DESIGN AND IMPLEMENTATION OF MULTIMEDIA MATADATA MANAGEMENT SYSTEM FOR HETEROGENOUS SOURCES

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ABSTRACT ... With the advance of internet and computer processing technique, users can easily access and use the multimedia contents involving the various pictures, videos and audios information. And users request more convenient and accurate multimedia services. In these environments, it is difficulties to integrate and manage metadata standards because there are various standards in multimedia applications according to types of services and data formats individually. In this paper, we design and implement the multimedia metadata management system for integrating from heterogeneous sources. In our system, we managed heterogeneous metadata by integrating to unified schema using mapping table. Through proposed system, users can search multimedia data easily without considering variety of application services.

KEY WORDS: Multimedia Metadata Management System, Metadata, MPEG-7, TV-Anytime

1. INTRODUCTION

Recently, the advance of internet technique and computer processing ability give of possibility of high-capacity for the processing multimedia data. Users can easily access and use the multimedia contents involving the various pictures, videos and audios information. There are many applications for providing multimedia data services such as VoD(Video on Demand) service, remote education, electronic library and digital broadcasting service [1].

In this environment, users request more convenient and accurate multimedia services for storing and retrieving multimedia information [2]. For the satisfaction of these requirements, the TV-Anytime forum established TV-Anytime metadata standard for supporting audio-visual service [4]. And the MPEG (Moving Picture Experts Group) which is video or audio compression research group of the international Standards Organization (ISO/IEC) established MPEG-7 standard for supporting content-based retrieval [3].

Metadata standards describe the multimedia data to present video and audio information and these are expressed in XML grammar. In the real applications, metadata is managed using the XML document. However, these applications have difficulties integrating and managing metadata standards. Because there are various standards in multimedia applications according to service types and data formats individually.

In this paper, we design and implement the multimedia metadata management system for integrating from heterogeneous sources. In our system, we manage heterogeneous metadata by analyzing each standard and integrating to unified schema using mapping table which comes from mapping step among various multimedia standards. Also, unmapped metadata by mapping table in some standards is added to mapping schema with raw name of each standard. Through proposed system, users can search multimedia data easily without considering variety of application services.

The rest of the paper is structured as follows. Section 2 summarizes the previously proposed systems for metadata management. In Section 3, we introduce proposed system architecture and functions of each module. Section 4 shows the implementation results. Finally, Section 5 describes the conclusion and future work.

2. RELATED WORK

Various standards have been proposed for integrating and managing multimedia metadata such as Doublin Core, TV-Anytime, MPEG-7, and ADI. Doublin Core is based on RDF(Resource Description Framework) for easily sharing and searching information in network environment. Also, Doublin Core is used in XML for explaing metadata. MPEG-7 is standard proposed by MPEG (Moving Picture Experts Group) for described metadata about multimedia content. TV-Anytime is standard proposed by TV-Anytime forum which

established in USA at 1999. TV-Anytime is related to digital broadcasting. Also, ADI is standard proposed by company of Cable Television Laboratories for cable industrial and information management of customers.

In the domestic study, XMF defined integration schema and rules as XMF-ML arbitration language against the heterogeneous characteristic and it is used in XML-QL. In this case, the processor needs how to define new rule and language. Also, in digital broadcasting, the methods to manage efficiently multimedia contents and metadata have been researched [6, 7, 9].

MAF (Multimedia Application File Format) proposed in the MPEG-A has the metadata properties of the MPEG-7 type and implements a system that has function of the Creation, Exchange, Modification, Search, and Play using these properties [3, 8]].

One of the important problems managing metadata is that each metadata is not harmonized with each other because metadata form other source have different format. Therefore structural and semantic heterogeneity of metadata is caused by these problems [5].

3. PROPOSED SYSTEM

3.1 System Architecture

In our system, we propose this metadata integration management system composed of four main modules: Metadata Acquisition Manager, Metadata Analyzing Manager, Metadata Mapping Manager, and Query Manager.

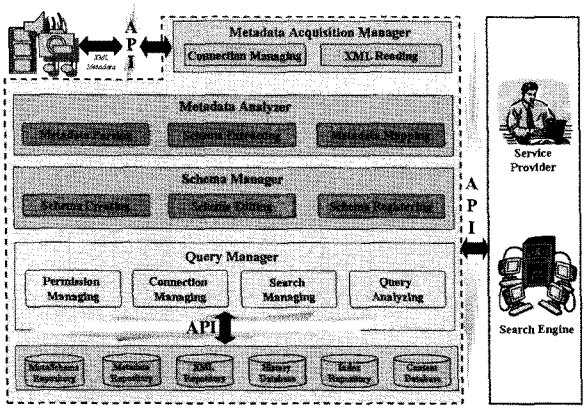

Figure 1. System Architecture

Figure 1 shows the whole system structure. In each module, Metadata Acquisition Manager receives XML-based metadata from clients. Metadata Analyzer parse received metadata using XML parser. Then extract element and attribute. Schema Manager performs schema mapping from extracted list with defined previous schema. Schema Manager manages common schema list. Finally, Query Manager performs the user's queries and stores the mapped metadata by mapping table into database.

3.2 Module Design

3.2.1 Metadata Acquisition Manager (ACM): ACM set up the connection between clients and server. ACM receives XML metadata files from clients, and create instance object. Figure 2 shows class diagram of ACM

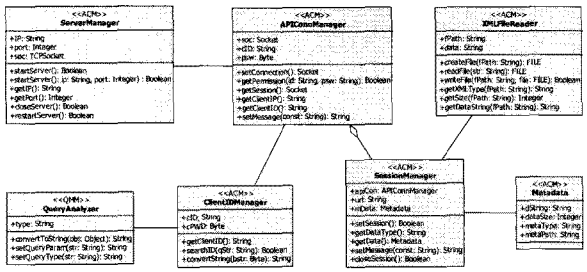

Figure 2. ACM Class Diagram

3.2.2 Metadata Analyzing Manager (ANM): ANM parse receives metadata from clients, and create DOM tree using XML parser. Then ANM extracts element and makes mapping lists with element name and its values from DOM tree. These mapping lists are compared with mapping table which is created by analyzing metadata standards and changed to integrated common schema. Figure 3 shows class diagram of ANM.

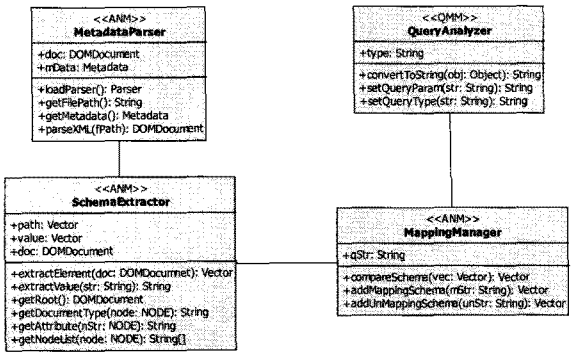

Figure 3. ANM Class Diagram

3.2.3 Metadata Schema Manager(MSM): MSM load XML mapping table/file into memory, and reload periodically. Also, undefined element/attribute, fined in system operation, registered into table/file by MSM. Figure 4 shows class diagram of MSM.

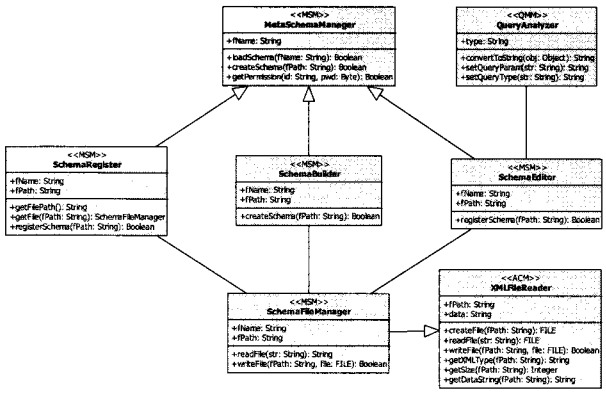

Figure 4. MSM Class Diagram.

3.2.4 Query Manager(QMM): QMM analyze query string, create syntax, and execute query through connect database. Figure 5 shows class diagram of QMM.

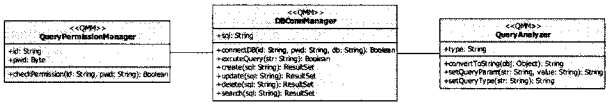

Figure 5. QMM Class Diagram.

3.3 Metadata Mapping

Multimedia metadata information can be managed by Metadata Acquisition Manager. Then, these acquired XML metadata documents are filtered and reparsed by the Metadata Analyzer, and next transformed into a uniform metadata semantics description by Metadata Mapping Manager. Finally, these segments metadata information are stored into the metadata repository by Metadata Schema Manager for further processing and searching/retrieval.

```
Algorithm ExtractSchema (imeta)
Input : imeta (metadata instance)
Output : schemaListSet (schema list instance)
Begin
  ptree = parseXML(imeta)
  proot = getRootElement(ptree)
  while(count of node in proot)
    ename = getElementName (proot.element)
    icontent = getElementValue(proot.value)
    schemaListSet = addList(ename, icontent)
    proot = getNextElement(proot)
  end while
  return schemaListSet
end
```

Figure 6. Schema Extracting Algorithm.

Metadata extraction is customized by generator for input multimedia document. It uses the TCP/IP protocol to acquire multimedia document. Figure 6 represents the algorithm for schema extracting from parsed metadata.

```
Algorithm MappingSchema (schemaListSet)
Input : schemaListSet (schema list instance)
Output : mappedListSet (mapped schema list instance)
Begin
  mappedListSet = schemaListSet
  dbCon = connect database
  while(count of list in schemaListSet)
    temp = find schema name the same with
           schemaListSet.name in mapping table
    mappedListSet.name = temp
  end while
  return mappedListSet
End
```

Figure 7. Schema Mapping Algorithm.

Extracted schema list by Schema Extracting Algorithm is mapped immediately with mapping table (shown Table 1) by Schema mapping Algorithm. Figure 7 represents schema mapping process. Through Schema Mapping Algorithm, we can expect results that have high-accuracy.

Table 1. Schema Mapping Table

Doublin Core	MPEG-7	TV-Anytime
Title	Title	Title, ShortTitle
Creator	Creator	CreditsItem
Subject	PackagedType	Synopsis
Description	CreationDescription	ProgramDescription
Date	Date	CreationDate
Type	Genre	Genre
Format	FileFormat	FileFormat

Table 1 describes example attributes extracted common features of each standard. Using mapping table, we can make unified common schema from different expression between each standard.

4. IMPLEMENTATION

We implemented prototype system along with proposed system architecture on Intel 2.4GHz, 1GB RAM, Linux operation system, using JAVA (JDK1.6) with Parser (SAX2, DOM). And we built database using My-SQL5. In our system, title metadata of TV-Anytime and MPEG-7 were used for integrating metadata and user's query was executed by integrated mapping table from each standards.

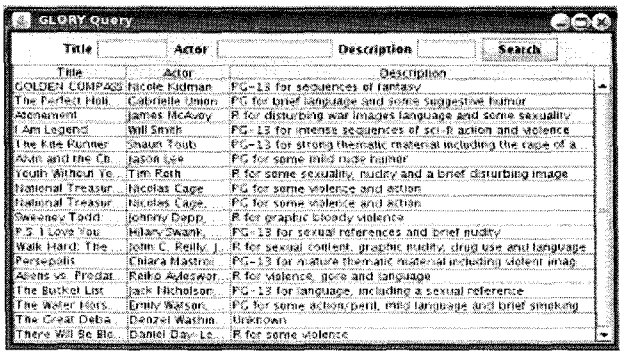

Figure 8. Query Result

The Figure 8 shows the result of integrated metadata parsed by Metadata Mapping processing. The implementation results shows that our system supports distributed services resource for a high sharing and searching throughout internet. Our approaches also help the system to reduce the complexity of various standards description data.

5. CONCLUSIONS

In this paper, we proposed the multimedia metadata management system for integrating from heterogeneous sources. In our system, we managed heterogeneous metadata by integrating to unified schema using mapping table. Through proposed system, users can search multimedia data easily without considering variety of application services. As on going work, our experiment works need to be evaluated with more various integrated standards especially for some emerging standards.

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