to call dropping than to call blocking [38].

We adopt a proportional threshold based optimal access threshold structure to implement CAC which, gives Seamless handoff calls and new calls different priorities, and offers high access bandwidth [39]. We apply mobile agent technology to VANET, each vehicular node is assigned a “C_MA” (Client’s Mobile Agent), to provide seamless handoff. The mesh client places its C_MA in the mesh router that it registers with [40]. If the C_MA moves from the range of one vehicular node to that of another vehicular node too. When a vehicular node wants to handoff, it will inform its current MH first.Then the current MH (Mobile Host) transfers the C_MA to the different MH for information retrieval for better handoff in neighborhood. To get the complete benefit of mobile agent system, a suitable information retrieval system for fault tolerance should be taken[41].For fault tolerance mechanism, check pointing and replication system is adapted to increase the reliability of the system. All the C_MA makes a duplicate copy of data at each vehicular node called IM_node, makes the system fault tolerance, when they migrates until the destination not found. In this paper we use timestamp ‘Ti’ and threshold ‘Th’ for making the system time consuming and reliable, that after a timestamp the data will be invalid[42].When C_MA reaches its final node then the communication operations between clients and replicated database servers are implemented using Mobile Agents, takes queries from other vehicular nodes and returning results to them. During the communication system the system must be secure. In this paper we use an authentication system for the secure communication. This authentication system uses a handshaking mechanism, when mobile agent sends request to the MH (vehicular node) for duplicate copy the server first check for the authentication by knowing the digital signature of the agent migrates [43-44].

5.1 Cluster Based VANET

A simple highway system is used for the VANET [16]. Each vehicle is using a global positioning system (GPS) [17]. Clusters are created dynamically in VANET the clusters remain stationary and predefined [21]. In VANET the cluster architecture follow the following steps:

- **Cluster creation:** In the present architecture, the VANET area has been split into a number of size clusters having cluster head and storage capability according to bandwidth, direction, velocity as per the cluster formation algorithm given. For information gathering between the cluster heads, a service announcement procedure takes place.
- **Cluster Head Creation**: It is the process of finding the cluster head in all the created clusters. Each cluster Head has its own responsibilities and powers.
- **Service announcement:** After creating cluster using cluster creation algorithm if any node wants to announce any service in the network then all the cluster heads update their values according to the algorithm.

5.2 Call Admission Control for Low Bandwidth Handoff

According to the Service announcement the cluster head provide admission to the call. A better handoff strategy should be applied to the VANET, when node changes their cluster. A call admission (CA) mechanism is used in vehicles while changing the clusters. A genetic algorithm is used for searching optimal solution for CA on the router (vehicle), which adopts threshold structure and gives handoff calls first priority and new calls second priority [5]. We assume there are 'Cn ; clusters in VANET and a node among all the clusters wants to change the cluster the two possible case can arise (i) it is simply a vehicular node (ii) it is a Cluster head. If node is a Cluster Head then it will be accepted is it has a optimal bandwidth and Genetic algorithm decide which device needs a priority first. Then we need to find new cluster Heads in All the clusters otherwise the node is accepted.

5.3 Information Retrieval Mechanisms Using Mobile Agent

In order to gets the complete benefit of information gathering in VANET. A mobile agent based information retrieval system is introduced in VANET. Mobile agent migrate in the network for getting the information from the appropriate node, if node is searching for the information in all the clusters C_1 to C_n retrieve information from the cluster head if Cluster head not found then find the cluster head and retrieve information after service announcement.

5.4 Shadowing Effects

A problem can arise while retrieving the information from cluster head in VANET, that when searching a node in cluster for information retrieval and two clusters having the information of same node then Shadowing helps in retrieving the latest information values by finding the cluster where the node is currently lies.

6. RESULT AND DISCUSSION

For analyzing the performance of the advanced FMIPv6 with respect to the standard FMIPv6, the different parameters like Handover latency, Packet Loss, Performance Comparison using tunneling, Service disruption time, Network Lifetime, Signaling overhead measured against time (ms, 100/10).

The simulation results and the performance comparison are as follows:

6.1 Packet Loss and Handover Latency

The packet loss during the handover of mobile router (vehicle) is less for the proposed scheme as compared to the standard FMIPv6 as shown by the Figure 2. As the time increases, packet loss is not increasing exponentially in the proposed scheme. The number of messages required for the handover is less in case of tunneling mechanism as compare to the signaling messages used for handover in FMIPv6. Handover latency of a mobile netwo rk is defined as the complete handover time from one access router to another access router and from the Figure 3, the handover latency of proposed scheme is less as compared to the FMIPv6.

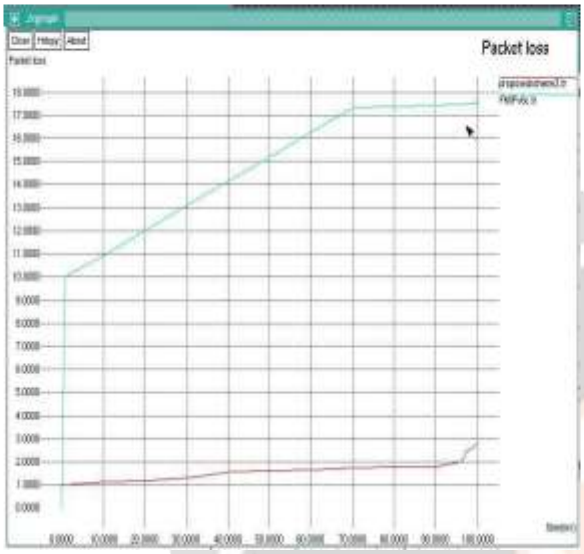

Fig-2: Packet Loss

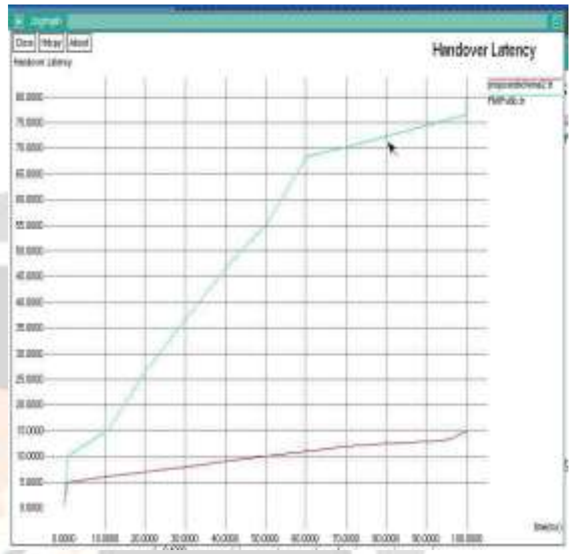

Fig-3: Handover Latency

6.2 Service Disruption Time and Network Lifetime

The service disruption time during handover can be defined as the time between the receptions of last packet from previous access router until the first packet is received from next access router via tunneling between them.Figure 4 depict that service disruption time for the proposed scheme is less as compared to FMIPv6. It is the amount of time that a network would be fully operative. The network lifetime of the proposed scheme and standard FMIPv6 is shown in the following fig (Figure 5):

Fig-4: Service Disruption time

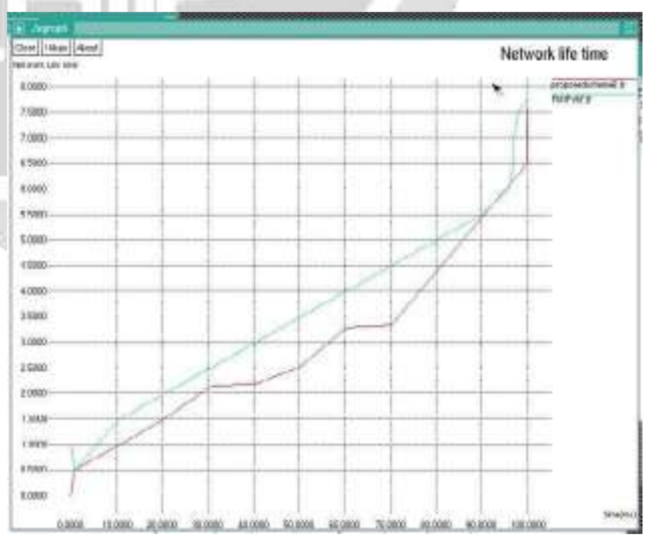

Fig-5: Network Lifetime

6.3 Signalling Overhead

Signalling overhead involves the number of signalling messages exchanged to manage handover process effectively and Figure 6 show that the signalling overhead of FMIPv6 is higher than standards FMIPv6.

Fig-6: Signalling Overhead

7. CONCLUSIONS

A method for fault tolerance information retrieval is given in VANET while traffic is moving with random speeds for random time intervals. Special Mobile agents are considered a suitable technology to develop applications such as information retrieval system for mobile computing environment. We review the necessary procedures involved in a VANET handoff process. We also review the fast handoff schemes proposed to improve the different procedures involved in the handoff process. Till now, not much work has been done on the fast handoff for VANET. How to combine the different handoff approaches and reduce handoff latency remains an open research issue and needs more. The mobility and handover management of vehicles in VANET is a broad area of research. There are various standard protocols for these techniques when each vehicle is having the internet connectivity. Various parameters like Handover latency, signalling overhead, performance comparison using tunnelling, packet loss, service disruption time, network lifetime are used for analysing the simulated result of advanced FMIPV6 as compared to the standard FMIPv6 using NS-2 simulator. There is a reduction in the handover latency, packet loss, signalling overhead, number of packets required for handover and service disruption time. Network lifetime is also computed. There is a need of evaluating these techniques in a more realistic scenario and applying.

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