International Islamic University Chittagong

Project Title : Wireless Ad hoc Network for different number of hosts.

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Muhammad Mahi- Al- Jawad (C153010)

Md. Mofasser Hossain (C153031)

Muntasir Arefin Chowdhury (C153047)

Submitted to:

Abdullahil Kafi

Associate Professor, Department of CSE

IIUC

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1. Introduction

Wireless ad hoc networks are collections of wireless nodes that communicate directly over a common wireless channel. The nodes are equipped with wireless transceiver. They don't need any additional infrastructure, such as base station or wired access point, etc. Therefore, each node doesn't only plays the role of an end system, but also acts as a router, that sends packets to desired nodes. The ad hoc are expected to do assignments, which the infrastructure can't do. The wireless ad hoc networks only consist of nodes equipped with transceiver. The network are created to be independent from an infrastructure. Therefore, the nodes must be able to arrange their own networks. Keep in mind, that a node can now communicate only with other nodes in its transmission range. In the infrastructure based wireless network, the nodes can communicate with a node, which is located in another network area, by transmitting data to destination access point and this access point relay the data to the desired node. It seems like, that the ad hoc networks are not powerful enough. Each node has its own transmission range, if these small transmission areas are combined, they will form a much bigger transmission area. The nodes transmit their data with single or multiple hopping technic. Now a suitable routing algorithm must be implemented, so the process of transmitting data will be more effective. Ad hoc networks are mostly used by military, rescue mission team, taxi driver. Their works can't rely on a infrastructure's network. As an illustrative example, imagine firefighters put out hazardous fire in a big forest. They have to communicate each other, but establishing a infrastructure or cabling in such area is impossible or too expensive. The main problems in ad hoc networks are routing and characteristic of wireless communication. In infrastructure's networks a node can communicate with all nodes in the same cell. In ad hoc a node can communicate only with nodes in its area. this node can communicate with other nodes, but a routing algorithm is necessary. Unlike wired communication, wireless networks have transmission problem with data transmission such as, possibility of asymmetric connections and higher interferences.

2. Methodology

The following subsections are the important ad hoc network components to establish an ad hoc network.

2.1. Hardware

The ad hoc networks don't have any infrastructure, except they are combined with other networks' type. Only end devices are needed to establish ad hoc. Firstly the devices must be equipped with transceiver, so they can catch the incoming signal and send a signal. Secondly the devices must be implemented after the standard IEEE 802.11. The devices like laptops, Personal Digital Assistant (PDA), smart phone are mostly implemented with the standard IEEE 802.11 so they can join a infrastructure network or ad hoc network.

2.2. Software

The most important software components of the ad hoc networks is routing algorithm. The following are some of most famous routing algorithms.

2.2.1. Destination-Sequenced Distance-Vector (DSDV):

DSDV routing is a table-driven routing scheme for ad hoc mobile networks and an Expansion of Distance Vector Routing for ad hoc networks. DSDV is using a routing method distance vector, which is based on Distributed Bellman-Ford algorithm. In the networks with dynamic topology this routing protocol act very bad. This protocol has count-to-infinity problem. To gather information about the actual topology, the nodes have to swap their routing table continuously.

In DSDV the routing table consists of:

- the destination's node address
- the number of hops required to reach destination
- the sequence number (or timestamp) of the information received regarding that destination, as originally stamped by the destination.

The routing table can consist an entry with the same destination but it has different timestamp or number of hops. In this case the entry with newer timestamp will be chose, otherwise fewer number of hops.

2.2.2. Dynamic Source Routing (DSR):

This protocol performs a route on-demand when a transmitting computer requests one. DSR take two steps to do a route:

Find the path: A node try to find its destination, if there is at the moment no known path to the destination.

Maintain the path: The obtained path muss be maintained. If a node has a problem, which is located in the path, the sender must find new path.

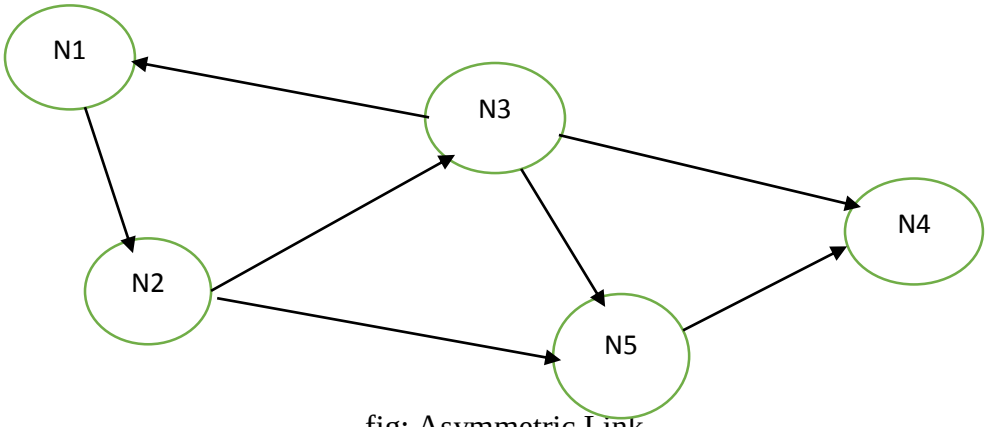


fig: Asymmetric Link

Imagine a scenario from fig. N1 want to send data to N5, DSR take the steps:

– N1 sends a broadcast ((N1), id = 42, Destination = N5). Only N2 can receive the broadcast.

– N2 hops the received message ((N1, N2), id = 42, Destination = N5), N3 and N5 can receive the message. – The message has reached the destination with path (N1, N2, N5).

– But N3 still broadcasts the message to N4 and N5. Both messages will reach N5, but they will be deleted, since the path (N1, N2, N5) is shorter.

This DSR may face problem, since the topology is asymmetric. In this scenario N5 won't be able to send back a message to N1. If N5 can broadcast to N3, the path to N1 will be (N5, N3, N1).

2.2.3. Ad Hoc On-Demand Distance-Vector (AODV):

AODV is similar to DSR in that it forms a route on-demand when a transmitting computer requests one. AODV is also similar to DSDV, it use destination sequence number to avoid loop. Route Requests (RREQs), Route Replies (RREPs), and Route Errors (RERRs) are the message types defined by AODV. These messages are received via UDP and normal IP header processing applies [10]. When a node have to perform a route. It will broadcast RREQ until reach the destination. Each node receiving the request caches a route back to the originator of the request, so that the RREP can be unicast from the destination along a path to that originator, or likewise from any intermediate node that is able to satisfy the request.

• Cluster Based Networks:

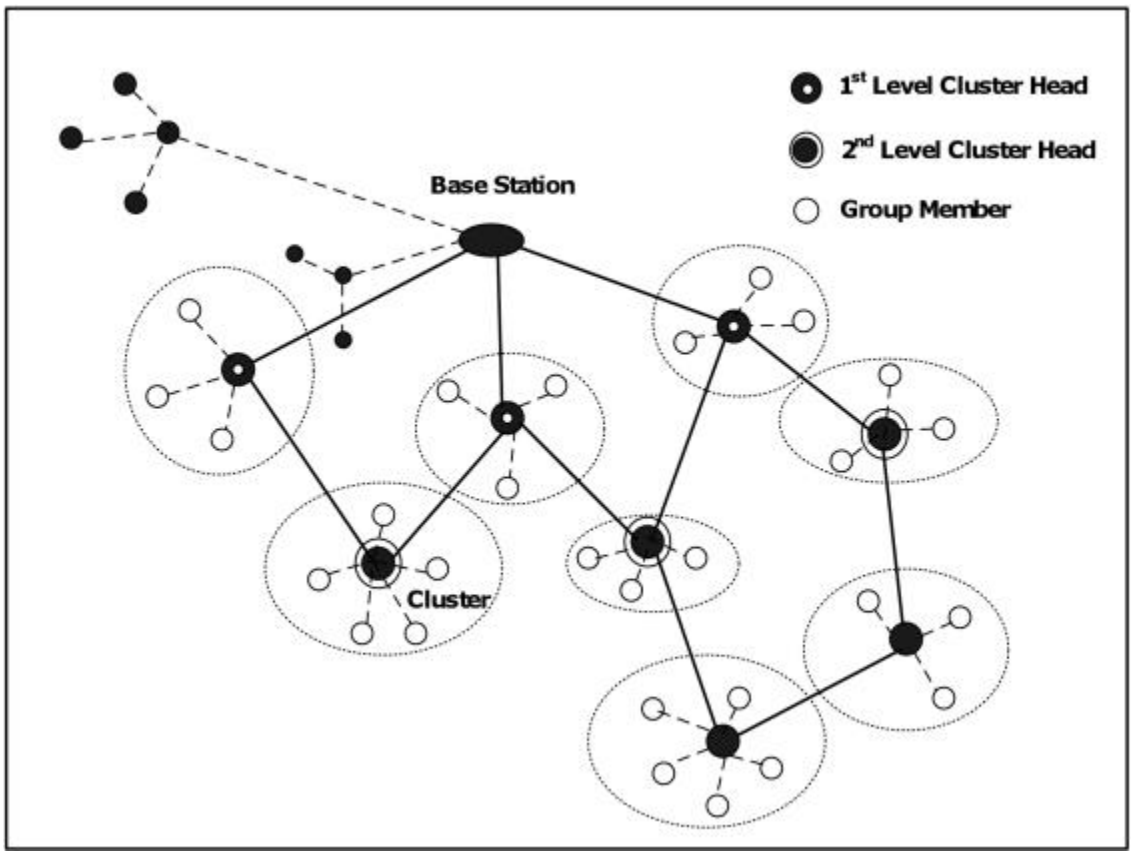
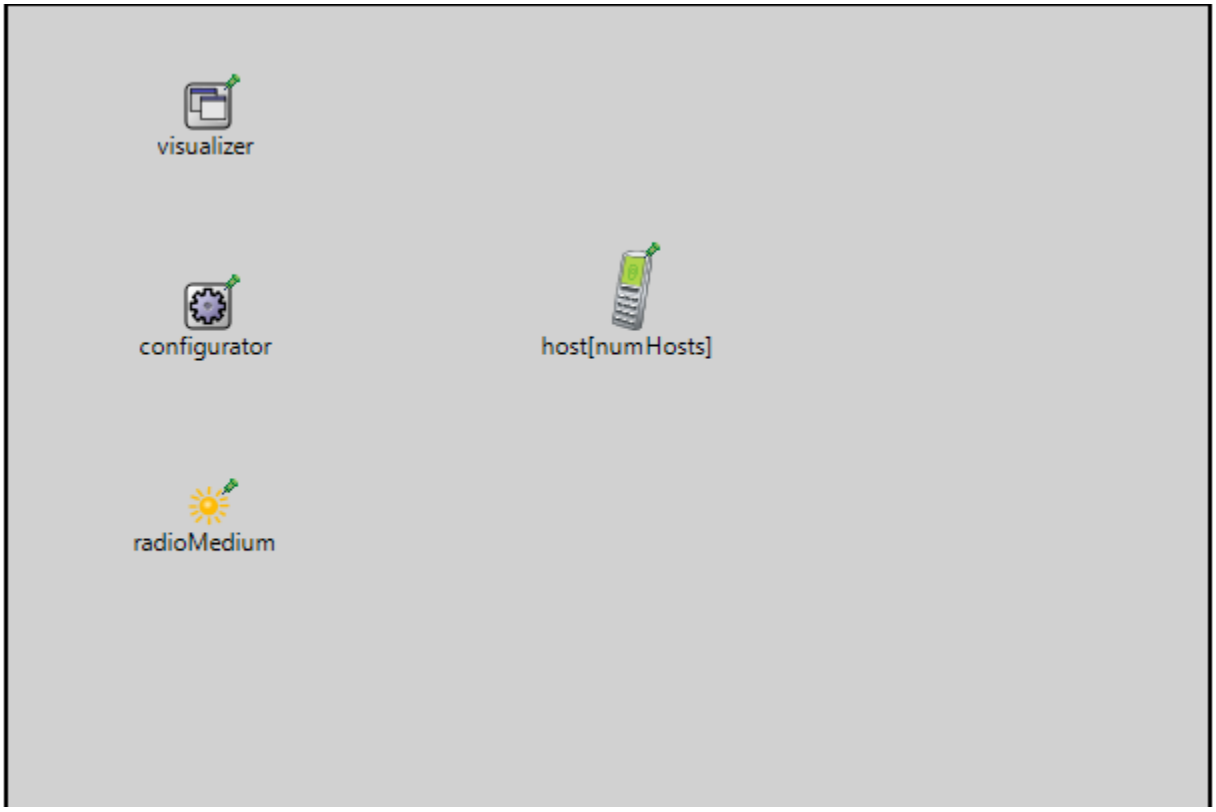


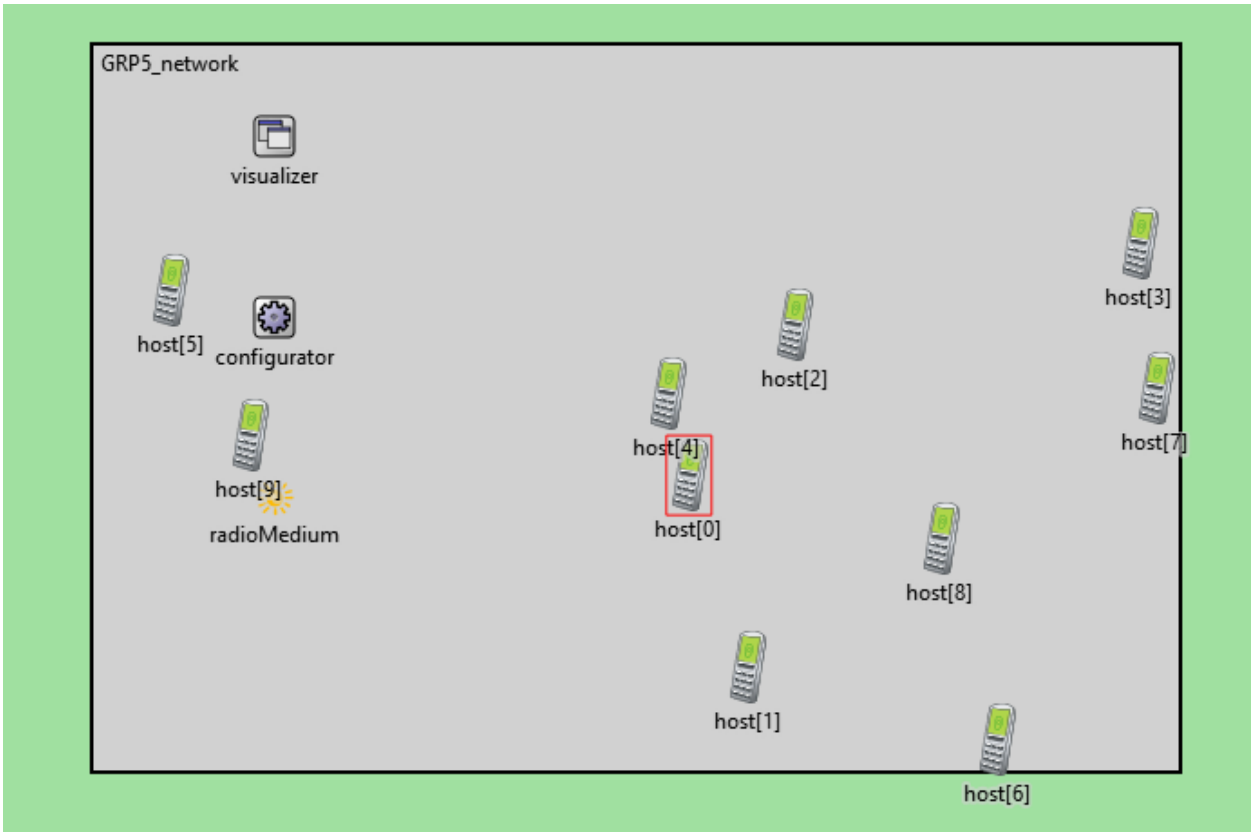
Fig: A Simple Example of Cluster-Based Multipath Network.

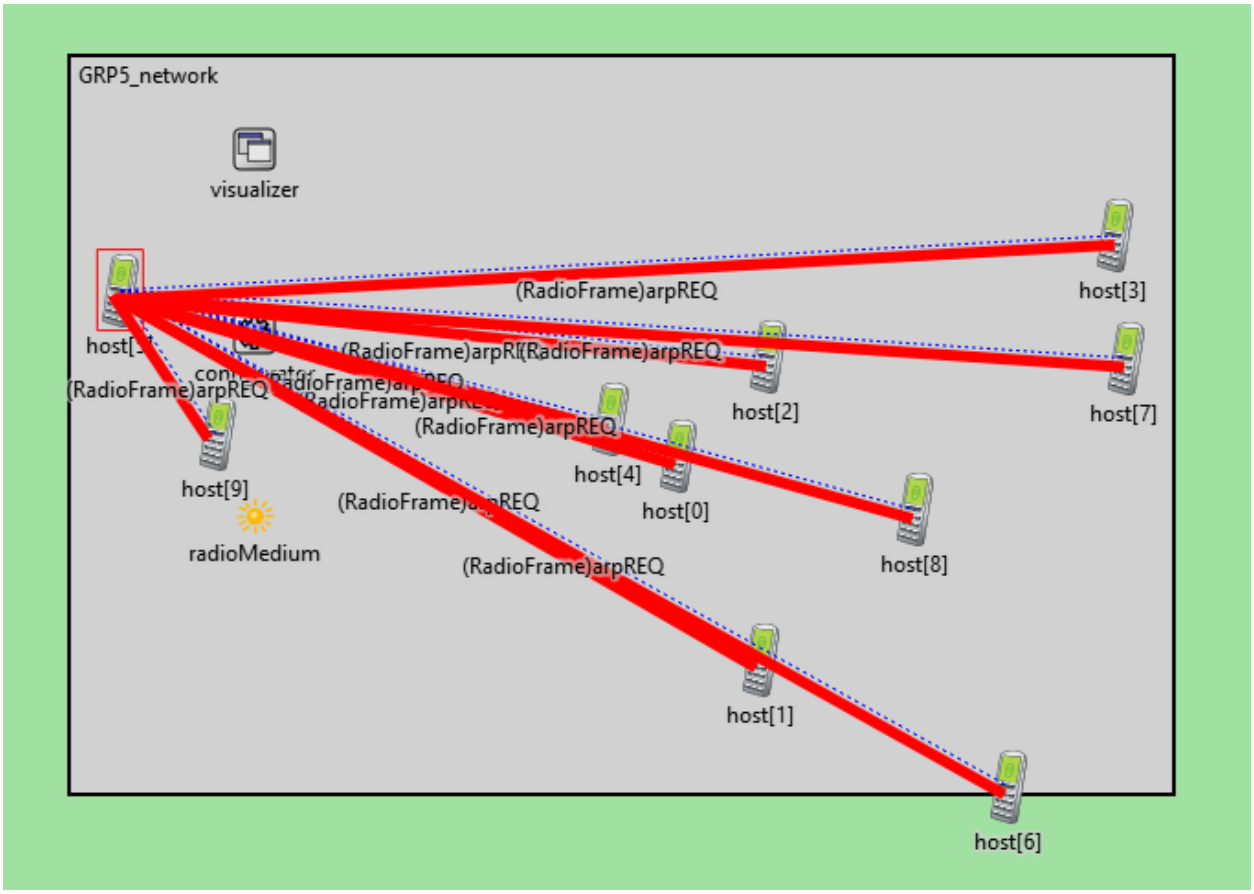
Both Routing algorithms, DSDV, DSR, AODV are used only in the networks with small number of nodes and high mobility affect routing's performance. For the networks with a big number of nodes, the nodes can be formed in smaller group like the above fig.

In our project we have used INET framework for ad hoc wireless which in turn implements AODV for routing.

3. Simulation:







4. Result & Analysis

Module	Count	Mean	StdDev	Variance	Min	Max	Min time	Max time
GRP5_network.host[0].wlan[0].queue	1	0	n.a.	n.a.	0	0	0	0
GRP5_network.host[1].wlan[0].queue	1	0	n.a.	n.a.	0	0	0	0
GRP5_network.host[2].wlan[0].queue	1	0	n.a.	n.a.	0	0	0	0
GRP5_network.host[3].wlan[0].queue	1	0	n.a.	n.a.	0	0	0	0
GRP5_network.host[4].wlan[0].queue	1	0	n.a.	n.a.	0	0	0	0
GRP5_network.host[5].wlan[0].queue	1	0	n.a.	n.a.	0	0	0	0

GRP5_network.host[6].wlan[0].queue	1	0	n.a.	n.a.	0	0	0	0
GRP5_network.host[7].wlan[0].queue	1	0	n.a.	n.a.	0	0	0	0
GRP5_network.host[8].wlan[0].queue	1	0	n.a.	n.a.	0	0	0	0
GRP5_network.host[9].wlan[0].queue	1	0	n.a.	n.a.	0	0	0	0
GRP5_network.host[0].wlan[0].radio	2	2	2.828427	8	0	4	0	0
GRP5_network.host[1].wlan[0].radio	2	2	2.828427	8	0	4	0	0
GRP5_network.host[2].wlan[0].radio	2	2	2.828427	8	0	4	0	0
GRP5_network.host[3].wlan[0].radio	2	2	2.828427	8	0	4	0	0
GRP5_network.host[4].wlan[0].radio	2	2	2.828427	8	0	4	0	0
GRP5_network.host[5].wlan[0].radio	2	2	2.828427	8	0	4	0	0
GRP5_network.host[6].wlan[0].radio	2	2	2.828427	8	0	4	0	0
GRP5_network.host[7].wlan[0].radio	2	2	2.828427	8	0	4	0	0
GRP5_network.host[8].wlan[0].radio	2	2	2.828427	8	0	4	0	0
GRP5_network.host[9].wlan[0].radio	2	2	2.828427	8	0	4	0	0
GRP5_network.host[0].wlan[0].radio	11	1.909091	1.044466	1.090909	1	3	0	3.559926
GRP5_network.host[0].wlan[0].radio	10	1.5	0.527046	0.277778	1	2	0	3.559926
GRP5_network.host[1].wlan[0].radio	11	1.909091	1.044466	1.090909	1	3	0	3.559926
GRP5_network.host[1].wlan[0].radio	5	1.4	0.547723	0.3	1	2	0	2.69557
GRP5_network.host[2].wlan[0].radio	20	2	1.025978	1.052632	1	3	0	3.559926
GRP5_network.host[2].wlan[0].radio	1	1	n.a.	n.a.	1	1	0	0
GRP5_network.host[3].wlan[0].radio	7	1.857143	1.069045	1.142857	1	3	0	3.559927
GRP5_network.host[3].wlan[0].radio	1	1	n.a.	n.a.	1	1	0	0
GRP5_network.host[4].wlan[0].radio	14	2	1.037749	1.076923	1	3	0	3.559927

GRP5_network.host[4].wlan[0].radio	1	1	n.a.	n.a.	1	1	0	0
GRP5_network.host[5].wlan[0].radio	3	1.666667	1.154701	1.333333	1	3	0	3.087636
GRP5_network.host[5].wlan[0].radio	7	1.428571	0.534522	0.285714	1	2	0	3.081116
GRP5_network.host[6].wlan[0].radio	7	1.857143	1.069045	1.142857	1	3	0	3.559927
GRP5_network.host[6].wlan[0].radio	1	1	n.a.	n.a.	1	1	0	0
GRP5_network.host[7].wlan[0].radio	7	1.857143	1.069045	1.142857	1	3	0	3.559926
GRP5_network.host[7].wlan[0].radio	5	1.4	0.547723	0.3	1	2	0	2.846869
GRP5_network.host[8].wlan[0].radio	17	1.941176	1.028992	1.058824	1	3	0	2.847336
GRP5_network.host[8].wlan[0].radio	3	1.333333	0.57735	0.333333	1	2	0	3.559926
GRP5_network.host[9].wlan[0].radio	7	1.857143	1.069045	1.142857	1	3	0	3.081116
GRP5_network.host[9].wlan[0].radio	3	1.333333	0.57735	0.333333	1	2	0	3.087635
GRP5_network.host[5].pingApp[0]	3	1	1	1	0	2	1.080874	3.080874
GRP5_network.host[5].networkLayer.arp	3	1	0	0	1	1	1.080874	3.080874

5. Conclusion:

Mobility in the wireless networks is very popular nowadays. Many peoples in the street walk and are using small devices like PDA, laptops, or phone to communicate, listening a music, write SMS, exchanging data with other people near them, etc. The wireless infrastructure networks support great mobility and very popular among the folks. But this kind of networks are centralized, not flexible, and sometimes too expensive. If a infrastructure is defect, the cell established by this infrastructure will be gone too. The nodes in this cell can't communicate again. The presence of ad hoc networks covers the infrastructure's weakness. Since the ad hoc networks are independent from infrastructure, the nodes must be able to work together to establish a greater network. They have multi hop the packet, if they have to send a packet to a destination nodes outside their transmission range. Therefore, routing algorithms are the main challenge.