TECHNICAL REPORT

ISO/TR 22126-5

First edition
2022-08

Financial services — Semantic technology —

Part 5: Mapping from FIX Orchestra to the common model

Reference number
ISO/TR 22126-5:2022(E)

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

Page

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 68, *Financial services*, Subcommittee SC 9, *Information exchange for financial services*.

A list of all parts in the ISO 22126 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

FIX Orchestra is a standard issued by FIX Trading Community to exchange message structures, workflow choreographies and application behaviours between trading counterparties. FIX Orchestra is currently Version 1.0 Draft Standard and is published as a specification with an XML Schema.

A study was conducted to map FIX message definitions, as encoded in the FIX Orchestra schema, to semantic terms consistent with the ISO 20022 metamodel. The objective was to map multiple financial protocols, including FIX, to ISO 20022, a common model, so that they can be compared, and for commonalities to be identified. Any deficiencies of the model discovered will be rectified so that its capacity to support other financial industry protocols can be improved in future versions.

Financial services — Semantic technology —

Part 5:
Mapping from FIX Orchestra to the common model

1 Scope

This document reports on a study to map messages defined using FIX Orchestra into the ISO 20022 model.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
actor
peer in a messaging system

3.2
code set
datatype that constrains message values to one member of a finite set

3.3
component
predefined part of a message that may be reused in many message types

3.4
datatype
context-free data domain

3.5
field
smallest unit of business semantics

3.6
presence
property that specifies whether the member is required

3.7
repeating group
group component with many-to-one cardinality

3.8
workflow
exchange of message types between actors

4 Mapping FIX Orchestra

4.1 FIX Orchestra

4.1.1 General

FIX Orchestra was designed to provide a distributable model of message definitions as well as workflow. Its motto is “machine readable rules of engagement”. FIX Trading Community uses Orchestra to publish the FIX standard. Firms may use it to publish their rules of engagement, typically a modified subset of the FIX standard. The final rules of engagement are determined by agreement between counterparties.

Orchestra is serialized as XML, and is controlled by XML schemas, but consideration has been given to using RDF/OWL in the future.

Orchestra has two XML schemas: repository and interfaces. The repository schema defines message structures and workflow. FIX Orchestra incorporates a message model, but unlike ISO 20022 the message definitions are not traced to a formal business model or metamodel.

Elements of an Orchestra repository file include the following:

— Message definitions, including their reusable parts: components, repeating groups and fields. In FIX, message types are often overloaded for multiple use cases, so message scenarios refine message definitions for each use case.

— Field definitions, which have a datatype and may be constrained to the finite values of a code set.

— Code sets, which may either be internal, with explicitly enumerated codes, or maintained externally by another standards body, e.g. ISO 4217.

— Datatypes, of which FIX has defined about 20, but the Orchestra structure can accommodate datatypes defined by other protocols.

— Workflow, the exchange of message types to define a protocol for a service offering.

— Documentation about every element.

FIX standardizes multiple wire formats, including the original tag-value encoding, FIXML schema, JSON and binary encodings such as simple binary encoding (SBE). However, the message definitions in FIX Orchestra are intended to be independent of presentation layer (i.e. the encoding syntax) and session layer protocols.

A counterparty may offer multiple services, such as order entry, market data, and clearing, each with its own protocol stack. FIX Orchestra provides a second schema, called interfaces, to define messaging protocol stacks and session configurations used to expose service offerings. Additionally, it supports declaration of sessions with user authentication and operational identifiers.

4.1.2 Relationship to FIX

Orchestra is being used to disseminate the FIX standard message definitions. However, it was designed to be capable of expressing other financial industry protocols as well.

4.2 ISO 20022 model

The ISO 20022 metamodel specifies the structure of a model comprising a business process catalogue, data dictionary and message transport package. The metamodel has been realized in Ecore, an

implementation of OMG's EMOF (Essential Meta-Object Facility), a standard for UML metamodels. These machine-readable artefacts support the mapping of Orchestra and other industry protocols to the ISO 20022 model.

However, these artefacts only cover high-level concepts and structures. They do not contain behavioural models. The models are supplemented by a document for each message set called a message definition report (MDR). Although the documents contain activity and sequence diagrams, they are human-readable artefacts, not conducive to mapping to other models.

4.3 Mapping approach

4.3.1 General

To map to the ISO 20022 model, FIX Orchestra is first mapped to the ISO 20022 message model. That process consists of the steps described in this subclause. When mapped to the ISO 20022 message model classes, common code that converts that model to an RDF/OWL representation can be utilized, resulting in an ontology in a standardized format.

4.3.2 Ecore model creation

The first step was to generate an Ecore class model from the FIX Orchestra XML schema using the Eclipse Modelling Framework (EMF). EMF is an open-source plug-in for the Eclipse platform. In essence, the types defined in the FIX Orchestra XML schema are translated into a UML metamodel. This translation is a mechanical process and was assumed to be accurate based on experience with the tool by SWIFT and others. This step only needs to be performed once unless there is a change to the FIX Orchestra schema.

From the Ecore model, EMF generates Java code to access an XML file in the FIX Orchestra schema and to populate an Ecore model with instances of the generated classes.

Ecore model and code generation have been performed for both FIX Orchestra XML schemas, the repository schema with message definitions and the interfaces schema. However, so far only the repository schema has been mapped to the ISO 20022 model since ISO 20022 has no direct equivalent to interfaces.

4.4 Model transformation

The Ecore model generated in the first step was programmatically transformed to a common semantic model encoded in RDF/OWL. Important FIX Orchestra classes are transformed as shown in Table 1. In some cases, the FIX Orchestra classes do not precisely correspond to the ISO 20022 model, but where mapping was possible the closest class was used. Imperfect and missing mappings are discussed in 4.5.

Table 1 — FIX Orchestra class to ISO 20022 metaclass mapping

Orchestra class	ISO 20022 metaclass
Section	MessageSet
Category	BusinessArea
Message	MessageDefinition
CodeSet	CodeSet
Code	Code
Datatype	DataType
Actor	BusinessRole
Field	MessageElement
Component, Group	MessageComponent

4.5 Incomplete mappings

These unmapped features and incomplete mappings deserve further exploration. At the time of publication there is no one-to-one equivalence and some features may only be partially covered by the ISO 20022 metamodel.

— An actor in FIX Orchestra is like a role but it has more attributes, including state variables.

— A FIX Orchestra StateMachine is based on UML concepts and has states, transitions and guards. There is currently no direct equivalent in the ISO 20022 model.

— The FIX Orchestra Flow class represents a unidirectional stream of messages between actors. It does not map directly to an ISO 20022 class. On the other hand, the ISO 20022 business model has BusinessTransaction, but not all flows are transactional. Much of FIX is based on asynchronous events.

— FIX has over 20 data types; the ISO 20022 model recognizes XML Schema datatypes as primitives and has a rich set of derived datatypes. FIX has multiple encodings, including binary wire formats. FIX has mappings to XML types to use when FIX encoded as XML, but FIX datatypes are intended to be independent of encoding and are not derived from XML schema types.

— Both models have syntax for constraints, but there is no interoperability. FIX Orchestra uses a domain-specific language called Score for conditions and assignments.

— Both models have a provision for a unique identifier for elements, but they are not using a common protocol to generate them. This issue is confounded by an intended use of Orchestra – firms publish their own model with user-defined elements not in the FIX standard. Identifiers were made globally unique to avoid collisions.

— The ISO model uses cardinality for relationships between messages and their components. On the other hand, FIX Orchestra has Presence enumeration:

  — Required: the member MUST always be present in a message.

  — Optional: the member MAY be present; it may be conditionally required based on a rule.

  — Forbidden: the member MUST NOT be present.

  — Ignored: the member MAY be present but is not processed by the receiving party and thus no validation is performed on it.

  — Constant: the field has a constant value.

4.6 Findings

4.6.1 General

The ISO 20022 model can be enhanced to describe FIX and other protocols.

4.6.2 Behavioural model

4.6.2.1 External state representation

Messages are a method to transfer business state information from sender to receiver. However, modelling a proper response to a message also depends on external states not conveyed in the message itself. FIX Orchestra provides two concepts to support state representation, features not supported by the ISO 20022 model.

4.6.2.2 State variables

In FIX Orchestra, an actor in a model can have state variables. For example, an actor representing a market can have trade date, the local market date that trades are recorded with. (Trade date is not always the same as calendar date supplied by a computing platform considering 24-hour trading sessions that span midnight.) This feature would be useful for modelling all protocol interactions. For instance, this would support generation of test cases that assert the expected values of a message given values of state variables. To use the example of trade date, modelling it as a state variable supports back tests to run as of a certain date with other state values from that date.

4.6.2.3 State machines

Many data transformations can be modelled as discrete state machines, with valid transitions between states, and FIX Orchestra supports this.

Implicitly, many code sets represent discrete states. In the case of FIX, the code set associated with the OrdStatus (order status) field implicitly represents a state machine, but the code set by itself does not tell which transitions are valid or invalid. Properly modelled, it would be apparent that a "new" order can be transitioned to a "filled" state, but a "cancelled" order cannot be revived as a "new" order. A model of the state machine would convey that "cancelled" is a terminal state.

4.6.3 Datatypes

The ISO 20022 model supports a rich model of derived datatypes, such as identifier set. However, it is based on a foundation of XML schema datatypes for primitive types. Many messaging systems use other type systems, including binary types. Rather than just changing to the popular data representation of the moment, such as JSON, it would be better for modelling to avoid any wire format for datatypes. Modelling of datatypes should be based on their semantic characteristics so they can be mapped to any new message encoding that comes along in the future.

Fortunately, there is already an International Standard for this purpose, ISO/IEC 11404. It provides a vocabulary to define datatypes independent of platform and programming language. By defining the datatypes for each financial protocol in terms of a common vocabulary, any protocol can be mapped to any other. This would directly support protocol translators.

4.6.4 Constraints

An area that calls for more investigation is a vocabulary for conditional expressions in a model. One use of this would be for conditionally required fields. A field may be required only if another field in a message has a certain value, for example. Another use is to describe workflow, i.e. when one kind of a message is sent in response to a request, but a different response is given under other conditions. It is inadequate to express that rule only in documentation – a better approach would be to encode the expression in a machine-readable model. FIX Orchestra provides Score DSL for that purpose, but other rule-based systems can be considered.

It has been suggested that a semantic model could use SHACL for constraints. This requires more research.