A SURVEY ON INFRASTRUCTURE ABSTRACTION OF WIRELESS SENSOR NETWORK

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ABSTRACT- Wireless Sensor Network (WSN) is an autonomous sensor. Several abstractions are harnessed to ease out the difficult WSN application development. Various parameters have been developed to satisfy the different requirements of the infrastructure requirements. The objective of our survey is to provide the analysis and description of the major infrastructure abstractions. The analyzed parameters are service discovery, metadata, processing, and data format homogenization. The classification of the parameters is divided into 5 types as Open Geospatial Consortium Sensor Web Enablement, Global Sensor Networks, Sense Web and Sensor Map, Smart-M3, SeNsIM.

Keywords: Wireless Sensor Network (WSN), Harnessed, Infrastructure Abstractions

I. INTRODUCTION

A wireless sensor network (WSN) contains more number of resource constrained nodes, which form a scattered autonomous network. Energy, computation, communication, and memory constrain WSNs reacts to the real world fact. It process and combines the data, and finally create a new knowledge. This knowledge must be presented to an end-user or analyzed to create value added end-user services. Getting data from a physical sensor to an end-user is not a simple task in WSN application development due to the resource constraints, complex protocols, and compound levels of technologies involved in the delivery. The different abstraction levels are needed to make application development easier.

II. TECHNIQUES

A. Open Geospatial Consortium Sensor Web Enablement

OGC provides sensor web enablement (SWE), which contains XML specifications and interfaces for WSNs. The specifications are sensor model language (SensorML), observations and measurements (O&M), sensor observation service (SOS). SensorML contains a set of models and XML schemas. It can be used to discover the services with the SensorML process models task the sensor services and process the observations with SensorML Process model. It provides reliable data format for the SWE services and contains metadata for processes.

Input, output, and parameters are provided by the Sensor ML process. O&M contains a set of models. XML schema describes the output information model for the sensor web applications.

B. Global Sensor Networks

GSN contains a set of virtual sensors, which have the similar structure of WSN. To define a virtual sensor XML is used, where each virtual sensor has one or multiple inputs and it contains any type of real sensors or other virtual sensors. To handle the different application requirements a time model with count- and time-based windowing mechanism is used for the temporal semantics. GSN lacks in a definition of ontology hence, the data format is described as a component of the virtual sensor. GSN supports the processing methods like network abstractions, the virtual sensor abstractions.

C. Sense Web and Sensor Map

Sense Web collects wired, wireless and mobile sensors. Application Programming Interface (API) is used to provide knowledge interoperability. The user sends the application requests of data, if it is similar to the data format then it caches capacity to sense the data, and provides service and resource discovery. Sensors are connected to the user through customized gateways, which provides the uniform access. Data Hub gateway is used as a reference gateway for the sensors but it could not be used as a customized data. A mobile proxy connects mobile sensors to sense web and delivers the capacity to the desired location.

Sensor Map is an application on peak of Sense Web. It provides tools to demonstrate sensor data on a map. It contains 4 components to transfer the data such as

a) GeoDB
b) Data Hub
c) Aggregator and
d) Sensor Map GUI

GeoDB contains metadata for sensors, Data Hub contains track of coupled sensors, Aggregator combines nearby sensors and Sensor Map GUI presents capacity on a map according to queries. It allows knowledge interoperability and service discovery through the GeoDB and Data Hub. Data processing is provided by Aggregator and Sensor Map GUI. Sensor Map provides the results of queries together with a map to imagine the data. Sense Web and Sensor Map provides the aggregate data and present it on web. It provides the question of security and privacy where, the Internet and WWW approach is not a general solution for the infrastructure abstraction: individual WSN applications are required as well.

D. Smart-M3

It is an interoperability platform for smart spaces. It provides small embedded devices to nearby share semantic information. Ontology API can be used through the application developer. Each device, or Knowledge Processor (KP), be able to store and recover information from the Semantic Information Broker (SIB). It can be used for a mobile phone be able to control local sensor network actuators and home appliances through Smart-M3. It can only communicate through a SIB by inserting, querying, or publishing the data into it. KPs can be used in mobile as follows:

It can join and leave to a SIB and can discover the data of other KPs from it. Smart-M3 is more a technology interoperation communication protocol than a entire infrastructure abstraction. It does not suggest any restrictions for the application development. To store the information it provides a frequent ontology. Smart-M3 implementation in home application can use different ontology. Switching between these locations with the same mobile device will require implementation of both ontology's on that mobile device.

Metadata or processing support will not be provided by Smart-M3. If these are necessary, they must be implemented on top of Smart-M3. The actuator device controlling the air condition can read by itself from the SIB what carbon dioxide and temperature sensors have reported and adjust the air according to those values.

E. SeNsIM

It is used for an architectural and a data model for knowledge interoperability between sensing technologies. It provides existing technologies with wrappers. It contains a mediator interface for end-user applications. The wrappers can be connected to the mediator. The mediator uses an XML query interface for end-user applications. The data is combined by providing an XML. It does not provide several metadata or processing maintenance. It implicates the process of the abstracted technologies. It might be utilized, and "the state of the sensor can be customized".

III. INFRASTRUCTURE ABSTRACTION REQUIREMENTS

The infrastructure abstraction is to divide the end-user application from the abstract technologies. The technologies can be changed without modifying the existing end-user applications. The technologies are as follows:

A. Service Discovery

Due to the possible node mobility, fault prone communication medium, hardware failures all the services could not be accessed. Hence, the new services can be added to the WSN. This method is needed to find the interesting services. The infrastructure abstraction solves the three main tasks in service discovery.

First, the networks contain its own service discovery methods, where it is similar to the end-user application development.

Second, the service discovery must be expanded to discover the technology that does not follows the existing WSN pattern.

Third, scalability and transparency are needed. The correctness of the sensor must be important on some applications and the sensor product name and the producer information must also be needed.

B. Metadata

Plain dimension data is not enough for the end-user applications but it must be completed with various kinds of metadata. Descriptions of position, hardware, measurement accuracy, measurement purpose, are the typical metadata for WSN measurements. If the dimension is made on a certain physical location, the end-user expects the measurement defines on a map, and the location should be updated.

The infrastructure abstraction cannot identify all the metadata for an end-user application. It supports the provided metadata abstracted technologies. The infrastructure abstraction requires the technology adapter and it completes the required set of metadata to the measurements.

C. Processing

Processing services provides two benefits for the infrastructure abstraction

(i) Aggregated data can be reused between diverse end-user applications

It reduces the data requests to the network, reduce data traffic, and build application progress simpler

(ii) Infrastructure has more resources to process the WSN

The infrastructure abstraction provides the more graceful services to the end-user application. The infrastructure abstraction allows new processing services. Processing services require an execution environment, which is used to create the processing services, and an inoculation technique to add new processing services.

D. Data Format Homogenization

The major duty for ontology is to take away the heterogeneity between different data producing technologies for the same data type. It describes some of the techniques for the data are format, units, and ranges. It simplifies the end-user application development. The application be able to rely that heat dimension is forever in the same format and has a unit of Celsius. The end-user applications parse and format the data from each technology for the last appearance of the data if it is requested from the resources with no ontology. The end-user application becomes technology self-determining data with the underlying technologies, where it can be distorted as long as they can produce data in the ontology format.

IV. ANALYSIS OF TECHNIQUES

Abstraction	***Service Discovery***	***Metadata***	***Processing***
Open Geospatial Consortium Sensor Web Enablement	SensorML models and XML schema can be mined for SensorML processes which includes connected sensors and actuators	SensorML contains processed metadata	SensorML process chains
Global Sensor Networks	Virtual sensor can be discovered with their metadata	Each virtual sensor holds metadata descriptions	virtual sensors can be a source to other virtual sensors
Sense Web	For sensors, according to sensor type or location service discovery is provided	Not used	Transformers can convert units for their process
Sensor Map	Services can be discovered from GeoDB	GeoDB holds meta-data	Aggregate geographically close sensors
Smart-M3	Knowledge Processor can find different Services through Semantic Information Broker	Not used	Not supported
SeNsIM	Wrappers discover sensors from abstracted technologies	Not used	Not supported

Table 1: Analysis of Techniques

V. CONCLUSION

In this article, the parameters of infrastructure abstraction are analyzed and described in detail. The selected techniques are classified based on the requirements used for the abstraction such as Open Geospatial Consortium Sensor Web Enablement, Global Sensor Networks, Sense Web and Sensor Map, Smart-M3, SeNsIM. The complete descriptions of the preferred techniques contribute in understanding the direction of the current research on WSN.

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