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Cost Analysis of Mobile IP for the Repetitive IP Stations during a Short Period of Time

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ABSTRACT
LEO satellites have important advantages such as low power requirements, low propagation delay and more efficient spectrum delay over MEO and GEO satellites. But, the handover management in LEO satellite becomes challenging for supporting global mobile communication. Here we propose cost analysis of a new method of introducing a location manager which will store the previous ip s depending on users choice and comparing the new ip address with the stored one and taking the decision whether to register or not. This method also reduces the binding updates and the packet loss during communication. It is the most useful process when the previous ip addresses are repeated for several times during a short span.

Keywords
Low Earth Orbit (LEO), Propagation delay, location manager, satellite networks, binding update.

1. INTRODUCTION
In order to provide global coverage to a heterogeneously satellite communication networks are utilized to co exist with terrestrial networks A LEO satellite takes about 100 minutes to orbit the earth, which means that a single satellite is in view of ground equipment for only a few minutes [1]. As a consequence, a LEO satellite system must hand over between satellites to complete the transmission if a transmission takes more than the short time period that any one satellite is in view.

In general, this can be accomplished by constantly relaying signals between the satellite and various ground stations, or by communicating between the satellites themselves using “inter-satellite links” (ISLs) [1], [2]. LEO satellites are also designed to have more than one satellite in view from any spot on the earth at any given time, minimizing the possibility that the network will loose the transmission. Due to the fast-flying satellites, LEO systems must incorporate complicated tracking and switching equipment to maintain consistent service coverage. In this paper, we focus on the handover management of satellite networks, specially the MIP which is a crucial design problem for supporting mobile communication services in the co-existing terrestrial and LEO satellite networks.

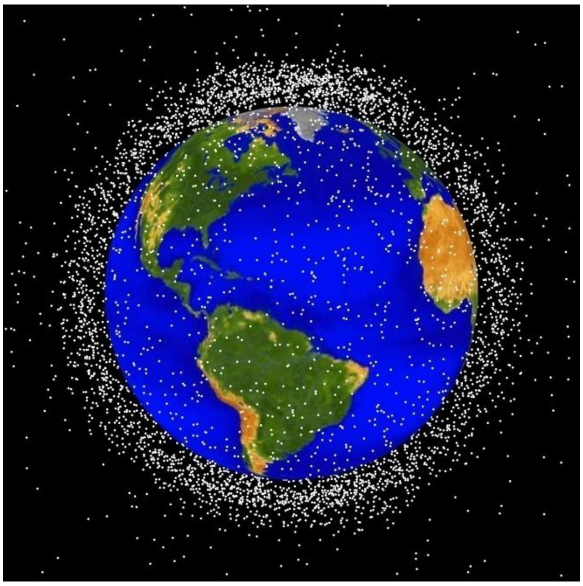

Figure 1 Handover:

H**andover** or **handoff** refers to the process of transferring an ongoing call or data session from one channel connected to the core network to another. In satellite communications it is the process of transferring satellite control responsibility from one earth station to another without loss or interruption of service. Handovers may degrade the system performance as an unsuccessful handover results call blocking and forced call termination. Forced call termination is less desirable than a new call blocking though both affect the performance of the system. A number of handover techniques have been proposed to solve this problem.
One of the proposed models for handover management in satellite networks is mobile IP (MIP) [3]. When a mobile host moves from one point of attachment to another it enables a TCP connection to remain alive and to continue receiving packets. Although MIP is a widely used approach applied to satellite networks, it has some important drawbacks including high handover latency and high packet loss [4] [5].

In our paper we have proposed an idea of reducing binding updates, handover latency and packet loss during handover. Our paper is structured as follows:
In the first section we have given a brief introduction related to LEO satellite and handover mechanisms. In section 2 we have discussed the related work regarding MIP network. In next section we have proposed our idea of introducing a location manager .In section 4 & 5 we have shown the simulation results and the conclusion and the future work regarding this paper.

2.RELATED WORK

Here we have described the related work and also our proposed work in the virtual environment of aysegul. The related works prior to our proposed algorithm have been discussed as follows

2.1 Mobile Mobility Management Related to MN

In low earth orbit (LEO) satellite network Mobility management is one of the key technologies. The aim of mobility management is to track where the subscribers are, allowing calls, SMS and other mobile phone services to be delivered to them.

The main concern of mobility management is to locating MNs position in the network and guarantees a seamless data transmission upon change in nodes position. Mobility management basically contains two operations, namely binding update and data delivery. The binding update operation aims to associate reach ability identity (Reach.ID) and routing identity (Route.ID) of each node [6] [7], whereas, Reach.ID indicates a unique name of the node and is not subject to change. The Route.ID specifies the position of the node in the network and changes in response to node movement. When a mobile node changes its position, the Route.ID changes as well and the old binding is no longer valid. To update the binding, mobile nodes are requested to send their new Route.ID to the location directory (LD) [8]. The main problem of this procedure arises when LD is geographically
Too far from mobile nodes. In this case, binding update cost becomes very expensive, especially in a high mobility environment such as satellite networks [9]. Although a handover is a local process that concerns only the MN, the old AR, and the new AR, a binding update is a global process hat may affect other network elements in addition to the three adjacent entities. Route.ID can be used to locate the position of the MN; therefore, no further operation is needed to transmit the data seamlessly. However, using Route.ID as the precise location of the MN requires frequent update of MNs registration even upon a slight movement of the nodes. Thus, the required update cost can be very huge [10].On the other hand, when Route.ID is used to indicate location of the MN roughly, an additional operation called paging is needed to find precise position of the MN. However, the paging cost can be very high in case of wide paging areas. As a result, Route.ID has a significant importance on the mobility management cost. The role of the Route.ID should be chosen carefully according to mobility management issues of underlying network.

2.2 Mobility Management in Terrestrial Mobile Networks

In terrestrial IP networks, IP addresses are designed for Route.IDs as well as Reach.IDs in higher layers. This causes an important problem for mobility management as MN can not be identified in the higher layers when its IP address changes after handover. The most dominant protocol among existing mobility management
Protocols are MIP that was proposed to solve this problem by using two different IP addresses for the two locations of MNs. First location is called as home network and identified by home address which serves as a Reach.ID. Second location is visiting network and identified by care of address (CoA) which functions as a Route.ID. In this protocol, locations of MNs are precisely managed by binding update for every handover occurrence. The details of MIP and its drawbacks will be discussed in the remainder of this section.
Also, there are other mobility management protocols such as paging mobile IP (P-MIP) [11] and cellular IP [12] which are based on the principle of loose location management of idle nodes. In loose location management, location management is Done for only idle nodes. When idle node becomes active, paging is usually used for locating the node in the network. Loose location management protocols have not covered here.

2.3 Drawbacks of Mobility Management in LEO Satellite Networks

The drawbacks are mentioned as follows:
The most widely used protocol for mobility management over satellite networks is mobile IP proposed by the Internet engineering task force (IETF) to handle mobility of Internet hosts for mobile data communications [13].
The MIP enables IP host mobility without breaking the high level connection. It enables a TCP connection to remain alive and to continue receiving packets when an MN moves from one point of attachment to another. MIP is based on the concept of home agent (HA) and foreign agent (FA) for routing of packets from one point of attachment to the next. During handover from the HA to the FA, a MN registers with the FA, waits for the allocation of channels, and updates its location in the HA database. The traffic flow of MIP is depicted in Fig. 1.
When MN moves to a new domain, a location update is sent HA. Therefore, the HA is informed by the CoA of the MN. The packets from the CN to MN are encapsulated and forwarded to MN’s current CoA. Then, these packets are encapsulated and delivered to upper layer protocols.

Although MIP is a widely accepted concept, it has some drawbacks like

1. **High Handover Latency:** A MN needs to wait for completion of the steps, which are discovering the new CoA, registering the new CoA with the HA (*binding update*), and forwarding packets from the HA to the current CoA, before it can
Receive forwarded data from the previous point of attachment. Since the frequency of handover occurrences in LEO satellite networks is very high, a large number of binding update requests is likely to be generated in a single burst.
2. **Inefficient routing path**: since large amount of data is routed to the HA, and then tunneled to the MN. This may decrease the scalability issues as the number of MNs managed by a HA increases.
3. **Network security solution:** The MIP conflicts with network security solutions such as ingress filtering and firewalls. It is hard to duplicate HA to various locations to increase survivability and manageability since HA must reside in MN’s home network. Therefore, this model needs some modifications to be applicable to internet infrastructure.

4. **High Packet Lost Rate** is another drawback omit. During the HA registration period, some or all of the packets directed to the MN's old CoA will be lost because the old point of attachment does not know the new point of attachment of the MN so that it cannot communicate with the MN during this period.

2.4 For overcoming the drawbacks of the different mobility management a new method have been proposed which is mainly based for the repetitive IP stations for a short period of time [14].

In this work we a new location manager has been proposed which will reduce the drawback of handover latency of the MOBILE IP network. In a mobile IP network MN needs to wait for the completion of the steps which are discovering the new CoA, registering the new CoA with the Home Agent, and forwarding packets from HA to current CoA before it can receive forwarded data from the previous point of attachment.Here, we have seen that every time the satellite needs to register for the new IP and to forward packets. In our proposed location manager it will store the IP addresses for a limited time and if the satellite goes to the previous footprint again, it has no need to register; the previous IP address will be assigned to it. This will reduce the binding update and also the handover latency for the Mobile IP network. It is very much effective for the repetitive IP stations during a short period of time.

The location manager is also designed to reduce the packet loss of the network. In a mobile IP network during sending the packets if the acknowledgement is lost, it will send the previous data again and if it is sent they it will erase the previous data. Thus it will drastically reduce the packet loss in Mobile IP Handover.

2.4. A.Algorithm:

1. Location manager is activated.

2. While the mobile nodes changes its position it will store the IP addresses the new network.

3. For the next change in mobile IP address the address will be matched to the previous stored addresses, if it matches, no need to register again

Else, register the new IP address of the satellite.

The addresses will be stored up to n matches with the IP addresses (n>0). The handover will be effective with the reducing values of n.

Now for the packet loss reduction after identifying the old imp address or registering the new one, the packets will be forwarded. It will check the acknowledgement after sending every packet and if acknowledgement s received then proceeds to the next

Else, resend it.

Thus this will also reduce the packet loss of the network.

Though it's an effective method, it will increase the time during the matching of data and the time will reduce with the value of n and also if the same IP address repeats in a short time period.

2.4. B Flow Chart:

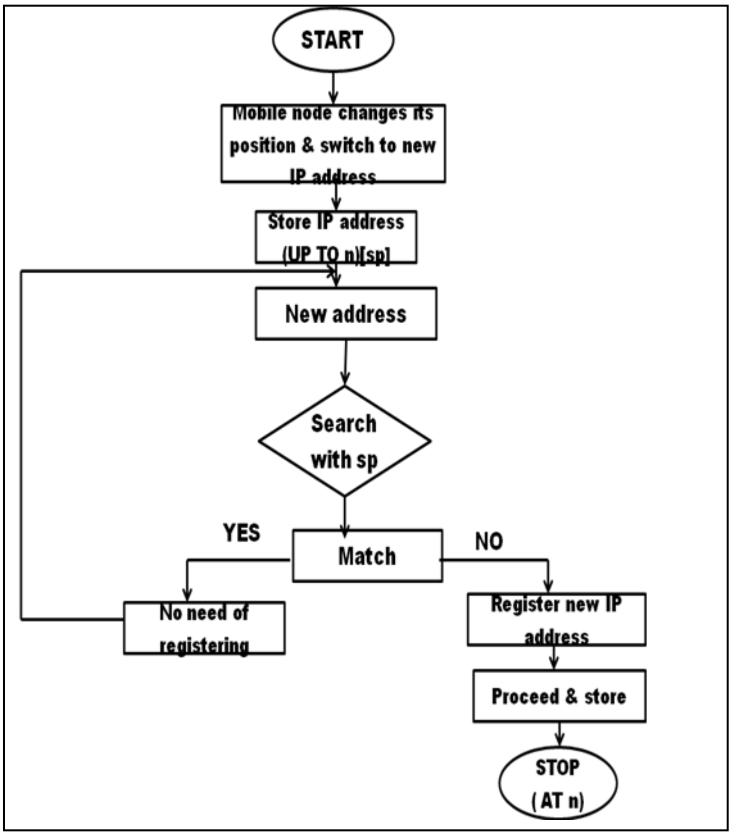

Fig2 Handoff algorithm

Then this loop will again go back to sp to store the data i.e. the addresses. Number of data to be stored i.e. n is basically user defined.

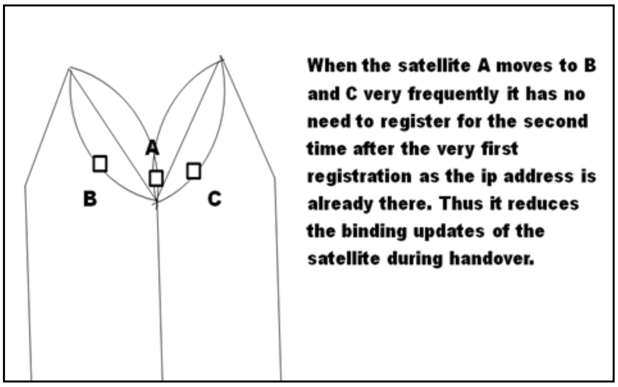

Fig3 handoff special case

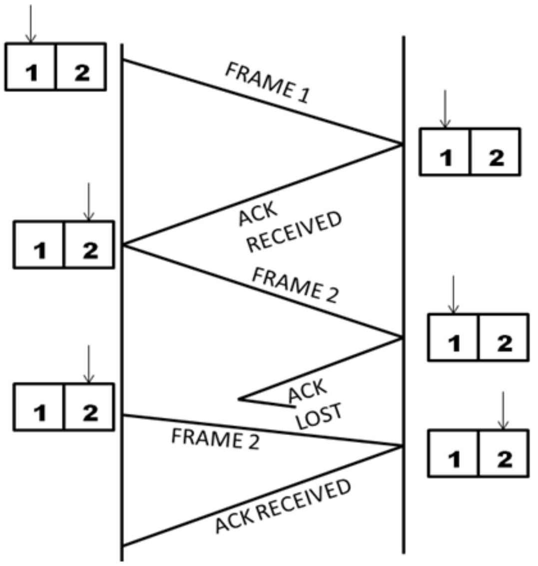

Fig4 less data criterion

In fig 3 we have shown the less data loss criteria of our proposed model. As we have said earlier that if the acknowledgement is lost the previous frame will be resend has been shown here schematically.

3. PROPOSED WORK

In our proposed work we have done the cost analysis of the repetitive IP networks.

Cost Analysis for the Repetitive IP Stations of Location Manager Enable Mobile IP Networks

In location manager based Mobility IP networks we have seen in[] that for repetitive IP stations Location manager itself generates the next IP address without searching the satellite and for that we can say the handoff latency is reduced and there is no need of any extra binding updates.

Now as the mobility management cost is dependent over different parameters we can show that here that the implementation of the location manager for the repetitive mobile IP stations will reduce the mobility management cost to a huge amount.

B. Analysis of Mobility Management Cost of MIP

In paper [15], the handover management cost of MIP protocol has been analyzed. The handover management cost consists mainly of the cost of binding update and data delivery. The management cost is computed, and the number of hops, H, required to deliver the message. Equation (1) indicates the definition of the cost in this evaluation.

Cost = M.H.... (1)

Now,

$$C_{MIP}(t) = M.H_{MN,LD}R_{HO}(t)\ldots (2)$$

$$R_{HO}(t) = V_{sat}L_{sat}\int_{V_{sat}(t-\Delta t)}^{V_{sat}t} D_l(V_{sat})\,t\,dt \ldots (3)$$

Where, V_{sat} and L_{sat} denote the ground speed of satellite and the coverage boundary length, respectively. D_L ($V_{sat}t$) is the linear density of nodes on the coverage of satellite at time t. In our evaluation, we calculated nodes density as the ratio of the total number of nodes to the coverage surface area. Here also controlling the term $H_{MN, LD\ we}$ can control the cost of MIP as the product of the generated control message size, M.

In repetitive IP networks the binding update cost is less as there are no extra binding updates needed and since the station is repetitive the and for a short time the packet data delivery cost is also low.

4. SIMULATION RESULTS

In the simulation part we have compared our proposed algorithm with the existing procedure related to the handover of the Mobile IP network. We have basically done three simulations here. First one is based on the binding updates cost, second one is packet data delivery cost and the third one is the total cost .The results have been shown as follows:

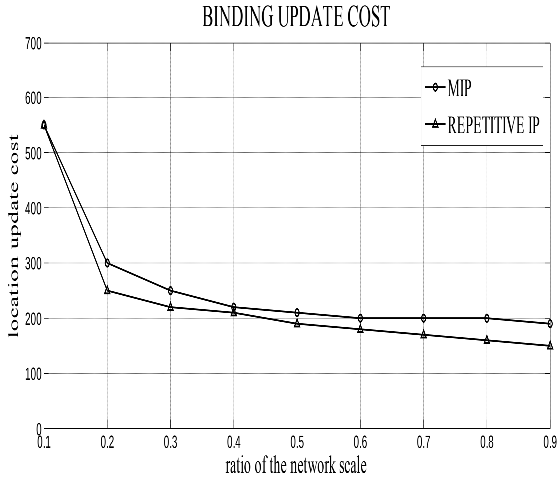

Fig5.binding updates cost (based on ratio of the network scale)

The above fig4 is the simulation result of binding update cost based on the ratio of network scale for MIP without applying our proposed algorithm and as well as after applying From both the waveforms we can conclude that introduction of the location manager in MIP will reduce the binding update cost

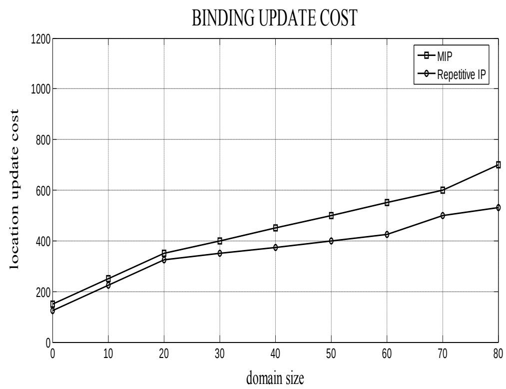

Fig6. Binding update cost (based on domain size)

The above fig5 is the simulation result of both MIP without applying our proposed algorithm and after applying. Comparing both the results we can say that the binding update cost based on the domain size is lesser .Hence it has a better cost control.

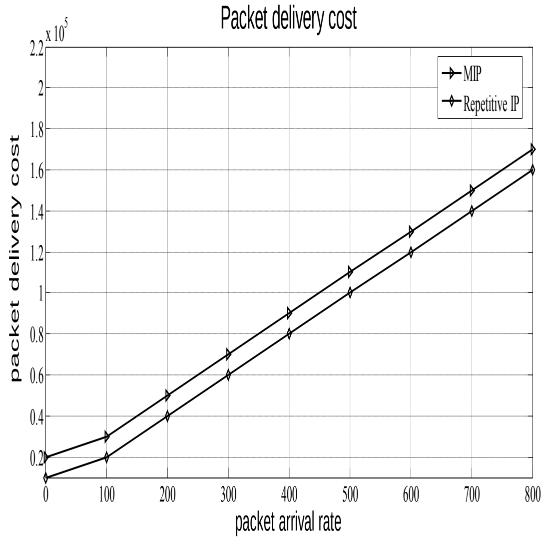

Fig7.packet data delivery cost

From the simulation results we can find it out that in LM based MIP packet delivery cost will also be less as compared to the MIP by their waveforms.

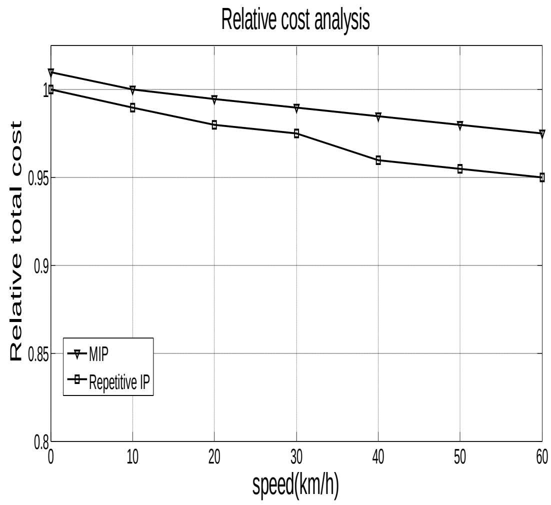

Fig8.Total cost

By the simulation results shown in the above figure we can conclude that the total cost will be reduced. Though from fig 4, 5, 6 we know that the binding update cost and packet delivery cost will be less and if it so the total cost will also be less as it comprises of those both. So by the above figure we have shown it also.

5. CONCLUSION

In this paper we have first discussed the satellite handover mainly related to Mobile IP network. We found the drawbacks of these concepts like high handover latency, packet or data loss, inefficient routing and some others. Then a discussion on a new location manager based handover is done for repetitive ip stations and in proposed work we have done the cost analysis of the new method and showed by various simulation results that it has a better cost management. The future work regarding this can be done is to remodeling the LM (Location Manager) by reducing the space occupied by the stored address content.

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