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Semantic Web in the expansion of E Commerce

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Abstract*: This study focuses on the enhancing the potential of the e-commerce websites with various Semantic web technologies. The involvement of semantic enrichment gives more meaning to the data and makes content more easily discoverable by both search engines and users. Daily thousands of people try searching for a product they are willing to buy and due to the system inefficiency, customers waste a lot of their precious time and resources and also there are a lot of problems with the current e-commerce systems. So, semantic web has certain technologies/languages specifically established for data, i.e. RDF (Resource description framework), OWL (Web ontology language) and XML, etc. which can help overcome the problems and accelerate the business to a higher level where e-commerce websites will be playing an important role.

Keywords* : *E Commerce ,E Business, Semantic

I. INTRODUCTION

E-commerce is an electronic system which manages both the collection and payments of goods and services via the internet. As the world is advancing, majority of the companies are moving towards e-commerce websites as it eases accessing the content online without any physical cost of store location. As there is a lot of irrelevant data present on the web, we need some proper data extracting mechanism or pattern which will help in improving the website and benefit the customers. A lot of conventional methods were tried upon, which eventually failed and that's where semantic web comes to overcome all these problems. It is a tool which automatically finds data from the website and makes the content understandable by the machines. It gives power to the system to search for a particular product which best suits the user's requirements. [1] The various semantic web technologies which are currently being used are RDF, which is used for defining the vocabularies, properties and various classes. OWL, a W3C recommendation is used to make ontologies and consists of RDF and XML as well. OWL overcomes some constraints of the RDF. SPARQL is basically like SQL but is used to extract information from the ontologies. [2] These semantic web technologies will improve the search accuracy by better understanding the searcher's intent.

With the Internet's popularity, the e - commerce market has also flourished the scale of the global e - commerce market is growing significantly every year and is growing at an amazing rate. With the emergence of more e-commerce websites, there is a greater opportunity for the companies to gain benefit as the products and services will be available to customers 24 hours. Because of this feature, the customers can buy their desired products at any time and pay online through credit cards and other options. The customers can also post their feedbacks and comments after receiving the products which would in turn help the company to improve in case of any discrepancies. A million searches are conducted daily as people are trying to find out what they need, and majority of these searches are in the consumer ecommerce field where a customer is searching for a product to buy it. This leads to a lot of time consumption and resources of the customers which can be replaced with the agent enabled semantic search, making the search more efficient and give the customer the best valued and appropriate search result without much work.

Fig. I. Search and dispersion curve

Information asymmetries create situations in which the best value is achieved by a better- informed buyer. For a specific example in the context of e - commerce, look for a specific model of a handy camera: Sony DCR-SR62. There are several websites selling the same product at various prices. A new consumer can go to Amazon for online purchase and purchase the product for 499.99. A consumer who is more educated about Internet searches can search through websites such as www.dealtime.com or www.pricegrabber.com quickly but in detail. In this way, the same product is sold at http:/www.tristatecamera.com for a cost of 409.99 and a total of 433.22 shipping. Total savings are 66.77 dollars.

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Due to the asymmetry of information, this is price dispersion, there is a significant increase. [3] The dispersion of prices means that households and companies need to spend time and energy seeking the best value. Search is an important and expensive economic activity. It is expensive that it stops before the consumer has all the information he needs and can lead to poor bargaining. With an increase in the price dispersion phenomenon, the search amount increases. Therefore, we see that the problem created by information asymmetry and price dispersion is that the costly economic search activity occurs, which can be seen as a loss of valuable resources as well as a market inefficiency. Another problem is that consumers don't get the best value for their money if their time is high. If this happens, companies that offer good quality dollars may lose out.

II. PROBLEM AND OBJECTIVE

A. PROBLEM

The search accuracy problem: For most e - commerce transactions, a search for a product or product offer is the starting point. The current search engine quality is far from perfect. Search engines, the most popular point of entry in the product purchase process, provide links to pages where the search phrases appear, but these links are often not helpful from the client's point of view.

For example, a consumer searching Google for " mobile phone " camera email download ringtones usually ends up with a list of links to websites that offer ringtones, as well as links to mobile phone manufacturers' or vendors ' websites. The search will certainly not return a list of all mobile phones with a camera, email and the ability to download ringtones. If the consumer decides to search for a mobile phone using an e-commerce portal such as eBay, the list of thousands of mobile phones would end up. However, the search results do not distinguish clearly between the phones that offer the desired features and those that are not of interest to the customer, which affects the satisfaction of the customer.

Therefore, Internet users could find a large number of offers from a large number of dealers using the above- mentioned approaches but would probably have to browse many different structured web pages to find the product that offers the necessary features and the best offer.

Today, consumers fall into an incredible amount of unstructured product and offer information. Common search engines and e - commerce portals cannot make this challenge easier for the user.

The quality of the information is also not accurate at times and it becomes a critical issue as the customers are not able to physically interact with the products and they are totally relying on the information provided online.

B. OBJECTIVE

• One of the main objectives for marketers is to keep consumers satisfied with their shopping experiences, as customer satisfaction has a strong impact on consumers, purchasing intent, loyalty and repeated purchases.

• To analyze the challenges of incorporating the features of semantic web to get better search results in e-commerce context.

• Analysis of the challenges of improving descriptions of product text.

• Comparing the pre-semantic era with the semantic era and analyzing its impact on customer satisfaction.

III. BACKGROUND

A. PRE SEMANTIC ERA[WEB 2.0]

Web 2.0 is WWW's second generation. This generation of Web is focused more on the people allowing them to share their information as well as collaborate via social media and many other platforms, rather than just viewing and downloading the content online as it was for the original web. This version (Web 2.0) of Web is more interactive and provides a dynamic experience where the users and the publishers can interact with each other rather than the one-way communication. Anyone can contribute to the web by sharing their thoughts, opinions, and editing site content, etc., using the new tools, even if they lack technical knowledge. But, there was a controversy for Web 2.0 as it had become too easy for an average person to post and affect the online content, which can impact the legality of the web content and raise concerns about security and privacy. There is also a lot of misinformation spreading among the users, cyber-bullying and many other online crimes which leads to serious problems. Also, Web 2.0 is just a transitional phase which engaged the users into the Web, but soon there will be an established version of the Web, known as the Semantic Web (Web 3.0).

B. SEMANTIC ERA[WEB3.0]

Web 3.0 or the Semantic web is going to be the third generation of the World Wide Web, i.e., the future of the Web. The Web will evolve into a space where 'everything is linked to everything' and information is shared and understood not only by humans, but also by machines. It reduces human tasks and decisions as well, giving the work to the machines, by providing machine-readable content on the web. This generation of Web focuses on machine-to-machine interaction. In this version, machines can interpret information more intelligently than humans and generate useful content as required by the users. It is the 'executable' phrase of the WWW. The main goal of the semantic web is that the users should be able to search, share and combine the information with very less effort. With the advent of semantic web, it will enable the machines to appropriately understand and respond to complicated human requests. The key benefits of web 3.0 is having large amounts of data, knowledge and information made understandable and accessible by the machines especially digital agents, assistants, artificial intelligent bots, etc.

C. PROS AND CONS

• WEB 2.0 focuses more on the user generated data and encourages interaction, information sharing and collaboration on the Web.

• 2.0 technologies have a wide variety of features and they can be implemented on any platform according to the convenience. For e.g.: you can interact with your customers through Facebook, twitter. You can build a strong professional network for your business and also post a video of your latest product on YouTube and get feedback from customers as well.

So, there is a vast scope and your success rate depends on how you utilize it.

- As this generation of Web is user interactive and allows web users to upload their content. It is more of an advantage to the hackers as well, because they also can upload malicious content on various sites infecting the community at a large scope.
- As a lot of information is posted daily by different users, there is an overload of information which degrades the quality and makes it unreliable.
- Possibility of many fake ID's and spammers.
- WEB 3.0 will be known as the 'intelligent web' as they will be making use of various AI based technologies, machine learning, natural language processing, etc.
- The information available will be more specific and the searches will become more relevant.
- As the internet is more personalized, it becomes easier to work on the internet and, it's not easy to 'fool' people online and operate with a fake identity unlike Web 2.0.
- The problem is that it would be easier to find personal information and the existence of anonymity will be less.
- The computers which are which are less advanced will not be able to handle it and the technology is currently not ready to face it.
- Also, the government has already spent a lot of money to research on it as it is very complicated.

IV. DESIGN

A. SEMANTIC WEB STACK

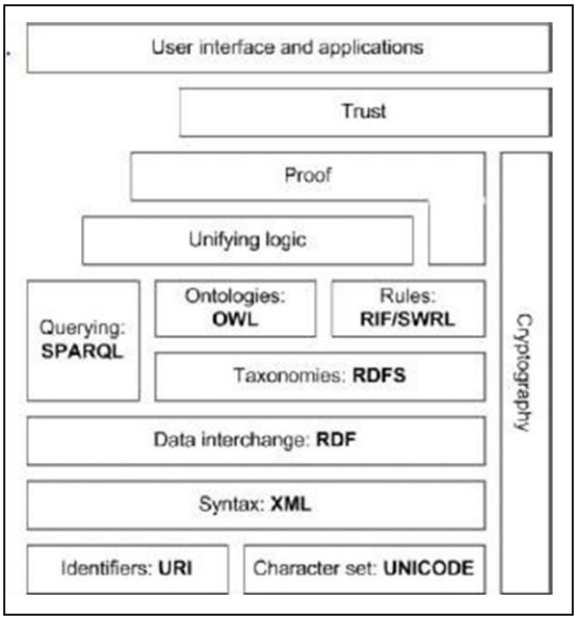

Fig. IV.1. Semantic Web Stack

The different layers of the semantic web architecture are described as follows:

- Unicode and URI: Unicode is a standard encoding character set which allows that all human languages can be used on the web following one standardized form. And Uniform Resource Identifier (URI) is unique identifiers for resources of all types and basically used for identification of the resource.
- Extensible Markup Language: It is a general-purpose markup language which contains structured information mainly for documents. It is also used to describe the different type of data. The elements in the XML document can be nested and may also have attributes and content.
- Resource Description Framework: It is a simple data model and represents the information about the resources in a graph form. At the semantic level, the RDF family supports interoperability. It is mainly based on the 'triples' [subject-predicate-object] that form the graph of data. Majority of the data present in the semantic web use RDF as the primary language.
- RDF Schema: provides a predefined, basic type system for RDF models. It describes classes and properties of the resources in the basic RDF model. RDF Schema provides a simple reasoning framework to infer types of resources. [4]
- Ontology: It is a W3C recommendation and is used to make ontologies. It is derived from description logics. RDF and XML both are present in the ontology and RDF has some limitations which are overcome by the OWL.
- Logic and Proof: This is on top of the ontology structure to make new inferences by an automatic reasoning system. The agents can make deductions as to whether particular resources satisfy their requirements by using such the reasoning systems. [4]
- Trust: The last layer of the stack addresses trust to provide an assurance of quality of the information on the web and a degree of confidence in the resource providing this information. [4]

B. SEMANTIC WEB ECOMMERCE ARCHETECTURE

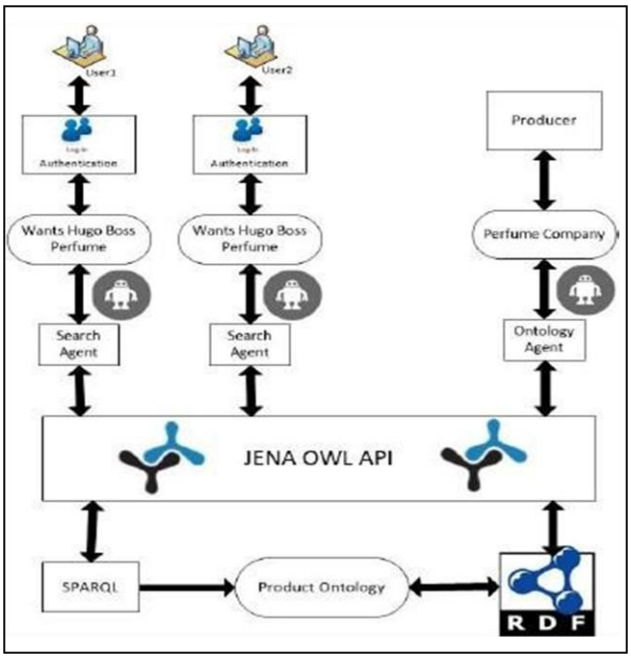

Fig. IV.2. Semantic Web E Commerce Architecture

In this architecture, they have shown the working for only two users, but it can be extended to N users. The concern being addressed here is the search problem, where the user is unable to get proper relevant results because of the generic attributes of the products like color, price, etc., which are not considered. User1 and User2 are the consumers who use the website and shop for the product and search for it. The producer is the manufacturer of the products; Hugo Boss is the company in this case.

The user logs in to the system and then searches for the Hugo boss perfume. The producer is the manufacturer of the products; Hugo Boss is the company in this case. The user logs in to the system and then searches for the Hugo boss perfume. This query is transmitted to the agents. Agents are available to help reduce the workload in the system. There are two types (Search and Ontology) of agents in the architecture. Request the transfer to the search agents and then transfer it to the JENA OWL API in java. Then the API SPARQL query is generated to obtain the price from Product Owl Ontology and the results are finally returned to the users.

V. METHODOLOGY

A. COMPARATIVE STUDY

The methodology used is a comparative based study, where the pre-semantic and semantic era is compared.

"Web 2.0 is the business revolution in the computer industry as a result of moving to the Internet as a platform and trying to understand the rules for success on this new platform. This is the main rule: build applications that use network effects to improve the more people use them. "Web 2.0 is also known for websites of wisdom, people - centered websites, participatory websites and read-write websites. The web could become bi- directional with reading and writing. Blogs, really simple syndication (RSS), wikis, mashups, tags, and folksonomy and tag clouds are the main technologies and services of Web 2.0. In order to create blogs, wikis, mashups and social networks, various development tools are available. These tools, such as mashup tools, wiki engines, blog software, make it easier, faster and cheaper to use web 2.0. To create Web 2.0 applications, developers use three basic development approaches: Asynchronous JavaScript and XML (AJAX), Flex and the Google Web Toolkit. [4]

The Semantic Web is a web that shows things in the way computers understand. The main purpose of the semantic web is to make the web readable not only by people but also by machines. Semantic websites are to be developed to solve current website problems. The current web is a document web. Semantic Web can be defined as a data web, in some ways like a global database, which includes most of its features: the aim of the data web design is first of all machines, later humans.

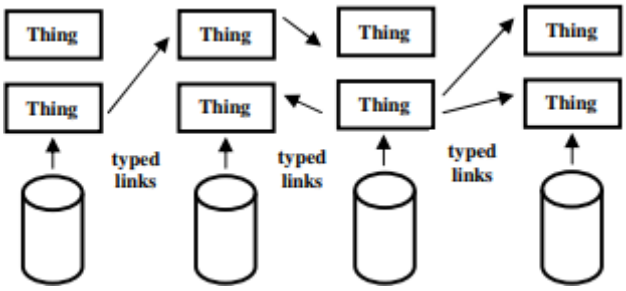

Fig V.1 Web of Data

B. METHODS OF ENHANCING

There are various methods of enhancing the e-commerce websites with the help of AI technologies.

• Enhancement of synonym names: using NLP, term-weighting and query modification techniques. Adding query word synonyms to the query should improve search efficiency. In early IR research, the thesaurus was used to find synonyms. Researchers have developed techniques for generating thesauri automatically for query modification. Most automatic methods are based on text co-occurrence analysis in the documents.

• Enhancing based on analyzing product features on their importance: using feature- based metrics, edge-counting metrics and information content-based similarities. Using tag information can boost classifier performance. There are three main types of recommendation engines: (1) Collaborative Filtering (CF): collecting user ratings and browsing experiences without any knowledge of the suggested items, Content-based recommendation: well-defined item descriptions and knowledge - based recommendation: matches user preferences with product properties. [1]

• Enhancement based on reviews and ratings: using RDF data, SPARQL reasoning and communication flow. Transform satisfied customers into influencers that spread the word on the product. This is the basis for personalizing search results and providing recommendations based on which members of their social network are most likely to trust a user in a given scenario for recommendations.

VI. ANALYSIS AND IMPLEMENTATION

Catalogs of products available on the Internet all have limitations of several kinds. They either offer a wide range of products but have a poor precision search engine or offer a limited range of products with a powerful but too specialized search engine (in terms of search variables). Whatever the catalogue, the user can easily be frustrated by their inadequate ability to provide him / her with precise results and a wide range of products. One of the challenges of the semantic web is to convert the information already available into more meaningful and useful data. So, to tackle all these issues, the architecture known as the "Catalog Search Engine" was developed. The catalog contains as many products as possible which helps the users to get the most accurate results and provides them with sufficient tools to search the catalog.

The accuracy of the search engine is achieved by a combination of the semantic enrichment of the information previously obtained and the automatic conversion into logical facts of all product characteristics.

A. ARCHETECTURE

The server consists of 4 main components; the web page fetcher, the parser, the creator of facts and the creator of profiles. The client is divided into two main components; a GUI that the end user communicates with and a proxy that is responsible for customer matchmaker communication. The main idea of this system is to collect and publish information about products sold on the Internet on the Matchmaker server. Semantics using ontologies will enrich this information. Semantic Service Matchmaker, a LARKS algorithm-based service search engine.

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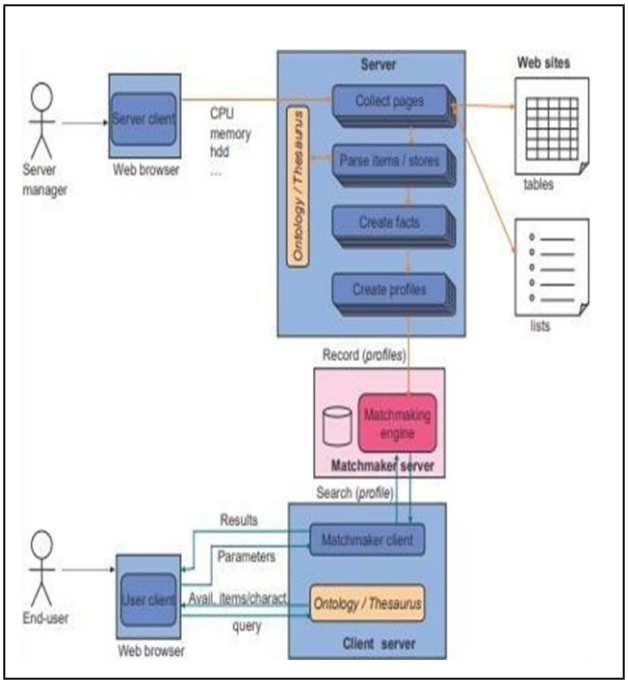

Fig : VI.1 Architecture and Flow of the System

It adopts a filtering approach that uses sophisticated information recovery mechanisms and ontological sub Sumption mechanisms to match advertising requests. Ideally, if the requester searches for a product, the matchmaker will get a product that exactly matches the expected product.

The matchmaker generally has five types of filters but in the prototype being discussed here, only two of them have been used.

Define abbreviations and acronyms the first time they are used in the text, even after they have been defined in the abstract. Abbreviations such as IEEE, SI, MKS, CGS, sc, dc, and rms do not have to be defined. Do not use abbreviations in the title or heads unless they are unavoidable.

B. LARKS ALGORITHM-MATCHMAKING PROCESS

In the following key steps, the matchmaker processes the received request:

- Compare the request to all the ads in the advertising database.
- Determine the agents of the provider whose capabilities best match the request. During the matching process, each pair of requests and advertisements must pass several different filters.
- Inform the requesting agent by sending the contact addresses and related descriptions of the corresponding provider agents.
- Larks offer the option of using the knowledge of applications in any advertisement or request. [6] To do this, a local ontology is used to describe the meaning of a word in a Larks specification.
- The user can specify what he / she is requesting or advertising in more detail.
- The matchmaker agent can make automated inferences on additional, formally defined semantic descriptions of this kind while matching Larks specifications, thereby improving overall matching quality.

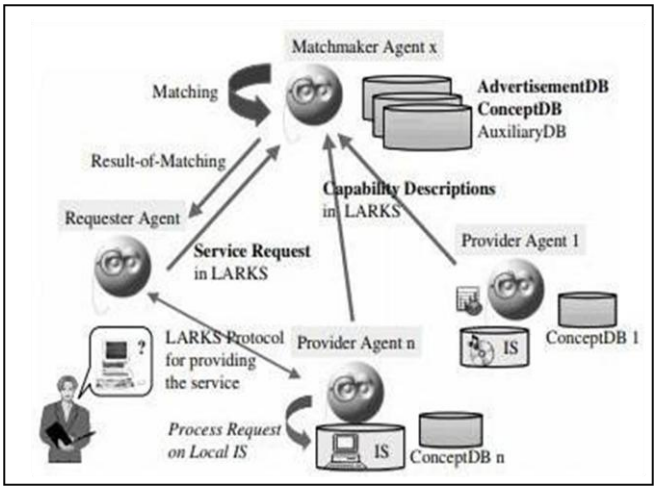

Fig : VI.2 Matchmaking using LARKS

1. Database for Advertising (ADB). This database contains all the advertisements that matchmakers receive from supplier agents in Larks.
2. Global ontology-partial. The ontology of the matchmaker consists of all ontological words descriptions in ADB advertisements. This description is included in the ConcDescriptions slot and sent with any advertisement to the matchmaker.
3. Database auxiliary. The auxiliary data for the matchmaker includes a database for word pairs and word distances, a hierarchy of basic types and internal information.

A Larks specification is a frame with the slot structure below

`Context`	Context of specification
`Types`	Declaration of used variable types
`Input`	Declaration of input variables
`Output`	Declaration of output variables
`InConstraints`	Constraints on input variables
`OutConstraints`	Constraints on output variables
`ConcDescriptions`	Ontological descriptions of used words
`TextDescription`	Textual description of specification

Fig : VI.3 Slot Structure

C. SCENARIO OF USE :

The server is initialized with a file containing information about the web pages that must be retrieved and parsed. This file connects each product type to a web page list. Web pages are then retrieved from selected websites. A parser will detect relevant information from these web pages once completed. When a new product is detected, the server automatically generates a new ontology class instance that describes the product type. The server then creates a file with a list of facts written in RDF-RuleML automatically. [5] Each fact corresponds to a product characteristic. The server will eventually create an “advertising " profile for each product. The semantic description of a product is a profile. After all the profiles have been created for all the products, they are registered on the Matchmaker server.

The user enters a query first. This query is analyzed, and its contents are compared to the words of the thesaurus and the name of the instances of the types of products.

If the answer to the query is a list of instances, the user can click on one of them to see the selected product details.

If the answer is a list of product types, the user can click one of them to show a list of the characteristics of the type chosen. If the user wants to do a good search, he / she must enter certain values for the characteristics with which the result is relevant. The system creates a “request “profile automatically. This profile is then sent to the matchmaker, who tries to match this “demand” to the “advertisements “in his database.

A product is characterized by its characteristics. A hard disk has a certain search time, interface, capacity, etc. It is quite natural to translate the characteristics of products into facts, as each characteristic can be regarded as a truth about the product it describes. The facts created by their system are all P (x, y) in which P is a predicate and y two terms. The server facts use two types of predictions, “equal " when the term y is a numerical value and " is " when the term y is a string of characters The facts written by the customer use the predictions " is less than or equal to " and " is more than or equal to " if y is a numerical value, " is " if y is a character string. Each property of our main ontology classes of products is converted to OWL classes and used as the term of the facts.

Server side	
Char. fetched from web sites	Facts
sold at **45,000** Yen	*equal* (COST, 45,000)
manufactured by **Toshiba**	*is*(MANUFACTURER, Toshiba)
sold by **anotherMart**	*is* (SELLER, anotherMart)
a capacity of **80** Gb	*equal* (CAPACITY, 80)
Client side	
Char. with values	Facts
price $\leqslant$ **50,000**	*is less than or equal to* (PRICE, 50,000)
capacity $\geqslant$ **60**	*is more than or equal to* (CAPACITY, 60)

Fig : VI.4 Characteristics translated into facts

The characteristics of a hard disk taken from the Internet on the server side are converted to facts. On the customer side, features which values are entered by the user are also converted to facts.

A profile is an OWL file containing a semantic description of a product and a list of links to each fact in the fact files relating to the product itself. The information in these profiles is the ontology class of the product type, the product name, the list of facts and the URL to the product shop. Once advertising profiles have been registered with the Matchmaker, when a request profile is submitted, the Matchmaker applies a match to the ontology class of the product type using its type filter and its constraint filter on all the facts.

CODE: Demonstrating an example of a fact and a profile.

```
<product: description rdf:
id="Kakaku_CPU_Athlon_64_2800_Socket754_5">
<product: name>ATHLON 64 2800
Socket754_5</productName>
<product: restrictedTo rdf:
resource="http://somewhere/onto.owl#cpu" />
<product: constraint rdf:
resource="http://somewhere/facts.rdf#clockspeed" />
<product: constraint rdf:
resource="http://somewhere/facts.rdf#cost" />
<product: constraint rdf:
resource="http://somewhere/facts.rdf#manufacturer" />
...<product: shopURL>
http://www.aShopURL.com/</product: shopURL>
</product: description>
<ruleml: Fact ruleml: label="cost">
<ruleml: head>
<ruleml: Atom
ruleml:rel="http://somewhere/predicates.owl#numericallyEq
ual">
<ruleml: args>
<rdf: Seq>
<rdf: li>
<ruleml: Var ruleml:
name="http://somewhere/store.owl#COST" />
</rdf: li>
<rdf: li>
<ruleml: Ind ruleml: name="20990" />
</rdf: li>
</rdf: Seq>
</ruleml: args>
</ruleml: Atom>
</ruleml: head>
</ruleml: Fact>
```

D. COMPARATIVE ANALYSIS

In e-commerce, data is mostly bound by specific characteristics. For example, laptop has RAM and processor as characteristics. In another website or for another product, the characteristics may be different. There is no universal language that can be used to connect all these products from different websites. Therefore, the data in Web 3.0 must be equipped to deal with unstructured search strings and parse them to form machine-readable queries. Hence, the missing data includes semantic data relevant to the product that can be uniformly distributed across vendors and categories.

There are various negative impacts if Web 3.0 is not incorporated. Web 2.0 will not provide the link between objects, which could facilitate the emergence of new services. This is because Web 3.0 organizes and assembles the pages found by the search engine by themes or topics beforehand. Such services include Wolfram Alpha which can provide curated results for a specific search query. These services read, analyze and identify directions of semantic words so that information can be related to each other. For example, as shown in Fig. 6.4, if “Brazil vs Argentina” is searched, it shows their past encounters, recent news about them, and also compares their countries statistically. This is in contrast with Google which only shows pages that contain the aforementioned keywords.

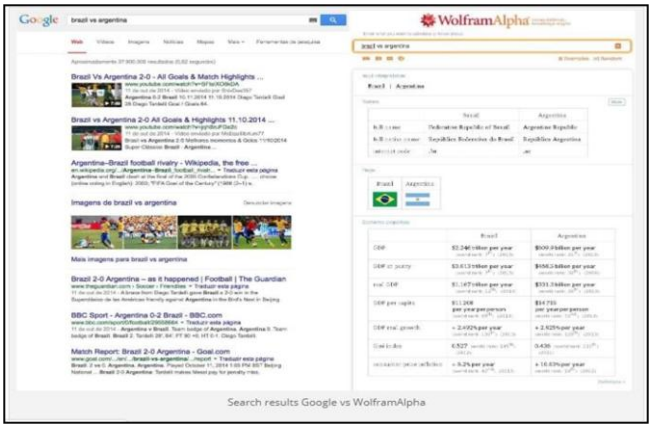

Fig : VI.5 : Comparison between search results from Google and Wolfram Alpha

Web 2.0 does not learn from past searches performed. However, in Web 3.0, not only will results be displayed based on the past searches, results would also be customized based on the user's interests. Web 2.0 does not take into account the main interests of the user, which could drastically improve the quality of the searches. On the other hand, the quality of searches in Web 3.0 improves as we search more. Using a custom generated user profile, companies can ensure users receive a more targeted message. For example, advertisements could be displayed to users based on their past purchase history and their interests.

Web 2.0 involves clicking around many websites in order to reach certain desired information. Contrarily, Web 3.0 aims to incorporate the possibility of making purchases without leaving a single platform. For example, Facebook already offers applications that can integrate many storefront applications into the Facebook business page. Its content would be provided by accounting for the user's purchase history, profile, geo-locational attributes, and various other factors.

Web 2.0 offers methods for Customer Relationship Management (CRM) that usually involves a staff for maintaining customer relations. However, Web 3.0 can semantically interpret the company's data and generate ontologies in order to facilitate knowledge sharing and reuse. It can improve the ability to target profitable customer, integrate offerings across channels, improve pricing and provide custom marketing messages relevant to the customer. In e-commerce, a new user may purchase a product for a higher price than its actual value, while an experienced user would search the web more thoroughly and arrive at a better price point. This situation could be improved by Web 3.0, where due to inter-linking of data from multiple sources, the users can benefit as they would arrive at the lowest price for the product, directly. It is about deploying robots on the web that can automatically make decisions on behalf of the user.

Web 3.0 is a smarter version of the web as it embeds intelligence inside the whole web. It is about deploying robots on the web that can automatically make decisions on behalf of the user and also agreeing on some common standards for the websites to represent content which any program is able to understand what semantic meaning is conveyed by the web pages.

VII. DISCUSSION AND RESULTS

A. DISCUSSION

In today's generation, majority of us prefer online shopping and there are some constraints associated with it, such as, the unavailability of time to search for the appropriate product and not getting the desired product even after crawling through many websites. Also, the people who have been regularly purchasing online suggested that it would be much better if the product descriptions were enhanced through semantic annotations.

By making use of Catalog search engine architecture and larks algorithm, the Search efficiency is achieved by handling user feedback on product characteristics. We also noted that a user needs about half the number of clicks needed to access the same product information on other websites. In this model the RDF-

RuleML was used to describe the product characteristics instead of the class of ontology. This was done to make the search engine more powerful, rather than just giving an opportunity to enter the value for each characteristic. Also, rules such as "customers can have 5% discount if the credit card is American express or Visa" is not possible or cannot be expressed using OWL classes.

Some of the screenshots of the prototype:

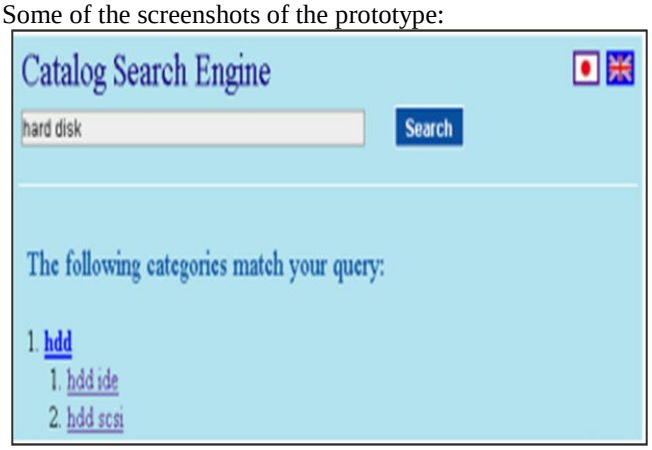

Fig VII.1 : Screenshot 1

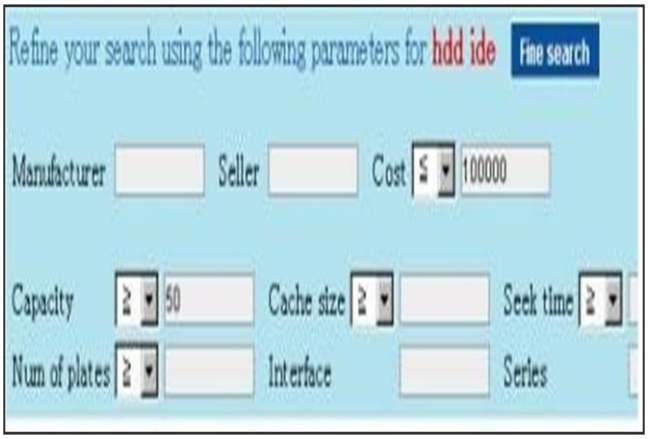

Fig VII.2 : Screenshot 2

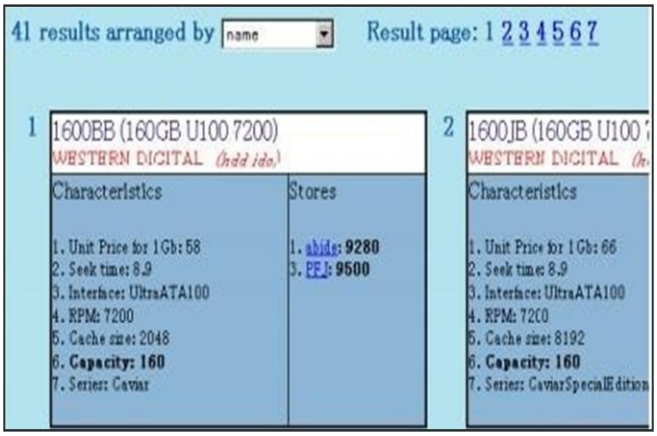

Fig VIII.3 : Screenshot 3

B. RESULT OF THE ANALYSIS

WEB 2.0	**WEB 3.0**
Read-Write web	Portable personal web
Communities	Individuals
Sharing content	Consolidating dynamic content
Blogs	Livestream
AJAX	RDF
Wikipedia, google	Dbpedia, igoogle
Tagging	User engagement
Targets users and producers content creativity	Targets linked data sets

Fig VII.1 : A Comparison of Web 2.0 & Web 3.0

Upon analyzing the results, it is observed that Web 3.0 provides more intuitive ways for the customer to interact with the web.

VIII. CONCLUSION AND FUTURE WORK

As the WWW is growing at a rapid rate and almost every business is moving towards the e-commerce website, there is a bulk of data available on the WWW and we need some mechanism to make the best use of this data. The semantic technologies or the use of semantics in improving the search accuracy helped in achieving customer satisfaction. Also, the customers can state what they want specifically and in minimal time. Semantic web data enables search engines to display information in a much more user - friendly manner, which again is a key for attracting more customers and keeping them satisfied. Therefore, increasing market transparency will maximize the opportunity to find the best and cheapest offer.

In the future, semantic web services will allow search/digital/smart assistants to order products for a user in the web shop of a dealer. This means that users don't have to get used to another platform's user interface. Users just have to register once on the platform of the Semantic Search Assistant and this assistant can then interact on behalf of the consumer with the dealer's websites and order a certain product, for example, mobile phone

Also, future works could include analysis of how to incorporate different types of languages in the thesaurus, so that the user can interact with the search engine by choosing a language he/she is comfortable to search in, without affecting the efficiency of the system.

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