

A Robust Service Discovery Approach for Hybrid Ad Hoc Networks

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Abstract

Recently, service discovery has attracted lots of attentions for unreliable ad hoc networks. Although several protocols have been proposed to support service discovery, they generally consider only one type of the network such as wired infrastructure or ad hoc network. Therefore, these protocols may cause inefficiency in the hybrid network which is formed with ad hoc networks joined to wired infrastructure. The reason is that they do not reflect heterogeneous characteristics of each network. Therefore, service discovery in hybrid networks is important research issue on the aspect of practical uses of ad hoc networks. In this paper, we propose a robust service discovery scheme for hybrid networks. Our scheme is utilized to improve the robustness of service acquisition.

1. Introduction

During the last decade, great improvement has been done in the ad hoc networks that consist of individual moving nodes act as router. Based on this result, recent research on mobile ad hoc networks tends to concern more practical issues such as providing internet connectivity to mobile ad hoc nodes. For example, in [1], authors propose a mechanism including address configuration and route maintaining algorithms of mobile nodes to support internet connectivity through the internet gateway.

Research on middleware for unreliable ad hoc networks is also important for making the development and deployment of applications more reliable [2]. Among various middleware services, service discovery plays a critical role to offer a method that the mobile nodes are able to automatically and efficiently discover the available network services. Various protocols have

been proposed for service discovery in the context of wired infrastructure environment [3, 4], and the ad hoc networks [5]. These protocols generally assume that a network is constructed by only wired or wireless mobile clients. Therefore, they are not suitable in the real network environment that ad hoc networks are integrated into wired infrastructure. In such a hybrid network environment, protocols should be designed by considering heterogeneous characteristics of both network sides. There are two design approaches: *closely coupled united approach* and *loosely coupled interoperable approach*. Closely coupled approach means of developing a complete solution that can cover whole networks. However, it may not to be feasible or inefficient. On the other hand, more loosely coupled approach means of designing some interoperable mechanism among different service discovery protocols that can run in each type of networks. It helps the protocol design to be easier by restricting network boundaries in which each service discovery protocol works. Moreover, for each localized network, protocols can be utilized as well. Therefore, it does not have to make major changes on those existing protocols, so the cost of designing and implementing a new protocol can be minimized by.

In this paper, we propose a simple but efficient mechanism using the loosely coupled approach for reliable service acquisition. As mentioned before, most of internet connectivity mechanisms basically assume the existence of the internet gateway performing a role of relaying between mobile ad hoc networks and wired infrastructure. Our proposed scheme makes the gateway convert each service discovery protocol.

2. A Robust Service Discovery Approach

This section describes our proposed scheme, REDA (Robust Service Discovery Approach), which provides an efficient mechanism for service discovery in the hybrid ad hoc networks. Our scheme consists of two

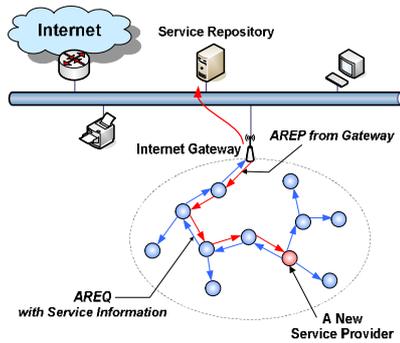


Fig. 1. Service Registration

phases: Service registration - update phase and Service request - reply phase.

2.1. Service registration - update phase

In [1], when a node joins in the ad hoc network, it first tries to find internet gateway for the address configuration through flooding the AREQ (Address Request) packet. We extend this AREQ packet to embed service information. As seen in Fig. 1, if a new node is the service provider, it floods an AREQ packet including its available service information. After receiving the AREQ packet, the gateway extracts service information in the packet, and converts it to a new service registration packet according to the service discovery protocol used in wired networks, for example SLP [3]. The gateway then sends it to wired service repository that maintains a list of available service information. In order to perform this protocol translation, the internet gateway is assumed to know both service discovery protocols each of which runs in wired infrastructure networks and wireless ad hoc networks, respectively.

After connected to the internet gateway, a mobile node periodically exchanges gateway solicitation and advertisement messages with the gateway in order to maintain the routing path. We also embed service information into the gateway solicitation packet to update its own service information in the wired service repository.

2.1. Service request - reply phase

In general, most of service discovery schemes proposed for ad hoc networks exploit an application level flooding to obtain appropriate service information. In this paper, we basically use similar flooding mechanism to find service information, but the process is slightly different when the requested service does not exist in the same ad hoc network. In this case, our scheme makes the internet gateway send a query to the

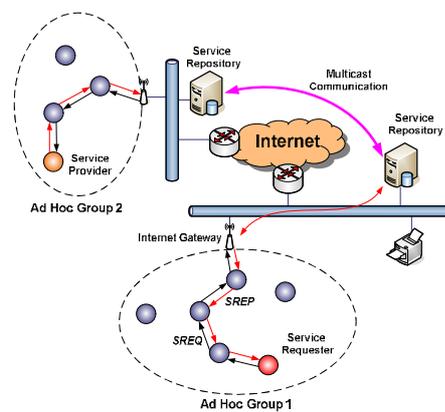


Fig. 2. Service Request and Reply

fixed service repository. If the target service recorded in the service repository is available, the gateway receives a service reply. Then, the gateway translates this information into the SREP (Service Reply) message, and delivers it to the original service requester. Through this process, any node in ad hoc network can obtain the service existing in wired internet or even another ad hoc group. Thus, the robustness of the service acquisition is improved by the aid of dependable service repository in the wired network

3. Conclusion

In this paper, we present a robust service discovery approach, REDA, for hybrid ad hoc networks. REDA helps a node to obtain service information whether requested services are in the same network or over the network boundary. It could contribute to future ubiquitous network to converge all the networks on the one. Future work would include the more optimized algorithms to reduce overhead, and a performance evaluation study of the proposed scheme.

4. References

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