

# Semantic Web Architecture and their Issues

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**Abstract** - The semantic web is a vision which captures information from the web and makes it possible to help machines to understand complex human requests. It is not a separate Web; however it is an extension of the current web that gives information in well-defined meaning, superior communications among machine and people to work in cooperation. It will bring structure to the meaningful content of Web pages, making an environment where software agents moving from page to page can readily carry out sophisticated tasks for users. The inspiration to use Semantic Web is to automate the processing of Web-based information and to improve interoperability of Web based information systems. In this system, we have provided a comprehensive review of Semantic Web architecture and their counter measurements.

**Keywords** - *Semantic Web Architecture.*

## 1. Introduction

The semantic web is an extension of the current web that provides well-defined meaningful information, better facilitating computers and people to work in collaboration. It is based on the thought of having information on the web defined and linked such that it can be used for more successful detection, computerization, amalgamation and reuse across various applications. It has drawn significant consideration of researchers in the field of information retrieval, knowledge discovery, artificial intelligence, and machine learning. Researchers in the artificial intelligent systems are taking attention to formulate utilize of Semantic Web technology as a central component of their software productions.

The central aims of SW is to developed languages for expressing information in a machine accessible way. Tim Berners-Lee, who is the inventor of the World Wide Web (WWW), first visualization of semantic web, which gives automated information access based on machine-accessible semantics of data. The apparent illustration of the semantics of data, accompanied with domain ontologies that will facilitate a web that gives a qualitatively new level of service. These services are the technical extensions of the presented World Wide Web (WWW). It essentially transforms the dispersed set of information of the web pages into a knowledge oriented

set of services. The inspiration behind Semantic Web is to automate the processing of Web-based information and to improve interoperability of Web based information systems. It is an addition of the current World Wide Web. Semantic Web services are semantic extensions of the existing web services which support involuntary searching, composition, invocation and interoperation of services.

## 2. LAYERED ARCHITECTURE OF SEMANTIC WEB

With the Semantic Web, machines will scan and interpret information on Web pages using with software agents. These agents utilize ontologies to perform their tasks in heterogeneity environment. These are parts of software that work autonomously and proactively on the Web to perform certain tasks. The development of the Semantic Web is proceeding in a step-by-step approach building one layer on top of another as shown in figure 1 below.

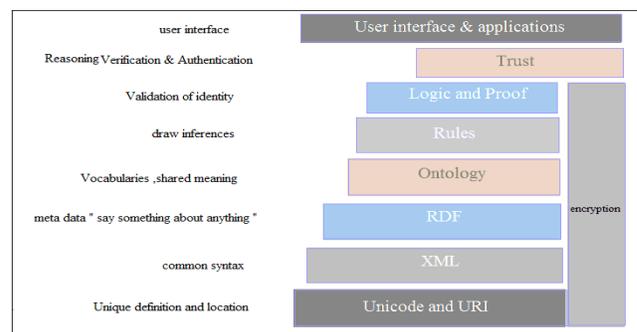


Figure 1: CFL Architecture of Semantic Web

CFL architecture overcomes the drawbacks of Lee's architecture and provides a sound base for semantic web development. The four versions of semantic web architecture given by Berners-Lee, however vague they proved as milestones in semantic web implementation and

served as reference architecture. All layers of semantic web are explained in detail in upcoming subsections.

### 2.2.1 Unicode and Uniform Resource Identifier (URI)

This layer is answerable for the programming of any character of any language or character set and at the same time responsible for uniquely identifying different resource or entities. It is standard for computer character representation, and URIs, the standard for identifying and locating resources (such as pages on the Web) provide a baseline for representing characters used in most of the languages in the world and for identifying resources. Unicode is a norm of determine international character sets and it summarized that all human languages should be determine using a standardized appearance. URI is also a string in standardized structure that permits unique identification of resources. URL is a subset of URI that holds access mechanism and a location of the web contents. These two standards are important in distributed World Wide Web as it provides understandable identification of all resources.

### 2.1.2 Extensible Markup Language (XML)

The extensible Markup Language (XML) is a universal meta-language for defining markup. It gives a uniform structure for replacing data among applications. It makes upon the unique and most basic layer of the Web, Hypertext Markup Language (HTML). However, XML does not give a method to deal with the semantics of information. It is associated principles such as Namespaces and Schemas and outlines a common means for structuring information on the Web. An XML document includes those components that can be nested and may have attributes and contents. It permits identifying different markup vocabularies in one XML document and gives schema for an exacting set of XML documents. At present XML is not an essential element of semantic web technologies as alternative syntaxes such as Terse RDF Triple Language (Turtle) that is a series format for Resource Description Framework (RDF) graph.

### 2.1.3 Resource Description Framework (RDF)

Resource Description Framework (RDF) was developed by the World Wide Web Consortium (W3C) for Web supported metadata in organizes to make and extend XML. The aim of RDF is to build work simplest for

independent agents and automated services by delivering a rudimentary semantic ability. The RDF is an arrangement for data, which utilizes a common relational form that permits structured and semi structured data to be exported and communal across different applications. It is a data model for objects and relationships among them and is made with an object-attribute-value triple called a statement. It is a structure for representing information about a resource in a graphical form. It was principally intended for representing metadata about WWW resources; however it can be used for saving any other information as well. It crafts utilize of subject-predicate-object which results in graphical information. It gives a common language for expressing data models i.e. objects and their associations. An RDF based model can be specified in a variety of syntaxes such as RDF/XML etc. RDF is a, elementary measurement of the semantic web. RDF itself serves as a description of graph formed by triples.

It can define vocabulary of terms used for more detailed description of taxonomy and other ontological constructs. RDF schema extends RDF and is a vocabulary for describing properties and classes of RDF based resources with semantics for generalized-hierarchies of such properties and classes & thus can be used to describe taxonomies of classes and properties and use them to create lightweight ontology. Figure 2 explains the above mentioned concept.

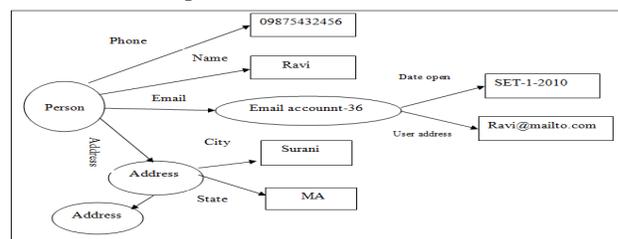


Figure.2: RDF Triples

### 2.2.2 Ontology

Ontology refers to the vocabulary of a domain. To build computers understand meaning of various terms these must be supported by some files containing description of terms along with their relationship with each other.

Ontology can be defined as a collection of terms used to describe a specific domain. It provides a mechanism for describing objects their properties and the relation between different resources or objects. Ontology has the capability to assist inference (see figure-3). Some applications need simple ontology while others may need ontology with broad capabilities. Thus the ontologies can be enhanced either using RDF schema for describing objects properties and their relationships for a simple ontology, or Ontology Web Language (OWL) can be used for developing more descriptive ontology. This depends on the needs and the aim of the ontology under consideration.

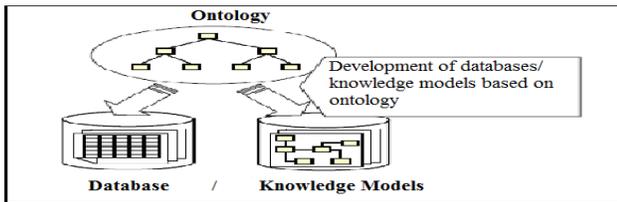


Figure 3: Role of Ontology in Inference Drawing

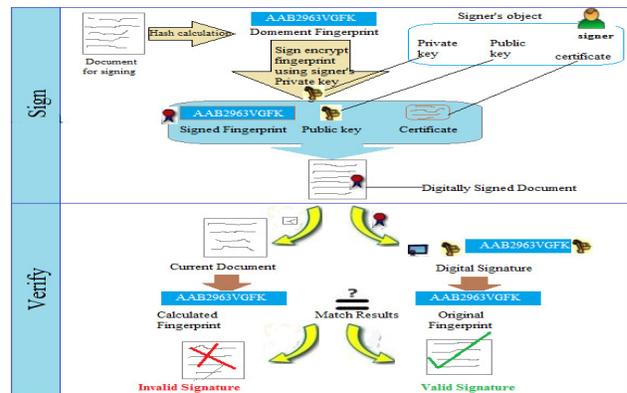
There are two main classes of ontology. The first would be the one that is employed to explicitly capture "static knowledge" of a domain in contrast the 2<sup>nd</sup> ontology provides reasoning about the domain knowledge (problem solving knowledge).

**Rules**

This layer aims to support inference drawing to allow query and filtering. Up till now, there is no recommended language for this layer but Rule Interchange Format (RIF) is the most commonly employ in rules, which utilized by the production systems presented in the corresponding knowledge illustration subsection. They confine open knowledge as a set of situations that must be fulfilled in order to achieve the set of consequences of the rule. The skill inside this layer is the Semantic Web Rule Language (SWRL) [4]. It is based on Rule Modeling Language (RuleML). Similar to RuleML, SWRL covers the entire rule continuum, from origin and conversion rules to response rules. Thus it helps queries and inferences drawing using web ontology, mappings between various ontology, and dynamic web behaviors of workflows, services and agents.

**Logic & Proof Layer**

This layer provides facility of writing logic into documents thus providing rules for deduction of one type of document into another type. This layer includes predicate logic and quantifiers so as to facilitate deductions. Knowledge Interchange Format (KIF) is the language used to specify logic in this layer. The proof is a chain of assertions and reasoning rules with pointers to all the supporting material. This layer helps in checking the authenticity of the users and thus helps in trust establishment. Figure 4 represents the structure of proof layer.



**Trust Layer**

Trust layer ensures that the source of information is genuine and authentic at the same time ensuring that that only authorized application agents and users can have access to the information. It necessitates that the analysis system must include signature authentication system. This will outcome into a system which can express and reason about relationships across the whole range of public key based security and trust systems.

**2.3 Challenges**

A significant appearance at the preceding segment reveals assorted unfolded challenges; however three major challenges are being listed as follows:

### 2.3.1 Centralized Controls

A single server may get overloaded as almost all agents tend to find information on one of the servers. Maintaining the weight on every link is a key challenge as there might be other links/URLs which can provide better & quick information.

### 2.3.2 Delay in Response Time

Sometimes when a client requests a web page from the server, it may take lot of time to respond or it may not reply at all. In this instance the client may leave the server and switch to another server for better response. So reducing the delay time of server's response is also a major issue in semantic web.

### 2.3.3 Congestion on Path

Path congestion occurs when a link or node is carrying so much data that its quality of service depreciates. Representative outcomes contain queuing delay, packet distortion or the blocking of original connections. The key problem is to decrease overcrowding by diverting the traffic to another server or delegating the high priority tasks to ants may solve this problem since ants may mine other servers for performing the same task.

## 3. CONCLUSION

This work gives a concise explanation of semantic web with its architecture. Architecture for semantic web will support in the expansion of specifications and applications. Semantic web architecture are experiencing intensified interest due to the rapid growth in the utilize of the web, together with the improvement and restoration of information content technologies and development focuses on the way through which machines can understand the constitution, performance and even meaning of the published information thereby making search of information and its integration more efficient.

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