

**Research on Ontology Constructing by Delphi Technique
(with Modeling Mischeogul Tourist Resort)**

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1. Abstract

Continual attempt to accumulate and apply information eventually gives birth to the concept of the 'Semantic Web'. Thus, the 'Semantic Web' can be defined as a product of mankind's desire to standardize information. A term of knowledge is used as information or data in computer science. These are regarded and are divided sometimes each other in terminologies that have similar meaning. If it is divided, knowledge is different from information. However, some kind of information in Knowledge Representation is called knowledge often if it can be expressed in computing system. Therefore, knowledge representation can talk as information representation. The purpose of the study is systematizing knowledge through knowledge representation that uses Delphi technique and ontology is designed by utilizing assistance editor called protégé-2000 to construct semantic web environment's ontology.

Level of interest regarding the construction and evaluation of search systems based on ontology is set to increase. If defined well, semantic can reflect human's thinking to knowledge information on web. Furthermore systematizes knowledge, search of information and comprehension about Jeju tour using present computer may be done intelligence.

2. Introduction.

The 'Semantic Web' is an attempt to systematize human knowledge that has been actively pursued in the Web Consortium, the academic arena, and industries led by Tim Berners Lee, creator of the World Wide Web.

Recently researched by many people, the Semantic Web represents the Web which can be understood by computers as well as human beings. The existing Web has some limitations including the difficulty in expressing semantic information that indicates content and meaning of the data. It is difficult for a non-human agent program to automatically derive meaning from the data. This research has an application on ontology construction by applying the Delphi technique. In its basic work to realize the Semantic Web, it attempts to systematize the knowledge of the Micheon Cave Tourist Resort and develop it into an extended system.

In Chapter 3, the overall outline of the Semantic Web is explained. In Chapter 4, by using the Micheon Cave Tourism Resort as a model for the Delphi technique, knowledge expression and constructing ontology is designed by utilizing Protégé 2000. In Chapter 5, the application of the ontology in various parts of the industry is examined. This research explores system design and ontology construction through knowledge expression. System realization is the further research topic.

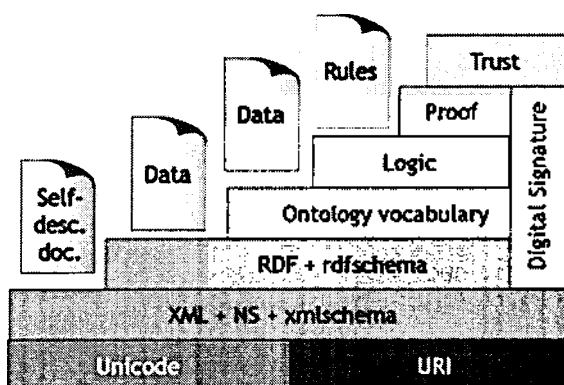
3. Explanation on Semantic Web and Ontology

3-1. The evolution of the Web and the appearance of Semantic Web

Tim Berners Lee envisioned 'a global information space where information stored on computers everywhere was linked and available to anyone anywhere'. However, as the use of Web has become common, the information offered by the Web has increased exponentially. As a result, the inaccuracy and the inefficiency of data retrieval have emerged as the most urgent matter to solve.

The Semantic Web seeks for forming a paradigm in which the agent can automatically derive the semantic information. This is possible by adding the Semantic Web information to the Web data through the concept of metadata.

The Semantic Web is not a separate Web but an extension of the current Web in which information is given well-defined meaning that enables computers and people to work in better cooperation (Berners Lee, 2001). In short, it is 'the Web in which computers can understand and manipulate the meaning of the information'.



3-2. The concept of Ontology

Ontology is a concept in philosophy. It is the exploration of the existence of all types of objects, which form the world. The ontology used in knowledge system expression is a type of dictionary, which defines the relationships between terms. Gruber said that 'An ontology is a formal, explicit specification of a shared conceptualization' (T. Gruber, 1993).

3-3. The Ontology Languages

3-3-1. HTML

HTML expresses the information with the limited metadata called Tag. Through the hypertext link, as the present link net, the information has been shared and offered. However, due to the limitations of expression in using the Tag, it has been difficult to offer a variety of information. The basic language to present the Web data on the monitor is HTML.

3-3-2. XML

XML is a language to describe the data on the Web. The meaning of Tag as defined by the XML can be easily decided by the user.

```
<note>
<date>10/10/2004</date>
<to>Kim</to>
<from>Kang</from>
<heading>Reminder</heading>
<body>Happy Birthday to you! </body>
```

<Table1>

In the above table, the meaning such as the person who sends the message (from), the person who receives the message (to), title (heading), and message contents (body) can be

figured out. The expression is much freer than HTML.

```
<note>
<date> <day>10</day><month>10</month>
<year>2004</year> </date>
<to>Kim</to> <from>Kang</from>
<subject>Reminder</subject>
<body>Happy Birthday to you! </subject>
```

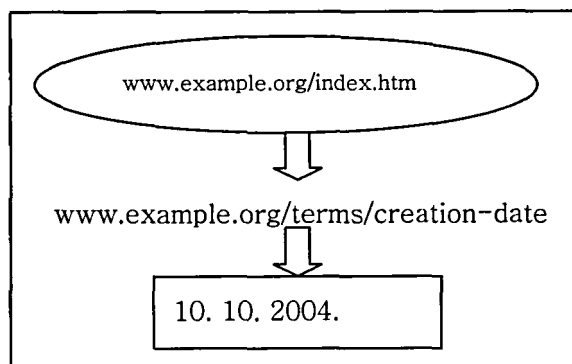
<table2>

However, even though <Table1> and <Table 2> technically indicate the same contents, the computer can't recognize the difference between the heading and subject. The process for the interoperability that defines the semantic relationship between these resources is needed. Therefore, the necessity of schema or ontology has emerged.

3-3-3. RDF

RDF is the most fundamental Semantic Web language of the W3C to express the meta-information of the resource on the Web. The RDF model consists of concepts of Resource, Property, and Statement. The Statement indicates a particular value of one characteristic of a given Resource and it is the basic unit of the RDF sentence.

<Table 3>. The constituent of the above sentence is as follows.



Subject	www.example.org
Property	www.example.org/terms/creation-date
Object	"2004. 10. 10"

<Table 4> expressed using RDF as follows

Table 3 expresses the presentation by the RDF schematization rule. Table 4 analyzes the constituent of the sentence. RDF offers a well-defined sentence structure needed to express it. However, the overlapping and ambiguity of the tag name still exists. This problem can be solved with the concept of ontology. RDF Schema, a concept similar to a dictionary, exists for that function. It defines the terms that make up RDF sentences and describes the specific meaning of those terms.

3-3-4. OWL

Since OWL offers more measures to express meaning than XML, RDF, and RDF-S, it is more useful than other languages in content construction that a machine can interpret on the Web. OWL ontology is a convergence of class, property, and constraints and includes the following.

- | |
|--|
| <ul style="list-style-type: none"> ● Division System between Classes ● Value of Property ● Description on the relationship between Classes ● Instances of Classes and Object |
|--|

<Table 5>

Since a computer has no imagination, it is impossible to teach a computer terms which carry emotion or imagination such as 'beautiful', 'went under', and 'succeeded'. Provided that it can recognize the logical relation such as opposition, similarity, and inclusion, ontology

was devised. By inputting the relationship between terms, the computer can be taught new words.

4. Constructing Ontology for Knowledge Expression

4-1. The definition of knowledge expression

In the theory of knowledge is defined as justified true belief. However, in Computer Science, 'knowledge' is not always defined as strictly. 'Information' or 'data' is used together. At times, these terms hold similar meanings but at other times, they can be differentiated. However, since any information that can be expressed on the computer system is called 'knowledge' in Knowledge Representation, knowledge representation can be defined as information representation.

4-2 The Ontology Development Process

Since the creation or acquisition of knowledge is the core process of the system development in the knowledge base system, the effective reapplication of knowledge is recognized as very important. Generally speaking, the challenges of the reapplication of knowledge include differences of language, expression form and the development measure, and lexical/ semantic problems. Ontology development is the activity carried by the team's organic cooperative work in order to maintain consistency for reapplication.

4-3. The Ontology design

The cooperative method, one of the ontology development methods, is accomplished by many people's cooperation based on the initial ontology. By combining many

people's perspectives and through continuous evaluation and suggestions, the ontology is developed. However, one weakness is that it requires the developers' continuous participation. In the preparation stage, the design standard for ontology is defined, the area conditions are listed, and the evaluation standards are decided. In the construction stage, unified language and concept and the correlation in the evaluation standard are integrated. In this stage, through several repetitive processes, the ontology is developed. In the repetitive improvement stage, the knowledge constructed by corrections through the cooperative method that applies the Delphi technique, ontology is designed. Lastly, in the application stage, the utility of the ontology that was constructed by mutual agreement is proven by the application of various methods.

4-4. The Application of the Delphi Technique

The Delphi technique used for the experts' agreement has a logical ground of the statistical objectivity principle, "Two people's opinion is more accurate than one person's." and the democratic decision-making principle, "Many people's judgment is more valid than a few people's" (Lee, Jong-sung, 1988).

In the ontology construction of the Micheon Cave Tourist Resort, the first questionnaire was designed with questions on writing five things of pride in the Micheon Cave Tourist Resort in order of priority, distinguishing characteristics compared to other tourist attractions in Jeju Island, and the opinion about the division of the Micheon Cave Tourist Resort into admission, viewing, experience, amenities, and organization. 17 out of the whole staff of 37

responded to the first questionnaire. Although the response rate was low, the information obtained from the open-ended questions was very abundant. The second questionnaire was made with questions to draw agreement for the decision of the Class and the layer architecture of Class of the ontology.

No	Characteristic	1 st response	2 nd response
1	Micheon cave	17	()
2	Art center	15	()
3	Three leg Hackberry	13	()
4	Cactus House	12	()
5	Recording Movie	11	()
6	Azalea	10	()
7	Ground Fountain	8	()
8	Basalt Bonjai	5	()

<Table 6. 2nd Questionnaire 1>

No	Items of Differentiation	1 st response	2 nd response
1	Experience Art Center	17	()
2	1 st Ranked kindness	13	()
3	Biggest cactus	12	()
4	Most various Azalea	10	()
5	Building Design	6	()

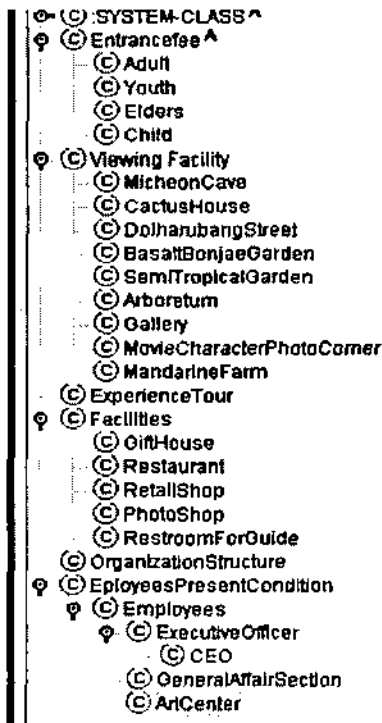
<Table 7. 2nd questionnaire>

4-6. The ontology construction

Ontology was constructed by utilizing Protégé 2000. Ahead of that, synonyms from the list of important terms were organized and the layer architecture of Class was decided by utilizing the Delphi questionnaire conducted twice.

Property	Same meaning
Adult	成人入場料, adult entrance fee, formal entrance fee. 성인 입장료
Youth	靑少年入場料, entrance fee for student. 청소년입장료

<Table8> example of deciding a list of important terms.



<Picture1> deciding hierarchy between class and class.

5. The application and the development direction of ontology

The significant application case is annotation mechanism of increasing the retrieval rate on the Web. It is the method of adding additional explanation to the existing Web and publishing it on the Web again. The understanding of natural language is also an important application area of ontology. The ontology is the structure focused on concepts. When a proper indexing

algorithm is given to it, it can play the role of a medium that connects different lexicons of natural language which expresses the same terms. Therefore, ontology can support the access to the data with natural language at the level of semantics rather than that of syntax. In terms of managing knowledge, ontology offers core measure by semantically connecting knowledge in the data for enabling the integral knowledge management and business processing. This can be applied to e-business that requires free and accurate information exchange. Moreover, it could be applied significantly to the Ubiquitous in which mutual cooperation is an important factor.

6. Conclusion

The ultimate purpose of the Semantic Web is to develop a standard and the technology to assist the computer to understand the information on the Web better. The reason why ontology has emerged as the core technology of next generation for information processing is that it is the processing method of the grand knowledge information of Web, and the systematizing method of the enormous knowledge information that we face at present of a thread of connection with each other. Another reason is the mechanism that enables the same semantic information as the way of thinking of human beings to be stored to the computer so that the computer can appreciate that.

In this research, the ontology was constructed using Protégé 2000 and the Delphi technique, technique to draw the opinion of experts, was used to decide very significant aspects in the

ontology construction such as the domain and constituents and layer of Class. This was conducted in an attempt to use the method to draw agreement. Even though the application of the Delphi technique to a small-scale tourist attraction may not have a significant meaning, this research is an attempt to systematically apply a method to secure objective and professional data in the construction of ontology.

Further research on the definition of language and connection with other ontologies in order to construct more organized and re-applicable ontology is expected.

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