Industry Adoption Scenarios for Authoritative Data Stores using the ISDA Common Domain Model

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Abstract
In this paper, we explore opportunities for the post-trade industry to standardise and simplify in order to significantly increase efficiency and reduce costs. We start by summarising relevant industry problems (inconsistent processes, inconsistent data, and duplicated data) and the corresponding potential industry solutions (process standardisation, data standardisation, and authoritative data stores). This includes transitioning to the International Swaps and Derivatives Association (ISDA) Common Domain Model (CDM) as a standard set of digital representations for the events and processes throughout the lifecycle of a trade. We then explore how financial market infrastructures could operate authoritative data stores that make CDM business events available to broker-dealers, considering both traditional centralised models and potential decentralised models. For both models, there are many possible adoption scenarios (depending on each broker-dealer’s degree of integration with the authoritative data store and usage of the CDM) and we identify some of the key scenarios.

1 Introduction
The stages of the trade lifecycle include client onboarding, execution and post-trade. This paper focuses on post-trade, which refers to the back-office and middle-office activities after a trade is executed. These activities include matching, confirmation, trade enrichment, collateral and margin, trade settling, and certain lifecycle events and corporate actions. The post-trade industry is large (with an estimated $20 billion total annual spending on post-trade processes [16]) and complex (partly due to the incremental evolution of post-trade processes and technology over decades). There are significant opportunities to simplify and reduce costs.

Here we aim to provide a design discussion of relevance to financial institutions. We consider some important industry problems and the corresponding potential industry solutions, including the use of the ISDA CDM [10] and an authoritative data store (ADS). We then provide high-level descriptions with architecture diagrams to illustrate some of key adoption scenarios for both centralised and decentralised models, with the intention of conveying a sense of the variety of architectural options in this design space. We hope the topics raised in this paper will stimulate discussion and look forward to continuing industry collaboration on ADSs and the CDM.

2 Industry Problems
The industry’s current methods of managing trades through the post-trade lifecycle can be inefficient, with estimated potential cost savings of 80% [2]. Additionally, it has been noted that, if the cost per trade and the cost of doing business become unacceptably high, then financial institutions may start exploring the ongoing viability of certain offerings [11]. It is therefore of strategic importance that the fundamental problems are identified, acknowledged, and addressed by the industry.
We summarise three fundamental industry problems:

- **Inconsistent processes**: Over time, each financial institution has separately developed a large number of complex post-trade business processes to support functions that are essentially the same both within asset classes and also across asset classes [8]. The resulting variation across the industry in processing business logic and lifecycle events has introduced significant inefficiencies and increased the risk of errors requiring remediation.

- **Inconsistent data**: Over time, each financial institution has separately enriched trade data and reference data with custom fields and values to incorporate the additional information required by their custom processes. The resulting variation across the industry in both data formats and data values has, similar to the variation in business processes, introduced significant inefficiencies and increased the risk of errors requiring remediation.

- **Duplicated data**: Trade data is stored in multiple entities across the industry, for example at each of the counterparties and at a central counterparty (CCP). In addition, partly as a side-effect of satisfying additional requirements over many years, changes to existing infrastructure have sometimes included storing trade data in multiple locations within each entity. Such data duplication across the industry clearly introduces inefficiencies.

Therefore, there is a perfect storm of industry inefficiency in post-trade processing, fueled by duplicated inconsistent processes operating on duplicated trade data in inconsistent data formats. One result of this situation is that, every time there is a lifecycle event, each of the copies of the trade may need to be updated and then reconciled with each other [11]. However, there are potential industry solutions to these industry problems and the next section discusses a promising way forward.

3 Potential Industry Solutions

The industry problems identified above (inconsistent processes, inconsistent data, and duplicated data) could be resolved via the rigorous adoption of process standards, data standards, and authoritative data stores. Given the nature and scale of these industry problems, the potential industry solution must be bold. Transformation across both financial market infrastructures (FMIs)\(^1\) and broker-dealers\(^2\) covering processes, data formats and data repositories would clearly be a significant and lengthy endeavour. Therefore, in this paper we explore the incremental stepping-stones on the route towards a desirable end state.

3.1 Standardisation

The current lack of standardisation could be ameliorated via industry-wide adoption of the ISDA CDM. The industry already has a standard file exchange format called FpML (Financial products Markup Language) [6], but that does not address the problem of process variation

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\(^1\) We use the term financial market infrastructure (FMI) to refer to a “legal or functional entity that is set up to carry out centralised, multilateral payment, clearing, settlement, or recording activities” and “exclude the participants that use the system” [1].

\(^2\) We use the term broker-dealer to refer to “any person engaged in the business of effecting transactions in securities for the account of others” (a broker) or “any person engaged in the business of buying and selling securities for his own account, through a broker or otherwise” (a dealer) [18].
resulting from custom business logic and custom calculations. Building on top of the principles of FpML, the CDM provides process standardisation as well.

ISDA published an initial digital representation of the CDM in 2018, providing “a standard digital representation of events and actions that occur during the life of a derivatives trade” [9]. In 2019, ISDA and REGnosys provided open access to the “full version of the CDM for interest rate and credit derivatives” [17]. Since then, the model has been downloaded, deployed and tested by many market participants. For example, Barclays (in collaboration with ISDA and REGnosys) has hosted coding hackathons for market participants to explore the CDM for derivatives (Barclays DerivHack 2018 [2]) and securities (Barclays DerivHack 2019 [3]). There are currently several industry working groups that are expanding and maturing different aspects of the CDM, for example ISDA has CDM working groups for collateral and equity [12], and ICMA has a CDM working group for bonds and repo markets [7].

Furthermore, ISDA is working to directly integrate more of its legal documentation (such as the Credit Support documents, the new 2020 Interest Rate Definitions [13, 14] and ISDA Clause Library [15]) with the CDM via legal agreement components in the model. This will allow the consistent implementation of operational clauses and related procedures from ISDA documentation, thus tying the legal data and systems which perform activities governed by the legal contracts and permitting analyses to improve legal risk management.

3.2 Authoritative Data Stores

The industry problem of duplicated data could be ameliorated via industry-wide adoption of authoritative data stores. An ADS can be considered a primary source of information that acts as a single logical reference point, thereby avoiding the inconsistencies that can arise in duplicated data. Significant effort and resources are required to build an ADS for an individual financial institution and so, when considering an ADS for the industry, broker-dealers may look to FMIs to help drive industry adoption.

4 Architecture Models

Building on the potential industry solutions discussed above, we now explore how ADSs could be deployed to make CDM business events available to broker-dealers. For simplicity, we assume each ADS would be operated by an FMI. We take a high-level architecture perspective and consider both a traditional centralised model and a potential decentralised model. For each model, there are many possible adoption scenarios (depending on each broker-dealer’s degree of integration with the ADS and usage of the CDM) and we also explore some of the key adoption scenarios as architecture options. Our working assumption is that such architecture options could, if required, all coexist within a particular infrastructure system, thereby permitting broker-dealers with different degrees of integration to all participate in the same system.

4.1 Centralised Model

In a centralised model, the FMI maintains a central ADS, as shown in Figure 1. The FMI receives trade submissions (from sources such as electronic communication networks and voice), processes the trades internally, and persists CDM business events to the central ADS. Broker-dealers can then consume the CDM business events via an applications programming interface (API). Each broker-dealer maintains a local copy of relevant data from the central ADS, implemented in a form that could potentially range (depending on requirements) from a simple
log to a database containing replicated trades. The broker-dealer also maintains relevant local controls and services (including trade process data that is private to the broker-dealer). The combination of the local copy of the ADS and the local controls and services can be considered the broker-dealer’s ADS. There are several implementation options to create this combination, such as enriching private fields in CDM business events with broker-dealer specific data or joining “immutable” trades with broker-dealer specific data in a separate repository.

Until the broker-dealer’s internal applications are able to consume CDM business events directly, the broker-dealer would have to transform CDM business events into its internal data model (IDM) business events for its applications to consume. Such IDM business events are typically in an existing proprietary-format and would be persisted in an internal data store, so it should be noted that the CDM has synonyms to allow firms to internally extend the CDM to map to their IDM and manage those mappings over time until they transition to use the CDM directly. The internal data store may need to be reconciled with the broker-dealer’s ADS, so careful design is required to minimise any increase in complexity arising from interim adoption scenarios.

We now consider some specific options that may be made available to broker-dealers regarding their degree of integration with the central ADS. Figure 1 illustrates four key options that can be viewed as different adoption scenarios along a long-term journey of increasing integration:

- **Scenario 1** shows a broker-dealer that has minimal integration with the central ADS. It receives CDM business events and transforms them into IDM business events which are then persisted in its internal data store (this corresponds to an extract, transform, load (ETL) pattern of extracting at the FMI ADS and then transforming and loading at the broker-dealer). The IDM business events are then consumed by the broker-dealer’s trade applications. The CDM business events are also logged. Note there is no local ADS and the trade applications remain unchanged. Reconciliation may be required between the broker-dealer’s internal data store and the CDM business events log.

- **Scenario 2** shows a broker-dealer that receives CDM business events and maintains its own local ADS including replicated trades from the central ADS. It retrieves CDM business events from its local ADS and transforms them into IDM business events, which are then persisted in its internal data store and consumed by its trade applications which remain unchanged. Reconciliation may be required between the broker-dealer’s internal data store and its local ADS.

- **Scenario 3** shows a hybrid model in which some of the broker-dealer’s trade applications continue to consume IDM business events from its internal data store (as per Scenario 2) but other trade applications consume CDM business events directly from its local ADS (which includes replicated trades from the central ADS). This scenario illustrates the additional flexibility (resulting in some additional complexity) that may be required while a broker-dealer is transitioning from IDM to CDM.

- **Scenario 4** shows a broker-dealer that has fully integrated with its local ADS (which includes replicated trades from the central ADS) and fully adopted the CDM internally, with its trade applications consuming CDM business events directly from that local ADS. This is the least complex centralised scenario and can be considered a target state for the centralised model of ADS using CDM.
Figure 1: Centralised model showing a financial market infrastructure maintaining a central authoritative data store and generating CDM business events that are consumed by broker-dealers. The four adoption scenarios illustrate different degrees of integration with the authoritative data store and adoption of CDM.

4.2 Decentralised Model

The set of architectural options for a decentralised model is typically more complicated than for a centralised model. For example, instead of the ADS being maintained centrally by the FMI,
the ADS could be maintained by a combination of both the FMI and the broker-dealers, using both distributed data and decentralised processing. Overall synchronisation could potentially be facilitated via emerging technologies such as distributed ledger technology (DLT) [19], where a system of distributed ledger nodes acting together can provide a single source of truth among multiple parties. DTCC is one of the post-trade market infrastructures that is exploring the potential to leverage DLT as a pivotal piece of technology that may help bring about new efficiencies in clearing and settlement [4, 5].

Migrating from a centralised model to a decentralised model would involve significant infrastructure changes, but such a journey can also be viewed as a series of incremental stepping-stones. Figure 2 illustrates four of the options that can be viewed as different adoption scenarios along a long-term journey of increasing integration with an ADS and with DLT:

- **Scenario 5** shows a broker-dealer that has not adopted DLT, so it relies on the FMI to host its DLT node on its behalf. Similar to Scenario 1 in the previous subsection, the broker-dealer receives CDM business events and transforms them into IDM trade events which are then persisted in its internal data store (this corresponds to an ETL pattern of extracting at Broker-Dealer’s DLT Node hosted at the FMI and then transforming and loading at the broker-dealer). The IDM business events are then consumed by the broker-dealer’s trade applications. The CDM business events are also logged. Note there is no local ADS and the trade applications remain unchanged. Reconciliation may be required between the broker-dealer’s internal data store and the CDM business events log.

- **Scenario 6** shows a broker-dealer that receives CDM business events and maintains its own ADS including replicated trades from the central ADS. Similar to Scenario 2 in the previous subsection, the broker-dealer retrieves CDM business events from its local ADS and transforms them into IDM business events, which are then persisted in its internal data store and consumed by its trade applications which remain unchanged. Reconciliation may be required between the broker-dealer’s internal data store and its local ADS. Similar to Scenario 5, the broker-dealer has not adopted DLT, so it relies on the FMI to host the node on its behalf.

- **Scenario 7** shows a broker dealer hosting its DLT node and therefore taking on greater responsibility within the DLT network, with the FMI continuing to be an operator of the DLT network including setting the rules. The local ADS contains the broker-dealer’s DLT node. Similar to Scenario 3, there is a hybrid model in which some of the broker-dealer’s trade applications continue to consume IDM business events from its internal data store but other trade applications consume CDM business events directly from its local ADS (which includes trades in its DLT node). This scenario illustrates the additional flexibility (resulting in some additional complexity) that may be required while a broker-dealer is transitioning from IDM to CDM and also the additional complexity that may be required while a broker-dealer is transitioning to DLT.

- **Scenario 8** shows a broker-dealer hosting its DLT node and full integration with its local ADS (which includes trades in its DLT node). Similar to Scenario 4, the CDM has been fully adopted internally, with the trade applications consuming CDM business events directly from the local ADS. This is the least complex decentralised scenario and can be considered a target state for the decentralised model of ADS using CDM.
Broker-Dealer Scenario 5: Broker-dealer does not adopt DLT, minimal integration with FMI hosted DLT node, no local ADS, trade applications remain unchanged.

Broker-Dealer Scenario 6: Broker-dealer ADS contains replicated trades (received from FMI hosted DLT node) and controls and services, minimal integration with trade applications which remain unchanged.

Broker-Dealer Scenario 7: Broker-dealer hosts its DLT node, broker-dealer ADS contains the DLT node and controls and services, hybrid integration with trade applications consuming IDM and CDM business events.

Broker-Dealer Scenario 8: Broker-dealer hosts its DLT node, broker-dealer ADS contains the DLT node and controls and services, full integration with trade applications consuming CDM business events.

Figure 2: Decentralised model showing a financial market infrastructure maintaining a distributed authoritative data store with broker-dealers and processing CDM business events. The four adoption scenarios illustrate different degrees of integration with the authoritative data store, adoption of CDM, and adoption of distributed ledger technology.
5 Summary and Further Work

In this paper, we highlighted an opportunity to significantly increase efficiency and reduce costs in the post-trade industry. We discussed using the ISDA CDM standard to address the industry problems of inconsistent processes and inconsistent data. We also discussed using authoritative stores to address the industry problem of duplicated data. We then explored various adoption scenarios, considering both traditional centralised models and potential decentralised models.

For further work, Barclays is planning to develop prototypes of the target states for both the centralised model and the decentralised model. These correspond to Scenario 4 and Scenario 8 above. We expect to report publicly on the findings, including a technical comparison between the two models. There are many design choices when architecting industry ADSs using the CDM and we look forward to continuing industry collaboration to develop good patterns and frameworks.

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