CU*ANSWERS HIGH AVAILABILITY PROGRAM REVIEW

EVENT DATE(S): 9/17/2023 – 9/20/2023

SUMMARY

As part of an ongoing business continuity program, CU*Answers actively maintains a high-availability (HA) core processing environment with near real-time data replication between identical hosts located at two geographically dispersed, state-of-the-art data centers. A minimum of twice each year, live HA rollover events are scheduled to redirect CU*BASE production and operations to the secondary data center (located in Yankton, SD) for a period of one full business week or longer. At the conclusion of the rollover event, core processing is redirected back, and operations resumed at the primary data center (located in Kentwood, MI).

These live production HA rollover events are invaluable to ensure the ability to recover CU*BASE GOLD core processing in an effective and timely manner when unexpected incidents occur that threaten to disrupt business operations. That objective was put to the test during this rollover period when an unscheduled HA rollback was required, 72 hours into the event. Initially scheduled for one full business week, system performance issues observed on the HA host during the early morning hours of Wednesday, Sept. 20th, resulted in the decision to redirect core processing back to the production site.

First detected by the Operations Team at approximately 2:30 AM ET, response teams were put on alert in case prompt action would be required. After close monitoring, troubleshooting, and analysis, at 4:30 AM the decision to rollback core processing to systems at the primary data center was made. Teams were engaged and automated nightly processing jobs put on hold. CUA-PROD was placed in stand-in mode to allow existing transaction and data replication queues to empty. At 5:30 AM, CU*BASE was taken offline from the secondary data center in Yankton, SD, and procedures initiated to redirect core processing back to the production site. By 7:00 AM, all applications and services were back online and running smoothly. Nightly processing procedures were completed for the remaining time zones, concluding the HA rollover event.

The objectives of the fall HA rollover centered around two primary goals: minimizing latency for web-based applications and reducing the amount of time required for the rollover process itself. Teams sought to validate the changes made as a result of the issues observed during the spring HA rollover conducted in May. These issues included online/mobile banking latency and application performance delays. The causes of those delays have been published in the gap analysis report available for review on our website. Software and system configuration updates were performed for the data replication software in an effort to reduce the length of time required to "roll" live core processing between CUA-PROD and CUA-HA systems. The planning and hard work put into this project paid off well when the duration of both the rollover and rollback were dramatically reduced.

The remainder of this report reflects the details of the event, challenges observed, and continuing efforts to improve the HA rollover process, given the significance it plays in ensuring availability of CU*BASE core processing during potentially disruptive scenarios.

**All times noted in this report are Eastern Time.*

EVENT DETAILS AND TIMELINE

As noted in the previous section, one of the key objectives going into this rollover was to reduce the amount of time CU*BASE is offline (operating in stand-in mode at third-party EFT vendors) during the rollover process. The most time-consuming stage involves data audits and integrity checks as well as the actual "role-swap" procedure when the secondary host becomes primary, and primary becomes secondary (also known as Source and Target for data replication purposes). To aid in reducing the amount of time required, software updates and configuration changes were implemented prior to this event, enabling multi-threaded processing and more efficient use of system resources.

Timeline of events:

Sunday, September 17th

On the morning of Sunday, September 17th, beginning at **2:00 AM ET**, teams initiated the procedures to perform the HA rollover. At 2:17 AM, after pre-roll checks were completed, the official role-swap process began. What took 68 minutes during the previous rollover, now only took 15 minutes. As a precautionary measure in light of the significant time savings, support teams were called in to analyze again the data on both CUA-PROD and CUA-HA hosts before bringing systems online at the secondary data center. Once confirmed, the final stages were initiated to finish the rollover process. By **3:40 AM**, all applications were back online from the secondary data center.

Monday, September 18th

On the morning following the rollover, two separate issues were reported. The first involved a missing CU*BASE credit union library file on the CUA-HA host for a pre-conversion training event. To more effectively allocate network and system resources during rollover exercises, only production data library files are replicated. Given the close proximity to the conversion date, the training library was copied from the production host, resulting a short delay for the scheduled training event.

The second issue involved approximately 70 credit union web sites, all using the login widget for **It's Me 247** online banking. During the HA rollover, a secondary project was completed involving the migration of new SQL servers for the online banking application. During this migration, a key configuration setting required for the functionality of the widgets was not synchronized with the new SQL servers. Once reported, this was corrected, and steps were taken to prevent a repeat during future migration projects.

Wednesday, September 20th

During the nightly processing window, members of the Operations Team detected that select automated jobs were taking longer than they normally would to complete. At **2:00 AM**, the iSeries Administration Team was engaged to troubleshoot the issue. Intermittent delays were spotted on one of the fiber switch ports that provide I/O communications to the Storage Area Network appliance (SAN). This resulted in mild performance degradation for disk-intensive automated jobs. Even though the SAN appliances are configured with redundant fiber switches in a mesh configuration, the system was not handling the condition as expected. At **2:30 AM**, the hardware support vendor was engaged, and the Business Continuity Team notified in case an unplanned rollback was necessary.

At **4:30 AM**, after attempts to correct the intermittent delays, the decision to perform the rollback was authorized. To prepare, steps were taken to place CU*BASE in stand-in mode to allow current transaction and replication queues to finish processing. At **5:30 AM**, CU*BASE subsystems were taken offline on the HA host and rollback procedures initiated. Similar to Sunday morning's rollover, the time required for the "role-swap" process was dramatically reduced relative to the spring HA rollover. The duration was reduced from 3 hours and 45 minutes to 20 minutes. Once again, as a proactive measure, support teams were called in to analyze the data on both the CUA-HA and CUA-PROD hosts, before bringing core processing online at the primary production data center.

By **7:00 AM**, all core processing applications were back online. Post-EOD processing jobs that were paused to perform the rollback were released and completed during the morning hours. A few select file generation jobs experienced a slight delay but recovered quickly with minimal impact. In some instances, daily snapshot files created on the CUA-HA host prior to the rollback were recreated on CUA-PROD using a manual process. No additional issues were reported after the completion of the rollover event.

CHALLENGES AND CONTINUING EFFORTS

Prior to this event, all scheduled HA rollovers over the past 24 months have included planned maintenance and upgrades for both servers and network devices. A key benefit of performing live rollovers is that it enables teams to take production equipment offline without incurring lengthy downtime for critical applications. One example is the spring HA rollover performed back in May where both the CUA-PROD and CUA-HA received IBM Operating System upgrades without interruption to CU*BASE. When issues do arise, maintenance projects can add a layer of complexity when determining the root cause given the number of changes that have occurred.

For this event, the objective was to get back to the basic rollover to work out any and all wrinkles and improve the process by focusing on system performance and user experience. As mentioned earlier, teams set out to enhance both the process of the rollover itself by reducing the amount of time required (minimize downtime) and to prevent or detect latency issues before they impact system performance (user experience). Although this exercise was shortened to 72 hours, both of those goals were achieved, and the rollover declared a success.

It is important to note that these live production high availability rollovers are really disaster recovery exercises under the surface. Each rollover involves bringing system online running on servers that have been "idling" for approximately six months, storing replicated data from the active host. Some disruptions and delays are to be expected, improving over time through experience as the program matures.

Challenges observed during this rollover event include the following:

1. Planning the HA rollover outside of scheduled planned maintenance and system updates proved to be challenging. Today's data center is continuously changing to adapt to evolving technologies as well as the growing number of client credit union and integrated vendors that make up the suite of core processing applications. In a nutshell, there is always something new happening.
    - Teams sought to avoid a rollover period that was within two weeks of a significant CU*BASE software release.
        - During the two weeks following a software release, updates are often pushed out to correct any bugs that are reported.
    - Typically designated as security patch day, installation of all but the most critical patches are scheduled around the HA rollover period.

- One project was scheduled at the same time as the rollover but did not impact operations. A new computer room air conditioner was staged for installation in the production data center while CU*BASE was running at the secondary data center.
    - The existing redundant AC units will remain in use for the foreseeable future.
    - The next scheduled HA rollover (likely in the spring of 2024) will include wiring the new AC unit to the generator, requiring a power interruption to the data center. More details will follow as we approach that event.

2. Scheduled CU*BASE training for a pre-conversion credit union was delayed by 45 minutes for teams to generate the "practice" library file for staff to learn the core processing application.
    - As noted earlier, test and training libraries are not part of the data replication process between PROD and HA servers.
        - The required files were recreated and copied over to the CUA-HA host.
        - Documented procedures have been updated to review the pre-conversions training calendar when preparing for future rollover events.
3. **It's Me 247** login widgets.
    - The scheduled downtime during the HA rollover process provided the opportunity for migrating the online/mobile banking environment to new SQL servers. Initial testing was successful.
    - On Monday morning, it was reported that some members were receiving 404 errors when attempting to login to online banking.
        - Support teams discovered that the most recent revision of a configuration file had not been synchronized to the new SQL server. This issue affecting approx. 70 credit unions with login widgets on their web sites to authenticate OLB users.
        - This synchronization step and check has been added to the server deployment process for future projects.
4. CU*BASE system performance degradation detected during nightly processing early Wednesday morning.
    - At 2:00 AM, third shift Operations Team members monitoring nightly automated EOD/BOD processing noticed that jobs were taking longer to complete. No system errors were present. Support teams were engaged who isolated the issue to an intermittent problem on a SAN fiber switch port.
    - The fiber patch cable from the controller card to the switch port was replaced along with SPF module. Although performance did return to a more normal state, there were still some lingering issues that tipped the scales in favor of performing the HA rollback before credit unions started to open for the business day.
        - A secondary concern centered around the way the system handled the intermittent performance issues with the redundant components. As a precautionary measure, in light of the performance issues observed during the spring HA rollover, the rollback was authorized.
        - Following the successful rollback, teams worked with the hardware vendor (IBM) to isolate and replace components that contribute to the performance degradation.
        - Diagnostic scans on the HA SAN continue to come up clean giving confidence to the teams that the system is ready for production. As a precautionary measure, ongoing testing will continue to monitor system performance.

5. Initiating the HA rollback before the completion of EOD/BOD nightly processing required modifications to the job automation schedule as well as custom manual procedures to copy origination files from the CUA-HA host to CUA-PROD.

- Past unscheduled HA rollovers included delayed processing but rarely have they involved finishing nightly processing that started on the alternate host. This required thorough evaluation of nearly 8,000 automated jobs and careful coordination from the third and first-shift Operations Team.
- The experience gained and documented details from past emergency HA rollover events proved extremely valuable in completing the nightly processing under adverse conditions.

CLOSING REMARKS

Given the range of issues that had surfaced during the previous two rollover events, this exercise was designed from the start with the removal of any maintenance and upgrade projects. This scenario provided recovery teams the opportunity to focus on the primary procedures for redirecting core processing and to validate whether changes made to (1) reduce the amount of downtime required, and (2) improve the customer experience by eliminating application latency were effective. Unscheduled rollback aside, the answer to both of these objectives was a resounding "yes." Downtime for the rollover and rollback process was reduced by a factor of 4x and latency for web applications was kept well below the established baseline given the distance between data centers.

The conditions surrounding the HA rollback performed on Wednesday morning required teams to expect the best but plan for the worst. At best, the rollover would be completed successfully before staff started to arrive at the credit union branch locations. Anything less would require a coordinated and well thought communications plan to alert and inform all clients about the system delays with estimated time of resolution. While recovery teams were busy performing the emergency procedures to bring CU*BASE online, others were working on the crisis communications effort. All parties involved were pleased with the speed and effectiveness of the recovery effort, announcing that core processing was back online by 7:00 AM ET that morning.

This rollover event is another reminder that the investment made over the past two decades in building and testing its Business Continuity Program has positioned the CUSO to navigate the storms on the horizon and enables it to reach for new opportunities and serve its owners and client credit unions in innovative ways.

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