the Availability Digest

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JPMC Downed by Replicated Corruption

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JPMorgan Chase is a big bank. It is one of the big four in the United States, along with Bank of America, Wells Fargo, and Citigroup. With over $2 trillion in assets, $100 billion in revenue, and over 200,000 employees, JPMorgan Chase forms an important part of the backbone of commerce in the United States and in the rest of the world.

If the bank's operations are compromised, it is felt by millions of customers. In September, 2010, exactly this happened when the bank lost for three days its online banking services used by over 16 million online customers.

The System that Failed

The problem occurred in a large Oracle database. The database is managed by an Oracle cluster comprising eight Solaris servers, each with 64 GB of RAM. Mirrored EMC SANs provide the data storage. The database holds authentication data and user profiles for its online customers.

It appears that an Oracle bug corrupted key files in the authentication database. This corruption was dutifully replicated by the EMC SANs so that both the active and mirrored SANs were corrupted. With no authentication, the online applications became inaccessible.

The Outage

The data-center operations staff became alerted to problems early Monday evening, September 13. Shortly thereafter, the applications crashed. Users trying to log on to their accounts were greeted with a message that simply advised them to "log on later."

In addition to online banking services, connection to the ACH (Automated Clearing House) for scheduled payments was lost as well as access to private-client trading portfolios. Online loan applications died. Web and mobile applications were down. However, ATMs, branch services, and call centers were not affected.

Services were not restored until Wednesday morning.

The bank's only explanation was a posted note that said:

> "A third-party database company's software caused a corruption of systems information, disabling our ability to process customer log-ins to chase.com. This resulted in a long recovery process."

The Recovery

Because both the active and standby data storage units were corrupted, the bank's only option was to rebuild the database. Its last backup had been taken the previous Saturday night. This backup was loaded onto the database.

The database was then brought into a current state by replaying lost transactions from the Oracle replay log. 874,000 transactions were replayed, requiring most of the day Tuesday. The system was finally brought back online early Wednesday shortly after midnight.

Even then, the applications suffered hours of poor performance as users logged on and tried to catch up. Online bill payments scheduled for Monday and Tuesday did not get made until Wednesday. $132 million in ACH scheduled payments were held up. Also held up were hundreds of auto-loan and student-loan applications.

The Apology

On Thursday, the day after system recovery, the bank issued an apology to its customers:

> "We are sorry for the difficulties that recently affected Chase.com, and we apologize for not communicating better with you during this issue. Giving you 24-hour access to your banking is of the utmost importance to us. This was not the level of service we know you expect, and we will work hard to serve you better in the future and to communicate with you better if a situation like this should arise again.
>
> Online Bill Payments scheduled for September 13, 14 or 15 were processed by Wednesday night, September 15. It is not necessary to reschedule these payments. If you scheduled a payment during those dates, but do not see it reflected in your payment activity by September 16, please contact us.
>
> We will refund any late fees that you may have incurred as a result of our delay in processing your payment.
>
> Thank you for your patience and for the opportunity to work harder to serve you in the future."

Lessons Learned

This is not the first serious outage that JPMorgan Chase has had in its online banking services. These services were reported to have been also inaccessible for fifteen hours early in the previous month. The bank's only explanation was that the services were down for scheduled maintenance, though customers complained that they had not been notified.

The September outage described above graphically illustrates the need for database backups. If the bank had relied only on its redundant database to provide data protection, it would have lost its entire authentication and user-profile database. Though the database could perhaps have been recovered by requiring all customers to reregister, this procedure would have been very painful to the bank's customers.

Acknowledgements

Thanks to our subscriber, Moore Ewing, for pointing us to this incident . Information for this article was taken from the following sources:

JPMorgan Chase's online banking site crashed, *Computerworld*; September 14, 2010.
Speculation about the JPMorgan Chase authentication database outage, *DBMS2*; September 16, 2010.
JPMorgan Chase's online banking outage sparks questions, *USA Today*; September 16, 2010.
Details of the JPMorgan Chase Oracle database outage, *DBMS2*; September 17, 2010.
JP Morgan Chase's IT failure: An apology and some informed speculation, *ZDNet*; September 17, 2010.
A little more on the JPMorgan Chase Oracle outage, *DBMS2*; September 24, 2010.
Oracle database crashes JPMorgan Chase web site, *WordPress*; undated.
Oracle database design slowed Chase online banking fix, *Computerworld*; September 24, 2010.