Social Behavior of Global Community in MANET with Human Mobility

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Abstract - In mobile networks, the performance of data forwarding is understood by Human mobility models. Human mobility patterns are used for the evaluation and analysis of protocols and application performance. The decision for the movement of people is strongly affected by the interaction between people belonging to social circles such as families, friends and co-workers. The Heterogeneous Human Walk (HHW) mobility model analyse the structure of community that overlaps in social networks. The general features of human mobility such as time correlation, location heterogeneity, node heterogeneity and node correlation are considered. Routing in DTN is challenging since it must handle partitioning, long delays and dynamic topology in such networks. Routing performance is improved by taking advantages of positive and negative social characteristics. Positive social effects such as community, friendship and negative social effects such as selfishness. Community is important concept in ecology and sociology. Ecology is where two or more populations of different species occupying same geographical area. In sociology, a group of interacting people living in common location. Two nodes having long-lasting and regular contacts are defined as friendship. Selfishness is where nodes behave selfishly at individual level and aims to only maximize their own utilities without considering system-wide area. They may drop others messages and replicate its own message. Cooperative caching in DTN is enabled for sharing and coordination of cached data that reduces data access delay. The network stability region is characterized by considering the probability of visiting of each node and transmission resource at each location. The network stability decreases when node correlation and location diversity are considered and increases when diversity of location on visiting each node. We need to analyze the throughput optimal policy by means of stability related optimization problem. Using the baseline algorithm 2hop and bubble algorithm and will provide the results.
Keywords-DTN,Pocket switched Networks, Network Region, Social Networks.

I. INTRODUCTION

A **Mobile Ad hoc Network** (**MANET**) is a continuously self-configuring, infrastructure-less network of mobile devices connected without wires. *Ad hoc* is Latin and means "for this purpose. Setting up of fixed access points and backbone infrastructure is not always viable because Infrastructure may not be present in a disaster area or war zone and also infrastructure may not be practical for short-range radios like Bluetooth (range ~ 10m)Ad hoc networks do not need backbone infrastructure support and they are easy to deploy. Ad hoc networks are useful when infrastructure is absent, destroyed or impractical.

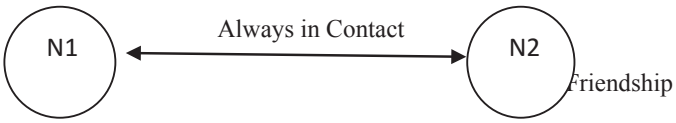
A delay-tolerant networks lacks in continuous network connectivity and is designed to operate effectively over extreme distances. Delay-tolerant networking differs from disruption-tolerant network but there are few same technologies. A delay-tolerant network can store large amounts of data in hardware that survive extended power loss and system restarts. Using the following strategies Label Routing, SimBet Routing, BubbleRap Forwarding, Friendship based Routing the data packets are sent. The performance of data forwarding in overlapping community networks is analyzed based on mobility model for tracing out the characteristics of social behavior.

Asynchronously time-varying social roles can be modeled by extensive simulations to improve the ratio of queries satisfy and reduces data access delay. The delivery ratio is achieved by using enhanced protocol for better efficiency. More realistic and accurate social characteristics can be used to further improve performance of DTN routing. Model and extract accurate social characteristics in dynamic DTNs can be analyzed. Social-based solutions considering both positive and negative social characteristics together can be applied.

To analyze the performance of data forwarding in overlapping community networks based on mobility model the characteristics of social behavior considers friendship, selfishness, similarity and centrality.

A. FRIENDSHIP

Friendship describes the close personal relationship between two nodes in the social network. Fig 1 shows a defined between a pair of nodes. Two nodes must have long lasting and regular contact between each other to be considered as friends. It can also be stated as, individuals who share similar actions and frequently meet each other.



This phenomena is termed as homophily phenomenon. Therfore friendship in DTNs can be determined between the contact history of two nodes.

B. SELFISHNESS

Selfishness is a common factor used in both sociology and economics, which is recently involved in the design of computer networks.

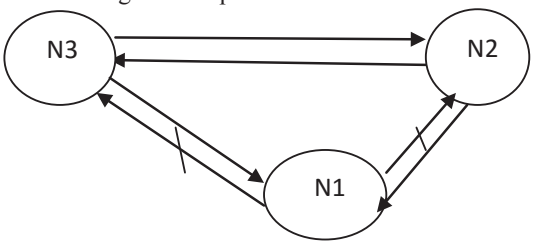


Fig.2. Selfishness

Selfishness is measured by the behaviour of nodes. Nodes that behave selfishly at individual aim and aim only to maximize the own utility were termed as selfishness. In DTNs, the nodes may drop others message excessively and replicate its own message to increase the delivery rate. In fig 2. Node N1 acts as a selfish node that only looks for the self utilization and does not forward the packet.

C. SIMILARITY

Similarity is measure of degree of separation. In Social network it can be measured by the number of common neighbours between individuals. The probability of two people being acquainted is possible if they have one or more acquaintance in common. Similarity can be defined as the probability of two nodes being connected by link is higher when they have more common neighbour. Similarity will be low when the nodes are unlikely to be in contact with each other and diffusion occurs. Similarity can be define in two ways, such a similarity on user interests and similarity on user location.

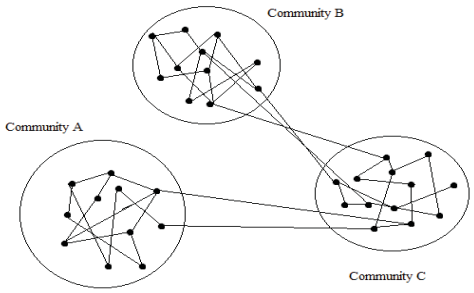


Fig.3 Similarity

CENTRALITY

Centrality is the measure of topological vertex in the graph. The central node has the strongest capability of connecting nodes within the graph. The centrality are of three types namely, degree centrality, betweeness centrality, and closeness centrality. Degree centrality is defined by the number of links incident on the given node. In fig 4, the degree of centrality of node a is 3, and node b,c,.d has 1.

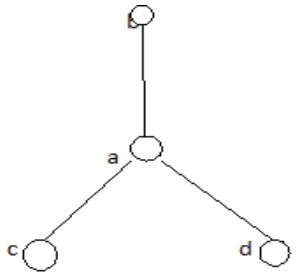


Fig.4 Centrality

Betweenness centrality is measured by the number of shortest paths passing through the given node.In the above example the betweeness centrality is 6 for node a and it has the shortest path while all other nodes has 3.Closeness centrality is defined as the inverse of average shortest distance to all nodes in the graph.from the below example, the closeness centrality of node a is 1 while for all the other nodes it is 0.6 probability between nodes but also the data propagation orders

II. RELATED WORK

In the existing literatures, [1] Throughput of human mobility and delay on people centric application are studied. The general features of human mobility such as time correlation, location heterogeneity, node heterogeneity and node correlation are considered. Throughput optimal policy is analyzed by solving stationary randomized policy. In [8], Delay performance is characterized by obtaining upper and lower bounds. Implementation is done by Simulation based on numerical and theoretical model and real traces. Time heterogeneity can also be considered for better results on simulation. Social properties in DTNs are summarized and social based DTN approaches is surveyed [4]-[5]. Routing performance is improved by taking advantage of positive and negative social characteristics. Positive social characteristics are community and friendship in packet forwarding. Negative social characteristics includes selfishness. In [11], Community is important concept in ecology and sociology In ecology, two or more populations of different species occupying same geographical area. In sociology, group of interacting people living in common location. In [3], Cooperative caching in DTN is enabled for sharing and coordination of cached data among multiple nodes. Network Central Location (NCL) is set for easy access of other nodes in a network.

In [2]-[11], Mobility based on overlapping community structure in social networks. The realistic assumption of an overlapping community structure is done by HHW (Heterogeneous Human Walk). The performance of data forwarding protocols is accurately understood by Human mobility models.

In **[3], [13],** A Social-based privacy-preserving packet forwarding protocol for vehicular DTN is presented. The Road Side Units (RSUs) are deployed for assisting packet forwarding to achieve highly reliable transmission. RSU is placed in the high-social intersections and they provide packet storing and forwarding. Performance evaluation is done by simulation. Few attacks that degrade performance is considered

i. Packet analysis attack – recovers packet content and infer the source.

ii. Packet tracing attack – the source and destination location of packet is traced.

iii. Black hole attack – the router instead of forwarding the packet, discards them.

iv. Grey hole attack – forwards only some packet not all packet.

Enhanced protocol can be used for better efficiency in terms of delivery ratio in vehicular DTNs can be achieved.

The comparison is made between existing and proposed is as follows,

S. No	Parameter	Existing	Proposed
1	Throughput	0.9	0.98
2	Endogenous data	Not supported	Supported
3	Community structure	Not formed	formed
4	Delivery Ratio	0.89	0.99

III. SYSTEM ARCHITECTURE

The design structure shows step by step process of out project. The data is explored from internet and the social graph is formed. The graph formed is the connected graph and the link from each node is analysed. The data of the social graph is managed by the social network manager and each node is configured as soon as it is created. Due to heavy load the traffic is controlled by using label routing strategy i.e, the data is delivered only to the labelled node using unicast technique.

After data forwarding is done following metrics such as betweenness, closeness centrality and eccentricity is analysed for each node. After the metric analysis, the network management handles the data to database manager for verification of accounts. The protocol administrator consists of two characteristics positive social characteristics and negative social characteristics. The outcome of positive social characteristics will be deleted, default and unused accounts whereas for negative characteristics trusted and untrusted accounts

IV. PROPOSED SCHEME

The proposed system aims for the better performance of throughput in DTN with human mobility. This can be done by considering the node occurring at the same time forming a community structure. When the endogenous data arrive at node (source) and are targeted to different node, then data form a unicast. The social network is formed from the data explored form internet. Routing is done based on features of human mobility such as time correlation, node correlation, location heterogeneity, and node heterogeneity. Community is being identified in two phases:

- 1st Phase: Small communities are optimized (Modularity).
- 2nd Phase: aggregate nodes of same community and build new network.

Few merits of the proposed system are:

- Delivery ratio and better efficiency is achieved.
- More realistic and accurate social characteristics for better performance of DTN routing is achieved.
- Social characteristics in dynamic DTNs can be modeled.

V. PROMISING KEY FOR SOCIAL BEHAVIOUR

The implementation is done by the following techniques

a. *Reduction of Traffic*

Reduction of traffic is based on label routing. Based on community labels in pocket Switched Networks (PSN). Reduces the amount of traffic created during packet forwarding. It assumes that people from the same community tend to meet more often than people of different communities and hence the good forwarders relay messages destined to the members of same community (with the same label). Label routing requires very little information about each individual. This is easy to implement in PSN applications, by tapping a mobile device and writing down the affiliation of the owner. This may significantly increase the delay or even fail to deliver the message.If the message delivery fails, the source does not meet any member from the destination's community, and even there is a possible relay of nodes from other communities

b. *Identification of bridge node*

Bridge node is identified using SimBet routing. Nodes with high betweenness centralities are nodes who can act as bridges in their neighborhood, while nodes with high similarities are more likely to find common neighbor with the destination. the betweenness centrality Bet_n for each node *n* in its local neighborhood. For similarity metric, $Sim_n(d)$ is considered the number of common neighbor nodes, of the current node *n* with the destination node *d*.

$$SimUtil_n = \frac{Sim_n(d)}{Sim_n(d) + Sim_m(d)}$$

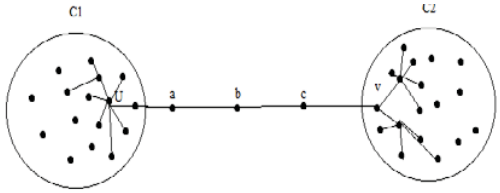


Fig.5 SimBet Routing

$$BetUtil_n = \frac{Bet_n(d)}{Bet_n(d) + Bet_m(d)}$$

Nodes with high betweenness centralities can act as bridges in their neighborhood, while nodes with high similarities are more likely to find a common neighbor with the destination which can act as the forwarder.

c. *Creating multiple communities*

Multiple communities are created using Bubble rap forwarding. Two forwarding strategies both bubble up based on local and global communities are considered. Bubble Rap Forwarding uses the concept of community along with node centrality to for forwarding decision.

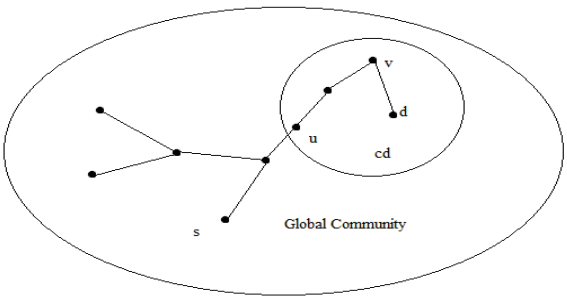


Fig.6 BubbleRap Frowarding

When a node *s* has a message with destination of *d*, it first bubbles the message until it reaches a node which is in the same local community C_d as the destination . After the message reaches *d*'s community at node *u*, Bubble Rap Forwarding skips to the second phase which uses members of C_d as relays. This strategy continues to bubble up the message through the local community based on local centrality until the destination is reached. The introduction of local centrality inside a community is more beneficial than local centrality around local neighborhood. The bubble-up operations allow fast transfer of a message towards the destination or its community.

d. *Managing DTN*

Single data multicast and multiple data multicast problems to deliver data is done. In such model, the contact process of each node pair (*i*, *j*) evaluated based on Possion process with the contact rate of $\lambda i,j$. Then the cumulative contact probability of node *i* can be de fined as

$$C_i = 1 - \frac{1}{N-1} \sum_{j=1, j \neq i}^{N} e^{-\lambda_{ij} T}$$

Here, *N* is the total number of nodes in the network, and *T* is the total time period and , *Ci* is the average probability that node *i* meets a random node within time *T*. This centrality metric is used in the proposed multicast methods to select a relay node with higher centrality

e. *Homophily based selection*

Similar data items shared between friends and diffuse different data between strangers. DTNs, data may not be delivered from one node to another node during a contact between them, since the contact time is too short to transmit the data or the storage buffer available at the receiving node is insufficient to hold the data. Therefore, in the design of data diffusion protocol, not only the contact.

VI. IMPLEMENTATION

GEPHI

Gephi is a tool for people to explore and understand graphs. Like Photoshop the user interacts with the representation, the structures, shapes and colours are manipulated to reveal hidden properties. The goal helps data analysts to discover patterns, isolate structure singularities or faults during data sourcing. It is a tool to traditional statistics with interactive interfaces and visual is recognized to facilitate reasoning. This software is mainly for Exploratory Data Analysis in the Visual Analytics field of research.

Real-time visualization

The Graph visualization engine is to speed-up the understanding and pattern discovery in large graphs. Gephi shows how interactive and efficient networks up to 50,000 nodes and 1,000,000 edges and visualization through dynamic filtering.

Layout

Layout gives a perfect shape to the graph. Gephi provides layout algorithms, both for efficiency and quality. The Layout palette allows user to change layout settings using Force-based algorithms, Multi-level algorithms (graph coarsening)

Fig.7 Layout of gephi

Metrics

The metrics that are commonly used in social network analysis (SNA) and scale-free networks are Betweenness, Closeness, Diameter, Clustering of Coefficient, Average shortest path, Community detection, Modularity.

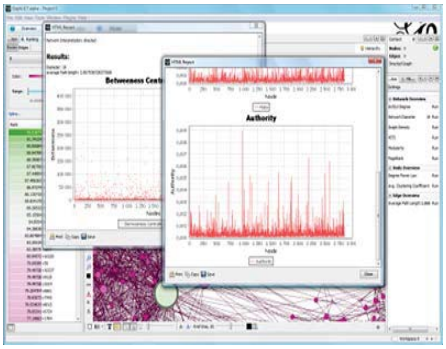


Fig. 8 Metrics

Dynamic Network Analysis

Innovation of dynamic network analysis (DNA)is explained by the leading platform Gephi. Dynamic structures in social networks can be filtered with the timeline component by importing temporal graph with the GEXF file formatand by Graph streaming.

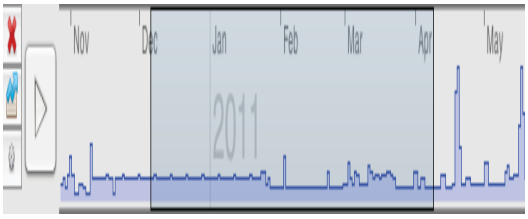


Fig. 9 Dynamic Network Architecture

Clustering and hierarchical graphs

Multi-level graphs are explored with Gephi by exploring large, and hierarchically structured graphs like social communities, biochemical pathways or network traffic graphs.The networks are aggregated using data attributes in clustering algorithm by Expanding the subgraphs and Linking them.

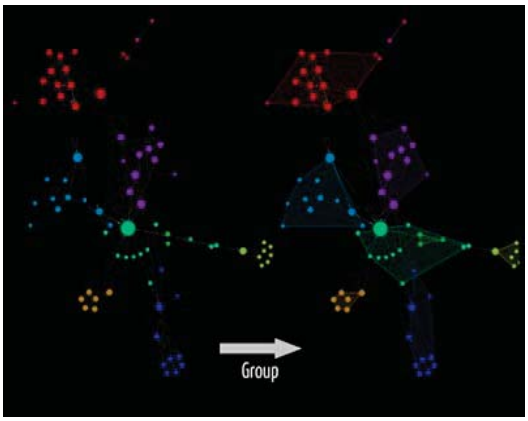


Fig.10 Cluster and Hierarchical Graph

HOW TO INSTALL GEPHI

STEPS TO INSTALL GEPHI IN **Windows**

1. Be sure you have a recent Java JRE installed on your system.
2. After the download completes, run the installer and follow the steps

a) If after installing the software doesn't work, do the following steps
b) Go to your Gephi folder (probably C:\Program Files (x86)\Gephi-0.8.2) and locate the folder etc
c) Inside etc folder you will find a file named gephi.config, open this file with notepad. Search for the keyword #jdkhome="/path/to/jdk
d) Once you find this part of code, remove the # from the beginning since the machine will not execute this code and it will consider it as comment.
e) Replace the text inside the double quotations /path/to/jdk with the directory address of your Java folder in your system.
f) Save the config file, if you are not allowed to do so save it on some other place and once done, replace it on the original file.

VII. RESULT

The Fig 11 graph shows the delivery ratio of social network with respect to the simulation time. The home network utilization of data packets is higher compared to social network.

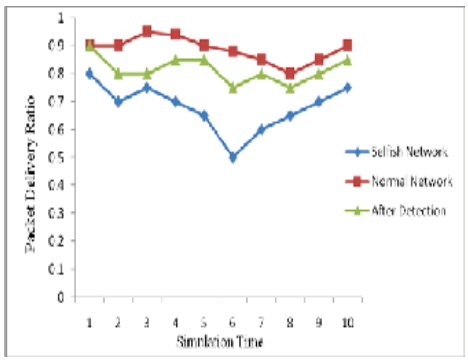


Fig.11 Comparison Graph

Fig 12. shows the various distribution on closeness count, betweenness and eccentrality where the shortest path is measured and the community with high modulatity is caluculated.The Eccentrality shows the better result than the closeness and Betweenness centrality as the average of both the distribution is high.

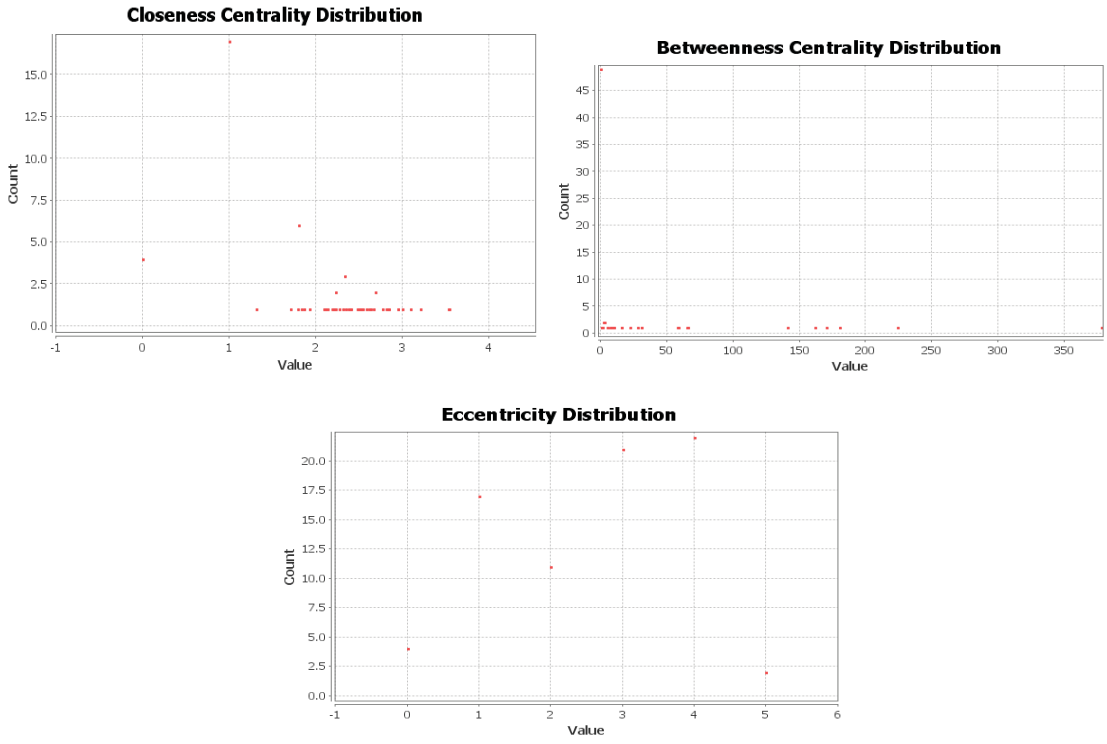


Fig.12 Graph showing various distribtution like closeness, betweennness and Eccentrality.

VIII. CONCLUSION AND FUTURE WORKS

People's social interactions, strongly affect their movement decisions, understanding social network plays a significant role in accurately modeling their mobility. We propose a general human mobility model for

MANETs, which can capture important human mobility features. We aim to study the impact of human mobility on delay and throughput based people-centric applications in MANETs. We characterize the network stability region in terms of communication parameters and mobility parameters. We analyze the impact of human mobility features on the network stability region. We also develop a stationary randomized policy, which is shown to be throughput-optimal. The delay performance is characterized by the upper and lower bounds under the proposed policy characteristics to assist packet forwarding in DTNs. The social graph is formed and the data are analyzed. The dynamics of the social graph is plotted by grouping the nodes of local and global community. The community is analyzed by the metric modularity.

A model for asynchronously time-varying social roles can be done as future enhancement. Extensive simulations can be done to improve ratio of queries satisfy and reduces data access delay Enhanced protocol can be used for better efficiency in terms of delivery ratio in vehicular DTNs can be achieved.

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