Proceedings of the 4th National Conference; INDIACom-2010
Computing For Nation Development, February 25 – 26, 2010
Bharati Vidyapeeth's Institute of Computer Applications and Management, New Delhi

# A Survey of Gateway Discovery Mechanism in Ad Hoc Network

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**ABSTRACT**
*Integrating MANET and Internet extends the coverage area and application domain of MANET and thus provide ubiquitous Internet access. This integration allows nodes attached to Internet to be connected to MANET nodes which can't access Internet directly. MANET and Internet have several differences in their structure, topology and communication protocol. Thus, the main challenge is to integrate these networks by overcoming these mismatches. This paper discusses the various issues of connecting mobile ad hoc networks to the Internet. It further discusses eight solutions for Internet-MANET integration which are categorized as Mobile-IP based and Non-Mobile-IP based. The objective of this survey is to make these useful approaches available to the interested readers. It also reviews the characteristics of these proposed solutions with their relative merits and de-merits in the light of a few specific parameter. It concludes with a discussion on the suitability of the solutions under different scenarios.*

**KEYWORDS**
Multi-hop Internet access; gateway; MANET; mobile IP; routing protocols; classification; comparison

## 1. INTRODUCTION

Mobile ad hoc network (MANET) [1,2,3] is self-configurable network that can be formed without need of any established infrastructure or centralized administration. It is a collection of mobile nodes forming a temporary network . It normally consists of mobile nodes, equipped with a wireless interface, that communicate with each other. MANETs are Multi-Hop networks because each packet must pass through several nodes( i.e. multiple hops) till it reaches its destination. These networks are very useful in emergency search-and-rescue operations, meeting conferences, military operations etc. If such a network can be connected to Internet, it will give a ubiquitous Internet access. But both the networks have several differences, called *network architectural mismatches* [6], in their structure, topology and communication protocol. The architecture of MANET provides the facility to nodes to join the network arbitrarily. These networks have no explicit router to pass on the data packets. In fact each mobile node operates not only as a host but also as a router, forwarding packets for other mobile nodes in the network that may not be within direct wireless transmission range of each other. Each device is free to move independently in any direction, and therefore changes its links to other devices frequently. On the contrary, the Internet has a network infrastructure with fixed and wired gateways, wherein base stations act as bridges and mobile nodes communicate with the nearest base stations within their communication range. Connecting these two types of networks is an appealing solution that will benefit from the advantages of both networks.

## 2. BACKGROUND

The ad hoc network together with Internet can provide seamless Internet access. The main objective of this integration is to allow nodes attached to the Internet to share connectivity with MANET nodes, which may be unable to directly access Internet resources.

### Routing in MANET

Opposite to structured networks with their predefined routers and subnetworks, MANETs have no subnetworks and therefore, no explicit routers. In fact, every member of the ad-hoc network acts as a router for all other members. Data packets are forwarded from one node to the next until they are received by a destination node. For this purpose, Ad Hoc routing protocols are needed. [2, 3]

### Routing in Internet

Internet has a different infrastructure from that of MANET, with predefined routers and gateways in which nodes communicate with other nodes via those routers. Furthermore, all hosts on a certain network use the same network ID. Therefore only one entry in the routing table can handle all hosts sharing the same network ID. Also, default routes can be used when no other route exists to a destination. The ability to use one route to an entire network instead of having one route per host and the ability to use default routes are two powerful features of Internet routing. [4]

### Issues in Integration

The several issues that should be considered while integrating MANETs with Internet.

- **Load Balancing:** Gateway nodes in MANET are the entry points to the Internet. Therefore, they may have to face heavy traffic. So, Load balancing techniques are needed to distribute the load so as to avoid the situation wherein the gateway nodes become bottleneck nodes.
- **Security from attacks:** Security is a major concern as any node can join or withdraw from MANET arbitrarily. Also nodes have no restrictions on their Mobility. All these features of MANET make it difficult to guarantee security.
- **Service, address, and location discovery:** In Internet, protocols exist to provide service, address and location

discovery. They need to be extended to service ad hoc networks which are connected to the Internet.

- **Addressing and Routing:** A mobile node in MANET with Internet Connectivity has to maintain two addresses; one to ensure mobility and other to have global connectivity simultaneously. In opposition to the Internet with predefined routers that connect subnetworks, MANET use a flat or unstructured routing approach.

**Solution**

A new node, the gateway[2] or Internet gateway, is introduced to interconnect ad-hoc mobile nodes to the Internet. It may be a static node or a mobile node and is equipped with two wireless interfaces, one as part of the ad-hoc network and the second as an link to Internet.Thus gateway is part of both networks simultaneously. To get connected to the Internet, gateway must firstly be discovered by the mobile nodes of a MANET. Different approaches are used to achieve this discovery, namely, Proactive, reactive and hybrid.

**Proactive approach** wherein , gateway periodically broadcasts a gateway advertisement message throughout the MANET to provide every MANET node about gateway information ,which will be rebroadcast by nodes, to be received by nodes beyond the gateway's transmission range.

**Reactive approach** is initiated by mobile node that needs the information about reachable Internet gateways by broadcasting or unicasting Gateway Solicitation messages throughout the MANET to create or update route to the Internet. These solicitation will be relayed by other ad hoc nodes to reach gateways via multiple hops. In response to the solicitation, a gateway may broadcast or unicast an advertisement to the mobile node.

**Hybrid approach** provides a trade-off between the advantages of proactive and reactive approaches and serve the purpose of controlling the scope of flooding advertisement and decreasing the routing overhead by combining these two approaches. The nodes using proactive approach are restricted within a certain range, and the nodes beyond this range may use reactive approach.

## 3. CLASSIFICATION OF GATEWAY DISCOVERY & INTERNET INTEGRATION APPROACHES

We have examined different approaches to connect MANET to the Internet and provide mobile nodes with continuous Internet access. Each of these approaches has its own characteristics and working assumptions regarding Mobile IP protocol, ad hoc routing protocols, and their interworking mechanisms. We have attempted to survey all of the techniques that have been proposed in a thorough and systematic manner. We have classified gateway discovery approaches into two main categories based on their ability to use Mobile IP for the purpose of Integrating MANET and Internet.

- Mobile IP based solution
- Non-Mobile IP based solution

### 3.1. MOBILE IP BASED SOLUTIONS

**Tseng et al's Approach**

In the solution proposed by Tseng et al [5], routing within the MANET is performed using the Destination-Sequenced Distance-Vector (DSDV) protocol. The network model consists of several MANETs each of which is attached to the backbone Internet through a point of attachment called gateway as shown in Figure 1.Each gateway has two Network Interface Cards (NICs), one wireless and one wired.

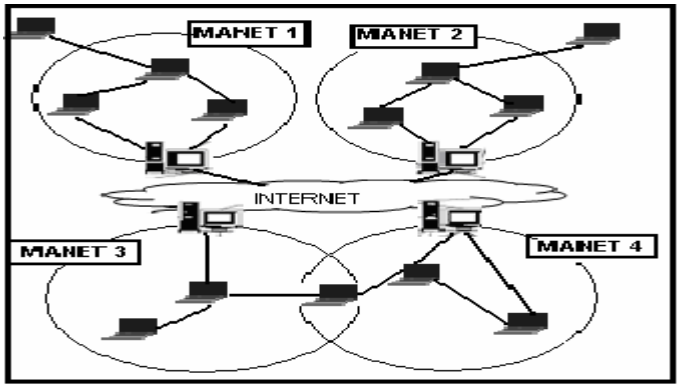


**Figure 1**- Integrating MANET and Internet

Gateways are connected to the Internet through their wired interface. Each gateway also serves as a Foreign Agent (FA) and periodically broadcasting Agent advertisements to announce its service to the members of MANET. Associated with each gateway is a parameter N. The TTL (Time-to-live) field in the advertisement's IP header is set to N, to control the rebroadcasting hop count. Only nodes within N hops from the FA can receive the advertisement and lies within the service range of this gateway. When no Agent advertisements are received, a mobile node can multicast Agent solicitation with destination field set to all-routers multicast address to obtain Internet connectivity. Each time a solicitation fails, the TTL value can be doubled, thereby making it possible to reach four times as many hosts as in the previous round. Therefore, a hybrid approach is used for mobile node registration. In case a mobile node wanders outside its MANET, or, the link between a mobile node and its gateway breaks, or, the mobile node misses an Agent advertisement, it can multicast an Agent solicitation message with TTL=N. The solicitation can be heard if N`>=N. On receiving a solicitation, a gateway may decide to increase its N. A mobile host always collects and propagates routing information for mobile hosts within M wireless hops from itself. M reflects the protocol's service range. Therefore hosts in different but connected MANETs can communicate with one another directly, if they are distanced by no more than *M* hops. Such optimization reduces routing and tunneling overhead. *M* must be >= N so that a mobile host always knows a route to its local gateway.

However, this solution has some limitation; if the broadcast advertisement does not contain any routing information, the recipient of the Advertisement cannot simultaneously obtain an

active route towards the gateway, and another route discovery towards the gateway has to be launched. The extra route discovery can be expensive, as the flooding of Route Request will consume network resources.

**Ammari et al' Three Layered Approach**

Ammari et al [6] use a three layered approach, as shown in Figure 2 to provide Internet connectivity in a MANET. The innermost layer contains the wired backbone together with fixed routers, base stations and the Mobile IP FAs, which will provide Internet connectivity to all the mobile nodes attached to them. The middle layer contains the mobile gateways and mobile Internet nodes which are one-hop away from the elements of the first layer. The outer layer includes the rest of MANET nodes and visiting mobile Internet nodes, which have lost connectivity with their home networks and want to get connected to them through mobile gateways.

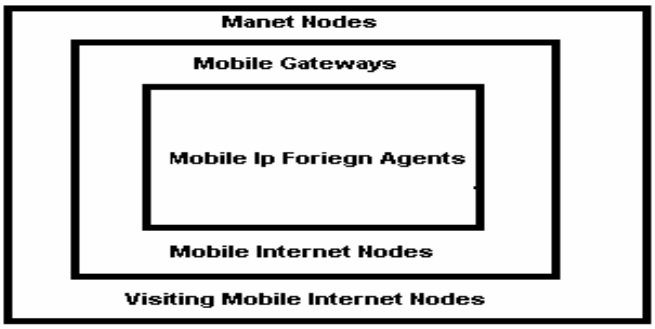


**Figure 2**: Three layer Architecture

The DSDV protocol is used for routing within the MANET. This integration framework uses some border MANET nodes called mobile gateways to connect the rest of MANET nodes to the Internet. Mobile gateways should be close to FAs in order to connect MANET nodes to the Internet through these FAs. To obtain Internet connectivity, MANET nodes must be registered with mobile gateways which in turn must be registered with the FAs. A mobile node and mobile gateway must therefore select which mobile gateway and FA to register with respectively. This selection is performed based on two criteria: Location information (the Euclidean distance between two nodes) and Load information. A mobile gateway selects a closest and/or least loaded FA to register with. Similarly, a MANET node selects a closest and/or least loaded mobile gateway. FAs on the Internet willing to serve, broadcast Agent advertisements which will be received by mobile gateways. In response, the mobile gateway unicasts a FA registration request to the corresponding FA. Similarly, mobile gateways, which are registered with an FA, will broadcast their Agent advertisements. Due to these Agent advertisements, MANET nodes wishing to have Internet connectivity become aware of those mobile gateways willing to offer Internet access. Only mobile Internet nodes and mobile gateways can send Agent solicitations to FAs. MANET nodes have to send their solicitations only to mobile gateways. Hence, a restricted hybrid approach is used to perform mobile node registration.
However, this scheme involves deployment of a redundant interface (mobile gateway) between the foreign agent and the mobile nodes which is not needed. Another registration protocol between the mobile gateways and mobile nodes is involved. Besides the standard Mobile IP registrations between mobile gateways and foreign agents, redundant registrations between mobile gateways and mobile nodes have to be used, which will introduce unnecessary protocol complexity.

**Jonnson's Approach**

MIPMANET by Jonnson [10] is a solution for connecting a MANET to the Internet. MIPMANET provides Internet access by using Mobile IP v4 with Foreign Agent Care-of-Address (CoA) .The FA acts as access points to internet and keep tracks of where a node is located in a MANET and also direct packets to border of that MANET.

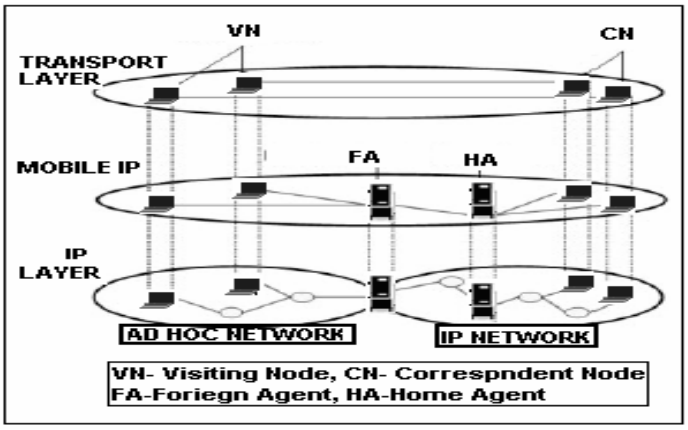


**Figure 3**: Conceptual view of MIPMANET

To deliver packets between FA and MANET node, Ad Hoc On-Demand Distance Vector Routing protocol (AODV) is used. A layered approach with tunneling is used for the outward data flow to separate the Mobile IP functionality from the MANET routing protocol. MANET's node willing to access Internet uses their Home address for all communication and register with a Foreign Agent. To send a packet to a host on Internet, tunneling is used i.e. MANET nodes forward packets to the FA with which they are registered, by encapsulating them with the IP address of the FA as the destination address in the outer IP header. The ad hoc routing protocol then treats the encapsulated packet just as any other packet .If the node is not currently registered with any foreign agent; it considers the destination to be unreachable. Then the route discovery mechanism of AODV is used to find a route. Packets tunneled to the foreign agent are delivered to the host on Internet by ordinary IP routing. The packets sent by a host on Internet to a MANET node are routed to the foreign agent using the standard mobile IP mechanism, and FA then deliver the packets to the MANET node. By using this solution only registered visiting nodes get Internet access; the only traffic

that will enter the MANET from the Internet is traffic that is tunneled to the foreign agent from a registered node's home agent and the only traffic that will leave the MANET is traffic that is tunneled to the foreign agent from a registered node. This approach uses hop count as the metric to decide whether a visiting node should change foreign agent or not. For this, the MIPMANET Cell Switching (MMCS) algorithm is used .Two methods, Unicasting of Advertisement and broadcasting of Advertisement, are designed. In the Unicasting method, a gateway unicasts Agent advertisements periodically to its registered visiting nodes. So a visiting node always stays associated with the gateway that it has registered with and cannot receive any advertisement from other gateways, until it loses connectivity with the current gateway and solicits a new gateway. In the broadcasting method, a gateway periodically broadcasts Agent advertisements flooding the MANET. This approach works with an advantage of having a single IP address as CoA used by FA can provide Internet access to an entire MANET.

However, the mechanism for rebroadcasting Agent advertisement, and the optimal Advertising Interval, is totally unclear. Also, results for gateway discovery time or handover time are not presented.

**Broch's Approach**

This solution proposed by Broch et al. [7] focus on the integration of the flat addressing of ad-hoc network with the hierarchical addressing of Internet to facilitate communication between nodes of MANET and Internet.

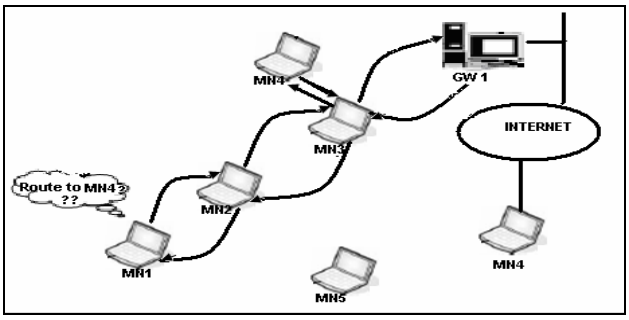


**Figure 4**: Route request for MN4 is answered by MN4 and G1

It described a principle that allows a DSR-based MANET with single gateway to span across heterogeneous link layers. The figure 4 shows the connectivity of an ad-hoc network with Internet. Node G1 is a gateway (border router) between the MANET and the Internet which has two interfaces. One is connected to the Internet and other is to MANET. Local delivery within the MANET is done using the Dynamic Source Routing (DSR) while standard IP routing mechanisms decide which packets should enter and leave the MANET.A node within the MANET may broadcast a Registration Request (RREQ) to discover routes to a destination. Upon receiving the RREQ, if the gateway believes that the destination is outside the MANET by checking the destination's prefix, it may send a proxy-Request Reply (RREP) listing itself as the second-to-last node in the route and destination as the last node in the route. Gateway uses the reserved gateway interface index (253) to distinguish this reply from normal RREP.

However, this solution has some limitations such as If a mobile node within the MANET loses connectivity with its currently registered gateway, it cannot be reactively send solicitation to solicit a new gateway. Another problem is that if the requested node is located within the MANET, both the requested node and the gateway (via proxy reply) answer to the request. This leads to confusing routing information. Furthermore, Most of the issues e.g., the periodic agent advertisements, choosing from several FAs, hand off etc are not even recognized here.

**Ratanchandani's Hybrid Approach**

Ratanchandani et al's [11] hybrid approach combines the advantages of both proactive and reactive approaches for AODV and Mobile IP based MANET, where FA acts as gateway. Mobile nodes use an arbitrary address within the MANET and use a COA for external communication, as specified by Mobile IP. AODV routing protocol is used to deliver packets between the FA and the mobile nodes. An Agent Advertisement is propagated within N hops from the gateway by scoping the TTL=N in its IP header. Upon receiving an Agent advertisement, mobile nodes send registration request to the FA and register themselves; they also temporarily cache the Advertisement. This is the proactive approach. On the other hand, mobile nodes which are outside the n-hop neighborhood may never receive Agent advertisements. These nodes send Agent solicitation messages. If an intermediate node which cached an Agent advertisement from the gateway during the last Advertising Interval, receives this solicitation, it will unicasts an Agent Advertisement to the initiator mobile node with valid route to the gateway. On receiving this advertisement, the mobile node may send a registration request to the FA. This is the reactive approach.

To reduce flooding of solicitations, an Expanding Ring Search technique [13] is used to broadcast the Agent Solicitation. In this way the proactive and reactive approaches are combined to yield a hybrid approach which combines benefits from other two approaches. The proactive part contributes high mobility for nodes while the reactive part is responsible for relatively low routing overhead per node. However, this work has some limitations. First, the recommended N only suits a certain scenario with certain number of nodes and topology size, and is not suitable to a generic scenario. Second, the way of sending Agent solicitation may lead to long delay for reactive gateway discovery. For the nodes beyond N-hops distance from the gateway, the Agent solicitations may take several retries to reach the nodes within the N-hops distance from the gateway. In brief, the reactive gateway discovery is not efficient, and suffers from long delay.

### 3.2. NON MOBILE IP BASED SOLUTIONS

**Rosenschon's Approach**

The work of Rosenschon [8] is based on HELLO messages of the AODV, for distributing Internet gateway routing

information. With this approach, every node sends HELLO messages periodically with a TTL of 1. HELLO message receiving node learns about the HELLO message sending node and creates an entry in its routing table (list of neighbors).Gateway nodes send HELLO messages too, but they set a special flag, I- flag in their HELLO messages to 1 (true). Such messages are called HELLO_I messages. The gateway sequence number is written to the Destination Sequence Number field of HELLO message so that all nodes can have latest information about Internet gateway. On receiving a HELLO_I message, a mobile node first creates an entry in its routing table pointing to the gateway and then, it creates a default route to that gateway. A mobile node that does not receive HELLO_I messages from a gateway due to the one hop limit of HELLO_I messages is not provided with gateway information, but it gets gateway information from the HELLO message from its neighbor node which again set the I-flag to indicate that this HELLO message contains gateway information. With the I-flag set, receiving nodes knows that this HELLO_I message contains gateway information. HELLO and HELLO_I messages are sent periodically without demand at a rate of HELLO INTERVAL (1 sec). A mobile node (MN) may select between multiple gateways if multiple gateways are attached to the ad-hoc cluster and it may receive HELLO_I packets from more than one gateway. Then, MN uses the nearest gateway, which is defined by the hop count to the gateway. The gateway itself sends its HELLO packets with a hop count of zero. An MN accepts gateway information from another gateway only if the hop count of the new gateway is at least two hops less than the current gateway information.

The HELLO algorithm utilizes no periodical flooding of the MANET cluster with advertisements and no solicitation broadcasts. Thus, no additional routing overhead for gateway discovery burdens the limited bandwidth of wireless network resources. However, this hop count based approach does not decide for gateways with respect to the gateway's utilization, i.e. the Internet gateway's network traffic load. Moreover, When a MN is performing a handover procedure the HELLO message based algorithm performs worst with increasing interval time since then the MN needs more time to detect the loss of connectivity to neighbor nodes. A node recognizes the loss of connectivity after three consecutive missed HELLO messages until it starts rediscovery routines and this increased interval time degrades the performance of the algorithm.

**Michalak's Common Gateway Architecture**

The Common Gateway Architecture (CGA) [9] considers the problem that If only one Internet gateway exists in the MANET, it becomes a bottleneck for Internet access. Therefore, the CGA introduces several access points (AP) connected to one common Internet gateway via wired links or IP tunnels, as shown in figure5 and therefore there will be no additional MobileIP overhead caused by multiple gateways with different prefixes since all nodes in this ad-hoc cluster use the same Ipv6. Three types of nodes are defined:

- **Mobile Nodes**: These are standard ad hoc nodes running AODV routing protocol.
- **Access Points**: They are full routers that implement two interfaces, one wireless connecting to the MANET and the other connecting to the gateway.
- **Gateway**: Only one gateway is connected to all the access points. It is a router connected to the Internet, has full router capabilities, forwards packets between access point links and the Internet. It runs the MANET routing protocol.

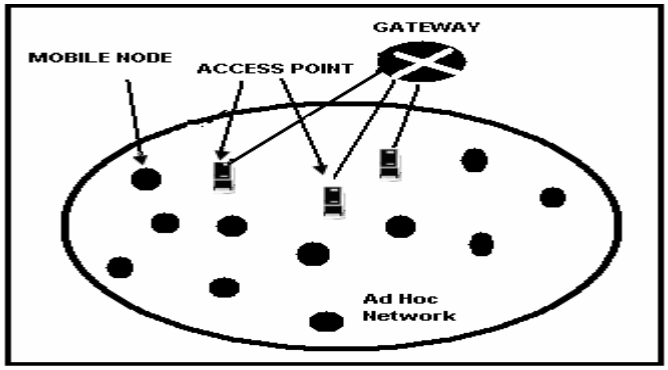


**Figure 5**: Type of nodes in Common Gateway Architecture

A mobile node initiates gateway discovery by initializing a route request as per the AODV protocol. The advantage of having only one Internet gateway is that, its address may be preconfigured into the mobile nodes, thus saving the time taken to find the Gateway's address. Therefore, the gateway discovery mechanism is reactive. When a mobile node loses contact with an access point due to mobility, it can always detect an optimal route to the gateway through another access point following the route request mechanism of the AODV protocol. Thus handovers are performed without overhead. The CGA is scalable, since adding new access points in the ad hoc network increases the coverage area. The advantage of this approach is in the reactive gateway discovery method. The access points will answer to RREQs directed to the gateway, since they always have a valid route to it (fixed wired link). Thus, the MNs within the cluster find short cut routes to a gateway via the access points. However, the authors do not take a look at the proactive discovery method. In the proactive method all access points would flood the network and therefore this approach will perform very badly since the flooding is multiplied by the number of used access points. Furthermore, no results are given on how long a specific node needs to find a valid route to the gateway and since they place only one gateway into their scenario no handover procedures between gateways are considered.

**Lee's Hybrid Approach**

In Lee's work [12], a hybrid gateway advertising scheme is proposed describing two kinds of gateway advertisements. To provide gateway information with minimum overhead, the gateway sends Periodic Advertisements (Figure 6) but MNs do

forward the received advertisements only if they describe a shorter route to the gateway than any other advertisement from other gateways. This results in the effect that every gateway in overlapping ad-hoc clusters is flooding only that part of the cluster where it is located in and thus, the routing overhead in the proactive approach for gateway discovery is reduced. A gateway only sends out new advertisements called Adaptive Advertisement (Figure 7), when it detects any topology change in the ad hoc network. Also, advertisements are only forwarded to nodes that are either connected to the Internet or that have actually moved. It, thus limit a flooding area to only those nodes in need of gateway advertisement.

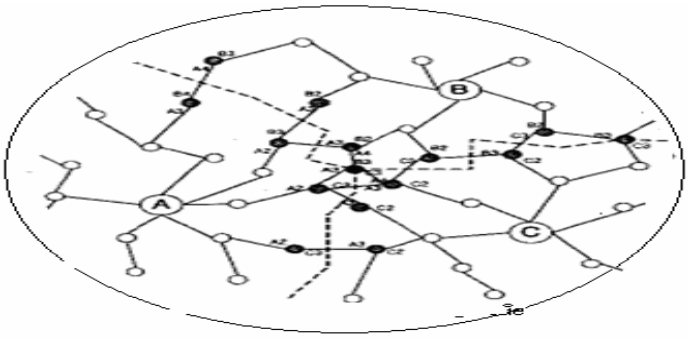


**Figure6** - Periodic Advertisements

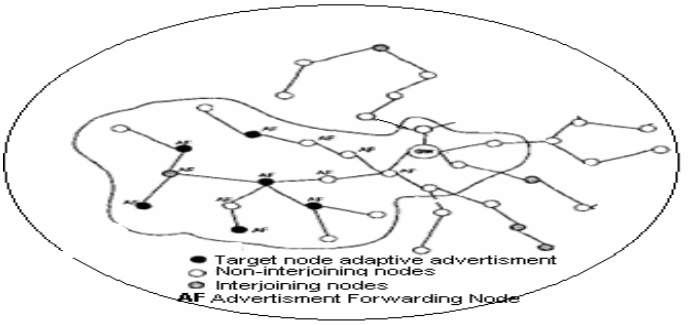


**Figure 7**- Periodic Advertisements

The working of this approach is based on three assumptions: (1) those nodes that need Internet connectivity, called Internet-Joining nodes (IJ), are already known by all other nodes in the MANET. (2) DSR protocol must be utilized. (3) the gateway must know the total number of Advertisement-Forwarding (AF) nodes. Before the gateway broadcasts an advertisement, it will compute a Regulated Mobility Degree (RMD), which is ratio of the total number of IJ nodes to the number of AF nodes If the computed RMD is larger than RMD Threshold, the gateway will broadcast Adaptive Advertisement. In which a counter k is set. Only the AF nodes and k non-AF nodes can rebroadcast such Advertisement. In this method, the flooding of the Adaptive Advertisement is restricted to a small area, so the network wide flooding can be avoided. However, in this work, the optimal RMD Threshold and the value of the counter k are not determined. Thus, the proposal is of limited use. Moreover, this method can only be applied to DSR-based MANET, and the global knowledge about the IJ nodes and AF nodes must be available. Moreover, this work only presents a single-gateway advertising scheme, and other issues like handoff, addressing and routing interoperability required for connecting MANETs with the Internet are not mentioned.

## 4. COMPARISON FRAMEWORK

The proposed approaches to connecting MANET to the Internet differ with respect to several key properties, which are representative of these approaches. I have attempted to identify the most important design decisions that characterize any solution to the problem of connecting MANET to Internet. The comparison of different approaches is given below in form of following tables.

| **Integration Strategy** | **MANET Routing Protocol** | **Interface(Gateway)** | **Gateway Discovery** | **MANET Node Registration** |
|---|---|---|---|---|
| Tseng et al | DSDV | Gateway hosts acting as Mobile IP foreign agents | Restrictive agent advertisements and solicitations | Proactive |
| Ammari | DSDV | Mobile gateways supported by Mobile IP foreign agents | Mobile gateway advertisements and solicitations | Hybrid |
| Ratanchandani | AODV | Mobile IP foreign agents | Restrictive agent advertisements and solicitations | Hybrid |
| Broach | DSR | Gateways with Mobile IP foreign agent capabilities | Mobile IP foreign agent advertisements and solicitations | Reactive |
| Jonnson's MipMANET | AODV | Mobile IP foreign | Agent advertisements and | Hybrid |

**Table 1**: Mobile IP based Solutions

| Integration Strategy | MANET Routing Protocol | MANET Node Registration |
|---|---|---|
| Rosenschon | AODV | Hybrid |
| Lee | DSR | Hybrid |
| CGA | AODV | Reactive |

**Table 2**: Non-Mobile IP based Solutions

In Table 1 & Table 2, the **MANET Routing Protocol** is the protocol used for routing packets within the ad hoc network. The **Interface** is the intermediate entity that acts as a bridge between MANET and the Internet. **Gateway Discovery** refers to the mechanisms used by mobile nodes to discover existing components that act as an interface between the Internet and MANET. **Mobile Node Registration** is the registration strategy that a mobile node uses to register itself with a FA

| Integration Strategy | Cell Switching Strategy | Cell Switching Metric |
|---|---|---|
| Tseng et al | Value of N | Hop |
| Ratanchandani | MMCS | Hop |
| Ammari | Extended Handoff | Euclidean Distance |
| Jonsson's MipMANET | MMCS | Hop |
| CGA | Distance to Gateway | Hop |

**Table 3**: Cell Switching Parameter

In Table 3, Cell Switching Strategy is the strategy that a mobile node uses to decide how to switch over to a new Gateway. Cell Switching Metric is the metric used in the Cell switching Strategy.

## 5. CONCLUSION

Each research concerning gateway discovery described in this paper is suited only for a limited range of network conditions and its performance can vary dramatically as the network conditions change. By reviewing the eight strategies discussed in this paper, for Integrating MANET with the Internet, which provides a good insight to the researchers for review and further modifications, we have observed that all three approaches for gateway discovery have their merits and demerits. A hybrid mobile node registration approach is useful under the circumstances where not many nodes in the ad hoc network want to access the Internet. When a majority of the nodes with in an ad hoc network want Internet access, a proactive approach is recommended.

## 6. FUTURE SCOPE

As this paper throws light on the various issues and solution for gateway discovery, it can be served as a base for extending the gateway discovery approaches with consideration to QoS. One of the problems that have not been addressed by the proposed approaches to the integration of MANET and Internet is that MANET routing protocols typically find routes with minimum hop-count .When a mobile node detects several Internet gateways, it should select the best one according to the QoS demands and then start the data transmission. This selection could be based on the distance to the Internet gateways or certain QoS parameters. Thus we would focus on extending any of the approach for Gateway Discovery while considering the QoS Requirements.

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