CLIENT/SERVER TECHNOLOGY AND ITS IMPACT ON ENTERPRISE RESOURCE PLANNING SYSTEM

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ABSTRACT
In this Information era, Client/Server model is gaining popularity as people begin to reckon the benefits of this technology. As a method for dividing the tasks of the application into several dissimilar components in a networked system, this technology is bringing long term cost benefit for support and development.
This paper serves the purpose of reviewing and discussing the client/server models. A comparison between ERP solution from Oracle and SAP, and a discussion of Service Oriented Architecture (SOA) impact on ERP and distributed system are also presented towards the end of this paper.

Keywords: Client/Server Technology, ERP System, Service Oriented Architecture.

1. OVERVIEW OF THE CLIENT/SERVER MODELS

In general, Client/Server refers to a network where a client program requests a particular service from a server program which usually resides on a different machine. In client/server architectures, database server is applied to provide a query response rather than whole file (Schussel, 1995; Sadoski, 1997).

1.1 One-Tier Architectures

This is the simplest form of client/server technology. The configuration only requires a mainframe host and terminal that directly connected to the mainframe (Micromax Ltd., 1999a). Yet, One-Tier Architecture is not suitable to implement in the enterprise-wide organization because it does not have access to the remote services (Chaffe, 2000).

1.2 Two-Tier Client/Server Architectures

In this implementation, three components of application, Presentation, Processing and Database are distributed in two entities: client and database server (Schussel, 1995). Presentation is handled at the client level, while access to database is provided by server. The processing management is split between client and server, thus creating two tiers.
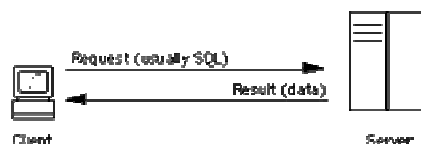

Figure 1. Two Tier Client Server Architecture Design (Gallaugher, 1996)

The client requests a specific service, from the database server, in form of Structured Query Language (SQL) and then the server will answer the query by matching it against a relational Database Management System (DBMS).

However, most of the application is processed in the client side and the server only provides the part of processing that related to data retrieving (Gallaugher, 1996; Sadoski, 1997).Thus, the client carries out the whole application workload and the needs to store numbers of application oriented procedures at the client is increasing (Micromax Ltd., 1999a). Another limitation is that different language used in client-based applications possible create a conflict with the vendor preferred database procedures, thus it limits the choice of DBMS for applications (Sadoski, 1997; Micromax Ltd., 1999b). Lastly, under this design it is difficult to move program functionality between servers without manually restoring procedural code (Sadoski, 1997).

1.3 Three Tier and N-tier Architecture

The tree tier architecture (Figure 2) has evolved in response to the two-tier schemes limitations. This design put the presentation, processing, and data management into three different software tiers. The presentation program resides on client side and database server handles the data management. However, when a function is requested, the presentation client is now calling a middle tier functionality server rather than database server. The middle tier, then performs queuing, executes calculations or carries out the requests as a client to database servers (Gallaugher, 1996; Sadoski 1997). All the business-objects that construct the business rules are served to the client-tier by this server. This tier also utilizes the object oriented analysis (OOA) accordingly configuring the middle tier straight from the CASE-tools that endorse OOA. Another benefit is that this architecture sets the client side only to hold the visual components of applications and puts the other on the server-side as configurable objects. Therefore, it is easier to implement a change management because components of a program will only be exchanged on the server side rather than on many PCs (Distributed Technologies GmbH, 1998).

This architecture mostly uses a Remote Procedure Call (RPC) as mechanism of communication in which let the client to simply put on parameters for a request and specify its own data structure for a report. Because the three tier presentation client is not necessarily sending SQL, data can be structured "hierarchically, relationally, or in object format without requiring changes to PC-based presentation clients" (Gallaugher, 1996). This compliance allows the organizations to easily utilize

data from the legacy system and arrange the data for newer database technologies (Gallaugher, 1996; Micromax Ltd., 1999a).
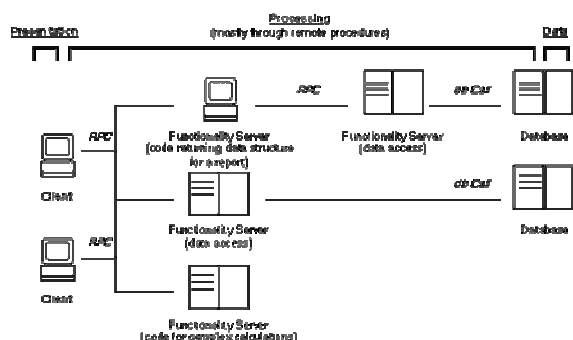

Figure 2. Three Tier Architecture.
(Gallaugher, 1996)

The three tier architecture then can be expanded to N-Tiers in which the middle-tier integrates and couples the services from various types of server to the client, and to each other (Micromax Ltd., 1999a). However, the language for middle-tier is still in immature stage, therefore potential problem in maintaining the code through whole IS organization is looming (Gallaugher, 1996).

2. THE COMPARISON BETWEEN ERP SOLUTION FROM ORACLE AND SAP

Currently, SAP and Oracle are the two leading ERP system developers. The comparisons of their client/server ERP products, SAP R/3 and Oracle E-business Suite are based on the business delivery cost, installation, disaster recovery and data security.

2.1 Business Delivery Cost

Total number of CPUs, Operating system licenses, application-related licenses, LAN installation, storage connections, Administration costs, Floor space, Cooling capacity and Power consumption (kW) comprise the cost of client/server software implementation (Atre, 1995; Tolkes, 2003). SAP R/3 product prices are start from $4,000 per user. Then there is cost implementation which is determined by Timeframe, Resource Requirements and Hardware. Consequently, SAP project may need from $400,000 to hundreds of millions dollars (Independent SAP Information, 2005). On the other hand, Oracle E-Business Suite sells its license for $4,000 per "power user" and lower pricing "casual users"; discounts for volume buying also available and there is a different pricing for hosted solution (ecommercetimes, 2005). Thus, Oracle's approach has some cost benefit over SAP R/3's offering (Rainier, 2005).

2.2 Disaster recovery

SAP R/3 system does not have a disaster recovery solution, however SAP provides the users with procedures and techniques for backups and restoring the SAP environment (Danielsson, 2002; Hernandez, 2000). The disaster recovery application for SAP usually provided by third party, depends on what kind of RDBMS that the installation use, such

as Network Appliance (NetApp) Filers, Aviant even Oracle products, or developed in-house. In contrary, Oracle E business Suite is embedded with Oracle Data-Guard as a default complete disaster recovery that range from administration, data management and controlling to quickly prevent, detect and recover from unintentional system suspension (Oracle, 2005).
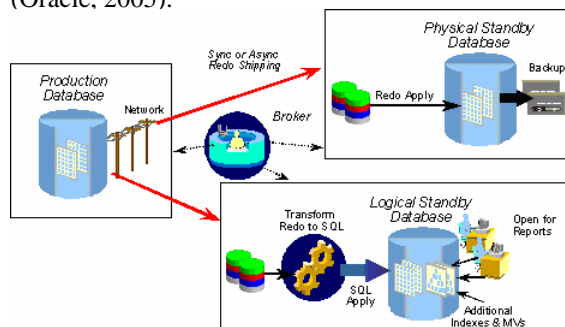

Figure 3. Data Guard Architecture Diagram
(Oracle, 2005)

2.3 Installation

Both, SAP and Oracle use installation wizard to handle the installation procedure, yet implementers often must complete the installation manually by doing additional step outside the wizard. SAP and Oracle also provide process modeler for configuring business requirements, however SAP modeling can only be applied within its own applications. For data transportation, Oracle utilizes iSetup to automate and generate parameters and flows for the application to be used. While, SAP equips users with tools that allows data transfer from different sources without any programming. To be integrated with web services and other vendor applications, Oracle uses open connector standards such as SOAP or WSDL and SAP utilizes a Web-service based proprietary method called SAP Netweaver (Rainier, 2005).

2.4 Security

The most important security features provided by SAP (figure 4) are User Authentication and Authorization, Auditing Tools, R/3 Internet Applications Security, Secure Network Communications (SNC) and Secure Store and Forward Mechanisms (SSF). SAP provides Data Security up to the user level. In SAP R/3 system, users are assigned by Client in which setting for each user is Client dependent and the level is regulated under Authorization Object in the form of authorization, Profile and User ID (Corbitt C & Menshing J.R, 1998). To provide security of R/3 Internet Applications, SAP Internet Transaction Server (ITS) stands in between the Web Server and the R/3 Application Server. Secure Network Communications (SNC) provides protection for the communication links between the distributed components of an R/3 System and enables the organizations to use third party security product. Secure Store and Forward (SSF) Mechanisms enfold R/3 data and documents in secure formats, before they are saved on data carriers or transmitted over communication links (SAP, 2005).
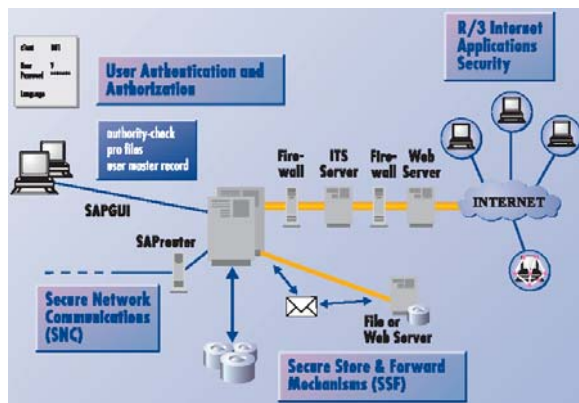
Figure 4. SAP R/3 Security Mechanisms
(SAP, 2005)

Oracle E-business provides security through Virtual Private Database, Oracle Label Security, selective data encryption and auditing. Virtual Private Database enables separation of per-customer data access within single database.
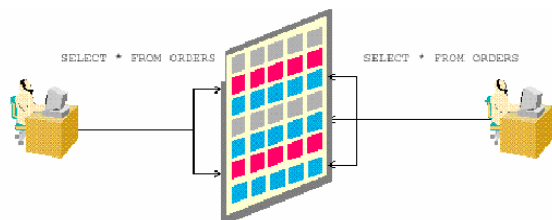

Figure 5. VPD: User sees their own orders.
(Heimann & Ng, 2005)

Label Security allows the company to mark data with appropriate sensitivity label, therefore it controls the access to the data based on that label.
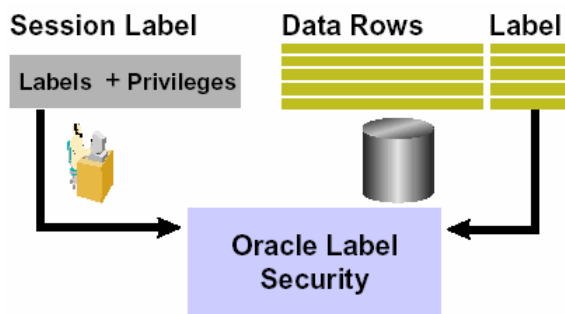

Figure 6. Oracle Label Security
(Heimann & Ng, 2005)

For internet transactions security, Oracle provides SSL, Java security, proxy authentication, and Enterprise User Management (Heimann & Ng, 2005).
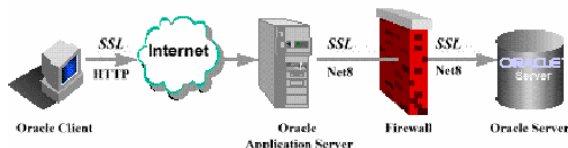

Figure 7. SSL secure Internet and Oracle Communications (Heimann & Ng, 2005)

Oracle-based products have password authentication which encrypted with a customized DES algorithm for every database connection. The administrator may put user limits on certain system resources or prevent users from accessing specific commands. Oracle also has two types of privileges that allow a user to create or manipulate objects, without accessing actual database objects, or allow access to a specific database object (Hazel, 2001).

3. SERVICE ORIENTED ARCHITECTURE (SOA) IMPACT ON ERP AND DISTRIBUTED SYSTEMS

To be successful in today's hyper-market era, enterprises must be quickly adapt to the ever-changing business requirements and integrate the processes faster to generate more earnings. A new solution based on a service-oriented architecture (SOA), will deliver these benefits. In computing, the term Service-Oriented Architecture (SOA) refers to an architectural concept that "defines the use of services to support the requirements of software users" (Wikipedia, 2005). SOA deem a software as method that sustain whole business processes and each element of service that provided by software can be utilized and re-used for another functions across the system (Bisson, 2004).

Figure 8, illustrates a service-oriented architecture which places services on top of the business objects and the legacy system rather than to entities within the software. The orchestration layer, is responsible for organizing calls to the business objects and managing responses and the database itself becomes common resource. This architecture employs XML to tie applications together through the system. XML also set as common language to connect new tools to legacy systems, and because of its widespread usage in HTTP protocols, XML able to link the businesses across the internet (Bisson, 2004; Senor, 2005).
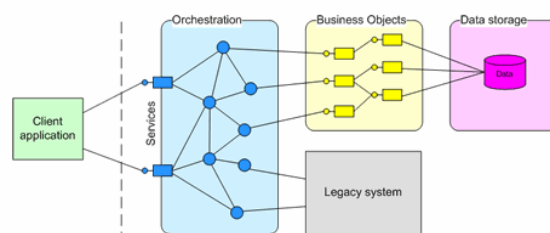

Figure 8. Service Oriented Architecture.
(Bisson, 2004)

Thus, once the business entities is exposed as sets of service, any other programs that have same standards and protocols can access and use this service to converge or develop new breed of applications. Furthermore, SOA allows the users to revise service, without interrupting the applications or processes and consequently, reduce deployment time of upgrades (Bisson, 2004; Brown J.S & Hagel III, J, 2005).

What is the impact of SOA towards ERP and distributed system? It will be more likely that the ERP applications become modular and more trouble-free to "plug and play" with. ERP applications also will evolve provide more web-

based interoperability to link the services on the internet, whether it's from the legacy system or an external business partner (Manes A.T, 2005). Upgrades of a system will also become less bulky, because SOA incorporate each element of a service as a component that can be re-used many times. Therefore, services can be upgraded and scaled regarding to what the enterprise needed at that particular time (Bisson, 2004; Manes A.T, 2005).

4. CONCLUSION

The creation of a scalable, maintainable, and effective distributed computing system has proven to be a frustrating task for large organizations worldwide. Now, that client/server technology has transformed the design of Information System many software vendors developed their products based on this architecture. For instance, SAP and Oracle have made use of client/server concepts, offering simplicity and affordability of information technology for companies to implement. Nevertheless, newest development on this architecture, called Service Oriented Architecture attempt to overcome the complexity of client/server construction, and the scope of the organizational changes required for its maintenance and operation.

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