

A Study of Wireless Ad-hoc Network Protocol using Composite Routing Distance Algorithm

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Abstract - A wireless ad-hoc network is a collection of transceiver equipment with many nodes forming a temporary autonomous network. It has no fixed infrastructure or topological structure and is changeable, not completely open channel. In such networks node malicious behavior is difficult to control, leading to network instability and other shortcomings and, compared to the traditional networks and routing protocols, it is easy to be affected by a variety of attacks. Based on a distance related composite routing node localization algorithm, NS2 (Network Simulator-2) open simulation software was used to design and simulate the network. Finally we discuss the design of a hybrid routing protocol with high security.

Keywords - the wireless route, distance network, ad hoc network, hybrid protocol

I. INTRODUCTION

Technology promotes work on network and communication protocols to the development of globalization, to guarantee information exchange at any time, any place. Having a fixed infrastructure, mobile communication has been widely used, but this cannot use the network in the region had no infrastructure or infrastructure has been destroyed. In order to meet the social demand for ubiquitous mobile communications, wireless communications network has made leaps and bounds, and has become an important part of the global communications network, a wireless communication network to free people from the constraints of a fixed communication lines to better meet social personality of communication needs. Due to the special nature of wireless ad hoc network application environment and application conditions, the routing protocol must be a high degree of robustness and adaptability to adapt to the complex and changing environment and changing the network structure.

The wireless MANET routing protocol can be divided into table-driven (Table-driven) routing protocol, on-demand (On-demand) routing protocol categories. Table-driven routing protocols (Table-driven Routing Protocol), also known as the first should be the type of routing protocol. The first should be based routing protocol routing similar strategy with the traditional routing protocols, nodes periodically broadcast routing information packets to exchange routing information, and take the initiative to find the route. When the network topology changes detected, the node sends routing update messages received routing update messages node will update its own routing table, in order to ensure consistency, timeliness and accuracy of routing

information. Typical first wireless mobile routing protocols: OLSR (Optimized Link State Routing), DSDV (Destination Sequenced Distance Vector), WRP (Wireless Routing Protocol), STAR (Source Tree Adaptive Routing). Demand routing protocols (On-demand Routing Protocol), also known as reactive (Reactive) routing protocol, when need only find the route selection method. Node does not save the timely and accurate routing information. Source node when the source node to the destination node sends packets through the network launched routing lookup process, find the appropriate route, began sending packets, in order to improve efficiency, routing node can be found stored in the cache for follow-up sends use. On-demand routing found by the route (Route Discovery) and route maintenance (Route Maintenance) composed of two parts. Its advantage is that the routing information do not need to be periodically broadcast, saving a certain amount of network resources. The disadvantage is that when sending data packets, if there is no route, the data packet destined for the destination node to the delay caused by waiting for route discovery. The typical reaction of wireless mobile routing protocols: AODV (MANET On-demand Distance Vector), DSR (Dynamic Source Routing), TORA (Temporally Ordered the Routing Algorithm). MANET network routing protocol does not provide the security mechanism, the security issue has also become one of the hot research. So far, the researchers at home and abroad, many improved routing security protocol, summed up, roughly following: SEAD, Adriane, DSDV, DSR, GLS, GHLS etc.. But these routing protocols are the application characteristics, does not apply to all mobile ad hoc networks. This study is mainly used in large and complex mobile ad hoc networks, the existing routing protocols in this perspective, we especially VHLS agreement were

related improvements suitable for our application.

Wireless ad hoc networks using multi-hop networking mode, the routing protocol is an important part of an integral part of the wireless ad hoc network architecture. Wireless ad hoc network problem is the current hot and difficult to study. Radio channel quality of wireless ad hoc networking influenced by the environment, nodes can move freely, the independent join or leave the network, the plus node Sleep, node failure and other factors, making wireless ad hoc network topology dynamic changes constantly. With global wireless ad hoc network topology changes, frequent changes. Traditional Internet routing protocols for MANET directly, will lead to a series of questions. The dynamic nature of the network topology MANET important difference between the fixed internet. The routing protocols to topology changes with rapid response capability, convergence can quickly calculate routes, avoid unreachable destination node. Wireless ad hoc network to the limited bandwidth of wireless transmission network topology dynamically changes, the routing control packet transmission inevitably consume some bandwidth resources. The faster the topology changes, the greater routing control overhead. In order to more efficient use of valuable bandwidth resources, the need to minimize the routing control overhead. The loop will cause data forwarding error, wasting a lot of bandwidth resources. In wireless ad hoc networks, due to the dynamic changes in the topology will lead to a large number of existing routing information in a short period of time set aside, and thus more prone to routing loops. Traditional Internet routing protocols choose the best route, do not consider node energy consumption problem. The energy consumption is the primary objective of the wireless sensor network routing protocol design. Wireless sensor network node energy is limited, and generally do not have the energy to supplement, routing protocols need to consider the problem of node energy consumption and network energy balanced use as much as possible to extend the lifetime of the whole network. The wireless mobile terminal or the sensor, CPU performance, memory size, and external storage capacity is far lower than the fixed wired terminal, central control node. MANET nodes with limited storage resources and computing resources, the node can not be too complex route calculation. Node can only obtain the local topology information and limited resources, the route calculation is simple, easy to implement. Early studies proposed wireless ad hoc network is supported by the agreement only to small and medium-sized network of dozens to hundreds of nodes.

II. DETERMINATION OF EACH LAYER CENTER POSITION COORDINATE

Wireless ad hoc network routing protocol can be divided roughly for table driven routing protocol (Table-

driven), on-demand routing protocol (On-demand) two[1]. Table driven routing protocol (Table-driven Routing Protocol), also known is proactive routing protocol. It is based on routing table routing protocol. Proactive routing protocol routing discovery strategy and traditional routing protocol is similar, nodes through periodic broadcast routing information packet, to exchange routing information, take the initiative to find a route. When network topology changes, node sends a route update message is received, a routing update message node will update its routing table routing information, in order to ensure the consistency, accuracy and timeliness [2-6]. Wireless ad hoc network using multi-hop forwarding network, routing protocol in wireless ad hoc network architecture is an important part in the [7]. Wireless ad hoc network routing problem is current research hotspot and difficulty. Ad hoc wireless channel quality influenced by the environment, the node can move freely, independent join and leave the network, and node dormancy, node failure and other factors, makes wireless ad hoc networks topology in dynamic changes. Wireless ad hoc network topology change is global change frequently, etc.. Traditional Internet routing protocol for wireless ad hoc networks directly, will cause a series of problems [7-9]. Wireless ad hoc network positioning can be divided into two categories, node autonomous localization and external target positioning. The former is based on the known location of the node, in accordance with a positioning mechanism (distance or a distance determining node position). The latter is to rely on external goals of providing information and find the relative position information.

[1] Among the classification of routing protocols routing protocol is based on location with respect to a direction based routing protocols. Low cost GPS receivers become possible with the development of GPS technology, the mobile node, the node can know its own location. Based on this, many researchers have proposed using the position information of the routing protocol. This type of protocol has better scalability and better adaptability of the network changes. Location-based routing protocol basically consists of two phases, search, access to the location of the sink; packet forwarding. Location-based routing protocols, nodes obtain their own location via GPS and other location services to get the location of the destination node. The location of the neighbor nodes by hop broadcast acquisition, which is maintenance protocol neighbor information. Nodes participate in location-based services, location-based services can be divided into a section node to participate in the location-based services, and all nodes participating location services. According to each location server maintains the location information can be divided into the part of the node position "and" all node location. Two together, and location-based services can be divided into partial node participation part of the node location

services, some nodes all nodes involved in location-based services, part of the node, all nodes involved in location-based services, the participation of all nodes the location of all nodes of four. Know the position of their own and other nodes, the nodes will be able to forward packets. Packet forwarding strategy can be divided into greedy packet forwarding. Nodes will forward packets to a neighbor near the sink direction; the choice of the neighbor nodes depends on the optimization criterion of the algorithm. , Limited to flooding. Nodes will forward packets to the multiple hop neighbors near the sink direction, the hierarchical packet forwarding. Node forwards the packets to accommodate the expansion of the network size three-level organizations. The location service is the basis of the location-based routing protocols. Currently centralized location service, four location-based services for distributed location services, grid position and hierarchical location services were researched. Centralized location service: a centralized location service network all nodes to interact were done with the location server to update their location information, or to obtain location information of other nodes. This type of location-based services so that the network produces a hot, some impact on the location of the hot spot will give service robustness. Distributed location service: service in this position of each node maintains a location library; location library contains the location information of all nodes in the network. The contents of the location database entries node identification, with respect to the junction. Direction and distance, and entries generated time. Location library to be updated each node through flooded position packets to other nodes. And each "position" and the packets further comprises a time to live TTL field, and the transmission distance for control packets. This library to update the location of each node by flooding position packets is the basic idea of the fully distributed location services. The different protocols specific strategies were researched. Location services in some routing protocols that exist between nodes farther distance effect refers to the distance of two nodes, the smaller each other relative mobility; It also believes that the mobile node has autonomy, referring knot the updated trigger point position is only dependent on the rate of movement of the mobile node. So, in their packets, the TTL value low packet to send high frequency; In addition, according to the autonomy of the mobile node, these routing protocols based on the rate of movement to dynamically adjust more frequency. At the the raster location service, the network is divided into a grid. The grid is defined as the order of the smallest grid for 1 the n bands raster order raster of $(n + 1) \frac{1}{4}$. A junction of its location information is distributed to the plurality of servers is stored in the network. Location server is not specified, but according to a certain algorithm choices, which avoids the Design and Implementation of server election protocol. The

realizations of the grid location services mainly include the following aspects: the choice of the location server GLS through a hash function, the only node named mapped to a globally unique ID. And define a node of the "closest node" minimum ID is greater than the ID of the node corresponding to the node. HELLO packets a node A in the raster of each order has a location server, and the location server is the closest node in the bands raster A junction; location update, each node 2 hops limited Man broadcast. HELLO packets include all nodes ID, position, moving average speed, the ID and location of a neighbor. In this way, the node is learned that the two-hop neighbors within a node ID and location information changes. Each node by sending UPDATE messages to update their location information to its location server. In the actual process UPDATE messages by the nodes in order grid node closest stepwise outward position query: GLS location server selection algorithm to ensure that the location selected by the query server and location update forwarding; the selection of the server is the same. Hierarchical location services network into each other alternately area. The region is determined at the design stage, not dynamic, the size of the region depends on various factors, such as node mobility, junction density, transmission power and a radio wave propagation characteristics. Of course, this division can be a simple geographical. Location services in some routing protocols network topology is divided into two, the node-level, regional level. Hierarchical link-state routing protocol, each node supports two types of control packets, node link-state packets and regional link state packets. These routing protocols including all neighbors of node First broadcast in the region. Include both the connection region by the node ID list, and the method of flooding the whole network broadcast. Two packets node maintains two routing table, a regional routing table, created through the short-circuited by the protocol to find the routing table. Know the location of the destination node, the current node location forwarding, forwarding delay relative to the passive-demand routing protocols; does not need to maintain routing tables stateless. Maintain routing tables because they do not exist, so the location-based routing protocol is a stateless routing protocol, it has good scalability can adapt to large-scale networks, more suitable for frequent network topology changes.

III. ANALYSIS OF INCLINATION

Based on the distance and distance independent node positioning algorithm for the basic principles including four specific ways were researched. In the choice of the reference node, a node from the adjacent reference node there to obtain reference information, when it acquired a series of reference node information, it will use a method of classification and sort these reference node. The reference node to show their surplus value, node selection

minimum residual value reference nodes in the next level application algorithm were researched. For a coordinate is X, Y, Z node residual value is defined as. Its surplus value equal to the points to each reference node and the reference node distance standard coverage of the square of the difference. In other words, surplus value is the reference node to calculate the distance of the node and the reference node radius in the range of different area of the sum of. Originally from the reference node to consider, surplus value should be close to 0. Composite type distance measuring, when the node selection in a series of reference node, it will be collected from each reference node distance. For some of the measurement techniques, when a node receives a message from the reference node, it needs some location information should be included in the reference node information. For a precise measurement technique, node can collect a series of sample information, until the sample information change tends to 0. The node that can use the information of sample, i.e. the distance between node and the reference node; the reference node provides message sample is not stable. Position estimation, when a node is estimated it to the reference node distance, its position can also be estimated using this method, the use of linear equation and Taylor series. This method based on Taylor expansion formula of nonlinear equations, linear equations. Through linear iteration to get the parameters were researched. But unfortunately, in some cases, this method will produce great error, results of vibration greatly. Many kinds of techniques are used, to reduce the occurrence of such a situation. Carefully choose the start of system parameters. The use of acceptable parameters, so, can make the system to a static balance. Loop phase, if a node to obtain a reasonable position of budget, it can in the agreement as a new reference node, the node need most now is through the reference node limits. Therefore, a large part of node position well budget, only more accurately the position of the node budget, so, we can expand the coverage of network, and can avoid the error produced, large. New reference node increases both the known the exact position of the node number, at the same time, improve the position accuracy of budgeting. By this method, continuous accurate budget out of some node position, these already know the precise location of the nodes in the network and can be used as a reference node. Thus, through continuous circulation can get most of the precise location of network nodes, in the application of wireless sensor network will play an important role. The above is we are prepared using composite node localization technology basic principle.

[2] Based on the blind search and blind positioning combined routing algorithm basic principle relates to many aspects, this article only to some of the more important process is discussed. Network node via local area some rules for locating detection blind area, not exist

locally, and judgment for non local Scotia. But the use of the greedy algorithm will forward the packet to a neighbor node or through a multi-hop after reaching a node, if the destination point in the blind area, still can encounter the routing void. So for the current node, the other nodes in the network of local area may also be own by greedy algorithm can not reach the area. We design a current node information and one hop neighbor blind information fusion method, to find a neighbor blind area on their route also affected the region, in order to update their blind spot. The neighborhood, blind spot information fusion processes such as shown in figure 1.

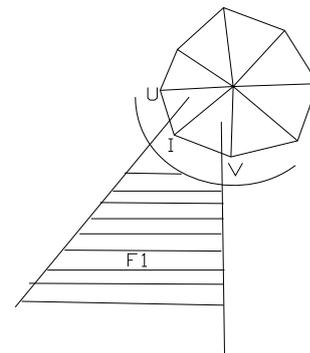


Figure1. The neighborhood, blind spot information fusion diagram

The graph if the current node P, after localization of blind searching algorithm by P LBA (P) for local area were researched. Through the blind spot information exchange between neighbors, mastered after one hop neighbor blind spot information, the I neighbor local area is LBA (I). Node i and P respectively in the counterclockwise direction and I two adjacent neighbor. And V line UI and VI perpendicular bisector, two perpendicular bisector between and P communication outside the territory of the symbol is Fir. The first blind spot information exchange and fusion process, when the destination point in the F_i region, neighbor I is the current node P hop neighbor distance destination point nearest node. P will be through the I forwarding packets. Therefore, the I neighbors LBA local area (I), if the area falls in F_i , the fall in F_i intermediate portion also will become P blind, or P in the I direction of the blind spot for BA (I) F_i . Calculation of all jump neighbor zone of influence on P, P blind area should be (BA (I)) U (nFI) BA (2) F_2 ...U (BA (I) nFi)...U (BA (n) nFn) UBA do not). At this point, P blind spot information recording range is extended to two jumping range. At the same time, P hop neighbors' blind record may also be changed, then again blind spot information exchange and fusion between neighbors. Thus, each node's local area information will gradually spread outward, and tended to converge, the final stable after the blind spot information is recorded global blind information. Node zone is actually in each node's local area network convergence and fusion of.

Each of the nodes in their own hands and jump the neighbor node's blind spot information, we can clearly understand the network in which regions are themselves through the greedy algorithm can not reach, which area is provided through which the neighbor node using the greedy algorithm is not reachable.

We adopted the method of dividing the network into $k \times K$ grid, each grid is calculated in each node of the dead zone range. Each node of the blind spot information recorded in a blind area inside and outside, blind area table size is K^2 hit, every L bit marks the corresponding grid is blind, if the blind, the position in 1, if not blind, then the position 0. Each node holds a own blind table and all jump neighbor zone table. This recording method is relatively simple, and to make the set operation is very convenient, can be very good to save storage space. However, the size of the grid will give blind judgment has some errors. In the ideal case, namely the K is big enough, and each grid has only one node, which can accurately know whether the current node for each node in the blind spot. However, the corresponding storage and communication overhead is quite large. The decrease of K , will appear as shown in Figure 2, shown in 3 cases.

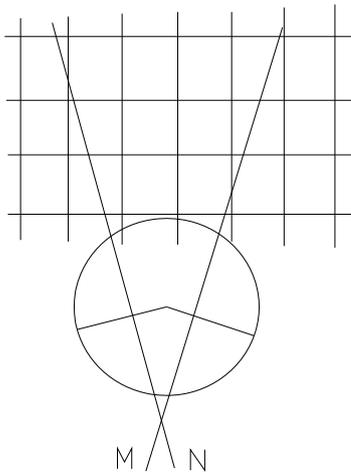


Fig. 2. Schematic diagram of local area information recording

From the chart we can see that some part of the grid in the blind area, a portion located outside the blind spot. So, whether the block grid judged to be blind or blind area, will lead to some error. Choose the suitable mesh size and mesh blind decision rules, can reduce error, improve the routing performance. This composite based on node blind spot information routing algorithm to achieve the data packet transmission. According to the different condition of our node routing algorithm with Greedy+ mode and Sink blind mode two were researched. Greedy+ algorithm for the current node P jump of the neighborhood, also meet the following conditions node, and aim at point d nearest node as the next hop node. In the current node P

hop neighbors, chosen to satisfy $Blind(d) = 0$ nodes, and destination point d point the distance to the nearest node as the next hop node. Sink blind mode is aimed at data packet at the source node, the destination point of D : found on their own dead zone.

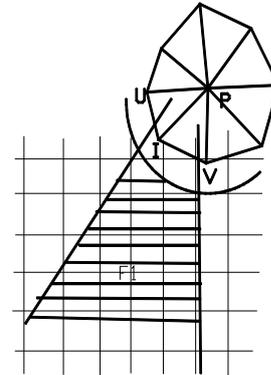


Fig. 3. Schematic diagram of neighbor blind spot information fusion

If the network information can accurately record the blind area, using the Greedy+ algorithm forward mode can fully guarantee the reliable data delivery. But due to the mesh form recorded blind spot information, while simplifying record mode, however the error is inevitable, affect the routing reliability. In agreement with sink blind models to compensate for errors caused by routing grid effect, can ensure the reliable transmission of data. If the Recovery mode selected routing has been back to the source node s , this time there may be s all neighbor zone table destination node blind spot information for L , then their blind form d point blind information marked as 1, then use Sink blind mode. This mode is the starting point, if you will send packets to the D nearby, so it is not difficult to from here it successfully sent to d . However, the simulation results show that, often in nearby grid center for the new target of the routing process, a two or three jump to return to basic forwarding mode will be successful data packet is sent to the D . This is the portion of the composite node localization algorithm description.

IV. SIMULATION ANALYSIS BASED ON A DISTANCE RELATED HYBRID ROUTING PROTOCOL

This section will be on the algorithm and simulation analysis. The simulation software of choice is NS2, which is a powerful network simulator, which is the C++ 2 and OTCL language completed. The initial NS2 only simulation cable network, CMU (Carnegie Mellon University) the NS2 is extended, in physical layer, link layer, MAC layer, increased for wireless network support, with the increase of parts can be on the wireless local area network, Ad Hoc network, and mobile IP simulation.

In the hybrid blind search and blind positioning algorithm simulation test, we are using the same composite node positioning simulation software for the same, namely NS2. As a result of the simulation to verify the effective control to the wormhole attack primarily, therefore in the simulation environment settings on the balance of this feature. The simulation environment of the main parameters: 800m × 800m square area within a random spread of 500-2500 nodes, node average degree of changes in the range of 5-25. Network for UDG, MAC layer using a 802.11 protocol, wireless transmission radius 50m. In the 100s simulation time, randomly chosen node to send 100 packets. Each set of data consists of 5 randomly generated network measurement data and its mean and. The comparison of routing protocols for the current application more GPSR routing protocol algorithm. Through the comparison of their safety performance to verify the effectiveness of the combined location routing were researched. In the node localization in the process of simulation, the simulation for regional random distribution within a certain number of nodes, which has 3 anchor node. Comparison of the composite algorithm and DV-distance algorithm in different nodes (mean connected degree) under the condition of average localization error, a number of nodes, in a different random distribution under repeated 30 times experiment, calculated the average location error.

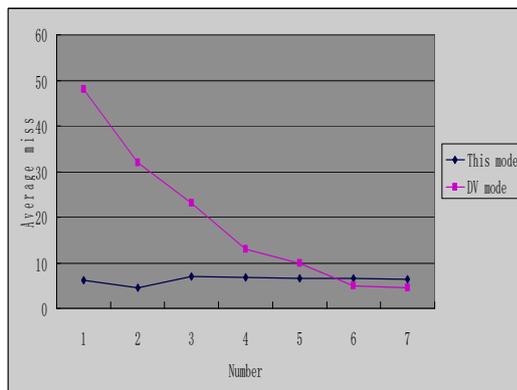


Fig. 4. The composite type node localization algorithm simulation results

From the chart we can clearly see the composite algorithm is better than DV in average path hops advantages. Along with the network empty increases, DV routing hops increases obviously. However, the algorithm of routing hops is almost not affected by hole size effects, only with network density. This was enough to prove that this hybrid algorithm in routing security performance better.

CONFLICT OF INTEREST

The authors confirm that this article content has no conflicts of interest.

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