Temporal Based Multimedia Data Archive

Syarilla Iryani A Saany, M Nordin A Rahman, Ahmad Fakhri Ab Nasir

Abstract: To manipulate multimedia data efficiently, data annotation must explain how the object is organized and how the parts of the object are represented. In a large scale multimedia data transaction environment, data annotations need to be linked with time series (temporal aspect) in order to provide effective data management. The aims of the temporal data management are to identify an appropriate data type for time and to provide query algebra temporal data. Web service is an emerging technology in sharing business logic, data and processes among various providers. It allows different applications from different resources to communicate with each other. This paper proposed a temporal based model for archiving a set of multimedia data which is developed under web services framework. The developed model can create a process and services dynamically without having to underlie the complicated interfaces.

Index Terms: multimedia data, software as a service, temporal database, web services.

I. INTRODUCTION

Existing multimedia database management systems (MDMS) are developed to fulfil the necessities of recent trend applications [1]. Multimedia data archiving application is very vital in today's current applications. Massive size of multimedia data are disseminating in many localities. This creates the archiving process of multimedia data becomes tedious, harder and more complex. Immense development and distribution of multimedia applications also denote a causal effect factor to the archiving process issue [2]. Obviously, an efficient data archiving technique is crucial especially for many other multimedia data process. Besides that, the techniques for retrieving process of multimedia data are still primitive, whereby the Internet search engines today still rely on the keyword based search.

Web services has become an evolving technology in many information application development [3], [4]. Many research groups have been exploring of how the service concept can be applied to many application that involve information discovery, brokering, management and ontology. Web services technology offers dynamic and stable programming composition. This enables the development of a service application. A multi composite business process as in a big multimedia production industry often utilize collaborative web service. This collaborative web service consists of some services components that interact among each other and operate in a dynamic cycle [5], [6]. Resources can be collaboratively accessed under supervision of privacy rules or guidelines [7].

Revised Manuscript Received on February 11, 2019.

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In conventional data model, during the updating process, a new entering value will overwrite an existing data value. This new data value becomes the current view data [8]. However, in temporal database approach, it captures the progression of the object throughout certain period by upholding several data states such as state-of-past, state-of-current and state-of-future. Time dimensions in temporal data management can be categorized into three forms. Table 1 shows the categories and definition of the time dimensions [9]-[11].

Table 1: Category of time dimensions and definitions

Time Dimensions Categories	Definition
User-defined time	time that meet the representation of the specific needs of user perspective
Valid time	time when an event is true in the real world of a particular application. It can be considered as a time for past, present and future event
Transaction time	time that concern when an event of data is stored or presented in the database. In other words, the transaction time of an event presents the exact database image of the modelled world.

Research in multimedia data management is inherently an interdisciplinary one, and requires for collaboration between fields of soft computing, database, web services, data science and machine learning techniques. Within the context of multimedia data management, the specific research question of this research can be divided into two: "Is web service technology can be used to enable the archiving process of multimedia data under distributed environment" and "Is temporal data approach can effectively improve the process of primitive operations in data archiving management". The effective of multimedia data archiving will provide tremendous benefits to multimedia application production house including increase user productivity, reduce of database and storage maintenance cost, quicker reporting and increase enterprise resource planning activity performance. This paper discusses the multimedia data archiving model based on web services technology framework.

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The remainder of this paper is divided into 4 sections. Section 2 discusses the related work. Section 3 presents the overview of the proposed model. Section 4 describes the development of web services application for multimedia data archive for distributed environment. Section 5 concludes the paper with conclusions and future works.

II. RELATED WORKS

Many research domain such as biology, entertainment, astronomy and medical sciences employs scientific images and rely increasingly on multimedia datasets. Not only that, social media applications also produce huge multimedia dataset which can be shared through any cloud platforms. These become means and sources of input for many other research domains and relevant companies or organizations. The needs on multimedia data archiving are very promising.

The general conceptual framework of distributed multimedia data archiving is depicted in Fig. 1.

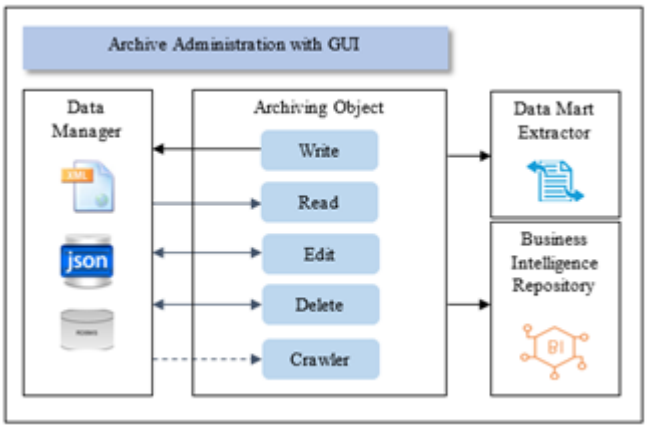

Fig 1: Conceptual framework of a multimedia data archiving application

There are three main components fashioning the process of multimedia data archiving including archiving object, data manager and data mart extractor [1], [2], [12]. Some of the advanced multimedia production factory has business intelligence repository component to provide analytical reporting and decision support application. Archiving object is serviced for primitive operations which involve the process of write, read, edit and delete of any related data in the domain. In a collaborative based multimedia data archiving application there is also consist of crawler engine that operate the process of data gathering and integration. The general functions of data manager are to systematically organize the structure of existing data in the application. The purpose of data manager component is for data modelling and analyzing. Generally in multimedia data archiving application, both archiving object and data manager components can be managed by user using archive administration interface.

In a multimedia data archiving application which involve several independent datasets, it requires for a specific data mart extractor. This development of independent datasets is because of need to have solution within a shorter time. Data mart extractor provides the process which involve moving data from operational systems, filtering and loading data into the databases. Nowadays organizations are considering an integrated enterprise approach of data management and reporting and it is also happened in multimedia production industry. Multimedia data archive management is also applied the technology of business intelligence repository in purposing for data integration, analysing and reporting.

In a distributed environment of multimedia production organization, any big volume of multimedia data demands an effective technique on the archiving process. Here, the strengths of web services technology and temporal data technique are utilized to develop an effective multimedia data archive. Below are the opportunities that can be embarked on development of multimedia data archive in distributed environment:

- Temporal data technique-to represent data archive with dynamic data type such as data valid period and transaction;
- Web services technology-to generalize the communication and functionality of different application providers in order to gain wide collaboration of data.

III. RESULTS & DISCUSSIONS

A typical way to capture temporal information and incorporate time in any information system is by extending a database relational scheme with a time attribute. The aspect of time granularity in database is useful, not simply as a measure, but to associate a temporal context with common events. The organization which involves massive data transaction such as in a multimedia production house demands an explicit or implicit temporal context. This can be denoted in terms of time granularity.

As for that, a definition on the relations of time granularities is constructed based on the theory of time-element. It consists of two groups which are intervals and points [11]. Fig. 2 summarizes the definition in set notations.

If T is a nonempty set of time-elements and
d is a function from T to R+ which is a set of nonnegative real numbers then
t is an interval if d(t) > 0 and
otherwise,
t is a point.
Hence, the set of time-elements, T is $T = I \cup P$, where
I is the set of intervals and
P is the set of points.

Fig. 2: Time granularities relations definition

In this proposed model, there are two time elements which are transaction time (tt) and valid time (vt). Fig. 3 describes these two elements when the transactions occurs on the multimedia data. In this study, time format is based on [day/month/year].

tt = td
// transaction time = transaction date
// transaction date is recorded during read, edit and delete operation

vt = [vt-from, vt-until]
// valid time = valid period
// valid time is the valid period for multimedia stored in database
// valid period is amended when multimedia object is edited
// valid period = valid-from .. valid-until

Fig. 3: Time elements description

The 2-dimensonal time elements embedded in temporal based multimedia data management depicted as Fig. 4.

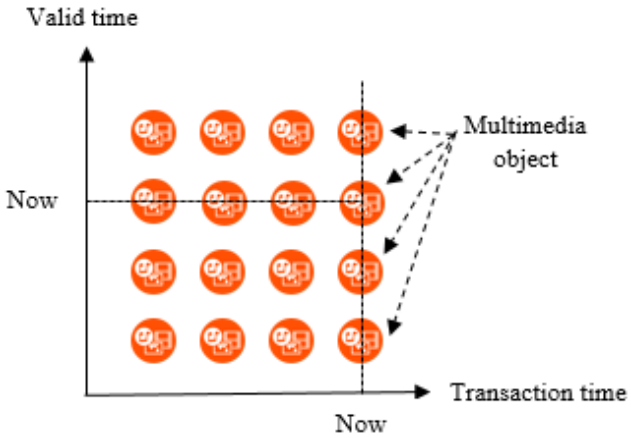

Fig. 4: Multimedia data in 2-dimensional time value

The transaction of multimedia objects in this dynamic archive contains a set of multimedia data denoted as, $M = \{m_1, m_2, \ldots, m_n\}$. This transaction performs a set of modification process, $U = \{u_1, u_2, \ldots, u_n\}$ which will deduce a set of version as expressed below:

$$M = \{m_1, m_2, \ldots, m_n\} \text{ then} \quad (1)$$

$$\forall m_i \in M \Leftrightarrow \exists (u_i \in U) \text{ and} \quad (2)$$

$$\forall m_i \in M \Rightarrow \exists (\text{vt-from} \in I \cup \text{vt-until} \in I) \quad (3)$$

where vt-from < vt-until. This implies, every multimedia data stored in a temporal data archive has a valid time or can be classified as a time interval, and

$$\forall u_i \in U \Rightarrow \exists (tt \in P) \quad (4)$$

This implies every updating process of multimedia data in a data archive has a transaction time or can be classified as a time point.

Then, a complete model for temporal based multimedia data archive is:

$$\text{TEMPORAL}(m_i \in M) \subseteq (tt \cap vt) \quad (5)$$

where tt is transaction time and vt is valid time.

Thus, if the multimedia data archive has a set of features attributes A_i then a complete scheme for a temporal based multimedia data management can be denoted as:

$$R = (A_1, A_2, \ldots, A_n, tt, \text{vt-from}, \text{vt-until}) \quad (6)$$

IV. THE DESIGN OF SERVICES IN MULTIMEDIA DATA ARCHIVE

A web service application requires to be equipped with a fault handling mechanism for reliable services over the Internet [6]. In this model, the concept of Software as Service (SaaS) is employed to all primitive operations in multimedia data archiving process. The elements of SaaS are used together with the dynamic alignment and binding of elementary services at the time of archiving process. Fig. 5 shows the hierarchy structure and function of each module in the developed multimedia data archive.

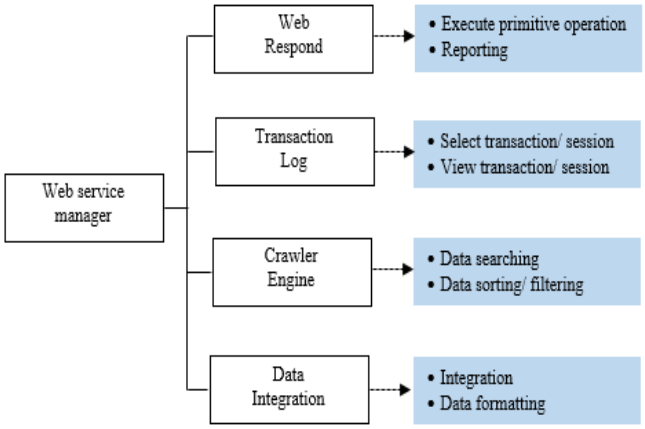

Fig. 5: Hierarchy structure of web services application

The service allows request from user (or other application) to be recognized automatically by device protocol (HTTP protocol). The service also translates between requested task and HTTP protocol request and therefore confirms a uniform interface to control different system environments. A common multimedia data archive application is adapted where, a web services manager is developed to cope with four main services {web respond, transaction log, crawler engine, data integration}.

Two main operations are defined as service and query in this proposed service model. Details of service and query as in Fig. 6.

If a service set S contains the services and an ontology domain T then
each service $s \in S$ is composed of
a set of essential input $I_s \subseteq T$,
a set of generated outputs $T_s \subseteq T$,
a set of native data used by the operation of s $D_s \subseteq T$
and a set of primitive operations, O^s offered by s to be performed on a distributed multimedia archive resources over the Internet, where each primitive operation, O^s denotes an interaction between the service and query.

submitted query, q is
q consists of a set of provided inputs $I_q \subseteq T$,
a set of preferred outputs $T_q \subseteq T$ and
a set of required primitive operations O^q

Fig. 6: Definitions of service and query

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A prototype of the proposed model is developed by using Java Technology application program interface. Tools are provided by the integrated web service protocol stack. Fig. 7 and 8 show two samples of screens for status updating and archive transaction respectively.

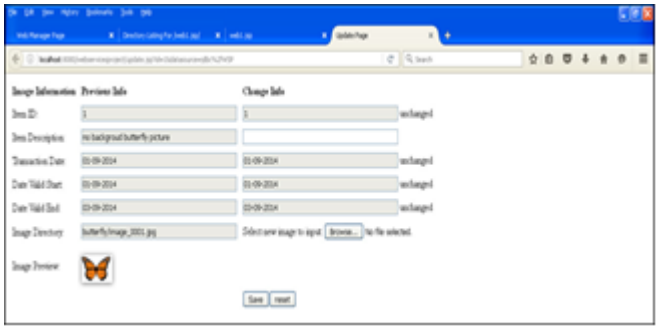

Fig. 7: Sample screen for multimedia data status updating

Fig. 8: Sample screen for multimedia data archive transaction

V. CONCLUSION

The study of multimedia data archive, especially for a high volume multimedia data is crucial. This paper has proposed a web service application for temporal based multimedia data archive. A dynamic multimedia data archive application has been developed using the features of temporal elements. In order to offer wide service for distributed collaborative multimedia industry, the application is reengineered for implementing under web service environment. As a result, the multimedia data archive application can be managed efficiently in term of interoperability and protocol standardization. In future work, we are considering for embedding analytics application in temporal based multimedia data archive repository. This analytics application will combine the emerging field of visual analytics and multimedia analysis technique that focused on large scale multimedia data set environment. Besides that, the study for developing a fault handling technique is also needed in order to provide reliable services over the unreliable Internet connection.

VI. ACKNOWLEDGMENT

Special thanks to University Sultan Zainal Abidin on the research grant (University Research Grant – DPU2015) for this research work and Research Management, Innovation and Commercialization Centre (RMIC) UniSZA.

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