The Computerworld Honors Program

CASE STUDY

ORGANIZATION:

The Bank of New York

PROJECT NAME:

TPC Data Center Consolidation Project

LOCATION:
New York City, New York, United States

YEAR:
2006

STATUS:
Laureate

CATEGORY:
Finance, Insurance and Real Estate

NOMINATING COMPANY:
EMC

Summary

Founded in 1784, The Bank of New York Company, Inc. (NYSE: BK) is the oldest bank in the United States. It is a global leader with operations in 33 countries and one of the largest U.S. securities clearance agents, clearing approximately 50 percent of U.S. government securities. Between 2002 and 2005, the Bank completely restructured its IT infrastructure in order to consolidate its data centers, add more geographic diversity, provide scalability for future growth, and upgrade its disaster recovery and contingency capabilities. Unlike traditional contingency strategies, which tend to keep production facilities near a company's business center and deploy a disaster recovery facility within a hundred miles to maintain synchronous data replication, The Bank of New York took a totally different approach. It located its main production facility in a different region with a lower geographical risk profile, several hundred miles from the Bank's business center in New York. The Bank asynchronously replicates data from this remote production facility to a disaster recovery facility, located in a different state than the business center. The Bank also created a third data center, a data bunker facility located near the production facility, that maintains an up-to-date synchronous copy of all transactions for complete data protection. The result – The Bank of New York is capable of supporting a zero transaction loss requirement in the event of a disaster while recovering in a separate region, using EMC technology. Implemented under tight deadlines in less than three years, the Bank's multi-regional, triple data center solution has set a new standard for IT infrastructure resilience.

Introductory Overview

Founded in 1784, The Bank of New York Company, Inc. (NYSE: BK) is the oldest bank in the United States. It is a financial holding company with total assets of $102 billion and total assets under custody and administration of $10.8 trillion, as of December 31, 2005. The Bank is a global leader with operations in 33 countries, and is one of the largest U.S. securities clearance agents, clearing approximately 50 percent of U.S. government securities. In recent years, the Bank has gone through an extraordinary phase of transformation and growth, including significant internal growth, the integration of more than 90 company and business line acquisitions, and expansion into a variety of world financial markets. This was accomplished through signifi-

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cant enhancement of the Bank's processing capacity. Initially, the Bank's computer systems were housed in multiple data centers, with sites for production and disaster recovery concentrated in close proximity, primarily in the greater New York City metropolitan area.

Prior to the attacks on the World Trade Center on September 11, 2001, the Bank had established data centers in the New York area with a concentration of production processing located in downtown Manhattan. Following 9/11, there was an immediate need to rebuild its production processing in various locations to satisfy the needs of its major businesses. This resulted in additional processing locations which added to the complexity of the Bank's production and contingency requirements.

To streamline both its worldwide business operations and business continuity efforts, the Bank made a strategic decision to consolidate its multiple data center configuration into two, state-of-the-art data centers. The new facilities were designed to increase bankwide efficiency, provide scalability to support business growth over future decades, add more geographic diversity, and meet all of the Bank's contingency requirements.

Unlike traditional contingency strategies, which tend to keep production facilities near a company's business center, and deploy a disaster recovery facility within a hundred miles to maintain synchronous data replication for zero data loss, The Bank of New York took a totally different approach. It located its main production facility in a different region with a lower geographical risk profile, several hundred miles from the Bank's business center in New York. The Bank asynchronously replicates data from this remote production facility to a disaster recovery facility, located in a different state than the business center. However, asynchronous replication could have possibly left the Bank vulnerable to losing up to 60 seconds of data in the event of a catastrophic failure at the production site. To mitigate this risk, the storage and telecommunications teams, along with the Bank's vendors, developed a unique approach, featuring two-stage replication of key data:

1.Asynchronous replication between the production and disaster recovery/contingency sites

2.Synchronous replication to a third data center near the production site

The synchronous site – a "data bunker" – was situated in close proximity to the production site. The bunker is part of the overall network, fully linked to both the new production site and the new recovery site. It maintains an up-to-date synchronous copy of all transactions for complete data protection. The result – The Bank of New York is capable of supporting a zero transaction loss requirement in the event of a disaster while recovering in a separate region, using EMC technology. Implemented under tight deadlines in only three years, and without impact on its customers, the Bank's multi-regional, triple data center solution has set a new standard for IT infrastructure resilience.

Benefits

The Bank of New York's triple data center solution delivers a wide range of benefits. It provides a highly resilient, consolidated technology infrastructure to support the Bank's core businesses. In addition, the solution's low-risk, multi-regional footprint provides geographic diversity, with zero data loss in the event of man-made or natural disasters, such as the 9/11 attacks, the East Coast blackout of 2003 or Hurricane Katrina. This is particularly important since the Bank is one of the world's largest custodians, responsible for trillions of dollars in assets, and one of the

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largest players in the daily processing of government securities and funds.

The solution fully complies with regulations and specific issues outlined by The Federal Reserve, The Office of the Comptroller of the Currency, and The Securities and Exchange Commission in their white paper, Interagency Paper on Sound Practices to Strengthen the Resilience of the U.S. Financial System, published in April of 2003 and pertaining to the events of 9/11. The new infrastructure guarantees that all transactions are captured and retained, and all processes are maintained on their normal schedule. It establishes The Bank of New York as the industry leader in business continuity planning and information security, and provides scalable capacity to support operations for decades to come.

But it is not simply a technological achievement. The solution's business benefit goes beyond securing financial data, because the Bank's customers not only need to know that their accounts are protected in the event of a disaster, they also want to continue doing business with the Bank even if operations are disrupted in an entire region. To maintain this level of 24/7 business operations, The Bank of New York built and staffed a virtual command center and help desk environment at both the new production facility and the new disaster recovery site. If one site suffers a disruption, the other picks up the workload and the result is transparent operation and uninterrupted customer service around the clock.

This is a unique capability that differentiates The Bank of New York in the financial services industry. Many organizations assume that a small staff at a disaster recovery site can recover from a production site failure and maintain and sustain full operations without additional help, but this is not always the case. In addition, many organizations count on moving survivors from a production facility to a contingency facility during a crisis, a move that may not be possible when faced with blackouts, air travel disruptions or other factors in an affected region.

The Bank of New York has eliminated these potential problems with its multi-regional solution. It relocated a significant number of experienced people to the new "out of region" production facility, in order to put experienced workers with corporate knowledge on the ground to run the facility every day. Another group of workers with equal experience operate the command center and help desk at the disaster recovery site. Normally, these dual command and help desk operations share the Bank's workload 50/50, but either can assume the full workload if an outage occurs. As a result, the Bank can sustain operations in the event of a failure without the need to move anyone to a different site. The Bank has combined a strong business resilience vision, leading-edge technology, and smart staffing to ensure its customers uninterrupted service as well as support a zero transaction loss requirement.

The Importance of Technology

For its triple data center solution, The Bank of New York made the unique decision to locate its production facility in a different region than its primary business center, and set out to design and build world class-facilities unmatched by competitors or industry peers. Special emphasis was placed on data storage capacity, telecommunications, resilience to withstand catastrophic events, and geographical site diversity.

Between 2002 and 2005, the Bank successfully completed development and implementation of two proprietary data centers, located several hundred miles apart – they are exact mirrors of each other. The Bank also deployed a synchronous data bunker site in the same region as the

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production facility. The project included migration of all contingency and production systems, an extraordinary amount of application testing, and migration of more than five petabytes of data in 2005 alone. Both production and disaster recovery facilities were given staff capable of managing the Bank's entire operation. And all this was accomplished without impact to the Bank's customers and business operations.

The overall project was managed by the Bank's Technology Project Office (TPO), working with the following groups: Enterprise Storage Services, Computer Operations, System Software, Telecommunications, Hardware Facilities Planning, Property Management Division, and Technology Senior Management.

Since 9/11, regulators have required large financial services firms to separate their data centers into a minimum of two distinct regions, to mitigate the potential risk associated with regional disasters. EMC SRDF/Star replication software provides advanced multi-site business continuity protection for The Bank of New York's solution. It allows the Bank to support a zero transaction loss requirement in the event of a disaster while recovering in a separate region by enabling concurrent synchronous and asynchronous replication from the same source volumes. Using SRDF/Star, the Bank replicates data from the production facility synchronously to the nearby data bunker, and asynchronously to the distant disaster recovery site. This is the first live production use of SRDF/Star, which runs on EMC Symmetrix DMX high-performance storage systems at all three data centers.

In the event of an outage, SRDF/Star enables the Bank to incrementally establish a session and quickly resynchronize the synchronous and asynchronous copies by replicating only the differences between the sessions. This allows the Bank to meet a recovery time objective (RTO) of less than two hours for its most critical applications, by facilitating faster resumption of protected services after a source site failure. Synchronous replication to the data bunker also enables the Bank to achieve a zero data loss recovery point objective (RPO) by recovering to the exact point of failure.

Given the high velocity and high dollar value of its transactions, it's critical that the Bank recover to the point of failure, but that's a very complex task. Many of the Bank's transactions traverse multiple platforms, for example, coming in through a front-end system, handing off to a mid-tier machine, collecting some information from a back-end system and so on as processing continues. The more such systems are integrated with each other, the more complicated the recovery operation. With SRDF/Star, the Bank can establish consistency groups that aid in rapid restoration, regardless of the complexity of the processing environment, and support a zero transaction loss requirement in the multi-regional data center configuration.

Telecommunications is another key element in the solution's success. Since 9/11, The Bank of New York has taken a strong leadership position in encouraging telecom providers to ensure route diversity with no single points of failure in their critical connections. The Bank combined network carrier diversity and route diversity with broad bandwidth capability in its wide-area network backbone. The backbone can maintain a substantial number of online systems, process large daily transaction volumes in a timely fashion, and sustain high data rates under all circumstances. In fact, the triple data center's bandwidth capabilities are so robust that, if the Bank were a telecommunications carrier, it would rank 9th in the entire nation.

The triple data center solution was implemented in two phases over three years. The first phase involved consolidating the Bank's multiple existing facilities into the new contingency site,

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which delivered important economies of scale. It also gave the Bank the opportunity to solidify its information lifecycle management (ILM) capabilities, completely eliminating tape from its operations, and maintaining different types of critical business data on various cost-effective tiers of disk-based storage, with defined levels of disaster recovery for all data types.

At the same time, the Bank surveyed numerous locations for its "out of region" production facility, evaluating every candidate site against a list of 72 criteria, including such things as distance from major airports, regional risk for natural disaster, etc.

The second phase included building the new production facility, testing, migrating systems and data, and relocating staff. All necessary technology upgrades were done prior to migration, with firm cut-off dates for changes as each aspect of the project moved forward. This enabled the Bank to migrate "like for like," using the same equipment models and software, so there was no change in the underlying technology during migration, and application testing was significantly simplified. The Bank's key customers and business partners participated in the validation process during testing and migration, just as they do during the Bank's frequent disaster recovery tests.

The data centers were built with duplexed power, cooling and external communications systems, so that each side is fully capable of handling the entire operation. Enhanced computer capacity was provided to meet today's rapid growth trends for the Bank's data and major business applications, as well as future growth stemming from both internal business expansion and third-party acquisitions. Square footage and physical space also were set aside at each data center for expansion to accommodate future business needs. All three data centers are operated by The Bank of New York, eliminating the need for third-party disaster recovery service providers and the sharing of facilities with other organizations. The infrastructure was designed to meet or exceed current and expected business and contingency requirements of the industry, its regulators, the Bank's Board of Directors and upper management, as well as adhere to industry infrastructure standards identified in the IT Infrastructure Library (ITIL).

All aspects of this complex project were completed on schedule and under budget – an impressive achievement that included the relocation and hiring of command and help desk staff to enable full operation of the Bank's business from both the production and disaster recovery facilities.

In fact, the Bank migrated five petabytes of data over eight months in 2005 to accommodate a tremendous amount of application testing prior to the move, as well as the change of production locations. In addition to data, the Bank also physically moved hundreds of servers on multiple platforms. The entire migration to the new production facility, which involved collapsing three production data centers into the new production center several hundred miles away, was accomplished within ninety days of the facility group turning over the keys. Hundreds of servers were relocated over a single weekend and 85 percent of system consolidation was accomplished over a single night with no impact to normal business operations.

Originality

Traditionally, companies have maintained a production facility near the center of business operations, and a contingency facility within a hundred miles to replicate data synchronously between the two sites and promise zero transaction loss in the event of an outage. But it has

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become evident, following both man-made and natural disasters, such as the 9/11 attacks, the East Coast blackout of 2003, and Hurricane Katrina, that an outage can easily affect an entire region, potentially leading to significant transaction loss.

After 9/11, regulators insisted that financial services firms – particularly those like The Bank of New York, that play a key role in the nation's financial infrastructure – must locate production and recovery sites in two different regions to mitigate against problems that affect an entire region.

The Bank built on this mandate with the unique idea of locating its production facility away from its primary business center in New York City, where the majority of its staff is located. Selecting a site that has far lower potential for geographical risk, several hundred miles from the metro New York area, the Bank created a state-of-the-art production facility staffed with seasoned employees who, in effect, carried the Banks operational processes, as well as corporate culture, to the new region.

To support a zero transaction loss requirement, the Bank synchronously replicates from the production facility to a data bunker facility located in the same region as the production site. The Bank also replicates asynchronously to a disaster recovery/contingency site, located in close proximity to the Bank's primary business center. This concurrent synchronous/asynchronous replication is made possible by the first live use of EMC SRDF/Star replication technology.

In addition, the Bank fully staffed the disaster recovery site with command and help desk personnel equal to those at the production site, so that both sites are capable of handling 100 percent of business operations if one site should fail. This means the Bank can maintain its operations and customer service while recovering from an outage, without having to transport personnel to a different site – an important point when considering the blackouts, air travel disruptions or other factors that may occur in the event of a disaster.

Success

The Bank of New York set an aggressive deadline for completion of the triple data center project by the end of 2005 – a requirement that was met with outstanding success. The new disaster recovery site came online in 2004 followed by the new production site in the fourth quarter of 2005. All major bank processing now runs at the new production data center with the recovery site located in a separate region. Both production and contingency sites are active, so the Bank's entire operation can be run from either data center location. A virtual command center is housed in each location, and control can be switched from one to the other easily, to run all operations on a scheduled basis, with immediate failover in the event of an outage. Synchronous replication between the production site and data bunker supports the Bank's zero transaction loss requirement.

In developing the solution, the Bank simplified and consolidated its computing environment and provided appropriate levels of disaster protection for all data types. Through careful planning and execution, the Bank was able to shrink the time required for the actual migrations, minimize the risk in moving data processing from one location to another, and maintain strict control of project costs by using identical, "like-for-like" computer systems. The Bank created project windows, during which no upgrades to hardware or software were permitted without senior management approval, and installed a dynamic change management system to automati-

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cally distribute change requests to impacted project areas. The overall project met all milestones and time schedules, and was completed under budget. At no time during the migration was service to the Bank's customers impacted.

Here are a few metrics that illustrate the project's scope and success:

•Implemented two, state-of-the-art data centers, each with 1.4 acres of raised floor to house computer systems,

•Collapsed three existing production data centers into the new production center several hundred miles away, within ninety days of the facility group turning over the keys,

•Migrated hundreds of large computer systems and mainframes to the two new data centers, capable of executing 10.2 billion instructions per second,

•Built 20,000 local area network (LAN) connections in the data centers,

•Migrated more than five petabytes of data in 2005 alone,

•Moved hundreds of servers to the new production facility over a single weekend and accomplished 85 percent of system consolidation for the new production facility in a single night, and

•Installed a network backbone capable of transmitting 30 billion bits of data per second.

Difficulty

The Bank of New York faced some noteworthy challenges in implementing its triple data center solution. For example, significant effort was put into working with telecom providers to ensure network diversity, route diversity with no single points of failure in critical connections, as well as deployment of a broad bandwidth network backbone. The resulting infrastructure can maintain a substantial number of online systems, process large daily transaction volumes in a timely fashion, and sustain high data rates under all circumstances. In fact, the bandwidth capabilities are so robust that, if the Bank were a telecommunications carrier, it would rank 9th in the entire nation.

Another technical challenge associated with projects like this, which involve moving applications over such large distances (several hundred miles between the production and disaster recovery sites) was latency. This was particularly true for applications such as funds transfers or broker/dealer services that lacked a Web tier. The schedule didn't allow enough time to rewrite the applications, so the Bank concentrated on solving latency through improved performance in the file servers. Ultimately, latency was not a serious issue.

Finally, the Bank's staffing plan called for relocating a significant number of employees from New York to the new "out of region" production center. The large number of relocated people not only took with them their experience with bank operations, they effectively moved the Bank's corporate culture to a new region. The result was the ability, from the very first day, to operate the Bank's technology enterprise from both data centers, in both regions.