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Ontology based Secured Data Migration

SureshKumar R[1], Vijayakaran V[2], SampathKumar TT[3]

*(Department of Information Technology, Sri Manakula Vinayagar Engineering College, India)

** (Department of Computer Science, Sri Manakula Vinayagar Engineering College, India)

***(Department of Computer Science, Sri Manakula Vinayagar Engineering College, India)

ABSTRACT

This work proposes an ontology based data migration for large database. Our approach provides a reduction and integration of the ontology from the diverse databases. The ontology is classified into two major categories: global ontology and local ontology. During the data migration process all the local data, relationships among the local data is represented into ontology tree and this local ontology tree is mapped with the global ontology tree. This mapping process involves ontology disintegration, merging of sub-tree and validation of the ontology mapping process. Once the ontology tree has been created and mapped to the global tree, the process of data migration starts on its way. During the migration process there is a possibility of the attackers in the network from whom the data has to be protected. Since we also propose a secured way of data migration process in which there is a least possibility of the data theft.

Keywords: ***"Data migration, Ontology Mapping, XML, Schema Mapping".***

I. INTRODUCTION

According to moore's law, the number of transistors that can be placed inexpensively on an integrated circuit doubles approximately every two years. This creates a technological shift from the legacy system to the current supercomputing systems. The data persisted in every organisation also been increasing in the past decade due to the cheap availability of several Databases. This creates the need to migrate the data from the existing databases to new database. Data migration is the process of transferring data between storage types, formats, or computer systems. Many cloud applications [4] [5] [6] [7] [8] requires migration process where the data is the very important entity.

Data migration [1] [2] [3] [9] is usually performed programmatically to achieve an automated migration, freeing up human resources from tedious tasks. It is required when organizations or individuals change computer systems or upgrade to new systems, or when systems merge (such as when the organizations that use them undergo a merger or takeover).During this process of migration there cannot be a direct migration from older databases to new databases. There arises variation in the storage level, access level, meta-data[10], schema, relationships among the data which differs from database to database. In such process of migration one has to be keen in the integrity and the consistency of the data during migration. Hence there is a need of the data to be transformed into a flexible model such that the migration process is flexible to apply.

This work describes about the data migration for large database using ontology mapping and schema mapping technique. Since ontology is proven technique in today's word for web data migration and to represent the data/relationship among data. Several tools such as ETL tools available for the data migration process but those ETL cannot be applied for the data migration when there are different types of databases and has many relations among the data. In present decade the amount of data to be stored and retrieved is increasing exponentially due to the increasing business process and to capture the customer's data. Several methods of construction of ontology are proposed to assist in the creation of ontologies but most of them are not interested in how to acquire the relevant information in the domain of discourse.

II. Data Migration process

In the migration process the data and the relationships of the data have to be converted into suitable ontological structure, hence we use XML to represent the meta-data of the database. In this representation the XML is ontological tree which is generated locally and it has to be checked with the global ontology. Sometimes the entire data has a complex relationship; hence we can construct the ontological tree from the Entity relationship diagram as explained in [ref]. In the process of capturing the meta-data the prior information about the database has to be tabled since each database has its own representation to represent the data and the relationship.

2.1 Data Type Mapping

The data-type also differs from the versions of the same database due to the technological advancement. In recent days there has been a wider support for the xml data types and the query to retrieve the xml data is increasing due to the interoperability of the XML.

In migrating the multi-media contents there is a extensive variations in the storage level of the contents, due to the difference in the data types of the database. This difference may not arise due to the specifications of the database, it also arises due to the difference in creation of the attributes (ex: to represent employee id, both integer and String can be chosen as in figure 1). In such scenario the local ontology tree has to be matched with the global ontology tree.

Figure 1. Data type mapping

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This issue can be resolved by

- Change the data type in either side which suits the change
- Xml representation

2.3 Normalization in Attribute Mapping

In the normalization process the attributes of the database is converted into the local ontology tree (XML format). During this process the attributes which are named specifically are generalized with the attribute names of the global ontological tree. The global ontological has the set of rule base for attribute generalization process.

- FNAME <=> FIRSTNAME
- ENO <=> EMPLOYEENUMBER
- STDID <=> STUDENTID
- MGRID <=> MANAGERID

2.4 Attribute Level Mapping

The attribute level mapping describes about the representation of the attributes. In Figure 2, Name can be represented as a combination of FName, MName, LName and the same Name can be represented only by FName and LName. In such scenario FName and MName has be combined or the LName has to be splitted into MName and FName. Hence we provide a merge () and split () algorithm to handle this situation in the ontology tree mapping.

- Merge()
- Split()

III. ONTOLOGY BASED DATA MIGRATION

Ontology technologies have recently been introduced in the field of semantic web to organize data and knowledge of a domain in order to share, disseminate and update them. These technologies seem to provide a solid methodological framework, both relevant and innovative, to deal with document images. In figure 4, the ontological tree creation and ontology comparison is explained. Initially after the normalization process, ontology Tree is created with the meta-data and relationship between the data. After local ontology creation both in source and destination databases the comparison of the ontology tree has be performed with the size level mapping process and attribute level mapping.

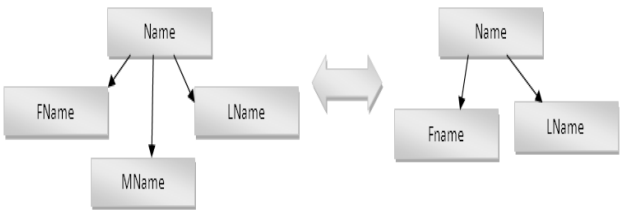

Figure 2.Attribute Level Mapping

2.4 Size Level Mapping

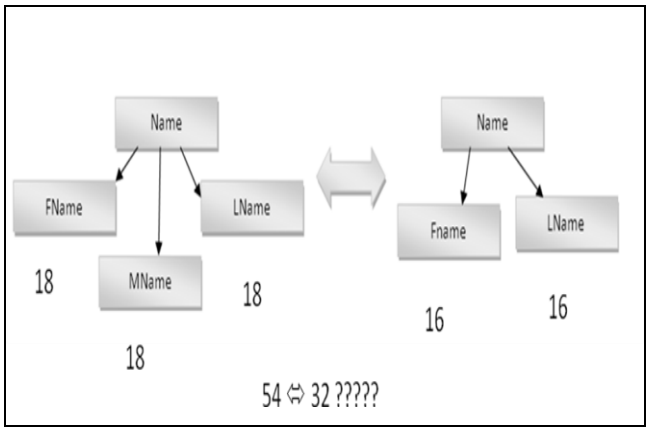

Figure 3. Size Level Mapping

3.1 Ontology and Sub-Ontology Matching Algorithm

Step 1. CreateOntologyTree()
Step 2. Verification and Validation()
Step 3. Normalization
Step 4. Attribute-Level-Mapping()
Step 5. Size-Level-Mapping()
Step 6. Data-type-Maping()
Samedatatype()
Differentdatatype()
Step 7. Data_Migrate()

3.2 Ontology Tree Creation Algorithm

Step 1. Create_ontology_tree()
Step 2. {
Step 3. Fetch_table_structure()
Step 4. Map_attributes;
Step 5. Map_relations;
Step 6. Represent_ontology;

3.3 Verification Process Algorithm

Step 1. validation()
Step 2. {
Step 3. errors=verification();
Step 4. If(errors) then
Step 5. Alter_ontology()
Step 6. Else
Step 7. No Action;
Step 8. }

3.4 Validation Process Algorithm

Step 1. verification()

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Step 2. {
Step 3. Fetch_table_structure;
Step 4. Fetch_ontology_structure;
Step 5. Fetch_relations;
Step 6. Compare_table_ontology;
Step 7. Return errors;
Step 8. }

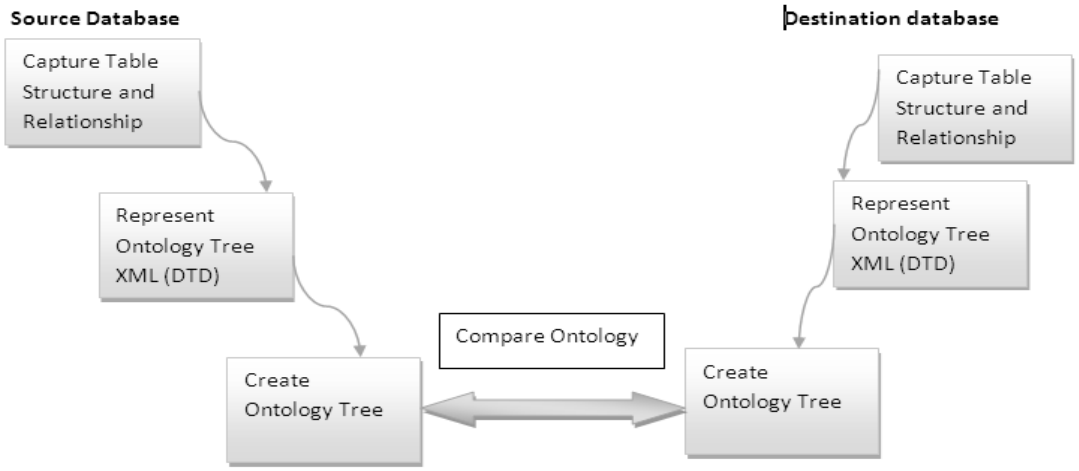

Figure 4. Ontology tree creation and comparison

IV. Secured Data Migration Architecture

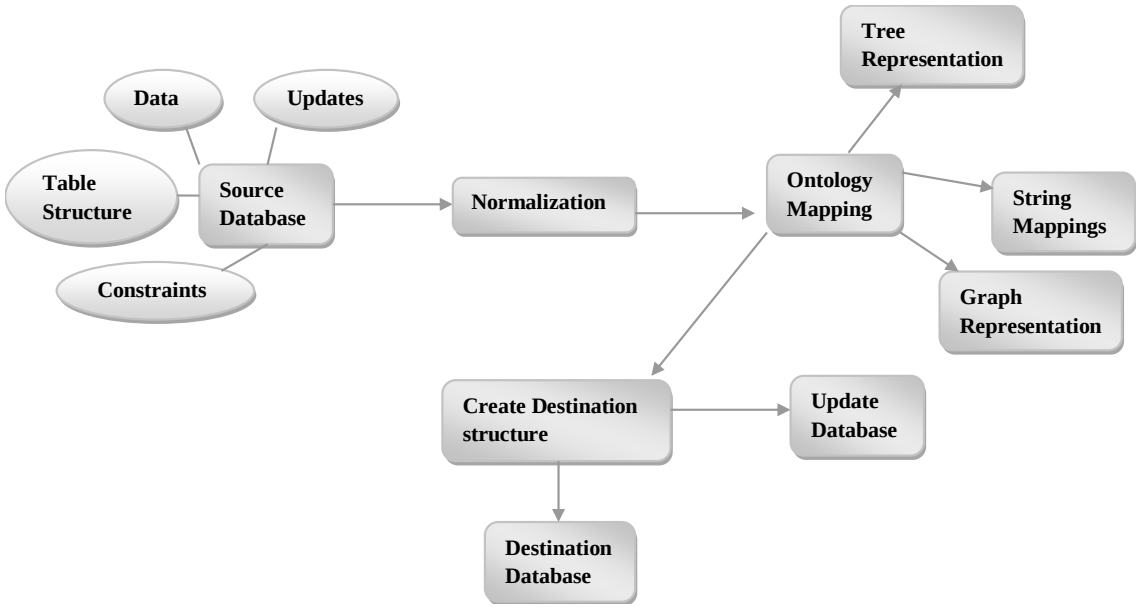

Figure 5. Ontology Based Secured Data Migration Architecture

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In figure 5 the secured data migration architecture is described. In this process source data is encrypted before the data migration process. The ontology tree is created and the source and destination ontology is matched and the migration process is initiated once the ontology tree matching is successful.

V. IMPLEMENTATION DETAILS

In our approach we have taken the university database. The migration process can be taken in two processes.

1. Periodical migration
2. Complete Migration

Periodical Migration

In our institution there has been a heavy traffic and queue attendance enrolment of the staffs. This traffic is due to all the staffs of various departments and administration staffs have to enroll in the finger print scanner. The database is updated severely during the entry process.

We proposed and implemented a migration process where the queue is reduced to very least amount. We created a department wise database and updated the attendance records by 9 O clock. This update is taken place in the local database od the departments. Our algorithm will update the periodically according to the departments.

Hence there is a great reduction in the

1. Waiting time of the staffs
2. Server's congestion as the data is migrated periodically
3. Data loss is reduced as the congestion is reduced to a greater extend

Fig 6 shows that the migration using the ontology mapping consumes lesser time when compared to the schema mapping. Fig 7 shows the comparison between the average waiting times of the staffs in the queue. Our proposed migration process drastically reduces the waiting time and also it reduces the server overload by creating lesser congestion for the server to update the data. Due to the lesser overload of the server there is very least amount of data lost during the updates. During the migration process from local server to centralized server the data are encrypted to avoid the intruders to see the important data.

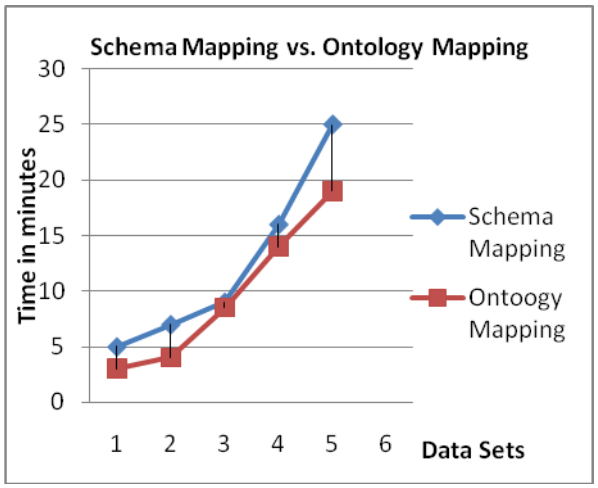

Figure 6. Comparison of Ontology Mapping and Schema Mapping Migration

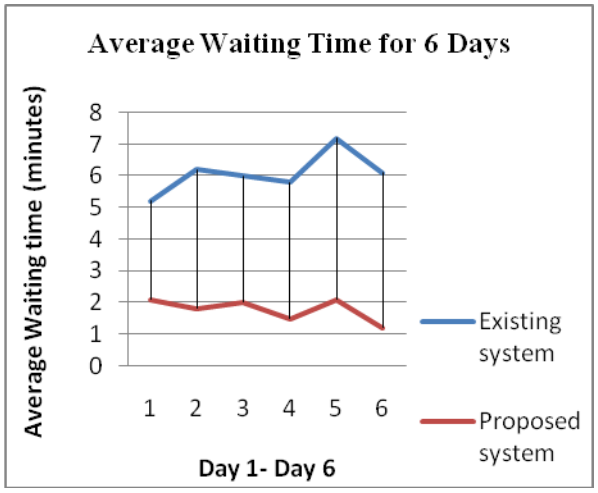

Figure 7. Average waiting time of the Staffs

VI. Conclusions

The Ontology based data migration process is explained with the initial data pre-processing technique. The ontology tree creation with the XML and ontology matching is also discussed with the algorithm in our work. We also proposed an algorithm for the university record updation and migration which reduces the queue, waiting time, server's overload. The secured migration is proposed for the data security but the time is utilized during the encryption and decryption process that we will cover up in our future work.

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