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Multipath Routing in Fast Moving Mobile Adhoc Network

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Abstract ***The explore the problem of improving the reliability of packet transmissions in MANETs . Unlike existing solutions that address individual causes leading to packet losses in MANET it proposed routing protocol handles all causes - transmission failures, link failures, and network congestion – in holistic way. Specially it takes advantage of broadcasting nature of wireless communication and accommodates sender-receiver joint-decision-making mechanism with a timer-triggered retransmission for opportunistic routing simulation results demonstrate that the new holistic routing protocol significantly improves the packet delivery ratio over AODV, DSDV in major MANET application scenarios. For example, by using the proposed holistic routing protocol, more than 90% of data packets can be successfully delivered in a MANET when the maximum moving speed of nodes is 50 m/s and the loss rate for each link is 20%.***

Keywords: MANET, Multipath routing, energy consumption, AODV

1. Introduction

Recently laptop computers have replaced desktops with all respect as they continue to show improvements in convenience, mobility, capacity and availability of disk storage. Now small computers can be equipped with storage capacity of Gigabytes, high resolution color display, pointing devices and wireless communication adapters. Since, these small computer can be operated with the power of battery, the user are free to move as per their convenience without bothering about constraints with respect to wired devices.

In a wireless ad hoc network, the devices communicate with each other using a wireless physical medium without relying on pre-existing wired infrastructure. That's why ad hoc network is also known as infrastructure less network. These networks are also known as mobile ad hoc networks (MANETs), can form stand-alone groups of wireless terminals, but some of these may be connected to some fixed network. A very fundamental characteristic of ad hoc networks is that they are able to configure

themselves on-the-fly without intervention of a centralized administration. The terminals in the ad hoc network can not only act as end-system but also as an intermediate system (routers). It is possible for two nodes which are not in the communication range of each other, but still can send and receive data from each other with the help of intermediate nodes which can act as routers. This functionality gives another name to ad hoc network as "multi-hop wireless network" [7].

The major characteristics which distinguish an ad hoc network from a cellular network is the adaptability to changing traffic demand and physical conditions. Also since the attenuation characteristics of wireless media are nonlinear, energy efficiency will be potentially superior and the increased spatial reuse will yield superior capacity and thus spectral efficiency. These characteristics make ad hoc networks attractive for pervasive communications, a concept that is tightly linked to heterogeneous networks and 4G architectures.

Depending on their communication range, wireless ad hoc networks can be classified into Body (BAN), Personal (PAN) and Wireless Local (WLAN) Area Networks. A BAN is a set of wearable devices that have a communication range of about 2 m. The second type, PANs, refers to the communication between different BANs and between BAN and its immediate surroundings (within approximately 10 m). WLANs have. The main communication ranges of the other of hundreds of meters existing technology for implementing BANs and PANs is Bluetooth, while for WLANs the main option is the family of standards IEEE 802.11. Although ad hoc networks are not restricted to these technologies, most of the current research assumes Bluetooth or IEEE 802.11 to be the underlying technologies

The most active area of concern and research field in ad hoc networking is routing. In recent works the objective of routing algorithm to minimizing the number of hops has been taken over by the optimization of multiple parameters, such as packet error rate over the route, energy consumption, network survivability, routing overhead, route setup and repair speed, possibility of establishing parallel routes, etc. Since the advent of Defense Advanced Research Project Agency (DARPA) packet radio network in the early 1970s, a number of protocols have been developed for ad hoc mobile networks. The proposed protocols are intended to deal with the typical limitation of ad hoc networks like high power consumption, low bandwidth and high error rates. The existing protocols can be broadly categorized into 2 types; Table-driven (proactive) and Demand-driven (reactive).

Table-driven routing protocols attempted to maintain consistent, up-to-date routing information from each node to every other node in the network. These protocols require each node to maintain one or more table to store their routing information, and they respond to changes in network topology by propagating updates throughout the network in order to maintain a consistent network view. The areas in which they differ are the number of necessary routing tables and the method by which changes in the network structure are broadcast. Some examples are DSDV (Destination-Sequenced Distance-Vector Routing), CGSR (Cluster-head Gateway Switch Routing), WRP (Wireless routing protocol), etc.

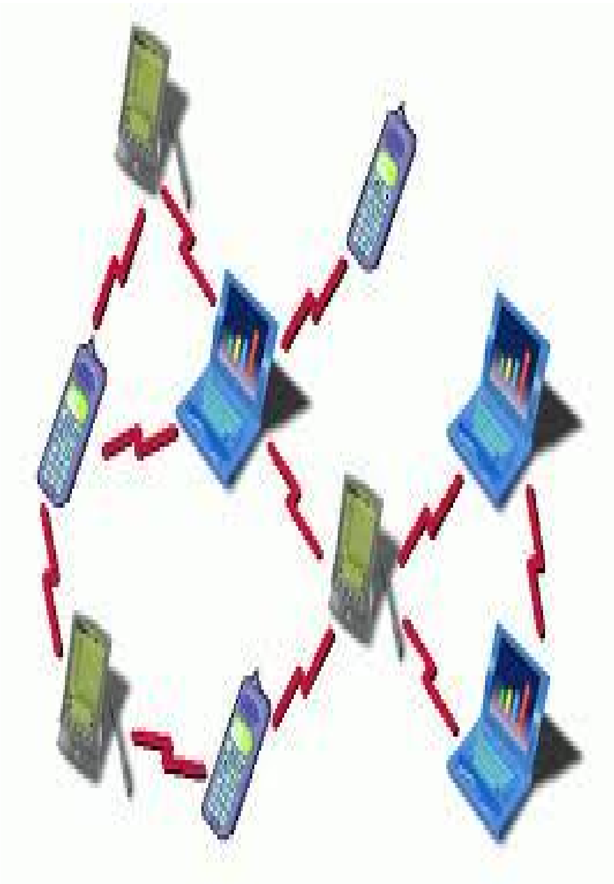

Figure 1: MANET

2. MULTIPATH

Due to limited transmission range of wireless network nodes, multiple hops are usually needed for a node to exchange information with any other node in the network. Thus routing is a crucial issue in the design of MANET. On-demand routing protocols for mobile ad hoc networks discover and maintain only the needed routes to reduce routing overheads. They use a flood-based discovery mechanism to find routes when required. Since each route discovery incurs high overhead and latency, the frequency of route discoveries must be kept low for on-demand protocols to be effective. The wide availability of wireless devices requires the routing protocol should be scalable. But, as the size of the network increases the on-demand routing protocols produce poor performance due to large routing overhead generated while repairing route breaks. The proposed multipath routing scheme provides better performance and scalability by computing multiple routes in a single route discovery. Also, it reduces the routing overhead by using secondary paths. This scheme computes combination of the node-disjoint path and fail-safe paths for multiple routes and provides all the intermediate nodes of the primary path with multiple routes to destination.[1].

To send data from a source to destination, a path has to be found before hand. If a single path is established, sending all the traffic on it will deplete all the nodes faster. Also, in case of path failure, alternate path acts as a backup path. Thus, establishing multiple paths aids not only in traffic engineering but also prevents faster network degradation[2].

3. AODV

AODV is a reactive protocol that discovers routes on an as needed basis using a route discovery mechanism. It uses traditional routing tables with one entry per destination. Without using source routing, AODV relies on its routing table entries to propagate an RREP (Route Reply) back to the source and also to route data packets to the destination. AODV uses sequence numbers maintained at each destination to determine freshness of routing information and to prevent routing loops . All routing packets carry these sequence numbers. AODV maintains timer-based states in each node, for utilization of individual routing table entries, whereby older unused entries are removed from the table. Predecessor node sets are maintained for each routing table entry, indicating the neighboring nodes sets which use that entry to route packets. These nodes are notified with RERR (Route Error) packets when the next-hop link breaks. This packet gets forwarded by each predecessor node to its predecessors, effectively erasing all routes using the broken link. Route error propagation in AODV can be visualized conceptually as a tree whose root is the node at the point of failure and all sources using the failed link as the leaves. The advantages of AODV are that less memory space is required as information of only active routes are maintained, in turn increasing the performance, while the disadvantage is that this protocol is not scalable and in large networks it does not perform well and does not support asymmetric links.

4. AOMDV

Ad-hoc On-demand Multipath Distance Vector Routing (AOMDV) protocol is an extension to the AODV protocol for computing multiple loop-free and link-disjoint paths. The routing entries for each destination contain a list of the next-hops along with the corresponding hop counts. All the next hops have the same sequence number. This helps in keeping track of a route. For each destination, a node maintains the advertised hop count, which is defined as the maximum hop count for all the paths, which is used for sending route advertisements of the destination. Each duplicate route advertisement received by a node defines an alternate path to the destination.

Loop freedom is assured for a node by accepting alternate paths to destination if it has a less hop count than the advertised hop count for that destination. Because the maximum hop count is used, the advertised hop count therefore does not change for the same sequence number. When a route advertisement is received for a destination with a greater sequence number, the next-hop list and the advertised hop count are reinitialized. AOMDV can be used to find node-disjoint or link-disjoint routes

5. IMPEMENTATION DESIGN

NS-2 is chosen as the simulation tool among the others simulation tools because NS-2 supports networking research and education. Ns-2 is suitable for designing new protocols, comparing different protocols and traffic evaluations.

Run the simulation in Network Simulator (NS-2) accepts as input a scenario file that describes the exact motion of each node and the exact packets originated by each node, together with the exact time at which each change in motion or packet origination is to occur. The detailed trace file created by each run is stored to disk, and analyzed using a variety of scripts, particularly one called file *.tr that counts the number of packets successfully delivered and the length of the paths taken by the packets, as well as additional information about the internal functioning of each scripts executed. This data is further analyzed with AWK file and Microsoft Excel or Xgraph to produce the graphs.

5.1 The simulation parameters are as follows:

- Number of nodes: 30(maximum connections 12) and 40(maximum connections 20) and 50(maximum connections 20) respectively;
- Node mobility speed(m/s): 20, 30, 50, 60, 80 respectively;
- Area: 1000m x 1000m;
- Mobility model: random way point model (when the node reaches its destination, it pauses for several seconds, e.g., 2s, then randomly chooses another destination point within the field, with a randomly selected constant velocity);
- Pause time: 2 seconds;
- Traffic load: Constant Bit Rate;
- Simulation Time: 200 seconds;

To evaluate performance of EN-AODV with that of AODV protocol, we compare them using three metrics:

- Packet Delivery Ratio
- Normalized Routing Load
- Throughput

- **Normalized Routing Load (NRL)**

- NRL is the ratio of routing packets by received packet
  NRL = (routing packets / received packets) *100
- **Packet Delivery Ratio (PDR)**

  PDR is the ratio of received packets by sent packets.

  PDR = (received packet / sent packets) *100

- **Throughput**

  Throughput is the rate at which a network sends receives data. It is a good channel capacity of net connections and rated in terms bits per second (bit/s).

  Throughput, $T_P = P_a / P_f$,

  where P_a is the packets received and P_f is the amount of forwarded packets over certain time interval.

Table 1: Simulation Results

30 Nodes						
Mobility of node (m/s)	**NRL**		**PDR**		**Throughput**	
	AODV	EN_AOMDV	AODV	EN_AOMDV	AODV	EN_AOMDV
20	.87	52.91	89.88	90.78	15.68	27.92
30	3.84	53.69	92.59	96.52	18.73	28.33
50	2.82	60.76	91.67	95.74	17.29	28.05
60	17.33	63.33	50	60	31.59	35.33
80	25.33	65.57	78.72	88.52	33.78	38.71
40 Nodes						
20	4.3	68.91	45.57	88.52	17.72	22.52
30	17.6	76.85	55.56	95.89	17.82	22.95
50	23.68	80.49	60.74	94.83	17.96	23.87
60	21.5	89.38	66.67	83.87	18.66	24.54
80	26.33	92.5	78.87	90.91	19.97	27.77
50 Nodes						
20	3.5	105.08	94.12	95.12	19.59	20.04
30	4	106.81	81.25	89.29	17.29	24.36
50	5.58	104.33	98.79	108.08	25.68	32.84
60	6	111.14	90	102.04	21.15	23.78
80	9.17	114.81	85.71	97.88	21.64	24.88

6. CONCLUSION

The work is proposed in direction of multipath routing. The proposed work is focused on implementation of path hopping using the available multi paths in catch of routing table. The work is also extended after analyzing the effects for fast moving nodes.

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