ORACLE SEMANTIC TECHNBOLOGY ENABLE SMART DISCOVERY OF SPATIAL SERVICES

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1. PURPOSE

With the rapid development of web technology, in particular the emergence of web services technology and service-oriented architecture offer the huge potential for the geographic information sharing and interoperability. More and more web services are becoming available from the internet, and facing the mass amount of spatial processing services, the traditional keyword-based search and discovery technology can not meet the fast-growing demand of web-based spatial applications. However, the emergence of semantic web technology that include ontology-based semantic DB and semantic enable discovery technology can promise a smart search and discovery capabilities, and be able to effectively improve the efficiency and quality of spatial service discovery, and along bring about the better user inquiry experiences.

Since Oracle Spatial 10g, a set of semantic technology packages(STP) was released to support ontology-based semantic modeling and applications in RDBMS. Specifically, 1) Oracle provides SDO_RDF_TRIPLE_S object to store and manage RDF, OWL format data, in fact all the semantic data are stored into a triple format (NT format) in Oracle. 2) a set of SQL operators, namely SEM_MATCH, SEM_RELATE and SEM_DISTANCE are introduced to perform ontology-based semantic inference, query RDF/OWL data and ontologies, and perform ontology-assisted Query of relational data. Oracle‘s semantic approach enables users to refer to the ontology data directly from SQL and API using the semantic match operators, thereby opening up possibilities of combining with other operations such as joins as well as making the ontology-driven applications easy to develop and efficient. 3) Oracle provide the developer the client API JeanAdapter to inquiry semantic DB via SPARQL.

Aiming at the current requirement of service discovery during service automatic chaining and other web spatial applications, this paper firstly builds a unified spatial service classification model and a unified spatial data classification model and their semantic DB, and then designs and develops a smart discovery and retrieval system. Afterwards, this paper will brief introduce the system approaches, implementation and discovery experiments.

2. METHODS

Based on the analysis on the system requirement, the major system functions below were designed and defined, and the corresponding implementation strategies were studied. Here are brief descriptions about them both.

(1) Establishment of a unified spatial services classification model and a unified spatial data classification model. Referring to the ISO 19119 standards and OGC related services classification specifications, an upper layer spatial service hierarchy is built, according to ISO19119, the spatial information services are divided into human-computer interactive services, model/information management services, workflow/task management services, processing services, communications services and systems management services. Therefore, the most top-level of our model for spatial services can be classified in six classes; specially, we focus on the class of processing service, and adding one subclass of remote sensing image processing services to it, and further, remote sensing image processing services taxonomy has been concretely built. Meanwhile, a unified spatial data classification model is also built by referring to the ISO 19115 specification, whose emphasis is also put on remote sensing image data.

(2)The built and storage of semantic models: two abovementioned semantic models are firstly built via the protégé software, which has a friendly interface to help to build the preliminary OWL/OWL-s ontology models, and then the built ontology models are transformed into N-triples format of RDF model via Jena tool provided b Oracle, and then these N-triples are uploaded into semantic DB of oracle spatial via a uploading tool provided by oracle.

(3)OWL-S based service semantic representation and storage: OWL-S is a semantic service description mechanism, which include three components: ServiceProfile, ServiceModel, and ServiceGrouding. OWL-S provide a web service vocabulary to describe service semantics. Our research use OWL-S as the basic carrier of semantic information. A detailed frame is designed and implemented to use Oracle DB to store the correspondent OWL-S XML file of spatial service, so as to speed the semantic retrieve of OWL-S. By this way we can build semantic information DB based on OWL-S Schema.

(4) Semantic enable discovery experiment: Firstly, all kinds of semantic relations and rules can be discovered and inferred via Oracle semantic operators. The following SQL statement embedding in semantic operator SEM_MATCH will find out all the subclass of the remote-sensing- processing service by the matching of the semantic relations “(?x :subclass ?y)”.

```
SELECT x service, 'remote-sensing-processing' service FROM TABLE(SEM_MATCH( '(?x :subclass ?y) ',
SEM_Models('spatialserviceclassification'), sem_rulebases('owlprime'), SEM_ALIASES (SEM_ALIAS
('', 'http://www.example.org/spatialserviceclassification /')), null));
```

Secondly, by associate the data field with a semantic concept, which is referred to semantic marking, all service instances that meet the specified template can be smart searched and discovered.

2. SYSTEM THEIR IMPLEMENTATION

As we abovementioned, Oracle provide the developer the client API JeanAdapter to develop inquiry application of semantic DB via SPARQL. Based on JAVA Eclipse platform, we designed and implemented a semantic enable smart discovery client of spatial services. The key technologies to develop the client includes using Jena-API and Oracle Jena adapter API for 11g to implement the SPARQL inquiry and inference of both semantic DB and service instances DB.

4. CONCLUSIONS

Based the semantic technology provided by oracle spatial 11g, this paper build two semantic DB to support the knowledge representation of spatial service related, and based on semantic matching and reasoning ability, a semantic enable discovery client tool is developed, which can support 4 types of discovery (match) of spatial services, which are "exact", "plug-in", "subsume", and "fail". Compared to a traditional keyword queries, this query tools and interfaces can improve the inquiry efficiency and quality, and bring users a better inquiry experience. However this system is not very mature. In the Future, our work is to perfect this system, and refer to OGC CSW catalogue specification and further develop it into a CSW compliant catalogue service.

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5. REFERENCES

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