Demo Abstract: Discovering Services in Mobile, Flexible and Heterogeneous Wireless Sensor Networks

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ABSTRACT
Wireless Sensor Network applications (WSNs) are starting to enter into our daily life. Discovering sensor nodes and the services hosted by them is imperative to any large scale and flexible sensor network application. The heterogeneity and dynamics of wireless sensor networks and their applications are challenges for service discovery protocols. In this demonstration, we present a lightweight Service Discovery protocol (nanoSD) and its integration into a health care application with heterogeneous network architecture. NanoSD is a sensor network specific service discovery protocol that is specifically designed to be scalable and meet real WSN deployment challenges. Furthermore, it can easily be integrated with web-service based backend systems with very minimal resource costs.

1. INTRODUCTION
WSNs have a lot of promising applications in many fields, especially in the area of healthcare. Many healthcare applications impose stringent requirements. WSNs must be able to (1) handle heterogeneity of nodes; (2) be adaptive to environment and node software changes; (3) provide multiple simultaneous service lookups; and (4) quite often have to support some sort of mobility. The evolving technology demands flexible and adaptable platforms that can easily incorporate new software and hardware components. Service discovery is becoming an important functional need for many WSN systems. Systems are required to manage multiple parallel different service lookups and efficiently handle the resulting replies. Furthermore, due to the nature of healthcare applications, mobility of the nodes generated frequent topology changes.

Service oriented view of the whole network can help making the WSN operations more unified and tractable [1]. The dynamics of the network directly affects the availability of the services hosted by nodes. In order to use different services, one also needs to know the attributes and the service invocation procedure. Thus we require a protocol that is able to discover not only services, but also their description, and availability in the network. In this demonstration, we present a service discovery protocol called nanoSD, that is able to effectively manage discovery, advertisement, and tracking availability of services in the network.

2. SYSTEM OVERVIEW
We show the reference system architecture of our system in Figure[1]. The work has been done in the context of cooperative project (WASP) that has both academic and industry partners. The system consists of a backend system, which communicates through gateways to a static ambient sensor network. The ambient sensor
network is connected to mobile body sensor networks. Since the backend system is less resource-constrained than the WSN, the architecture allows exploiting any standard service discovery protocol running on the backend system. Besides notifying the service availability, the nanoSD tool chain produces an XML-like service description at the gateway so that it can be relayed as a web-service to the backend system. Service advertisements are also used to announce any new services and service modifications in the system. In order to save memory on sensor nodes, Service Description is split into two parts; attribute-value information from the sensor node, and service template from the gateway specially created for the particular service. Service Template information is extracted from a tree-like global service database, which resides on the gateways. The global service database is defined in the form of a tree so that each service is categorized by certain criteria which is also used for service naming. For example, a temperature service can be named as Sensor.Body.Medical.BodyTemperature (see Figure 2). Service Descriptions are created by mapping service attribute-value information from the sensor node and service template from the gateway using a unique service identification that resides both on the sensor node as well as the gateway.

3. DEMO DESCRIPTION

We propose to demonstrate a fully functional but stand-alone version of nanoSD, which will be shown to handle the aforementioned challenges. The on-site demo setup will consist of a heterogeneous network including different types of sensor nodes, a gateway node and a backend system. The demonstration will cover multiple types of service discovery sessions and communication aspects across different entities of the network. Furthermore, a graphical interface will be used to present the protocol details.

First, graphical user interface is used to create service discovery requests. One can flexibly choose a particular service, category of services, or all the services to discover. Once the service list is retrieved, it is directly mapped with the information from the tree-like global service database, and the resulted service description will be shown. We will also demonstrate several features of the protocol including service naming and identification in addition to its compression form, varying from as short as 1 to 4 bytes. Furthermore, an effective compression scheme is demonstrated. It can create compact messages in order to lessen the number of messages sent in the network. NanoSD can also be used to piggyback the service values, when desired. We will also show the multisession support of nanoSD. Since nanoSD itself is independent of the protocols beneath it, it allows any of the underlying software components to be used. Thus the demonstration shows fully working light-weight sensor capable service discovery framework and protocol. The audience will be able to try hands-on service discovery setups. The demonstration is backed up with a poster that gives a more technical details. It is also planned to release nanoSD as an open source for WSN community. Our demo will be realized in a table-top fashion.

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4. REFERENCES

