J. Basic. Appl. Sci. Res., 3(2s)751-755, 2013
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ISSN 2090-4304
Journal of Basic and Applied Scientific Research
www.textroad.com

An Overview of Traffic-Oriented load Balancing Routing Protocols Based on the Multiple Metrics in Mobile Ad Hoc Networks

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Received: June 10 2013
Accepted: July 10 2013

ABSTRACT

Create a routing with high reliability is one of the most important issues in mobile Ad hoc networks. Therefore, load balancing and congestion the main issues of network are routing creating. Presented numbers of the works and several routing protocols for load balancing have been proposed with different metrics. The majority of proposals are currently looking at the routing overhead, Try to achieve load balancing and avoid adding additional routing overhead during a route is creating. In this paper, we investigate the routing protocol load balancing metric-based for multiple discussed and we are saying that with choosing a routing structure multi path and selecting suitable metric in a routing protocol can improve network performance.

KEYWORDS: Mobile ad hoc networks, routing, load balancing, congestion.

1. INTRODUCTION

Ad hoc mobile networks (MANETs) have limited communication band width and range than other wireless networks. Routing is one of the most challenging aspects of Mobile Ad hoc Networks and all of the limitations associated with the dynamic topology, adding to the complexity of routing in mobile ad hoc networks. Low bandwidth devices in MANET means that there is high probability of network congestion and necessary measures should be taken to avoid congestion. Over the years, many routing protocols for MANET is proposed with emphasis on load balancing.

The main objective of load balancing protocols is to divert traffic data from paths and nodes that currently exist in the congestion. If there is no load balancing mechanism it cause that increases will be delayed. With solutions suitable for Transfer traffic load on routes where there is less congestion power and time delay can be reduced. Thus the traffic distribution cause to reduce congestion and delays and will increase the delivery rate. Several Ad hoc routing protocols use the number hop, and the choice of single-path structure, such as DSR and AODV Trying to choose the appropriate direction from the source to the destination.

Choosing a routing structure multi path, special importance for routing and also taking into account node and link with the appropriate metric can improve network performance. This study investigates the load balancing routing protocols taking into account various metrics, and We expressed by choosing a multi path routing and chosen Metric multiple for nodes and links can selected stable routes.

2. Congestion and the Need to Load Balancing

Ad hoc mobile networks (MANETs) have limited communication bandwidth and range than other wireless networks. MANET routing is one of the most challenging aspects of and all these constraints with dynamic network topology, routing in MANET is to add complexity. Low bandwidth devices in MANET means that there is high probability of network congestion when congestion occurs, appropriate measures should be taken to avoid congestion. Over the years, many routing protocols for MANET is proposed with emphasis on load balancing [7] [8].

The main goal of the protocol, load balance has to divert traffic from congested paths and nodes that currently exist in or larger amounts of data in transit from them to other nodes or other host route. If there is no load balancing mechanism increases will be delayed. Suitable for transmission to solve the traffic congestion on routes where there are relatively fewer total throughput and reduced latency generally increases traffic congestion, Including packet loss rate, end-to-end delay and battery power consumption. This motivated the study of load balancing routing protocol is much [9] [10] [11] to disperse the crowd by choosing the appropriate path by the routing stage.

Several routing protocols Ad hoc use of the route as a routing metric. Although it is intuitive and simple, we did not consider the link capacity. Most of routing protocols try to avoid congestion on routes and consider a metric to measure and calculate the amount of congestion on the routes and the nodes are between source and destination pairs. Values can be achieved by using the proper distribution of the load of different trails less crowded it is done.

3. Comparison of Multi-Path and Single-Path routing

There are different criteria for Comparison single-path routing and multi-path routing in Ad hoc networks. First, the overhead of route discovery in multi-path routing is much more than single-path routing. On the other hand, the frequency

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of route discovery in a network that uses multi-path routing, is so less. Even if one or a small number of multi-path between pairs of source and destination fails, the network can still operate.

Second, there is much debate over the use of multi-path routing that will result in higher throughput. The reason is that all the nodes of fixed capacity (limit) is assumed (bandwidth and processing power) because routing of multi- path could have better load distribution, so total power will be higher.

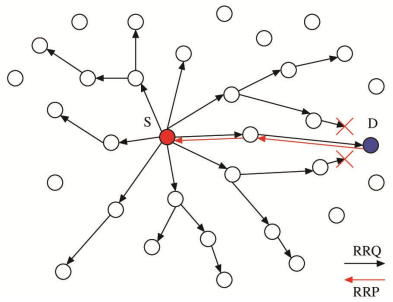

Fig. 1. Route discovery in single- path routing mechanism

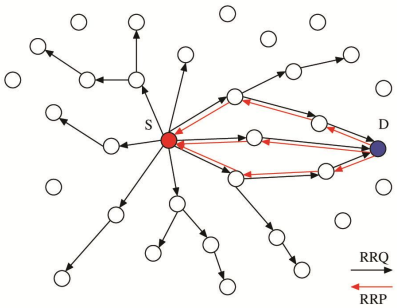

Fig. 2. Routediscovery in multi- path routing mechanism

4.Protocol Classifying Based on the Load Balancing

Over the years, many routing protocols have been proposed Ad hoc load balancing. Most methods of application protocols that are based on load balancing strategies are combined with the route discovery [12].Low load path, which is usually chosen, may be from source to destination.

4.1. Based delay

To prevent node where load balancing is achieved by Delay the link above.

4.2. Based traffic

That balances the traffic load evenly distributed among the nodes in the network are obtained.

4.3. Based combination

The balance of time Delay Based traffic the combination of and traffic characteristics are obtained.

5. Metric Load

Metric term load bustle of the first node to receive and send packets over the wireless media. Also, the processing power and memory bandwidth per node. Reactive protocols find a path to the destination only when the resource is requested, No explicit routing information is maintained. Previous Ad hoc many protocols, including those that are active and reactive. Select the number of "hop" to the destination node as the basic metric you look at. Each of the shortest path routing protocols to select a suitable metric (number of hop), battery capacity, congestion (size traffic load) and to balance the load direction estimations are used in routing to send packets [12].

6. The Structure of Load Balancing Routing Protocols

Structure of most of routing protocols is AODV and DSR routing protocol. Routing protocols load balance by considering a suitable structure try to improve performance and suitable load distribution among network nodes. Usually shift inherently routing network and node mobility in mobile networks makes it difficult. Using appropriate routing, thereby transmit and adjust the load on multi-path and congestion control instead of selecting a suitable structure is important.

7. Traffic-Oriented Load Balancing Routing Protocols

In this part, routing protocol traffic load balance oriented Comparative study put.

7.1. Based delay

Protocol MP-QMRB [13] (multi-path routing backbone) provides support for quality of service and traffic congestion control according to the level of the nodes. These protocols use intermediate nodes with communication and processing capabilities for better and more effectively participate in the routing process are used. The protocol guarantees that the

bandwidth of the network for distributed evenly for better load balancing and congestion control provides. Protocol MP-QMRB, multi-path routing protocol AOMDV QMRB single-path and protocol are combined.

7.2. Multiple metric based load balancing routing protocols

The protocol MM-AOMDV [14] (different metrics), a new method of traffic characteristics by taking three parameters load the channel, access contention, the remaining energy of a node in the path selection decision is affirmed. The Channel routing protocol with low productivity leading to better efficiency and sustainability of the network will be created. These protocols select routes with low efficiency Channel and Lower collision rate per node, select the node that has a long life with regard to energy, the band insists. MM-AOMDV channel access and collision rates are measured in order to estimate the load. Each node in Channel availability and the rates for period of Radio monitoring the media tries.

7.3. Routing protocols for load balancing in distributed real-times traffic

Algorithm DLBR [15] (distributed load balancing routing protocol), fee-based traffic load on the links is calculated. In this protocol, dynamic traffic and multimedia traffic can be categorized into normal traffic. Routing multimedia traffic with high priority and low priority traffic is normal.

High priority traffic links are selected with lighter loads, in addition, can also be the source of the high priority traffic and the low priority traffic is shared. The routing protocol over a link loads paths can be considered, With regard to the link below to a link with heavy loads better load balancing can be applied in the routing process. In this protocol, the Class 1 and Class 2 traffic flows can be classified depending on their priority. The real-time traffic with high priority class 1 and class 2 traffic flows has been considered the normal low priority.

7.4. Routing mechanism for load balancing

The mechanisms LBRM [16] (load balancing routing mechanism) design suitable for load balancing and traffic distribution based on three metrics The remaining battery capacity, weight values and the average number of hops along the length of the interface queue to be affirmed. Fixed or adaptive weights to these parameters over the network. The proposed protocol path among all possible paths for each route is selected based on the calculated weight In the directions above for distributing the weight of traffic. In the first plan routes using the remaining battery capacity is less than the design values to give greater weight to the weight in the direction Find short routes and less congestion during the initial route discovery process. In the third proposal is to limit the broadcast RREQ packets.

7.5. A multi-path load balancing method using Fibonacci series

Protocol FMLB [17] (Fibonacci series) distributes data packets over different paths through the nodes using the Fibonacci sequence. The task is to balance FMLB protocol packets transmitted along the selected routes, and tracks the number of steps of this sort. To show FMLB protocols assume that we have 5 different paths between the source and destination are, Where the paths of decreasing the length of each track are sorted first so the longest path and the shortest route will be the fifth. For each of the five designated routes and rates, packages distributed the Fibonacci levels are calculated. The general rule is that if this protocol FMLB K path exists and the number of hops they are arranged in order of weight values:

Fibonacci (K), Fibonacci(K-1), Fibonacci(K-2), …, Fibonacci(2), Fibonacci(1)

7.6. Load balancing routing scheme

In this algorithm FDAR [18] (Routing degrees of freedom), a new metric is proposed, which is called the nodal degrees of freedom. This protocol for delivery of data packets and bypass congested routes and considered to be crowded. The basic structure of the protocol is similar to DSR. The protocol is a reactive protocol of the traffic-oriented. The availability of the nodes according to the communication activity is defined as FD (degrees of freedom) node i is given by the following equation:

$$\phi(i) \stackrel{def}{\equiv} \frac{\alpha_i}{(\beta_i)^2} \quad (1)$$

α_i Represents the transmission rate of and β_i Indicates rates are on.

In This protocol, each node in the time interval T, Rate data their send and receive updates according to the Exponential Moving Average weight method (EWMA) is as follows:

$$\begin{cases} \alpha_i \leftarrow w \times \alpha_i + (1-w) \times \tilde{\alpha}_i \\ b_i \leftarrow w \times \beta_i + (1-w) \times \tilde{\beta}_i \end{cases} \quad (2)$$

Where the weight W, which is always 0 <W <1, $\tilde{\beta}_i$ and $\tilde{\alpha}_i$ are current values α_i and β_i. At this plan rates in conditions of the number of bytes instead of packets was measured. Specifically α_i value is calculated as follows.

$$\tilde{\alpha} = \frac{1}{T} \times (\alpha_{data} + h \times \alpha_{head}) \quad (3)$$

α_{data} Represents the amount of data transmitted during T and α_{head} The number of frames taken through the T and h header frame size (in bytes) is.

7.7. Reliable and efficient load balancing routing protocol

This protocol RELBR [19] (reliable, efficient routing, load balancing), a reliable and efficient technique based on protocol (DSR) is proposed. during course of this protocol, traffic load, energy levels and freshness to any given path and then the path is stored in the cache, Based on the combined weight of the paths are arranged. The best routes based on their combined weight of the selected paths is selected. Then traffic during these routes are distributed using a variety of network coding. route cache updates, and minimum weight functions can be removed from the list. Estimated combined weight function (CWF) by using received signal strength metric, path length, traffic load and the residual energy is calculated.

7.8. Using node disjoint multiple routes for load balancing

This protocol MNDP [20] (multiple node disjoint paths) in different ways to identify and distribute data packets during This route. Identify and assign priority values to different paths based on the number of paths hop and the shortest path from among the many possible routes. this protocol uses metric number of hop, based on the comparison protocol (AODV) is emphasized. This data transfer protocol packets on the paths according to the priority assigned to them. Beck priority of route routes used (MAX-Routes) and counting the number of hop depends.

7.9. Response to a single route routing protocol with load balancing

Protocol AODV-B [21] (reactive routing protocol for single rout) optimized routing protocol (AODV) with load balancing. The aim of offering a better distribution of traffic on different network nodes. This protocol uses route request packet (RREQ) a new metric that allows a node to choose the shortest path is less loaded, use:

$$\text{Min } 1/n \sum \text{nbr\_of}_{\text{flow}}(i) \qquad (4)$$

nbr_of_flow (i) I represents the number of flows through a group involved in the n, N is the number of hop.

7.10. Ant-based algorithms for load balancing in mobile ad hoc networks

A new family of algorithms inspired by the swarm intelligence for optimization of the routing path, there is load distribution. AALB [22] an ant routing algorithm based on this method to ensure proper load balance in mobile networks using AODV Ad hoc ant colony optimization and meta-heuristics have been proposed. This algorithm is most efficient routes for the transmission of packets from source to destination is selected.

7.11. A comparative study of routing traffic oriented

A comparative study of routing protocols in this section are paid based on the traffic-oriented.

Table 1. Compares the delay-oriented load balancing routing protocols

Parameters	MP-QMRB	MM-AOMDV	DLBR	LBRM	FMLB	FDAR	RELBR	MNDP	AODV-B	AALB
Routing path	Single& Multi path	Multi path	Multi path	Single path	MultiPath	Single path	Single path	Multi path	Single path	Single path
Category	ActivePath	Channel access Probability	TrafficSize	ActivePath	TrafficSize	Trafficsize	TrafficSize	TrafficSize	Trafficsize	Packet Interface queue
Traditional protocol used	QMRB – AOMDV	AOMDV	AODV	AODV	AODV	DSR	DSR	AODV	AODV	AODV
Neighboring load	No	No	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes
Load balancing used	Node	Node	Link	Node	Link	Node	Node	Node	Node	Node
Interface queue	No	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes
Metric used	Intermediate nodes	Channel access contentions and remaining energy and channel load	Traffic Load	Weight values for each path	Hop count	Free degree Adaptive Routing	combined weighted function	Path count And Hop count	Shorter route	Collective Intelligence
Routing structure	Reactive	Reactive	Reactive	Reactive	Reactive	Reactive	Reactive	Reactive	Reactive	Reactive
Load balancing effect	Intermediate nodes	Network	Network	Network	Network	Network	Network	Network	Network	Network
Complexity of capturing load	High	High	High	High	Low	High	High	Low	High	Low
Consideration load balancing	Destination Based	Destination Based	Destination Based	Destination Based	Source Based	Destination Based	Destination Based	Source Based	Destination Based	Source Based

8. DISCUSSION

Most of routing protocols for load balancing routing with creating better structure try to appropriate distribution in the load created. Many of routing protocols using number hop consider as the basic metric. Any of routing protocols selects an appropriate metric including shortest path (hopnumber), battery throughput capacity, congestion (size of traffic load) and etc., the direction routing packets used to estimate the load balance. Traffic load as a metric can be considered as a good choice for balancing. To consider the link and node, and selection of multiple metrics such as bandwidth capacity and battery throughput capacity etc., can increase network performance.

Most of load balancing routing protocols by choosing a single path routing protocol AODV and DSR can be considered as routing structure. Therefore, selecting multi path routing structure Such as AOMDV and considering the appropriate metric and Calculate this metric, Choice of routes for sending packets from the destination or source is carried out. That this depends on routing structure and metric calculation. Thus, taking into account that metrics like traffic load, energy remains for nodes and calculate bandwidth for links by selecting AOMDV multi path routing, we can consider routing with the better load balance.

9. Conclusion

Route discovery with the proper distribution of the load on the paths is important. How to choose the appropriate metric and considering the traffic load for Route selection can provide better load balancing for the network. Multi-path routing mechanism can provide better load distribution by selecting multiple paths with high throughput for network. Multiple metrics chosen should be a manner that all aspects of a network, whether self-nodes, neighboring nodes or other route to consider. Most of load balancing routing protocols choose the appropriate metric taken into consideration in order to choose a path to high performance. Most structure of the traffic-oriented routing protocols, DSR and AODV is the traditional protocol. So we consider traffic-oriented load balancing routing protocol based on multiple metrics have been studied. In addition, expressed choosing multiple metrics considering the traffic load and use a multi-path routing can improve network performance.

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