DEVELOPMENT OF UNIVERSAL NAMESPACE FOR WORKFLOW OF UNIVERSITY DOMAIN FOR ASPOCMS

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ABSTRACT

In recent years, the term paperless environment has almost become essential to manage various office contents. We have proposed a system aSPOCMS (An Agent-based Semantic Web for Paperless Office Content Management System) to provide paperless environment based on workflow ontology to manage the files and documents of various departments and sections of higher educational institutions. The metadata of explicit information of various workflows of the university plays the important role in aSPOCMS. Though a number of semantic workflow systems services based on OWL-S ontology, WSDL and SAWSDL/WSDL-S languages are available to provide Semantic Web services in various domains, however to define the terms (metadata) of workflow in university otology, a universal namespace is required. Therefore, we discuss the development of universal namespaces to define the workflow for university domain and their management for an ontology-driven office content management system. Furthermore, we described the information of workflow in TRIPLE and validate them from W3C RDF Validation service.

Keywords

Semantic Web, aSPOCMS, Namespace, TRIPLE, Workflow of University.

1. INTRODUCTION

Semantic Web [1] is a group of methods and technologies that allow machines to understand the meaning (semantics) of the information which is residing on World Wide Web. This upcoming technology was invented by Tim Berners-Lee in 1980s. Furthermore, Semantic Web is providing the share and reuse of knowledgebase representation, global linked representation of knowledgebase [2] to stipulating semantic based access of web resources and extracting information from these resources.

We need the Semantic Web to express the information of departments, sections, workflow of files and documents in a precise, machine interpretable form, ready for our system aSPOCMS (An Agent-based Semantic Web for Paperless office Content Management System) [3] to process, share and reuse of information. The workflow services of aSPOCMS have become more and more complex task of workflow process in typical University. Ontology of the workflow repository of higher educational institutions will play the important role in our system aSPOCMS. There are many advantage of aSPOCMS such as decrease the chunk of files, reduce the processing time and many more but our main focus is to make paperless office of the universities based on Semantic Web. There are a large number of Semantic Web Service languages such as OWL-S [4] based systems, WSDL [5] and SAWSDL/WSDL-S based systems. These ontology and languages have been used to provide various Web services in different domains. Some OWL-S reference examples [6] are ExpressCongoBuy ontology and BravoAir ontology etc.

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ExpressCongoBuy Web service allows a customer to buy books. BravoAir is a fictitious airline site that allows users to book a ticket.

In this paper devoted our effort to create a namespace for workflow of universities that could help for paperless office content management system by using Semantic Web technologies such as Uniform Resource Identifier (URI), Resource Description Framework (RDF) [7][8][9], Resource Description Framework Schema (RDFS) [10][11] and Ontology Web Language (OWL) [12][13]. The information in the information space is represented by URIs as resources [14]. The resources have unique identifier such as Uniform Resource Identifier (URI) in Semantic Web architecture [15]. A number of related technologies that have been developed and established, which can fulfill the promises of Semantic Web are now ready for use in application domain. XML and its related standards such as Namespaces and Schemas are used to structuring the metadata on the Web. Resource Description Framework (RDF) is the framework to represent the metadata of resources and establish the relationships between resources. Several syntactic representations are available, including a standard XML format. Resources Description Framework Schema (RDFS) is the modeling language, which is describing the classes of resources and properties between them. RDFS provides a simple reasoning framework for inferring types of resources. There is another powerful ontology language Ontology Web Language (OWL), which resides on the top of RDF and RDFS in Semantic Web tower. OWL is providing more complex constraints on resources and their properties.

2. RELATED WORK

A number of namespaces are available to define the resources of various domains such as persons, bank account and books etc., which are discussed in subsection 4.2 of this paper. A large number of semantic workflow systems such as OWL-S based system and SAWSDL/WSDL-S based systems are available to define the web services of distinct domains. Rest of them some namespaces, OWL-S web services and related research works done by various researchers are presented as below:

Sharmin Rashid Linta *et al.* [16] proposed a model of E-learning Management System using Semantic Web and also created a namespace `"univ"` to represent a university on Semantic Web where course syllabus, teaching methods, learning activities and learning styles are included. This namespace is used to identify any university around the world that is based on their proposed model. They have also provided the hierarchical content structure and semantic relationship between concepts which is facilitated the useful information for searching and sequencing learning resources in web-based E-learning systems.

Stojanovic *et al.* [17] introduced an E-learning scenario based on the Semantic Web technology. This scenario is concentrating on ontology of E-learning objects and correlated with the Learning Lab Lower Saxony, which itself is a partner in the Wallenberg Learning Network. They developed ontology in three ways: for describing the content of the learning materials which is the domain dependent ontology, for defining the learning context of the learning material and for structuring the learning materials in the learning courses.

S. Lovrenčić *et al.* [18] described a model of a university studies in Croatia domain. They have developed the ontology of university for study content. Ontology of university studies domain has super classes, subclasses and their individuals and properties of study content of university. Formal documents related to university studies are identified by this ontology. The study content

is represented as hierarchical structure, which is able to show the entire educational content, the sequence of learning and the structure of educational concepts such as super and sub classes.

Boyce, S. *et al.* [19] presented a method for domain experts rather than ontology engineers to develop ontologies for use in the delivery of courseware content in particular on relationship types that allow to model rich domain effectively. They have divided the overall knowledge into two spaces: the concept spaces and the educational content space for ontology implementation.

The researchers of ontology-centered work have created the vocabulary or namespace or OWL-S web services for university or course content or semantic workflow systems which is used to design university ontology and identify the university or course content or other workflow processes semantically. We can create the ontology of workflow services in context of OWL-S or WSDL etc. for our system aSPOCMS. As there is no namespace available to define the resources of workflow of administrative processes of typical university ontology, we create a namespace `"uniwf"` to identify the workflow of administrative process of university.

3. SEMANTIC WEB FOR WORKFLOW MANAGEMENT

The use of aSPOCMS services can be extended across the various departments and sections of typical university. This section focus on web based technologies and the potentials of Semantic Web technologies for workflow management in university ontology. It imposes the relevancy of Semantic Web technologies for aSPOCMS. These technologies have technical and relational potential to manage the knowledge of the university resource.

3.1 Semantic Web and aSPOCMS

In Semantic Web technologies, ontology-based knowledge management approach defines the common terminologies (concept) of domain. The term 'ontology' refers the conceptualization of terms. The study of ontology is categories the things that exist or may exist in the domain. From the perspective of workflow management, the main challenges [20][21] related to Semantic Web are to identify the relevant object of workflow of higher educational Institutions and understand the process which will use these objects and related semantics. We have provided the architecture of our system aSPOCMS as shown in figure 1.

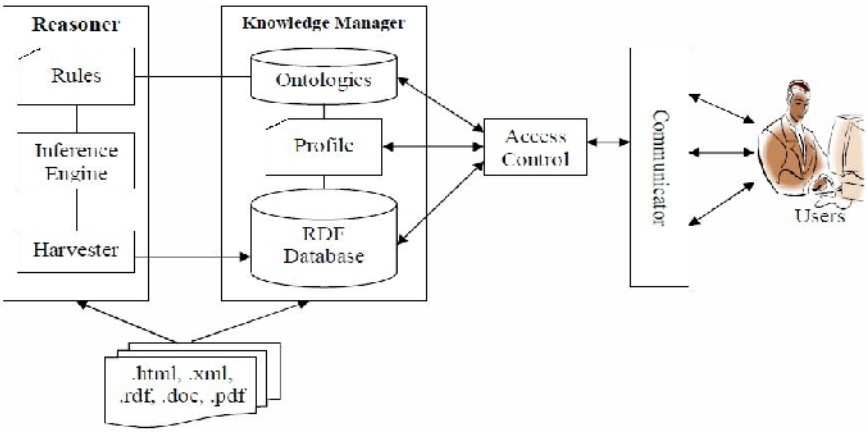

Figure 1: Architecture of aSPOCMS (adopted from [3]).

The aSPOCMS is an agent-based Semantic Web system. It enables paperless office content management system that uses RDF, RDFS and OWL for metadata declaration and reasoning rules. This system has four sub-modules: communicator, access control, knowledge manager and reasoner. Communicator will be provided the interface to users to communicate with the system. The access control has the capability of specifying authorizations over concepts defined in ontology. The knowledge manager is the major component of the architecture as it will manage aSPOCMS knowledge base and knowledge picking order by storing, structuring data according to the domain ontologies and also revise incoming information. The reasoner will use facts and ontologies to derive additional realistic knowledge that is provided perfectly.

3.2 Workflow Management approaching the Semantic Web

Presently, most of the processes depend on the Internet and workflow management has evolved into a network discipline. Administrative workflows define processes, while collaborative workflows focus on teams working toward common goals. When workflow management combined with Semantic Web technology, it can provide the advantages of presenting a clear semantics of information content upon workflow. This can improve the transparency of conventional workflow system where information regarding the files and documents are hidden and explicit knowledge is difficult to obtain. Workflow management is considered as a restricted discipline to the automation of processes. Electronic files and documents can be transmitted by the agent from one section or department to other section/department on the basis of metadata. In administrative processes, Semantic Web and ontology-based approaches can support for some objectives [22][23] such as systematic management of all kind of informational resources, improving the service quality of the administration and information retrieval and knowledge management with respect to different actor perspectives.

4. DOMAIN AND NAMESPACES

4.1 Domain

Ontology is the formal representation of knowledge, which has a set of concepts within a domain and relationship between these concepts [24]. Ontology leads the concepts of domain. The domain of discourse is the set of entities having certain properties with range. The domain of discourse is also called the universe of discourse (universe) [25]. The universe is a class containing all the entities which are referred to in a discourse or an argument [26]. In the concept of ontology, domain ontology is the model of specific domain, which represents the part of world with terms. The meanings of terms are provided by domain ontology. For example, the meaning of world “uniwf” (Namespace for University Workflow) has all the workflow of processes of the university.

4.2 Namespaces

The attribute namespace is an identifier, which provides the namespace of ontology (similar vocabulary). It is identified by the Uniform Resource Locator (URL) as an additional service [27]. The namespace is the collection of terms that a large number of people agree to use and share it. Further, those people have the same opinion on specific meanings of terms. Semantic Web technology provides a powerful way of sharing the namespaces. We can define them with the URL on WWW and anyone can use these terms. The user, who wants to use those terms knows that where these terms are found along with their meanings.

The Dublin Core Metadata Initiative (DCMI) [28] is the first namespace on web which provides the vocabulary of properties. It is a collection of terms that can be used to describe resources that can be found on the web or any other place where the information regarding these terms are stored. These terms include fifteen properties such as Contributor, Coverage, Creator, Date, Description, Format, Identifier, Language, Publisher, Relation, Rights, Source, Subject, Title and Type [29].

In addition to the Dublin Core elements, some other popular namespaces are Publishing Requirements for Industry Standard Metadata (PRISM) [30] and Friend of a Friend (FOAF) [31]. PRISM defines an XML metadata vocabulary for managing, aggregating, post-processing, multi-purposing and aggregating magazine, news, catalog, book, and mainstream journal content in a semantic way. FOAF is a RDF based schema to describe persons and their social network in the semantic way.

5. THE "UNIWF" NAMESPACE

As discussed in the previous section, the namespace PRISM is used to manage and process the information of books etc. and the namespace FOAF is used to describe person's metadata. Therefore, we created a namespace `"uniwf"` that is able to provide the information and the workflow process about university in Semantic Web. The `"uniwf"` is the namespace and supported ontologies to visualize the information regarding workflow process of a university in Semantic Web.

5.1 Ontology for "uniwf" namespace

Here, `University_Workflow` is the base class of the workflows of various files and documents of the university (using Altova SemanticWorks 2009 [32]), which is shown in figure 2. The term `uniwf:bag` is used to define the list of workflows of `University_Workflow` (OWL class). Term `uniwf:List_1` represents that `Admission` is the workflow of `University_Workflow` list.

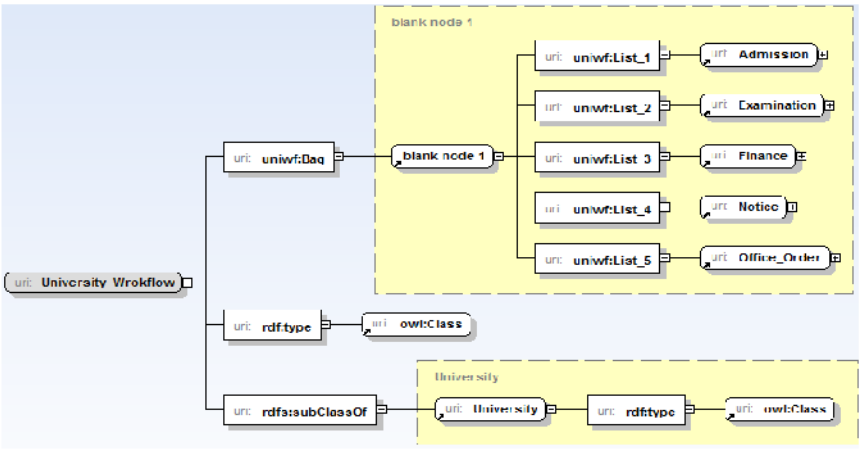

Figure 2: A part of snapshot of proposed ontology of workflow for 'uniwf' namespace using SemanticWorks2009 (Ontology Editor)

5.2 Description of "uniwf" ontology

The University ontology has various sections, departments and workflow to processes the files/documents and provides the services to actor. Here, the relationship among several classes and objects are shown in figures (3, 4, 5). In figure 3, `University_Workflow` is an OWL class, which has all the workflow of University. `University_Workflow` is the part of `University` so we can represent the vocabulary such as "`University_Workflow` is the subclass of `University`". Furtheremore, each workflow is the subclass of `University_Workflow`. Figure 4 shows that `Examination class` is the equivalent class of `Notice` and subclass of `University_Workflow`. The informaiton of `Examination` resource is defined by using `"uniwf"` namespace. The `uniwf:eDepartment` (Object Property) depicts the name of the department of examination and `uniwf:eSubject` defines the name of the `Examination`.

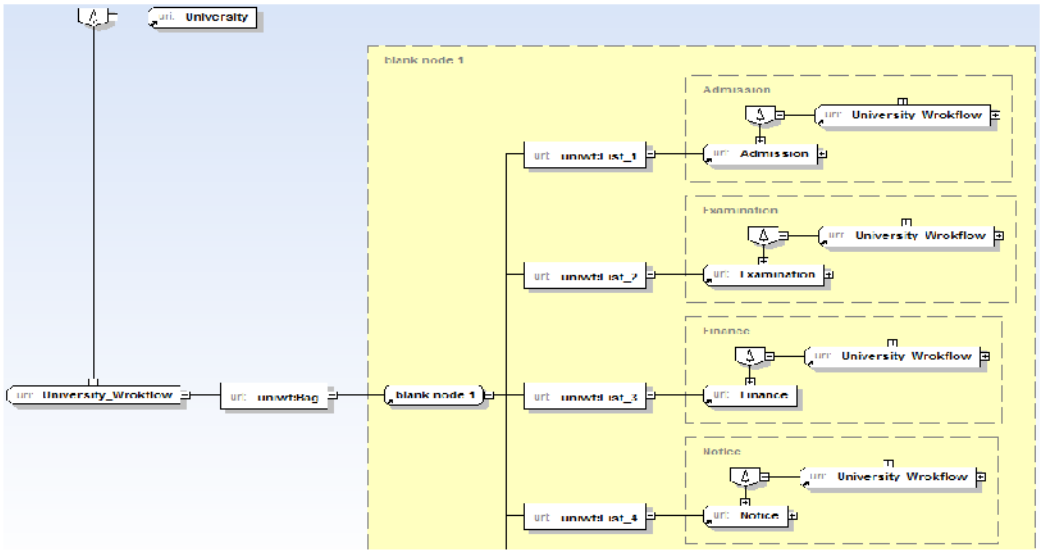

Figure 3: Relationship among various OWL classes.

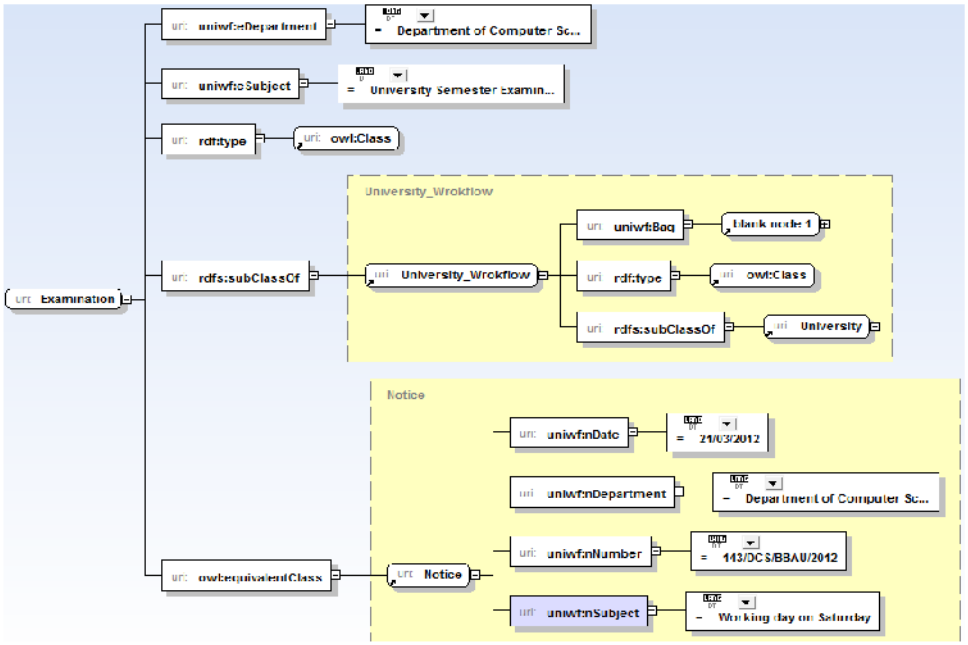

Figure 4: Relationship among Examination, Notice and University Workflow Classes.

In figure 5, `Admission` is the subclass of `University_Workflow` and equivalent class of `Notice`. The metadata of `Admission` class can be defined by `uniwf:aDate`, `uniwf:aDepartment` and `uniwf:aSubject` etc. The `uniwf:aDate`, `uniwf:aDepartment` and `uniwf:aSubject` define the date, name of department and subject respectively. Further, the `Notice` class is the subclass of `University_Workflow`.

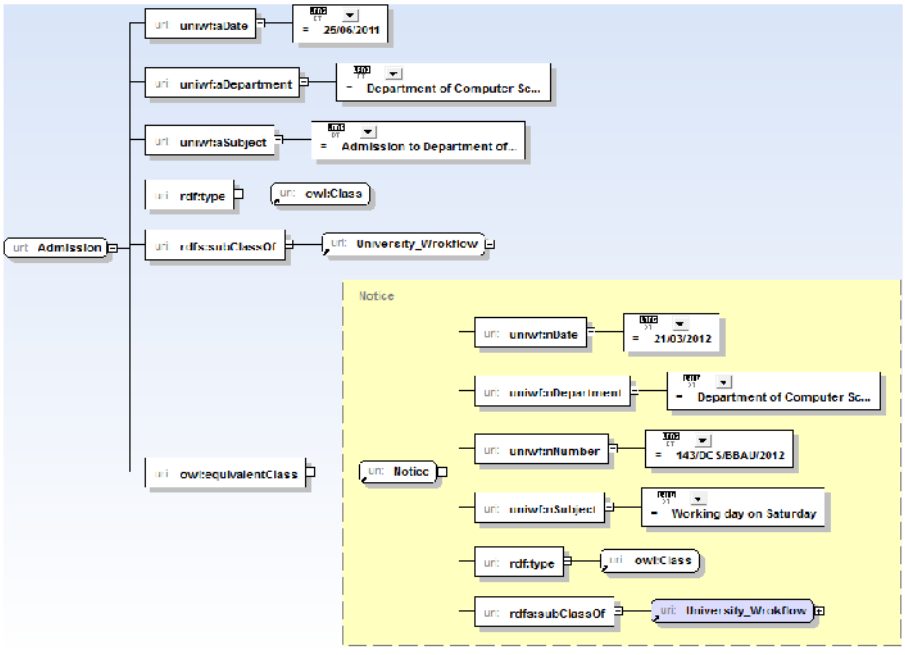

Figure 5: Relationship among Admission, Notice and University Workflow Classes.

5.3 "uniwf" namespace specification

The relationship among the OWL classes such as Admission, Examination, Finance, Notice and other workflow of University Workflow etc. objects are implemented by using "uniwf" namespace. Here, we are using some of the OWL classes and their properties of Indian universities as shown in figure 6 and 7.

Classes:
University, University_Workflow, Admission, Examination, Finance, Notice and Office_Order etc.

Object Properties:
rdf:type, rdfs:subClassOf, owl:equivalentClass etc.

Data Properties:
uniwf:eDepartment, uniwf:eSubject, uniwf:Bag, uniwf:aDate, uniwf:aDepartment, uniwf:aSubject, uniwf:nSubject, uniwf:nDepartment, uniwf:nNumber and uniwf:nDate etc.

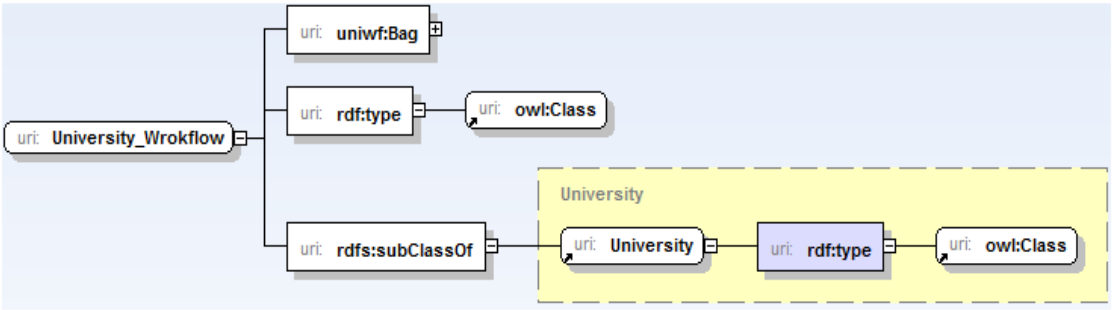

Figure 6: Relationship among University_Workflow and University Classes.

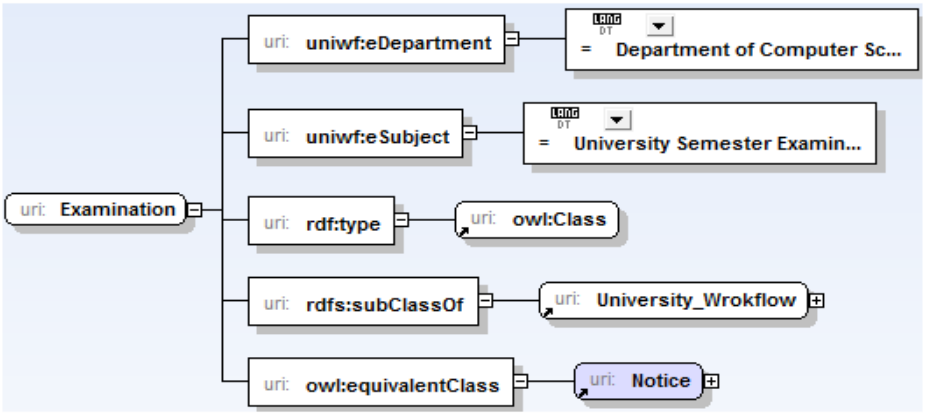

Figure 7: Object Properties of defined Classes.

Figure 6 depicted that the `University_Workflow` class is the subclass of `University` class. `University_Workflow` and `University` classes are the type of `owl:class`. In figure 7 `Examination` class have the object properties `uniwf:eDepartment` and `uniwf:eSubject`. Object properties `uniwf:eDepartment` and `uniwf:eSubject` have

the property values Department of Computer Science and University Semester Examination respectively.

5.3.1 Description of OWL Classes

OWL class is a concept in domain. Usually, OWL classes constitute the subclass and superclass hierarchy. The descriptions of some OWL classes and declaration within ontology are as follows:
University: A University
Has Subclass: University_Workflow, Admission, Examination, Finance and office order etc.
Properties include: Name, Address, City, State, and Country.
The University Class contains a collection of subclasses that represents a university system in ontological structure.

University class:

```
<rdf:Description rdf:about="#University">
        <rdf:type>
                <rdf:Description rdf:about="http://www.w3.org/2002/07/owl#Class"/>
        </rdf:type>
</rdf:Description>
```

Subclasses of: University

```
rdf:Description rdf:about="#University_Wrokflow">
        <rdf:type>
                <rdf:Description rdf:about="http://www.w3.org/2002/07/owl#Class"/>
        </rdf:type>
        <rdfs:subClassOf>
                <rdf:Description rdf:about="#University"/>
        </rdfs:subClassOf>
</rdf:Description>
```

Subclass of: University Workflow

Office order class:

```
<rdf:Description rdf:about="#Office_Order">
        <rdf:type>
                <rdf:Description rdf:about="http://www.w3.org/2002/07/owl#Class"/>
        </rdf:type>
        <rdfs:subClassOf>
                <rdf:Description rdf:about="#University_Wrokflow"/>
        </rdfs:subClassOf>
        <owl:sameAs>
                <rdf:Description rdf:about="#Notice"/>
        </owl:sameAs>
</rdf:Description>
```

Examination class:

```
<rdf:Description rdf:about="#Examination">
        <rdf:type>
                <rdf:Description rdf:about="http://www.w3.org/2002/07/owl#Class"/>
        </rdf:type>
        <rdfs:subClassOf>
                <rdf:Description rdf:about="#University_Wrokflow"/>
        </rdfs:subClassOf>
        <owl:equivalentClass>
```

```
            <rdf:Description rdf:about="#Notice"/>
        </owl:equivalentClass>
</rdf:Description>
```

5.3.2 Description of Metadata and Properties of Resources (Classes)

Metadata has been defined as data about data. In this perspective, metadata is describing the information of resources. We have described the information of the resources by using the proposed namespace in this paper. Here, the metadata of Admission resource is given below:

Resource: #Admission
type: OWL Class
subClassOf: #University_Workflow
aDepartment: Department of Computer Science
aSubject: Admission to Department of Computer Science
aDate: 25/06/2011
equivalentClass: #Notice

The metadata and properties of resource **#Admission** refers that admission will be done under specific department. For example, a fragment of the **#Admission** metadata and its properties are shown below in RDF form:

```
<rdf:Description rdf:about="#Admission">
        <rdf:type>
            <rdf:Description rdf:about="http://www.w3.org/2002/07/owl#Class"/>
        </rdf:type>
        <rdfs:subClassOf>
            <rdf:Description rdf:about="#University_Wrokflow"/>
        </rdfs:subClassOf>
        <uniwf:aDepartment>Department of Computer Science</uniwf:aDepartment>
        <uniwf:aSubject>Admission to Department of Computer Science</uniwf:aSubject>
        <uniwf:aDate>25/06/2011</uniwf:aDate>
        <owl:equivalentClass>
            <rdf:Description rdf:about="#Notice"/>
        </owl:equivalentClass>
</rdf:Description>
```

Resource: #Notice
nDepartment: Department of Computer Science
nSubjact: Working day on Saturday
nDate: 21/03/2012
nNumber: 143/DCS/BBAU/2012

The metadata and properties of resource **#Notice** refers about various notice of each department. For example, here is a fragment of the **#Notice** metadata and properties:

```
<rdf:Description rdf:about="#Notice">
        <uniwf:nDepartment>Department of Computer Science</uniwf:nDepartment>
        <uniwf:nSubject>Working day on Saturday</uniwf:nSubject>
        <uniwf:nDate>21/03/2012</uniwf:nDate>
        <uniwf:nNumber>143/DCS/BBAU/2012</uniwf:nNumber>
        <rdf:type>
            <rdf:Description rdf:about="http://www.w3.org/2002/07/owl#Class"/>
        </rdf:type>
```

```
        <rdfs:subClassOf>
                <rdf:Description rdf:about="#University_Wrokflow"/>
        </rdfs:subClassOf>
</rdf:Description>
```

The rest of metadata and properties of various recourses are given in this paper which is also specified like the similar procedure.

6. TESTING THE "UNIWF" NAMESPACE

As discussed about the namespace "uniwf" in Semantic Web in previous section for the workflow of university, we can now test and validate the namespace. We used W3C RDF Validation Service [33] for testing of the namespace. This RDF validation service is based on Another RDF Parser (ARP). It currently uses version 2-alpha-1. ARP was created and maintained by Jeremy Carroll at HP-Labs in Bristol.

First, we have to develop an RDF file, which uses the "uniwf" namespace. We test the namespace in localhost through following link:

<xmlns:uniwf="http://localhost/ontology/uniwf.owl#">

The workflow ontology for University can now be developed. Here, we consider some resource visualization of the university as example. This should be represented in Semantic Web by using namespace "uniwf".

Admission:
resource= "#Admission"
aSubject= Admission to Department of Computer Science
aDepartment= Department of Computer Science
aDate= 25/06/2011

Examination:
resource= "#Examination"
eSubject= University Semester Examination
eDepartment= Department of Computer Science

Notice:
resource= "#Notice"
nNumber= 143/DCS/BBAU/2012
nSubject= Working day on Saturday
nDepartment= Department of Computer Science
nDate= 21/03/2012

The RDF file of above resources with additional information and metadata has been shown below for validate through TRIPLE for testing purpose:

```
<?xml version="1.0"?>
<rdf:RDF xml:base="http://www.xyzu.ac.in/univ-ont" xmlns="http://www.xyzu.ac.in/univ-ont#"
xmlns:owl="http://www.w3.org/2002/07/owl#" xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
xmlns:rdfs="http://www.w3.org/2000/01/rdf-schema#" xmlns:uniwf="http://localhost/ontology/uniwf.owl#">
        <rdf:Description rdf:about="#University_Wrokflow">
                <rdf:type>
                        <rdf:Description rdf:about="http://www.w3.org/2002/07/owl#Class"/>
                </rdf:type>
```

```
        <rdfs:subClassOf>
                <rdf:Description rdf:about="#University"/>
        </rdfs:subClassOf>
        <uniwf:Bag>
                <rdf:Description>
                        <uniwf:List_1>
                                <rdf:Description rdf:about="#Admission"/>
                        </uniwf:List_1>
                        <uniwf:List_2>
                                <rdf:Description rdf:about="#Examination"/>
                        </uniwf:List_2>
                        <uniwf:List_3>
                                <rdf:Description rdf:about="#Finance"/>
                        </uniwf:List_3>
                        <uniwf:List_4>
                                <rdf:Description rdf:about="#Notice"/>
                        </uniwf:List_4>
                        <uniwf:List_5>
                                <rdf:Description rdf:about="#Office_Order"/>
                        </uniwf:List_5>
                </rdf:Description>
        </uniwf:Bag>
</rdf:Description>
<rdf:Description rdf:about="#Notice">
        <uniwf:nDepartment>Department of Computer Science</uniwf:nDepartment>
        <uniwf:nSubject>Working day on Saturday</uniwf:nSubject>
        <uniwf:nDate>21/03/2012</uniwf:nDate>
        <uniwf:nNumber>143/DCS/BBAU/2012</uniwf:nNumber>
        <rdf:type>
                <rdf:Description rdf:about="http://www.w3.org/2002/07/owl#Class"/>
        </rdf:type>
        <rdfs:subClassOf>
                <rdf:Description rdf:about="#University_Wrokflow"/>
        </rdfs:subClassOf>
</rdf:Description>
<rdf:Description rdf:about="#Office_Order">
        <rdf:type>
                <rdf:Description rdf:about="http://www.w3.org/2002/07/owl#Class"/>
        </rdf:type>
        <rdfs:subClassOf>
                <rdf:Description rdf:about="#University_Wrokflow"/>
        </rdfs:subClassOf>
        <owl:sameAs>
                <rdf:Description rdf:about="#Notice"/>
        </owl:sameAs>
</rdf:Description>
<rdf:Description rdf:about="#Examination">
        <rdf:type>
                <rdf:Description rdf:about="http://www.w3.org/2002/07/owl#Class"/>
        </rdf:type>
        <rdfs:subClassOf>
                <rdf:Description rdf:about="#University_Wrokflow"/>
        </rdfs:subClassOf>
        <uniwf:eDepartment>Department of Computer Science</uniwf:eDepartment>
        <uniwf:eSubject>University Semester Examination</uniwf:eSubject>
        <owl:equivalentClass>
                <rdf:Description rdf:about="#Notice"/>
        </owl:equivalentClass>
</rdf:Description>
<rdf:Description rdf:about="#Admission">
```

```
                <rdf:type>
                        <rdf:Description rdf:about="http://www.w3.org/2002/07/owl#Class"/>
                </rdf:type>
                <rdfs:subClassOf>
                        <rdf:Description rdf:about="#University_Wrokflow"/>
                </rdfs:subClassOf>
                <uniwf:aDepartment>Department of Computer Science</uniwf:aDepartment>
                <uniwf:aSubject>Admission to Department of Computer Science</uniwf:aSubject>
                <uniwf:aDate>25/06/2011</uniwf:aDate>
                <owl:equivalentClass>
                        <rdf:Description rdf:about="#Notice"/>
                </owl:equivalentClass>
        </rdf:Description>
        <rdf:Description rdf:about="#Finance">
                <rdf:type>
                        <rdf:Description rdf:about="http://www.w3.org/2002/07/owl#Class"/>
                </rdf:type>
                <rdfs:subClassOf>
                        <rdf:Description rdf:about="#University_Wrokflow"/>
                </rdfs:subClassOf>
        </rdf:Description>
        <rdf:Description rdf:about="#University">
                <rdf:type>
                        <rdf:Description rdf:about="http://www.w3.org/2002/07/owl#Class"/>
                </rdf:type>
        </rdf:Description>
</rdf:RDF>
```

We tested the RDF in the RDF Validator and found the result as TRIPLE.

7. RESULT

After validating the RDF file by using W3C RDF Validator as discussed in previous section, we have the TRIPLE as shown in figure 8. In this figure, the information of various resources can be divided in triples as: subject (resource), object (property) and predicate (property value). A subject is anything that can have a URI such as `http://www.xyzu.ac.in/univ-ont#Admission`. A predicate is a property of subject, which has a URI. In figure 8, `http://localhost/ontology/uniwf.owl#aDepartment` has represented as predicate. Object is a property value, which may be a literal value or a URI such as “Department of Computer Science”, `http://www.xyzu.ac.in/univ-ont#Notice`.

In figure 8, we see that RDF file is merging the linked data by proper (well-formed) statements. If syntax of RDF file is not well-formed then RDF Validator may show the TRIPLE with error message or only error message.

Number	Subject	Predicate	Object
1	http://www.xyzu.ac.in/univ-ont#University_Wrokflow	http://www.w3.org/1999/02/22-rdf-syntax-ns#type	http://www.w3.org/2002/07/owl#Class
2	http://www.xyzu.ac.in/univ-ont#University_Wrokflow	http://www.w3.org/2000/01/rdf-schema#subClassOf	http://www.xyzu.ac.in/univ-ont#University
3	http://www.xyzu.ac.in/univ-ont#University_Wrokflow	http://localhost/ontology/uniwf.owl#Bag	genid:A66407
4	genid:A66407	http://localhost/ontology/uniwf.owl#List_1	http://www.xyzu.ac.in/univ ont#Admission
5	genid:A66407	http://localhost/ontology/uniwf.owl#List_2	http://www.xyzu.ac.in/univ-ont#Examination
6	genid:A66407	http://localhost/ontology/uniwf.owl#List_3	http://www.xyzu.ac.in/univ-ont#Finance
7	genid:A66407	http://localhost/ontology/uniwf.owl#List_4	http://www.xyzu.ac.in/univ-ont#Notice
8	genid:A66407	http://localhost/ontology/uniwf.owl#List_5	http://www.xyzu.ac.in/univ-ont#Office_Order
9	http://www.xyzu.ac.in/univ-ont#Notice	http://localhost/ontology/uniwt.owl#nDepartment	"Department of Computer Science"
10	http://www.xyzu.ac.in/univ-ont#Notice	http://localhost/ontology/uniwt.owl#nSubject	"Working day on Saturday"
11	http://www.xyzu.ac.in/univ-ont#Notice	http://localhost/ontology/uniwf.owl#nDate	"21/03/2012"
12	http://www.xyzu.ac.in/univ-ont#Notice	http://localhost/ontology/uniwf.owl#nNumber	"143/DCS/BBAU/2012"
13	http://www.xyzu.ac.in/univ-ont#Notice	http://www.w3.org/1999/02/22-rdf-syntax-ns#type	http://www.w3.org/2002/07/owl#Class
14	http://www.xyzu.ac.in/univ ont#Notice	http://www.w3.org/2000/01/rdf-schema#subClassOf	http://www.xyzu.ac.in/univ ont#University_Wrokflow
15	http://www.xyzu.ac.in/univ ont#Office_Order	http://www.w3.org/1999/02/22-rdf-syntax-ns#type	http://www.w3.org/2002/07/owl#Class
16	http://www.xyzu.ac.in/univ-ont#Office_Order	http://www.w3.org/2000/01/rdf-schema#subClassOf	http://www.xyzu.ac.in/univ-ont#University_Wrokflow
17	http://www.xyzu.ac.in/univ-ont#Office_Order	http://www.w3.org/2002/07/owl#sameAs	http://www.xyzu.ac.in/univ-ont#Notice
18	http://www.xyzu.ac.in/univ-ont#Examination	http://www.w3.org/1999/02/22 rdf syntax ns#type	http://www.w3.org/2002/07/owl#Class
19	http://www.xyzu.ac.in/univ-ont#Examination	http://www.w3.org/2000/01/rdf-schema#subClassOf	http://www.xyzu.ac.in/univ-ont#University_Wrokflow
20	http://www.xyzu.ac.in/univ-ont#Examination	http://localhost/ontology/uniwf.owl#eDepartment	"Department of Computer Science"
21	http://www.xyzu.ac.in/univ ont#Examination	http://localhost/ontology/uniwf.owl#eSubject	"University Semester Examination"
22	http://www.xyzu.ac.in/univ-ont#Examination	http://www.w3.org/2002/07/owl#equivalentClass	http://www.xyzu.ac.in/univ-ont#Notice
23	http://www.xyzu.ac.in/univ-ont#Admission	http://www.w3.org/1999/02/22-rdf-syntax-ns#type	http://www.w3.org/2002/07/owl#Class
24	http://www.xyzu.ac.in/univ ont#Admission	http://www.w3.org/2000/01/rdf-schema#subClassOf	http://www.xyzu.ac.in/univ ont#University_Wrokflow
25	http://www.xyzu.ac.in/univ-ont#Admission	http://localhost/ontology/uniwt.owl#aDepartment	"Department of Computer Science"
26	http://www.xyzu.ac.in/univ-ont#Admission	http://localhost/ontology/uniwf.owl#aSubject	"Admission to Department of Computer Science"
27	http://www.xyzu.ac.in/univ ont#Admission	http://localhost/ontology/uniwf.owl#aDate	"25/06/2011"
28	http://www.xyzu.ac.in/univ-ont#Admission	http://www.w3.org/2002/07/owl#equivalentClass	http://www.xyzu.ac.in/univ-ont#Notice
29	http://www.xyzu.ac.in/univ-ont#Finance	http://www.w3.org/1999/02/22-rdf-syntax-ns#type	http://www.w3.org/2002/07/owl#Class
30	http://www.xyzu.ac.in/univ-ont#Finance	http://www.w3.org/2000/01/rdf-schema#subClassOf	http://www.xyzu.ac.in/univ-ont#University_Wrokflow
31	http://www.xyzu.ac.in/univ-ont#University	http://www.w3.org/1999/02/22 rdf syntax ns#type	http://www.w3.org/2002/07/owl#Class

Figure 8: List of TRIPLEs of RDF validated by W3C RDF Validator

In figure 8, we have a small representation of the resources of a typical Indian University. However, it shows the possibility of full visualization of any university by the terms given in "uniwf" namespace.

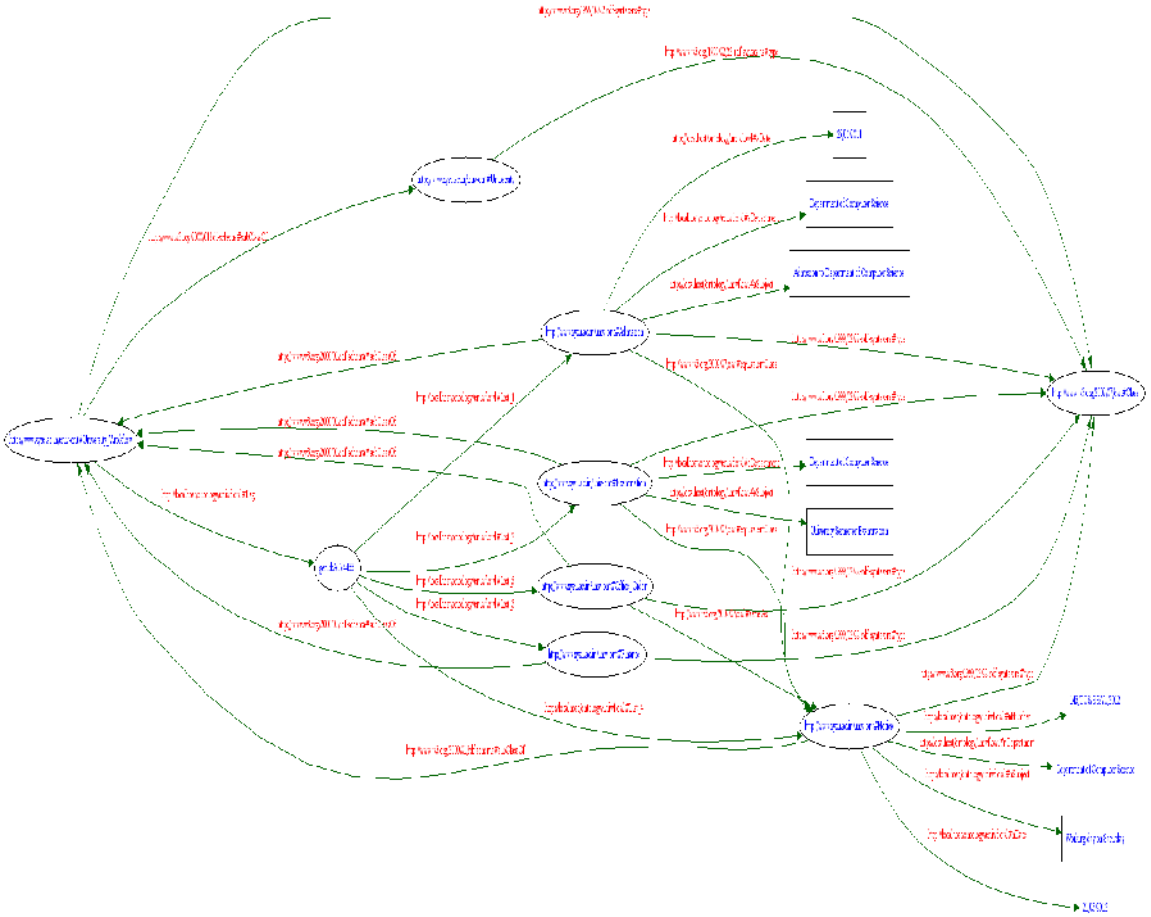

Figure 9: Graph of tested RDF file by W3C RDF Validator.

The graphical view of the related information is represented in figure 9, which is generated by RDF validator based on RDF statement. The circles represent the classes of resource, which have various types of resources. Rectangular shape is represented the metadata of the resource. The arrows show that the relationship between classes and their metadata. The graph shows the proper linking of subject, predicate and objects of statement.

8. CONCLUSION

The metadata of various resources of workflow of university has been defined in ontology by using "uniwf" namespace. The "uniwf" namespace introduces the collection of terms that the people agree to use and share. We have represented the hierarchical structure like super class and subclass of the information and semantic relationship among concepts of workflow of various sections and departments of higher educational institutions that provide related and useful information for transmitting the electronic files and documents over the workflow. It also provides the way to create namespace to represent the workflow of a university on Semantic Web. We expect that this namespace will be very useful to represent the workflow processes of various Indian universities. It will also be beneficial over other office content management systems, which may not be enabled with Semantic Web.

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