A comparison of different approaches (Reactive, proactive, and hybrid gateway) for Mobile Ad Hoc Networks

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مقارنة بين الأساليب المختلفة (البوابة التفاعلية والاستباقية والهجينة) لشبكات الجوال المخصصة

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المستخلص:

كان التركيز في هذه الورقة على التحقيق في العلاقة بين شبكة الجوال المخصصة والانترنت باستخدام بروتوكول التوجيه المخصص أو AODV (Ad hoc On-Demand Distance Vector) (ناقل المسافة المخصص حسب الطلب). حيث تم استخدام Network Simulator 2 (NS−2) لهذا الغرض. ثلاث طرق مقترحة وضعة للعثور على البوابة قيد الفحص. تؤكد النتيجة انه من المستحيل تحديد تقنية اكتشاف البوابة المثالية في كل موقف. ومع ذلك، هناك العديد من المتغيرات القابلة للتعديل التي يجب دراسة أثارها.

الكلمات المفتاحية: *مخصصة، بروتوكول التوجية، الانترنت، رد الفعل، الاستباقي، الهجين، بوابة، AODV*

Abstract:

In this paper, the relationship between a mobile ad hoc network and the Internet is investigated using the ad hoc routing protocol, or AODV (Ad hoc On-Demand Distance Vector). Network Simulator 2 (NS-2) has been utilized for this purpose. Three suggested methods for gateway finding are put into examination. The result confirms that it is impossible to determine which gateway discovery technique is ideal in every situation. However, Numerous variables are modifiable, and it is important to examine their effects.

Keywords: *Ad hoc, Routing protocol, AODV, Internet, Reactive, Proactive, Hybridgateway.*

Introduction:

Over the past three decades, the internet has drastically changed the globe. It is not difficult for people to connect to the Internet. Small and high-performance computing and communication devices are becoming more and more common in daily life and the computer industry thanks to advancements in wireless communication technology. many wireless hot spot technologies, for instance, IEEE802.11 (IEEE,1997), Bluetooth (Haartsen, 1998) and Dedicated Short Range Communication (DSRC) (Dedicated Short-Range Communication, 2002), enable Internet access from many locations.

Additionally, scientists can collaborate and exchange ideas via email on the internet.

Social media and email allow people to stay in touch with one other no matter where in the globe they are. The Internet Protocol (IP) (Postel, 1981) and other associated protocols (Reynolds, 2001) have served the world very well even during the explosive growth that has taken place over the years of their existence.

To connect to the Internet, though, one needs to locate a stationary computer that has a modem or network card. This reduces the number of ways that one can connect to the Internet. As a result, being able to access the Internet via portable devices like laptops, PDAs, and cell phones is recommended.

Faster and more dependable mobile connectivity is becoming increasingly necessary due to the growing demand for wireless information and data services. The use of the worldwide system for mobile communication (GSM), a mobile communication standard, has enabled people to communicate with one another. People utilize PDAs, laptops, and mobile phones in both their personal and professional lives.

The majority of the time, these gadgets are utilized alone, but occasionally, a collection of portable electronics creates a transient network. This makes it possible for attendees at a meeting to exchange papers, presentations, and other materials. Mobile ad hoc networks (MANETs) are the name given to this type of network. Currently, the manet working group is considering AODV (Postel, 1981), Dynamic Source Routing (DSR) (Johnson et al., 2001), Optimized Link State Routing (OLSR) (Jacquet, 2001) and Topology Broadcast Based on Reverse-Path Forwarding (TBRPF) (Ogier, 2002) as base routing protocols for use with ad hoc networks.

A network created by wireless hosts is called a mobile ad hoc network. It is made up of mobile nodes that connect with one another via a wireless interface; it operates without the need of a base station or other fixed infrastructure. Each mobile node has the ability to function as both a host and a router, so they can pass packets on each other's behalf.

As a result, by enabling multi-hop communication, the mobile nodes are able to communicate beyond their transmission range.

There are several other efforts related to the work under study. In the work of Perkinset.al (Broch et al., 1998), evaluation of DSR and AODV was studied with node density as 50 and 100 only using nS-2 network simulator. Another relative work has been presented by Brochet.al (Das et al., 2000). In the work (Perkins et al., 2001), four ad-hoc routing protocols are evaluated using nS-2 for 50-node network models.

Because mobile nodes are free to move at random, routing in a mobile ad hoc network becomes challenging. Three categories can be used to categorize ad hoc routing protocols: proactive, reactive, and hybrid. Every node's routing is periodically changed in proactive routing.

Reactive routing, on the other hand, is done on-demand; the sending node only looks for a path to the destination node when it needs to connect with it. These two routing strategies are combined in hybrid routing.

In other words, reactive routing is employed outside of the small area around the mobile node, and proactive routing is used inside it.

The main objective of the paper:

To put several gateway finding strategies into practice and compare them.

In a mobile ad hoc network, packets can be routed between mobile nodes using the AODV ad hoc routing protocol. However, because it does not provide routing between a mobile ad hoc network and a fixed network like the Internet, access to the Internet via mobile nodes is not feasible.

A solution is offered in the Internet draft "Global Connectivity for IPv6 Mobile Ad Hoc Networks" that involves altering the AODV protocol to enable packet routing to both

fixed and mobile wired networks. The goal of this paper is to simulate a solution using Network Simulator 2 (NS-2) for the comparison of three different approaches (Reactive, proactive, and hybrid gateway) for Mobile Ad Hoc Networks.

Outcomes of the simulation:

The effects of adjusting the gateway advertisement intervals are investigated and assessed in this section. When no gateway advertisements are given, the reactive gateway discovery approach produces consistent results regardless of the duration between adverts. Each data point is the average of ten random creations of the same communication model with unique movement patterns.

The packet Delivery Ratio:

Figure (1) displays the packet delivery percentage with advertisement intervals ranging from 2 to 60 seconds. The three gateway discovery algorithms have very high packet delivery ratios (over 99.8%), the three approaches' differences are from one another. Nonetheless, when it comes to brief marketing intervals, the proactive and hybrid approaches outperform the reactive strategy in terms of packet delivery ratio. The rationale for its short advertisement intervals is that it results in more gateway information (RREP_I and GWADV packets).

When a mobile node receives a GWADV or RREP_I message, it modifies the gateway's route entry. The likelihood of mobile nodes having newer, shorter paths to a gateway increases as a result, reducing the possibility of link failures. Since the source keeps sending data packets until it receives an RERR message from the mobile node that has a broken link, link breaks can cause data packets to be lost.

Since it takes longer for the source to get an RERR, more data packets could be lost over a route with more hops.

When the advertisement interval rises, a mobile node does not update the route to the gateway as frequently as it would during short advertisement intervals because it receives less information from the gateway. As a result, when the advertisement interval grows, the beneficial impact of periodic gateway information decreases.

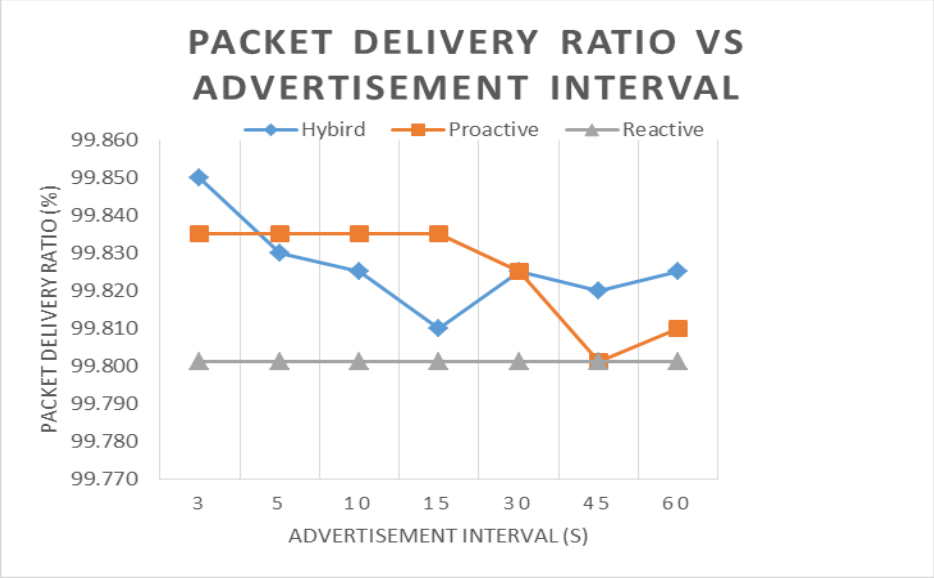

Figure (1): Packet delivery ratio.

The average Delay:

Figure (2) displays the average end-to-end latency with advertisement intervals ranging from 2 to 60 seconds. Compared to the reactive strategy, the proactive and hybrid approaches have a lower average end-to-end delay.

The rationale is that the mobile nodes can update their route entries for the gateways more frequently, leading to shorter and more recent routes, thanks to the gateways' periodic gateway information.

When using the reactive approach, there are situations where the route can be quite lengthy (in terms of hop count). In these situations, the mobile node does not use the nearby gateway; instead, it sends data packets to the gateway down the lengthy route until the route is broken.

Stated differently, a mobile node follows a path to a gateway until it is disrupted. As a result, the average end-to-end delay for all data packets rises as the end-to-end latency for these particular data packets grows.

increasing the advertisement interval results in a modest decrease in the average end-to-end latency for short advertisement intervals. This may come as a surprise, but it makes sense because very brief advertisement intervals generate a lot of control traffic, which causes each node's data packet processing times to increase.

Furthermore, data packets must wait in the routing queue until the AODV messages are dispatched because they are prioritized above other messages, which increases the end-to-end delay.

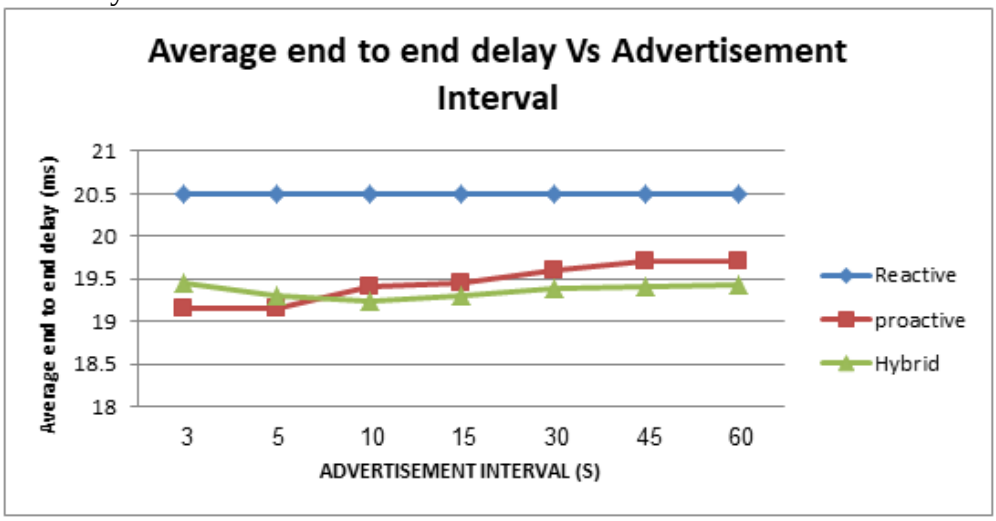

Figure (2): End-to-end Average delay

The overhead of the AODV:

The RREP _I and GWADV messages that are periodically broadcast are contained in the AODV overhead. The AODV overhead with advertisement intervals ranging from 2 to 60 seconds the proactive and hybrid approaches have higher AODV overhead than the reactive strategy, particularly for brief advertisement intervals.

This is an expected outcome because the proactive and hybrid techniques periodically broadcast gateway information whether or not the mobile nodes need it, but the reactive strategy only does so in response to a request from a mobile node.

Furthermore, as the advertisement interval rises, the proactive and hybrid techniques'

AODV overhead decreases, Less frequent gateway information broadcasts are the cause of this.

Finally, it is evident that when the advertisement interval is short, the hybrid approach's overhead is significantly higher than the proactive approach's. The reason for this is that there are duplicate messages.

Under the proactive approach, mobile nodes forward GWADV messages only if they haven't already. Gateways broadcast the messages. Therefore, when the proactive strategy is applied, no duplicate broadcast messages are generated. Under the hybrid approach, mobile nodes forward RREP_I messages that gateways broadcast until the messages' TTL (time to live) value drops to zero.

As a result, certain RREP_I messages are duplicated, and a mobile device may receive the same RREP_I more than once.

When using hybrid gateway discovery simulations, ADVERTISEMENT_ZONE, which is defined as 3 in this paper, is the TTL value that has been established. This suggests that every mobile node within a 3-hop radius of the gateway receives an RREP_I message. RREP _I messages cannot be utilized for a proactive gateway discovery approach unless they are adjusted, as discussed above. Since the proactive approach would require the TTL value to be set to NETWORK_DIAMETER, which in the AODV implementation in NS equals 30 hops.

When TTL is set to 3, many duplicate RREP_I messages are sent. One can only speculate as to how much overhead a TTL value of 30 would have generated.

Conclusion:

Reactive, proactive, and hybrid gateway discovery are the terms used to describe the three gateway detection techniques. The comparison of different approaches gives us important insights. Whichever gateway discovery method is employed, the outcome is essentially the same in terms of the packet delivery ratio. The proactive and hybrid approaches outperform the reactive method in terms of average end-to-end delay.

In terms of routing overhead, the reactive approach produces significantly less overhead than the proactive method, which in turn produces significantly less overhead than the hybrid strategy, when the advertisement period is short. The routing overhead produced by the three approaches is almost equal as the advertisement interval rises.

As a result, it is impossible to determine which gateway discovery technique is ideal in every situation. Numerous variables are modifiable, and it is important to examine their effects.

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