MANET ROUTING PROTOCOL

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ABSTRACT

Mobile Ad hoc protocol that also could be implemented in VANET protocols is presented. In the literature, there are numerous mobile Ad hoc networks (MANET) routing protocols aiming to find the most suitable path from source to destination. Therefore these protocols should be categorized and classified. This classification helps in understanding, analyzing, comparing, and evaluating the routing protocols. Also, the classification can assist researchers and designers to differentiate the characteristics of the routing protocols and to find the relationships between them. This classification helps in understanding, analyzing, comparing, and evaluating the routing protocols. Also, the classification can assist researchers and designers to differentiate the characteristics of the routing protocols and to find the relationships between them. The routing protocols cannot be included under one category or one classification, therefore, the known characteristics should be listed and the MANET routing protocols classified according to these attributes. In this paper, varies routing protocol classifications are presented that depend on design philosophy, on network structure, or on the routing protocol characteristic (packet casting and network routing metrics). The routing protocols cannot be included under one category or one classification, therefore, the known characteristics should be listed and the MANET routing protocols classified according to these attributes. In this paper, varies routing protocol classifications are presented that depend on design philosophy, on network structure, or on the routing protocol characteristic (packet casting and network routing metrics).

KEYWORDS: MANET routing protocols, MANET design philosophy, network structure, packets casting and MANET routing metric.

INTRODUCTION

In recent years, network structure has changed significantly; 40 years ago the only known and available network was the wired network. However, as mobility needs continue to grow, wireless networks have appeared as an efficient solution to increasing service demands. The development in wired networks has paled in comparison to the tremendous increase in wireless networks. This has happened in spite of the limitations of wireless network techniques, such as the changes in network topology, a high error rate, power restrictions, bandwidth constraints, and issues with link capacity. These limitations are the result of the freedom of movement in mobile wireless networks, as mobile wireless networks are dynamic and feature multi-hop topology. As such, researchers have stepped forward to solve these challenges, putting substantial effort behind inventing new technologies. They have hence addressed the problems with innovative solutions to support the robust and efficient operation of mobile wireless networks. One of the main areas of research has been routing technology which will route packets from source to destination. The focus of this paper is the presentation of different classifications of Ad hoc routing protocols according to different criteria.

Mobile Ad-hoc Networks (MANETs) are self configuring networks consisting of mobile nodes that are communicating through wireless links. There is a cooperative engagement of a collection of mobile nodes without the required intervention of any centralized access point or existing infrastructure. The nodes move arbitrarily; therefore, the network may experience unpredictable topology changes. It means that a formed network can be deformed on the fly due to mobility of nodes. Hence, it is said that an ad-hoc wireless network is self organizing and adaptive. Due to infrastructure less and self organizing nature of ad-hoc networks, it has several applications in the area of commercial sector for emergency rescue operations and disaster relief efforts. MANETs also provides a solution in the field of military battlefield to detect movement of enemies as well as for information exchange among military headquarters and so on.

Also, MANET provides an enhancement to cellular based mobile network infrastructure. Nowadays, it is an inexpensive alternative for data exchange among cooperative mobile nodes

For communication among two nodes, one node has to check that the receiving node is within the transmission range of source if yes, and then they can communicate directly otherwise, with the help of intermediate nodes communication will take place. Each node will act as a host as well as a router. All the nodes should be cooperative so that exchange of information would be successful. This cooperation process is called as routing

Due to the presence of mobility, the routing information will have to be changed to reflect changes in link connectivity. There are several possible paths from source to destination. The routing protocols find a route from source to destination and deliver the packet to correct destination. The performance of MANETs is related to efficiency of the MANETs routing protocols and the efficiency depends on several factors like convergence time after topology changes, bandwidth overhead to enable proper routing, power consumption and capability to handle error rates

MANET ROUTING PROTOCOLS TAXONOMY

In MANET, each node has the freedom to join, leave, and move around the network. This movement creates a highly dynamic environment that effects packet routing. Therefore, efficient packet routing is one of the most challenging problems in MANETs. The objective of routing is to guide packets through the communication subnet to their final destinations. As a result of working on this problem, numerous routing protocols have been proposed in the literature. The aim is to find the most suitable path from source to destination, with the ultimate goal being to establish efficient route and efficient message exchange within MANET. This section, as shown below, classified the routing protocol depending on design philosophy, on network structure, or on the routing protocol characteristic (packet casting and network routing metrics).

DESIGN PHILOSOPHY

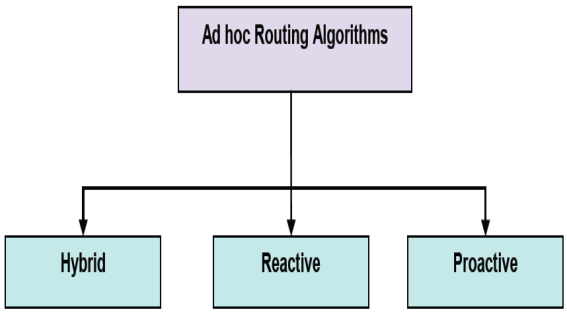

Figure 1. MANET routing protocol classifications depending on design philosophy.

Design philosophy is the most popular method to distinguish MANET routing protocols. It is based on how routing information is acquired and maintained by mobile nodes. Depending on design philosophy, Ad hoc routing protocols are represented by three main categories; proactive (also called Table Driven routing or Source routing), reactive (the other names are On Demand and Distributed routing), and hybrid (or Hierarchical routing). References present surveys of the current routing protocols based on routing philosophy structure.

CLASSIFYING MANETS ROUTING PROTOCOLS

The protocols may be categorized into two types, Proactive and Reactive. Other category of MANET routing protocols which is a combination of both proactive and reactive is referred as Hybrid.

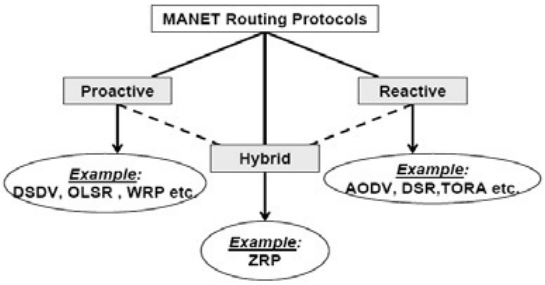

Figure 1 Classification of MANET routing protocols

Proactive routing protocols: In it, all the nodes continuously search for routing information within a network, so that when a route is needed, the route is already known. If any node wants to send any information to another node, path is known, therefore, latency is low. However, when there is a lot of node movement then the cost of maintaining all topology information is very high

Reactive Routing protocols: Whenever there is a need of a path from any source to destination then a type of query reply dialog does the work. Therefore, the latency is high; however, no unnecessary control messages are required.

Hybrid routing protocols: These protocols incorporates the merits of proactive as well as reactive routing protocols. A hybrid routing protocol should use a mixture of both proactive and reactive approaches. Hence, in the recent years, several hybrid routing protocols are proposed like ZRP, ZHLS, SHARP and NAMP etc

In recent years, a variety of routing protocols have been proposed and a comparative analysis of routing protocols has been done either on the basis of simulation results by different simulators like OPNET, NS2, OMNET++ etc. or analytically . In some cases, the comparative analysis is done between reactive routing protocols based on some performance metrics and in other cases between proactive routing protocols. Few researchers have done the simulation based comparison between on demand and table driven routing protocols. The present paper comparatively analyzes all three categories of MANETs routing protocols namely, proactive, reactive and hybrid protocols. In order to compare the protocols, we selected the representative protocols from each category; DSDV from proactive, ZRP from hybrid, and AODV and DSR from the reactive. The performance metrics considered are throughput, average delay, routing overhead and number of packets dropped.

Casting Packets

In this section, the routing algorithms are classified depending on the packet casting type, either unicast or multicast routing protocols

There are three categories to cast the control and/or the data packets in network:

? Unicast: source will send messages to a single destination.

? Multicast: source will send same messages to specific destinations.

? Broadcast: source will send same messages to all possible destinations.

Unicast Routing

Most MANET routing algorithms previously categorized could be classified as unicast routing algorithms such as Optimized Link State Routing (OLSR) protocols, Dynamic Source Routing (DSR) protocols and Ad hoc On Demand Distance Vector (AODV) routing protocols

Multicast Routing

Many multicast routing schemes have been proposed for wired networks, such as the Multicast Open Shortest Path First (MOSPF) which has been widely used in these networks. Multicasting in MANET is defined as the transmission of packets to a group of hosts identified by a single destination address. Multicast service is crucial in management applications where one-to-many dissemination is necessary. Applications that include close team collaboration in rescue patrols, military battle, and among scientists with requirements for audio and video communications, are few examples of multicast routing services.

The classification methods for unicast routing algorithms are also appropriate for the existing multicast routing algorithms to be classified into reactive, proactive, and hybrid multicast routing. The Ad hoc Multicast Routing (AMRoute) belongs to the proactive multicast routing category, whereas On Demand Multicast Routing Protocol (ODMRP) is a reactive multicast routing protocol and the Core-based Tree (CBT) is a hybrid multicast routing protocol. The existing MANET multicast routing approaches can be sub classified into tree-based, mesh-based, core-based, and group forwarding-based multicast routing protocols. This sub classification is based on how the distribution paths among group members are constructed. Some of the multicast routing protocols could be included in more than one category, such as the Core-assisted Mesh Protocol (CAMP)which can be characterized as both a core and mesh multicast routing protocol.

Tree-based

In tree-based multicast routing protocols, the source nodes are the roots of multicast trees and in them the executing algorithm for distribution tree contraction and maintenance. This requires that a source must know the topology information and address all of its receivers in the multicast group. Therefore, when used for dynamic networks, source-rooted tree-based multicast routing protocols often suffer from control

traffic overhead. The AMRoute is an example of one such source-rooted tree-based multicast routing.

Core-based

In a core-based multicast routing algorithm, cores are nodes with special functions such as multicast data distribution and membership management. Some core-based multicast routing algorithms also utilize tree structures, but unlike source-rooted tree-based multicast routing, multicast trees are rooted at core nodes. For different core-based multicast routing protocols, core nodes may perform various routing and management functions. For example, in a CBT multicast routing protocol cores are cross points for all traffic flows of multicast groups and may become bottlenecks along the network. On the other hand, in protocols like CAMP core nodes are not necessarily utilized by all routing paths

Mesh-based

In a mesh-based multicast routing protocol, packets are distributed along mesh structures that are a set of interconnected nodes. The mesh structure is more robust than the tree structure for multicast routing in dynamic networks because a mesh provides alternate paths when link failure occurs. However, the cost for maintaining mesh structures is normally higher than that of trees. The ODMRP and CAMP are examples of mesh-based multicast routing protocols.

Group Forwarding-based

In the group forwarding-based multicast routing, a set of mobile nodes is dynamically selected as forwarding nodes for a multicast group. Forwarding nodes then assume the responsibility for multicast packet distribution. Using this scheme, it is possible to obtain multiple routing paths and send duplicate messages to receivers through the different paths obtained. ODMRP is a group forwarding-based multicast routing protocol that uses adaptive forwarding groups to accomplish this.

Broadcasting Methods

The broadcasting mechanism is used by MANET nodes for periodic messages. A number of research groups have proposed efficient broadcast protocols based on distributed and hierarchical methodologies. The broadcasting methods could be sub classified according to their transmission methodology (or how nodes broadcast their packets). In addition to the simple flooding, the sub classification includes probability-based methods, area-based methods, and neighbour knowledge methods. Most existing distributed network-wide broadcast techniques have been summarized and categorized in Reference

Simple Flooding

Most of the routing protocols use a generally inefficient form of broadcast called simple flooding. In simple flooding, when a node receives a packet to be broadcast for the first time, it transmits the packet to all nodes within its transmission range. In dense networks, the simple flood wastes bandwidth and node resources. DSR and AODV routing protocols use the simple flooding technique.

The following methods improve upon simple flooding and do not require that every node receive a packet to transmit it further.

Probability-based Methods

Using the probability-based protocols the node decides whether to rebroadcast according to a specified probability or a simple conditional event which relates to the probability of reaching additional neighbours.

Area-based Methods

Area based methods use knowledge of sender node locations to estimate whether a transmission will reach a significant amount of additional coverage area. LAR and DREAM include area-based methods in their routing protocols.

Neighbour Knowledge Methods

Neighbour knowledge methods require the use of “Hello”-type packets so that nodes have explicit data regarding their neighbourhood topology; the nodes then use this neighbour data to decide whether to rebroadcast a packet. The OLSR routing protocol implements this method.

NETWORK STRUCTURE

A classification of the routing algorithms according to the network structure is provided. The routing algorithms that depend on the network structure consider two important elements which effect the routing operation: the nodes’ mobility and the network scalability.

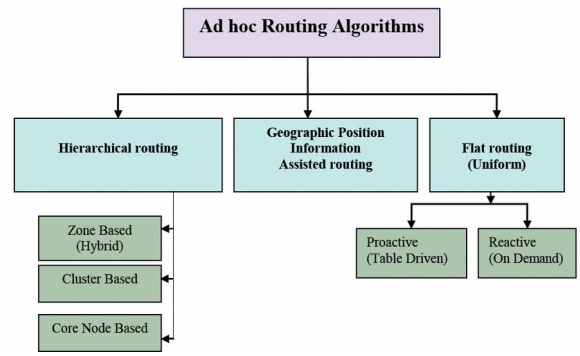

Figure 2. MANET routing algorithms classifications depending on network structure

Flat Routing

Flat routing approaches adopt a flat addressing scheme in that each participating node plays an equal role in routing. Therefore, the routing protocol is named as a uniform routing protocol in which all its mobile nodes have the same role, importance, and functionality. Flat routing schemes extend into two classes, proactive and reactive, according to their design philosophy. In a large network, flat reactive protocols are better than flat proactive routing protocols because of the reactive design philosophy; for example, if there is no communication, this means that there are no routing activities and no permanent routing information maintained at the network nodes. The Optimized Link State Routing (OLSR) protocol, Dynamic Source Routing (DSR) protocol and Ad hoc On Demand Distance Vector (AODV) routing protocol are examples of uniform routing protocols.

Hierarchical Routing

Hierarchical routing has been implemented in wired networks for a long time. In contrast to uniform flat routing, the non-uniform hierarchical routing usually assigns different roles to network nodes; as explained. In contrast to uniform flat routing, non-uniform routing approaches are related to hierarchical network structures to facilitate node organization and management. Normally, reactive algorithms are exploited to select the special nodes which carry out reactive management and/or routing functions. Generally, in wireless network, flat routing schemes become inefficient when the wireless network size increases due to link and processing overhead. Therefore, hierarchical routing has been presented as an efficient solution to solve the problem and produce a scalable network. Non-uniform hierarchical routing protocols can be further sorted into three subcategories: zone-based, cluster-based, and core-based. These protocols are categorized according to the organization of the mobile nodes, their respective management, and their routing functions

Zone-based (Hybrid)

With zone-based hybrid routing algorithm technique each node has a local scope and different routing strategies are used, inside and outside the scope, as communications pass across the overlapping scopes. Given this flexibility, a more efficient overall routing performance can be achieved. Compared to maintaining routing information for all nodes in the whole network, mobile nodes in the same zone know how to reach each other with a smaller cost. In some zone-based routing protocols, specific nodes act as gateway nodes and carry out inter-zone communication. Therefore, the network will contain partitions or a number of zones. The Zone Routing Protocol (ZRP) is a MANET zone-based hierarchical routing protocol.

Cluster-based

A cluster-based routing protocol is the most popular hierarchical routing technique. It uses a specific clustering algorithm for cluster head election in which mobile nodes are grouped into clusters by geographic proximity. Cluster heads then take responsibility on behalf of the cluster for membership management and routing functions. Cluster head Gateway Switch Routing (CGSR) is an example of a cluster-based MANET routing protocol. The Hierarchical State Routing (HSR) protocol also supports a multi-level cluster structure.

Core Node-based

In core node-based routing protocols, critical nodes are dynamically selected to compose a "backbone" for the network. The “backbone” nodes carry out special functions, such as the construction of routing paths and propagation of control/data packets. Optimized Link State Routing (OLSR) and Core Extraction Distributed Ad hoc Routing (CEDAR) protocols are typical core node-based MANET routing protocols

Geographic Position Information Assisted Routing

Routing with assistance from geographic location information requires each node to be equipped with a Global Positioning System (GPS). This satellite system provides reliable positioning, navigation, and

universal timing services to worldwide users on a continuous basis, in all weather, day and night, anywhere on Earth. This requirement is quite realistic today since such GPS devices are advanced, updated, inexpensive, and can provide reasonable precision; GPS provides location information with a precision within a few meters. Location information can be used for directional routing in distributed Ad hoc systems. Research in this area has shown that geographical location information can improve routing performance in Ad hoc networks. Additional care must be taken in a mobile environment because locations may not be accurate by the time the information is used. All protocols based on GPS assume that the nodes know their positions. The Location Aided Routing (LAR), the Distance Routing Effect Algorithm for Mobility (DREAM) and geographical routing are examples of geographic position-assisted routing protocols.

NETWORK ROUTING METRICS

A new classification for routing algorithms has been added which depends on the routing metric. The routing metric used in the identification of the routing path could also be used as a criterion for MANET routing protocols classification. In the previous sections, all abovementioned MANET protocols have based on the hop number as a routing metric, such as in OLSR, DSR, and AODV. If there are multiple routing paths available, the path selected will be the shortest routing paths with the minimum hop number in order to decrease traffic overhead and reduce packet collisions when compared to longer routing paths. However, one disadvantage to the mobility in MANET is that it can cause route failure and frequently leads to route discovery. Therefore, the link stability is an important metric that was considered in the route construction. An example for that is the Associativity-based Routing (ABR) that selects routes based only on nodes' link stability, where each node has an associative state that implies the period of stability. ABR is a simple bandwidth-efficient distributed routing protocol that supports mobile computing in a conference-sized MANET environment. Unlike the proactive or reactive routing algorithms, this protocol does not attempt to consistently maintain routing information in every node. In this manner, the routes selected are likely to be long-lived; hence, there is no need to restart frequently, resulting in a higher attainable throughput. Route requests are broadcast on a per need basis. The protocol is free from loops, deadlock, and packet duplicates and has scalable memory requirements.

This network metric taxonomy could include hop number, link stability (such as mobility), congestion, data rate, computing and power consumptions and many other network metrics.

CONCLUSION

A review of the routing process in MANET, which is much more complex than in wired networks because of the host mobility, interference of wireless signals, and the broadcasting nature of wireless communication. The complexities of this process and the associated issues have motivated researchers to develop several MANET routing protocols, with varying performance under different conditions. Each routing protocol developed according to a specific criterion. In this paper, an overview of four different MANET routing protocol categories was presented, including design philosophy, network structure, packets casting, and network routing metric. Each of these categories was used to compare, classify, and group MANET routing protocols with similar characteristics. These characteristics relate mainly to the information utilized for routing that determined the nodes' roles in the routing process. In this paper, a new type of classification for MANET routing protocols was added based on network routing metrics. The review in this paper indicates that the invention of new protocols is not a solution due to the large number of protocols already available. However, there should be an understanding of the network requirements and conditions for which each protocol is suited and will function best. For each of these criteria, there is a wide list of protocols that will meet its needs; therefore, this understanding of requirements and conditions is crucial to selection of the right protocol to enhance efficiency and performance.

REFERENCE

[1] J. Andrews, S. Shakkottai, R. Heath, N. Jindal, M. Haenggi, R. Berry, D. Guo, M. Neely, S. Weber, S. Jafar, and A. Yener, "Rethinking information theory for mobile Ad hoc networks," IEEE Communications Magazine, vol. 46, issue 12, pp. 94–101, 2008.

[2] A. S. Tanenbaum, "Computer Networks", 4th Edition, Prentice Hall PTR, 2003.

[3] J. Kakarla1, S. Siva Sathya1, B. Govinda Laxmi2, B. Ramesh Babu "A Survey on Routing Protocols and its Issues in VANET," International Journal of Computer Applications (0975 – 8887), vol. 28, no.4, Aug. 2011.

[4] S. Sesay, Z. Yang, and J. He, "A survey on mobile Ad hoc wireless network," Information Technology Journal, vol. 3, no. 2, pp. 168–175, 2004.

[5] C. Liu and J. Kaiser, "A survey of mobile Ad hoc network routing protocols," University of Ulm Tech. Report Series, no. 2003-08, Oct. 2005.

[6] M. Abolhasan, T. Wysocki, and E. Dutkiewicz, "A review of routing protocols for mobile ad hoc networks," Ad Hoc Networks, vol. 2, no. 1, pp. 1–22, 2004.

[7] E. M. Royer and C. K. Toh, "A review of current routing protocols for Ad hoc mobile wireless Networks," IEEE Personal Communications, vol. 6, no. 2, pp. 46–55, Apr. 1999.

[8] X. Hong, K. Xu, and M. Gerla, "Scalable routing protocols for mobile Ad hoc networks," IEEE Network, vol. 16, issue 4, pp.11–21, 2002.

[9] W. Kiess and M. Mauve, "A survey on real-world implementations of mobile Ad hoc networks," Ad Hoc Networks, vol. 5, pp. 324–339, 2007.

[10] T. Clausen and P. Jacquet, "Optimised Link State Routing Protocol (OLSR)" Project Hipercom, INRIA, IFTF RFC 3626, 2003.

[11] D. B. Johnson, D. A. Maltz, and Y. Hu, "The Dynamic Source Routing Protocol (DSR) for mobile Ad hoc networks for IPv4", IETF RFC 4728, 2007.

[12] C. Perkins, E. Belding-Royer, and S. Das, "Ad hoc On Demand Distance Vector (AODV) Routing," IETF RFC 3561, 2003.

[13] Z. J. Haas, M. R. Pearlman, and P. Samar, "The Zone Routing Protocol (ZRP) for Ad Hoc Networks", IETF MANET Working Group, 2003.

[14] C. C. Chiang, T. C. Tsai, W. Liu, and M. Gerla, "Routing in clustered multihop, mobile wireless networks with fading channel," The Next Millennium, Proceedings of IEEE Singapore International Conference on Networks, SICON, pp. 197–221, 1997.

[15] G. Pei, M. Gerla, X. Hong, and C. C. Chiang, "A wireless hierarchical routing protocol with group mobility," IEEE Wireless Communications and Networking Conference, WCNC '99, vol.3, pp. 1538–1542, New Orleans, LA, 1999.

[16] P. Sinha, R. Sivakumar, and V. Bharghaven, "CEDAR: a Core-Extraction Distributed Ad hoc Routing algorithm," IEEE Journal on Selected Area in Communication, vol. 17, issue 8, pp. 1454–1465, 1999.

[17] A. Fard, "Global Positioning System (GPS)," [Online], available on: http://www.network-tutorial.com/global-positioning-system-gps, [accessed Feb. 6, 2012].

[18] X. Du, "QoS routing based on multi-class nodes for mobile ad hoc networks," Ad Hoc Networks, vol. 2, issue 3, pp. 241–254, 2004.

[19] Y. B. Ko and N. H. Vaidya, "Location Aid Routing (LAR) in mobile ad hoc networks," Proceedings of the 4th ACM/IEEE International Conference on Mobile Computing and Networking, MobilCom'98, pp. 85–97, 1998.

[20] S. Basagni, I. Chlamtac, V. Syrotiuk, and B. WoodWard, "A Distance Routing Effect Algorithm for Mobility (DREAM)," Proceedings of the 4th ACM/IEEE International Conference on Mobile Computing and Networking, MobilCom'98, pp. 76–84, 1998.