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Routing Protocol in Wireless Communication: Challenges and Discussions

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ABSTRACT
Mobile ad-hoc networks (MANETs) play a significant role in the construction of campus, resident, battlefield and search/rescue region. MANET is an appropriate network for supporting a communication where is no permanent infrastructure. MANET is an effective network that uses to establishing urgent communication between rescue members in critical situations like, disaster or natural calamities. The sending and receiving data in MANET is depending on the routing protocols to adapt the dynamic topology and maintain the routing information.

Keywords:- Wireless networks, Mobile ad-hoc networks, Routing protocol, Dynamic source routing, Ad-hoc on demand distance vector routing.

INRODUCTION
The Ad Hoc network [1] is a special wireless network, it had been popular among many scholars since its appearance, Ad-Hoc network is an automated and intelligent network. Its main specialties are that the internal nodes have no control center, the nodes act as routing and communicating functions simultaneously, the operation of the entire network does not require external intervention. These features can effectively complement your existing network.

Especially in the case of earthquake relief, construction of temporary Ad Hoc meetings, and operation of individual sites and so on, the ad hoc network seems to be the main network backbone in that case. In-vehicle Internet, Internet of Things, and Wireless Mesh Networks derived from networking have evolved rapidly in recent years [5].

The mobile ad-hoc network (MANET) is dynamically formed by wireless mobile nodes that arbitrarily move without the administration of a base station or any central point. MANET is considered as a multi-hop network; within a multi-hop network, the source node can communicate with its destination through intermediate nodes because the destination is out of the communication range of the source node. MANET is considered a promising technology that offers temporary connections without any preexisting infrastructure, which is needed during abnormal situations or temporary events such as in emergencies, catastrophic recovery areas, and battle fields. However, one of the main challenges in MANET is that the link breakages that occur disrupt the established connections. Many protocols for MANET recommend the construction of routes reactively by flooding the network with route request (RREQ) packets. As a result, when establishing connections to the desired destination, the flooding procedure causes

high control overhead, which can degrade the performance of MANET [2].

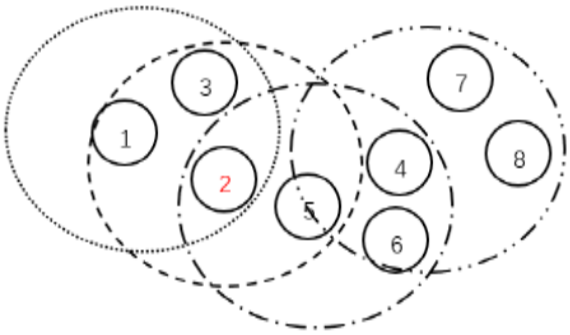

Fig 1: Ad Hoc network data communication [5].

Routing in the mobile ad hoc networks, can be conducted in different ways, which is dependent of the routing strategy and network structure. According to the routing strategy, routing protocols conclude of two parts: Table-driven routing and On-demand routing protocols. Table-driven routing protocols, maintain the routing information, even before it is needed, so these protocol are called Proactive routing protocols, too, where the provided protocols of this group is DSDV [1]. On-demand routing protocols, do not maintain routing information, if there is no connection, so, these protocols, are called reactive routing protocols, too. The provided protocols of this group are DSR, AODV and TORA.

MANET's networks are autonomously organized and Self-configured without any infrastructure assistance and it can be installed quickly and easily at a very low cost. Since node mobility is high, unpredictable topology modifications may occur in such networks. Mobility and the lack of existing infrastructure make MANETs very appealing to time-critical apps. There is a need for a routing algorithm when a packet or data wants to be transferred to a node through a set of different nodes. A routing protocol is a fundamental requirement for the network to create routing decisions even for the immobile network. All of the network nodes function like routers and play a role in maintaining routes to other network nodes. In the case of emergency or search and rescue operations, ad-hoc networks are very useful for gathering information in difficult terrains or in meetings or conferences where people want their data to be shared fast. Routing is a network layer task which decides the path between the source and the target for traffic flow. It can be seen at first glance that directing in wireless (multi-hop) network causes no other issue than dealing with a very dynamic topology [9].

Routing protocols in MANET are methods for sending information in data bundles or packets to a destination from an originating point or source in a system. Before correspondence can happen between nodes, two activities take place in routing protocols. Firstly, is the assurance of the best route way and the sending of bundles through the system while keeping up a low power consumption in computing. Also, for the above activities to be achieved, various parameters are used by each routing protocol to look at the ideal way that packets should utilize during packets transmission in the system. Efficient execution can be accomplished in a system if cautious thought is given to the idea of routing calculations, structure and execution issues. Two categories of routing protocols are available. These are proactive and reactive protocols. The variance between them is, the reactive routing protocols are determining the route when a packet is required to be forwarded, while, the proactive routing protocols are determining the route periodically. Ad hoc on-demand distance vector routing (AODV) and dynamic source routing (DSR) protocols are examples of reactive routing protocols. Destination sequenced distance vector (DSDV), and optimized link state routing (OLSR) are examples of proactive routing protocols [10].

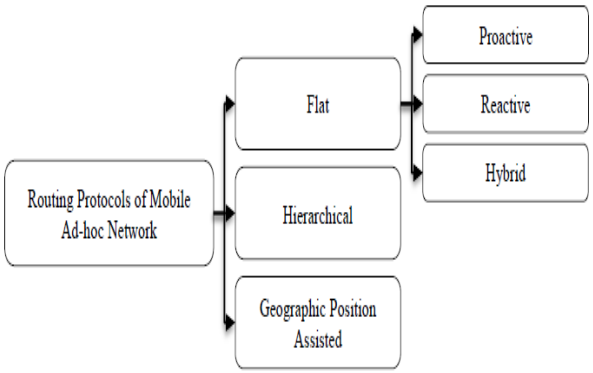

Fig 2: The types of routing protocols in MANET.

II ROUTING PROTOCOL CHALLENGES

Security services are needed to make sure that the data is transferred over the network with reliability and also the keeping the resources of the system protected. To attain the objectives, the categorizations of security services are: availability, confidentiality, authentication, integrity and non-repudiation [7].

• Availability: Though the system is suffering from various problems like with bandwidth, connectivity but the availability service ensures that still the resources are available in a timely manner. The harmful effects of availability of a network are resource depletion attacks and packets dropping ratio.

• Confidentiality: The information prevailing in the network is not to be shared among all unauthorized nodes and this is achieved by Confidentiality. In order to achieve Confidentiality many encryption techniques can be used to make only the authorized nodes can share the transmission of information and the private and public keys.

• Authenticity: To prove a node as a legitimate user the network service used is Authenticity. The absence of this service can make any node in the network impersonate any node, and then having a total control capture and control over the complete network.

• Integrity: The data which is been transmitted in the network can be modified either wantedly or sometimes un-wantedly. The Integrity network service ensures that the information which is been transmitted is not modified.

• Non-repudiation: This service guarantees that the message transmission has been done between the two parties and it cannot be denied. Also using this service it helps in detecting and isolating of compromised nodes in the network.

Communicating through the network in safe and secure way has been a challenging task because of
• Not being a stable infrastructure.
• The links in the network are prone to break and not secure.
• Scarcity or overload on the system resources
• The network topology being dynamic

III RELATED WORK

AODV and DSR are the on-demand unicasting routing protocols to evaluate their performance based on Quality of Service (QoS). For MANETs, together AODV and DSR routing algorithms are executed on the root of an on-demand gateway discovery algorithm anywhere every other through the entry and exit point of a system and where required.

[1] In this paper, the target is to provide a stable routing protocol with high efficiency for these kinds of networks, by improving the DSR routing protocol. In the provided protocol, beside the path stability, the energy of the path nodes and path length will be considered too, in order to discover a path with higher quality and use it. The provided protocol will be called as ST-DSR. The protocol is based on the DSR protocol, and in discovering a path, a path is discovered that has sustainability and high quality in terms of the stability of the path links, the energy of the nodes and the path length. The result of simulation in the NS-2 environment shows that the ST-DSR has a better operation toward the base protocol, meaning DSR.

[2] In this paper, enhancement mechanisms are proposed for the existing protocols that still suffer from packet looping in the route discovery process and do not ensure route establishment. Another drawback of the existing protocols is the routing overhead as the amount of flooding varies with the number of chosen nodes and this overhead can be significant. Moreover, the existing link failure predication strategies that utilize the signal strength do not function well in high density and are not efficient owing to the fluctuation of the signal strength. In addition, they have high overhead and consume network bandwidth and energy owing to the consecutive measurement of signal strength and continuous updating of the signal information table.

[3] The network topology varies normally in MANET nodes and is free to stir erratically and individually. In the existing technique, Ad hoc On-Demand Distance Vector (AODV) was employed for node selection to attain the shortest path strategy. In this technique, huge amount of control messages are transferred which consumed bandwidth of the network and increase congestion. In the proposed system, the hybrid AODV technique incorporates the MFR (Most Forward within Radius) technique is utilizing to detect the shortest path routing algorithm. The MFR technique has been performed for the neighbor node selection whereas Hybrid AODV has been performed for the shortest path routing algorithm. Firefly algorithm is also incorporate in Hybrid AODV to find out the optimum path based on the updating equation. The performance analysis and the comparative analysis of this paper are measured by using End to End delay, Average Routing Overhead, Throughput. Proposed algorithm (HAODV) shows improvement in all these parameters.

[4] This paper intends to develop a multi-objective optimization (MOO) model for effective load distribution and security in the network. The presented MOO technique operates on two main stages namely clustering and secure routing. In the first stage, fuzzy logic technique with multiple input parameters namely energy, distance, link duration, latency, and trust are used for effective cluster construction. In the next stage, Lion Whale optimization (LWO) algorithm is introduced for secure routing. Using the determined MOO variables, a fitness function is derived to select the optimal routes for secure routing in MANET.

[5] In this paper author proposed The Q-AODV algorithm and finds an optimal data transmission path by gradually detecting the node using blockchain technology in the route establishment process. Through simulation experiments, the algorithm shows great advantages in the delivery rate of data packets and the end-to-end delay of data packets, which can well guarantee the stability of network data transmission. However, it is also found that the end-to-end delay of the algorithm also rises significantly when the node moves faster. This is mainly because the node moves quickly away from the path chain and must be searched for again. This situation may be improved by establishing a multipath approach.

[6] In this research, they introduced a new protocol based on the well-known DSR protocol. The proposed routing protocol adds a mechanism to control the RREQ Flooding process; this aims to reach more stable routes while reducing the overhead of routing process caused by link breakage between nodes, and reduces the overhead of network flooding with RREQ messages with each attempt to find a path. In this proposed mechanism, RREQ messages are sent to subset of the devices that are adjacent to the transmitter node, this selection depends on a stability evaluation criterion calculated based on three weighted factors: the speed of the node, the out-degree value (the number of adjacent nodes), and the number of tracks stored in the nodes' memory. The proportion of devices selected is automatically changed adaptively to ensure the achievement of the expected throughput for this network.

[7] The proposed integrated approach at every node improves the throughput with low network overhead even in presence of malicious nodes. The

dynamic behavior of the nodes may turn into malicious or sometimes repent from being malicious. The triple factor inclusion not only allows integrating a faulty misbehavior back into the network after considering the reason for misbehavior but also allows adding basic cryptographic algorithm to have secured packet transmission through the path. As the nodes are not eliminated from the network unless and until they fail in proving their trust, the network is strong and will result in more throughputs with low network overload. Further these protocols can be simulated by making this architecture as a part of the routing process, which will be carried out as our next following research.

[8] In this paper author proposes a stable link routing algorithm suitable for mobile Ad-hoc networks based on GPS positioning technology, and takes into account the balance between stability and hop times. Simulation results show that the new algorithm has better comprehensive performance and can better adapt to high density or high moving rate network. This algorithm has good portability and obvious effect. Although the link stability is considered in this paper, the survival time of the link is only considered in depth. In future studies, queue, energy and other information will be added to make a more comprehensive prediction of the link stability.

[9] The article compared three routing protocols (DSDV, AODV, DSR) using NS2 to evaluate and measure efficiency. AODV and DSR generally, perform better in fast mobility simulations than the DSDV protocol. Fast mobility often leads to connection errors. The AODV and DSR use a demand-based search procedure for a route, but the routing mechanisms are different. The DSR uses the buffering mechanism and holds multiple paths for each location. However, for each place, AODV has one path. According to the general observation based on the simulation, the DSR for application-based metric values, such as delay or packet delivery fraction, is used in less “stressed” environments with larger performance gaps (i.e. low node count and low load and/or mobility) shows higher performance. However, less routing load is generated by the DSR than the AODV protocol.

[10] This paper evaluates the performance of three routing protocols in MANET: ad-hoc on-demand distance vector (AODV), destination sequenced distance vector (DSDV), and ad-hoc on-demand multipath distance vector (AOMDV). These protocols are inherent from different types of routing protocols: single-path, multi-path, reactive and proactive mechanisms. The NS2 simulator is utilized to evaluate the quality of these protocols. Several metrics are used to assess the performance of these protocols such: packet delivery ratio (PDR), packet loss ratios (PLR), throughput (TP), and end-to-end delay (E2E delay). The outcomes reveal the AOMDV is the most suitable protocol for time-critical events of search and rescue missions.

[11] In this paper they survey routing metrics and protocols proposed recently for MANETs. They classify routing metrics according to four different approaches: traffic, radio information, energy and mobility-location. In particular, they enhance the current research directions that concentrate on network performance improvement. Also, we examine all MANET routing protocols, which are published on the IEEE Xplore digital library from 2010 to 2017. The surveyed protocols are divided into four categories including Performance Overall, Quality of Service (QoS), Effective Energy and Security. In each sort, they select some proposals to describe and highlight their objective and main idea.

[12] This paper proposes a routing strategy called Mobility, Contention window, and Link quality sensitive multipath Routing (MCLMR) in MANETs, which considers the nodes mobility, contention window size, and link quality estimated value of the intermediate nodes in the optimal route selection. Also, Technique for Order of Preference by Similarity to Ideal Solution; a multi-criteria decision-making technique, which provides weights according to node mobility,

contention window size, and link quality estimated values, is also employed for the selection of intermediate nodes, whereas the Expected Number of Transmissions metric is used to minimize the effect of control message storm.

IV CONCLUSION

The last decade has witnessed an ever-growing user demands for a better quality of services. This has led to the rapid evolution and advancements in wireless communication technologies in an attempt to produce a standard that satisfies the users' demands. Recent developments have led to the emergence of several new technologies that bring wireless technologies to our fingertips. These include Cognitive Radio (CR), the Internet of things (IoT), MANET, Massive Multiple Input Multiple Output (MIMO), Device-to-Device Communication (D2D), Fog Computing, and Vehicular Ad hoc Networks (VANET). Due to dynamic properties of MANETs, routing in these networks is considered a challenging problem.

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