

Incident Overview

As APAC markets began opening for the February 12 trade day, we were alerted to TT Gateway startup issues for multiple exchanges. Initial reports involved traders using Tokyo based HKEX Gateways not receiving prices. We saw that the Price Servers for both HKEX and SGX (located in Tokyo and Singapore) were both considering themselves as primary, which is typically caused by multicast communication problems between the two Price Servers. Investigation determined that multicast data was not getting to the Tokyo data center from the Singapore data center. We moved the Tokyo based HKEX Gateways to Singapore in an attempt to restore service, but those Gateways were not able to fully initialize due to multicast issues within the Singapore data center. The customer order routing HKEX Gateways were not properly receiving multicast prices from the Price Servers. Other hosts that were not initializing as normal due to these multicast issues included SGX Gateways and SFE Gateways in the Singapore data center. Some customers also reported that remote users connecting in to Singapore based X_TRADER Remote Host machines were not receiving price updates from multiple exchanges. Holistically, these issues all indicated that there was a multicast issue in Singapore. Any TT software that relied on multicast traffic within or coming from the Singapore data center was potentially impacted by this issue.

As we worked to resolve these issues, we recommended that remote users utilize X_TRADER Remote Hosts in data centers outside of Singapore to circumvent the ongoing multicast issues. In an attempt to restore service, we performed emergency maintenance on impacted TT Gateways in Singapore. By failing over TT Price Servers, we were able to establish multicast connectivity for some TT Gateways as multicast subscriptions were re-requested.

Ultimately, our investigation determined that the rendezvous point (RP) for multicast in the APAC region was not set up properly. Over the weekend and prior to these multicast issues, our backbone router between Tokyo and Singapore experienced a hardware failure and needed to be brought offline. That router had served as the primary RP for the region. After it was brought offline, the backup RP on the backbone router in Hong Kong needed to take over. This router was not set up properly, as it was discarding encapsulated messages that are needed to serve as the RP. A configuration change was made at around 22:30 SGT, so that the Hong Kong backbone router would properly handle the messages needed to serve as a RP. This change

resulted in multicast traffic being properly handled and forwarded within the hosted environment. After this change, all SGX and SFE Gateways in Singapore were able to fully initialize. A handful of HKEX Gateways continued to have issues initializing, and we needed to fail over price servers to force customer HKEX Gateways to re-request multicast subscriptions. Once this failover took place, the remaining HKEX Gateways came online at approximately 00:10 SGT on Tuesday morning.

After services were restored, we continued to work with Cisco to make sure multicast setup was optimized in the region. Emergency maintenance in the Singapore data center was performed at 04:45 SGT on February 13 to clear mroutes, so that routing tables would not have problematic data from the earlier issues. After this work, network checks confirmed that all necessary multicast joins were in place, and that mroutes looked as expected. As the APAC markets came online for the February 13 trade day, we closely monitored the overall service to ensure everything behaved as expected, and no further issues were reported.

Root Cause

The router that took over as the primary rendezvous point (RP) for the APAC region after the primary experienced a hardware failure had a misconfiguration that resulted in multicast traffic not being forwarded properly. This caused TT hosts in the APAC region to inconsistently subscribe to necessary multicast data, resulting in some TT services being unavailable.

Remediations

- While the multicast issues were ongoing, we failed over price servers to force multicast re-subscriptions, resulting in some impacted Gateways being able to fully initialize.
- We directed customers to point to alternative X_TRADER Remote Hosts in different data centers, to circumvent the multicast issue impacting remote users.
- We amended the configuration on the router that took over as the active rendezvous point (RP), so that multicast traffic would be forwarded properly.

- We worked with Cisco to identify router and RP configuration changes to harden multicast. We cleared mroutes in Singapore to ensure any problematic multicast routes could no longer cause any residual issues.
- The failed backbone router in Singapore is scheduled to be replaced over the weekend of February 17, and it will again take over as the primary RP for the APAC region.
- We have reinforced to internal support staff how RP are configured within our hosted solution.