TECHNICAL REPORT

# ISO/TR 22126-3

First edition
2023-01

# Financial services — Semantic technology —

## Part 3: Semantic enrichment of the ISO 20022 conceptual model



Reference number
ISO/TR 22126-3:2023(E)

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Published in Switzerland

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# Foreword

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



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# Introduction

This document contains information on the perceived state of the art of semantic technology as it pertains to information exchange in financial services. It is informative, not normative.

This document reports on semantic enrichment of the ISO 20022 conceptual model.

The ISO 20022 series defines a scalable, methodical process to ensure consistent descriptions of messages throughout the financial services industry.

Beyond its primary purpose of providing an operational model of elements, messages and their associated workflows, there is a further requirement for metadata to add an understanding of the meaning of their content and context.

The advent of semantic technology enables the enrichment of an ISO 20022 model repository:

— in a repository, annotating repository concepts with metadata using semantic markup or constraints;

— outside a repository, using references to repository concepts.

This is illustrated by demonstrating how the provenance of changes to a model repository can be tracked using the W3C PROV-O ontology specification[10].

In a repository, each concept can be annotated with semantic markup to indicate it is a synonym of a concept in another model or that it as an external code set. Semantic markup can also be used for tagging of names and definitions in other languages. Constraints enable the formal specification in logical languages of relationships between concepts.

Outside a repository, the resource description framework (RDF) can be used to reference repository concepts with internationalised resource identifiers (IRIs) constructed from object identifiers (OIDs), universally unique identifiers (UUIDs) or their names with the namespace of the schema, model, metamodel or registration authority website. This is illustrated with the provenance ontology (Prov-O), which can be used to track changes to concepts in a repository.

# Financial services — Semantic technology —

# Part 3:
# Semantic enrichment of the ISO 20022 conceptual model

## 1 Scope

This document examines semantic enrichment to support the maintenance of the ISO 20022 conceptual model. It reports on existing and proposed practices to enrich a model:

— in a repository, annotating repository concepts with metadata using semantic markup or constraints;

— outside a repository, using references to repository concepts, such as the provenance of changes.

## 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 20022-1, *Financial services — Universal financial industry message scheme — Part 1: Metamodel*



## 3 Terms and definitions



For the purposes of this document, the terms and definitions given in ISO 20022-1 and the following 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**
**semantic**
related to distinct meaning

Note 1 to entry: As each word can have several meanings, the purpose of semantics is to clarify the exact meaning of a word in a context to refer to a particular concept.

**3.2**
**provenance**
information on the place and time of origin, derivation or generation of a resource or a record or proof of authenticity or of past ownership

[SOURCE: ISO/IEC 11179-7:2019, 3.1.10]

**3.3**
**pedigree**
relationship to an authoritative source

# 4 Semantic markup

## 4.1 Synonyms

The ISO 20022 metamodel specifies that any repository concept can have semantic markup. Semantic markup has been used by the Registration Authority to state that a concept is a synonym of another concept in another model. For the type name "synonym", its element names are "name" and "context".

For example: The messageElement "PriceDetails" is a synonym of value ":90a:" in context "ISO 15022".

## 4.2 Multilingual support

Semantic markup can be used to provide translated property values on any repository concept. For the type name "translation", its element names are "language" and the name of other textual features of the repository concept including and not limited to: name, definition, example, expression, meaningWhenFalse, meaningWhenTrue, unitCode and messageTypeDescription.

The value of the language tag is a code conforming with IETF's Best Current Practice 47.[6] It comprises sub-tags from the IANA Language Subtag Registry.[11] This permits extensions for transliteration and private use.

When the model is represented using RDF, the translations become named properties of the repository concept whose string value is the named elements value, appended with the language element value. Constraints on the graph can be used to restrict the occurrence of a string to one per distinct language tag.



For example: a *messageElement* with the name "PriceDetails" has semantic markup of type "translation" for language "zh-Hans" with the name "价格明细", and Latin transliteration of the Mandarin dialect using pinyin would be represented in Terse Triple Language (TTL, Turtle) as:



```
[ a iso20022:messageElement ;
  iso20022:name "PriceDetails"@en , "价格明细"@zh-Hans , "Jiàgé míngxì"@zh-Latn-pinyin ;
 … ]
```

## 4.3 External code sets

Semantic markup has been used by the Registration Authority to state that a *CodeSet* is validated externally to generated syntax message scheme. For the semantic markup type named "ExternalCodeSetAttribute", its element "IsExternalCodeSet" has the value "true".

CodeSets and Codes can include provenance information in semantic markup. For the semantic markup type named "ExternalCodeAttribute", its elements record the Requestor, Status, LastUpDatedDate and CreationDate.

# 5 Constraints

The ISO 20022 metamodel specifies that any repository concept can have constraints, which each have an expression and a language of expression. Expressions written in logical languages can be generated into artifacts which validate the definition of messages, the sequence of messages and the configuration of messaging participants.

For example, in order to create a variant message definition that allows only a subset of features of the original, it is simply a matter of adding constraints to check that only those features are used. This has the benefit of simply being able to reuse software that supports the original message definition as is, with undesired features disabled.

Options include, but are not limited to:

— CL: Common Logic, which is a first-order logical language;

— OCL: Object Constraint Language, associated with UML;

— SHACL: the SHApes Constraint Language, for validating RDF graphs against a set of conditions;

— XPath: a query language using XML technologies.

# 6 Metamodel resource identifiers

## 6.1 Internationalised resource identifiers

IRIs can be used to reference the metamodel, its metaclasses and their properties.

## 6.2 Metamodel as specified

The ISO URN namespace[8] can be used to reference the repository and its metaclass specifications. Fragments naming the property can be appended to each metaclass, as ISO 20022-1 does not specify the properties as individual document elements.

```
MetaModel-Specification-IRI ::= "iso:std:iso:20022:-1:ed-2:v1:en"
MetaClass-Specification-IRI ::= MetaModel-Specification-IRI docelement
MetaProperty-Specification-IRI ::= MetaClass-Specification-IRI "#" property-name
```

EXAMPLE A reference to the 'code' property of B.2.1.5 Metaclass CodeSet can be represented as IRI:

```
iso:std:iso:20022:-1:ed-2:v1:en:clause:B.2.1.5#code
```



## 6.3 Metamodel as implemented

The specified metamodel can be implemented in a variety of ways and can vary from the specification. The IRI of the metamodel can be followed by a fragment separator then the name of a concept, which can then be followed by a separator and property. As concept names are unique in the metamodel, the concept's parent or package names can be omitted from the IRI .



```
MetaModel-Implementation-IRI ::= MetaModel-name-IRI
MetaClass-Implementation-IRI ::= MetaModel-Implementation-IRI "#" MetaClass-name
MetaProperty-Implementation-IRI ::= MetaClass-Implementation-IRI property-separator
MetaProperty-name
```

EXAMPLE A reference to the 'code' property of B.2.1.5 Metaclass CodeSet, in the ecore implementation which uses a slash as a separator becomes IRI:

```
urn:iso:std:iso:20022:2013:ecore#CodeSet/Code
```

# 7 Model resource identifiers

## 7.1 Internationalised resource identifiers

IRIs can be used to reference a repository and its concepts. There can be several identifiers under different schemes to the same concept.

## 7.2 OID (object identifier)

The ISO 20022 metamodel specifies that any repository concept can have an object identifier as:

An ITU-T X.660 | ISO/IEC 9834 series OID (object identifier).

This can be assigned and recorded with the object in its registry.

They can be referenced using the [URN OID namespace]. For example, to reference ISO 20022, use:

```
urn:oid:1.0.20022
```

## 7.3 UUID (universally unique identifier)

UUIDs can be generated for any part of the model. Options include:

a) UUID version 4 – generation of random identifier, recorded with the repository concept.

b) UUID version 5 – generation of identifier based on hash of namespace and canonical name. Once generated, the canonical name must not change in order to preserve identity.

See ISO/IEC 9834-8.

```
urn:uuid:358badd7-5f28-4a20-96e3-de1b172f83c0
```

## 7.4 Tool-specific identification schemes

Repositories can be developed using tools that provide their own identification scheme. As these are not part of the ISO 20022 metamodel, they are referenced by query rather than by fragment.

```
Repository-Concept-Query-IRI ::=
    Repository-IRI  Query-Separator  ID-Scheme  Equality-Separator  ID-Value
```

One such scheme is xmi:id – XML Metadata Interchange identification.

```
?xmi:id=_aNmaeNp-Ed-ak6NoX_4Aeg_1957291337
```

resolved with a base of "urn:my:iso20022repository" is also an absolute IRI:

```
urn:my:iso20022repository?xmi:id=_aNmaeNp-Ed-ak6NoX_4Aeg_1957291337
```



## 7.5 Repository concept name IRIs

The ISO 20022 metamodel has constraints that require unique names of top-level entries in the data dictionary or the business process catalogue. Further constraints require descendants of the top-level entries to be named uniquely in the context of their parent. This enables the definition of semantic IRIs in human languages.

An IRI for a repository concept can comprise an IRI of its data dictionary or its business process catalogue, followed by a separator, followed by a name of the repository concept. The name of the concept comprises names of the concept's ancestors and itself, with separators.

```
Repository-Concept-IRI ::= ( Data-Dictionary-IRI | Business-Process-Catalogue-IRI )
   Fragment-Separator Repository-Concept-Name
Repository-Concept-Name ::=
   ( Ancestor-Concept-Name Name-Separator )* Concept-Name
```

EXAMPLE

```
urn:my:iso20022repository:dictionary#NoReasonCode.NoReason
```

NOTE A repository can offer a joint IRI where concept names are unique across both its data dictionary and business process catalogue. For example:

```
urn:my:iso20022repository#NoReasonCode.NoReason
```

## 7.6 Language-specific IRIs

Each ISO 20022 repository can have several IRIs to support multiple languages and versions, using either of the following:

a) a query component

```
Repository-Concept-Query-IRI ::=
    Repository-IRI  Query-Separator  Language-Scheme  Equality-Separator  Language-Tag (
Fragment-Separator Repository-Concept-Name )
```

EXAMPLE

```
urn:my:iso20022repository?language=en#NoReasonCode.NoReason
```

b) a path segment

```
Repository-Concept-Query-IRI ::=
    Repository-IRI Language-Tag Path-Separator ( Fragment-Separator Repository-Concept-
Name )
```

EXAMPLE

```
https://iso20022.plus/semantic/repository/en/#NoReasonCode.NoReason
```

## 7.7 ISO 20022-4 schema references

XML schema generated using ISO 20022-4 sets the target namespace to the URN of the schema. In XML, each element name is qualified by the namespace of message. In translating to RDF, a hash "#" can be appended to the namespace to select a fragment and use the post-schema validation information set to get the type which provides the context for the element name. For example:

```
urn:iso:std:iso:20022:tech:xsd:auth.016.001.01#SecuritiesTransactionReport4.TxId
```

The name of the element as implemented is the value of an "xmltag" property on a messageElement, which, though not defined in ISO 20022, holds an obfuscated abbreviation of the element's name.

In order for these to refer to model resource identifiers, a set of links for each message definition indicates how each schema IRI corresponds with a model IRI.

```
<urn:iso:std:iso:20022:tech:xsd:auth.016.001.01#SecuritiesTransactionReport4.TxId>
owl:sameAs <urn:my:iso20022repository?xmi:id=_KJ36MYG-EeaalK9UbuVGFw> .
```



## 7.8 Informative IRIs

Whereas the IRIs described previously can reference the same individual item (owl:sameAs), other IRIs can be used to provide information about concepts in the repository (rdfs:seeAlso).

EXAMPLE

```
urn:my:iso20022repository#NoReasonCode rdfs:seeAlso https://www.iso20022.org/
standardsrepository/type/NoReasonCode .
```

## 7.9 Prefixes

The following prefixes have been used for generating English and numeric identifiers:

```
@base <https://iso20022.plus/semantic/repository/> .
@prefix i: <https://www.iso20022.org/standardsrepository/type/> .
@prefix en: <?language=en#>

@prefix x: <?xmi:id=> .
@prefix O: <urn:oid:1.0.20022> .
@prefix U: <urn:uuid:358badd7-5f28-4a20-96e3-de1b172f83c0> .
```