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Super Node Approach to Integrate Internet in Mobile Ad Hoc Network

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Abstract:

Ad-hoc networks have become very well-known these days and penetrating our society rapidly. Also due to the attractiveness to connect the wired and wireless networks particularly the Mobile ad hoc Network is very interesting in real world situations due to its popularity and convenience. Different methods and mechanisms have been projected to integrate ad-hoc networks and the Internet. The existing mechanisms are diverge in gateway discovery mechanism, cell switching criterion and ad hoc routing protocol. In this present approach we eliminate the constraint from the former mentioned approaches and present a new approach in which cluster head(CH) and gateway node will be same and that node is known as super node (SN),in which all the tasks of cluster head(CH) and gateway will be executed by the super node and we have introduced the prediction table concept in such a way that if super node moves out or gone the network then which node will act as the super node, because if without handover the assign tasks of super node to any other capable node the rest of the node of that cluster has strong chances to failure the network. By applying this approach we have lessen the overhead for deciding the super node in place of cluster head and gateway node separately and by maintaining the prediction table we can decide which node will acts as super node in future to make ongoing communication unaffected.

***Keywords* — MANET, super node, FA, CH, HA, CN.**

INTRODUCTION

Upcoming technology will be largely based on wireless technology. Infrastructure based cellular mobile networks are still limited by the need of infrastructure such as base station and tower etc. The main challenge to the operation and acceptance of mobile applications is the requirement of enhanced connectivity. Solutions like Mobile IP [1] have no doubt contributed to the enhancement of the connectivity to include nodes with a wireless last hop. On the other hand, Mobile Ad-hoc Network is visualized as a standalone network, with communication being supported between nodes in the network. In order to allow the connectivity outside of the ad hoc network, a very stable bridge between ad hoc network and the Internet is required, which would expand the communication base of the ad hoc Network. In this proposed mechanism, we incorporated the super node [8]with mobile IP protocols to provide the bi-directional connectivity.

The very basic requirement for providing the Internet connectivity is that the MANET [18-19] nodes should be registered with the super node in order to access the Internet. In turn the super node must be registered with the Foreign Agents. The MANET nodes using Pro-active Protocol forwards the packets to the super node and super node further forwards those packets to the Internet node using Mobile IP protocol via the Foreign Agent. In case if any super node is not registered with the Foreign agent or is not in a position to deliver the packets in the Internet, then it uses as alternate route to forward the packets to another super node. This may add to the route length but will ensure the delivery of the packets and thereby improves the performance.

I. RELATED WORK

The offered approaches are to integrate mobile ad-hoc network and the internet are divided into two categories based on two criteria. The outer most criteria are related to the type of architecture of the hybrid network. This classification leads to two-tier [3-9] and three-tier strategies [10-11]. Further, the Gateway discovery process and their selection are considered as other criteria to produce a finer classification of the existing approaches. A couple of three-tier strategies can be found in [10-11].

II. PROPOSED APPROACH

The proposed approach shown in Fig.1 consists of the Mobile ad hoc Network (MANET) which is divided in clusters. Each cluster has a super node (SN). The main function of a super node is to take care its member node. At least one super node shall be in the transmission range of the Foreign Agent (FA) in the internet backbone. It is assumed that correspondent Node (CN) is there in the wired Internet.

The Integrated Protocol uses the basic functionalities of the table drive or dynamic protocol with Mobile internet protocol (IP). It is assumed that the super node is close to Foreign Agent in order to make available the Internet connectivity to the ad-hoc nodes. The super node is assumed to be registered with any Foreign Agent at any time.

The Agent advertisements issued by the FA are meant only for the super node. If any super node receives advertisements from multiple FAs, then it selects

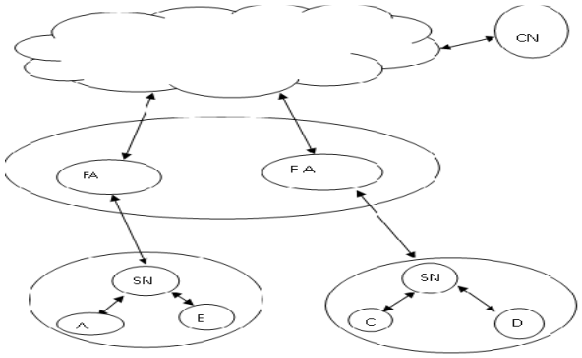

Fig 1: Proposed Communication architecture of MANET network with Internet networ

the one FA which is lightly loaded. All the communication from the nodes towards the Internet side is through the super node. Therefore the super node acts like a Mobile IP proxy for the mobile ad-hoc nodes and the visiting mobile nodes.

A. Communication between the MANET and the Internet

In the present model, super node and ad hoc nodes be familiar with each other's presence via routing protocol. Whenever the Ad hoc host says "A" joins the ad hoc network, the host "A" broadcasts its advertisements to its neighbor's nodes with some sequence number. Each host takes a note of it and makes an entry about host "A" in their routing table. later on they broadcast with increased sequence number to their neighbors. This broadcasting process continues until the advertisements reach to the destinations node. The super node also comes to know about the host "A" and makes an entry in its routing table. The host "A" also gets routing updates from its neighbours and thereby creates its routing table, including the path to super node. After that, the host "A" sends its registration information to the super node such as its home address. Based on this information super node acts as a mobile IP proxy for "A". The super node sends the registration request to the host's Home Agent (HA). After successful registration, a registration reply is acknowledged to the super node from the H A. The super node then informs the host "A" about the registration status. The super node keeps the registration information of all the ad hoc host nodes and uses it during re-registration.

B. Types of Communication

The proposed approach provides three types of communication in order to provide bi-directional communication:

(i) Intra-MANET routing: This form of communication is the conventional communication within the ad hoc network by means of Pro-active routing which is the local Protocol within the Cluster.

(ii) Communication between an ad hoc Host and a Correspondent Node (CN): This type of communication is initiated by the Mobile Node in the MANET. The node wishing to send data to the Correspondent Host, first checks its routing table. If the destination is not found in the routing table, then it sends the packet to its super node. If the super node is registered with the FA, forwards the packet to the CN through the FA as shown in Fig. 2.

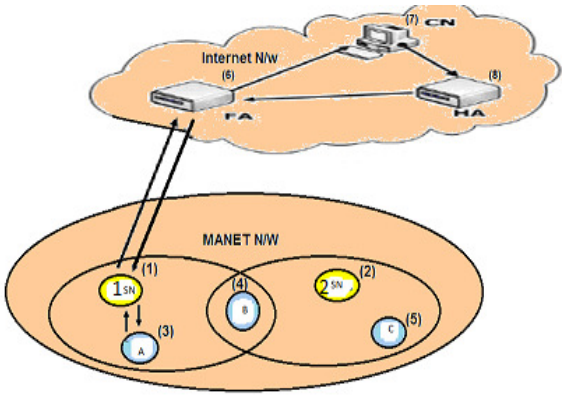

Fig: 2 Mobile Node 1 communicating with Correspondent Host in the Internet via its Local Super node (SN-1)

In case if the super node is not registered with the FA, then it forwards the packet to another super node which is within the overlapping zone of the super node. If that super node is registered with the FA, then the packet will be forwarded to the CN via this super node which is shown in Fig. 3. In case if this super node is not registered well with the FA then the packet will be dropped.

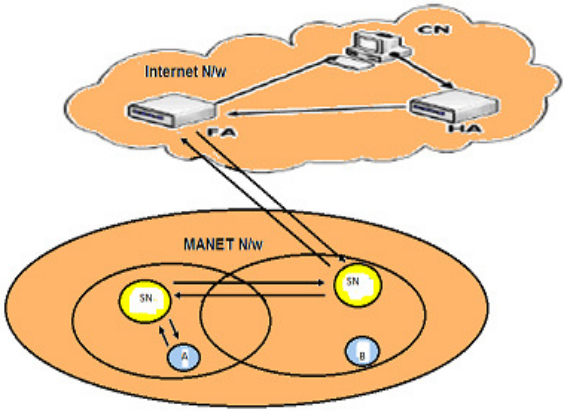

Fig:3 Mobile Node MN1 communicating with Correspondent host in the Internet via Other Cluster Head Gateway

(iii) Communication between Correspondent Node and an ad hoc Host:

This type of communication is initiated by the Correspondent node (CN). The CN, when wishing to send packets to the ad hoc host, delivers the packet to the HA. If the ad hoc host had registered with the HA, then it will forward the packet to the ad hoc host in consultation with its routing table. If the ad hoc host has roamed away from it's HA domain, then the HA will have the COA of the super node if it has registered. Using the COA the packet will be tunnelled to the super node by the HA. The super node checks its routing table, and delivers the packets to the requested destination ad hoc host using the Pro-active routing protocol.

In this approach super node has the following responsibilities to maintain the routing table of all super nodes or other Nodes & Mobile Nodes as shown Fig.2.As in our case for the SN-1 has to maintain the routing table for other super nodes and ad-hoc Nodes.

TABLE 1.

Routing Table for Other super nodes/ Nodes

Super node /Other Nodes	Via	Distance	Member list
2	B-2	1	5
6	1-6	1	7,8

TABLE 2

Super node N1domain members List

Member node	Via	Distance in hop
3	1-3	1
4	1-4	1

IV. CONCLUSION

In this work integration of mobile ad-hoc networks and Internet is proposed using a unique concept of super node. One of the significant part of this approach is reduced overheads due to the multiple selection of gateway node and cluster head separately hence less congestion and

overheads during the time of communication between internet nodes and mobile ad-hoc nodes and it provides an alternate path to the mobile node through another Cluster node in the cluster, in case if super node moves out from cluster . Proposed approach will provide better packet delivery, less end-end delay and better connectivity in comparison with the Integration strategies. Our Future work will employ multiple super nodes per cluster in order to avoid link failure if one super node fails then other super node can take over the task for reliable communication. Hence better throughput of the network.

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