

Semantic Web Approach towards E-Commerce

V.Kiran Kumar¹, S.Murali Mohan²

Abstract

Semantic Web Technologies enable machines to interpret data published in a machine-interpretable form on the web. The existing e-commerce web data can be understandable to humans to read but machines cannot process it due to lack of semantics. To gain the advantage of using online shopping, consumer needs to search different e-commerce websites for a better price of product. Hence searching plays a crucial role in e-commerce to overcome information asymmetry and price dispersion. In this paper, we explained the basics of e-commerce with advantage, disadvantages and where the semantic web technologies can be applied is given for the benefit of consumer.

Keywords

World Wide Web (WWW), Ontology Web Language (OWL), Resource Description Framework (RDF), Resource Description Framework Schema (RDFS), internet

1. Introduction

Electronic Commerce (e-commerce) has grown extraordinarily with wide-spread internet usage and many companies are comes forward to start online trading to develop their business. The consumer needs to find best e-commerce websites where he can purchase product at cheaper cost, as different websites are offering products at different costs and even some companies are giving discounts on selected products. Hence the consumer needs to browse most of the websites to satisfy his requirements. The existing e-commerce websites contains data targeting humans to understand and interpret. But machines cannot understand what actually it contains. Semantic technologies play a crucial role to provide data understandable to machines. To achieve machine understandable, we should add semantics to existing websites.

V.Kiran Kumar, Department of Computer Science, Dravidian University, Kuppam, India.

S.Murali Mohan, Controller of Examinations, Vikrama Simhapuri University, Nellore, India.

With additional semantics, we can achieve next level web where knowledge repositories are available for better understanding of web data. This facilitates better search, accurate filtering and intelligent retrieval of data. For example if a consumer wishes to purchase a product, he needs to browse different websites and collects information. With additional semantics, we can design an application which browses different websites for collecting information and submits to consumer for taking decision. Semantic web will perform the same work intelligently.

Semantic web is not a separate web it is an extension to the current web with additional semantics. According to the World Wide Web Consortium (W3C), "The Semantic Web provides a common framework that allows data to be shared and reused across application, enterprise, and community boundaries." [1]. The term was coined by Tim Berners-Lee for a web of data that can be processed by machines [2].

The rest of the paper is organized as follows: Section 2 briefly explains about electronic commerce (e-commerce), Section 3 and 4 focuses on advantages, disadvantages and limitations of existing e-commerce system, Section 5 focuses on introducing new technology called semantic web and how it can be implemented in e-commerce to reduce problems at some extent, Section 6 gives brief introduction to Semantic agents and section 7 ends with the conclusion.

2. Literature Review

Early work by David Trastour, Claudio Bartolini, Chris Preist [3] developed a lifecycle model to help us understand the interactions between businesses in e-commerce. The lifecycle explains different stages of e-commerce like matchmaking, negotiation, contract-form and contract fulfillment. During matchmaking, the agent needs to fulfill the requirements given by the consumer. To achieve this web data should be coded in such a way to use by applications. XML is one form of coding data to use by applications. The limitations of XML reflected by

the growing infrastructure for web services based standards such as SOAP, WSDL, UDDI.

Massimo Paolucci, Katia Sycara, Takuya Nishimura, Naveen Srinivasan [4] had focused on knowledge representation using XML and with ontology languages. An attempt was made to explain the Web Service Architecture in detail with some test applications.

E-commerce applications were developed along with the astounding growth of internet usage. Still it is facing some limitations which are focused by Kamaljit, Lakhtaria and Munesh Trivedi [5] and Sabin Buraga, Marius Cioca [7]. A case study was taken with a simple web application by B.Vijayalakshmi, A.Gauthamilatha, Dr Y.srinivas and Mr K.Rajesh [6] showing how to represent semantic web data and how to retrieve it from web.

In this paper we had presented a brief introduction to e-commerce with pros and cons of using it and also pointing out its limitations in detailed. 'Agent' is an application or web service which will help the human being in extracting data from web. We had given theoretical concept of agents and how it can be used in e-commerce websites for the benefit of consumers while purchasing products.

3. E-Commerce (Electronic Commerce)

Electronic commerce is a type of industry where buying and selling of products is conducted over electronic systems such as the Internet and other computer networks[8]. This can also be called as next generation shopping where the seller or buyer need not go to the market for buying or selling products. The major advantage of e-commerce is that, we can cross geographical boundaries and can extend business to all over the world with the help of internet. The types of e-commerce include B2B (Business to Business), B2C (Business to Customer), B2G (Business to Government), C2C (Customer to Customer) and m-commerce (Mobile Commerce). B2B e-commerce deals with transactions between companies, B2C deals with companies and customers, B2G deals with company and public sector, C2C deals between individuals and finally m-commerce is a special type of e-commerce where trading is done through wireless technology like cell phones and other wireless devices.

The basic idea of starting a Business to Consumer (B2C) e-commerce website is to create a website that includes list of products and its particulars displayed in multimedia objects like text, audio, image with payment options for trading purposes. The most popular B2C e-commerce applications are online shopping websites like amazon, e-bay etc., and other e-commerce applications like internet banking, e-tickets, online trading, and supply chain management etc., for example if a person wishes to purchase a mobile, he needs to browse an e-commerce website like amazon, e-bay, where list of products with descriptions like price, color, webcam, company etc., are mentioned in website for choosing the product and then proceed for purchase it online using internet. Due to the vast usage of internet and online shopping by the consumers, many companies are coming forward to start their business online.

4. Pros and Cons of E-commerce

Online shopping is now becoming very popular because of vast availability of internet. Many people prefer online shopping because of many benefits which are pointed out in table 1. The major advantage of e-commerce is that we can cross the geographical boundaries and can expand our business all over the world. Hence we can have consumers or buyers from any part of the world. It will be easy to find a product from the website using search facility available online. Conventional physical stores will maintain fast moving products only due to space available at shops. But all products can be placed online; hence rare products can be purchased online. There are many e-commerce websites available today. The consumer can browse different websites for comparing the prices and can decide selecting a product at cheaper cost. In view of heavy traffic and busy schedules, a consumer need not go to the market for purchasing a product; he can purchase online to save time. At physical stores, only brief information about the product is available on packs, but we can get detailed information about the product online with complete documentation available. The other aspect of online purchase is we can purchase the product online throughout 24X7, which will mostly be useful to employees with busy schedules today. All the payment transactions are done through online and are carried in electronic mode only. Since e-commerce processes are automated to a large extent, fewer employees are required for lower-end jobs. Human resources can be used more effectively for higher-

level functions. Logistics is a key to successful e-commerce business.

Table 1: Pros and Cons of E-commerce

Pros	Cons
We can cross geographical limitations with the help of internet	Need internet connection and internet devices
Rare products can be purchased quickly	Security issues
We can find products using search tools available in websites	Lack of personal touch
Purchase product at cheaper cost	Inability to identify scams
Eliminate Travel Time and Cost	Credit card issues
We can get detailed information about the product before purchase	Chargeback
We can purchase products online throughout 24X7	Phishing
No need to handle currency	Experience the product before purchase
We can reduce employee costs	Some of the goods cannot be placed online
Ability to track logistics	Need to improve logistics for successful e-commerce

The growth of e-commerce has increased the opportunity to start new businesses quickly. But still it is facing many disadvantages which are listed in table 1. The minimum requirement of a consumer is to have an internet connection and a device to purchase products online. Hence many technical issues are related to start e-commerce. One can start new e-commerce website with many online tools available today. Then he needs to focus on developing business by advertising it online to attract customers. While purchase a product at physical store, we can touch and feel the product before purchasing it. This cannot happen if we purchase products online. One of the key drawbacks is electronic payment. While transferring amount online, we need to send secured information like credit card details, password, pin etc., hence we should be cautious in electronic payment. Phishing is collecting someone's personal information, bank information etc., Many fake websites will collect this information in different ways; hence a consumer

needs to identify a proper e-commerce website for purchase products online. We cannot find some special goods from e-commerce sites like perishable and odd-sized, because it needs special care of delivering goods to consumer.

5. Limitations of present E-commerce

The major limitation of present e-commerce includes information asymmetry, price dispersion, semantic description, business attributes and interoperability[9]. Information asymmetry relates to the lack of equivalence of same product from different e-commerce websites, price dispersion relates to same product has different rates on different websites. Semantic description relates to how existing information could be processed by machines. Interoperability concerns to exchange of web data with other items. Primarily, information asymmetry and price dispersion could be the major problems to the consumer while purchase product online. For example a consumer or buyer wants to purchase a laptop 'HP 6530b' through online shopping. A consumer, who is new to online purchasing will default opts the Amazon site and buy the product for Rs.75000/- (approximately). A consumer who has much experience in online purchasing will go through other websites like flipkart, jabong, naaptol and ebay etc., for a best price of same product and assumes that he purchased the same product for Rs.68000/-. The total savings for experienced consumer will be around Rs.7000/-. This is because of 'price dispersion' i.e., cost of same product is different in different websites. In other example, let us assume that the consumer wishes to purchase a mobile phone with specifications like android operating system, touch screen, Google maps with internet and voice recorder facility. Due to information asymmetry in various e-commerce websites, the consumer needs to visit all the e-commerce websites and collect the information about the product, where different websites represents different specifications about the same product.

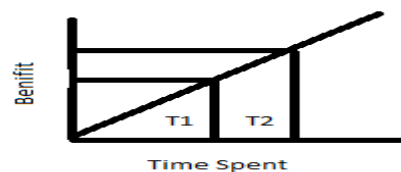


Fig.1 Time and Benefit Curve

The consumer needs to write down all the specifications of a particular product from all e-commerce websites to take the final decision before going for an online shopping. In both cases, search plays a vital role in deciding the product. Fig.1 shows time spent – benefit curve that shows that when a consumer spends more time in searching the product he will get more savings in product price.

To avoid information asymmetry and price dispersion at some extent, the consumer needs to search most e-commerce websites before purchasing a product through online shopping for a better price. Hence search plays a vital role in the present e-commerce. To search anything on the web we use search engines. Google Search is the most-used search engine on the World Wide Web (WWW), handling more than three billion searches each day. Present search engines collect text from public documents and assign ranks to web pages and retrieve text based on the keywords given by the user. These keyword-based search engines return many inappropriate results to the user. For example, if a user wishes to retrieve data about “Nissan cars costing between 3 to 5 lakhs” will return some inappropriate results consisting of around one lakh links out of those many unnecessary links shown. Now the user needs to check all the links for appropriate information. As the web is growing at an astounding pace, many web pages will come up with lots of information that results in many inappropriate results further to the user. This is because existing web content is meant for human consumption or human reading purposes, machines cannot understand what actually it contains. If the machines are able to understand the content, we can develop applications to retrieve appropriate results to the users. The growth of electronic commerce mainly depends critically on interoperability between different systems. Interoperability links systems together. For example, it enables banks to link together their cash-point networks, extending the number of points at which service can be provided in a consistent and predictable fashion even though ownership remains split between the individual banks. [10]

6. Semantic Web approach towards e-commerce

The application of Semantic Web in the field of e-business is wide and significant in terms of exchanging information between different business

groups for mutual or collective purposes[11]. According to the World Wide Web Consortium (W3C), "The Semantic Web provides a common framework that allows data to be shared and reused across application, enterprise, and community boundaries." [1] the term was coined by Tim Berners-Lee for a web of data that can be processed by machines[2].

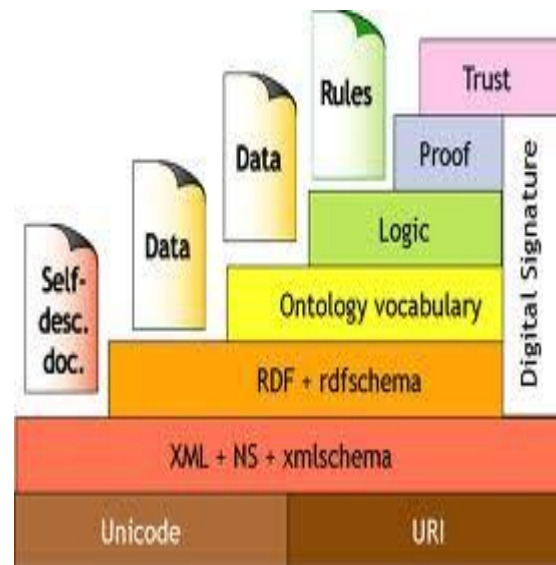


Fig.2 Semantic Layer cake

Fig.2 represents Semantic Layer with different technologies are used in designing Semantic Web applications[12]. The primary purpose of these languages is to represent machine-understandable information and to support interoperability between applications on web. Once we add semantics to the website, we can design semantic web applications for the users to use. Uniform Resource Identifier (URI) represents any resource on the web with unique name. The key technologies include Resource Description Framework (RDF), Resource Description Framework Schema (RDFS) and Ontology Web Language (OWL). These languages are useful in creating ontology for a particular e-commerce website. Once we develop ontology for a website, then the machines are able to understand it and can design applications on it.

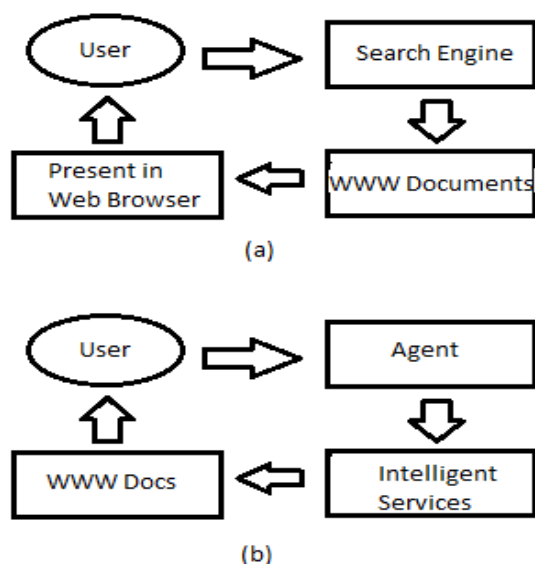


Fig.3 (a) Present E-commerce (b) Semantic enabled E-Commerce

Fig.3 represents a scenario of two models like present e-commerce website and semantic enabled e-commerce website. In the first one, the user approaches particular search engine, which returns many inappropriate links and then the user, must interpret for required result. When we apply semantic web technologies to e-commerce, user can approach personal agent with his own preferences. Then the agent will search the web based on user preferences and gives back results to the user for taking final decision online.

7. Agents in Semantic Web

An 'Agent' is semantic web application which roams around the web and searches the information as per the user preferences given[14]. According to Tim Berners-Lee, software agents will be responsible for coordinating searches, comparing and negotiating on the web and greatly reducing the user effort (Berners-Lee et al.2001)[13]. For example, if a consumer wants to purchase some product, he can give his preferences like model, price and color etc., to e-commerce agent. Then the agent takes the responsibility of gathering information from different e-commerce websites and returns appropriate results to user for his decision. These 'Agents' looks like a conventional software application, but there is a clear distinction exists like 'Agents' are semi-autonomous, pro-active, adaptive and long lived[15]. There are

different types 'Agents' which include Interactive Agents, Adaptive Agents, Mobile Agents, Coordinative Agents, Intelligent Agents and Wrapper Agents. Each 'Agent' has its own advantage of how to approach to other 'Agents' and environments.

8. Conclusion and Future Work

In this paper we had given brief introduction to current e-commerce websites with advantages, disadvantages and its limitations. The consumer needs to browse different e-commerce websites for a better price with the help of search engines. As the existing search engines are all implemented mostly on keyword-based, may return inappropriate results to the consumer. This will obviously give more burdens to the consumer to browse appropriate links and note down the product specifications from various sites before finalizing the product. This is because the existing web content is meant for human consumption only. If the content is able to understand or process by machines, consumers can reduce the burden by assigning responsibility of gathering product specifications from different sites for final decision. Semantic web technologies can be applied to e-commerce websites for the benefit of consumer in purchase products online.

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Dr V.Kiran Kumar (M.Sc., Ph.D.,) is working in Dravidian University as an Assistant Professor and had more than 15 years of teaching experience. His research interests are web technology and semantic web. At present he had published 5 international journals on semantic web and internet till now.



S.Murali Mohan (B.E, MSc IT, M.Tech, M.Phil, MBA, PGDIT, PGDTT) presently working as controller of Examinations at vikram simhapuri university, Nellore. His research interests are software engineering and internet. He has published 3 international journals on

software engineering and internet till now.