Implication of the REST based Design Patterns over Semantic Web

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Abstract

The paper is about REST (Representational State Transfer) patterns URI using various new web technologies. This paper discusses use of REST URI with several Semantic Web components, along with Semantic Web and Ontology technology implementation approaches along with theory concepts in mind so the practical implementation can be further carried out with variety of measurements. In Ontology terminologies, SPARQL is a standard query language for RDF but plays a vital role by using FOAF function which deals with information of particular URI (Uniform Resource Identifier) to process.

Keywords: REST, Semantic Web, Ontology, FOAF (Friend of a Friend)

1. Introduction

1.1. What is REST?

REST (Representational State Transfer) architecture was originally coined by Roy Thomas Fielding in 2000s to support the high performance and scalability requirement specifications of the hypermedia environment. REST is a style of Software Architecture for Distributed hypermedia systems such as WWW (World Wide Web). Since then, its application has gone beyond the original environment and made further applications into the B2B (Business-to-Business) area and in the other areas related to network based programming. Its applications are very useful in the all the area of the computer science. RESTful architecture can be based on other Application Layer protocols if they provide a rich and uniform vocabulary for applications based on the transfer of meaningful representational state.

1.1.1. REST URI

REST Architecture style comprises four major principles.

1.1.1.1. Resource identification through URI.

The interface of a RESTful web service is the set of the resources and uniquely identified URIs. This unique resource identified and it is globally accessible. RESTful Applications are accessed through its unique URIs. If client wants to access these resources then initially must invokes the URI. Resources are identified by URIs, which provides a global addressing space for resource and service discovery.

1.1.1.2. Uniform Interface

When resources are identified then those are manipulated through CRUD (Create, Read, Update, Delete) operations: All these possible through HTTPs four Methods which are GET, PUT, POST, DELETE.

❖ **GET** requests are used to retrieve the current state of the resources. This is the Read-only operation, they can retrieve the information only they can't be changed using the GET method (verb). Now at the server side result of these types of requests cached and at the other side client always be able to perform a GET request prior to the knowledge.

- **PUT** creates a new resource. If the resource identified by the URI then PUT request doesn't apply. Otherwise It can be updated as the new resource and give the URI.
- **DELETE** requests are used to delete an existing resources and broken resource links. If the resource is deleted then it will no longer be respond this resource via GET method.
- **POST** transfers a new state onto a resource.

1.1.1.3. Self-descriptive Messages

Resources are departed from their representation so that their content can be accessed in a variety of formats (e.g., JSON, ATOM, HTML, XML, plain text, PDF, JPEG, etc.). Metadata about the resource is available and used to retrieve information to display it.

1.1.1.4. Stateful Interactions through Hyperlinks.

Each and every interaction with a resource is stateless, i.e., request messages are contains self-information. Stateful interactions are based on the concept of state transfer in an explicit manner. Several techniques exist to exchange state, e.g., Cookies, URI rewriting and hidden form fields. State can be concreted in response messages to point to valid future states of the interaction.

1.2. The Semantic Web

Semantic web is an effort to enhance current web so that computers can process the information presented on WWW, interpret and connect it, to help humans to find required knowledge. In the same way as WWW is a huge distributed hypertext system, semantic web is intended to form a huge distributed knowledge based system. The focus of semantic web is to share data instead of documents. In other words, it is a project that should provide a common framework that allows data to be shared and reused across application, enterprise, and community boundaries. It is a collaborative effort led by World Wide Web Consortium (W3C).

The Semantic Web is a collaborative movement led by the World (W3C) that promotes common formats for data on the World Wide Web. The given term "Semantic Web" was coined by Tim Berners-Lee who is inventor of the WWW(World Wide Web) and also director of the W3C(World Wide Web Consortium). In general, Semantic Web is a type of web which got any data that can be processed indirectly and directly by machines. Semantic Web meaning to the web making more collaborative, communicative and interactive.

1.2.1. Semantic Web Architecture (Stack)

The first layer (Bottom one), URI and Unicode, follows the important features of the existing WWW. Unicode is a standard of encoding international character sets and it allows that all human languages can be used (written and read) on the web using one standardized form. Uniform Resource Identifier (URI) is a string of a standardized form that allows to uniquely identifying resources (e.g., documents, image). A subset of URI is Uniform Resource Locator (URL), which contains access mechanism and a (network) location of a document - such as http://www.example123.com/. The usage of URI is important for a distributed internet system as it provides understandable identification of all resources. An international variant to URI is Internationalized Resource Identifier (IRI) that allows usage of Unicode characters in identifier and for which a mapping to URI is defined. In the rest of this text, whenever URI is used. A layered architecture for the Semantic Web that adheres to software engineering principles and the fundamental levels of layered architectures which will assist in the development of Semantic Web speciûcations and future applications.

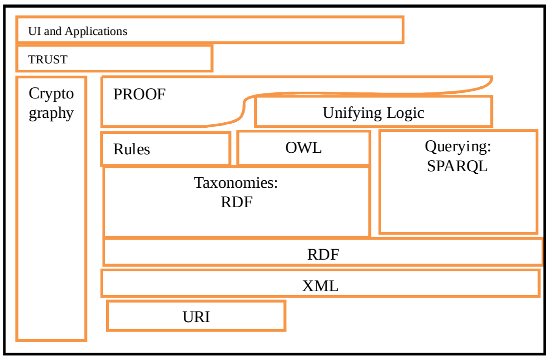

Figure 1: Semantic Stack Scenario

1.3. Ontology

Ontology defines a common vocabulary for researchers who need to share information in a domain. It includes machine-interpretable definitions of basic concepts in the domain and relations among them. Ontology is a formal explicit specification of shared conceptualization. The Semantic Web is a vision for the future of the Web, in which information is given explicit meaning, making it easier for machines to automatically process and integrate information available on the Web. The Future Web will build on XML's and RDF ability to define customized tagging schemes and RDF's flexible approach to representing data. The first level above RDF required for the Semantic Web is an ontology language what can formally describe the meaning of terminology used in Web documents.

1.3.1. Ontology Types

A specification consisting of

- ❖ classes
- ❖ relations between classes
- ❖ individuals

2. Semantic Web and Ontology: Theory to Practice

Semantic Web and Ontology relations are required to improve the scalability of the Web. For improving scalability many questions arise, many implementations needs, many directions are involve, etc.

2.1. How Ontology Works with Semantic Web

Ontology forms one important layer in the semantic stack. In the Semantic Web, this comes from schemata and ontologies. These are two related tools for helping a computer understand human vocabulary. Ontology is simply a vocabulary that describes objects and how they relate to one another. A schema is a method for organizing information. As with RDF tags, access to schemata and ontologies are included in documents as metadata, and a document's creator must declare which ontologies are referenced at the beginning of the document. Ontology adds more meaning to semantic type of web. With the combination of XML and RDF, OWL file is structured to process the query and web resources in a suitable way.

Various Schema and ontology tools used over the Semantic Web include:

- ❖ RDF Vocabulary Description Language schema (RDFS) - RDFS adds classes, subclasses and properties to resources, creating a basic language framework.

- Simple Knowledge Organization System (SKOS) - SKOS classifies resources in terms of broader or narrower, allows designation of preferred and alternate labels.
- Web Ontology Language (OWL) - OWL, the most complex layer, formalizes ontologies, describes relationships between classes and uses logic to make deductions. It can also construct new classes based on existing information. OWL is available in three levels of complexity — Lite, Description Language (DL) and Full.

As the technology is rapidly changing day by day there have been many changes in the web and application servers, the technology is trying to find out the similarities in the semantics, to resolve the domain independent relationships informational retrieval technologies are used web techniques of the semantics are used to resolve domain-specific similarities the relationships among the concepts are modeled as domain ontology semantic annotations are annotated in the web services from domain ontologies.

The semantic web is collection of knowledge it is built in order to make the people know on internet and also it helps them find answers to their questions information is provided in the semantic web it is given in the natural language text and it is structured in a proper form it is very east for the people to work on with it, in the semantic web the structure is simple, in descriptive statements the knowledge is expressed the knowledge which is in the semantic web is an aggregate of contributions from many sources. When the true state of world changes the fact that is stored in the semantic web changes the browsers get the correct form of the answers.

2.2. Specification of Conceptualization

The second definition of ontology mentioned above, "explicit specification of conceptualization", comes from Thomas Gruber. The exact meaning depends on the understanding of the terms "specification" and "conceptualization". Explicit specification of conceptualization means that ontology is a description (like a formal specification of a program) of the concepts and relationships that can exist for an agent or a community of agents. This definition is consistent with the usage of ontology as set of concept definitions, but more general.

A conceptualization can be defined as an intentional semantic structure that encodes implicit knowledge constraining the structure of a piece of a domain. Ontology is a (partial) specification of this structure, i.e., it is usually a logical theory that expresses the conceptualization explicitly in some language. Conceptualization is language independent, while ontology is language dependent. The use can be illustrated in the figure below - it shows how an ontology restricts (i.e., defines) possible use of constructs used in the description of the domain. Notice that ontology does not have to express all the possible constraints - the level of details in conceptualization depends on the requirements of the intended application and expressing conceptualization in ontology in addition depends on the used ontology language.

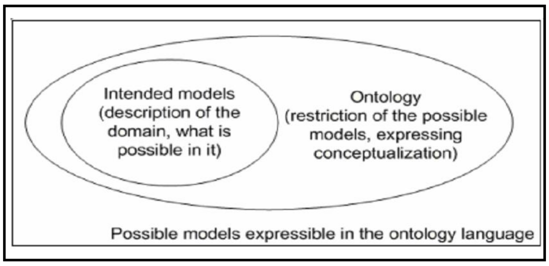

Figure 2: Ontology Expressing Intended Models for Description of the Domain

The representation of a body of knowledge (knowledge base) is based on the specification of conceptualization. A conceptualization is an abstract, simplified view of the world that we wish to represent for some purpose. Every knowledge base, knowledge-based system or agent is committed to some conceptualization, explicitly or implicitly. For these systems, what "exists" is what can be represented. When the knowledge of a domain is represented in a declarative formalism, the set of objects that can be represented is called the universe of discourse. This set of objects and the describable relationships among them are reflected in the representational vocabulary with which a knowledge-based program represents knowledge. Thus, in the context of AI, we can describe the ontology of a program by defining a set of representational terms. In such an ontology, definitions associate the names of entities in the universe of discourse (e.g. classes, relations, functions, or other objects) with descriptions of what the names mean, and formal axioms that constrain the interpretation and well-formed use of these terms. Formally it can be said that ontology is a statement of a logical theory.

The backbone of ontology is often taxonomy. Taxonomy is a classification of things in a hierarchical form. It is usually a tree or a lattice that express subsumption relation - i.e., A subsumes B meaning that everything that is in A is also in B. An example is classification of living organisms. The taxonomy usually restricts the intended usage of classes - where classes are subsets of the set of all possible individuals in the domain. A taxonomy of properties can be defined as well.

Ontologies provide a shared conceptualization of a domain:

- ❖ Ontologies must be restricted to a specific application area (Domain) to be manageable
- ❖ Shared conceptualizations enable knowledge pooling
- ❖ Sharing means consensus - may not be easy to obtain

2.3. FOAF and SPARQL Working

2.3.1. What is FOAF?

The FOAF ("Friend of a Friend") project is a community driven effort to define an RDF vocabulary for expressing metadata about people, and their interests, relationships and activities.

FOAF facilitates the creation of the Semantic Web equivalent of the archetypal personal homepage: My name is Krunal, this is a picture of me, I'm interested in XML (eXtensible Markup Language), and here are some links to my friends. And just like the HTML version, FOAF documents can be linked together to form a web of data, with well-defined semantics.

Care has been taken in the schema to ensure that, where appropriate, the FOAF classes have been related to their equivalents in other ontologies. This allows FOAF data to be immediately process able by applications built to understand these ontologies, while allowing the FOAF project to defer the definition of more complex concepts, e.g. geographical metadata, to other communities.

```
<foaf:Person>
  <foaf:name>Krunal Chauhan</foaf:name>
<foaf:mbox_sha1sum>cf2f4bd069302febd8d7c26d80bd82</
foaf:mbox_sha1sum>
 </foaf:Person>
```

<foaf:Person>

<foaf:name>Vishal Bajaj</foaf:name>
<foaf:mbox_sha1sum>cf2f4bd069302febd8d7c267f20bd82</foaf:mbox_sha1sum>

</foaf:Person>

2.3.2 What is Semantic Tagging?

A semantic wiki (Tagging) is a wiki that has an underlying model of the knowledge described in its pages. Regular, or syntactic, wikis have structured text and untyped hyperlinks. Semantic wikis, on the other hand, provide the ability to capture or identify information about the data within pages, and the relationships between pages, in ways that can be queried or exported like a database. Many Social bookmarking systems currently using Wikipedia articles for tagging for ex: Faviki.Faviki actually uses URLS in the DBpedia namespace that correspond to Wikipedia pages.

2.4. Limitations of FOAF Using Ontology Terminology:-

- **Batch Mode:** For performance reasons, the FOAF data is not processed dynamically, but more so in a batch mode. This can lead to problems when someone updates their FOAF file. This is apparently being addressed by the FOAF community.

- **Trust:** You might tell me in your FOAF file that you are the CEO of ABC Inc, or that Bill Gates is your buddy, but how do we authenticate that information?

- **Parsers:** Parsers show a graphical view of FOAF files, but current parsers cannot show a graphical representation of newer extensions being added to FOAF.

- **Security:** FOAF files store your personal data, and as such, security becomes a key issue. Applications using FOAF files need to consider the different data security mechanisms that they need to use to protect user data.

2.5. Retrieval of Detailed Information using REST URI (Methods)

SPARQL and REST

SPARQL is the standard query language for RDF, but currently is a read-only language defined in a way similar to SQL. RDF is the core specification of the Semantic Web. It is a graph-based meta-model that is based on triples of subject, predicate, and object, where subject and predicate are always URIs, whereas the object can be a value or a URI. SPARQL introduces such a concept in the form of named graphs, but this concept only exists in the context of SPARQL, is not necessarily supported in all SPARQL implementations. SPARQL is a recursive acronyms stands for SPARQL Protocol and RDF(Resource Description Framework) Query Language. REST‘s, various acronyms have been proposed to name the instantiation of that style in the Web technologies today, most importantly URIs, HTTP, HTML, media types, and XML.SPARQL is query tool which easily manage to work with REST design patterns(REST URI).

3. Conclusion

REST is increasingly becoming a key architectural style, thanks to the growing popularity of the web 2.0 and Semantic Web. Our paper deals with several technologies concept like Ontology, FOAF, and Semantic tagging which is future of the world used for processing of more detailed information retrieval process. The concern future process requires the mark-up language like XML and

HTML. In the future terminology, FOAF deals with REST URI for processed detailed information of the entity related to another own entity in the form of web resources which will be quite easy to access. The given idea in future deals with processing of the information with SPARQL, FOAF and some other components of Semantic Web with using RESTful styles and API.

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