

# Comparative Analysis of Flooding, Random walk, Gossip Based Path Identification Protocols in DSR Based MANET Networks

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**Abstract**— All the mobile communication devices can be categorized into two categories. One is based on centralized infrastructure and other is without infrastructure. MANET is such network where there is no infrastructure. Each node works as sender, receiver and switch node. In MANET the request sent for route discovery can be done on three bases. 1. Broadcasting 2. Random walk 3. Gossiping. In all the technique main objective is to identify the route such that data packet can be sent on to that route which become better route. Now in our research work our main objective is to compare all the three techniques on different parameters so that better technique can be identified. As in base research they have taken AODV as routing protocol and defines that broadcasting is the better technique compared to random walk and gossiping. In our research work we are focused on DSR. Such that we can check whether broadcasting is better technique in this protocol as well or not.

**Key words:** Gossip, Random Walk, Broadcast, Macload, Throughput, Flooding

## I. INTRODUCTION

### A. P2P Networks

In p2p networks consist of nodes refers to peers having equal role. P2p networks are categorized as centralized p2p & decentralized p2p. Centralized p2p networks have centralized directory. Hence there is Server bottleneck occurred. Decentralized p2p networks may be structured decentralized or unstructured decentralized. Structured networks have well planned structure is maintain by distributed hash functions. No unstructured decentralized networks neither require centralized or strict regulations for maintains of p2p networks. P2p are fault tolerant [2].

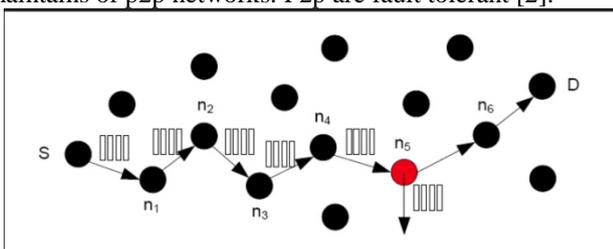


Fig. 1: P2P network [1]

There are three classes of P2P systems:

- Pure p2p system: In this two nodes talk with each other without use of any central server.
- Hybrid p2p system: In this node moderately depends on central server, while the communication between nodes still takes place separately.
- Federated p2p system: In this nodes communication get place within pre-defined area such as within an association [6].
- P2P architectures are defined by their capability to adjust to failures and dynamically varying network topology with a temporary population of nodes.

### B. MANET

MANET is infrastructure less networks where each node communicates on temporary basis. In MANET nodes move freely and have their own memory. Each node is act as source, destination & intermediate. Combination of technologies p2p & MANET are called mobile p2p network [1].

Some of Characteristics of MANET are:

- MANET can be created not including any preexisting interactions.
- It requires self-motivated topology.
- Its security is challenging aspect.
- Every node act as router for transferring packets in the network [8].
- Autonomous performance.
- Multi hop transmission: MANET can transfer data from source to destination message go through one or more nodes.
- Dynamic changing nature: connection establish between nodes on short-term basis.
- Infrastructure less environment: MANET runs autonomously from any fix communications.

Application areas of MANET are:

MANET is applied to different fields:

- Military Warfield: Military hold an information system among the vehicles, armed forces and military head quarters
- Commercial sector: it can be used in urgent situation e.g. flood, fire, earthquake.
- Local level: it might be used in residence to transfer information between devices [5].

Security criteria's for MANET

Following security criteria's are considered:

- Confidentiality: means information is only accessible to those who have right permission to access.
- Integrity: means message have been transmitted not at all corrupted.
- Availability: means node remain available to provide all designed services.
- Authentication: means that participants in communication are real.
- Attacks using fabrication: creation of false routing messages is termed as fabrication.

Attacks on MANET: Two common attacks in MANET are:

- Black hole attack: a malicious node always gives fake reply.
- Grey hole attack: a node sometimes act as malicious not always.

### C. Routing

Routing is process of information exchange or packet transferring from source to destination. In routing mainly involves two activities: firstly, determining best possible

steering paths and secondly, transferring the data through an internetwork. There is several metrics to determine the optimal path between source and destination. Routing protocol for ad-hoc network can be categorized in three strategies.

a) Pro- active Vs Re- active routing protocol.

Pro- active Vs Re- active routing protocol

In Pro-active protocol each node contains routing information of network. Protocols like Global State Routing (GSR), Destination Sequenced Distance Vector Routing (DSDV). In Reactive protocols each node contains the information of active path. Protocols are Ad hoc on-demand Distance Vector Routing (AODV), Dynamic Source Routing (DSR).

#### D. Random Walk

In random walk source node send request to randomly selected node from neighbor's list. If it is owner of resource it will reply otherwise request is continue.

Some advantages of random walk are:

- Overall overhead is small because message is unicast to selected node.
- It is scalable and no broadcast storm problem occurs.
- It is suitable with high mobility.
- It has more control over search termination.

Various disadvantage of random walk are:

- High latency due to message transfer through only single node.
- Probability to reaching resource node is low.
- It is more expensive search.

Some applications of random walk are:

There are various properties of random walk which make it more useful for many applications-

- It is used in structure free networks for distributed model checking.
- It is used to perform well-organized distributed computation of a class of decomposable functions.
- Mobile agents use random walk in ad hoc networks.
- Random walk search is easily used in wired networks but inefficiencies associated with random walk in wireless Domain due to the following three important aspects:
  - one step implementation
  - of RW large mean number of steps required for searching a service
  - termination of RW when, for example, service is not found

Transmissions in random walk will be less than in case of flooding and gossip. Random walk is inefficient due to loop creations. To reduce loop creations various mechanisms are used. Latency in random walk is depends on the number of paths required to reach the destination. More the steps required more delay will occurs. Random walk is chronological search hence one step occurs after the other. If at any point message will not transfer to next node then search will stop before to reach the destination. As flooding and gossip resource discovery methods depends on topology of networks, random walk does not requires any topological information of networks hence it is more trustworthy for high mobility.

#### E. Gossiping

In this method source node select G neighbors from neighbor's list and send request to first node of G then message on other nodes with gossip interval. If any neighbor node is owner of resource it will reply otherwise request is continue. To reduce the negative effect of flooding gossiping is used. Gossiping is more reliable method. There is low latency and no control over search termination. Gossip nodes transferring data with some probability. Hence there is two probability factors such as static probability if requires fixed probability otherwise called adaptive probability. In Gossip there is consciousness among neighbor's hence useless nodes does not take part in transferring message to save energy [11].

Gossip message consist four fields:

- Node: this contains node state information. This field consist the IP address.
- Avail: this field value indicate the availability of the resource. Large value of field indicates the more availability of resource and less value indicate the low availability of resource.
- Create: this field indicates the message creation time.
- Expire: this shows the message expire time.

In actual implementation gossip message contain 21 bytes such as four bytes require for node, one for avail, 8 for each create and expire [16].

Combining the gossip method to AODV (denoted as AODV+G) can decrease regular delay and expand the entire life span of the network. AODV+G by getting node are left over energy into concern in transferring RREQ packets. On the other hand, the probability of transferring RREQ in the AODV+GE will be 1 if the part of node is less than the required threshold value. Otherwise, the probability will between 0.6 and 0.8. Hence we can get the following:

- 1) Recover the lifetime of the entire network: The nodes with less remaining energy have a lower probability of forwarding, so minimizing energy utilization and avoiding network overlays due to energy exhaustion.
- 2) Raise the packet delivery ratio: avoiding nodes from vanishing out due to energy exhaustion can raise the success rate of packet delivery.

We can modify the AODV+G to AODV +GE because AODV+GE can enlarge the life time of network. AODV+GE gives better result than AODV and AODV+GE in terms of packet delivery ratio, overall energy required.

#### F. Flooding

Flooding is method in which each node broadcast the message to neighbor nodes. Each node rebroadcast the message until message has been propagate the network. Flooding is different from broadcasting in which transmission of message is within transmission range of broadcasting node.

#### G. Broad Storm Problem

Blind flooding which causes redundancy and retransmission of messages leads to conflict and collision problem called broad storm problem. Gossip approach is more suitable method to resolve this problem.

- 1) Redundant and superiors message
- 2) Probability of collision

### 3) Congestion of wireless medium

#### H. Flooding Control

Following are the different methods to control:

- Hop limits: this indicate that query will not expend to certain number of hops.
- Expansion ring scheme: there are two variant of this scheme, DSR and AODV protocols. In DSR message is broadcast to one hop neighbor first if resource is not exist then search entire network. In AODV node enlarge its penetrating radius linearly until resource not found.
- Geographical area: flooding is controlled by it geographical area. Nodes broadcast message to other nodes if they are within specified area.

## II. LITERATURE SURVEY

### A. An Analysis of the Overhead and Energy Consumption in Flooding, Random Walk and Gossip based Resource Discovery Protocols in MP2P Networks 2015.

This paper describes the p2p network. Wireless p2p networks have certain advantage over centralized p2p networks. P2p networks now wounding the wireless and movable domains. Initial p2p networks was dating client. Mp2p requires different architectures like point to point network, meshed networks, cooperative networks. But mp2p networks contain various challenges due to p2p network work on application layer and MANET work on network layer. Ad hoc networks have drawbacks of limited bandwidth, power utilization, and infrastructure les. MANET is dynamic in nature so the neighbors of node changes with time hence no one will be in fix position. Mobile nodes with its limited battery power if mobile nodes use its all energy they becomes dead and searching will be stopped. Hence routing of mobile p2p network is challenging factor. This paper describes the p2p network on MANET and resource discovery methods under MANET. There is three resource discovery methods flooding, random walk, gossip approaches. It will take gossip interval of one sec. gossip interval is a time a node wait to transmit a message to other node. This paper measure the performance of these methods over two parameters such as

- average energy consumption of p2p networks
- Overheads of p2p networks.

#### 1) P2P Network Overheads

Overheads are measured in terms of total number of message created and transmitted at network layer.

#### 2) Average Energy Consumption

Average energy is measured as total energy consume by all the node of network. It is measured in joules.

This paper find that the overall overheads and energy utilization is less in flooding than random walk and gossip. Hence random walk and gossip based resource discovery methods achieve poor results than flooding. Under MANET we will use unicast in random walk and gossip which degrades the performance. It is based on AODV protocol which is reactive protocol. It will establish path on demand when will be needed. Where in proactive protocols build and maintain routing tables.

### B. Issues of implementing random walk and gossip based resource discovery protocols in p2p MANET & suggestions for improvement 2015

A p2p network is a kind word to the usual client-server system. In a P2P system, the computing power relies on the ends of a link rather than the complete network itself, and all nodes generally called as "peers" have alike roles. Resource searching is one of the more difficult works in p2p in wireless networks. This paper evaluates random walk, gossip, flooding resource discovery methods with objective to:

- Study their performance under MANET.
- Define related issues in searching methods.
- Suggest improving these methods for more resourceful discovery.

In flooding message is send to all one hop neighbors for resource search. In random walk message is unicast to randomly selected neighbor node hence probability to reach message at destination is minimum because message may be lost in routing. There is no broadcasting message is moved to one node at a time. The random walk and the gossip based methods effort to find out route at each and every hop while transferring messages to another node; in gossip message is send with some probability to lower the overheads in routing protocols. There involves periodic message transmission between nodes. Replication of message also raises the resource discovery effort.

Disadvantage of gossip is:

- Low speed
- Unstable
- Message replication
- High delay to transfer message

MANET is challenging topology where routes are discovered on temporary basis. This paper evaluates these resource discovery methods for various parameters as: success rate, response time, network overheads, average energy consumption, overall packet dropped, MAC load, hop to hop packet delay, throughput, hop to hop packet delivery ratio. This paper describes that flooding performs well than gossip and random walk hence flooding is more energy efficient method than random walk and gossip based resource discovery methods. This is based on AODV protocol where it takes the neighbor list and calculates the neighbors for each present node.

### C. Mukta Chandna, Bhawna Singla, "Comparative Analysis of Flooding and Gossiping in Wireless Sensor Networks Using SIR," 2015

This paper describes that network consist of wireless and sensing links between the nodes. It compares two resource discovery methods flooding and gossip algorithms. It describes that limitations of flooding is resolved by gossip method. Wireless sensor networks are the networks in which small size devices sense the environment to communicate. There are two functions of sensors first intellect the act according to neighboring. Wireless sensor networks are composes of number of sensing strategy. Routing in wireless sensor network is based on different routing algorithms.

1) Flooding: In flooding node send the packet to neighbor of nodes. Each node stores the packet and transmits it to other nodes. It is easy process. Round is the amount of

time nodes take to get packet and resend to their neighbor nodes.

- 2) Gossip: In gossip source node send particular copy of packet to a node. It avoids sending copies to all neighbors.
- 3) Source initiated dissemination: This method broadcast the packet to available path when resources are found. Source initiated reactive based gossip method. In this process executes as:
  - Source node send the packet to neighbor node contains its time stamp, source id, sender address.
  - When a node receives a packet it stores its time stamp, source address.
  - When the destination node is reached it send the control note to source node.
  - After receiving the control message source node select the same route for communication.
  - Comparison parameters taken for evaluating flooding and gossip methods are:
    - Packet delivery ratio
    - Energy consumption

Packet delivery ratio is calculated by number of packet send to nodes over number of packets successfully received. This paper evaluate that in gossip have 16% high packet delivery ratio than flooding. Energy consumption is overall energy required to send and receive message. According to this paper flooding approach achieves 20% more energy than gossip method. Hence this paper calculate that gossip based sensing is most excellent than flooding.

### III. RESULTS

#### A. Simulation Parameters

We consider a network of nodes placing within a 1000m x 1000m area. The performance of our algorithm is evaluated by using the following parameter values

SIMULATION PARAMETERS	
COVERAGE AREA	1000m x 1000m
PROTOCOLS	DSR
NUMBER OF NODES	30
SIMULATION TIME	10 seconds
TRANSMISSION RANGE	250m
MOBILITY MODEL	RANDOM WAY POINT MODEL
LOAD	5 Kb-UDP Packets
MOBILITY SPEED(variable)	Slow moving
TRAFFIC TYPE	CBR,UDP,FTP,TCP
PACKET SIZE	512 Kbps
PAUSE TIME	1sec

Table 1: Parameter Values of DSR Simulation

#### B. Performance Metrics

- 1) Success rate
- 2) Response time
- 3) MAC Load
- 4) Throughput/Bandwidth

#### C. Experimental Process

The simulation scenario and parameters used for performing the detailed analysis and study of three types of

communication methods like broadcasting, random walk, gossiping. All these techniques will be suitable for path identification. Our purpose is to identify the better technique on the basis of different parameters.

Following steps have been used for simulation.

Inputs to Simulator:-

- Scenario File
- Movement of nodes.
- Traffic pattern file.
- Simulation TCL file
- Outputs File from Simulator
- Trace file
- Network Animator file
- Output from Trace Analyzer
- xgr file

Nam animator output:

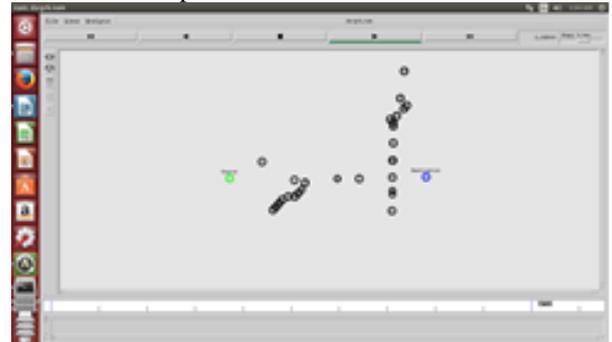


Fig. 2: Network animation

Success Rate: In this snapshot there are three parameters like broadcast (red), Gossip (green), Random walk (green). Out of the all three success rate for broadcast is better.

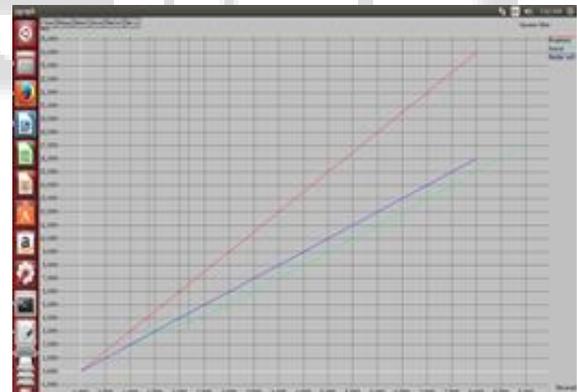


Fig. 3: Success Rate

Response Time: In this graph minimum response time is for random walk. As broad cast and gossiping has more response time.

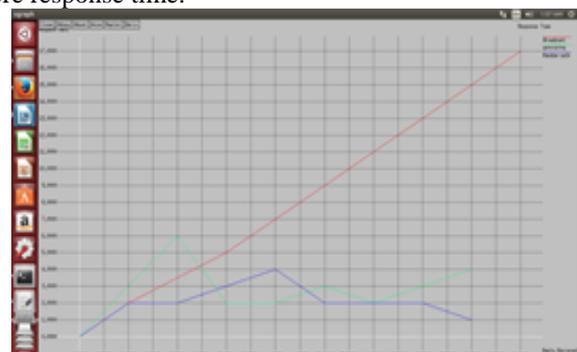


Fig. 4: Response Time

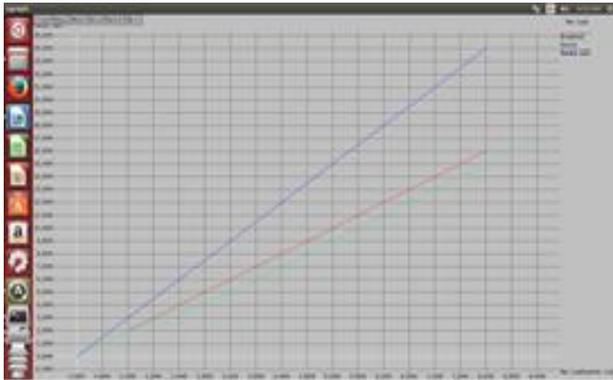


Fig. 5: Mac Load

Mac Load: In this case Mac load for random walk is minimum and broadcast has bit better Mac load.

Throughput: In this graph throughput for broadcast is

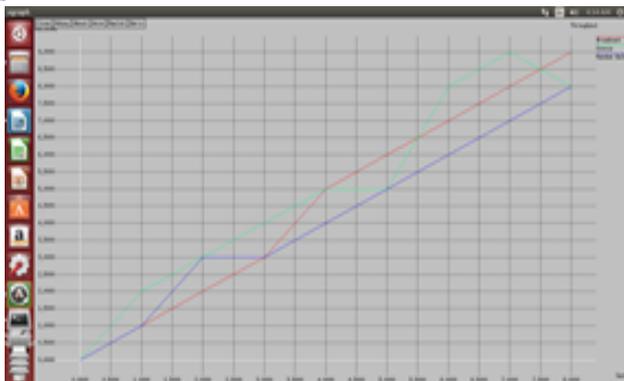


Fig. 6: Throughput Better than the others

#### IV. ALGORITHM TAKEN

- Step 1. Build a network based on DSR protocol.
- Step 2. Identify the route based on three techniques like Broadcasting, Gossiping, and Random Walk.
- Step 3. Compare their basic factors for all the techniques used.
- Step 4. Identify the best technique for identify the route in MANET.

#### V. CONCLUSION

From the above four factors comparison for broadcast, random walk, gossiping, the parameters used are throughput, Mac load, success rate, response time. Protocol used was DSR. It is clear that broadcast shows better results in two factors in throughput and success rate. Gossiping has better results in MACLOAD. And random walk has better response time. On the whole we can say broadcast is better technique in average factors. So DSR based network we can adopt broadcast as technique for path identification.

#### VI. FUTURE WORK

In future work other factors like hop to hop delay, packet dropped etc can also be checked for DSR protocol. So that it becomes clear that surely broadcast is better technique.

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