



TMX Quantum XA Frequently Asked Questions

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General:

1. What is TMX Quantum XA? As part of TMX Group’s technology roadmap, TMX Quantum XA is the next generation of our Quantum equity trading platform, designed to offer a material improvement in performance, representing twenty-fold reduction in median latency over the current system, to sub-100 microseconds (0.1 milliseconds roundtrip from customers’ demarcation point) on order executions by using hardware acceleration. This means TMX Quantum XA will position TMX as a leader in the Canadian and global marketplace as a provider of high performance trading technology.
2. What does the name ‘TMX Quantum XA’ represent? TMX Quantum XA stands for TMX Quantum Express Accelerated, representing the latency reduction that will result from this hardware acceleration upgrade.
3. What is “hardware acceleration”? Hardware acceleration is a general term that refers to the offloading of processing work from the server CPUs onto specialized hardware. The TMX Quantum XA hardware acceleration upgrade will reduce latency and jitter (latency variability) while increasing network capabilities.
4. What are the differences between TMX Quantum and TMX Quantum XA?

	TMX Quantum	TMX Quantum XA
Latency	2.3 milliseconds median order processing latency	Sub-100 microseconds (0.1 milliseconds) median order processing latency (via a 10G network connection)
Protocol requirements	FIX 4.2 or STAMP 6.1	FIX 4.3 or STAMP 6.1
Routing Methodology	Customers route orders to TMX Quantum Gateway through one connection. TMX Quantum Gateway routes order to appropriate partition and market based on symbol.	Customers will route orders by symbol and market through separate session bundles.
Network connection	1G copper network connection	Existing 1G copper network connection with optional upgrade to 10G fibre network.



5. What are the benefits of TMX Quantum XA? TMX Quantum XA offers many benefits to participants and the Canadian capital markets, including:
 - ✓ Improved trading performance in the form of lower latency, less latency variability (jitter), and enhanced network capabilities
 - ✓ Reduced trading risk through quicker response times and less variability in order processing (i.e. less jitter)
 - ✓ Reduced data feed latency
 - ✓ Improved market quality and efficiency
 - ✓ Strengthening Canada's competitiveness on the global stage, to attract additional investment, trading, and liquidity to Canada
 - ✓ Increasing Canada's profile as a technology leader in the global trading community
 - ✓ Being responsive to growing industry demand for high performance marketplace technology
6. Will TMX Quantum XA impact jitter? Jitter (ie. latency variability) is expected to significantly improve as a result of TMX Quantum XA both in absolute terms and as a percentage.
7. Who will benefit from the TMX Quantum XA upgrade? The significant reduction in roundtrip order processing latency and jitter will benefit the Canadian equities market as a whole, in that it will lead to improved market quality and efficiency, increased order flow and turnover, and additional size at the top of the book and tighter spreads, while operational risks are decreased.
8. What is jitter? The term jitter (also referred to as 'latency determinism') describes the latency variability or consistency. High jitter means the range of the order flow latency is high. As jitter is reduced, the latency becomes more consistent and thus more predictable. Jitter is reduced by avoiding operating system scheduling through the use of hardware acceleration and other techniques.



9. Who will be impacted by the TMX Quantum XA upgrade? Anyone with a direct connection to TSX, TSX Venture, or TMX Select with a certified order entry application will be impacted and required to make changes as a result of the TMX Quantum XA upgrade. This includes, but is not limited to:
- Service Bureau vendors
 - Participating Organizations, Members, or Subscribers with in-house proprietary systems
 - Software providers
 - DMA customers supporting direct connections

Market Data feed customers will have the option to upgrade to a 10G fibre network connection, but will not be required to make changes for the TMX Quantum XA upgrade.

Customers that access TSX, TSX Venture, or TMX Select through a service bureau vendor will not be required to make changes for the TMX Quantum XA upgrade.

10. How will customers using FIX 4.2 protocol to directly connect to TMX Quantum be impacted? Customers using FIX 4.2 protocol will be required to use FIX 4.3 protocol to connect to TMX Quantum XA. This means during the gradual migration of TMX Select symbols to TMX Quantum XA, customers will have a separate connection each for TMX Select symbols trading on Quantum (via FIX 4.2 protocol) and TMX Select symbols trading on TMX Quantum XA (via FIX 4.3 protocol). FIX 4.3 protocol will provide an additional via an authentication key. Once the TMX Select symbol migration to TMX Quantum XA is complete (approximately one month after symbol migration inception), FIX protocol users will connect to TMX Select only via FIX 4.3, while continuing to connect to TSX and TSX Venture via their current FIX 4.2 connections.
11. Will STAMP protocol users be required to make any updates? There will be a minor optional change to the session login code. The message authentication tag will become optional for STAMP customers who wish to further reduce their latency. Moreover, during the TMX Select migration period, customers will be required to establish an additional STAMP connection to TMX Quantum XA to be able to trade all symbols on all markets.
12. Will all market participants have an equal opportunity to trade on the new TMX Quantum XA platform? Yes, all market participants will have an equal opportunity to access and complete the certification for the TMX Select migration to TMX Quantum XA.



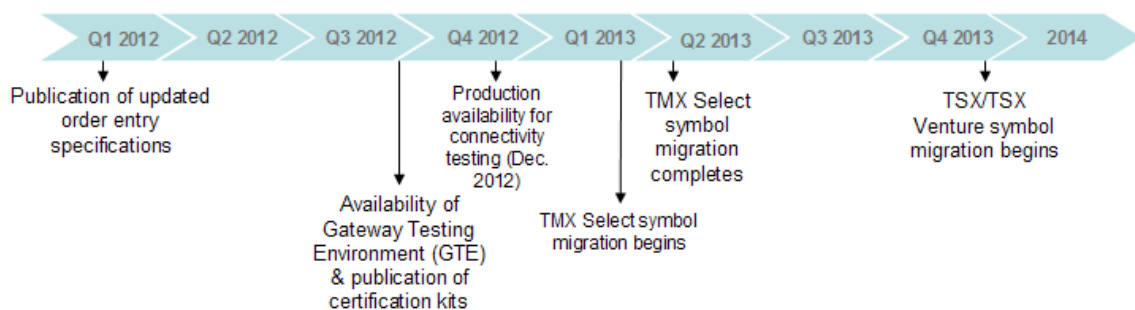
13. What's the difference between EEP2 and TMX Quantum XA? Enterprise Expansion 2 is the scaling up of our systems through partitioning that resulted in doubling the capacity of the order processing throughput. The primary goal of EEP2 was to increase the throughput and capacity designed to accommodate 40,000 order messages per second. TMX Quantum XA optimizes the message processing in the TMX gateway and the trading engine in order to substantially improve the roundtrip order processing latency. Combined, these initiatives support TMX's advancement of technology to ultimately increase performance through latency (TMX Quantum XA) and throughput (Enterprise Expansion 2).
14. How will TMX communicate the TMX Quantum XA upgrade to the industry? TMX will endeavor to provide frequent and comprehensive updates to the industry through various communication channels with customers. Beginning with the publications of a media release and PO Notice one year prior to the production launch, TMX will continue to provide periodic updates via one-to-one customer meetings, PO notices, media releases, TMX hosted lunch & learn sessions, and regional roadshows. We also encourage anyone interested in more information to visit our [website](#) on a regular basis for ongoing updates.
15. Why is TMX providing over one year notice for this upgrade? Recognizing the impact to the industry, TMX would like to provide the community as much advance notice as possible to allow for planning, resources, testing, development and implementation.
16. Will customers be required to sign any Agreements? No. Customers will not be required to submit any new Agreements as part of the TMX Quantum XA upgrade.
17. Will customers be required to recertify their existing application? Yes. A modified certification will be required to certify connectivity to TMX Quantum XA. As business functionality is not changing, customers will not be required to re-certify business functionality. A single certification will cover TMX Quantum XA connectivity to TMX Select, and in the future, TSX and TSX Venture.
18. What is the impact to Participating Organizations who do not directly connect to the existing TMX Quantum platform for order routing? Customers who do not directly connect to the TMX Quantum platform will continue to route their orders to their access vendor. The access vendor will be required to make the upgrade to TMX Quantum XA. Customers should contact their access vendor to ensure system readiness. As always, TMX will continue to work closely with all access vendors to ensure they are supported during the upgrade.



19. Are there any planned changes to the existing order types? New trading functionality will not be introduced as a direct result of the TMX Quantum XA upgrade. Moreover, in order to minimize the impact to customers, TMX will impose a code freeze on new functionality once the Gateway Testing Environment (GTE) becomes available for the TMX Select migration to TMX Quantum XA (September/October 2012).
20. Have the regulators been consulted in regards to TMX Quantum XA? TMX has engaged the regulators and will continue to keep them fully informed on the TMX Quantum XA initiative.
21. Who can customers approach for more information about TMX Quantum XA? Customers with questions or feedback are encouraged to contact their TMX Equity Markets Account Manager, or the Market Operations team at 416-947-4705 (vendor_services@tsx.com).

Schedule:

22. When is the TMX Quantum XA upgrade expected to take place? TMX Select on TMX Quantum XA is expected to be in production in Q1 2013. A phased approach for the implementation will take us from present day until 2014, as follows:
- Q1 2013 – TMX Select will migrate to TMX Quantum XA
 - End of 2013 – TSX and TSX Venture will begin to migrate to TMX Quantum XA





23. Why is TMX Select migrating to TMX Quantum XA before TSX and TSX Venture?
There are a number of reasons why TMX Select is migrating to TMX Quantum XA prior to TSX and TSX Venture. As communicated during the launch of TMX Select, the alternative marketplace was designed provide a nimble and innovative platform that will meet the rapidly evolving needs of the Canadian equities market. In addition, the customer impact will be reduced with the TMX Select upgrade as it will only require one new connection to TMX Quantum XA (compared to multiple connections required for TSX and TSX Venture), and thus will limit the risk to the industry. Finally, introducing the upgrade on TMX Select prior to TSX and TSX Venture will provide TMX an opportunity to leverage the lessons learned from the TMX Select upgrade to optimize the migration of TSX and TSX Venture to TMX Quantum XA.
24. Why is there a one year gap between the migration of TMX Select to TMX Quantum XA and the migration of TSX/TSX Venture to TMX Quantum XA? Recognizing that the TMX Quantum XA upgrade may have a substantial impact to some customers, TMX has endeavored to provide an appropriate timeframe to facilitate client readiness for both the TMX Select and TSX/TSX Venture migrations. In addition, the scope of work for TMX to prepare and implement Quantum XA for TSX and TSX Venture is considerably larger than for TMX Select given the respective sizes of these markets and the technology used to support them. As such, that time is required for TMX to successfully roll out this new technology.
25. When will testing be available for the TMX Select upgrade to Quantum XA? The TMX Select upgrade to TMX Quantum XA will be available for testing in TMX's Gateway Testing Environment (GTE) approximately 6 months prior to the commencement of the TMX Select symbol migration to the TMX Quantum XA platform (September/October 2012).
26. When will details pertaining to the migration plan for the launch of TMX Quantum XA on TSX and TSX Venture be available? The migration plan for the launch of TMX Quantum XA on TSX and TSX Venture is expected to be communicated in Q4 2012.
27. When will the 10G network be available? While the 10G network upgrade is not mandatory, interested customers will be able to connect to it as early as January 2013.
28. When will the certification kits be available for the TMX Select upgrade to TMX Quantum XA? TMX Quantum XA certification kits will be made available in conjunction with the availability of TMX Quantum XA in the Gateway Test Environment (GTE). TMX Quantum XA is scheduled to be available in GTE in September/October 2012.



29. When will the testing environment and specification documents be available for the TMX Select upgrade to TMX Quantum XA? Specification documents for the TMX Select upgrade to TMX Quantum XA are expected to be available in April 2012. The Gateway Testing Environment (GTE) is expected to be available in September/October 2012.
30. Will there be a code freeze prior to the implementation of TMX Quantum XA? Yes, in order to minimize the impact to customers, TMX will impose a code freeze on new functionality once the Gateway Testing Environment (GTE) becomes available for the TMX Select migration to TMX Quantum XA (September/October 2012).
31. What is the migration plan for the launch of TMX Quantum XA on TMX Select?
The migration to TMX Select will be implemented in the following stages:
Stage 1: Symbol migration from TMX Select Quantum to TMX Select Quantum XA
Customer Impact: Customers will be required to:
- A. Complete a certification process on TMX Quantum XA
 - B. Send orders using FIX 4.3 protocol for customers currently using FIX. Orders for symbols that have migrated to TMX Quantum XA will need to be routed via FIX 4.3 protocol, while orders for symbols that have not migrated are to be routed via the existing FIX 4.2 protocol. Customers will receive a PO Notice to determine where to route each symbol for TMX Select orders.
 - C. Customers using STAMP protocol will continue to use version 6.1, but will need to route TMX Select orders based on symbol and IP address.
 - D. Ensure orders can be routed to TMX Select by symbol and IP address. Orders for symbols migrated to Quantum XA must be sent to a different destination IP address than orders for symbols that have yet to migrate.
 - E. Provide a new session bundle to access TMX Select Quantum XA that will run in parallel with existing connections to TMX Select Quantum, TSX and TSXV Quantum.
 - F. Continue sending orders to TSX and TSX Venture via existing protocols with existing sessions.
 - G. An optional 10G network connection will be available to customers who may wish to subscribe to it.
- Stage 2:** Complete symbol migration to TMX Select Quantum XA
Customer Impact: Customers will be required to:
- A. Provide a new session bundle to access TMX Select Quantum XA that will run in parallel with existing connections to TSX and TSXV Quantum.
 - B. Continue to route orders to TSX and TSX Venture via FIX 4.2 or STAMP 6.1 protocols. TMX Select orders will only be routed via FIX 4.3 or STAMP 6.1 protocol.

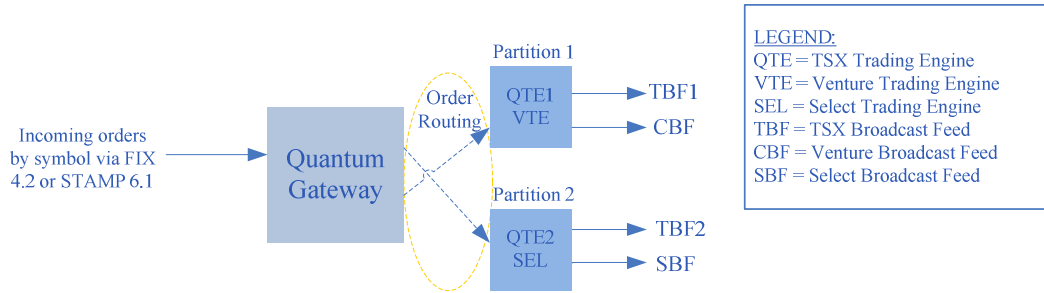


Technical:

32. How often will a symbol 'destination' be modified? Similar to the partitioning of symbols on EEP2, the symbol 'destination' is not expected to be altered, unless required for load balancing purposes.
33. Will there be parallel run during the TMX Select migration where customers can route symbols that migrated to TMX Quantum XA to the TMX Quantum platform as well (ie. Will there be backward compatibility)? No. Once TMX Select symbols are migrated to the new TMX Quantum XA platform, they will no longer be available on TMX Quantum.
34. What does this mean for the messaging rates and bandwidth projections? As previously communicated, the bandwidth recommendations for 2012 are not expected to change. Messaging rates are likely to be impacted upon the TMX Select migration to TMX Quantum XA in 2013. Future recommendations to the messaging rates and bandwidth projections will be communicated at a later date via the current communication channels.
35. Does TMX Quantum XA impact the Quantum Gateway? While TMX Quantum XA is a separate system from TMX Quantum and will not directly impact the TMX Quantum Gateway, it will eventually replace the TMX Quantum platform.
36. Will there be an immediate impact to latency? Yes. The significant latency reduction for TMX Select orders will be experienced immediately upon the TMX Select symbol migration to TMX Quantum XA.
37. What impact will TMX Quantum XA have on the existing trading engine partitions? TMX Quantum XA will not impact the existing trading engine partitions. However, customers will be required to modify their order routing methodology. Currently, the TMX Quantum Gateway routes the orders to the appropriate trading engine partition on behalf of customers. As soon as symbols begin migrating to the TMX Quantum XA platform, customers will be required to route their orders to TMX Quantum XA by symbol and market through separate session bundles for each TMX Quantum XA node (see diagram below).

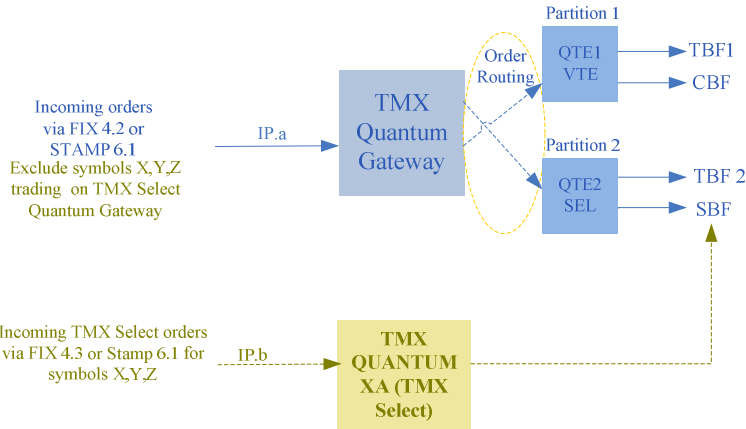


Current State:



* Customers route orders to TMX by symbol. TMX Quantum Gateway routes incoming orders to appropriate trading engine partition

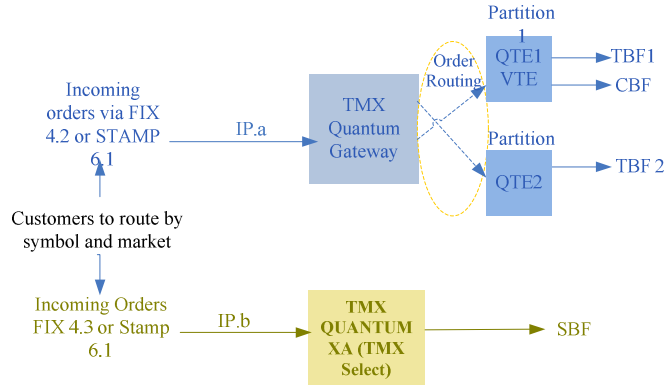
Partial TMX Select Symbol Migration (Q1 2013):



* Customers will route TSX, TSX Venture and TMX Select orders (for symbols that have NOT migrated to TMX Quantum XA) to the existing TMX Quantum platform using FIX 4.2 or STAMP 6.1 protocols, while TMX Select orders for symbols that have migrated to TMX Quantum XA will be routed via a separate session bundle to TMX Quantum XA using a FIX 4.3 or STAMP 6.1 protocol.

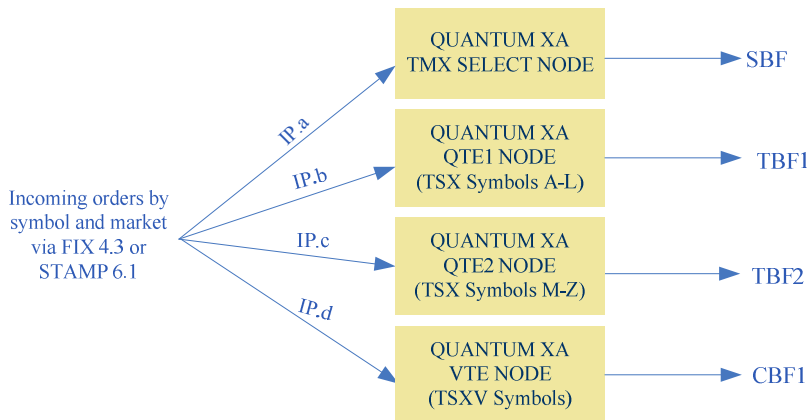


Complete TMX Select Symbol Migration (Q2 2013):



* Customers will route TSX and TSX Venture orders to TMX Quantum using FIX 4.2 or STAMP 6.1 protocols, while using a separate session bundle to route TMX Select orders to TMX Quantum XA.

Complete Migration to TMX Quantum XA for TSX, TSX Venture, TMX Select (2014):



* Customers will be required to route their orders to TMX Quantum XA by symbol and market through separate session bundles for each TMX Quantum XA node .

** The above diagram has been created for illustrative purposes only. The number of nodes and the allocation of the symbols have not been fully determined yet.

38. How will customers know which IP address to route their orders to? During stage 1 of the TMX Select migration, customers will be advised in advance via PO Notices as to where to route each TMX Select symbol (TMX Quantum vs. TMX Quantum XA). Once the symbol migration for TMX Select to TMX Quantum XA has been completed (expected Q2 2013), all TMX Select orders will need to be routed to TMX Quantum XA, while all TSX and TSX Venture orders will need to be routed to the



original Quantum platform. For the TSX / TSX Venture implementation, TMX expects to publish IP information by symbol on a feed.

39. Will an Ex-Destination tag still be required to route orders to TMX Select? During the symbol migration phase of TMX Select to TMX Quantum XA, the TMX Select Ex-Destination tag will be required for routing orders to the TMX Quantum platform. After the full migration of TMX Select to TMX Quantum XA, the Ex-Destination tag will no longer be required.
40. What is the difference between FIX protocols 4.2 and 4.3? The main difference between FIX protocols 4.2 and 4.3 is that FIX protocol 4.3 adds a layer of security by offering session authentication that will validate the customer connection to TMX Quantum XA through an authentication key. Changes to tags are expected to be minimal.
41. Why are customers required to route by symbol and market? The TMX Quantum platform is completely separate from the TMX Quantum XA platform, and as such orders that are not routed by symbol and market will be rejected (see diagram in question 41 for further details).
42. Will there be an impact to customers' network connection as a result of TMX Quantum XA? From a network perspective, there will not be an impact to customers' network connection. However, TMX will be offering an optional 10G network connection for customers.
43. Will TMX Quantum XA impact the reliability or redundancy of the TMX technology? TMX Quantum XA is expected to be more reliable as it contains fewer points of failure while maintaining the current availability and disaster recovery targets. Failover rates are expected to improve as well. Redundancy will not be impacted. The TMX technology team has undertaken extensive research and development (R&D) and quality assurance (QA) efforts over a two year period to ensure the TMX Quantum XA achieves the best possible latency outcome with the least amount of risk to TMX and the industry.
44. Will TMX be throttling message rates? As per our current design, safeguards will be in place to protect against extreme message bursts.
45. Will there be any impact to the Daily Diary Reports? Yes. During the TMX Select symbol migration phase, TMX Select will produce two sets of Daily Diary reports, one for each platform. After the complete TMX Select symbol migration to TMX Quantum XA, TMX Select will only produce one set of Daily Diary reports.



Market Data Feeds:

46. Does TMX Quantum XA impact the market data feeds? While TMX Quantum XA will not impact the format or content of the Market Data feeds, customers will experience reduced latency once symbols have migrated to TMX Quantum XA. Customers who elect to take advantage of the optional 10G Network connection will experience an even greater latency reduction.
47. Will latency on the market data feeds be impacted? Yes. As a result of the overall reduction in median order processing latency, the roundtrip latency on the market data feeds will be lowered as well. Customers who elect to use a 10G network connection will experience an even greater latency reduction in their market data feed.
48. Will there be any impact to the feed recovery/retransmission? No, the recovery/retransmission process will not be impacted by TMX Quantum XA.