Case Study: AmTrust Bank
Maximum Availability Architecture – Oracle Database 10*g*

AmTrust Bank

- **$17 Billion in Assets**
- **Retail Banking, Wholesale Mortgage Lending, Construction Lending**
- **Innovative Online Banking Services**
- **Bank Branches in Ohio, Florida, and Arizona**
- **www.amtrust.com**

Oracle Database 10*g* Release 2 Maximum Availability Architecture:

- **Oracle Real Application Clusters**
- **Oracle Data Guard**
- **Oracle Recovery Manager**
- **Automatic Storage Management**
- **Oracle Enterprise Manager Grid Control**

OVERVIEW

Founded in 1889 as Ohio Savings Bank, AmTrust Bank has grown from a local savings and loan to a nationally recognized leader in retail banking, wholesale mortgage lending and construction lending. AmTrust Bank has been nationally recognized for its innovative products, service, and commitment to the community. For example, it was one of the first banks to introduce convertible adjustable rate mortgages, fixed rate credit cards, and a host of other products.

Amtrust Bank ended its first year with one branch office and $20,000 in assets. Since then, it has grown to $17 billion in assets, and is one of the 20 largest mortgage lenders in the United States.

HA/DR REQUIREMENTS

The bank's most critical applications must be continuously available (excluding limited planned downtime). Service Level Agreements (SLAs) for Recovery Time Objectives (RTO) and Recovery Point Objectives (RPO) are as follows:

- RPO is zero. Under no circumstance can any failure result in data loss.
- RTO, or the maximum amount of downtime allowed before a system is available following a failure depends upon the scope of the failure.
  - RTO in the event of server or disk failure is zero.
  - The Disaster Recovery (DR) RTO in the event of primary site failure is 15 minutes.

ORACLE DATABASE 10*g* ARCHITECTURE

The bank's Online Mortgage Applications, Call Center, Internet Banking, APEX, eNote and Voice Response System applications all run on Oracle Database 10*g* Release 2. AmTrust Bank has implemented the Oracle Maximum Availability Architecture (MAA)[1] utilizing the following MAA features:

- Real Application Clusters [2]
- Data Guard [3]
- Recovery Manager (RMAN) [4]
- Automatic Storage Management [5].

Production runs on a five-node RAC database. Data Guard maintains a synchronized copy of production at a remote standby location running on a five-node RAC standby database (Figure 1).

Site A - Production
Production Database
5-node RAC Cluster
HP DL-380, EMC Symmetrix
& Clariion SAN attached
Red Hat Linux

Site B - Remote DR Site
Standby Database
5-node RAC Cluster
HP DL-380, EMC Symmetrix
& Clariion SAN attached
Red Hat Linux

Production
Database

20 miles >

Data Guard
Maximum Availability
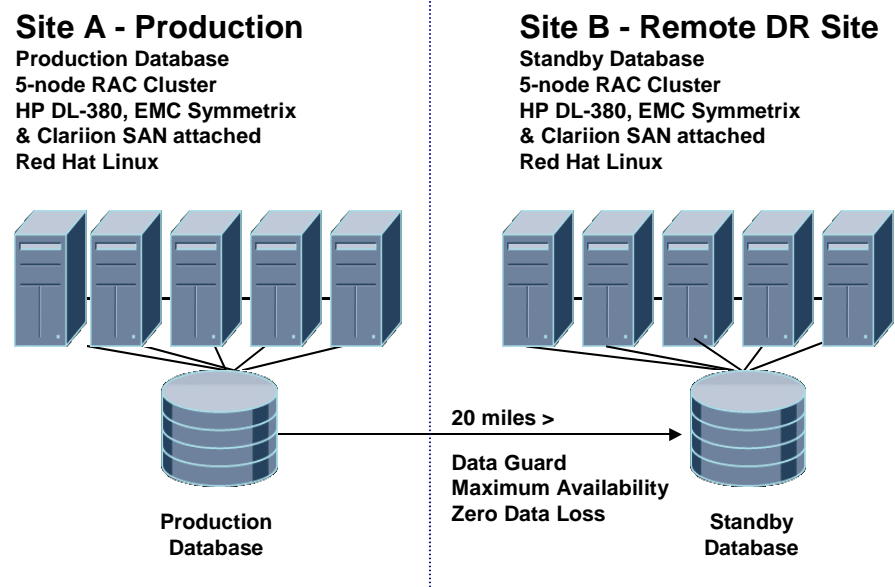Zero Data Loss

Standby
Database

Figure 1: Oracle Database 10*g* Release 2 Architecture

Production and standby systems run Red Hat Enterprise Linux 3, Release 2. A Cisco 1 GB switch is used for interconnect, with dual NIC/server. Storage is EMC Symmetrix and Clariion disk arrays, SAN attached, with dual HBA/server.

Zero Data Loss protection is achieved by using Data Guard's Maximum Availability mode (LGWR SYNC transport services). Data Guard 10*g* replaced 3rd party remote-mirroring previously used by Amtrust Bank for replicating Oracle data to their remote standby data center. Primary and standby data centers are 20 miles apart and are connected by a 1GB network (SBC's GigaMAN service).

The importance of high availability delivered by the above architecture cannot be understated. Any interruption of customer access to the online Mortgage Application system has a direct impact on bank revenue. The Call Center application provides call center agents with a complete understanding of customer accounts and past interactions with the bank. If the Call Center application is not available, agents are forced into a tedious process accessing a series of internal systems to look up information. Simply put, high availability translates into more revenue and greater customer satisfaction, which in turn, generates more revenue.

The MAA architecture utilized maintains high availability in the case of server or disk failures (RAC handles server failure, local disk mirroring is used to protect against disk failures). If the scope of the failure is greater, for example a bad host bus adapter (HBA) corrupts the production database, or a SAN fails, or external events cause the entire primary site to fail, Data Guard is used to quickly failover to the standby site. Utilizing best practices described in the MAA paper, Oracle

Database 10g Release 2: Switchover and Failover Best Practices [6], such failovers can be completed in less than a minute.

The bank has also executed switchovers (a planned transition of the standby database to the production role) on its production systems, demonstrating that applications can be up and running in the standby data center in less than 8 minutes. The bank executes switchovers using the Data Guard Broker (DGMGRL) management interface. The 8 minutes measured for switchover time is the end-to-end time required to shut down the production RAC database and have all applications and users back up and running on all nodes of the RAC database at the standby location. The actual switchover time measured is ½ of the time allowed by the bank's RTO SLA.

Fast switchovers minimize downtime during planned maintenance periods that are anticipated to occur four to six times a year. Such maintenance includes major systems upgrades, hardware maintenance, and operating system upgrades. It is worth noting that database patches can often be applied in rolling fashion with RAC, making even a switchover unnecessary in such instances.

Oracle Database 10*g* made it advantageous to consolidate multiple applications on a single RAC database. A RAC database simplifies management by providing a single view of system status across multiple RAC nodes. Different application workloads running on a RAC database can be defined as services so that they can be individually managed and controlled. Rules can be defined to automatically allocate processing resources to these services. These rules can be modified dynamically to meet changing business needs. Rules can also be defined to reallocate processing resources automatically when failure conditions occur to ensure that the highest priority services continue to meet required service levels.

RAC – PROVING ITS VALUE

RAC enables multiple servers to share a single Oracle database in a clustered environment (each server, or node, runs a single Oracle instance). AmTrust Bank has experienced several occasions where the Oracle instance on one of the RAC nodes crashed due to an operating system problem. In these situations, the database remained available through the Oracle instances running on the surviving RAC nodes and customers were not impacted. AmTrust Bank has also benefited from their RAC environment whenever maintenance operations require that Oracle instances be stopped and restarted. As noted above, these operations can be completed on one instance at a time in a rolling manner. There is never an interruption in database availability since there is always another functioning Oracle instance available to support customer activity.

ADDITIONAL MAA FEATURES DEPLOYED

Automatic Storage Management

AmTrust Bank uses Automatic Storage Management (ASM) [5] for all Oracle 10*g* Database environments: development, test, QA, production, and standby databases. AmTrust Bank is also using the Oracle Managed Files (OMF) feature together with ASM. ASM provides a simple storage management interface that is consistent across all server and storage platforms. ASM virtualizes the database storage into disk groups. DBA's are able to manage a small set of disk groups and ASM automates the placement of the database files within those disk groups. ASM automatically spreads data evenly across all available storage resources to optimize performance and utilization. This even distribution of database files makes the manual I/O performance tuning obsolete.

As a vertically integrated file system and volume manager, specifically designed for Oracle Database files, ASM provides the performance of raw I/O with the easy management of a file system. Furthermore, ASM enables DBA's to change the storage configuration without having to take the database offline. ASM automatically rebalances files across the disk group after disks have been added or dropped. ASM is a tool specifically built to simplify the job of the DBA. It is a capability that saves DBA time and provides flexibility to manage a dynamic database environment with increased efficiency.

AmTrust Bank has verified the value of using ASM and has experienced first hand, the savings in time and effort due to ASM's ability to automatically balance the distribution of data among the drives in a disk group when a drive is added or removed from the group.

Flash Recovery Area

AmTrust Bank is utilizing Oracle Recovery Manager 10*g* (RMAN) [4] features that enable RMAN to automatically manage backups and recovery using a Flash Recovery Area. A Flash Recovery Area is a unified disk-based storage location for all recovery related files and activities in an Oracle Database. RMAN automatically creates all backups in the Flash Recovery Area and manages the space. The database archiver writes archive logs to the Flash Recovery Area and RMAN automatically deletes, or moves to tape, obsolete backups and archive logs that are no longer required based on the retention policy set by the administrator. RMAN does all recovery within the retention period automatically from disk. If recovery is required to a point in time that exceeds the retention policy, RMAN will restore the data from tape. AmTrust Bank successfully tested database restores from the Flash Recovery Area and is utilizing them as the primary source for recovery via RMAN. The bank has configured RMAN with 2 output channels to write backups to both the flash recovery area and to a file system. The bank currently utilizes a third party tape backup system to write the database backup on disk to tape. Future plans include utilizing the tape backup system RMAN API to write backups directly to tape.

LOWER COST, BETTER FUNCTIONALITY

Before Oracle9*i* and RAC, AmTrust Bank relied completely on multiple third party software components and more expensive server and storage subsystems to implement highly available systems for their Oracle databases. AmTrust Bank took the first step toward an integrated HA solution for its Oracle Databases with the adoption of Oracle9*i* RAC. The bank's upgrade of production applications to Oracle Database 10*g* has nearly completed the build-out of an HA/DR environment that uses the full breadth of Oracle's Maximum Availability Architecture and industry standard hardware architectures.

AmTrust Bank implemented RAC 10*g* on Intel/Linux platforms to benefit from reduced cost. With lower cost/server, the bank can implement a cluster with more nodes than was possible with their previous platform. Adding incremental server capacity is also less expensive. Availability, scalability, and customer service levels are all improved with additional nodes in the cluster.

AmTrust Bank replaced third party remote-mirroring with Data Guard to benefit from reduced cost and complexity, as well as benefit from enhanced data protection and higher availability. Data Guard is an included feature of the Oracle Database Enterprise Edition. No additional installation, purchase, or support contract is required. It is completely application and hardware transparent, reducing cost and complexity as new applications, new database versions, or storage requirements evolve over time. Refer to "Data Guard and Remote-Mirroring Solutions" [7] for a more complete discussion of the benefits provided by Data Guard.

AmTrust Bank uses RMAN with Flash Recovery Area for a more automated, easy to manage solution for backup and recovery. In addition, ASM has replaced third party file systems and volume managers while providing better functionality and efficiency for managing Oracle data. The usefulness of these new features has led the bank to recognize an opportunity to consolidate database and storage administration into one organization, reporting to a single director. The integration of these areas of expertise using standard Oracle features optimized for managing all aspects of an Oracle environment have led to the increased efficiency of individual administrators, as well as the Information Technology group as a whole.

CONCLUSION

AmTrust Bank, an innovator in the mortgage lending industry, has again demonstrated the value of compounding. The same Oracle Database 10*g* MAA environment deployed on the most sophisticated hardware platform money can buy, can also be deployed on low cost Linux-based computer systems generating cost savings at the same time it enhances the service level provided to customers.

ADDITIONAL REFERENCES

1. Oracle Maximum Availability Architecture

http://www.oracle.com/technology/deploy/availability/htdocs/maa.htm

2. Oracle Real Application Clusters
http://www.oracle.com/technology/products/database/clustering/index.html

3. Oracle Data Guard Overview
http://www.oracle.com/technology/deploy/availability/htdocs/DataGuardOverview.html

4. Oracle Recovery Manager
http://www.oracle.com/technology/deploy/availability/htdocs/rman_overview.htm

5. Automatic Storage Management
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6. Oracle Data Guard 10g Release 2: Switchover and Failover Best Practices
http://www.oracle.com/technology/deploy/availability/pdf/MAA_WP_10gR2_Switc
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http://www.oracle.com/technology/deploy/availability/htdocs/DataGuardRemoteMi
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