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# Handelsbanken Turns to Parallel Sysplex

October 2009

Founded in 1871, Svenska Handelsbanken (www.handelsbanken.com) survived two world wars and multiple recessions to become one of the largest banks in the Nordic countries. Headquartered in Stockholm, Sweden, it has more than 460 branches in Sweden and 240 branches in the rest of Scandinavia and throughout the world, including the U.S., England, Singapore, China, and Russia.

The bank offers a full range of services to corporate, institutional, and private customers. It is a global universal bank that covers the traditional areas of corporate financing, investment banking and trading as well as consumer banking. It provides corporate and individual clients with deposit products, loans, credit cards, and other banking services. Subsidiaries operate in several related areas, including life insurance, mortgages, pensions, fund management, and Internet banking.

An innovative feature of Handelsbanken's Internet services is its unique branch office web sites and direct e-mail addresses to each branch for enhanced customer service.

## Facing the Need for Continuous Availability

Handelsbanken realized that the growing dependence by its customers on online banking and credit cards required these critical services to be continuously available. Should online banking services go down, customers could not query their account balances, execute bill payments, transfer funds between accounts, or accomplish the many other banking tasks that they were accustomed to doing from their PCs.

Furthermore, if the bank's card services failed, customers using cards issued by Handelsbanken would not be able to make in-store or online purchases nor get cash from ATM machines.

Continuous availability means that customer services can never be taken down, either because of a system failure or for system upgrades and bug fixes. Because the bank was growing, the system also had to be scalable based on business demand.

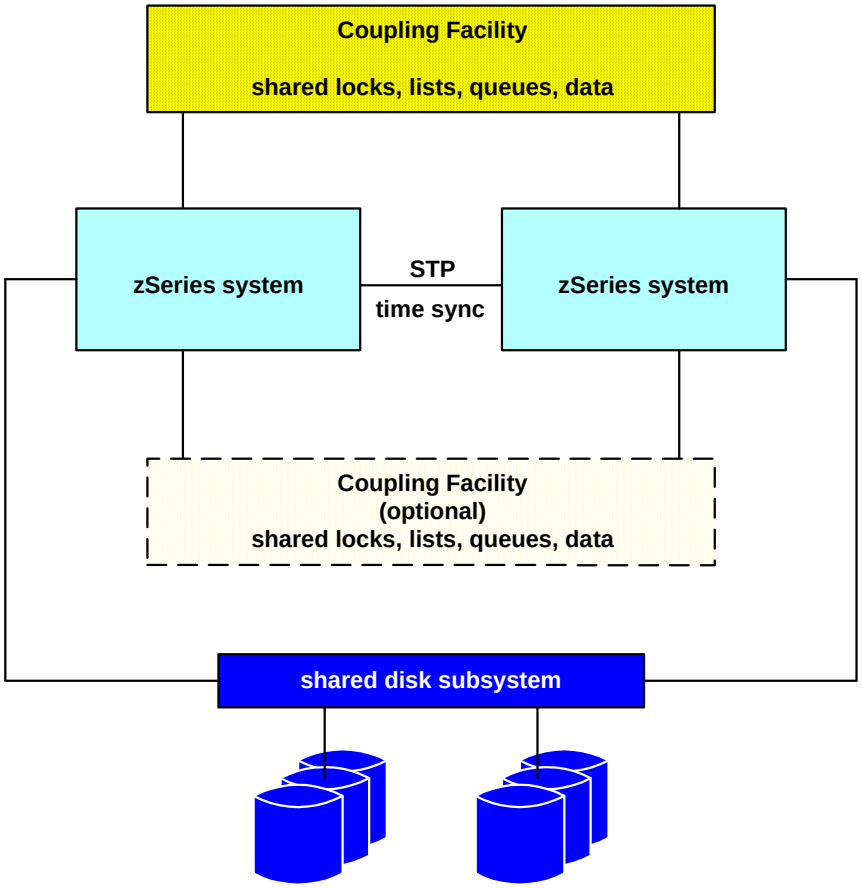
Handelsbanken decided to implement these mission-critical functions using an IBM Parallel Sysplex system. Parallel Sysplex is an active/active architecture[1] that allows multiple geographically-separated nodes to cooperate in a common application. Should a node fail, all that needs to be done is to route all transactions to the surviving node. Consequently, faults in the system can be transparent to the bank's customers.

[1] What is Active/Active?, *Availability Digest*; October, 2006.
http://www.availabilitydigest.com/public_articles/0101/what_is_active-active.pdf

## The Parallel Sysplex Architecture

IBM's Parallel Sysplex systems[2] are multiprocessor clusters that can support from two to thirty-two mainframe nodes (typically S/390 or zSeries systems). A Parallel Sysplex system is nearly linearly scalable up to its 32-processor limit.

A *node* may be a separate system or a logical partition (LPAR) within a system. The nodes do not have to be identical. They can be a mix of any servers that support the Parallel Sysplex environment. zSeries and S/390 mainframe systems are supported as Parallel Sysplex nodes.




**IBM Parallel Sysplex System**

The nodes in a Parallel Sysplex system interact as an active/active architecture. The system allows direct, concurrent read/write access to shared data from all processing nodes without sacrificing data integrity. Therefore, transaction load can be distributed between the nodes in the system.

The Coupling Facility (CF) is the key to shared processing. The CF enables high-performance read/write sharing of data by applications running on each node of the cluster through global locking and cache coherency management mechanisms. It also provides cluster-wide queuing for workload distribution and for message passing between nodes.

[2] Parallel Sysplex – Fault Tolerance from IBM, *Availability Digest*; April 2008.
http://www.availabilitydigest.com/public_articles/0304/ibm_sysplex.pdf

The nodes are time-synchronized via the Server Time Protocol (STP), which is implemented as microcode within the nodes' processors.

To provide disaster tolerance, the nodes may be separated by arbitrary distances. IBM's GDPS (Geographically Dispersed Parallel Sysplex) data-replication engine is used to maintain geographically separated database copies in synchronization. GDPS Metro Mirror provides synchronous replication over distances up to 200 km. GDPS Global Mirror provides asynchronous replication over unlimited distances.

## IBM System z10 Chosen by Handelsbanken for Parallel Sysplex Nodes

Handelsbanken choose the IBM System z10 mainframes running the z/OS operating system as the nodes for its Parallel Sysplex system. The z10 EC (Enterprise Class) is a massively scalable symmetric processing system (SMP) that can contain up to 64 processing units (PUs) and 1,136 gigabytes of memory. The PUs use quad-core chips operating at 4.4 gigahertz. The z10 BC (Business Class) is a somewhat slower and smaller version of the System z10 EC.

The PUs contained in a z10 system come in several configurations. Those configured as Central Processors (CPs) are the general-purpose central processors in the system. In addition, several processors may be configured as one of the specialty processors. The specialty processors use the same hardware as the CPs but have microcode limited to their specific function. Specialty processors include:

**IBM System z10 EC**

- zIIP (Integrated Information Processor), which relieves the central processors (CPs) of specific DB2 database processing loads.
- zAAP (Application Assist Processor), which is dedicated to running specific Java and XML workloads to accelerate performance.
- ICF (Internal Coupling Facility processor), which implements the Coupling Facility function in software instead of having to use the CF hardware option.

Multiple specialty processors of each type may be configured within a single z10 system.

In addition, the z10 offers a feature important to Handelsbanken, and this is capacity on demand. By configuring the z10 system with spare processors, called CBUs (Capacity Backup Upgrade), the customer can invoke those PUs at any time to handle additional loads. When needed, any or all of the CBUs can immediately be put into service for whatever time is necessary to temporarily add capacity without any communication with IBM.

## The Handelsbanken Parallel Sysplex System

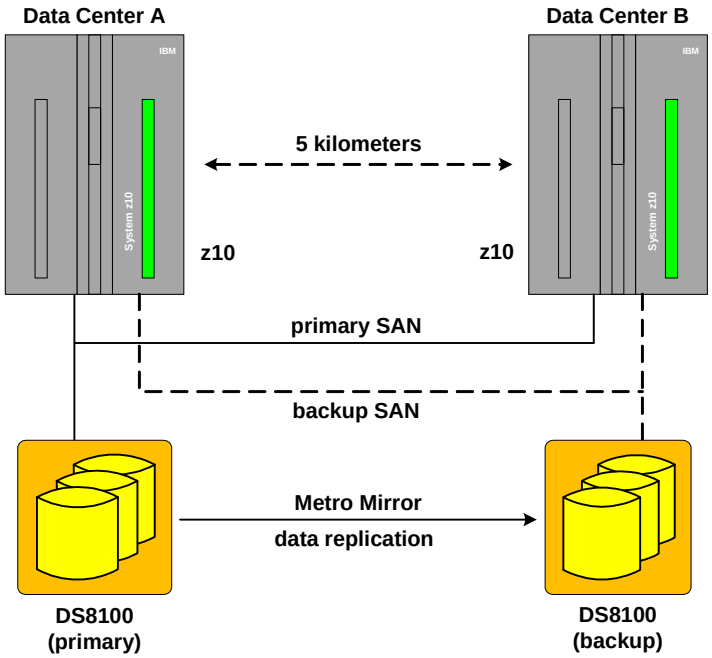
Handelsbanken utilizes two Stockholm-based data centers that are five kilometers apart to house the two nodes of its Parallel Sysplex system. The two nodes are each IBM System z10 EC mainframes configured almost the same. One node has the following configuration:

- 7 general purpose processors (CPs).
- 1 zAAP processor for Java processing.
- 1 zIIP processor for Distributed DB2 load
- 1 ICF processor for shared data.

- 6 CBU processors for additional capacity during single-node operation.
- 45 gigabytes of memory.

The other node is configured similarly except that it has six CPs rather than seven.

Each site has a DS8100 disk storage array providing 45 terabytes of disk storage (expandable to 384 terabytes). The DS8100s at each site are connected to each node via a fibre-channel SAN (storage area network). One DS8100 is designated the primary data storage and the other the backup data storage The application data stored on the primary DS8100 is replicated to the backup via IBM's Metro Mirror synchronous-replication engine.




**Handelsbanken's Parallel Sysplex System**

Since both nodes are using the same database across the primary SAN, transaction load can be balanced across the nodes. Any transaction can be sent to either node for processing. Load balancing is accomplished by the z10"s WLM (Workload Management) facility and the Sysplex Distributer.

Should the primary DS8100 fail, the GDPS Hyper Swap facility will switch all disk access from the primary storage unit to the backup storage unit by activating the backup SAN. Switchover is done in seconds and is transparent to the users.

Should a node fail, all transaction traffic is routed to the surviving node, and its six spare CBU processors are activated to handle the increased load. Should an entire site fail, all traffic is rerouted to the surviving site, which will use its local DS8100 for the application database. In all cases, failover is measured in seconds.

A common problem with active/backup configurations is that failover testing is complex, expensive, and risky. Therefore, failover testing is often not done or only partially done, leaving the company with nothing but hope that a failover will succeed in the event of a failure. Not so with an active/active system. It is known that both nodes are operational because they are actively processing transactions.

Handelsbanken takes advantage of this capability by testing failover to a single site twice per year. Therefore, they are certain that failover will work if needed.

## Summary

Handelsbanken's requirement for continuous availability of its mission-critical services in the event of a system failure is satisfied with its Parallel Sysplex system. Even if a data center is destroyed by some disaster, all transactions will be immediately shifted to the surviving data center so that customer services will suffer no interruption.

Equally important, planned downtime is eliminated since the transaction load can be routed totally to one node, allowing the other node to be being upgraded.

Furthermore, Handelsbanken's scalability requirement is met because of the massive scalability of the z10 EC systems. Handelsbanken's initial configuration is only about 10% of the z10"s capability. Should a capacity upgrade be necessary, one or more CBUs can be put into permanent service. Other upgrades can be rolled through the system one node at a time while the other node carries the full load.

As a result, the use of Parallel Sysplex has allowed Handelsbanken to meet its availability and scalability goals.