Design of Message-Oriented Middleware Based on Social Messenger

[1]1Made Sukarsa, [2]Nyoman Sarasuartha Mahajaya, [3]Gusti Made Arya Sasmita

Dept. of Information Technology, Faculty of Engineering,

Udayana University, Bali, Indonesia

[1]*e_arsa@yahoo.com*
[2]mank_komank@yahoo.com
[3]aryasasmita@yahoo.com

Abstract: **Message-Oriented Middleware (MOM) is type of middleware that provides integrated mechanism for effective and flexible complex data in distributed system. This article introduces about MOM and its application in integrated system processes, the implementation of PL/SQL in data integration process in order to improve the efficiency of message delivering and to make it easier to adapt in business area covered and the use of social messenger network as inter-site media communication. MOM is designed by using point to point model to reduce excessive message queue at one point and spread it on connected sites to enhance distributed system.**

Key words: **Distributed Systems, Middleware, Message-Oriented Middleware, PL / SQL, yahoo messenger.**

I. INTRODUCTION

The primary motivation in database developing system is an expectation to joint operational data in one organization and controlled data access. Integration and data control have been implemented on centralized form, however thus are not belong to the aims of database system. The developing of computer network results in distributed system form.

Distributed system is a computer system where the components of the system are separated physically ([2]) generally this database system is implemented on organization with multiple sites that spread elsewhere. The implementation of centralized system on this organization surely not quite suitable solution since it will reduce operational performance in the matter of access speed. Database system will be installed on each site (distributed) so that each site will not need to access the main database system to perform operational activities. This kind of approach certainly will increase data access efficiency, and at the same time influences operational performance of the organization. Another benefit of integrated database system is the ability in handling data volume expansion and data availability along with autonomy in data management on each local.

Issues mostly appeared on integrated database system development is integrated data problem. Distribution database system to some sites results in imbalance data from one sites to others, since the development of each site is differ. Relevance between each site cannot be avoided.

One site might be need data from another site. Integration data is needed to solve such problems. Integrated data implementation seems to be urgent and believed to be the right solution for realization of excellent and transparent data synchronized process even data location spread all around. The problem can be solved by utilizing middleware. This infrastructure enables inter-site communication and coordination worked well. This condition will result in up to date and equable of data and information services in whole sites available. If this condition is worked so prime services as the main indicator of sites management can be considered success.

In integrated database system, generally data integration is employed by web/desktop application with internet connection used. Internet is effecting in the difference data communication between sites. Internet can be the source of information and communication which is cheap and fast. Likewise, on messenger application people can do long-distance communication directly by using messenger that the internet provides it for free. Nowadays, the popular and commonly used messenger is Yahoo Messenger (YM). Using this yahoo message services, the distribution message process inter-site will be cheaper and easier.

Middleware as infrastructure has important role to perform data integration. Middleware defined as software layer located on operation system, network and database, and to be under distributed application, manage computer resources and communication network.([5]) Middleware enables interaction and communication between difference application through Application Programming Interfaces (API).[1,6,7] API is interface which used in application program to access other operation system and services. ([3]) Middleware enables connection inter-component of different platform, differ in language and operation system used. ([2]) Middleware made synchronized or integrated data inter-sites so integrated database system can be running well, which functions comparable with centralized system but with better performance as well. This article introduce about MOM and its application within integrated system process, implementation of PL/SQL in integration data process to increase message delivery efficiency and make it easier to adapt in business process growth, and yahoo messenger as communication media inter-site.

II. REFERENCES OVERVIEW

A. Distributed Database System (DDBS)

Distributed Database System (DDBS) is the combination of two approaches in data procession that to be in contrast that is database and computer networking. Meanwhile the main purpose of DDBS is to integrate and centralize data so access (description, manipulation and control) toward data highly controlled. On the other hand, computer networking purposed to make work mode that truly avoid centralized work load. The basic motivation for distributed database is to upgrade system performance and to raise upgrade data availability, shareability and access facility. Distributed database design becomes optimal problems which need solution for two problems that is designing global connection and design fragment allocation to sites on communication networking.

There are several approaches related to data/table savings on distributed basis adapt system, as follows:

1. Fragmentation

Fragmentation is a relation that is divided into several parts , each part is stored in different locations.

2. Replication

Replication is a technique make copies and data distribution and object database from one database to another and execute synchronization between databases for the guaranteed data consistency.

3. Replication and Fragmentation

This design is a combination of replication and fragmentation. Client is partitioned into several parts. System maintains identical copies of each part.

Since organization tends to spread geographically, one DDBS is very suitable to be applied with better organization structure than traditional - centralized DBS. Each location will has local data and ability to obtain needed data from other location through communication networking. Furthermore, one server failed in one location will not make distributed database system inaccessible. Only the infected site which involves directly that will be failed. Likewise, if any data needed from one site seemingly to be failed, those data can be obtain from other location which contains data replication. Extended distributed system is rather easy, since it only add the new location and has no affect to data that already exist.

On the other hand, DDBS has some weaknesses. Distributed system usually shows more complexity and expensive costs from the centralized one. As this matter caused by the costly of hardware and software involved to resist a reliable and efficient system. Another weakness is related to security issue. Security management in some location is rather more complex. Besides, communication inter-sites are risky to be hacked.

Some failure can be occurred in distributed database system:

Transaction Failed: if the transaction failed then it will be cancelled. In that case, database must be returned to normal condition before the transaction begun. Transaction can be failed for several reasons. Some failure might be caused by network disconnection or deadlock process.

Site Failed: sites failure usually caused by software or hardware failures. This kind of failures results in the lost of the main memory contents. In distributed database, sites failure consists of two types:

1. Total Failure where all sites in that distributed system are failed.

2. Partial Failure where only some sites from the system are failed.

Media Failed: the failures refer to secondary savings equipments. The failures actually caused by crash or controller failed. In this case, media failed results in inaccessible of partly or whole database that be saved in secondary savings.

Communication Failed: as it is called, this happens when communications between two or more sites are totally failed. It causes network of each partitied site or some sites classified all together and separately operate. Indeed, message from one site will not be reached by another site and will be lost. Reliable protocol then makes use timeout mechanism to detect the message sent. One message will not be sent if the receiver does not receive acknowledgement. Communication network failed to send the message called as performance failure.[12]

B. Message Oriented Middleware (MOM)

Message Oriented Middleware (MOM) is a middleware that enables communication through messages. Message Oriented Middleware (MOM) provides message service layer between transportation and application layer from network protocol stack. ([8])

MOM is an effective and flexible mechanism for interconnection system.[10] MOM service simplify integration from some application and enables flexible distribution and adaptable easily. MOM also allows the system to overcome unpredictable leap in one activity of one subsystem without affected other area in the system. [11]

MOM provides various competences to send message including *point-to-point* message model and *publish-subcribe*, message filtering, transactional message and *once-and-once-only* message delivery. Generally, MOM services more similar like post services, that is message is delivered to post office, and then post services will have responsibility to proceeds message delivery safely to the receiver.

According to [9] there are two types of different MOM that is message queue and message passing. Message queuing define as indirect communication model, where communication happened through message queue. Message from one application send to particular queue that identified from its label. After the message has been saved, then it will be sent to the receiver. This enables application to send and receive information without having direct connection of what two have been established. One program only deliver message to message queue service, identified the queue label. Message queuing service is acted as a mediator, and the message mechanism sent absolutely hidden from the application. Meanwhile, message passing model is a direct communication in which the information is sent to attracted party. One feature of message passing is middleware publish-subscribe (pub/sub) model. Client in pub/sub have the capability to subscribe interesting subject to follow. After being subscribed, client will receive message related

to topic followed. In traditional network application, when two process have to communicate each other, they need a network address to start communicate. If the process wants to send message to another process, it needs to know physical network address of another process and make connection to all processes.

MOM supports both synchronized communication (via message passing) and asynchronized (via message queuing). Asynchronized communication is achieved naturally. Message sent to server without blocked by client. Client do not need to wait to answer and will be able to continue another activity. However, synchronized communication needs to be applied manually by client itself. MOM supports activation based on requests. This means by activating the trigger, where application program started as well the request message or reply message have been arrived in local queue and when it is not quite active. This can reduce the resources. Client' components use MOM to send message to server component through networking. The message contains confirmation about an event or request to perform services from server components. The content of the message includes service parameter. Server responds client' request with reply message contains the results of the service performed. MOM can be seen having tolerance with mistakes, since it can use constant queue, saved it in hard disk. This type of queue is perfectly use when the application cannot be connected directly (such as computers, mobile phone).

Message queue consists of two types that is constant and inconstant and set by queue manager. If the server were failed, the information will be saved after server restart. Constant queue is chosen when reliability considered more important than performances, such as money transferring in the bank. To increase reliability, message queue supports different Quality of Service (QoS). This Qos determined as follows:
1. Credible message delivering : as long as there is no packet networking lost in message transmission..
2. Guaranteed message delivering : message send to destination in instant (on timenetwork available) or immediately (late-network unavailable). In the case of lateness, middleware guarantee that message will be sent as long as network available in recent time.
3. Certainty, original message delivering (non replicate) : if the message is sent, it only sent once.

C. PL/SQL

PL/SQL (Procedural Language/Structure Query Language) is a block contains procedural language scripts. PL/SQL is procedural language to extend SQL capability. PL/SQL makes connection to the gap within the database and procedural language programming. PL/SQL allows the user to combine between commands SQL using to take and execute data manipulation by using procedural commands such as If control structure, looping to execute data processes. PL/SQL combines manipulation data potency from SQL with the strength of data process from procedural language.

In general, block or unit program of PL/SQL can be divided into two categories, as follows:
1. Anonymous Block (block without label/name)

2. Stored Subprogram (subprogram saved)

Stored Subprogram is a block PL/SQL that compiled, saved into database with a label and ready to be executed. Thus, data saved in data dictionary will become object scheme as can be referred or applied by applications connected with the database. PL/SQL consists of two subprograms that is procedure and function. Stored procedure can be sent for and executed by calling the name procedure. Actually, Function almost the same as producer but a function always give return value.

D. Social Messenger

Social Messenger is the recent communication technology based on messages. Social messenger technology enables people to communicate without limited by time and space. The rapid growth of information technology leads to the emerge of various social messenger, Yahoo Messenger is one of them. Yahoo Messenger (YM) is a well-known instant messenger program provided by Yahoo. YM is available for free and can be downloaded and accessed by using Yahoo ID and concurrently to access another Yahoo services like Yahoo Mail. Using YM, user can enjoy exchange message facility based on text (chatting), video (webcam) and voice. YM is so popular since it is easy, complete, fast and secure, that makes YM become the most messenger application used recently.

With this messenger technology, the message exchange process between each site will be faster and cheaper. It says so since there is no charge to create an YM account, so by using this media the distributed system cost seemed cheaper.

III. RELATED CONCEPTS AND TECHNOLOGIES

A. Communication Mode Component

Communication model of MOM by using social media messenger consists of message delivering module and message receiving module. Message delivering module functions as sending the encrypted message to message queue of MOM according to the address. While, message receiving module functions as supervisor of the received message and take quick action to inform that message come into message queue. Besides, message receiving module will decrypt the message before processed further. Encrypt and decrypt process are being used to maximize security of the message sent by social media messenger.

B. Message Format

MOM communicates to all sites of registered MOM. To carry out delivering process between MOM and its sites, it needs to have message format.
According to inadequacy of yahoo messenger which only can send messages maximize 800 characters so the message format as following:
text_message#multipart_status#index_multipart# numbers_of_parts #message_type#message_id
- text_message is message proceeding by autorespon service (max 760 characters)
- multipart_status is useful as a signal if amount characters from message sent over 760 charcters or not.

Value = 0 (if less than 760 characters) and 1 (if more than 760 characters)

• index_multipart is useful as index to sequence separated message into several parts so make it easier to recombine. Default value = 1 (multipart status = 0)
• numbers_of_parts valued 1 (if amount characters less than or equal to 760) and valued more than 1 (if message characters more than 760)
• message_type is a signal that defines message execution process on autorespon service. Below the types of messages been used:

1. Normal message type, only contains standard information without executiom or autorespon processes. (type valued = 1)
2. process_sql_searching message type is type of message contains sql syntax to proceed information search. This process will automatically reply message sender with the information resulted in execution (type valued = 2)
3. result_proses_sql_searching message type is message type contains execution results typed 2 (type valued = 3)
4. process_plsql message type is message type contains syntax PLSQL to proceed information search and manipulation data process. This process automatically reply message sender with the information results of this execution. (type valued = 4)
5. result_process_plsql is message type contains the results of message execution typed 4 (type valued = 5)

Examples of messages by message type 2:
SELECT a.nama_user, a.alamat_user, a.phone_user FROM tb_user AS a WHERE a.username LIKE "%putu%"
#0#1#1#2#1012012041800000001
Examples of messages by message type 4:
CALL show_user("%putu%")
#0#1#1#4#1012012041800000001

IV. MODELING SYSTEM

A. Statement of Purpose

MOM based on YM is a system model that used to synchronize data from some sources in coherent form so each related organization received all accurate information since information available always has been renewed. This application tasks to receive, execute and give automatic respond to each user' requests through decided format keyword (PL/SQL and dynamic SQL). Therefore, this software is able to apply in integration process of distributed system.

This model might be dynamic software since it can be reflected into all types of format keyword (PL/SQL and dynamic SQL) which made according to recent needs and data sources, without modify the program code from the previous system. This one considered more effective in the process of information search and data manipulation.

B. System Overview

The overview of the system can be seen in picture 1 below, including the explanation of each process.
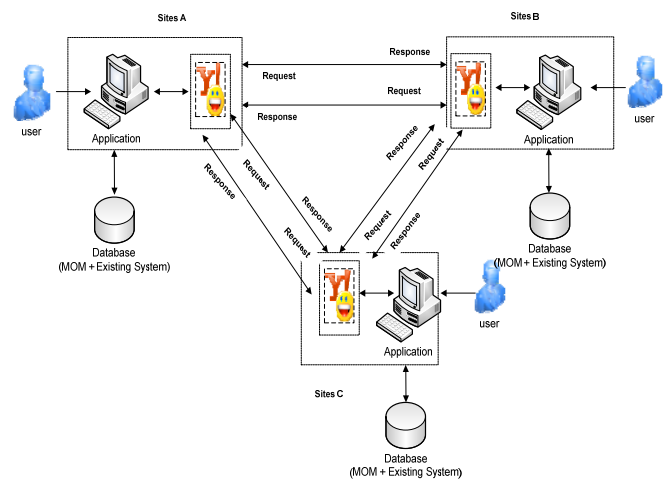

Fig. 1 Overview MOM Based on Social Messenger

System overview started with system setting process by admin, the setting covers database selection process as data source, setting process and activation of yahoo account as communication media inter-site, site identity setting process and site data listening involves in integration process, autorespond service activation, keyword formulation, and the last data integration process (information search and data manipulation). Integrated data applications of yahoo messenger basis will automatically sending messages to other registered sites in the system.

V. ARCHITECTURE SYSTEM

This system is a MOM dynamic model since it is easily to adapt in business process occurred. By only creating keyword for each branch, it is easy to carry out integration data both manipulation data and information search. The strength of keyword use (PL/SQL and dynamic SQL) makes this MOM model become flexible and simple in implementation at any system without affecting other process on the previous system. Below is the brief explanation of system architecture and its implementation.

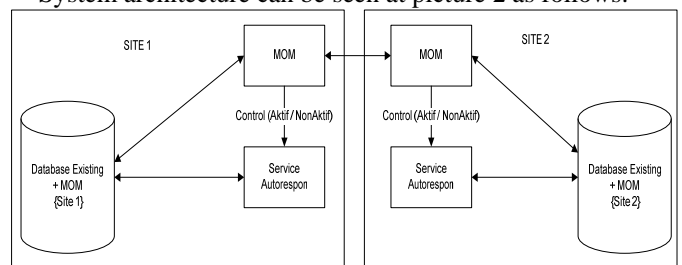System architecture can be seen at picture 2 as follows:

Fig. 2 Architecture System

Based on the picture above, it can be seen components are involved in the system. There are two main components as the core of the system, those components are MOM components and autorespon services. Below is the detail information of each component.

A. MOM components

MOM components are components that function as panel or main menu of MOM, it happened when the

occurring of all integration data process configure by this components. Processes involves on this components are database selection process as data source, setting process and activation of ym account as communication media inter-branch, branch identity setting process and branch data listening involves in integration process, autorespon service activation, keyword formulation, and the last data integration process (information search and data manipulation using keyword). Below is the component architecture of MOM shown:
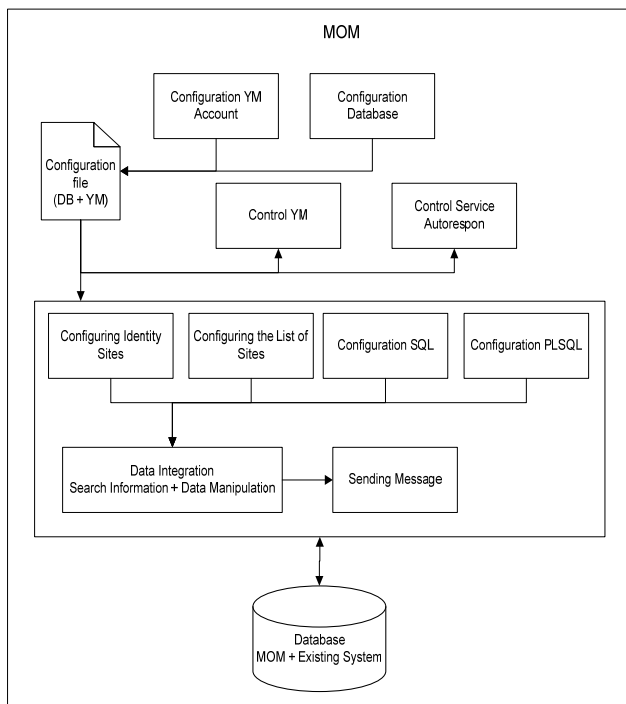

Fig. 3 Mom component architecture

B. Autorespon service components

Autorespon service components are the active components lied on the background of the system that function as an executor on each particular message received and send the results of that message execution. Each message always have message identity (type), this identity is used as a signal on each execution process or delivering process. Below is the type of message registered in these components:

1. Text message
2. sql_search
3. Execution result sql_search
4. Plsql
5. Execution result plsql

Based on message types above, only the type 1, 3, 5 that cannot able to be executed by these components. The only reason is those types do not need execution process as well.
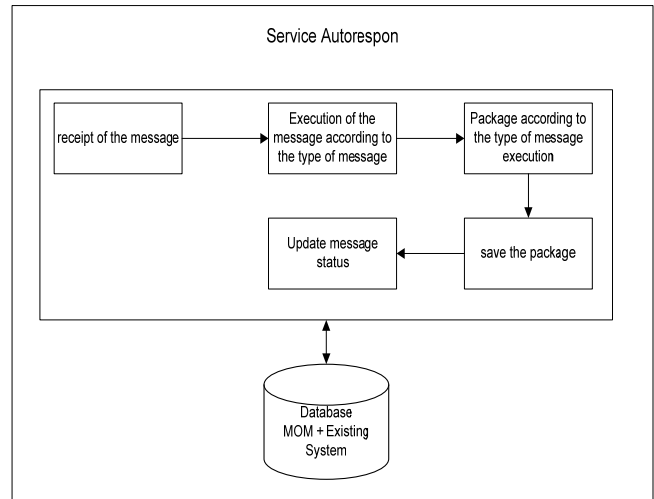

Fig. 4 Service component architecture

VI. ANALYSIS OF ADVANTAGES AND DISADVANTAGES OF THE SYSTEM

A system would have advantages and disadvantages. The advantages of the system have been made are as follows:
1. Flexibility in the implementation of a database

At the preparation system process, it has been shown that objects needed in integration data process as table (includes trigger) and procedure, to be added on the previous database. Those objects do not have any connection with the existing object on the previous database. So, table object and other object that already exist on the previous one will become data source that manipulated during data integration process occurred, meanwhile, additional data will be used to save required data in integration data process.
2. Keyword flexibility used in integration data process
Keyword (PL/SQL and dynamic SQL) that supports integration data process can be made according to the needs.
3. Table flexibility that can be manipulated during integration data process

The table features is flexible or in other word can be adjust according to the needs. Not all tables in database can be manipulated. This matters to save the existing data security.
4. *Field-field* table flexibility that can be manipulated during integration data process

Similar as table, field-field table can be manipulated during integration data process and it is flexible or easy to adjust according to the requirement. Not all Field-field in the table can be manipulated. This matters to save the existing data security.
5. Data security
Data security of message sent by using yahoo messenger during integration data process is guaranteed since before message delivering process, the message will be encrypted first in case another party will infiltrate through yahoo mesenger address without knowing the content of the message delivered.
6. Lost data handling during integration data process

Disadvantages of the system have been made are as follows:

1. User must have the knowledge and profound understanding of database and business process from integration data system made.

2. System will not execute integration data appropriately if one object or required data are not available.

3. Keywords that been used in integration data process only perform information searching process and data manipulation on several tables of database. Those keywords cannot handle other processes requested by the user, so this system only suitable to handle the cases that do not required specific additional process.

VII. CONCLUSION

This paper proposed integration data process and maintaining data consistency in efficient and at low cost. Even using the messenger service (yahoo messenger), the system also completed with encrypted and decrypted message process, so that message are not easily to be read by other party. PL/SQL and dynamic SQL using as keyword that support integration data process make the system likely more dynamic and flexible.

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REFERENCES

[1] R. P. Bob Hulsebosch, Wouter Teeuw. "Middleware tintel state-of-the-art deliverable". 1999.

[2] Nunn R., "Distributed Software Architectures Using Middleware", 2005. Available: http://www.cs.ucl.ac.uk/staff/ W.Emmerich/lectures/3C05-02-03/aswe18-essay.pdf

[3] Hennadiy Pinus, "Middleware: Past and Present a Comparison", June 2004. Available: http://userpages.umbc.edu/~dgorin1/ 451/middleware/middleware.pdf

[4] W. Emmerich. "Software engineering and middleware: A roadmap." Communications of the ACM, pages 117-129, 2000.

[5] An Xiao-Fei, Bian Li-Ying, "Design of Message-Oriented Middleware of Distance Teaching Platform Based on Distributed Message Control".2010. in International Conference on Computational Aspects of Social Networks.

[6] Philip. A. Bernstein. "Middleware: a model for distributed system services". Communications of the ACM, pages 86-98, 1996

[7] J. M. Myerson. "The Complete Book of Middleware". Auerbach Publications, 2002.

[8] Jinfu Wang, John Bigham, Bob Chew, Jiayi Wu, "Enhance Resilience and QoS Awareness in Message Oriented Middleware for Mission Critical Applications", 2nd Symposium on Middleware and Network Applications, April 11-13, 2011, Las Vegas, Nevada

[9] Talarian: "Everything you need to know about middleware", 2000. Available: http://searchwebservices.techtarget.com/ searchWebServices/downloads/Talarian.pdf.

[10] Curry Edward, "Increasing MOM Flexibility with Portable Rule Bases", IEEE CS Press, 2006.

[11] Curry, Edward. 2004. "Message-Oriented Middleware". In Middleware for Communications, ed. Qusay H Mahmoud, 1-28. Chichester, England: John Wiley and Sons. doi:10.1002/0470862084.ch1. ISBN: 978-0-470-86206-3

[12] Ghazi Alkhatib, Ronny S. Labban, "Transaction Management in Distributed Database Systems: the Case of Oracle's Two-Phase Commit".2002. In *Journal of Information Systems Education*

[13] Gunjan Verma, Vineeta verma, Komal Singhal, Megha Maheshwari, "Transaction Processing and Management in Distributed Database Systems".2011. In International Journal of Computer Science and Technology

[14] Hitesh Kumar Sharma, Ranjit Biswas, Aditya Shastri, "PL/SQL and Bind Variable: the two ways to increase the efficiency of Network Databases".2011.