A Proposal for Defining Pervasive Computing Standard Ontology (PERCOM-SO)

Harry Chen
harry.chen@umbc.edu

I.   Objective & Motivation

The goal is to define an ontology to support *knowledge representation* and *communication interoperability* in building pervasive computing applications. This ontology will be defined using the Web Ontology Language OWL and published in RDF/XML representation.

Today's Pervasive Computing research covers a wide range of application domains (e.g., healthcare, intelligent rooms, entertainment systems). This project's goal is not aimed to construct a comprehensive ontology library that would provide vocabularies for all possible pervasive computing applications but <u>to construct a set of generic ontologies that allow developers to define vocabularies for their individual applications</u>. Through ontology sharing, this set of ontologies make possible for the represented knowledge in different systems to be shared and reused.

If using Semantic Web ontologies is crucial to the development of pervasive intelligent systems, then there is a need to experiment how different ontologies can be integrated into the implementation of a single system application, for example, building an intelligent meeting room system that make use of some subsets of the DAML-Time, DAML-Space, FOAF, FIPA device, and REI policy ontology. A possible strategy is to survey the existing relevant ontoloigies, which may or may not be defined in OWL, and map the relevant constructs from those ontologies into a coherent and consistent single ontology to support pragmatic system implementations and experimentations.

To demonstrate the feasibility of this ontology, we will described a set of use cases and show how this ontology can be used to support knowledge representation and communication interoperability.

An overarching objective is to stimulate discussions and research initiatives across the Pervasive Computing community and the Semantic Web community.

II.   Ontology Domain

This draft proposal identifies the following list of domains to be included in the PERCOM-SO. Listed domains are open to modifications.

1.   Spatial Ontology
2.   Temporal Ontology
3.   Person Profile/User Model
4.   Event Ontology
5.   Device Profile
6.   Digital Document
7.   Security and Privacy Policy

Spatial Ontology

Describing physical space and spatial relations. Both geometric (e.g., GPS, GIS) and symbolic representation (e.g., places that are identified by their names) of space will be supported.

- Related ontologies: DAML-Space, OpenCyc, SUMO, Region Connection Calculus (RCC)

Temporal Ontology

Describing time and temporal relations. The notion of time will be modeled using "time instant" and "time interval". Temporal relations will be defined based on these two concepts.

- Related ontologies: DAML-Time, Allen's Interval Calculus

Person Profile/User Model

Describing the background profile of a person (e.g., contact information, institutions that a person is associated with, CV).

This ontology will also include vocabularies for describing dynamic information about a person, e.g., whether the person is busy, whom the person is meeting with, the location of the user.

- Related ontologies: Friends-Of-A-Friend (FOAF)

Event Ontology

Describing events that occur in a pervasive computing environment. This includes events associated with sensing (e.g., sensors detect the presence of a device or a person), events that represent social gatherings (e.g., meetings).

This ontology will be use constructs in the Temporal Ontology and Spatial Ontology to define temporal and spatial properties of different events. For example, when and where a device is detected, when and where a meeting takes place.

Device Profile

Describing hardware and software attributes that are associated a typical computing device. Some hardware attributes include memory size, CPU power, network inferences, display monitor specification etc. Some software attributes include supported OS, applications installed etc.

This ontology will also include vocabularies for describing dynamic information about a device , e.g., the location of the device, who is carrying the device, the position of a device.

- Related ontologies: FIPA Device Ontology

Digital Document

Describing attributes associated common digital documents (e.g., pictures, presentations, papers, web pages). This ontology will also include vocabularies for describing contextual information about a document, e.g., for what purpose this presentation is created, who is the author of this paper, where was this picture taken from?

- Related ontologies: FOAF

Security and Privacy Policy

Describing policy rules for supporting access control and privacy protection in a pervasive computing environment. This ontology will provide vocabularies for defining rules that allow users to specify whether some agent or person has the right to access certain service or information, and allow users to specify the granularity of certain information (e.g., a user's location) that can be shared with others agents or people in the environment.

- Related ontologies: REI policy language