An Efficient Traffic Delivery in the Adhoc Network – A Survey

Anwar Basha Haffishthullah, and Sathish Kumar Pakkirisamy Janakiraman

Abstract—An ad hoc mobile network is a collection of mobile nodes that are arbitrarily located without any available fixed infrastructure. In such networks, change in interconnections between nodes depends on the movement of mobile nodes. Each mobile node acts as a router and moves in a discretionary manner. Due to dynamic topological changes and the lack of a fixed infrastructure, the problem of how to improve connectivity to guarantee delivery of information is one of the biggest challenges of ad hoc networks.In this survey we discuss the innovative TTL mechanism for ad hoc networks The connectivity of an ad hoc network can be improved by increasing the TTL. To store the packets for future transmission,each mobile node has an accumulator. The relationship between TTL,accumulator size and other network parameters including number of nodes in the network,traffic load, mobile node transmission range and velocity, is evaluated. If the accuracy of the prediction algorithm needs to be improved, the computing complexity is increased at the same time. Betweeness centrality is used to identify important nodes in ad hoc networks. The mobility of these important nodes will be predicted with higher priority.

Keywords—Traffic Delivery, Time to Live, Mobile Communication

I. Introduction

MULTIHOP ad hoc networks have been the focus of recent research and development efforts in mobile networks. These networks are dynamically reconfigurable wireless networks without any fixed infrastructure.[1] Each host acts as a router and moves in an arbitrary manner. Ad hoc networks are deployed in situations in which infrastructure is either not available, not trusted, or cannot be relied upon. Examples include disaster recovery, distributed collaborative computing, sensors scattered throughout a city for biological detection, rare animal tracking, space exploration, and undersea operation. A significant feature of ad hoc networks is that rapid changes in connectivity and link characteristics are introduced caused by node mobility and power control methodologies. Prediction of node mobility can lead to prediction of the network connectivity. If the prediction of the mobility of a node or group of nodes with good accuracy can be implemented in the routing algorithm, the router will estimate the mobile nodes available time in the path and choose better paths with longer route expiration time. This will be very useful in multicasting, routing and power control.[4]

Delayed transmission of the packet can improve the traffic delivery between mobile nodes. If there is no route between the source and destination node, the source node can transmit the packet to another node (the gateway node). Here the gateway node is the node which is predicted to be connected to the destination node in the future. The packet will be transmitted to the destination node from the gateway node when there is a route. The maximum delay of the packet is defined by the time to live (TTL).[1] TTL means a physical amount of maximum time that this packet stays alive before being transmitted to the destination node. We call this the TTL mechanism. Also we study how the range of TTL is bound by the traffic delivery ratio and mobile node buffer size. If the TTL is long, the packets have a higher probability of being transmitted but each mobile node needs more buffer space to store packets for future transmission. If the TTL is short, buffer size for each mobile node can be limited to an acceptable level, but the connectivity will not be improved.

The approach is realized by considering the following:

1. We will take into consideration that different patterns of node movement will create different scenarios, resulting in different network topologies.[4]
2. Two mobile nodes will not be able to transmit information to each other if they are out of range, there is no route between them, or if there is a communication failure.[4]
3. As predicting the future connectivity of the network improves the overall traffic delivery, we are going to propose a mobility prediction algorithm to realize our *TTL* mechanism with good accuracy and examine the connectivity improvement.[4]
4. We assume that each mobile node of ad hoc networks using the *TTL* mechanism has an Accumulator[4]
5. When the number of nodes in the ad hoc network increases or the velocity and density of mobile nodes increases, the prediction accuracy will be reduced, the average connectivity will be less, and the computing complexity will also be increased. Considering the limited calculation capability and battery life of mobile nodes, we need to select some mobile nodes to predict their movement instead of predicting the movement of all nodes.[4]

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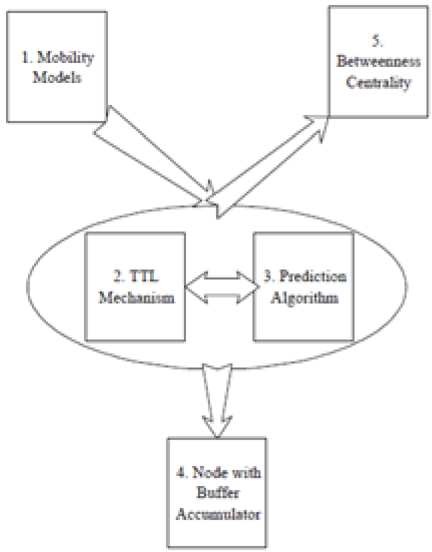

Fig. 1 System Structure

II. Mobility And Adaptability

In the mobile communications field, mobility usually refers to the movements of people or the communication terminals.

A.Terminal Mobility

Terminal mobility refers to the ability of a terminal to retain its connectivity within the network so that all present communication services remain active despite the terminal's movement.[1],[2] Terminal mobility tightly binds the relationship between the user and the terminal, because terminal mobility is a result of the user's mobility.

B. Personal mobility

Personal mobility refers to the provision of communication of computing services based on the user rather than the terminal. Universal Personal Telecommunication provides personal mobility by breaking the terminal-user relationship and allowing users to access subscribed services across multiple networks, wired or wireless.[3]

C. Service Mobility

Service mobility refers to the capability of a system to hide server interface from the clients. In addition, clients are ensured continual access to services despite server access failures and under movement of the terminal, server or user.[3]

Personal Mobility	Location-aware Applications
Terminal Mobility	Connectivity-aware Applications
Service Mobility	Often concerns with Application Movement

Fig. 2 Mobile Computing Characterized by mobility

III. Mobile Computing

Mobile computing is a very generic term that describes computing on the move. Computer users are no longer tied down to a particular machine, or to a particular location or to a specific time. Hence, mobile computing refers to anytime and anywhere computing. Although there has been criticism that wireless networks, with limited wireless bandwidth, are incapable of supporting highly overload tasks, research efforts have been evolved to overcome this problem.

A. Location Aware Mobile Applications

If an application is location aware, it does not need to be continuously connected over the wireless network. With information of the location of the mobile user, a user's application environment can be moved from its old environment to the new one. This process is commonly known as application movement. Application movement actually involves stopping the application on one node and restarting it, in the proper state, on another node. The application agent responsible for the movement transfers the application state to the new node, verifies that the resources are available and checks the restart.[4]

B. Context Aware Mobile Applications

In a context aware mobile application, the meaning of the location is not important. For example, a mobile user visiting a museum will encounter different objects and moving from one room to another.[4]

C. Connectivity Aware Mobile Applications

In a connectivity aware mobile application, the assumption is that an on-going communication path is available. This assumption is necessary in order to support real-time multimedia applications. This implication here is that handovers have to be supported in a seamless fashion, with minimum interruptions to traffic flows.[4]

D. Neighbour Aware Mobile Application

In a neighbor aware mobile application, the presence of neighboring mobile hosts governs and affects the mobile application. With mobile hosts acting as routers, spontaneous networks can be formed and disassembled to support nomadic collaborative computing. Adhoc mobile communications, i.e., mobile-to-mobile communications without the need of base stations, allow computer supported collaborative work to be possible in a mobile networking environment. [10]

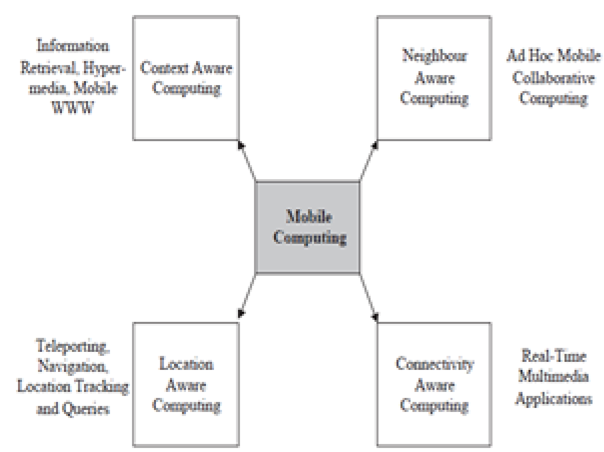

Fig. 3 A Taxanomy of Mobile Computing Applications

IV. Connectivity Analysis And The TTL Mechanism

Time-to-live (TTL) is a value in an Internet Protocol (IP) packet that tells a network router whether or not the packet has been in the network too long and should be discarded.[7] For a number of reasons, packets may not get delivered to their destination in a reasonable length of time. For example, a combination of incorrect routing tables could cause a packet to loop endlessly. A solution is to discard the packet after a certain time and send a message to the originator, who can decide whether to resend the packet. The initial TTL value is set, usually by a system default, in an 8-binary digit field of the packet header. The original idea of TTL was that it would specify a certain time span in seconds that, when exhausted, would cause the packet to be discarded. Since each router is required to subtract at least one count from the TTL field, the count is usually used to mean the number of router hops the packet is allowed before it must be discarded. Each router that receives a packet subtracts one from the count in the TTL field. When the count reaches zero, the router detecting it discards the packet and sends an Internet Control Message Protocol (ICMP) message back to the originating host.[10]

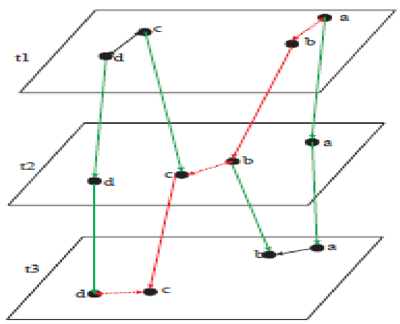

Fig. 4 Example of an Ad hoc Network with the TTL mechanism

In our TTL mechanism, if there is no route between the source and destination node, the source node can transmit the packet to the gateway node. Here the gateway node is the node which is predicted to be connected to the destination node in the future. The packet will be transmitted to the destination node, within an acceptable delay, from the gateway node when there is a route. The maximum delay of the packet is defined by the time to live. TTL is the maximum time that a packet will stay alive in the network. The connectivity of the ad hoc network can be improved by increasing the TTL instead of increasing the transmission range. [1]If there is no route available between source and destination node but we are convinced that a route will appear in the future TTL time slots, the question is how to decide the value of TTL to guarantee traffic delivery. As the nodes can move in different ways, the value of TTL is going to depend on the mobility of the nodes.[12]

V. Prediction Algorithm And Accuracy

A. Figures and Tables

There are many ways to predict the mobility of mobile nodes. The current motion parameters of a pair of neighbours nodes (such as speed, direction, and radio propagation range) to predict the length of time that these nodes will remain connected.[6] A similar algorithm is used to predict the network partition in the Group mobility models. The autonomous host-centric mobility prediction algorithms for predicting future movements of mobile hosts based on recent and past movement histories. Considering the characters of our mobility models, and to simplify the prediction complexity, we choose the prediction algorithm to check its impact on the connectivity of ad hoc networks.

There exists a monitoring system that collects and provides the coordinates an movement information of all nodes. Several light-weight localization techniques for ad hoc networks. The Unmanned Aerial Vehicles (UAVs) may collect and provide the position information of ground vehicles to the command center (or to one of the UAVs that act as the coordinator). At time *t*, assume node *i* 's velocity is *Vx* in the *x* axis direction and *Vy* in the *y* axis direction. Our prediction algorithm supposes node *i* will move with the same velocity and direction in the next *TTL* time slots, which means from time *t* + 1 to time *t* + *TTL*, node *i* 's velocity is predicted to stay the same as *Vx* and *Vy*.[2]

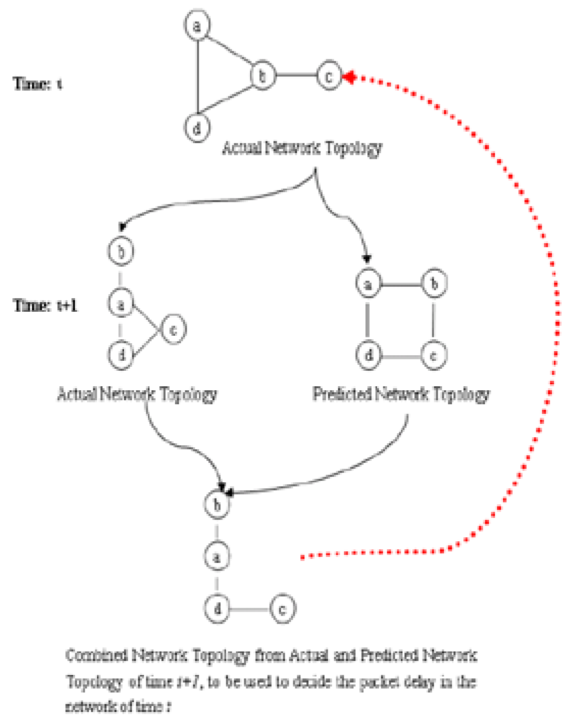

Fig. 5 A network topology generated from the actual and predicted topology

VI. Mobile Node With Accumulator

A. Node with Accumulator Works

The traffic is handled by the mobile node with accumulator. The traffic is divided into three different categories, one is the traffic coming from other mobile nodes, we call it *loado*, second is the traffic generated by the mobile node itself, we call it *loadi*, and the traffic coming from the accumulator, we call it *loadb*. The traffic coming from other nodes *loado* is divided into three traffic flows. One is the traffic which is able to be transmitted at this time slot, which means there is a path for this traffic, we call this traffic *loado;goes*. Another is the traffic which is not able to be transmitted at this time slot but it is expected that there will be a path for this traffic within the next *TTL* time slots, it is called *loado;stays*. The traffic which cannot be transmitted at this time slot and it is not expected to be delivered in the next *TTL* time slots will be dropped, we call it *loado;drops*.[8]

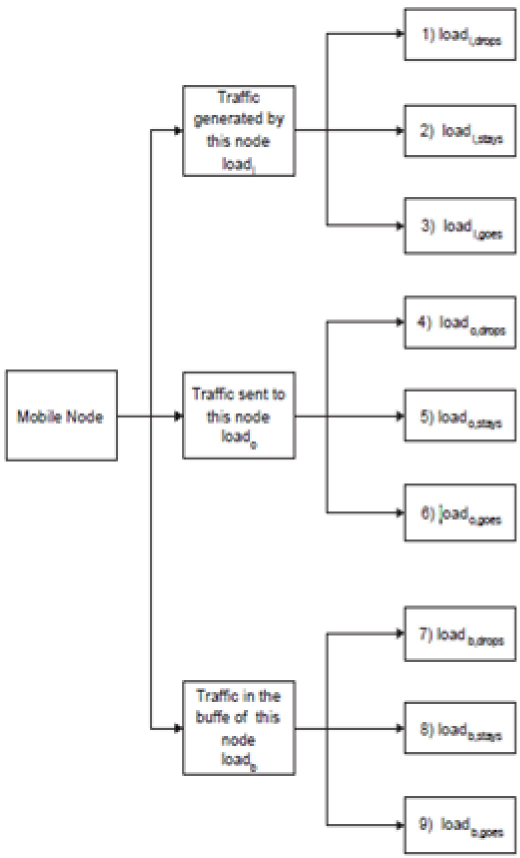

Fig. 6 Three categories of traffic in the mobile node with accumulator

VII. Conclusion

The proposed TTL (Time to Live) mechanism is a way of improving packet delivery of ad hoc networks for different mobility models. They are

1. The packet delivery ratio of the ad hoc networks for all mobility models is improved by adopting the TTL mechanism.
2. To implement the TTL mechanism, each node has an accumulator, where a packet stays until it can delivered. Even that the accumulator introduces some delay, the packet delivery ratio is improved.

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