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Analysis Of AODV And DSDV Routing Protocols In Mobile Ad-Hoc Networks: A Review Paper

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تحليل بروتوكولات التوجيه *AODV* و *DSDV* في شبكات الهاتف المحمول : مقارنة أوراق بحثية

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Abstract:
A mobile ad hoc network (MANET) is a collection of mobile nodes that is connected through a wireless medium forming rapidly changing topologies. Mantes are infrastructure less and can be set up anytime, anywhere. We have conducted survey of protocol properties of various MANET routing algorithms and analyzed them. The routing algorithms considered are classified into three categories proactive (table driven) , reactive (on demand) and Hybrid protocol. Ad-hoc On-Demand Distance Vector Routing (AODV) and Destination sequence Vector (DSDV) have been proposed to solve the multi hop routing problem in Ad-hoc networks. The comparison among three routing protocols are based on the various protocol property parameters such as Routing overhead, packet delivery ratio, end-to-end delay, path optimality, and throughput are some metrics commonly used in the comparisons.

Keywords: Mobile Adhoc Network, DSDV, AODV, Protocol property.

الملخص
شبكة الجوال المخصصة (MANET) هي مجموعة من العقد المتنقلة المتصلة لاسلكيًا، وتشكل طوبولوجيات متغيرة باستمرار. تتميز شبكات MANET بأنها لا تتطلب بنية تحتية، ويمكن إعدادها في أي وقت ومن أي مكان. أجرينا دراسة استقصائية لخصائص بروتوكولات توجيه شبكات MANET المختلفة، وقمنا بتحليلها. صُنفت خوارزميات التوجيه المدروسة إلى ثلاث فئات: استباقية (تعتمد على الجداول)، وتفاعلية (عند الطلب)، وهجينة. تم اقتراح بروتوكولي توجيه متجه المسافة عند الطلب (AODV) وتوجيه متجه تسلسل الوجهة (DSDV) لحل مشكلة التوجيه متعدد القفزات في شبكات Ad hoc. تستند المقارنة بين بروتوكولات التوجيه الثلاثة إلى معايير خصائص البروتوكول المختلفة، مثل: عبء التوجيه، ونسبة تسليم الحزم، والتأخير من البداية إلى النهاية، وأمثلية المسار، والإنتاجية، وهي بعض المقاييس الشائعة الاستخدام في المقارنات.

الكلمات المفتاحية: شبكة الجوال المخصصة، DSDV، AODV، خصائص البروتوكول.

Introduction

Mobile Ad-hoc Network (MANET) is a collection of mobile nodes that is connected through a wireless medium. MANETs are self-creating, self-organizing and self-administering. All nodes are allowed to be mobile, Mobile ad hoc networks (MANET) that contain wireless mobile nodes that can freely and dynamically self organize into

arbitrary and temporary ad hoc network topologies (C.Perkins and P. Bhagwat ,2021). Mobile Ad-hoc Network (MANET) is a collection of communication devices or nodes that wish to communicate with infrastructure less support and without predetermined organization of available links.In MANET, Routing is main problem to route the data packets from one source node to destination node in networks. Manet aimed is to provide communication capabilities to areas where limited or no predetermined communication infrastructures exist.

Routing Protocol

The routing protocols in MANETs are classified into three categories proactive (table driven), reactive (on demand) and Hybrid. Figure 1indicate the routing protocols types.

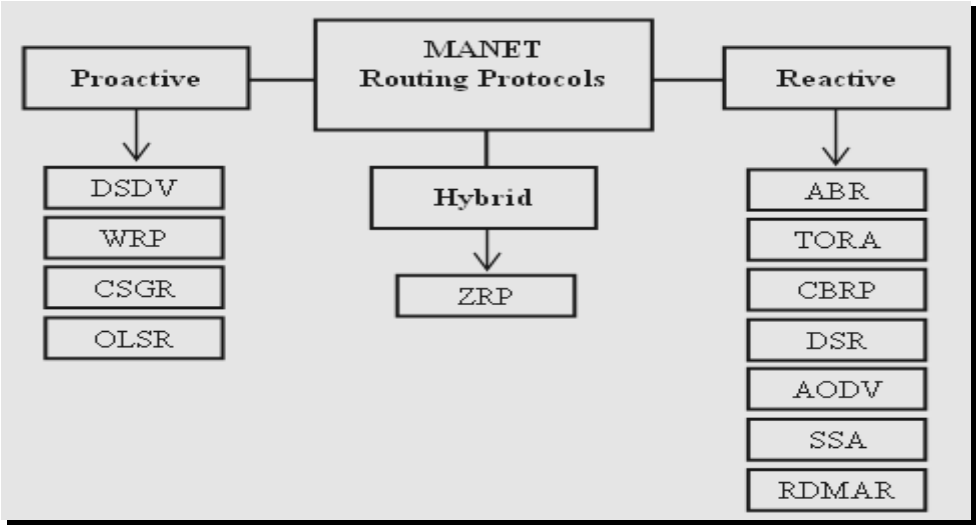

Figure 1: Ad hoc Routing Protocols

1.1. Proactive Routing Protocols

Each node in the network has routing table for the broadcast of the data packets and want to establish connection to other nodes in the network. These nodes record for all the presented destinations, number of hops required to arrive at each destination in the routing table. The routing entry is tagged with a sequence number which is created by the destination node. To retain the stability, each station broadcasts and modifies its routing table from time to time. How many hops are required to arrive that particular node and which stations are accessible is result of broadcasting of packets between nodes. Each node that broadcasts data will contain its new sequence number and for each new route (I. Basu, 2022), node contains the following information:

- How many hops are required to arrive that particular destination node
- Generation of new sequence number marked by the destination
- The destination address

Store the needed information for routing purposes in tables, which are updated through control packets that are sent by each node. The updates can also respond to topological changes of the network. Examples DSDV and WRP.

1.2. Reactive Routing Protocols

Reactive Protocol has lower overhead since routes are determined on demand. It employs flooding (global search) concept. Constantly updation of route tables with the latest route topology is not required in on demand concept.

Reactive protocol searches for the route in an on-demand manner and set the link in order to send out and accept the packet from a source node to destination node. Route discovery process is used in on demand routing by flooding the route request (RREQ) packets throughout the network.

Examples of reactive routing protocols are the dynamic source Routing (DSR), ad hoc on-demand distance vector routing (AODV).

1.3 Hybrid Routing

Based on combination of both table and demand driven routing protocols, some hybrid routing protocols are proposed to combine advantage of both proactive and reactive protocols. The most typical hybrid one is zone routing protocol. Example is DSDV.

2. Destination Sequnce Distance Vector (DSDV)

The Destination-Sequenced Distance-Vector (DSDV) Routing Algorithm is based on the idea of the classical Bellman-Ford. Routing Algorithm. The routing loop problem is solved which is present in Bellman-Ford algorithm.To solve the routing loop problem, this routing makes use of sequence numbers.

Each mobile node maintains a routing table that includes the number of hops to reach the destination, all available destinations and the sequence number tagged by the destination node. The sequence number is used to distinguish stale routes from new ones and thus avoid the formation of loops. So, the update is both time-driven and event-driven. A "full dump" or an incremental update technique is used to update the routing table(Sapna & Deshmukhm2009).

A full dump sends the full routing table to the neighbors and could span many packets whereas in an incremental update only those entries from the routing table are sent that has a metric change since the last update and it must fit in a packet. When the network is relatively stable, incremental updates are sent to avoid extra traffic and full dump are relatively infrequent .If there is space in the incremental update packet then those entries may be included whose sequence number has changed.DSDV protocol guarantees loop free paths and Count to infinity problem is reduced in DSDV.

3. Ad Hoc On-Demand Distance Vector (AODV)

AODV uses a very special technique to maintain routing information. AODV protocol is both an on-demand and a table-driven protocol. It adopts flat routing tables, one entry per destination. It is in difference to DSR, which can maintain multiple route cache entries for every one destination.

Unlike DSR The packet size in AODV is uniform. In AODV there is no need for system-wide broadcasts due to local changes, unlike DSDV.AODV has multicasting and uncasing routing protocol property within a uniform framework. Source node, destination node and next hops are addressed using IP addressing.AODV builds routes using a route request /route reply cycle.

AODV discovers paths without source routing and maintains table instead of route cache. It is loop free using destination sequence numbers and mobile nodes to respond to link breakages, changes in network topology in a timely manner. It maintains active routes only while they are in use and delete unused routes.

4. Related Works

There is a large number of Articles, papers and studies talking about performance of routing protocols in MANETS for different scenarios including.

(I. Basu, 2012) have conducted survey of protocol properties of various MANET routing algorithms and analyzed them. The routing algorithms considered are classified into two categories proactive (table driven) and reactive (on demand). With increasing node density in a fixed area, the performance of AODV and DSR is affected very badly with all performance metrics taken into consideration for this study.

(C.Perkins and P. Bhagwat ,2010) the authors mention that the performance of reactive routing protocols is highly dependent upon the scenario. It was observed during their simulation analysis that AODV and DSR suffers severely with performance degradation with the scenarios considered in the experiments.

(Md. Anisur Rahman, Md. Shohidul Islam, 2009) this paper the authors introduce a brief description about Ad Hoc Mobile networks and they analyze the performance of AODV and DSR using different QoS parameters like: level of congestion, rate of mistakes, changes of used route .

(A. Ade & P.A.Tijare,2010) this research has been done in comparing the different Ad hoc routing protocols which are AODV ,DSR and DSDV under different network scenarios , in this survey paper the performance metrics are routing overhead, packet delivery ratio, end-to-end delay and throughput .

The paper by (Alasadi et al., 2021) discusses the implementation of both types using various protocols including DSDV (Destination-Sequenced Distance Vector) and AODV (Ad Hoc On -Demand Distance Vector). It focuses on their performance in terms of metrics like throughput, packet delivery ratio, and end -to-end delay. The study found that while DSDV showed stable performance in less dynamic conditions, AODV outperformed in highly mobile scenarios.

This research by (Chandra et al., 2022) compares the performance of AODV, DSDV, and DSR routing protocols in MANETs under CBR traffic using the NS -2.35 simulator. It ev aluates these protocols with

varying node densities and traffic conditions. The results indicate that while AODV and DSR are more reliable under dynamic conditions, DSDV performs better with low node density and stable traffic patterns.

Another paper by (Leenas et al., 2022) presents an approach to improve the AODV routing protocol by considering both time and hop -count factors, addressing performance issues in mobile ad hoc networks. The modifications aim to optimize route discovery and maintenance, ultimately enhancing the reliability and efficiency of AODV under dynamic network conditions.

Razouqi et al. (2024) This comparative analysis evaluates the performance of MANET routing protocols DSDV, DSR, and AODVunder varying traffic loads and network conditions. The study reveals that DSR and AODV outperform DSDV in terms of throughput and packet delivery ratio, particularly under higher node mobility and packet rate variations.

5. Comparison

The mobile ad hoc networks have experienced an unprecedented growth since their inception. These are being widely deployed in various emergency scenarios. The various properties of the routing protocols chosen listed in Table 1.

Table 1:DSDV DSR and AODV Comparison

PROTOCOL PROPERTY	DSDV	AODV
Route mechanism/ Maintenance in	Route table with next hop	Route table with next hop
Table driven/ Source Routing	Table driven	Table driven and Source Routing
Need of Hello message	Yes	Yes
Route Discovery	Periodic	On Demand
Network Overhead	High	Medium
Node overhead	Medium	Medium
Multi-hop Wireless Support	Yes	Yes
Loop free	Yes	Yes
Multiple Routes	No	No
Unidirectional link support	No	No
Network Suitable for	Less number of nodes	Highly Dynamic
Route Discovery	No	Yes
Route Maintenance	No	Yes
Reactive/ Proactive	Proactive	Reactive
Routing Overhead	Medium	High
Routing Philosophy	Flat	Flat

6. Conclusion

This paper does the realistic comparison of three routing protocols DSDV and AODV. The significant observation is, comparison results agree with expected results based on theoretical analysis.

As expected, reactive routing protocol AODV performance is the best considering its ability to maintain connection by periodic exchange of information, which is required for TCP, based traffic. AODV performs better than DSDV with large number of nodes. Hence for real time traffic AODV is preferred over DSDV. For less number of nodes and less mobility, DSDV's performance is superior.

AODV is based on route discovery and route maintenance mechanism. Loop free routing Protocol Property is available to AODV and DSDV.

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