Ontology, Web Services, and Semantic Web Portals

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INTRODUCTION

In the article, entitled “Semantic Web, RDF, and Portals”, it is mentioned that a Semantic Web Portal (SWP) has the generic features of a Web portal but is built on semantic Web technologies. This article provides an introduction to two types of Web ontology languages (RDF Schema and OWL), semantic query, Web services, and the architecture of a Semantic Web Portal.

WEB ONTOLOGY LANGUAGES

RDF Schema (RDF-S)

RDF-S is a Web ontology language used to define RDF vocabularies. It extends RDF with some of the schema terms: class, subclass, property, subproperty, range, and domain. RDF schema provides the mechanisms to describe groups (or classes) of resources related by common characteristics, and also describe the relationship (properties) between these related resources (Brickley & Guha, 2004). The procedures for constructing a new vocabulary is as follows: define the class it is in, followed by describing the properties of the class. A property is used to declare the relationship between two resources. When it is necessary for the subject of any property to be in a particular class, that class is a domain of the property, and when it is necessary for the object to be in a certain class, that class is called the range of a property. It should be noted that a property can have more than one domain and range.

In the triple shown in Example 1 (of the article “Semantic Web, RDF, and Portals”), the subject of the RDF statement is #leonardo-isles_web_portal, the predicate (or property) is dc:creator, and lastly, the object (value of property) #creatorID01. Here, #leonardo-isles_web_portal is an instance (or a member) of a class of Web portal resources (known as #SemanticWeb_Portal in this chapter). The property, dc:creator, describes the relationship between two related resources, #SemanticWeb_Portal (class of resources) and #creatorID01 (individual resource). The #SemanticWeb_Portal class is known as the domain of dc:creator, while #creatorID01 is its range. Such a technique is considered a RDF property-centric approach (Brickley & Guha, 2004). Additional properties can be defined for both the domain and range. RDF schema use schema terms as building blocks for constructing new terms and defining the relationships among these terms.

RDF provides a predefined property rdf:type for classes of objects. The rdf:Type property could be used to declare a class of resources or to show that a resource is an instance of a class. When a RDF resource is described with an rdf:type property, the value of the property (object) is considered to be a category or class of things, while the subject of that property is considered to be an instance of that category or class.

As discussed earlier, #SemanticWeb_portal is a class of resources and #leonardo-isles_web_portal is an instance of the class #SemanticWeb_Portal. This can be written as shown in Figure 1 (In N3 syntax).

The class of semantic Web portals is a subset of the class of Web portals so we could expand the example in Figure 1.

As mentioned earlier, a property can be employed to describe the relationship between two resources (or groups of resources). Thus, the property dc:creator can be declared as shown in Figure 3 (in N3).

In Figure 4, we have represented a taxonomy for the concept “organization” (isA hierarchy in typical ontology, a subClassOf attribute for RDF schema), while Figure 5 shows its corresponding RDF/XML document. As mentioned earlier, a class defines a group of individuals because they share some common properties. The term rdfs:subClassOf is just like the subset notation in set theory or the isA relationship in general ontology. The rdf:Property indicates the type of relationships between individuals or properties. Once again, we can either use a fragment identifier (e.g., #school) or a complete URI reference for a resource (e.g., http://www.leonardo-isles.net/organizations#school). For the term rdf:Property, we have rdfs:domain and rdfs:range, which constrains the property as well. To reiterate, rdfs:domain is a domain of a property that limits the individuals to which the property can be applied, while rdfs:range limits the individuals that the property may have as
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Figure 1. Declaration of classes (i)

```
#Ontology,Web,Portal   rdf:type #Ontology,WebPortal.
#Ontology,Web,Portal   rdf:type #Ontology,WebPortal.
#Ontology,Web,Portal   rdf:type #Ontology,WebPortal.
```

Note: The URI of the resources are always used. # is a fragment identifier which indicates a relative URI reference. However, an absolute URI reference can be used as well.

Figure 2. Declaration of classes (ii)

```
#Ontology,Web,Portal   rdf:type #Ontology,WebPortal.
#Ontology,Web,Portal   rdf:type #Ontology,WebPortal.
#Ontology,Web,Portal   rdf:type #Ontology,WebPortal.
```

Figure 3. Declaration of a property

```
dc:creator rdf:type rdfs:Property.
```

Figure 4. A taxonomy (rdfs:subclassOf hierarchy) for organization

```
organization

formalOrganization
  rdfs:subClassOf
  higherInstitution
    rdfs:subClassOf
    university
      rdfs:subClassOf
      primaryLevel
        nursery
          reception
          year1
          year2
          year3
          year4
          year5
          year6
        primaryLevel
      secondary
        year7
        year8
        year9
        year10
        year11
        year12
    secondaryLevel
  furtherInstitution
    school
      college
    rdfs:subClassOf
      postSecondary

nonFormalOrganization
  rdfs:subClassOf
  business
    publicService
    privateBusiness
  voluntary
    trainingCentre
    communityCentre
```

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