Futurewei Technology's Position paper on "IoT Semantic Interoperability Workshop 2016"

- What is the state of the art in data and information models? What should an information model look like?

  Answer:

  Data and information models provide the common understanding on the attributes of the information and relationships between the information, independent of any specific implementations or protocols used to transport the data.

  W3C defined the Resource Description Framework (RDF), which is a data model with the basic unit of information known as a triple, consisting of a subject, a predicate and an object. RDF schema (RDFS) provides a specific vocabulary for RDF that can be used to define taxonomies of classes and properties, domain and range specifications of properties. The Web Ontology Language (OWL) extends the RDFS vocabulary with additional resources that can be used to build more expressive ontologies.

  The Open Geospatial Consortium (OGC) has specified interoperability interfaces and metadata encodings that enable real time integration of heterogeneous sensor web into the information infrastructure. OGC has created a new standards working group on the sensor web interface for IoT, which aims to develop a standard based on existing WoT (Web of Things) portals with consideration of the existing OGC SWE (Sensor Web Enablement) standards.

  There is also a need for the information model for IoT network data transport layer (like IP). We have not seen such a well defined model for inter-peer communications.

- What is the role of formal languages, such as schema languages, in describing information and data models?

  Answer:

  The formal languages are used to describe the protocol format, communication primitives, the data information model which specify the communication/management/control relationships among IoT informational entities. Normally a well-defined formal language should provide syntax and semantic description for the communication behavior among IoT informational entities and related engineering scope & restrictions without any ambiguity.

- What is the role of metadata, which is attached to data to make it self-describing?

  Some more definition on metadata you may add: Metadata describes the relationship between the individual atoms of information and other data. Metadata usually changes less frequently than the data itself.

Answer:

"metadata", in general, are the attributes which characterize IoT informational entities. The value of the metadata is scoped by the social/environmental/timing/location semantics of the IoT entities. In the IoT networking and applications, the metadata can be used for many functions such as context-based routing, data filtering and data aggregation, etc,.

- How can we achieve interoperability when different organizations, companies and individuals develop extensions?

  Answer:

  we need well-defined and common IoT data plane and mgmt/control protocols and information models for the data (metadata) embedded into the protocols between domains, both intra-domain and inter-domain. The domains could be social/organization based, routing/admin based, or technology based. The prerequisite of such activity is to agree on the schema language and framework that can be used for the information model definition. Also such common information model should be able to easily mapped, translated from other existing information models, and should be extensible for future emerging IoT applications.

- What is the experience with interworking various data models developed from different groups, or with data models that evolved over time?

  Answer:

  we are working on IoT data plane comm protocol, which is based ICN (Information Centric Networking) technology. Also we are working on how to use ICN protocol and metadata to support context-awareness IoT data collection, transport, filtering and aggregation, semantics mashup and reasoning.

- What functionality should online repositories for sharing schemas have?

  The online repositories should provide/store a collection of unambiguously defined vocabulary terms to be used for communication. The vocabulary terms should not be redundant and should have consistent meaning in all contexts. The vocabulary terms can be used to express the semantics information associated with the information, their interactions and context of use. The online repositories should provide the means of discovery and usage of the vocabulary terms.

- How can existing data models be mapped against each other to offer interworking?

  Answer:

we need a well defined common information model and inter-domain protocol, which can be implemented at the gateway for the mapping between different intra-domain models. Doing so we also need a common schema language and framework to describe the data model and the protocol.

- Is there room for harmonization, or are the use cases of different groups and organizations so unique that there is no possibility for cooperation?

  Answer:

  For the sake of IoT interoperability at the large scale and the data sharing, we do need to work on common ground.

- How can organizations better work together to increase awareness and information sharing?

  Answer:

  We need all STOs, industry forums, operators, vendors to work together. IETF IAB is such a organization to play the role. Hopefully, we can come with a IP-like protocol which will inter-connect all the IoT informational entities together.