TRADING TECHNOLOGIES

Reason for Outage (RFO)

CME Order Routing / Order Management Issues
Feb 2021

There were multiple issues over the last week on the TT Platform which impacted order routing and order management for CME. There were separate issues which occurred concurrently which led to the failures experienced. TT understands the impacts of these issues on our clients and are committed to preventing a recurrence.

Order Routing Issues

Summary

TT implemented a change on the weekend of 12-Feb to correct CME order routing issues experienced on 11-Feb. On 14-Feb at 23:00 UTC TT was alerted to issues impacting order routing on CME. Initial reports were isolated but as the investigation continued they expanded to all of the CME order routing components by 23:35 UTC. Standard operating procedures were followed in an attempt to recover, this included a rollback of the software which was successful and all sessions were reconnected by 00:18 UTC. To ensure stability a further action was executed between 00:44-00:45 UTC and services were fully restored by 01:06 UTC.

Unrelated to the prior issues, on 16-Feb at 14:35 UTC a node in the CME cluster experienced an out of memory event which triggered the expected automated failover to an alternate node. The alternate node subsequently experienced the same out of memory event at 14:40 UTC. Manual intervention was taken to move connections to alternate nodes and service was restored by 14:50 UTC.

Root Cause

The original issue which occurred on 11-Feb was a deadlock condition for which diagnostic data was insufficient to pinpoint specific logic at fault and our development team was unable to reproduce in the lab. The development team was able to identify potential sources of the problem and issued a patch the weekend of 12-Feb in an effort to prevent the failure. After the subsequent failure on 14-Feb, while the updated code did not prevent the failure, it did allow for sufficient diagnostic data to be collected and to deterministically reproduce the failure and identify the root cause. The issue was determined to be a defect within the processing logic for certain covered strategy fills which resulted in the deadlock condition; the defective logic was recently introduced (2-Feb) as part of a feature implementation for volatility quoted options. The specific scenarios which led to the deadlock conditions were not captured in our automated testing but we are enhancing our testing to ensure sufficient coverage for this and similar scenarios in the future. Corrective action for these issues was implemented after the end of trading on 14-Feb.

The 16-Feb out of memory event was caused by excessive logging triggered by a standard end-user operation which resulted in a rapid increase in memory utilization and ultimately memory exhaustion due to resource contention between the application and diagnostic tools (which consume these same logs). To prevent the issue moving forward we have reduced the logging when this type of end-user operation is taken and limited the diagnostic tools to a minimal memory footprint to prevent the possibility of resource contention. Corrective action for these issues was implemented after the end of trading on 16-Feb.

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Order Management Issues

Summary

There were no order management issues on 11-Feb as the failure resulted in an expected failover scenario which did not require an application restart. After service was restored on 14-Feb and 16-Feb certain customers experienced order management issues including unmanageable orders and restatement of orders, which in certain circumstances resulted in incorrect positions. For unmanageable orders customers were directed to verify their position with the exchange and perform force cancellation as necessary. For restated orders, impacted customers were provided a list of restated orders and asked to verify their position with the exchange and publish manual fills as necessary.

Root Cause

Unmanageable and stale orders

The cause of unmanageable and stale orders was the result of a defect in a failure scenario logic where, during recovery, the orderbook data is not fully loaded prior to reconnection to the exchange. This defect was introduced with a recent version (5-Feb). Corrective action for these issues were implemented after the end of trading on 16-Feb.

Restatement of orders, missing fills, and incorrect positions

Following the restart of services after the 14-Feb and 16-Feb TT connected to the exchange with a low sequence number resulting in the replay of previously processed messages from the exchange. In certain cases, the same fill was re-processed which resulted in incorrect positions. The mechanism used to reconcile sequence numbers was impaired due to a defect (introduced 12-Feb) which caused sequence numbers to be overwritten. Corrective action for these issues was implemented after the end of trading on 16-Feb.