SUMMARY

The web is a success story both in terms of availability of information and in terms of increasing number of users. Today people use the web for different purposes, including knowledge acquisition, sharing thoughts with others, business purposes, entertainment and so on. But most of the information till now on the web is mainly for human consumption and for human interpretation, not for machine. System cannot automatically discover, compose and execute the services.

Web services are the procedural extensions of the existing World Wide Web (WWW). They basically turn the distributed set of information of the web pages into a distributed set of services. At present, web services are struggling to expand against the limitations of existing web architecture. They also conflict with the proprietary standards. Semantic Web, an extension of the present web is characterized by the association of machine-accessible formal semantics with more traditional Web content.

The motivation behind Semantic Web is to automate the processing of Web-based information and to improve interoperability of Web based information systems. It is an extension of the present World Wide Web. Semantic Web services are semantic extensions of the existing web services which support automatic discovery, composition, invocation and interoperation of services. Researchers both in academic and industry are investigating how semantic web services can be described and what kind of operational environment is needed.

Biswanath Dutta         Dr. A. R. D. Prasad
Research Student         Research Guide
The main problem with HTML language (most of today’s web content is represented using HTML language) is that it is basically made for data presentation on the web, not for data interpretation by machine. So, what we need is, we should describe our data in such a way that different software agents can interpret them and can process and generate automatically (or semi-automatically) semantic web services. For this it is most important to use rich and standard language to describe domain knowledge. But only rich and standard language alone cannot solve the problem. When we expect the machine to deliver more personal and/or customized information, we need to encode well-grained data. My study is an effort towards the description of data in a machine friendly manner and to give emphasis on fine-grained data. The study also concentrates on binding the context, so the system delivers meaningful information according to user needs in a particular context.

In order to meet the present day demand that a software agent must be able to automatically discover, compose, invoke or execute the web services, we need to describe the services in a machine interpretable way. In this regard we concentrate on describing the services using a standard and rich language.

1. **Objectives of the present study**

   The main objectives of the present study are:
   
   1. Description of domain knowledge in machine processable form using ontology language;
   2. Description of the services semantically;
   3. Derive a common model in generating semantic web services across the domains and develop techniques for interaction among different semantic web services;
2. **Scope of the Work**

The scope of the work is to

1. Study the existing semantic web technologies
2. Build a model for generating web based information services which will be applicable across the domains of knowledge. For example, eLearning, eGovernance, eHealth, eCommerce, etc. We considered *eLearning* as an application domain.
3. Develop the ontologies
4. Encode the services

3. **Hypotheses**

The present study is based on the hypotheses,

- Domain knowledge base can be developed using ontology language;
- The web services can be described using ontology languages for web services;
- Semantic web services have cross-domain applications.

4. **Methodology**

An extensive study of the present Semantic Web technologies and tools was carried out. As it is mentioned in the scope of the work that we considered “eLearning” as an application domain, we first made an extensive literature survey to identify the eLearning and learners characteristics, learners requirements; etc. We also made an extensive study to identify the issues involved with the present eLearning systems which is an important part of our work. We translated the learner requirements and existing eLearning system issues into system competency. We then identified and selected the metadata standards in describing the learning contents and the learners and also identified the standard in organizing the domain (content) knowledge. We prepared an application profile based upon the metadata elements used, created classes and their properties. We designed a conceptual model
(component architecture), a Semantic Learning Layer Cake which works across the domains. We developed modular based ontologies, such as, domain ontology, document ontology, learner’s ontology, etc. for creating the back-bone of our system. Then we developed the algorithms and encoded the services semantically to generate the services. The knowledge-base was populated and tested. Evaluation of the system has been conducted. The observations, suggestions and further research questions are included in conclusion chapter.

5. Organization of the present work

The present study is organized as follows. Chapter 1 is the introductory chapter. It covers an overview of the entire research work. It discusses the need for the current study, present literature survey, scope of the study, hypothesis and discusses the methodology and provides the details of the chapterisation. Following this, chapter 2 describes the eLearning and learning objects, characteristic of eLearning and learners, benefits of eLearning and presents a state-of-the-art of the current learning management systems. Chapter 3 discusses the learning standards, giving special emphasis on the metadata standards. Chapter 4 concentrates on Semantic Web and Semantic Web technologies; it discusses the ontology & ontology languages and Semantic Web services. It discusses the logic and logic rule languages. Chapter 5 is the main system chapter. It deals with the verification of the present eLearning systems and ontology characteristics, semantic eLearning system architecture, UML representation of the class diagrams, ontologies, algorithm and encoding of the services. It also demonstrates our ontology supported eLearning system generating the information services. Chapter 6 concludes the present study noting down the overall observations and suggestions based upon study made in different chapters. It also discusses some of the system limitations and further research avenues.