

BANKSERV Goes Active/Active

April 2007

As a trusted partner, BANKSERV (www.bankserv.co.za) is an integral part of the infrastructure of the South African banking industry. It has been appointed by PASA (Payments Association of South Africa) under the National Payments Systems Act 78/1998 as a payment clearing house operation and consequently provides interbank electronic transaction switching services to the banking sector. BANKSERV prides itself on providing its clients with the highest quality of transaction, switching and value-added services in support of client business objectives while effecting significant cost savings and reducing risk and complexity in the industry.



BANKSERV is an exceptionally successful company. It performs well financially and employs a number of loyal, talented and experienced individuals. Intellectual capital and integrity form the bedrock of BANKSERV. It is committed to achieving the best possible results for all its stakeholders.

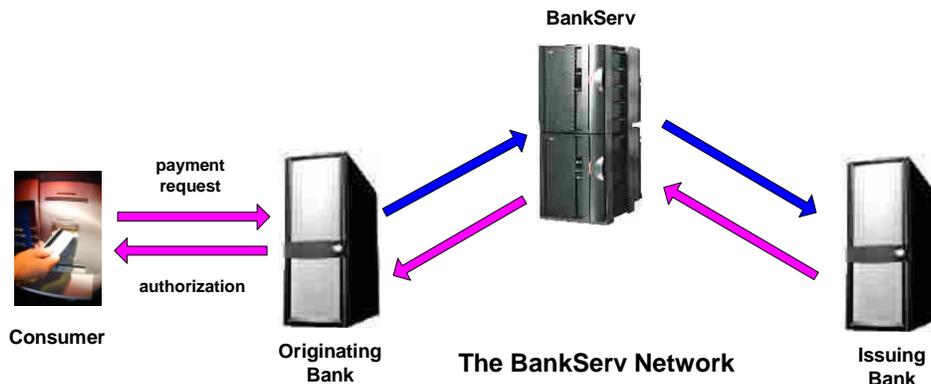
BANKSERV Background and History

Prior to the establishment of BANKSERV in the first half of 1993, the banking industry in South Africa jointly owned several companies that provided shared services to the banks in a number of different payment channels. The companies in this sector each followed their own directions and operated in their separate silos. There was clearly a need to consolidate them into a single structure. An interbank task group was appointed to investigate the feasibility of this proposal; and in March, 1993, the banking industry reached agreement and founded BANKSERV.

Payment Routing

When a consumer withdraws cash from an ATM or purchases an item via a point-of-sale (POS) device or via a debit card, a payment transaction is created. That transaction is sent to the bank managing that device. If the transaction is to be made on another bank, that transaction must be routed to the remote issuing bank, which then returns a confirmation or rejection message to the device to complete the transaction – either the dispensing of cash from an ATM, the purchase of the item, or the rejection of the transaction.

The routing of these transactions is the service provided by BANKSERV. The originating bank will send the payment transaction to BANKSERV, which will forward it to the issuing bank. That bank will process the transaction and will return a confirmation message or a rejection message thru BANKSERV to the originating bank.



Should BANKSERV's routing service become unavailable, the devices which it supports are out of service for interbank transactions. Therefore, 100% uptime of this critical service is a must for BANKSERV because if it can't forward a transaction, the customer standing at the cash register or ATM can't finish his purchase or get his money. The bank is always blamed, and this gets BANKSERV's customer banks very upset.

BANKSERV's Active/Active Strategy

According to Anton Lessing, Technical Manager of BANKSERV, 9s are of no interest to him - only 100% uptime. BANKSERV will soon achieve this extreme availability by using active/active technology to implement a Continuous Processing Architecture. In an active/active environment, multiple nodes sharing a common distributed redundant database are all actively processing transactions for a common application. Should a node go down for any reason (such as a hardware failure, software failure, operator error, planned outage, or disaster), all that needs to be done is to switch users over to a surviving node - an action that can take only seconds.



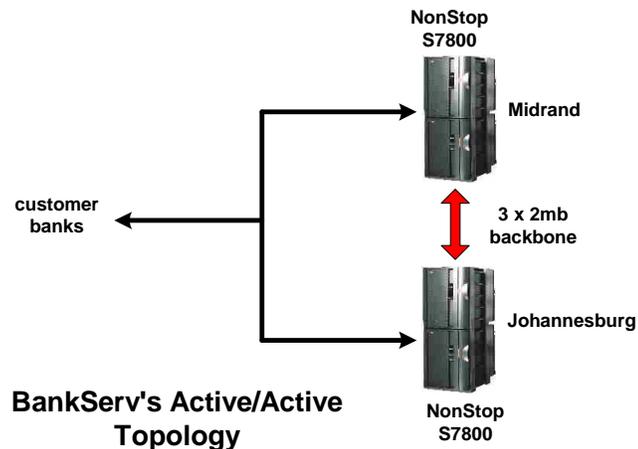
Anton Lessing
Technical Manager

Mr. Lessing feels that availability and active/active, in particular, is a rapidly growing need. There are many companies (banks in his case) that want to move to active/active but are waiting for others to do it first.

BANKSERV's current system is in Johannesburg and runs three major ACI Base24 applications – ATM, POS, and debit card. All customer banks connect to this site in Johannesburg. ACI has said it believes that BANKSERV could be the first Base24 payment transaction switch that does not have devices connected directly to it to achieve its mission.

BANKSERV's new active/active strategy is to bring up a second node in Midrand, about 35 km away from the current system in Johannesburg. The Midrand node will be identically configured and will also run the ATM, POS, and debit card applications under Base24. Both nodes will run on six-processor NonStop S7800 systems.

The nodes are connected by three 2-mb communication links. Traffic is prioritized so that Base24 traffic is given priority. Any particular bank will be assigned one of the two nodes as its primary node and the other as its secondary node. Each bank will submit all transactions to its primary node. Transactions will be replicated to the secondary node to keep the two nodes in synchronism. If the transaction is to be routed to a bank on the sending bank's secondary node, the routing will be done from the secondary node.



If a bank's primary node goes down, the bank will route all further transactions to its secondary node for processing. In this case, there may be some inflight transactions which are lost in the replication pipeline. To assist with these problems an application called the *Settlement and Query System* has been implemented, which is used to resolve queries on transactions. BANKSERV's data shows that it will lose an average of five to ten in-transit transactions following a node failure.

Production Cutover

BANKSERV's new dual-node system went live in late September, 2006. However, due to the holiday season, most banks chose not make any changes to their processing configurations until early 2007. Therefore, to take advantage of the increase in system capacity afforded by the two nodes, the debit card service will initially be moved to the Midrand node; and the ATM and POS services will remain on the Johannesburg node. If a transaction is destined for an issuing bank on the other node, it is sent to that node over the high-speed backbone network for routing.

However, even though the nodes were not initially running as an active/active network, the transaction data was replicated to the other node so that no transactions would be lost in the event of a node failure (except for those few which may be in flight)

Starting in January, 2007, BANKSERV began running applications in active/active mode for those banks who desire to use this service. All applications will be active on both nodes. Some banks will connect to one node and some to the other node. Still others will connect to both nodes and will split their load between the two nodes.

In order for a bank to run in an active/active configuration, it must first meet two criteria for BANKSERV to meet the service level agreement:

- The bank must have installed communication links to both nodes.
- The bank must change its applications so that they can interoperate with both nodes.

Should one node fail, the customer bank's system must be able to detect this failure and switch all transactions to the surviving node. Base24 already has this capability. It

supports both a primary and a secondary DTE (data terminal equipment), which are the connections to the dual communication channels. If Base24 cannot send a transaction over the primary DTE, it automatically switches to the secondary DTE.

Base24 is used by many of the larger banks. However, many smaller regional banks use Postilion from Mosaic, an S1 company. Unfortunately, Postilion can't automatically reroute messages. It must be manually reconfigured, a process that may take several minutes to accomplish. One possibility for these banks is to use intelligent routers such as F5 Networks' BIG-IP Global Traffic Manager, which can detect when the receiving end is down and can automatically reroute traffic to the other node. However, many intelligent routers detect a downed condition by lack of carrier. If the link is good, but data is not being sent or received as would be the case with a downed node, they are not aware of the downed condition.

Active/active configurations require that there be reliable connections to both nodes. Preferably, each of these connections would themselves be redundant and would be routed through different carriers to ensure that a carrier fault would not take down both connections. How likely is it that both connections could fail? Not very. However, BANKSERV recently lost fourteen lines when construction equipment dug up a major cable while building a new Johannesburg-Pretoria railroad for the 2010 Soccer World Cup.

Lost Transactions

As was mentioned earlier, BANKSERV has implemented a Settlement and Query System (SQS) to reconstruct lost transactions. Since data is being replicated via asynchronous replication, there is a small chance that a bank may lose a transaction due to a node failure. This generally will be noticed first by the consumer, who either does not get his cash or later finds that his account has been charged for a transaction that did not, in fact, complete. The consumer will report this to his bank, which can use SQS to make a query about the transaction. Using a unique serial number assigned to each transaction by BANKSERV, SQS can follow the movement of the transaction through its system and can adjust the settlement accounts for the banks participating in that transaction.

BANKSERV keeps records online for 90 days so that such issues can be resolved quickly during this time period. However, transactions cannot be resolved in real time since ACI opens its files with exclusive access, which prevents them from being updated by the replication engine. Resolution is generally accomplished the following day.

After the 90 day period, the data is still available in the archives; but it will take longer to resolve a lost transaction since the archived data must be accessed.

Lost transactions are a problem that goes beyond replication issues. For instance, if a communication line to an ATM is lost during a transaction, the ATM will time out and will display some sort of message such as "host down." The ATMs will back out this transaction.

Replication

ACI uses the GoldenGate replication engine to replicate data between the nodes. One problem, notes Mr. Lessing, is that ACI opens its Enscribe transaction log files with exclusive access. GoldenGate cannot currently replicate data to an open file with

exclusive access. Therefore, the log files on the two nodes are not identical copies of each other. Rather, each node will contain its own log file and a separate log file that is a replicate of the log file on the other node. At the end of the day, the two files must be merged in order to get a common unified log file.

GoldenGate has said that it has come up with a correction for this problem. However, at this critical time, Mr. Lessing does not want to be the pioneer and will live with this problem until a better time. The file merge is a minor irritation as his entire batch run only takes an hour or less.

Performance

File merging may not have been a minor irritation with the previous system. BANKSERV was running two K-series, 16-processor systems which were getting heavily loaded. At that time, BANKSERV upgraded to its current two S7806 processors. Prior to doing the upgrade, BANKSERV stress-tested the new systems by using the K-series systems to generate test transactions. It found that both K-series systems running fully loaded could generate only enough transactions to load the S-series machines to less than 50%, showing the significant increase in power provided by the S-series systems.

Mr. Lessing states that the K-series systems could not possibly have handled the current work load. However, the stress test showed that a single S-series system could handle 178 transactions per second at about a 44% load. His current peak transaction rate is 75 transactions per second, with a monthly rate of 38 million transactions. Consequently, he feels that he has a lot of room for growth.

The Future

Mr. Lessing believes that service downtime for maintenance can no longer be tolerated by customers. More and more vendors and customers are striving to achieve at least 5 nines uptime. Therefore, BANKSERV should use the technology available to achieve zero downtime for its customers.

BANKSERV no longer talks about disaster recovery plans. The word is now Continuous Processing.

Mr. Lessing is also a director of ITUG. He can be reached at anton@bankserv.co.za.