Study Period on Extending MDR for the Semantic Web

Procedure for the Specification of Web Ontology

ISO/IEC JTC 1/SC 32 Plenary and WGs Meetings
Jeju, Korea, June 25, 2009

Jeong-Dong Kim, Doo-Kwon Baik, Dongwon Jeong
{kjd4u, baikdk}@korea.ac.kr, djeong@kunsan.ac.kr
Korea University, Kunsan National University
Contents

- Discussion History
- Background and Motivation
- Goal and Purposes
- Conceptual Model
- Issues
- Scope
- Our Proposal
  - Part 2: Mapping Model between MDR and Web Ontology
  - Part 3: Procedure for Web Ontology Specification
- Conclusion & Future Plan
- Q/A
Discussion History of the Proposal

- The idea of this proposal has been presented in the following meetings
  - SC32 Joint Study Period, Clearwater, Florida, USA, January 2007
  - SC 32 Plenary and WG Meetings, New York, USA, May 2007
  - SC 32/WG 2 Interim, Seoul, Korea, December 2007
  - **SC 32 Plenary and WG Meetings, Australia, May 2008**
    - Extension of the Study Period and Change of its Direction

- ISO/IEC JTC 1/ SC 32 Workshop (September 2008, China)
  - ISO/IEC JTC 1/ SC 32 Workshop on ROR–ODMS-SMMP Study Period
    - WG2 N1177: “Extending the Metadata Registry for Semantic Web”

- ISO/IEC JTC 1/SC 32/WG2 Interim Meeting (November 2008, Portugal)
  - ISO/IEC JTC 1/SC 32/WG2 Interim Meeting
    - WG2 N1219: "Extending the Metadata Registry for Semantic Web“
    - Subtitle: PSO: Procedure for the Specification of Web Ontology (based on MDR)
Background

- **ISO/IEC 11179, MDR (Metadata Registry)**
  - Used whenever data must be used consistently within an organization or group of organizations

- **Semantic Web**
  - Extension of the current Web, Next generation Web, Intelligent Web
    - The Semantic Web is an evolving extension of the World Wide Web that the semantics of information and services on the web are defined, making it possible for the web to understand and satisfy the requests of people and machines to use the web content

- **Web Ontology**
  - For the web, ontology is about the exact description of web information and relationships between web information. [Core for Semantic Web]
  - Description: RDF, RDF-S, OWL, etc
  - Consists of classes, properties, instances, etc. (Triple set <S, P, O>)
Motivation

- An MDR provides a good introduction to metadata concepts, including a lot of insight into certain aspects of the granularity of metadata

- The MDR contributes knowledge integrity in a large scale
  - The simplicity provides the organization of implemental adaptation
  - The representational simplicity allows for easy sharing of metadata

- Semantic Web promotes structured metadata representation, such as an ontology schema that data concepts are associated via relationships
  - For creating Web ontology, concepts are firstly defined and then relationships are linked between the concepts
Background & Motivation

Syntax Web \[\rightarrow\] Evolution \[\rightarrow\] Semantic Web

Ontology

MDR (Metadata Registry, ISO/IEC 11179)
Contains standardized concepts for various applications fields

Specifying Web ontology using standardized concepts in MDR for the Semantic Web

Ontology
Goal and Purposes

- The goal of this proposal is to provide the specification support of Web Ontology using the concepts in MDR.
Goal and Purposes (cont.)

- The purposes of this proposal are to promote the followings:
  - Ease of definition of Web Ontology schema
  - Creation of Web Ontology schema consisting of standardized concepts
    - i.e., well-known concepts or generalized concepts, which are accepted by general users as well as domain experts
  - Common understanding of concepts across corresponding application fields
  - More formalized specification of Web ontology
Conceptual Model

Metadata Registry (ISO/IEC 11179)
- DEC
- OC
- CD
- DE
- VD

realize

MDRs (Sets of concepts)
- EDR (Environmental Data Registry)
- caDSR (US National Cancer Institute)
- METeOR (Metadata Online Registry)

Web Ontology

specify

Our Proposal
- Process Manager
- Mapping Info. and Rulus
Issues for Specifying Web Ontology using concepts in an MDR

How to use and build?

Semantic Web Level

Conceptual Level

Representational Level

MDR Level

Status Report of the Study Period on Procedure for the Specification of Web Ontology
Scope

- The scope of our proposal covers procedures for the specification of Web Ontology based on ISO/IEC 11179.

- This proposal consists of the following parts:
  - Part 2: Mapping Model between MDR and Web Ontology
  - Part 3: Procedure for Web Ontology Specification

- This proposal does not contain
  - Web Ontology building methods by a specific ontology description language, such as RDF, RDF-S, OWL, Topic Maps, KIF, and so on.
Our Proposal


Part 2: Mapping Model between MDR and Web Ontology

Part 3: Procedure for Web Ontology Specification
Our Proposal (cont.)


Metadata Registry

Key Concepts of MDR
- Conceptual Domain
- Object Class
- Data Element Concept
- Data Element
- Property
- ...
- Relationship

Process Manager
- Selection
- Definition
- Creation

Mapping Information and Rules

Web Ontology Schema
- Domain
  - concept
  - relation
- Range
- Property
- Property
- Property
- Type
- Type
- Type
Part 2: Mapping Model between MDR and Web Ontology

✓ Analyzes mapping relations between Web ontology and MDR

✓ Defines the relationships between components of MDR and Web Ontology

✓ Defines a metamodel for the mapping relations between MDR and Web ontology
Our Proposal (cont.)

Part 2: Mapping Model between MDR and Web Ontology

✓ Concepts and Relationships in MDR

- Object Class
  - Concept_Relationship
  - Data_Element_Concept
    - Data_Element_Concept_Relationship
    - Conceptual_Domain
      - Conceptual_Domain_Relationship
      - Value_Domain
        - Value_Domain_Relationship

- Object Class
- Data_Element_Concept
- Conceptual_Domain
- Value_Domain
Part 2: Mapping Model between MDR and Web Ontology

MDR

- Conceptual Domain
- Object Class
- Data Element Concept
- Data Element
- Property
- Value Domain
- Relationship

Web Ontology

- Concept (Class)
- Property
- Data Type
- Relation

Status Report of the Study Period on Procedure for the Specification of Web Ontology
Our Proposal (cont.)

Part 3: Procedure for Web Ontology Specification

✓ This part contains the overall process for building Web ontology, and develops and defines concrete/detailed operations of each process.
Part 3: Procedure for Web Ontology Specification

Selection Process (Concepts)
- Select a Concept in MDR
- Specify a Concept for Ontology
- Define URI

Definition Process (Properties)
- Select a Property in MDR
- Specify a Property for Ontology
- Define URI

Creation Process (Relations)
- Select a Relation
- Specify a Relation
- Define URI

Mapping Information, Rules, Restriction, Polity, …
Part 3: Procedure for Web Ontology Specification (Including URI)

- **Case 1**
  - In case of defined standard metadata by specific Organization:
    Use URL of registered Organization, the registered Organization URL information is registered in MDR

- **Case 2**
  - In case of registered and standardized metadata using registry system of MDR administered Organization: Use URL of Organization that administers MDR.

- **Case 3**
  - In case of temporary standard metadata that is unregistered in MDR: Define it using URL of Organization that defined the metadata, and a web ontology architect offers URL information.
Example

- **MDR_{sample} = (CD, DEC, VD, CR, URL_{organization})**
  - CR : Conceptual\_Domain\_Relationships
  - URL_{organization} : URLs of the registering orgs
- **CD = \{Student, Professor\}**
- **DEC = \{name, address, cellular\_phone\}**
- **VD = \{vd\_cellular\_phone\}**
- **CR = \{advise, advised\}**
- **URL_{organization} = \{http://ist.kunsan.ac.kr/\}**
Example (cont.)

- A Web Ontology Generated

```
xmlix:String
  ^--- ist:name
xmllix:String
  ^--- ist:address
ist:vd_cell_phone
  ^--- ist:cell_phone
ist:Professor
  ^--- ist:advise
ist:Student
  ^--- ist:name
xmllix:String
  ^--- ist:address
xmllix:String
  ^--- ist:name
```
Conclusion

- The goal of this proposal is
  - To specify Web Ontology using standardized concepts registered and managed in MDR

- This proposal
  - facilitates usability of MDR
  - enables creation of Web Ontology consisting of standardized concepts
  - supports common understanding of concepts across corresponding application fields
  - enables a more formalized specification of Web Ontology
Future Plan

❖ Project Subdivision of 20943
  ✔ 20943 Part 6 – Extending of the MDR for Semantic Web ;
    – Subtitle: Procedure for the Specification of Web Ontology
  ✔ Technical Report (type 3)
    – Technical Specification ‘
  ✔ Determined at Jeju meeting

❖ New Project Proposal
  ✔ Project Title: Procedure for the Specification of Web Ontology
    – Part 2 : Mapping Model between MDR and Web Ontology
    – Part 3 : Procedure for Web Ontology Specification
  ✔ Will be proposed at London meeting
Thank you!

Jeong-Dong Kim (kjd4u@korea.ac.kr)
Dongwon Jeong (djeong@kunsan.ac.kr)
Doo-Kwon Baik (baikdk@korea.ac.kr)