Survey of Load Balancing and Service Discovery for Mobile Ad hoc Networks

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Abstract—Recently, Service Discovery protocols in MANET have gained special attention from the research centers. In existing method, Service discovery protocols in mobile networks does not guarantee load balancing on routing paths between service providers and service requesters. It does not guarantee the performance attributes to service requesters and service providers. It permit to satisfy some performance attributes specified in client requests and to report on its performance evaluation such as, Success rate, Connection rate, Average response time, Bandwidth usage, Average load.

Index terms—MANET, Service discovery, Load balancing.

I. INTRODUCTION

Mobile ad-hoc networks have gained special attention from the research centers. The wireless mobile network consists of several mobile nodes which are deployed randomly. MANET is a Self-configuring which means if any nodes failures occur it will automatically reconfigure itself to its normal state, infrastructure-less network of mobile devices connected without wires (such as Personal computers, laptop, PDAs, mobile devices etc.). In mobile ad hoc network, the network topology changes frequently and unpredictably because of power limitations and node mobility in mobile environment. In mobile networks, multi-hop wireless links are located in between the mobile nodes. The data must be routed via the intermediate nodes. Here, each mobile node can act as a client, a server and a router.

1.1 Advantages of MANET

- Improved flexibility
- Scalable
- Network can be setup at any place and time.
- Self-configured
- Less expensive compared to wired network.
- They provide access to information and services regardless of geographic position.
- Robust due to decentralized administration.

1.2 Applications of MANET

MANET is used in various applications due to their flexibility such as:

i) PAN (Personal Area Networks): Personal area networks are computer network that are focused on individual uses only. PANs are used to set up an embedded network using nodes. It has different shapes of mobile devices. During node communication the different PANs can utilize facilities of ad hoc network. An example of PANs; a doctor can distribute a set of sensor devices on the patients body in order to get the information for analyze the diseases.

ii) MANET in Home: Two ad hoc devices one with the user and other in the home can communicate with other in order to accomplish particular task such as activate AC, lights on getting home.

iii) MANET in Military applications: The most popular application of MANET in battle field for military communication. But it is difficult to build a fixed network for military communication in battle field.

iv) Other commercial applications: Such as vehicle tracking, navigation purposes, peer to peer applications, road safety messages etc.

v) MANET in office: Emails and Files are synchronized between the office desktop and the personal digital assistant (PDAs) which allow transferring data in flexible way.

1.3 Limitations of MANET

i) They are limited by the wireless channel like other mobile communication system.

ii) MANETs are unstable due to some factors, such as channel interference, unidirectional links and noise etc.

iii) It has limited bandwidth power such as battery life time battery, storage capacity normally restricted in mobile nodes and CPU capacity.

iv) Nodes have limited transmission range since they depend on the radio waves.

v) The network topology changes frequently and unpredictably.

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vi) Because of the characteristics of nodes in MANET, such as light weight and small size, energy becomes a more prominent problem of the network.

1.4 Service Discovery in MANET

Service discovery allows devices to automatically locate network services with their attributes and to advertise their own capabilities to the rest of the network. Service discovery is defined as a process enabling networked entities to:

- Advertise their services.
- Query about services provided by other entities.
- Select the most appropriately matched services.
- 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:

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

Service Discovery Protocols can be defined as “Service Discovery Protocol is n/w protocols which allow automatic detection of devices and services offered by these devices on a computer networks”.

1.5 Load balancing in MANET

In MANET, to improve the performance, it is very important to balance the load. Load balancing is used to increase throughput of the network. Also it is possible to,

- End-to-End packet delay can be minimized.
- Packet delivery ratio, Maximize nodes lifetime.
- Network energy consumption can be balanced.
- Load unbalance and Minimize traffic congestion.

Various Load balanced ad hoc routing protocols are on-demand-based protocols; i.e. load balancing strategies is combined with route discovery phase [3].

In a broader context, the term load can be interpreted as:

i. **Load**: Specifically, it refers to how busy a node is in processing which relates to a node’s activity.

ii. **Neighboring load**: Represents the load generated by communication activities among neighboring nodes.

iii. **Channel load**: Represents the load on the channel where multiple nodes contend to access the shared media.

a) Load metrics

Load balanced ad-hoc routing protocols are based on different load metrics,

i. **Packets in interface queue**: This refers to the total number of packets buffered at both the incoming and outgoing wireless interfaces.

ii. **Traffic size**: This refers to the traffic load present at a node and its associated neighbors (measured in bytes).

iii. **Active path**: The higher the number of active routing paths, the busier the node since it is responsible for forwarding data packets from an upstream node to a downstream node. This refers to the number of active routing paths supported by a node.

iv. **Channel access probability**: This refers to the likelihood of successful access to the wireless media. It is also related to the degree of channel contention with neighboring nodes.

b) The Routing protocols can generally be categorized into three types:

i. **Hybrid-based**: Where load balancing is achieved by combining the features of traffic and delay based techniques. Examples are Content Sensitive Load Aware Routing (CSLAR) and Load Aware Routing in Ad Hoc (LARA).

ii. **Traffic-based**: Where load balancing is achieved by evenly distributing traffic load among network nodes. An example is, Associativity Based Routing (ABR), Load Balanced Ad Hoc Routing (LBAR) and Traffic-Size Aware (TSA) scheme.

iii. **Delay-based**: Where load balancing is achieved by attempting to avoid nodes with high link delay. An example is, Load-Aware On-Demand Routing (LAOR).

1.6 Load Balancing in service discovery of MANET

Mobile networks have multiple service providers of the same service it is very important to balance the load between the different service providers while satisfying requester’s performance attributes in order to guarantee a good service quality.

![Fig.1 Architecture Diagram for Load balancing in Service Discovery for MANET](image-url)
Mobility and load aware routing protocol for ad hoc networks [4], a mobility and load aware Routing (MLAR) scheme that utilizes the velocity and the routing path load of the nodes to reduce the effects of the broadcast problem. The markov decision process only decides whether the packet request is dropped or broadcast. This scheme does not reduce the congestion in the network. It can be combined with any ad hoc reactive routing protocol to make it more scalable and efficient. MLAR avoids routing path through high velocity and congested nodes to discover more stable routes.

A recent approach is the use of load balancing policy for distributed web service [5], a distributed web service (DSW) method is used to minimize the bandwidth consumption. Considering distributed web services with several running servers, a more bandwidth is wasted due to unnecessary task migration. It addresses the un-regulated tasks/loads migration among the servers. It is crucial to develop a policy that will address the bandwidth consumption while tasks/loads are being transferred among the servers to minimize bandwidth consumption.

In service discovery architecture of mobile ad hoc network with AODV-SD [6], an ad hoc on demand vector is a technique which can be adopted to work in any environment, scalable, flexible and efficient. It does not provide an appropriate route from requester to service provider. This technique not only pulls the demand on service provider information, but also a node will also be pushing the service advertisements periodically along with routing information.

Service Discovery Protocols in Multi-hop Mobile Ad Hoc Networks [7], Multi-hop Manet SDPs technique is used. It focuses on energy optimization. In these networks, devices can have unrestricted mobility that is no constraints on joining or leaving the network making service discovery difficult.

II RELATED WORK

In light-weight service discovery protocol for ad- hoc networks [1], light weight service discovery protocol select virtual backbone nodes based on stability constraints such as residual energy, average node speed, total number of neighbors, bandwidth usage, period of transmitter range. This protocol does not consider partitioning method in the network. Only stable nodes maintain the list of services available in the network. Only 80% of the message signaling was observed in the network. Nodes are not balanced while distributing their services.

Dynamic access clustering selecting mechanism based on Markov decision process for mobile ad-hoc network [2], based on the cluster analysis for selecting the roaming nodes in mobile network, a selecting mechanism which is named as DACSM, is proposed. Considering the performance improvement and the cost when the mobile node of the system accesses the different cluster, this mechanism makes the mobile nodes get better general utility such as more reliability and stability of the link and more communication bandwidth.

Adaptive and efficient load balancing schemes to achieve fair routing in mobile ad hoc networks [3], it uses method called ant-based load balancing scheme to avoid congestion in the network. This scheme does not offer optimal paths to the destination. It reduces the chances of load imbalance by distributing traffic.

In this proposed work, load balancing in service discovery would permit the service requester to connect the service provider through less congested routing path. Consider the performance improvement and bandwidth when the mobile nodes of the system accesses the service provided by the service provider. This mechanism makes the mobile nodes get better general utility such as throughput, response time and waiting time and bandwidth. The simulation result shows the better performance of this mechanism called Markova process.

III CONCLUSION

In service discovery architecture of mobile ad hoc network with AODV-SD [6], an ad hoc on demand vector is a technique which can be adopted to work in any environment, scalable, flexible and efficient. It does not provide an appropriate route from requester to service provider. This technique not only pulls the demand on service provider information, but also a node will also be pushing the service advertisements periodically along with routing information.

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REFERENCE


