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Discovering Most Interfered Sub Path of MANET Multi Paths Using Data Mining Technique

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Abstract— **In most common mobile ad hoc networking (MANET) scenarios, nodes establish communication based on some routing protocol. The reactive routing protocol like DSR performs two steps i.e. route discovery and route maintenance. During route discovery every node may get multiple paths to every other node in the MANET. The nodes may select one of the best paths out of available cached paths. Generally the selection is based on distance between the communication partners. To improve data delivery performance and to decrease collisions with other communications it is better to select less interference path instead of shortest path. In this paper we proposed a system that uses data mining technique for finding most interfered paths. Those paths which are having high interference will be discarded from the node's cache.**

Keywords: MANET ,DSR, Route Discovery, Route Maintenance, Cache, Data Mining

I. INTRODUCTION

A mobile ad-hoc network (MANET) is a self-configuring infrastructure less network of mobile devices connected by wireless. Ad hoc is Latin and means "for this purpose". Each device in a MANET is free to move independently in any direction, and will therefore change its links to other devices frequently. Each must forward traffic unrelated to its own use, and therefore be a router. The primary challenge in building a MANET is equipping each device to continuously maintain the information required to properly route traffic. MANETs are a kind of wireless ad hoc networks that usually has a routable networking environment on top of a Link Layer ad hoc network.

1.1 MANET Challenges

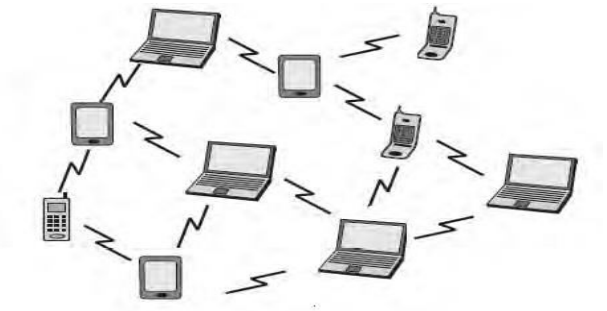
Regardless of the variety of applications of mobile ad hoc network, there are still some issues and design challenges that we have to overcome This is the reason MANET is one of the elementary research field. As it is a wireless network it inherits the traditional problem of wireless networking [3]:

- The channel is unprotected from outside signal.
- The wireless media is unreliable as compared to the wired media.
- Hidden terminal and expose terminal phenomenon may occur.
- The channel has time varying and asymmetric propagation properties.

With these problems there are some other challenges and complexities [3] :

- The scalability is required in MANET as it is used in military communications, because the network grows according to the need, so each mobile device must be capable to handle the intensification of network and to accomplish the task.
- MANET is a infrastructure less network, there is no central administration. Each device can communicate with every other device, hence it becomes difficult to detect and manage the faults. In MANET, the mobile devices can move randomly. The use of this dynamic topology results in route changes, frequent network partitions and possibly packet losses [1].
- Each node in the network is autonomous; hence have the equipment for radio interface with different transmission/ receiving capabilities these results in asymmetric links. MANET uses no router in between.
- In network every node acts as a router and can forward packets of data to other nodes to provide information partaking among the mobile nodes. Difficult chore to implement ad hoc addressing scheme, the MAC address of the device is used in the stand alone ad hoc network. However every application is based on TCP/IP and UDP/IP.

Figure 1. Mobile Ad-Hoc Networks



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1.2 Areas of Possible Scenarios

- *Military Scenarios* MANET supports tactical network for military communications and automated battle fields [3] .
- *Rescue Operations* It provides Disaster recovery, means replacement of fixed infrastructure network in case of environmental disaster.
- *Data Networks MANET* provides support to the network for the exchange of data between mobile devices.
- *Device Networks* Device Networks supports the wireless connections between various mobile devices so that they can communicate.
- *Free Internet Connection Sharing* It also allows us to share the internet with other mobile devices.
- *Sensor Network* It consists of devices that have capability of sensing, computation and wireless networking. Wireless sensor network combines the power of all three of them, like smoke detectors, electricity, and gas and water meters.

1.3 Application Possible scenarios/services

- *Tactical networks:* Military communication and operations, automated battlefields[3].
- *Emergency services:* Search and rescue operations , Disaster recovery, Replacement of fixed infrastructure in case of Environmental disasters Policing and fire fighting Supporting doctors and nurses in hospitals.
- *Commercial and civilian:* E-commerce- electronic payments anytime and anywhere environments , Business- dynamic database access, mobile offices ,Vehicular services: road or accident guidance, transmission of road and weather conditions, taxi cab network, inter-vehicle networks ,Sports stadiums, trade fairs, shopping malls & Networks of visitors at airports.
- *Home and enterprise:* Home/office wireless networking, Conferences, meeting rooms Personal area networks (PAN), Personal networks (PN)at construction sites.
- *Education:* Universities and campus settings, Virtual classrooms, Ad hoc communications during meetings or lectures.
- *Entertainment:* Multi-user games, Wireless P2P networking, Outdoor Internet access Robotic pets, Theme parks.

1.4 Security in MANET

There is very limited physical security in MANET. The type of attacks can be Active attacks or Passive attacks[11]. The common security issues are Passive attacks which include eavesdropping and information disclosure. Active attacks include Denial of service, Data modification by viruses, Trojans and worms.

There are other more specific problems with mobile ad hoc network such as vulnerability of channels and nodes, Byzantine black hole and Byzantine wormhole attack. The security issue also includes attacks that may inject erroneous routing information and diverting network traffic thus making routing inefficient.

There are many methods to reduce the impact of these attacks, which include a secure routing using public and private keys to get a certification authority and use of digital signatures and priori trust relationships. The drawbacks of such a system is that the priori trust needs to be in place before the network is set up this may not always be possible in a case of disaster affected areas

1.5 Routing in MANET

"Routing is the process of information exchange from one host to the other host in a network." Routing is the mechanism of forwarding packet towards its destination using most efficient path. Efficiency of the path is measured in various metrics like, number of hops, traffic, security, etc. In Ad-hoc network each host node acts as specialized router itself [11].

Different Strategies:

Routing protocol for ad-hoc network can be categorized in three strategies [6].

a) Flat Vs Hierarchical architecture.

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

c) Hybrid protocols.

a) Flat Vs. Hierarchical architecture

Hierarchical network architecture topology consists of multiple layers where top layers are more seen as master of their lower layer nodes. There are cluster of nodes and one gateway node among all clusters has a duty to communicate with the gateway node in other cluster. In this schema there is a clear distribution of task. Burden of storage of network topology is on gateway nodes, where communicating different control message is dependent on cluster nodes.

But this architecture breaks down when there is single node failure (Gateway node). Gateway nodes become very critical for successful operation of network. Examples include Zone-based Hierarchical Link State (ZHLS) routing protocol [5]. Where in flat architecture there is no layering of responsibility. Each and every node does follow the same routing algorithm as any other node in the network.

b) Proactive Vs Reactive routing protocol in MANET

Proactive routing protocol

In proactive routing scheme every node continuously maintains complete routing information of the network. This is achieved by flooding network periodically with network status information to find out any possible change in network topology.

Current routing protocol like Link State Routing (LSR) protocol (open shortest path first) and the Distance Vector Routing Protocol (Bellman-Ford algorithm) are not suitable to be used in mobile environment.

Destination Sequenced Distance Vector Routing protocol (DSDV) and Wireless routing protocols were proposed to eliminate counting to infinity and looping problems of the distributed Bellman-Ford Algorithm.

Examples of Proactive Routing Protocols are:

a) Global State Routing (GSR).

b) Hierarchical State Routing (HSR).

c) Destination Sequenced Distance Vector Routing (DSDV).

Reactive routing protocol

Every node in this routing protocol maintains information of only active paths to the destination nodes. A route search is needed for every new destination therefore the communication overhead is reduced at the expense of delay to search the route. Rapidly changing wireless network topology may break active route and cause subsequent route search.

Examples of reactive protocols are:

a) Ad hoc On-demand Distance Vector Routing (AODV).

b) Dynamic Source Routing (DSR).

c) Location Aided Routing (LAR).

d) Temporally Ordered Routing Algorithm (TORA).

Hybrid routing protocols in MANET

There exist a number of routing protocols of globally reactive and locally proactive states. Hybrid routing algorithm is ideal for Zone Based Routing Protocol (ZRP).

II. REACTIVE ROUTING PROTOCOL DSR

This is an On-demand source routing protocol. In DSR the route paths are discovered after source sends a packet to a destination node in the ad-hoc network. The source node initially does not have a path to the destination when the first packet is sent [1].

The DSR has two functions first is route discovery and the second is route maintenance [11].

Different DSR Algorithms

a) Route discovery.

b) Route maintenance.

Assumptions:

a) X, Y, Z, V and W form ad-hoc network.

b) X is the source node.

c) Z is the destination node.

2.1 Route Discovery Algorithm [11]:

a) X broadcasts a Route Request Packet with the address of destination node Z.

b) The intermediate nodes V, W, Y receive the Route Request Packet from X.

c) The receiving nodes V, W, Y each append their own address to the Route Request Packet and broadcast the packet further.

d) The destination node Z receives the Route Request packet. The Route Request packet now contains information of all the addresses of nodes on the path from the source node X to the destination node Z.

e) On receiving the Route Request Packet the destination node Z sends a reply called the Route Reply Packet to the source node X by traversing a path of addresses it has got from the Route Request packet.

f) DSR caches the route information for future use.

2.2 Route Maintenance algorithm:

a) In DSR algorithm a link break is detected by a node along the path from node X to node Z, in this case node W [1,11].

b) Then node W sends a message to source node X indicating a link break.

c) In this case, node X can use another path like X-Y- Z or it must initiate another route discovery packet to the same destination node, in this case 'Z'.

2.3 Maintaining Cache At Every Node:

A cache is maintained by every node to store discovered multiple paths. These paths are mined at every node by applying association rules to find out path is least interfered and noise free .If any node in the path is failed then that path is no longer valid. The source must initiate route discovery once again. For every failure in the path, the source should start route discovery.

Instead of finding route for every failure, every node in the MANET maintains a cache memory to store all the available paths from source to destination.

If the selected path has filed then the source immediately selects next path from the cache. If any node in the MANET

has failed or moved away then the path in the cache becomes stale.

Every node in the MANET gets a notification about failure or mobility of every other node in the MANET. If any node in the MANET gets a failure or mobility notification of the other node then the received node deletes all the stale paths which contain the failed or moved node.

III. Mining Multiple Paths

Data Mining or Knowledge Discovery in Databases (KDD) is defined as "The nontrivial extraction of implicit, previously unknown, and potentially useful information from data". DM is the process of finding hidden relationships in data sets and summarizing these patterns in models. These patterns can be utilized to understand the whole data sets. In simplified terms, DM is a technology that allows an applicant to discover knowledge, which is hidden in large data sets, by applying various algorithms [7].

Data Mining approaches are applied to MANET, in that the traffic of MANET is mined using Association Rule Techniques. Mining enables the establishment of the fact that there are still some hidden relationships (patterns) amongst routing nodes, even though nodes are independent of each other. These relationships may be used to provide useful information to different MANET protocols in different layers. Precisely, mining the paths, discover hidden patterns (meta-data) in the third layer to be used as common tokens (keys) in the application layer in a bid to address one challenging security problem in MANET, namely, key distribution [9].

Let A = {l1, l2, l3, l4, ..., lm} be a set of items.

Let T be a set of transactions on a database.

A transaction t is said to support an item li, if li is present in t. Moreover, t is said to support a subset of items $X \subseteq A$, if t supports each item l in X .$X \subseteq A$ is said to have a Support s in T, denoted by s(X), if s percent of transactions in T support X.

A subset X is said to be a Frequent Set (FS) in T with respect to σ (where σ is a user-specified minimum Support), If

$$s(X) \geq \sigma$$

FS is called Maximal Frequent Set (MFS) if no supper set of this set is FS.

The following are important properties of MFS:

– Downward Closure: Any subset of FS is FS.

– Upward Closure: Any supper set of an Infrequent set is an infrequent set.

Moreover, the set of all Maximal Frequent Sets (MFSs) is called maximum frequent set. For a given database, an association rule is an expression of the form:

$$X \Rightarrow Y$$

where X and Y are subsets of A. The intuitive meaning of such a rule is that a transaction of the database which contains X tends to contain Y.

Some used measures of rule interestingness are:

1. Confidence (τ): The association rule $X \Rightarrow Y$ holds with confidence τ if τ% of transactions in T that supports X also supports Y.
2. Support (σ): The association rule $X \Longrightarrow Y$ has Support σ in the transaction set T if σ% of transactions in T support $X \cup Y$

3.1 Mining the cached paths to find out most interfered sub path

Methodology:

After discovering available paths from source to destination, the mining subsystem performs the following steps:

1: Read all available paths from node's cache.
2: Consider number of nodes as items.
3: Consider number of paths as transactions.
4: Create a bit vector as rows represent all paths and columns as nodes.
5: Take the minSupport and minConfidence.
6: Find out the frequent item sets.
7: Form association rules based on frequent item sets to find out most interfered sub path

IV. Simulation & Results

Figure 2. MANET Construction

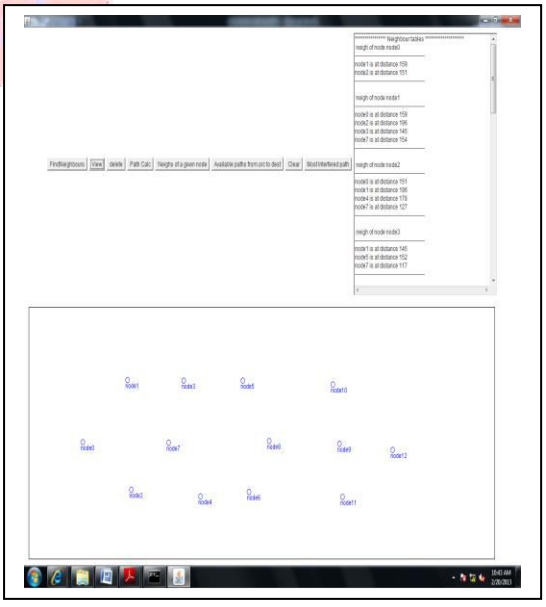


Figure 3. Path calculation from node0 to node12

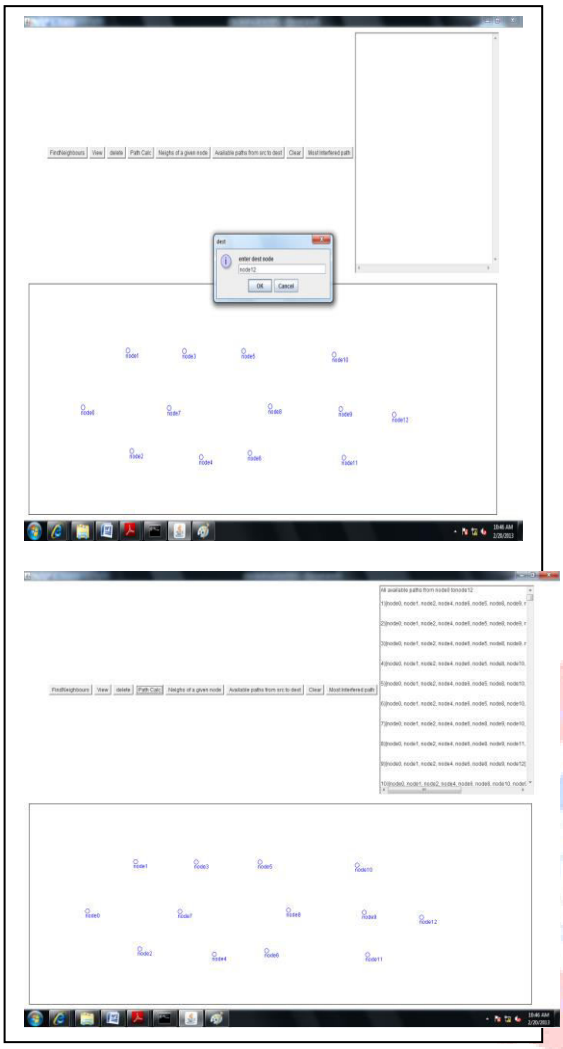
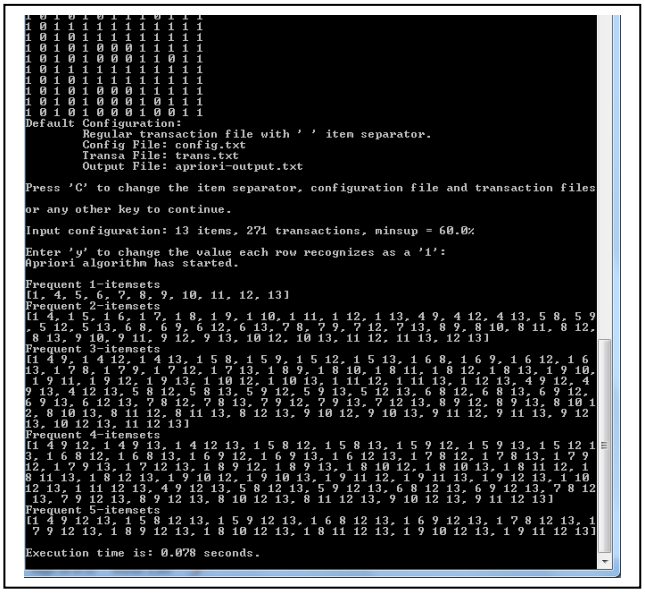


Figure 4. Finding most interfered sub path from all available paths



V. CONCLUSION

Each device in a MANET is free to move independently in any direction, and will therefore change its links to other devices frequently. Each must forward traffic unrelated to its own use, and therefore be a router. During route discovery every node may get multiple paths to every other node in the MANET. The nodes may select one of the best paths out of available cached paths. To improve data delivery performance and to decrease collisions with other communications it is better to select less interference path instead of shortest path.

REFERENCES

[1] A Cluster-Based Multipath Dynamic Source Routing in MANET Hui-Yao An, Ling Zhong, Xi-Cheng Lu, and WeiPeng.

[2] An Acknowledgment-Based Approach for the Detection of Routing Misbehavior in MANETs Kejun Liu, Jing Deng, Member, IEEE, Pramod K. Varshney, Fellow, IEEE, and Kashyap Balakrishnan, Member, IEEE .

[3] An Overview of MANET: History, Challenges and Applications. Kumar, R. Mishra, Indian J. of Compu. Sci. and Engineering, Indian Journal of Computer Science and Engineering (IJCSE)

[4] A Survey of Survivability in Mobile Ad Hoc Networks Michele Nogueira Lima, Aldri Luiz dos Santos, and Guy Pujolle.

[5] A Survey on Trust Management for Mobile Ad Hoc Networks Jin-Hee Cho, Member, IEEE, Ananthram Swami Fellow, IEEE, and Ing-Ray Chen, Member, IEEE.

[6] A Unified Analysis of Routing Protocols in MANETs Hui Xu, Student Member, IEEE, Xianren Wu, Member, IEEE, Hamid R. Sadjadpour, Senior Member, IEEE, and J. J. Garcia-Luna-Aceves, Fellow, IEEE

[7] Data Mining: Concepts and Techniques Second Edition Jiawei Han and Micheline Kamber University of Illinois at Urbana-Champaign.

[8] DSR: The Dynamic Source Routing Protocol for Multi-Hop Wireless Ad Hoc Networks David B. Johnson David A. Maltz Josh Broch Computer Science Department Carnegie Mellon University Pittsburgh, PA 15213-3891.

[9] Fast Algorithms for Mining Association Rules Rakesh Agrawal Ramakrishnan Srikant_IBM Almaden Research Center.

[10] On the Survivability of Wireless Ad Hoc Networks with Node Misbehaviors and Failures Fei Xing, Student Member, IEEE, and Wenye Wang, Member, IEEE.

[11] Overview of Routing Protocols in MANET's and Enhancements in Reactive Protocols, Amit Shrivastava, Aravinth Raj Shanmogavel, Avinash Mistry, Nitin Chander, Prashanth Patlolla, Vivek Yadlapalli

[12] Virtual-Force-Based Geometric Routing Protocol in MANETs Cong Liu and Jie Wu, Fellow, IEEE.