

# 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 defined 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 individuals and data values. 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 constraints 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

Figure 1. Declaration of classes (i)

```
#SemanticWeb_Portal    rdf:type rdfs:Class.
#leonardo-isles_web_portal  rdf:type #SemanticWeb_Portal.
```

**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.

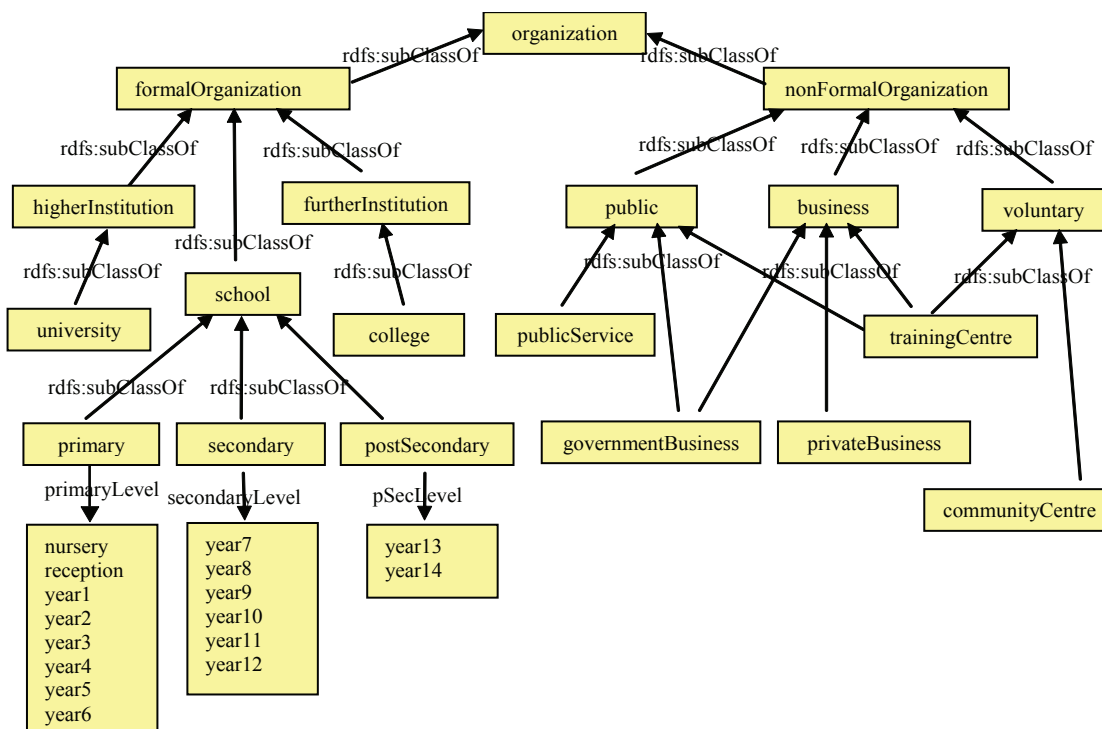
Figure 2. Declaration of classes (ii)

```
#SemanticWeb_Portal    rdf:type rdfs:Class.
#Web_Portal            rdf:type rdfs:Class.
#leonardo-isles_web_portal  rdf:type #SemanticWeb_Portal.
#SemanticWeb_Portal    rdfs:subClassOf #Web_Portal.
```

Figure 3. Declaration of a property

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

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



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