March 25, 2021

Keith Evans
Executive Director
Canadian Capital Markets Association

RE: CCMA Observations regarding PTM - BSO and Test Plan (by letter of January 8, 2021)

Dear Keith,

CDS acknowledges CCMA's above-mentioned letter and welcomes the opportunity to address the concerns raised by CCMA Advisory Council members. CDS appreciates the high level of participant engagement in the Post-Trade Modernization (PTM) program leading to these comments and concerns.

CDS has categorized CCMA and CCMA members' (collectively, "Members") requests into general categories, and paraphrased such requests as follows:

1. **CDS SIT and UAT Testing**
    a. Members request clarity regarding functionality types covered by each testing stage.
    b. Members seek comfort that SIT and UAT have been diligent and sufficiently broad in application, given that the PTM project represents the replacement of the CDSX system in its entirety.
    c. Members request transparency of test results for each testing stage.

2. **Industry Testing**
    a. Members request that test cases and test results from the Early Adopter test stage be shared with participants.
    b. Members request clarity regarding functionality to be tested in the scripted stage vs. the unscripted stage.
    c. Members seek comfort that scripted testing will cover the bulk of system functionality.
    d. Members request descriptions of each test scenario to ensure broad understanding of terminology.
    e. Members suggest end-to-end testing during scripted testing, including upstream activities (e.g. trade entry for exchange trades) and downstream activities (activities that may be unique to each participant).
    f. Members request that holiday processing be included in scripted testing.
    g. Members request that CDS provide support during unscripted testing to facilitate inter-participant, service-provider, and third-party testing.

3. **Functional System Changes**
    a. Members request a more detailed understanding of the new Batch Settlement Optimization (BSO) process, including individual participant impact in terms of ACV, lines of credit sizing, and settlement efficiency.
    b. Members request that BSO process testing use a time period longer than the 5 day period used in the original simulation.

4. Non-Functional System Changes
   a. Members express concern that the Centralized File Transfer (CFT) Hub introduces a material change to participants' systems.
   b. Members express concerns related to the User Access model and associated security architecture.

CDS acknowledges these concerns and is pleased to provide Members with such further clarity, transparency and assistance as we can. We have summarized our responses below.

Section 1: CDS SIT and UAT Testing

a. CDS is testing 100% of the functionality of the system against the identified business requirements. Within both SIT and UAT, test cases and end-to-end scenarios are being authored with reference to the Batch and Interactive Services Technical Information (BISTI) manual and internal business requirements documents. CDS will prepare a detailed listing of all SIT and UAT testing by functional area and proposes to share this information with participants on the PTM portal in late March, 2021.

   CDS intends SIT to verify system functionality against the business requirement system workflows that drive the external-facing GUI, messages and files, and is inclusive of all system components within the PTM internal ecosystem. CDS intends that UAT verifies the broader end-to-end workflow to ensure that the system's capabilities meet business needs; UAT serves as an additional quality gate ahead of the start of the industry scripted test stage. CDS plans to run a complete end-to-end clean UAT cycle before proceeding to the UAT exit criteria described below.

b. CDS has executed close to 21,000 test cases in SIT to-date, and expects to finish SIT with 24,000 test cases. For UAT, CDS has built 1,900 end-to-end scenarios to-date based on the integration of 10,000 test cases across all of the in-scope functional areas in UAT.

   CDS has strict exit criteria for both SIT and UAT to ensure that defects of Critical and High severity have been completely resolved and a sign-off has been received by the Business, Technology and TCS as the vendor.

   Exit criteria for SIT are as follows:

   1. Successful execution of all valid priority test cases.
   2. SIT exit report sign-off by Business and Technology, including Release Management.
   3. Regression sign-off by all CDS internal teams, TCS and Capco program management.
   4. Business sign off on open Sev-3 (Medium) defects with mutually-agreed resolution dates.
   5. SIT QA1 Exit Criteria: No Open Sev-1 (Critical), No Open Sev-2 (High) for defects identified 60 days prior to SIT completion date, no more than 25 Open Sev-3 (Medium) for defects identified 90 days prior to SIT completion date.
   6. In the case that the exit criteria above are not met, such as the number of open defects is higher than outlined in the exit criteria, the following steps are to be taken to successfully pass the gate:

a. Remediation plan is provided by TCS to decrease the amount of open defects to the level outlined in the exit criteria; and

b. Mutual agreement on the remediation plan is reached and signed off by CDS and TCS.

7. Formal sign-off by TCS for passing of Gate 3, which represents the completion of SIT.

Exit criteria for UAT are as follows:

1. Successful execution of test cases.

2. UAT sign-off by Business and Technology, including Release Management.

3. UAT E2E Exit Criteria (applicable to the last cycle of UAT only): No Open Sev-1 (Critical), No open Sev-2 (High) and no more than 25 Sev-3 (Medium/No functional impact) defects, unless mitigation or workaround is approved by the Business. The list of Sev-3 defects will be shared with participants prior to the start of industry testing.

4. In the case that the exit criteria above are not met, such as the number of open defects is higher than outlined in the exit criteria, the following steps are to be taken to successfully pass the gate:

a. Remediation plan is provided by TCS to decrease the amount of open defects to the level outlined in the exit criteria; and

b. Mutual agreement on the remediation plan is reached and signed off by CDS and TCS.

5. Formal sign-off by TCS for passing of Gate 4, which represents the completion of UAT.

In addition to all of the foregoing, the Bank of Canada expects CDS to engage an independent third party to review the proper functioning of the system, its security, and the completeness and adequacy of all aspects of the cutover strategy and implementation plan. CDS expects to conclude the selection of this independent third party in the coming weeks, and will provide an update to participants once that selection is made.

c. In addition to the exit criteria for SIT and UAT stated above, CDS will provide participants with a summary of SIT and UAT test results as well as any Sev-3 defects outstanding at the time of UAT exit.

While information about the defect backlog could be made available to participants during current SIT and UAT activities, the defect backlog represents only a snapshot in time as fixes are deployed, defects are closed, and new defects are identified. As a result, CDS is of the considered view that the successful exit from SIT, UAT, and Early Adopter testing remains a more transparent and comprehensive measure of CDS's internal testing.

Section 2: Industry Testing

a. CDS is not privy to the test cases run by the service providers. Accordingly, it remains at the service providers' discretion to share such test plans, progress, and results with their respective CDS participant clients. CDS is, however, in a position to share system statistics related to message and file flow, as well as the list of active and resolved issues raised.

By way of background, Early Adopter testing is intended for select users (principally service providers) to ensure preparedness for broader industry testing. Since service providers primarily use messages and files to interact with CDS's systems, testing with service providers allows for an external test of most of the functionality related to such communications.

Early Adopter testing is, therefore, driven by test strategies and plans designed by the service providers, not CDS itself, and are presumably focused on their respective, specific, internal development activities and requisite changes to their own systems. CDS's role in Early Adopter testing with service providers is to act as a host and facilitator by making available the GTE1 test environment as well as logging and resolving reported defects.

CDS assures Members that we are following a strict gating process that makes it clear that broader industry testing stages cannot proceed without an attestation of readiness by the Early Adopters, which include Broadridge, IBM, Paramax and CDCC.

In addition, the establishment and testing of connectivity with participants for files (Centralized File Transfer Hub), messages (MQ) and test user access (GUI) is another prerequisite for scripted industry testing.

b. The content of the scripted test cases has been driven by two key factors: (1) existing system usage patterns and demand; and, (2) PTM functional changes. Scripted testing is not intended to be an external UAT testing stage of the system; rather, it is designed to be a demonstration of system changes using a gated, collective exercise across the participant community.

In addition, scripted testing has the following objectives:

1. Adhere to Service-Level Agreements (SLAs) to meet the needs of participants and their respective teams in a collective system test.
2. Ensure regular and sufficient communication for industry testers and CDS to report issues.
3. Monitor, report and remedy issues across both CDS and external participants' systems.
4. Ensure industry test schedule and key milestones are achieved within pre-established timeframes.
5. Touch on all participant-facing clearing, settlement, and depository functions.
6. Demonstrate all functions that generate a transaction in CDSX and/or ledger update.
7. Focus on participant interfaces (files, messages, GUIs, reports and alerts).
8. Simulate third-party inputs (e.g. exchanges, DTCC) and engage these specific third-parties only as necessary for specific testing.
9. Validate that participants' systems have addressed all necessary system changes.

All of the scripted test scenarios have been published on the PTM portal in the *TMX CDS PTM Industry Scripted Test Runbook V3* under the worksheet *Full List of Scenarios*, along with other supporting documentation contained within the document, including step-by-step scripts. We urge participants to review these scenarios and identify any questions or the need for additional test scenarios. CDS is open to adding additional relevant test cases to the scripted industry test stage and proposes that participants aggregate those requests and communicate them to CDS for consideration via one of the industry communication channels, such as the CCMA Advisory Council or the Strategic Development Review Committee (SDRC).

c. The CCMA is correct in noting that scripted industry testing will not cover all of the functionality of the new CDS system. Instead, scripted industry testing will focus on those functions of the system that are most heavily used by participants. Unfortunately, it is not possible to test every functional nuance and every change to the functionality of the system in a timely manner with all participants testing the same sequence of steps in parallel.

CDS can confirm, however, that the majority of the functionality of the CDS system will be tested as part of the scripted test stage, and the remaining functionality, which differs in usage and demand from one participant to another, can be tested in the unscripted test stage.

d. As mentioned in 2(b) above, the descriptions of all test scenarios have been published as part of the *TMX CDS PTM Industry Scripted Test Runbook V3*. The tab named *Full List of Scenarios* in the runbook provides functional scenario names and objectives, while the tab named *Scenario Scripts* provides preconditions, input data, steps, and a description of expected results for each scenario. We ask participants to carefully review this runbook and identify any areas that require clarification by CDS.

e. CDS agrees that end-to-end testing must be conducted from trade entry down to interaction of participants' own systems with in-house systems and third-parties.

For exchange trades, the new system will continue to receive trade files from all of its current marketplaces in the same format and with the same content. CDS is testing the new system using exchange trade files with simulated, synthetic data that conforms to the existing file format, structure and content requirements. CDS and TMX have built a file path through the new CFT Hub from TMX-owned exchange test environments to PTM GTE1, and CDS is currently testing this end-to-end process in internal testing.

For non-exchange trades entered into the system directly by participants or their service providers, CDS is testing the new processes in its SIT and UAT testing stages. Participants and service providers will be testing non-exchange trades in the scripted industry test as outlined in the *TMX CDS PTM Industry Scripted Test Runbook V3.*

In parallel with functional business testing, CDS has designed, and is in the process of executing, a comprehensive non-functional test plan leveraging target state infrastructure and configuration. The objective of this stream is to ensure that existing SLAs are met and that additional contingency exists within the target state to handle load in excess of peak volume experienced in the existing production system. More specifically, CDS will be ensuring that the new system can process at least 200% of the peak load experienced by CDSX over the last 10 years. At a high level, the non-functional test stream covers performance, failover, disaster recovery, information security and operability SLAs and capabilities to ensure the robustness of the new platform.

Downstream, CDS advises participants to target the unscripted test stage to conduct tests that depend on entities external to CDS given that each participant has its own systems and requirements, into which CDS has little visibility. CDS will provide support for the unscripted test stage as discussed below. Given that participants will be responsible for testing their own downstream systems, CDS will require sign-off from every participant as to their readiness for Go-Live to ensure that the entire participant community is ready to convert to the new system.

f.   CDS is testing holiday processing in UAT and will share the results with participants once completed. If participants desire additional testing around holiday processing, CDS encourages participants to target that testing in the unscripted test stage.

g.   CDS will provide all the necessary support to participants for the unscripted test stage. CDS is committed to facilitating the unscripted test stage and plans to work closely with individual participants, and the industry as a whole, to ensure any testing activities required for Go-Live are fulfilled and any issues addressed with the same rigour as all previous test stages. As an example, if multiple industry participants would like to test the same area, such as holiday processing, CDS would provide the necessary support and facilitation, including helping define and organize system timings and calendar, and ensuring all in-scope participants are ready to initiate the test.

In addition, both scripted and unscripted test stages adhere to strict exit criteria. For example, in order to exit the scripted test stage, and start the unscripted test stage, the following exit criteria must be met:

1.   Scripted tests have been executed by participants.
2.   Any raised Sev-1, Sev-2 and Sev-3 defects resulting from scripted scenarios have been re-tested by both CDS and the affected participants within a retest cycle and have been subsequently closed.
3.   Any raised Sev-4 defects have been reviewed and deferred by CDS, and published and shared as part of the final Test Evaluation Summary.

These criteria represent CDS's commitment to the quality of the PTM system and to the resolution of any issues encountered prior to exiting the scripted test stage. These criteria are following the same exit and gating process that CDS has in place for SIT and UAT testing stages, and are meant to provide maximum transparency and accountability. Definitions for severity scores have been published as part of the *TMX CDS PTM Industry Testing Plan* document in the *Testing* section under Documents Libraries on the PTM Portal.

CDS will also deploy a customer-facing JIRA Service Desk to allow participants to submit and track issues throughout scripted and unscripted industry testing stages. CDS has committed to providing a view of the aggregate defect queues resulting from industry testing, such that both CDS and participants can collectively exit the gate with maximum transparency of all known outstanding issues.

If there are any additional requests for support from participants, we urge participants to come forward with those requests, such that we can prepare to accommodate them.

Section 3: Functional System Changes

    a.   Once the final code is received from TCS, CDS plans to run the new BSO process using a statistically valid time period and will share the results on a participant-by-participant basis.

    b.   See answer above.

Section 4: Non-Functional System Changes

    a.   CDS has performed individual outreach sessions with all of its participants and found that the majority of CDS's participants were in line with the proposed new model and raised no concerns. For the small number of participants that raised concerns, CDS is addressing the issue directly with that participant.

    b.   The revised user access model is currently under review with the Bank of Canada. An update will be provided to the industry in April as CDS finalizes the user access model with the Bank of Canada.

Next Steps

CDS thanks Members for raising the issues and concerns addressed above; such engagement invaluably broadens CDS's understanding of its participants' internal processes and capabilities. We hope that our responses to your concerns provide further insight and understanding of CDS's approach to testing, PTM program timelines, and system design overall. CDS remains committed to close collaboration with participants and their service providers to ensure industry testing, training, and remaining participant readiness activities are completed satisfactorily.

CDS's industry engagement team has rolled out a readiness engagement strategy in the form of regular touchpoints with participants. These touchpoints are expected to continue up until PTM implementation to ensure participant readiness and to allow CDS to continuously monitor and reassess the issues raised as participants move through scripted and unscripted testing. CDS will respond to industry feedback accordingly and will continue to hold regular industry-wide meetings to provide updates on the PTM program as needed. On-going support is also available via email (CDSPTM@TMX.com) or through the *Inquiries* tab on the PTM Portal.

We look forward to continued dialogue with our participants and the CCMA.

If you have any additional questions or concerns, we would be more than happy to address them. Please feel free to contact any of the undersigned with your questions.

Sincerely,

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