CU*ANSWERS HIGH AVAILABILITY PROGRAM REVIEW

EVENT DATE(S): 9/11/2016, 10/16/2016 – 10/19/2016

SUMMARY

As part of an ongoing business continuity program, CU*Answers actively maintains a high-availability (HA) core processing environment with real-time CU*BASE data replication between identical hosts located at two geographically dispersed, state-of-the-art datacenters. A minimum of twice each year, HA rollover events are scheduled to redirect core processing and operations to the secondary datacenter for a minimum period of 72 hours. At the conclusion of the rollover event, CU*BASE core processing is redirected back and operations resumed at the primary datacenter (located in Kentwood, MI). These HA rollover events are invaluable in an effort to validate procedures and ensure the ability to recover CU*BASE/GOLD core processing in an effective and timely manner.

Prior to this event, the HA environment for CU*BASE was located at the secondary datacenter in Muskegon, MI. In early 2014, CU*Answers launched a project to relocate the HA environment to the Site-Four facility located in Yankton, SD. Over the months that followed, several teams from across the organization participated in the design, engineering, installation, configuration, testing, and completion of the new HA environment in preparation for this first rollover event. Many hours were invested and miles traveled to bring this project from a vision to reality.

The procedures followed during this rollover exercise were similar to those in previous events. Each of these rollover exercises brings with it a unique set of circumstances and challenges, but common among them are the goals and objectives of a successful continuity and recovery program.

Notable characteristics of this event include:

- This rollover event encompassed the installation of two new IBM servers to replace both CUAPROD and CUAHA as part of a three-year lease agreement.
    - The installation and rollover to the new CUAPROD server was completed on the evening of September 11 at the Kentwood datacenter.
    - The installation and rollover to the new CUAHA server was completed on the evening of October 16 at the Site-Four datacenter, as detailed in this report.
        - Both of the new IBM servers were received and installed with a newer version of the operating system (V7R2) to that of the existing production servers (V7R1).
- This rollover event was the first performed in the new HA environment at the Site-Four datacenter.
    - The HA environment located at Site-Four was designed with a new IP address space, which required a configuration update on every device on the cuasterisk.com network (beginning with the internal networks and expanding out to every client credit union branch office) for proper routing and firewall access parameters.

    - The Site-Four Operations Team was involved to assist with daily operational tasks (tape rotation, etc.) as well as hand-on support for the new HA host.
- For the purpose of this first rollover event involving the new HA network, connectivity from external sources was "back-hauled" through the Kentwood and/or Muskegon datacenters using existing VPN channels.
    - After successfully performing daily operations from the new HA environment, the next phase of the project was launched to create the necessary VPN tunnels from external sources (i.e. credit union branch networks) directly to the Site-Four datacenter. This connectivity will be validated through offline testing and confirmed during the next scheduled HA rollover (tentative Q2 2017).

The following sections identify challenges observed, lessons learned, and recommendations for consideration related to this event.

EVENT DETAILS

On Sunday, September 11, at 8:00 PM ET, the production host in Kentwood, MI was taken offline and rollover procedures initiated to bring CU*BASE core processing live on the replacement production host. This process required the renumbering of the new host and server IPL (reboot). CU*BASE core processing was back online at approximately 12:15 AM on Monday, September 12.

On Sunday, October 16, at 8:00 PM, the production host in Kentwood, MI was again taken offline and rollover procedures initiated to bring CU*BASE core processing online at the new HA environment in Yankton, SD. By 9:10 PM, the rollover process had completed and recovery teams began testing core processing applications and systems before making them available. By 9:40 PM, member-facing applications such as home and mobile banking were online. Recovery teams worked to resolve connectivity issues with each third-party EFT vendor and self-processor. These were tackled and resolved one at a time with completion of all but two self-processors by 11:30 PM. Access for remote telnet support to the remaining self-processors was resolved at the open of the business day on Monday, October 17.

On Wednesday, October 19, at 10:00 PM, the rollback process was initiated bringing CU*BASE/GOLD core processing back to the primary datacenter in Kentwood, MI. This process was completed and systems back online by 10:50 PM.

CHALLENGES

With the continued expansion and improvements of products and services to a growing client network, the systems and resources required experience a rapid rate of change and increase in complexity. None perhaps more so than what has developed over the past several months with the installation of a new HA environment within the Site-Four datacenter, increasing the distance between production and high-availability datacenters from 50 miles to 750 miles in separate time zones. Performing these rollover exercises in a planned, controlled setting during non-peak business hours is a small investment in preparation, should the need arise under less optimal conditions to perform a true recovery during an unplanned disruption.

Maintenance windows necessary to perform these rollover events continue to shrink as more daily tasks are required of system operators. It is important to continuously seek ways to improve processing efficiency through

automation and managed productivity, while at the same time become even more creative in testing operational resilience.

Due to the nature of these 'live' rollover exercises (redirecting production traffic from 250+ credit union locations to systems at the new HA datacenter in Yankton, SD), potentially significant challenges and issues are anticipated and prepared for in advance, such as those observed in this event as detailed below:

- Network connectivity from 250+ credit unions (including all branches and remote office locations) to the newly created HA environment within the Site-Four datacenter.
    - This was complicated by the fact that the data communications carrier was unable to provide the requested network addresses needed for the new HA environment. Network planning teams were forced back to the drawing board to reengineer existing network address blocks and free up available addresses for reallocation. This created a delay in communicating the new address space to client credit unions and vendors, reducing the amount of time available to them for making the necessary changes to their networks and devices.
    - From September 14 through October 11, nine separate email / CU*BASE Alert communications were sent in addition to multiple personal call campaigns informing external stakeholders of the required networking changes for connectivity to the new HA host at Site-Four, including methods for testing (PING/TELNET).
        - For clients with an existing contract for managed network support from CNS, technical teams were able to make the necessary routing and firewall configuration changes. For those clients who manage their own or outsource to an alternate third-party vendor for network support, regular follow-up contacts were performed to ensure that they understood the significance of the changes required (failure to do so would have resulted in the inability of credit union staff to connect to CU*BASE/GOLD on the morning following the rollover).
    - During the week prior to the rollover, CNS developed and executed an automated script on each Guapple appliance to test connectivity from inside the credit union network to the new HA host at Site-Four. The reports generated helped to narrow the scope for support efforts as well as measure and adjust the effectiveness of communications.
    - On the morning following the HA rollover, access to two self-processors for remote support via TELNET was blocked. This required additional routing and firewall rule changes to resolve.
        - Remote printing to one self-processor was inadvertently blocked following the rollover and corrected.
- Network connectivity for 20+ third-party vendors (including EFT and credit bureaus).
    - Although connectivity to the new HA host at Site-Four was "back-hauled" through the Kentwood (or Muskegon) datacenters for the purpose of this rollover, some routing and firewall issues were discovered once the HA host was live. These were resolved one by one throughout the maintenance period, prior to the open of business the following morning.

        - The experience gained throughout this project to relocate the HA environment has resulted in a better understanding of the connectivity between CU*Answers and each third-party vendor for networks that have evolved over the course of several years.

- Synchronization of host table entries on the new host systems.
    - Real-time data replication is a critical component of the high-availability strategy for synchronizing member and user data between hosts. Excluded from data replication configurations are certain system variables that are unique to each host. This includes tables that maintain information about each server/application used for connectivity to the production host for data exchange.
        - A limited number of these host table entries did not match the table on the production server following the rollover, requiring changes to resolve connectivity and application issues when operating live from the HA environment at the Site-Four datacenter.
        - One of the database table names was not consistent with the production environment and required the modification of APIs for proper application execution.

CONTINUING EFFORTS AND RECOMMENDATIONS

Whether planned or unexpected, each recovery test and high-availability rollover exercise provides the opportunity to continually improve the process and adjust procedures. The best way to accomplish this is to "Practice. Learn. Repeat". The following is a list of action items and projects relative to this rollover event that will be pursued in an attempt to draw closer to that goal:

1. On the morning following the HA rollover, there were 14 credit union branches that were not able to connect to the new HA host at Site-Four. These involved both workstations and TCD/TCR units.
    a. Several of these branch locations were documented as "tested successfully" prior to the event by the client credit union using the tools provided. It appears that either the tool was used incorrectly or another factor was present, preventing connectivity to the HA host (i.e. improperly configured firewall access rules).
    b. During the weeks and days prior to the HA rollover when communicating to clients about the required network configuration changes, it was noted that a percentage of clients did not interpret the message accurately and/or failed to take action. Given the size and scope of this campaign, the experience gained will be used to enhance future communications.
    c. Related to the above, the documented requirements for network connectivity published in the AnswerBook will be updated and reminders will be issued on a regular basis to ensure that credit union branches remain able to connect to the HA host at Site-Four moving forward.
2. Every three years, the servers that host CU*BASE/GOLD are replaced with new technology as part of a lease agreement with the manufacturer. It is during these host replacement projects where potential errors in host-specific configuration files are uncovered (last project was performed in 2013). These include host table entries as noted in the challenges and issues above.
    a. The process and procedure documentation will be enhanced to better prepare teams for projects and events where the recovery and/or replacement of servers is required involving the synchronization of host table entries outside of the scope of data replication.

3. Third-party EFT vendors will be engaged in an effort to improve the process and recoverability of network communications and further minimize downtime during high-availability and recovery events.
    a. Proactive communications prior to the HA rollover events will continue in an effort to minimize downtime with each vendor.
    b. The scope of future HA rollovers will be expanded to include the redirection of network traffic to the secondary datacenter for those vendors who have invested in high-availability technologies.
    c. The growing size and amount of time required for the transmission of the card maintenance files has been squeezing the available windows for performing these types of tests and exercises. Efforts to collaborate will continue with third-party EFT vendors on solutions such as increasing bandwidth to reduce time required for file transmissions.
4. Celebrate success, then press forward
    a. When stepping back and evaluating all of the planning and effort invested over the years to achieve the level of preparedness the CU*Answers network has obtained through rigorous HA rollover exercises, a level of confidence is gained, helpful to continue building the networks and systems that will meet the demands of tomorrow.
    b. The relocation of the HA environment to the Site-Four datacenter now provides a level of redundant operational support not available prior to the move. Building on this relationship will enhance the capabilities to respond and recover from unexpected disruptions.

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