Distributed System for Report Efficiency in Manufacture Research and Development Division

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Abstract—**Research and development (RnD) related to many other departments to gain the performance appraisal. Manufacture business unit started by RnD's design, prototype, customer testing, and finally mass production. After all production steps ran, then all data from involved department will be collected including marketing, quality assessment, accounting, and also customer support to see the achievement. A cost down activity that can run anytime must be maintained effectively to get the accuracy. The report of accuration will influence in annual reward as the appreciation. Data flow must be designed to lead the information distributed effectively, up to date and accurate. Distributed system by fragmentation and replication is the best way to realize the information needed while the data is maintained by a big data management system. A network topology must be chosen wisely to support the system. The result of this research is a reliability of information system that is important for any report in the company.**

Keywords: performance appraisal, accuration, distributed system, fragmentation, replication

I. INTRODUCTION

In the manufacturer industry, a research and development team is mandatory, where business process started from. It creates new idea to fit the market needs, thinking efficiently in resources, utilization, processes, and also troubleshooting as well. Therefore, the team records so many data for many important purposes related to the product design as data history. Bigger institutions have more complexity of data in their database to accommodate every single business process, including the site issue that must consolidated. As The distributed database system is the combination of two fully divergent approaches to data processing: database systems and computer network to deliver transparency of distributed and replicated data [1][2][3]. Next issue is how to manage several database management system (DBMS) in which developed autonomous and locally to work together each other and serve information.

A simple way to establish data communication is network connecting, either intranet or internet. However, the Internet architecture is based on Client/Server (C/S) topology, therefore cannot use efficiently the client's features. Also, with appearance of new technologies such as ad-hoc networks, sensor networks, body networks, home networking, new network devices and applications will appear [4]. It is just because the new trend is about how

internet can be used as information server that supports the decision making, not only data transferring. To do this, infrastructure have to be designed and prepared properly by involving software development also.

Nowadays, one of the most important and difficult challenges in software systems research is to develop software and tools for storage, manage, and handling information on large amounts of data [5]. This issue related to the data complexity in the research and development needs, to analysis, history tracking, problem solving, predicting, do some preventive action, and decision making for business related in managerial perspective. As the division management, distributed system strongly supports general business management system.

II. LITERATURE

A. Distributed Database

Distributed database is a concept of distribution data storage at different remote locations [6]. In fact, many of servers are used to store these databases basically caused by separated location issue. The next problem is how to ensure all of data collected can serve a meaningful information at the time with no differences among the servers, so that can be used further. Databases have to be distributed to get the agility of operational transactions, and simplicity of uses because of its independency as well. The architectural distributed database system is shown as Figure 1.
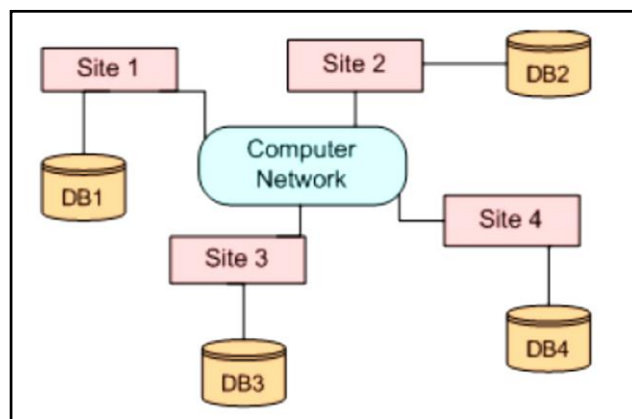

Fig.1. Distributed database system

While a distributed database management system (DDBMS) is the software that manages the distributed databases (DDB), and provides an access mechanism that makes this distribution transparent to the user, so it is the integration of DDB and DDBMS [7]. Because of this integration proposed to merge the databases through networking technologies, the system must possible to runs on a collection of machines that do not have shared memory, yet looks to the user like a single machine. This system has a benefit that local database still works even if the company network is temporarily broken [8]. It is makes sense since the system is described as collaboration of single databases.

Actually there are three main tasks of distributed databases development:1) improving the handling of failure, 2) separating the system manager from the transaction manager and 3) implementing multiple transaction generators with interfaces that run on mobile devices [9]. Considering all three issues mentioned, DDB helps the institutions with high rate of data operational transaction and communicate with many departments or divisions. For instance, Research and Development (RnD) which communicate with data centre, finance, quality control, and marketing to do their daily activities. The implementation of the concept is align with the characteristics of DDB [10]:

- Data is used at one location only.
- Data accuracy, security and confidentiality is a local responsibility.
- Files are easy and used by only a few applications. In this case, there is no advantage to maintaining difficult centralized software. Cost of updates is too high for a centralized storage system.

Another perspective about data management is distributed computing, that is a decentralisation approach to computing which is a potentially very powerful approach for accessing large amounts of computational power [11]. Many computers work together individually by their own resources to do large number of data transactions, will be more effective because each computer does not access the same resources at the time. After they finished the job, data transaction then could be consolidated for any kind of managerial purposes. Figure 2 describes decentralized database system, that every site member has single own independence database.
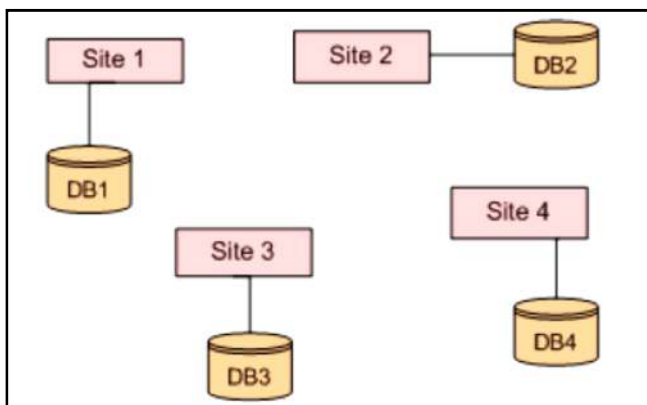

Fig.2. Decentralized database system

B. Datawarehouse

In recent years, due to increase in data complexity and manageability issues, data warehousing has attracted a great deal of interest in real life applications especially in business, finance, healthcare and industries [12]. It is related to data utilization in various fields of business management, especially decision support system. Data collection has also many types for the purposes, not enough by text documents, but image, sound, or even motion picture creates a certain complexity. The complexity of these challenges requires continual improvements in operational strategies based on accurate, timely and consistent Information [13].

Information distribution centres are time-variation since they keep up authentic information and late information for whatever length of time that required. This contrasts from the information that is put away inside value-based frameworks [14]. In the RnD Division, both of time variation and value-based approach will kept together, since they need historical data for trace or trouble shooting purpose. Finally, datawarehouse considers both of size and complexity issues to establish DDBMS that may need extraction, transforms, and loading process for each transaction.

C. Report in Information System

It is strongly recommended to managed reporting system tightly to drive managerial decision support system. An important channel through which organizations try to meet these demands is sustainability reporting. Then the organizations can execute many things listed in the strategy planning like aim to increase transparency, enhance brand value, reputation and legitimacy, enable benchmarking against competitors, signal competitiveness, motivate employees, and support corporate information and control processes [15][16]. Furthermore, sustainability reporting is being increasingly recognized as an important factor contributing to corporate sustainability. So the key word of reporting in the corporation especially for manufacture is sustainability reporting.

Now, a certain subsystem developed quickly to make reporting more attractive and informative, that is Information System (IS). An IS is a system in which human participants and/or machines perform work (processes and activities) using information, technology, and other resources to produce informational products and/or services for internal or external customers. This very powerful in the industrial environment since information lead to the best strategy planning and executing, even interrupted by some modification during implementation. It has capabilities generating managerial strategy planning, economic analysis, creates awesome products, pricing policies, and many more [17].

III. RESULTS AND DISCUSSION

This research is designing certain information gathering to build a comprehensive report in Research and Development Division. As described that the division need external data input and accommodate several types, it is considered to prepared data warehouse design first. In every common discussion of product design, we need at least four data marts involve in the system. Commonly business was

triggered by marketing team, through sample request (number) as the experiment/ project reference. The system managed by web-based application to provide the agility of salesman even if they are on field. Inventory data mart gives data stock, including batch number, incoming and expired date, availability, and also storage location which very useful to decide what material to be chosen in an experiment. For cost efficiency reason, we need to know the cost of material per each in which supplied by purchasing division. Finally, to wrap formulation up finance division will calculate total cost of product, immediately appears in the application interface. The scheme of data warehouse design is star scheme as illustrated in Figure 3.
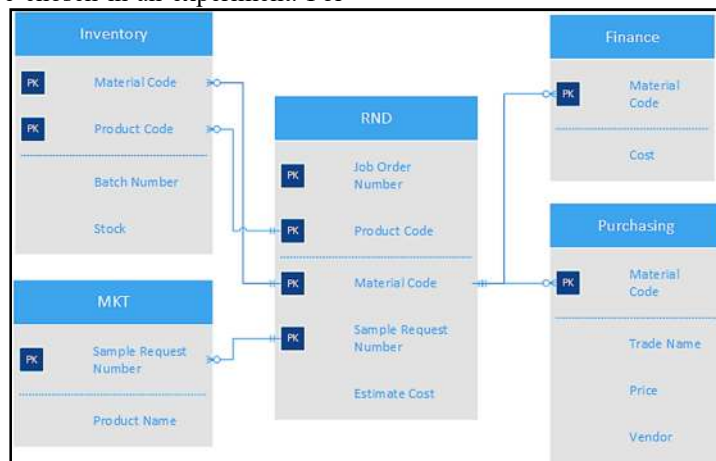

Figure 3. Star scheme RnD data warehouse

However, for specific reason eventually external data need to be retrieved for a period of time to compare initial condition with current. The product will be assessed after tested for a while to ensure the consistency, even the market price changing before launched. After all data test complete, the sample then will be delivered to the customer to pass the actual trial/ real condition. Once the response is positive, then commercialization executed immediately. Therefore, in this research concerned to:

1. Distributed Concurrency Control, to ensure data supply availability especially for mobility needs as the division has remote locations. This condition absolutely needs mobile system.
2. Replication Control, as division members has relatively high mobility in their job, data replication helps retrieving accurate information. But the control must be implemented to prevent any leak of data transfers.
3. Deadlock Handling, this situation related to the high rate of data transaction traffic, because of the network topology. That's why very important to prepare network and communication architecture earlier.
4. Security and Privacy, this term of course to balancing the data transparency among division members and also how to protecting from external accessing, since it will be delivered as a mobile.
5. Resource Management, because of the division is not administratively focused, need to be served a simple and powerful resources so the system will easy to run. The research shows that an enterprise hardware is not the priority unless they need a simplicity and high availability data.

The business process of experiment reporting can align with the simple algorithm as described in Figure 4.
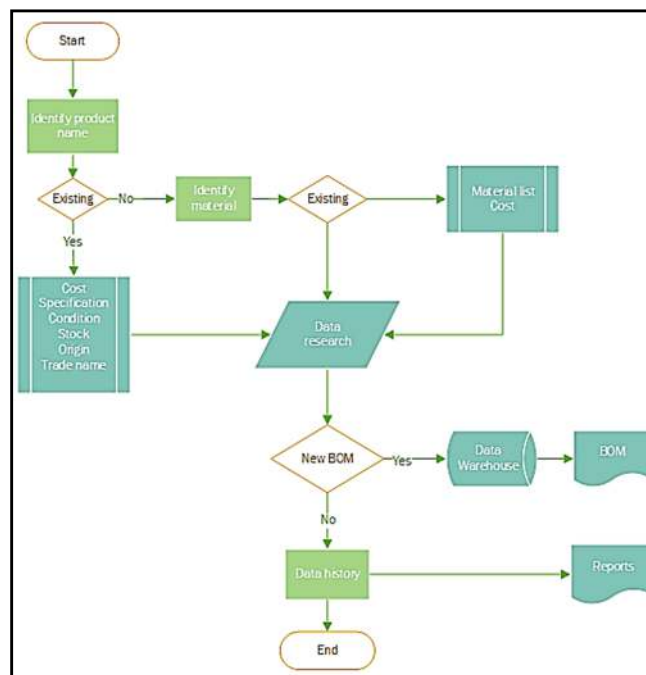
Fig.4. Experiment reporting algorithm

The DDBMS is created to accommodate mandatory information requirement for Research and Development Division:

- Retrieve data regarding assets listed in the inventory system followed by meaningful variable/ specification.
- Getting historical data either achievements or ideas.
- Analysis data by comparing competitor products, capture customer requirements, and predicting forecast.
- Calculated production cost lively, so it can be delivered to the market with best pricing policy.
- Information sharing internally related to research acceleration.

IV. CONCLUSION

Distributed Data(base) of research and development division designed to getting the simplicity in data retrieving, data collecting, and data capturing to build a sustainable reporting. While the report of any works in the division are the assets to run daily business process whereas online access for a better information availability. The main purpose of distributed data in the reporting are retrieve existing documentations for data analysis with update cost calculation to win the competition and finally can be shared and reported to the management as performance business report.

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