Research Paper

EFFICIENT SERVICE DISCOVERY AND ROUTING PROTOCOLS FOR MANET

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ABSTRACT

The emerging area of research in the field of ad hoc network is service discovery. The probability based service discovery is easy to implement it reduce the complexity of the protocol and at the same time it provides better performance with improved flooding algorithms in term of power saving of nodes and redundancy of network communication. In this paper we proposed the schemes to reduce redundant rebroadcasts and differentiate timing of rebroadcasts to alleviate in ad-hoc network. Our experimental results are showed of improvement over the basic flooding approach and also the proposed algorithm gives good performance in dense network with ensuring complete coverage but in sparse network.

KEYWORDS

MANET, Service Discovery Protocol, DSDV, AODV Routing.
INTRODUCTION

Automatic network configuration is difficult in a MANET due to the very dynamic nature of the system. Dynamism arises from the fact that nodes may entry or leave at any time, the nodes are expected to move, and these the properties of the wireless medium are time variant. In recent research efforts for MANETs have mainly focused on packet routing. In this paper, we focus on the issue of service discovery which is the most importance and the service discovery is required when a client application desires to access a service provided by a host or server. Using service discovery, members of the MANET are then able to use such a gateway service. An electronic parking system, service is defined differently. In such scenario, implemented in sensor network, each parking slot is equipped with a sensor. Using their wireless hand-held device or notebook, participants in collaborative applications or distributed gaming environments need to discover application or game servers before participating in a session.

Service Discovery in MANET is a challenging task due to decide where to the directory or list of the services available on the network. There is no prior infrastructure in MANET, we can’t dedicate any node or set of nodes as directory server, in advance. The directory is distributed among the nodes in MANET. The issue is the actual discovery of the service in the network, if there are few dedicated nodes, they can be queried for the service and broadcasting or their variations could be used for service discovery [1-3].

In MANET in particular, due to host mobility, such operations are expected to be executed more frequently and radio signals are likely to overlap with others in a geographical area, a straightforward broadcasting by flooding is usually very costly and will result in serious redundancy [4].

In this paper, we proposed the schemes to reduce redundant rebroadcasts and differentiate timing of rebroadcasts to alleviate this problem. Simulation results are presented, which showed different levels of improvement over the basic flooding approach.

BACKGROUND TECHNIQUES

MOBILE AD HOC NETWORKS

A mobile ad hoc network is a collection of wireless nodes that can dynamically be set up anywhere and anytime without using any pre-existing network infrastructure. It is an autonomous system in which mobile hosts connected by wireless links are free to move randomly and often act as routers at the same time.

Wireless networks consist of static or mobile hosts that can communicate with each other over the wireless links without any static network interaction. They can also forward packets destined for other nodes [5-6].
The traffic types in ad hoc networks are quite different from those in an infrastructure wireless network, including:

(i) Peer-to-Peer - Communication between two nodes that are within one hop.

(ii) Remote-to-Remote – The communication between two nodes with a single hop but which maintain a stable route between them. It may be the result of several nodes staying within communication range of each other in a single area or possibly moving as a group.

(iii) Dynamic Traffic - This occurs when nodes are dynamic and moving around. Routes must be reconstructed. This results in a poor connectivity and network activity in short bursts.

CHALLENGES FACED

Regardless of the attractive applications, the features of MANET introduce several challenges that must be studied carefully before a wide commercial deployment can be expected. These include following:

(i) Routing. Since the topology of the network is constantly changing, the issue of routing packets between any pair of nodes becomes a challenging task.

(ii) Security and Reliability. An ad hoc network has its particular security problems due to e.g. nasty neighbor relaying packets.

(iii) Quality of Service (QoS) Providing different quality of service levels in a constantly changing environment will be a challenge.

(iv) Inter-networking: The coexistence of routing protocols, for the sake of internetworking a MANET with a fixed network, in a mobile device is a challenge for the mobility management.

(v) Power Consumption. For most of the lightweight mobile terminals, the communication-related functions should be optimized for less power consumption [7-8].

BROADCASTING IN MANETS

Broadcasting means one node sends a packet to all other nodes in a network. Broadcasting may be used by a node to send data to all other nodes in the network or may be used by MANET unicast or multicast routing protocols to disseminate control information.

The problem considered here has the following characteristics.

(i) The broadcast is spontaneous. Any mobile host can issue a broadcast operation at any time.

(ii) The broadcast is unreliable. No acknowledgement mechanism will be used. However, attempt should be made to distribute a broadcast message to as many hosts as possible without paying too much effort.

The motivations to make such an assumption are
(i) A host may miss a broadcast message because it is off-line, it is temporarily isolated from the network, or it experiences repetitive collisions.

(ii) Acknowledgements may cause serious medium contention (and thus another “storm”) surrounding the sender.

(iii) In many applications 100% reliable broadcast is unnecessary.

Different synthetic entity mobility models for ad hoc networks:

(i) Random Walk Mobility Model including its many derivatives

(ii) Random Waypoint Mobility Model

(iii) Random Direction Mobility Model

(iv) A Boundless Simulation Area Mobility Model

(v) Gauss-Markov Mobility Model

(vi) A Probabilistic Version of the Random Walk Mobility Model

(vii) City Section Mobility Model [2] and [8].

SERVICE DISCOVERY

Most of the research on MANETs has focused on issues dealing with the connectivity between mobile nodes to cope with the dynamism of such networks and the arising problems thereof. This dynamism is due to the mobility of nodes, the adverse conditions of a wireless channel, and the energy limitations of mobile nodes, all of which lead to frequent disconnections and/or node failures. These research efforts have led to the creation of a sound technical basis for dealing with the aforementioned problems regarding node connectivity in MANETs (mainly through routing protocols, link layer protocols, etc.)

Service discovery is defined as the problem of automatically locating different services within a network. Services are entities available for use by a network node. For example, a service could be a printer, an image scanner, or a file server.

More precisely service discovery is defined as a process enabling networked entities to:

(i) Advertise their services

(ii) Query about services provided by other entities

(iii) Select the most appropriately matched services

(iv) Invoke the services

In the past, service discovery mainly was addressed in the context of wired networks. However, in the context of MANETs, the following new challenges arise:

(i) Node mobility, affecting service availability

(ii) Frequent disconnections of the server or the client or intermediate nodes breaking or changing the path and the service selection parameters
(iii) Channel variability, leading to significant communication characteristics variability (data rate, delay, etc.)

**WIRELESS NETWORKS**

Generally there are two distinct approaches for enabling wireless mobile units to communicate with each other:

(i) Infrastructure-based – Wireless mobile networks have traditionally been based on the cellular concept and relied on good infrastructure support. Here mobile devices communicate with access points like base stations connected to the fixed network infrastructure.

(ii) Infrastructure-less -- As to infrastructure-less approach, the mobile wireless network is commonly known as a mobile ad hoc network (MANET). A MANET is a collection of wireless nodes that can dynamically form a network to exchange information without using any pre-existing fixed network infrastructure [9-10].

**LITERATURE SURVEY**

For developing software new concepts are gained from the relevant changes in the exiting researches. This require a through literature survey. The important research papers are collected from the proceedings and publications of last twenty five years which has brought a significant technical development. The main work of these papers is considered to develop this work.


In this paper several service discovery mechanisms have been proposed so far, such as SLP, Jini, and UPnP. Among them, the Service Location Protocol version 2 uses administrative-scope multicast and is defined for use over IPv4 and IPv6. SLP provides service discovery both by service type and attribute, so a client can find a distinct server by specifying required characteristics. Compared to other service discovery mechanisms, SLP is open source software, independent of programming languages, based on TCP/IP and can work without directory agents. Therefore we focus on SLP in this paper. To achieve service discovery in ad hoc networks, in this paper we consider the integration of the SLP protocol with the reactive ad hoc routing protocol, AODV (ad hoc on-demand distance-vector).

The message format for service discovery is based on the route request/reply format plus a service request/reply extension to specify the service of interest. A RREQ with a service request extension is called a service request message (SREQ) and a Route Reply (RREP) with a service reply extension is called a service reply message (SREP). Service request extensions can be divided into two categories: URL extensions
and port extensions. The URL extension allows a user to request a service by specifying its type and optional attributes. The port extension, on the other hand, makes use of the port number to identify the desired service [1].


In this paper, there is an assumption is that mobile hosts in the MANET share a single common channel with carrier sense multiple access (CSMA), but no collision detection (CD), capability. Synchronization in such a network with mobility is unlikely, and global network topology information is unavailable to facilitate the scheduling of a broadcast. So one straightforward and obvious solution is broadcasting by flooding. Unfortunately, in this paper we observe that serious redundancy, contention, and collision could exist if flooding is done blindly.

This paper has identified an important issue in a MANET, the broadcast storm problem several schemes, namely probabilistic, counter-based, distance-based, location-based, and cluster-based schemes, have been proposed to alleviate this problem. As compared to the basic flooding approach, and a simple probability based scheme can eliminate many redundant rebroadcasts when the host distribution is dense [2].


One of the earliest broadcast mechanisms proposed in the literature is simple or “blind” flooding [3] where each node receives and then re-transmits the message to all its neighbors. The only ‘optimization’ applied to this technique is that nodes may remember broadcast messages received and do not act if they receive repeated copies of the same message. A probabilistic approach to flooding has been suggested as a means of reducing redundant rebroadcasts and alleviating the broadcast storm problem. In the probabilistic scheme, when receiving a broadcast message for the first time, a node rebroadcasts the message with a predetermined probability p; every node has the same probability to rebroadcast the message. When the probability is 100%, this scheme reduces to simple flooding. Studies have shown that probabilistic broadcasts incur significantly lower overhead compared to blind flooding while maintaining a high degree of propagation for the broadcast messages.

This paper has evaluated the performance of Adjusted Probabilistic flooding on the AODV protocol which is based on simple flooding in MANETs to improve saved rebroadcasts [3].

“An Efficient Neighbor Knowledge Based Broadcasting for Mobile Ad Hoc Networks”, authored by Sung-Hee Lee and Young-Bae Ko,
the Ubiquitous Autonomic Computing and Network Project, the 21st Century Frontier R&D Program, and the ITRC (Information Technology Research Center) published in year 2006.

In this paper, discussed the hybrid approach combining Neighbor knowledge based flooding and Area based flooding, and proposed a new algorithm called as FONIAH (Flooding based on One-hop Neighbor Information and Adaptive Holding). Although this concept can be useful to rapidly enlarge a coverage area, it may cause a high latency problem in a sparse network. Here assumption is that each node knows its own geographical location, and periodically sends HELLO packets containing its location information. Upon receiving a HELLO packet, a node updates its neighbor table. Consequently, every node becomes to know geographical locations of all neighbors within one hop transmission radius [4].

PROPOSED TECHNIQUES

Different MANETs vary both in size, equipment, applications and objectives, a variety of different protocols to solve service discovery in these networks are proposed and implemented. The aim in this paper is to create and evaluate a new service discovery design for dense ad-hoc networks primarily aimed at tactical and first responder networks in order to make an efficient service discovery solution suitable for such environments.

The main components we are using to design proposed method are following

(i) *Service Descriptor* – This is used to describe services completely, service parameter like message number, service number etc. are used. The processing element at the other side recognizes and processes these services information packets.

(ii) *Normal Node* – Nodes that have request for services available on the network and intermediate nodes that forward requests.

(iii) *Service Providing Node* – Nodes that have services and which response for requested services.

(iv) *Service Request* – whichever node wants services it request for service information as service request.

(v) *Service Reply* – Service providing nodes response as service reply mentioning available service information as available services

LOW LEVEL DESIGN OF PROPOSED METHOD

For service descriptor we will use main parameters messageID, serviceID, and command type whether service request (sreq) or service reply (srep) is used. Normal node receives packets extract messegeID and forwards it to next node mentioning data, size, BROADCAST_ADDR, and sport. Service providing node recognizes serviceID, and messageID and response to requesting node via
sending service information in prescribe format and size. We are using here energy model to calculate energy at nodes.

ARCHITECTURAL DESIGN
The architecture design is illustrated in Figure 1. Each node in an ad hoc network is either a server or a client. For each server, a replying service discovery agent is employed and for each client is a request service discovery agent employed. We choose the DSDV protocol as the underlying ad hoc routing protocols.

Algorithm Description
Here we are presenting relatively both algorithms say flooding and proposed probability based algorithms.

Algorithm 1 flood (m)
(i): L upon reception of message m at node n:
(ii): if message m received for the first time then
(iii): broadcast (m) {this is the basic local broadcast primitive to nodes within range only}
(iv): end if

Algorithm 2 p-flood (m,p)
(i) upon reception of message m at node n:
(ii) if message m received for the first time then
(iii) broadcast (m) with probability p {this is the basic local broadcast primitive to nodes within Range only}
(iv) end if

In first algorithm a node broadcast service request and intermediate node also flood the service request packet on the network so this method have many redundancy of connection consequently collision and contention occur.

In improved second algorithms we have used probabilistic scheme to control the flooding in which node first time broadcast service discovery packet but intermediate node forward it whenever a certain probability is satisfied so it can drop some packets.

Activity Diagram
figure 2 shows activity diagram for service requesting process in which whenever any node receives a service request packet it extract service information from packet and check it whether it is valid service binding or not if yes forward it to next node otherwise drop it. Further it has to check for valid root to forward packet it forward packet by constructing another service request packet by adding its own header.
SIMULATION PROCESS

Currently the network simulator 2 (ns-2) is a popular and powerful simulation for IEEE 802.11 wireless networks, including wireless LANs, Mobile Ad Hoc NET-works (MANETs), and sensor networks.

Using CMU’s wireless extensions to ns-2
A suitable Ns-2 network simulator should be installed from the standard web resources such as http://www.isi.edu/nsnam/ns/. Installation of ns-2 could be a bit lengthy and a time-consuming process. It involved downloading and setting up a huge package. However, getting the simulator to work was the first step involved in carrying out the simulations.

CMU’s wireless extension to ns-2 (incorporated in the current release ns-2.1b9a) provides the implementation of the DSR, AODV, DSDV, TORA routing protocols. Nam is the basic visualization tool used for ns-2 simulations. However, it doesn’t support the ad-hoc simulations. Ad-hockey is a Perl/Tk program that supports the visualization of ad-hoc simulations. Unfortunately, I couldn’t get the Ad-hockey visualizer tool to work because of its compatibility issues with the new versions of Perl/Tk module.

FUNCTIONALITIES

(i) Simulations in ns-2 are user-defined by tcl-scripts. The simulator interprets the scripts at simulation startup and performs the simulations via a scheduler. The scheduler uses both built-in and auxiliary network components. The service discovery code described in this chapter is an example of such an auxiliary component. The simulations result in one or several text files (Fig 3). Those text files can be interpreted by an external program to collect statistics, or be used as input to an animator program1 in order to visualize the node mobility and the packet flow.

(ii) Figure 3 shows the detailed pictorial representation of NS-2 algorithm description that how to ns2 process input tcl script and produce desired outputs both in data and pictorial form. At first mobility scenario generator take scenario parameters as input and give mobility files. At the other side traffic generator generate traffic by taking traffic parameters. Mobility files and traffic files are written in the form of .tcl file and
goes into ns2 simulator which create trace files and animator files. Animator files give pictorial representation of output and trace files are use to analyze module which can be written in some scripting language or java. Through the support of these modules performance graphs are created.

RESULTS

Figure 4 in the graphs of Algorithm1 and Algorithm2 denoted the following

Algorithm1: Service discovery using Normal Flooding based Broadcast

Algorithm2: Service discovery using Controlled Flooding based Broadcast

Figure 5 represents that the power was consumed little bit low in the proposed algorithm than the normal algorithm.

Figure 5 Comparison in terms of power consumed

Figure 6 shows that the Total packets send and received at Routing layer is little bit lower in the proposed algorithm than the normal algorithm.

Figure 6 Comparison in the term of Total packets send and received at Routing layer

Figure 7 shows that the service reply messages received in both of the cases were almost equal.

Figure 7 showing same throughput in terms of message delivery

It means that the proposed algorithm provided the same throughput in terms of message delivery with low overhead than the normal algorithm.
That is, with minimum power, minimum MAC and Routing overhead, the proposed algorithm provided good delivery.

CONCLUSION & FUTURE WORK

Simplicity of protocol reduces protocol perplexity and at the same time it gives improved results over flooding in various concerns in MANET. The analysis of the existing system has been done to bring out the relevant issues. We proposed the schemes to reduce redundant rebroadcasts and differentiate timing of rebroadcasts to alleviate this problem. We evaluated the performance of Probabilistic flooding on the AODV protocol using trace analysis which is based on simple flooding in MANETs to improve saved rebroadcasts. The results of the previous, the service reply messages received in both of the cases were almost equal. It means that the proposed algorithm provides the same throughput in terms of message delivery with low overhead than that of the normal algorithm. That is, with minimum power, minimum MAC & Routing overhead, the proposed algorithm provided good delivery. This work extends the state of the art in the performance of Probabilistic flooding on the Dynamic Source Routing (DSR) algorithm. We can refine our system by apply adjusted probability based flooding in which probability can be adjusted.

REFERENCES


