Survey On Service Discovery Protocols (SDP) In Vehicular Adhoc Networks

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Abstract

Vehicular network is an emerging wireless network where vehicles and roadside units are the communicating nodes, which provides information with each other such as safety warning, traffic information and the services available in region. There are numerous service providers available in the network providing various services, vehicles can get benefit from them. Service discovery protocols enable the vehicles to discover service provider in their region of interest providing desired service. The service discovery in other network such as mobile adhoc network cannot be applied directly in vehicular network, due to its unique characteristics. Service discovery in vehicular network must utilize the available common resources in the network. Three type of service discovery architectures are there: infrastructure less, infrastructure based and hybrid architecture. Service discovery enables to find services that satisfy the passenger's request. This paper deals with a study of various existing service discovery protocols in the vehicular adhoc network.

Keywords- Vehicular network, Service discovery, Service discovery protocols

1. Introduction

Vehicular network got considerable attraction from the research community where its development is beneficial in providing intelligent transportation system (ITS). Vehicular network spontaneously form between moving vehicles equipped with homogeneous or heterogeneous technologies and nearby fixed road side components. Vehicular network can be deployed by network operators and service providers or the integration of providers, operator and governmental authorities [1]. Vehicular network applications vary from road safety applications to entertainment and commercial applications for the passengers. Vehicular adhoc network have some characteristics and behavior which makes it unique compared to other type of mobile adhoc network. The features are [1],

Transmission Power: Unlimited transmission power can be provided to the mobile devices since the vehicle itself can provide continuous power for computation and communication.

Computational Capacity: Vehicles can afford equipments having high computation, communication and sensing capabilities.

Mobility: Unlike other mobile adhoc network, vehicles tend to have predictable mobility pattern. Since the movement of vehicles are only through roads and the roadway information are available from global positioning system.

The challenges faced by the vehicular network are rapid change in network topology due to high speed of vehicles, frequent disconnection between vehicles mainly due to low density of vehicles, high mobility pattern of the vehicle and bandwidth limitation of wireless medium.

A lot of study is going in the area of service discovery. Applications in the vehicular network heavily depends on service discovery for various

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reasons such as locate the accident and disaster spot; determine the location of gas station, coffee shop, tourist spot etc; sharing music etc [2]. Service discovery has been identified as a key technology to the development and operation of the vehicular network. The service discovery mechanism must be auto configurable, scalable, efficient, robust, and secure [2].

2. Service discovery protocols

2.1 A Hybrid Approach for Location-based Service Discovery in Vehicular Ad Hoc Networks

N. Klimin, et al, 2004 had proposed a hybrid approach for location based service discovery protocol for MANET. This protocol combines the proactive and reactive method to a hybrid approach and it utilizes geocast addressing of control messages for location based service discovery [3]. The main task of the protocol was to find the IP-address of a service provider, this approach was based on geocast addressing of control messages. Location Based Multicast (LBM) served as a building block for service discovery in ad hoc networks and geographic addressing and routing [3]. A client application chooses between two discovery modes: Discover All Servers and Discover One Server. Service binding is the process of storing service provider information in list. A service binding links the type of service with the IP address of the corresponding service provider. Service bindings are formed as a result of the registration procedure of a local server application.

This protocol was divided into three phases: Receiving the message and checking LBM forwarding rules: TTL expiration and packet duplicate detection, Making decision about further message processing due to message type, service bindings and discovery mode and Resulting action: forwarding message, sending service reply [3].

2.2 VITP: An Information Transfer Protocol for Vehicular Computing

Marios D. Dikaiakos, et al, 2005 introduced an application layer communication protocol, Vehicular Information Transfer Protocol (VITP) which is designed to support services over vehicular adhoc network. VITP is a location aware protocol which is based on VITP peers [4]. It uses on-demand dynamic groups in order to collect and communicate the information from different vehicles [4]. The VITP protocol supports both pull and push based types of information dissemination [2]. VITP transaction consist of different phase such as: query phase, computation phase, and reply delivery phase. The disadvantage of this approach is that, when the distance between the service provider and requester increases the dropping rate of service request would increase.

2.3 ABSRP - A Service Discovery Approach for Vehicular Ad-Hoc Networks

Brijesh Kadri Mohandas, et al, 2008 proposed Address Based Service Resolution Protocol (ABSRP) to discover services in vehicular ad-hoc networks. This paper explores the presence of road side units to perform service discovery since most of the transaction based services are provided using road side unit [5]. This approach is independent of the network layer routing protocol. [5] Every road side unit in the network will be connected to a back bone network and it has two interfaces, one is the wired interface and other is wireless interface. Unique address will be assigned to service provider in order to discover a route to that service provider. The service provider's address along with its service capabilities will be distributed to the road side units in the particular area. Each roadside unit will then utilize this information to service the request placed by the vehicles. A backbone network is used if the service provider is not reachable to service request.

2.4 An Efficient Vehicular Communication Outside the City Environments

B. Ramakrishnan, et al, 2010 proposed a service discovery mechanism outside the city environment where road side units are absent. This paper focuses to create a new clustering concept among the VANET nodes [6]. The type of data communication in the vehicular network can be classified into two main categories: broadcast application services and transaction based services. For efficient data communication a clustering model

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was introduced which considers as Simple Highway Vehicular Model. The cluster area is defined according to the speed of the vehicles, when the speed of the vehicle is low then the cluster area will be less and if the vehicles are moving in high speed the area of cluster defined will be high. Each cluster has a cluster head. It will be any vehicle with good database. [6] Each cluster head carries all the service descriptions that are available in the network and it will update frequently. If a node in a cluster is in need of a service then it initially contacts its local Cluster head, if it is available in local database then it will provide the necessary details about the service provider. [6] If the details are not available in the local database, the cluster head will get synchronize with other cluster heads in VANET, and again if the details are not available it will inform about it.

2.5 Fault Tolerant Location-Based Service Discovery Protocol (LBSDP): A New Approach in Vehicular Networks

Alireza Souri, et al, 2012 utilized fault tolerant techniques to improve the reliability and efficiency of the service discovery. This approach is based on a cluster-based infrastructure of Road side units (RSU). [7] Each RSU can be aware of its adjacent RSU or its link failure by using a failure detection algorithm. There will be flag in every messages received, "force to broad cast" if it high then the road components has to broadcast that message [7]. This is to make sure that the nearby road components are functioning properly or not. If failure occurs to one of the RSU, others will work on behalf of it. So the failure does not affect the function of the service discovery protocol.

2.6 Location-aware service discovery on IPv6 GeoNetworking for VANET

Satoru Noguchi et al, 2011 proposed a location-aware service discovery mechanism for Vehicular Ad-hoc Network. This mechanism exploited IPv6 multicast on top of IPv6 GeoNetworking specified by the GeoNet project [8]. The GeoBroadcast mechanism efficiently propagates service discovery messages to a subset of nodes inside a relevant geographical area with encapsulating IPv6 multicast packets. SLPv2 introduces three system components: User Agent (UA), Service Agent (SA), and optional Directory Agent (DA) [8]. SLPv2 enables to operate service discovery over IPv6. Service Providers join the multicast groups that correspond to the service type of their services. The multicast address is calculated according to service type string representation. Such a modification will reduce bandwidth usage. The operation processes of the service discovery mechanism were identified with three phases: service activation, service discovery and service operation [8]. When a service is activated, its SP joins an IPv6 multicast group. In the service discovery phase, the SC calculates the corresponding IPv6 multicast addresses and sends the mapping information.

2.7 Efficient load balancing and QoS-based location aware service discovery protocol for vehicular adhoc networks

Kaouther Abrougui, et al, 2012 proposed and efficient load balancing and QoS based location aware service discovery protocol for vehicular adhoc network. It is a service discovery protocol integrated with routing protocols and it guarantees load balancing on road side routers and routing paths between service providers and service requesters. The parameters considered in this paper are success rate, connection rate, average response time, bandwidth usage, and average load [9]. In vehicular networks multiple service providers providing the same service are available, it is very important to balance the load between the different service providers. This protocol guarantees the service requests are handled equitably by service providers in the desired region of interest (RI).

The load balancing and QoS based location aware service discovery protocol (QoSLocVSDP) proposed in this paper has four phases QoS based service advertisement phase, QoS based service request propagation phase, QoS-based leader election and service reply generation phase, and QoS-based service reply propagation phase [9].

The techniques used for load balancing and QoS aware service discovery in this paper are: Load balancing on service providers, Load balancing on leader road side routers inside RI, Load balancing on

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routing path between service providers and service requesters, Service provider quality requirement and Intermediate components quality requirement [9].

3. Conclusion

Service discovery is an active field of research especially in the domain of vehicular adhoc network. Vehicular network itself is also a demanding research area due to its wide range of applications and contribution to intelligent transportation system. In this survey different service discovery protocols for vehicular adhoc network were analyzed. Due to the unique nature of the vehicular network service discovery protocols used in other adhoc networks are not suitable for this network. Compared to other service discovery protocols QoSLocVSDP shows better performance by considering load balancing and service quality requirement. For efficient service discovery average response time of the service discovery protocol must be low because of the high speed of the vehicle.

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