International Journal of
Advances in Scientific Research and Engineering (ijasre)

E-ISSN : 2454-8006

DOI: http://dx.doi.org/10.7324/IJASRE.2018.32679

Volume 4, Issue 4
April - 2018

Preprocessed Online Banking Transaction Technique: An Effective Measure for Avoiding Long Queues at Banks and ATMs

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ABSTRACT

Online bank transactions such as those carried out using Automated Teller Machines ATMs have benefitted much from the concept of computer networks with centralized servers and databases. These vital components of the system make these online transactions real time in nature. But on the other side of the coin, the real time requirement and the central server concept attract some bottle necks in the system when the demand on the system gets to some thresholds. When this bottle neck occurs, the network becomes slow resulting in long queues at ATMs and baking halls thereby leading to customer dissatisfaction. These problems are peculiar with developing countries which are not up to par technologically. This paper takes a look at how these bottle necks can be avoided thereby improving banking system performance increasing customer satisfaction. In the recent times, efforts have been made by researcher to find out the optimal number of servers and ATMs a bank should operate for satisfactory system performance. This publication presents a better approach which is called "Preprocessed Online Banking Transactions". This technique involves breaking a single real time transaction into two real time transactions with the network dependent part of the transaction preprocessed from the comfort of one's home during the period of time that the network was formerly idle. The remaining part of the transaction which does not require network access is now completed at the bank's premises later. The proposed system was modeled and simulated. The existing system was also modeled and simulated. On comparison, it was found out that given any combination of system parameters, the proposed system is steadily better than the existing one and is capable of removing long queues at ATMs, saving customers' precious time and cutting banks' operating cost.

keywords: *ATMs, Server queue, bottleneck delays, Preprocessed-transactions.*

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1. INTRODUCTION

Sometimes ago, online banking was introduced in Nigeria and developing countries of west Africa, making it possible for all the branches to be connected using computer networks. Banks now have a common database so that any transaction made at any of the branches reflects in the central database immediately.

This introduction makes the following activities possible :

1. Money paid into an account at any branch can be withdrawn at any other branch.
2. Money can be transferred from one account to another.
3. A customer can withdraw money from any branch of his bank.
4. A customer can receive money from any branch of his bank.

So, the inter network between banks was of tremendous benefit to the bank and to the customers as well.

Following this online banking was the Automated Teller Machine (ATM) with the following features:

1. Some banking services became available to customers 24 hours in a day.
2. Customers can withdraw money from banks other than their bank.
3. Any bank is now your bank thereby making baking so flexible.
4. The queue inside the bank disappeared.

But as demand on the system increased beyond the capacity of the system, (as the capacity of the system was not improved in proportion with demand growth rate), the queue that left the baking hall came to the ATM to stay.

In fact long queues have become part of the side effects of online banking transaction, and other real time online services with centralized server and database architectures.

This new system has the following features:

1. Centralized server and database system. Due the fact that the server and database are centralized, there is a 'global' queue of thousands of people (although in small numbers at each of the branches all over the nation) waiting to be attained to by one server sequentially and that one server depends on one centralized database for operational data. Mathematically, one server is to attend to (total persons on global queue/ no of parallel servers).
2. Real Time transactions. The results of transactions must take effect immediately. So, once commenced, transactions cannot be suspended half way until it gets to completion. In other words, if the network is slow, it means delay to everyone in the queue. If there is no network, then people wait in queues almost indefinitely.

This has brought about increased customer dissatisfaction to an almost unbearable extent.

Several research efforts have been made to solve this problem but the solutions proffered seem not to be adequate up till now. So, this research is aimed at studying the system again to proffer a lasting solution to this problem that has been of long continuance.

2. PREPROCESSED ONLINE TRANSACTION

Before now, researchers have made effort towards determining when best a bank should add an extra server and when a branch should add an extra ATM which is rather expensive. All of these efforts are only to find a tradeoff between bank operational cost and customer satisfaction. Unfortunately none of the former findings has solved the problem satisfactorily.

One of the major causes of this problem is the unfavorable demand pattern of customers which causes a bottle neck in the network. Almost all customers place demand on the network within half the period of time the network is available. The network is available 24 hours in a day but most people place demand for real time transactions only between 7am and 9pm. So, the network is available almost half the time it is available but idle for the rest of the time.

The question now is : is there any way we can evenly distribute the demand placement over the 24 hours that we have in a day?

If we can achieve this then, we do not have to bother ourselves with additional servers and ATMs (those battling with this are statisticians and scientists but not engineers) we might even discover that we have more facilities than we currently need!

This is where the technique of Preprocessed Transactions comes in. This involves breaking one real time transaction into two real time transactions. The first part that requires the network is carried out from the convenience of one's home usually within the period of time the system is formerly idle. After this, the remaining part is completed at the bank without the need of the network- this eliminates the possibility of delays due to slow or unavailability of network.

This increases the overall utilization of the network and reduces the much load placed on the system during the peak hours.

We know that the factors that determine the efficiency of (ATM) computer network are

1. Reliability
2. Availability
3. Speed

Whereas these factors have been taken to high levels in developed countries, they are still low in developing countries. For instance:

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Availability is already almost 0.9999 in the U.S.A. This means that the network can only be unavailable for at most 15 minutes in 1 week. Reliability is also very high and up to 99.9% as we don't experience operational errors except for few cases where the machine may fail to dispense cash after the customer has been debited and that happens once in a blue moon.

The speed also is already very high as it has been observed that for over 65% of the time you are not likely going to meet more than 5 persons on the queue and each person spends at most 5 minutes.

A closer look at speed of any network reveals that the following factors affect its speed:

1. Processing. This is taken care of by faster processors.
2. Propagation. This is all about the network transmission medium
3. The stability of the Queuing system.

From closer look at the third factor, we see that the queuing system is always facing the threat posed to it by the unfavorable behavioral pattern of customers during the peak hours.

From experience we know that customers visit the ATMs between the hours 7am and 8pm due to

1. Security reasons.
2. Nature of daily routine.
3. Geographical separation from ATM.

So, network (all the networking facility acquired to keep the system available 24/7) are busy 13 hours and idle 11 hours a day.

During the peak hours certain things happen:

1. The demand on the network is at the peak.
2. The network is slowest. So, the waiting and service time for customers is longest.
3. The network facility to meet the demand on the network within this region is costly. So, the operating cost on the side of the bank is high.

We also see that meeting the demand on the network the peak hours is costly and wasteful since the facilities will be idle almost half the time.

All former research efforts focused on optimization: Determining the optimal number of servers for the bank depending on the number of customers or recorded ATM users in recent season.

Others also researched on when best to add an extra ATM to the existing ones in a branch depending:

1. Expected number of users due the calculated growth rate over the past years.
2. Expected number of users due the observed sudden development in the recent season within that geographical area.

All the former researchers see the problem as something that should be shared between the bank and the customers. Banks will have to enhance their facilities to some extent (at a cost) to increase customer satisfaction to a proportional extend also.

So, the solutions offered are restricted to addition of servers and ATMs which highly increase the banks' operational cost.

At this juncture, this publication has faulted those former approaches as being uneconomical and not cost effective.

This publication takes another look at avoiding the 'unnecessary' bottle neck experienced in the system during the peak hours without additional servers and ATMs thereby reducing banks' operational cost a reducing customers' waiting and service time which has other alternative (especially economic) uses.

One way to evenly distribute the use of the system/network is to enable customers to use/access the network during periods outside the busy hours. This means to have an evenly distributed use of the network which flattens the demand curve and stops it from entering the critical region hence making additional servers and ATMs unnecessary. This approach reduces the operational cost for banks and as well saves customers' time.

The possible way to use the network is to introduce what I will call "Advance Request " mechanism which allows customers to access the network through an android application (to be included in the existing internet banking app) and place request for cash in advance during periods outside the busy hours. This will enable them get their cash from the ATM during the day (busy hour) without any need to access the network.

One major reason for this approach is that it has been established that service unavailability is also one major reason why customers wait almost indefinitely in long queues. This may be due to the Bank's Internet Service Providers' (ISP's) fault, geographical peculiarities or sporadic irregular) environmental changes. So it will be an advantage to work with a system which operates independent of network availability as the immeasurable effect of network unavailability is smartly and completely taken care of.

2.2 Other Findings

The drastic reduction in service time for each customer can best be seen from the global queue perspective. With the queue localized, the reduction in customer waiting/service time is not so pronounced. But imagine that it takes 0.5 sec to access the central database, this implies that with 5 persons ahead of you in a local queue which needs to access the central database, you may have to wait for extra 2.5 sec in the queue. That may not sound significant. But imagine that there are 1000 branches connected to the central database and that there are 5 persons on the average to be attended to before you at each branch. This means a total of in 2500 persons ahead of you the global queue.

this is for only 5 persons ahead of you in a local queue which forms part the global queue with 1000 branches connected to the network.

Now imagine an average of 15 persons ahead of Your total waiting time in the queue becomes 1250 (2500 * 0.5) sec.

But that equals 1250/60 = 21 mins. And you in a local queue which forms part the global queue with 1000 branches connected to the network. That means 15000 persons ahead of you the global queue . Your total waiting time in the queue becomes 5000 (5000 * 0.5) sec.

But that equals 5000/60 = 62 mins. But you can only see 15 persons in the queue locally. But due to the global nature of the queue, you meet only 15 persons but spend an hour at the end of the day. So, the global nature of the queue increases the waiting time exponentially. Of a certainty, Advance Request method which sets aside the time wasting effect of global queue will be of great value to Banks and their customers.

3.0 ADVANTAGES OF ADVANCE REQUEST TECHNIQUES

1. To avoid 'Reserved Banking'. Keeping customers waiting in long queue before they collect their money from the bank may cause them to practice what I call reserved banking. Customers will begin to carry large amount of cash about because of the difficulty they face when they want to withdraw money and the embarrassment they face when there is urgent need of cash especially during emergencies. This implies that when customers become reluctant to bring their money to bank, the money that should have been made available in bank for business would no longer be there and bank might suffer shortage of cash supply to a great extent.

   But if the system is fast enough to customer satisfaction, there will be enough money in the banking system, customer waiting cost will be cut to a great extent.

2. This enhancement has to do with only software without tampering with hardware. So, it is cost effective.
3. Another reason for this approach is that it has been established that service unavailability is also one major reason why customers wait almost indefinitely in long queues. This may be due to the Bank's Internet Service Providers' (ISP's) fault, geographical peculiarities or sporadic irregular) environmental changes. So it will be an advantage to work with a system which operates independent of network availability as the immeasurable effect of network unavailability is smartly and completely taken care of.

4. CONCLUSIONS

The drastic reduction in service time for each customer can best be seen from the global queue perspective. With the queue localized, the reduction in customer waiting/service time is not so pronounced. But looking at it from the global queue concept the saved both for bank and customers is very significant. According to the results of experiments, the proposed system is steadily better than the existing one and is capable of removing long queues at ATMs, saving customers' precious time and cutting banks'

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operating cost. The new system when implemented will enable customers to place request in advance and have their transactions preprocessed ahead of time. This technique increases the utilization of the servers and also reduces the operating cost for banks.

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