VOL. 10, NO. 13, JULY 2015 ISSN 1819-6608
ARPN Journal of Engineering and Applied Sciences


www.arpnjournals.com

PERFORMANCE IMPROVEMENT THROUGH SCALABLE DESIGN OF HYBRID SERVICE DISCOVERY PROTOCOL

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ABSTRACT

Hybrid protocol is a blending of proactive and reactive routing approaches. This can be achieved by keep up-to-date topological map of a node centric zone. Initially the routing is accomplished with some proactively explored routes and then functions based on the demand from the nodes that are additionally activated by means of reactive flooding. In the proposed protocol a scalable design of hybrid service discovery protocol for efficient discovery of services is proposed. In the proposed protocol the zone size can be adjusted based on the overhead. The prediction technique is used here to predict the proactive as well as reactive overhead. The results show the scalability of the protocol. Thus adjusting the zone size improves the throughput, packet delivery ratio and reduces the number of control packets and end-to-end delay comparing to the existing approach.

Keywords: scalable, adjustable, prediction, service discovery.

1. INTRODUCTION

An Ad-Hoc Network is said to be a network without infrastructure and also it is self-organized as well as a dynamic topology network. One of the compelling claims of Ad Hoc wireless network is its nodes mobility. The free movement of the nodes of the Ad-Hoc Network can form themselves in an arbitrary manner. As a consequence, an effectively functioning routing protocol is expected to fulfill the necessities of the user. Ad-Hoc network nodes are arbitrarily mobile; topology is unpredictable as it often alters, so rapid route reconfiguration is essential to overcome path breaks. Nodes in the network should identify the services that are provided by other nodes.

As the network is dynamic, locating the actual Service Provider is a challenge. So ideal routing protocol to locate and provide services is necessary. Management of energy is also crucial part of the Ad Hoc network. The network life depends on managing the sources and consumption of energy by the nodes in the network. Therefore an efficient routing protocol is needed to avoid transient loops, packet collisions, frequent path breaks, stale routing information.

Routing protocols are classified into Proactive and Reactive. In the former up-to-date routing information is maintained by all the nodes in the Mobile Ad-Hoc NETworks (MANETs) by exchanging their routing tables and evaluating the routes to all reachable nodes, hence the name Table Driven. Whereas the latter is known as On Demand because routing path is searched only when a request is made. Hybrid protocols attempt to combine the proactive and reactive approaches. One such example for Hybrid routing protocol is Zone Routing Protocol (ZRP) that divides the topology into zones and are node centric. ZRP searches the destination path proactively within the zone and uses reactive scheme for route discovery outside the zone.

ZRP is totally modular, meaning that any routing protocol can be used within and between zones. Discovery mechanism helps for impromptu referencing a networks resource. These references are used by a client to get the requested service. The services offered by different servers in an Ad-Hoc Network are automatically discovered with the help of any one of the several Service Discovery Protocols. In MANETs the centralized points grant gateway service to the members in the network and acquire the service through these points. Service discovery enables service advertising, list of services rendered by other nodes, and selecting the required service.

Our proposed work involves a scalable design of hybrid service discovery protocol for discovering services for a low mobility environment. A broadcast mechanism is used to obtain the service and routing information of the nodes present within the zone. Combining the routing and service information reduces the packet flooding in the network hence decreasing collision and increasing packet delivery efficiency. Reduced control packet in turn reduces the battery power consumption. A query message is bordercasted via the peripheral nodes to the nodes outside the zone. This causes the discovery procedure more scalable hence increasing the node's coverage and reducing the latency.

Bordercasting mechanism is used when required to access nodes outside the zone. The service information of neighboring nodes is obtained in addition to routing information simultaneously.

2. RELATED WORK

Annapurna *et al* [1] proposed QHSDP for discovering services for a low mobility environment. A broadcast mechanism is used to get the service and routing information of the nodes present inside the zone. Combining the routing and service information reduces the packet flooding in the network hence reducing collision and increasing packet delivery efficiency. Reduced control packet in turn reduces the battery power consumption. A

query message is border casted through the peripheral nodes to the nodes outside the zone. This makes the discovery procedure more scalable hence increasing the node's coverage and reducing the latency. Askari Parichechrah *et al.* [2] introduced query control mechanisms to avoid frequent forwarding of similar query request various times and to prevent query requests being forwarded to previously visited zones. When larger zones are used response time is reduced but network traffic overhead is increased. Askari Parichechrah *et al.* [3] proposed a solution to reduce the response time without rising the traffic on the network. Askari Parichechrah et al., [4] made a modification in the query mechanism and advertisement mechanism to solve the same problem discussed in [3]. To decrease communication overhead and save battery power Christopher N Ververidis *et al.*[5] piggybacked the service information in routing messages. Fatma Outay e*t al.* [7] proposed a system to support flat bandwidth environments and inquire services using bloom filter in addition to the service caching.

Erik *et al.* [6] designed a decentralized SLP scaling small, unadministered networks to large enterprise networks Kaouther *et al.* [8] proposed a protocol. In that the zone size can be adjusted based on the overhead. The prediction technique is used here to predict the proactive as well as reactive overhead. Klimin *et al.* [9] propose a hybrid SDP in ad hoc vehicular networks. Their approach suggests geocast addressing of control messages and proactively disseminates advertisement messages and the reactively propagates.

In [10], Murat *et al.* proposed a push-based discovery approach; the service provider advertises its service in a proactive way and disseminates the service information to all the vehicles without waiting for service requests Sailhan, F. *et al.* [11] introduced a scalable SDP for MANETs, based on the dynamic and homogeneous deployment of cooperating directories within the network. Directories probably cache the description of a given service compactively. Higher scalability is achieved by these minimized overheads of compact directory.

In [12], Dolev *et al*. proposed a service discovery mechanism based on Virtual Mobile Nodes (VMNs) for mobile ad hoc networks. In [13], the authors present a robust service discovery protocol for hybrid networks permitting the discovery of services located in multiple networks but their work relies on the wired network for proper execution.

3. METHODOLOGY

The prediction procedure finds out which node is ready to accept the packet and which node is ready to provide the service. The first step in this action is advertisement that is sending message to the service provider. The message will not be given directly to the destination node. For this purpose a set of routers will be maintained. They are trying to perform advertisements. Routers are used to publish information that is they are ready or free to get information. This is from the perspective of service provider. But from the perspective of those who are sending the message, individual service provider, in next action, they are trying to advertise the message in their zone. Advertisement is carried out by the overall service provider. So that they can have very good overhead. The overhead is the range the service provider can provide service. In the perspective of zone, there will be some reactive overhead. Reactive overhead is the responses given by the node based on the advertisements. Proactive overhead is the amount of messages sent by the service provider. In the perspective of zone, there will be some reactive overhead. Reactive overhead is the responses given by the node based on the advertisements. Proactive overhead is the amount of messages sent by the service provider.

If the total number of messages send by the service provider is greater than the response messages, the service provider will get bigger. i.e., they can service more users. If the reactive overhead is more, then the system becomes complicate. So in the prediction procedure, it should be checked whether reactive variance is higher or proactive variance is higher. If the reactive variance is higher, the number of responses would be greater than the number of messages from service provider. At that time in the perspective of service provider, individual nodes start sending advertisements.

The service provider will increase their advertisements, so that they can satisfy maximum users. This can support more number of messages. If the proactive variance is higher, the number of messages from the service provider would be greater than the number of responses. At that time, the service provider will reduce the number of advertisements. If the number of service provider gets reduced, the overall performance would be more. Because, when requirements are lesser and number of service providers is higher, then there would be waste of requirements. Based on the number of requirements, the service provider could be increased or decreased. But if the requirement is more for service provider, then the service provider's could not be increased, but instead the services for the service provider can be increased. So that considerable amount of service providers and advertisements can be reduced.

4. ALGORITHM

a) The prediction procedure

The prediction procedure is illustrated in the below Figure-1.

1: if (Expected Reactive Variance > Expected Proactive Variance) **then**
Action:
The service provider decides to increase its advertisement zone size in terms of hops.
2: else if (Expected Proactive Variance > Expected Reactive Variance) **then**
Action:
The service provider decides to decrease its advertisement zone size in terms of hops.

3: end if

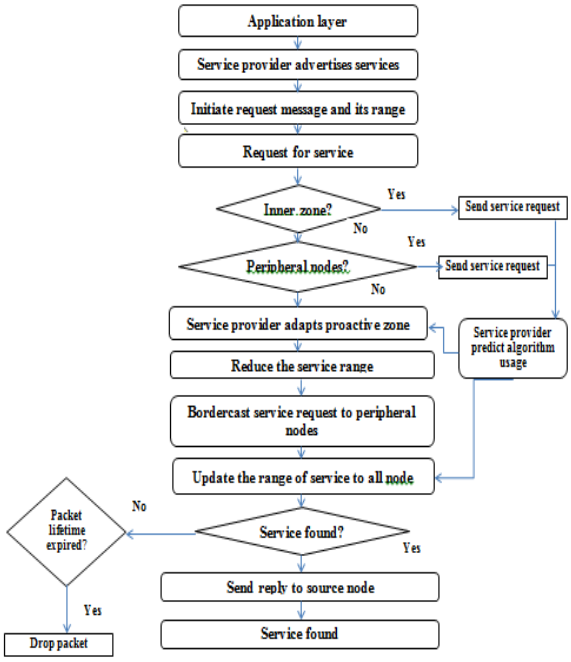

Figure-1. Prediction procedure.

5. PERFORMANCE ANALYSIS

The NS2 simulator is used to assess the performance of our proposed SDP. For simulation, in the proposed approach 5 to 25 nodes are considered. The simulation network coverage area of the proposed approach is 1000 x 1000m. To evaluate the performance of the proposed approach, four different quantitative metrics namely received control packets, throughput, packet delivery ratio and end-to-end delay are used**.** The node density is considered as the variable parameter.

Control packet analysis

The aggregate of control packets send and receive at each node gives the number of control packets flooded in the network. The control packet analysis is shown in the Figure-2.

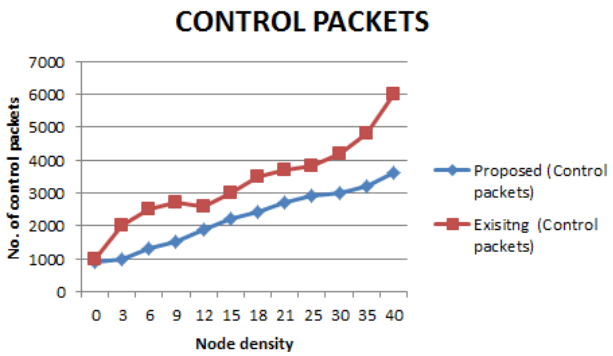

Figure-2. Node density vs. no. of control packets.

In the existing approach advertisement message carries service information alone. But in the proposed approach a broadcast mechanism is used to get the service and routing information of the nodes present inside the zone. Combining the routing and service information reduces the packet flooding in the network.

Packet Delivery Ratio

Packet delivery ratio (PDR) is the ratio of the packets that are successfully delivered to a destination. The higher value of packet delivery ratio means the better performance of the protocol. The packet delivery ratio is shown in the Figure-3. Since the control packet flooding is reduced in the proposed approach, collision gets reduced, which in turn increases the packet delivery ratio.

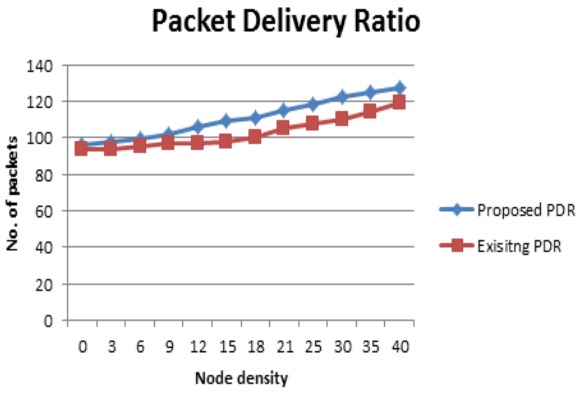

Figure-3. Node density vs. no. of packets.

Throughput

The throughput is defined as the total amount of data a receiver receives from the sender divided by the time it takes for the receiver to get the last packet. The throughput is shown in the Figure-4.

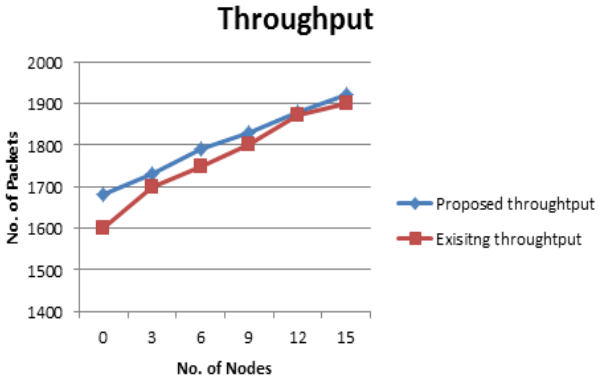

Figure-4. Node density vs. no. of packets (in bytes).

As the transmission of BQM packets have been randomized over an interval of time, the collision rate of the packet is decreased, which in turn reducing the traffic. Due to this the throughput performance of the proposed approach is better comparing to the existing approach.

End-to-end delay analysis

It refers to the average time taken for a packet to be transmitted from source to destination. The delay from the source to destination is shown in the Figure-5.

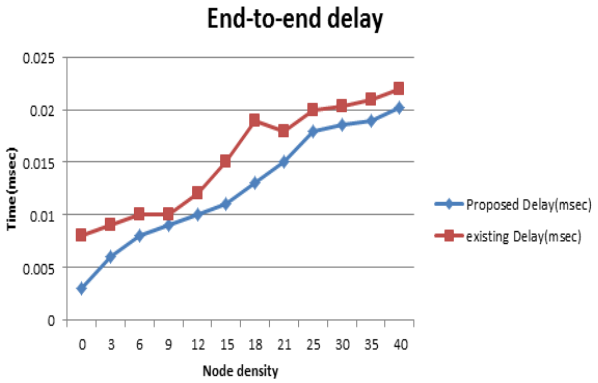

Figure-5. End to end delay.

In the proposed approach, the acknowledgement and retransmission of packets for control traffic is not considered, which results in reduced latency.

6. CONCLUSIONS

The protocol defines the prediction procedure which adjusts the size of the zone based on the proactive as well as reactive overhead. The results show the scalability of the protocol. Thus adjusting the zone size improves the throughput, packet delivery ratio and reduces the number of control packets and end-to-end delay comparing to the existing approach.

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