1.1 Middleware Technology in Banking and Payment Sector

Current generation is very dynamic and majorly focused in the area of Information and communication technology as a result of technological innovation, increased awareness and demands from customers. Today when we go through the newspaper, refer to term "new economy" or the "Information society". ICT are also introduced in Banking, Railway, Aviation, Health, Transportation, Food Industry, Manufacturing or any business bodies.

Earlier it was very difficult to wait for branch opening hours or stand in a queue, now a day’s hole banking process are going through the e-way and providing the customer to e-facilities including 24*7 customer supports. [1][2]

My research is focus on the effects of ICT on the banking sector and the payments system with middleware. My aim is to identify and understand the changes after ICT introduced on the banking and payment systems and how the technology is changing day by day. There are various methods to studying the effects of ICT on banks and payments systems. In this regard my research work is totally described about the Middleware technology in banking and payment system. Middle tier technology designed in such a way, developers provides the graphical user interface (GUI) through any programming language and user's computer contain that GUI and application-specific entry forms or interactive windows. [2]

All business logic written by developers is located on LAN (Local area network) server or may be deployed in application server like weblogic, websphere etc. The business logic reacts as the server for client request from their computer or workstation.

The Middleware technology is introduced in banking and payment system over the last few years. By using this technology banking and payment sector are very competitive in market and providing personalized or user friendly services to their users or their customers. Middleware technology basically used at second tier or middle tier in three tier technologies or in between the client or database tier, here below figure shows this architecture.[4][3]

![Figure 1 (Block Diagram for three tier technology)](image_url)
There is lot of Middle product available in market provided by different companies like Oracle, IBM etc. but there is no different by functionality wise and this technology is adopted in banking and payment system because it provides the Scalability, High-Availability, Load Balancing and Security.

1.2 Scalability

Supporting highly scalable applications is one of the strengths of the middleware system, as I have discussed above we use the application server in middle of the tier. Suppose an application initially is created and is accessible by 100 customers and application is deployed on 2 server in middle. Now suppose customer is more than 100 which are accessing the same application, what happen? answer is very simple; load will be high on server and performance will decrease. With scalability feature we can simply add one or more server as per requirement to improve the performance. As per banking environment application server must be available for 24*7 to take the request for client. Suppose banking application running on 2 servers, suddenly application getting slow due to number of request is getting increased, in that case we expand one more server that can share the load. [9][7]

1.3 High-Availability

The meaning of high availability means, a deployed or installed application in J2EE server provide the availability of services in 24*7 mode or it belong to downtime of application. It means high availability is directly related to cost, it means how much our system is highly available. At the time of SLA (Service level agreement) agreement customer define some specific down for an application, if the service is not available apart from that time that we need to pay the penalty. Basically this software (High-Availability) is a part of hardware, application and operating system. And it monitors all the activities in High-Availability system and initiates the recovery that is defined in system during failures.

In high Availability means, application that we installed on weblogic server, consistently accessible and operational to their client because in banking and payment system applications are always available for 24*7. For High availability we used cluster environment that I will cover latter in thesis.

As per today's, Application should be available in 24*7 mode with good speed and minimum down time. For it, there is a agreement happen between customer and companies that is called SLA agreement. If companies do not meet SLA then they should be charged in some cases this charge can be millions of dollars even in some system like telecom domain, there is no downtime is granted, for it we need to prepare such type of system that should be robustness, Through High availability we can prepare this type of system.[10]

High availability is the main important feature of Middleware technology. It describes how much time for our system is available and the down time that is mentioned or decided during SLA is called measurement of application.

Most of the companies, especially banking system using high availability feature because today's customer wants, every time application should be reachable.
1.4 Load balancing

Load balancing is a feature that we use in distributed system for better scalability and for better system throughput. In general, we can share the load of any application between more than one application server through load balancing and we can make the application is faster for users. Load balancing is mainly implemented in clustering environment.

We can do the load balancing in many ways, like below.

Through hardware load balancer

Through Webserver, and we can also do the load balancing after creating an application server as proxy server. [12][13]

In distributed system, we can give the better output and throughput via using the featured of load balancing. Many load balancing middleware services are simplistic, however, since they are geared only for specific use cases and environments. These limitations make it hard to use the same load balancing service for anything other than the distributed application it was designed for originally.

1.5 Security

Nowadays, we are doing everything though the internet, like shopping, booking of a ticket for railways, airline etc., it means middleware or 3-tier technology play a critical role during any electronic transaction. Suppose we are checking the balance in our personal account and checking availability of railway or flight ticket, and booking and type of ticket or purchasing anything from a supermarket then middleware publish a message in background that will moved in between the system. This architecture plays a vital role in financial system where transitions are shared through money transfer.

Here I want to focus on efficiency and security because all business that belongs to financial sector need information to be transferred between different systems and applications.

When we talk about the core banking and delivery channels, this middleware technology come in between. All important services like authorization, authorization, and communication etc., provided by middleware. It’s easy to use advanced network applications by making middleware while asking standardization and interoperability. [5][8][15]

1.6 Security Architecture

Below is the security architecture in which there are three sections Application layer, Middleware layer and underlying technology layer.
The application layer integrated in the communication path, Preserves abstraction, portability, automation. Middleware layer is the main layer which shows the Access control and audit policies, Preserves flexibility, interoperability. Underlying technology layer shows Cryptography (authentication protocols across the network) and Preserves flexibility, and interoperability. [3][9]

1.7 Literature Review

Bhaveshkumar R.Javani, APRIL 2012

This paper tell us about the security related existing pervasive computing based web services architecture and then proposes a middleware secure and scalable architecture. With open source protocols a lots of solutions have been proposed in the literature for implementing the security in pervasive environment. Most of them rely on the intermediate servers for securely transfer of data and communication between end user. This might be suitable for certain development but the broad range of users is not comfortable to accept and deploy such solutions. End-to-end secure communication between the users is a key for the communication protocol to be considered for deployment by broad range of users. The paper presents prototype architecture for pervasive computing based web service using open standards to implement a secure and scalable architecture.

Zachary B. Omariba, Nelson B. Masese and Dr. G. Wanyembi, July 2012

This paper is totally about the e-banking system. Through e-banking it's very easier to get anything within the as per demand and also get the services anywhere. The main important thing about e-banking is security and the privacy. This pepper explain all the things, First it discuss the starting or driving phase of e-banking, Second it discuss the concern about the e-banking, third about the security and privacy with regard to information and in last it says about the attack on e-banking and how we can safe us through on e-banking attack, all solution are discussed within this paper.
Communication media is very important for all technologies, Internet used by cloud computing as communication media. In cloud computing it's very important to provide the assurance of data security and this assurance provided by The Vendor. Every company or Organizations has a own Service infrastructure and they are using cloud computing as part of service infrastructure. For business critical insensitive applications, they found and examine the confidential and security issues. They provide the different services because it's difficult in cloud computing the security of corporate data. Each service provide its own type of security and it's have own security issues. In cloud computing it's very important to protect data, application, security and privacy because they all are the part of cloud computing. This paper says about some good feature of middleware with cloud computing like load balancing and SSL with cloud computing apart from that some security feature like authentication, confidentiality and integrity with cloud computing.

In today's market electronic commerce services is growing very fast. During any purchase, payment is done through different methods and online payment is one of them. In this regard network technology is not growing fast as compared to other. Over the internet, we are not safe because from virus, hacker and cybercrime. It's very important to secure our any information over the network and the task of network security management will growing more complex and difficult and how all will manage. In today's market Security threats and its parallel solutions are exits in the development of electronic commerce. This paper about on e-commerce payment security issues of network analysis.

Despite this progressive growth the security of transaction which involves money over the World Wide Web has been a major point of uneasiness for many to join this modernized way of buying and selling. It is very true that electronic commerce will revolutionize businesses, and customers will be offered new product and exciting services. As e-commerce businesses are expanding, more and more secure technologies are being developed and improved every day. There are various types of algorithms for encryptions are available, but the most commonly used for security of ecommerce transaction, such as Cryptography - Public and Private keys cryptography, DES, RSA, S/MIME, SET, SSL, and Digital Signature which will be discussed.

Karun Madan, May 2011
Nowadays everyone aware about the internet and from last couple of year everyone want to use online banking. It means number of online banking user are increasing day by day. This causes developer need to find out the easiest and user friendly methods to perform the banking transaction on mobile or can say mobile banking transactions. Transactions through mobile are very easier and comfort for user and it growing in market very fast. Currently there are two channels provide by most of the bank for mobile banking. First, through the Wireless Application Protocol over the General Packet Radio Service and Short Message Service by means of Wireless Internet Gateway. Performing mobile banking transactions is very convenient approach by user but there are security concern in today's mobile banking and still there are some improvement is required in mobile banking implementations and this paper tell all about these security concern in mobile banking etc.

Alaa Hussein Al-hamami, Fadi Ali Oqla Najadad and Mohammed Saad Abdul Wahhab, March 2012

To judge any system with regards to its failure or success Information security plays an important role. Nowadays Banking industries are taking care about the e-banking applications for transferring money and this is the one of the most critical application for any bank. Suppose we are transferring amount and at that time it's very important to maintain its process validity and accuracy to transfer the correct amount to correct receiver. This paper proposes a solution to the “Silent Banker” problem through blocking possible security vulnerabilities that Silent Banker can penetrate the security system through. The necessary tests were held through this thesis to prove the validity of the proposed solutions.

Three main phases are presented which are: phase (0): Lock the browser, phase (1): Encryption and phase (2): Decryption; all are combined in order to introduce the best results in preventing the Silent Banker attacks. Results showed that the banking side presents major role in the detection process as checking whether the transfer process was successful so to successfully transfer the amount and without any error through, or to inquire both bank and client sides about the failures if not.


In the Internet world, data centers or network servers are anticipated to be the bottleneck in hosting network-based services, even though the network bandwidth continues to increase faster than the server capacity. Most of the research is going on to minimize the response time of a Web server one of the most popular protocol is Secure Sockets Layer (SSL). This is to provide a secure channel between a client and a cluster-based network server, its high overhead degrades the server performance considerably and, thus, affects the server scalability. Therefore, improving the performance of SSL-enabled network servers is critical for designing scalable and high-performance data centers. In this paper, we examine the impact of SSL offering and SSL-session-aware distribution in cluster-based network servers. In a back-end forwarding scheme, called ssl_with_bf, that employs a low-overhead user-level communication mechanism like Virtual Interface Architecture (VIA) to achieve a good load
balance among server nodes. The experimental results with 16-node and 32-node cluster configurations show that, although the session reuse of ssl_with_session is critical to improve the performance of application servers the ssl_with_bf scheme can minimize the average latency by about 40 percent and improve throughput across a variety of workloads.

57 Meenu, Prabhat Kumar Pankaj and Tarkeshwar Nath, September 2011

This paper addresses the issue network security. The entire bank provides 128 bit ssl encryption in two way communication between client and server. This paper gives the mechanism behind 256 ssl encryption. By which two way communications is much secure (i.e.: using of secure socket layer 3.0)

39 IJCSI Publications 2009

This paper about the development of pervasive computing has put the light on a challenging problem: how to dynamically compose services in heterogeneous and highly changing environments? This paper proposes a survey that defines the service composition as a sequence of four steps: the translation, the generation, the evaluation, and finally the execution. With this powerful and simple model we describe the major service composition middleware.

33 Hamdan.O.Alanazi, Rami Alnaqeib, Ali K.Hmood, M.A.Zaidan and Yahya Al-Nabhani, May 2010

Because of the speed, flexibility, and efficiency that it offers, the Internet has become the means for conducting growing numbers of transactions between suppliers and large international corporations. In this way, the Internet has opened new markets to the world and has accelerated the diffusion of knowledge. The meaning of Internet markets or online business has been widely used in these days. The success of the business depends on its flexibility, availability and security. Since that the web-based systems should have a special way to design the system and implement it. Nowadays, the Internet Banking System widely used and the banks looking to provide the best quality system with highly available, fast response, secure and safe to use. The Unified Modeling Language (UML) is the uniquely language which is used to analyze and design any system. In this paper, the UML diagrams has been proposed to illustrate the design phase for any banking system and presented two types of architecture which is used for the Internet Banking System.

42 Jean-Michel Sahut 2008

The paper provides objective explanations of the success factors of Internet payment systems, and the domination of SSL card payment in the market (Turban and Alii, 2006). Moreover, unsuccessful experiences show that it is necessary to consider network effects (Shapiro and Varian, 1998; Shy, 2001) and which business models to implement in order to avoid killing a new Internet payment system before
it is launched. This article investigates also the stakes for the banking environment of the Internet payment systems and the problem of money creation.

78 Shashi Bhanwar, Seema Bawa 2010

In this paper, we propose TUX-INTERO - a portlet-based Grid portal for integrating existing grid technologies under a common interface and providing reliable services to the users. We have developed a prototype of TUX-INTERO - a grid portal using portlet technology. The paper presents design and development of TUXINTERO. The requirements for the portal, its design and technology choices lead to the utilization of globus Toolkit as middleware for connecting global resources, SUN N1 GE6 and Condor as Local Resource Management Systems for connecting local resources and Grid Sphere as the portal framework. The results demonstrate secure inter operation of grids as TUX-INTERO and TUX-TMS (Thapar University Extensible-Trust Management System) integrates to provide reliable services to the user.