NIEM Naming and Design Rules (NDR) Version 6.0

Project Specification Draft 01

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- Conformance Targets Attribute Specification (CTAS) Version 3.0. Edited by Tom Carlson. 22 February 2023. OASIS Project Specification 01. https://docs.oasis-open.org/niemopen/ctas/v3.0/ps01/ctas-v3.0-ps01.html. Latest stage: https://docs.oasis-open.org/niemopen/ctas/v3.0/ctas-v3.0.html.

Abstract:

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Comments on this work can be provided by opening issues in the project repository or by sending email to the project’s public comment list: niemopen@lists.oasis-open-projects.org. List information is available at https://lists.oasis-open-projects.org/g/niemopen.

Note that any machine-readable content (Computer Language Definitions) declared Normative for this Work Product is provided in separate plain text files. In the event of a discrepancy between any such plain text file and display content in the Work Product’s prose narrative document(s), the content in the separate plain text file prevails.

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The key words “MUST”, “MUST NOT”, “REQUIRED”, “SHALL”, “SHALL NOT”, “SHOULD”, “SHOULD NOT”, “RECOMMENDED”, “NOT RECOMMENDED”, “MAY”, and “OPTIONAL” in this document are to be interpreted as described in BCP 14 [RFC 2119] and [RFC 8174] when, and only when, they appear in all capitals, as shown here.

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1. Introduction

NIEM, formerly known as the “National Information Exchange Model,” is a framework for exchanging information

among public and private sector organizations. The framework includes a reference data model for objects, properties, and relationships; and a set of technical specifications for using and extending the data model in information exchanges. The NIEM framework supports developer-level specifications of data that form a contract between developers. The data being specified is called a *message* in NIEM. While a message is usually something passed between applications, NIEM works equally well to specify an information resource published on the web, an input or output for a web service or remote procedure, and so forth, basically, any package of data that crosses a system or organization boundary.

NIEM promotes scalability and reusability of messages between information systems, allowing organizations to share data and information more efficiently. It was launched in 2005 in response to the U.S. Homeland Security Presidential Directives to improve information sharing between agencies following 9/11. Until 2023, NIEM was updated and maintained in a collaboration between the U.S. federal government, state and local government agencies, private sector, and non-profit and international organizations, with new versions released around once per year. NIEM defines a set of common objects, the *NIEM Core*, and 17 sets of objects that are specific to certain government or industry verticals, the *NIEM Domains*.

In 2023, NIEM became the NIEMOpen OASIS Open Project. NIEMOpen welcomes participation by anyone irrespective of affiliation with OASIS. Substantive contributions to NIEMOpen and feedback are invited from all parties, following the OASIS rules and the usual conventions for participation in GitHub public repository projects.

NIEMOpen is the term generally used when referring to the organization such as Project Governing Board (PGB), NIEMOpen Technical Architecture Committee (NTAC), NIEMOpen Business Architecture Committee (NBAC), organization activities or processes. NIEM is the term used when directly referring to the model i.e. NIEM Domain, NIEM Model version.

This document specifies principles and enforceable rules for NIEM data components and schemas. Schemas and components that obey the rules set forth here are conformant to specific conformance targets. Conformance targets may include more than the level of conformance defined by this NDR, and may include specific patterns of use, additional quality criteria, and requirements to reuse NIEM release schemas.

1.1 Glossary

1.1.1 Definitions of terms

Term	Definition
Absolute URI	A Uniform Resource Identifier (URI) with scheme, hierarchical part, and optional query, but without a fragment; a URI matching the grammar syntax `<absoluteURI>` as defined by [RFC 3986].
Adapter class	A class that contains only properties from a single external namespace. [*see §4.4*]
Adapter type	An XSD type definition that encapsulates external components for use within NIEM. *(see §9.4)*
Appinfo namespace	A namespace defined by a schema document that provides additional semantics for components in the XSD representation of a model. *(see §9.7)*
Association class	A class that represents a specific relationship between objects. *(see §4.4)*
Attribute property	A data property represented in XSD as an attribute declaration. *(see §4.8)*
Augmentation	The means by which a designer of one namespace adds properties to a class defined in a different namespace. *(see §3.7, §4.15)*

Term	Definition
Augmentation element	An element in an XML message that is a container for one or more augmentation properties. *(see §4.15.2)*
Augmentation point element	An abstract element declaration that provides a place for augmentation properties within the XSD representation of an augmented class. *(see §4.15.2)*
Augmentation property	A property added by one namespace to an augmented class in another namespace. *(see §4.15)*
Augmentation type	An XSD type definition for an augmentation element. *(see §4.15.2)*
Cardinality	The number of times a property may/must appear in an object.
Class	A definition of an entity in a model; that is, a real-world object, concept, or thing *(see §3.4, §4.4)*
Code list datatype	A datatype in which each valid value is also a string in a code list. *(see §4.12)*
Code list	A set of string values, each having a known meaning beyond its value, each representing a distinct conceptual entity. *(see §4.12)*
Conforming namespace	A namespace that satisfies all of the applicable rules in this document; a reference namespace, extension namespace, or subset namespace. *(see §6.1)*
Conforming schema document	A schema document that satisfies all of the applicable rules in this document. *(see §6.1)*
Conforming schema document set	A schema document set that satisfies all of the applicable rules in this document. *(see §6.1)*
Data definition	A text definition of a component, describing what the component means.
Data property	Defines a relationship between an object and a literal value.
Datatype	Defines the allowed values of a corresponding literal value in a message.
Documented component	A CMF object or XSD schema component that has an associated data definition.
Element property	An object property, or a data property that is not an attribute property; represented in XSD by an element declaration. *(see §4.8)*
Extension namespace	A namespace defining components that are intended for reuse, but within a more narrow scope than those defined in a reference namespace. *(see §3.6)*
Extension schema document	A schema document that is the XSD representation of an extension namespace.
External attribute	An attribute declaration in external schema document.

Term	Definition
External component	A component defined by an external schema document. *(see §9.4)*
External namespace	Any namespace defined by a schema document that is not a conforming namespace, the structures namespace, or the XML namespace http://www.w3.org/XML/1998/namespace . *(see §3.6)*
External schema document	A schema document that defines an external namespace. *(see §3.6)*
Literal class	A class that contains no object properties, one or more attribute properties, and exactly one element property. *(see §4.4)*
Literal property	The element property in a literal class.
Local term	A word, phrase, acronym, or other string of characters that is used in the name of a namespace component, but that is not defined in OED, or that has a non-OED definition in this namespace, or has a word sense that is in some way unclear. *(see §4.16)*
Message	A package of data shared at runtime; a sequence of bits that convey information to be exchanged or shared; an instance of a message type. *(see §3.1.1)*
Message designer	A person who creates a message type and message format from an information requirement, so that an instance message at runtime will contain all the facts that need to be conveyed.
Message developer	A person who writes software to implement a message specification, producing or processing messages that conform to the message format.
Message format	A specification of the valid syntax of messages that conform to a message type. *(see §3.1.2)*
Message model	A data model intended to precisely define the mandatory and optional content of messages and the meaning of that content. *(see §3.1.3)*
Message object	The initial object in a message.
Message specification	A collection of related message formats and message types. *(see §3.1.4)*
Message type	A specification of the information content of messages. *(see §3.1.3)*
Model file	The CMF representation of a NIEM model; a message that conforms to the CMF message type. *(see §3.5, §6.1)*
Namespace	A collection of uniquely-named components, managed by an authoritative source. *(see §3.6)*

Term	Definition
NCName	A non-colonized name, matching the grammar syntax `<NCName>` as defined by [XML Namespaces].
Object class	Represents a class of objects defined by a NIEM model.*(see §4.4)*
Proxy type	An XSD complex type definition with simple content that extends one of the simple types in the XML Schema namespace with `structures:SimpleObjectAttributeGroup` . *(see §9.5)*
Relationship property	A property that provides information about the relationship between its parent and grandparent objects. *(see §4.6, §5.5)*
Reference attribute property	An attribute property that contains a reference to an object in a message.*(see §4.8)*
Reference namespace	A namespace containing components that are intended for the widest possible reuse.*(see §3.6)*
Reference schema document	The XSD representation of a reference namespace. *(see §9.8)*
Reuse model	A data model entirely comprised of reference namespaces and extension namespaces; a model intended to make the agreed definitions of a community available for reuse.
Schema	An artifact that can be used to assess the validity of a message; in XML Schema for XML messages, JSON Schema for JSON messages. *(see §3.1.2)*
Schema document set	A collection of schema documents that together are capable of validating an XML document.*(see §10.2)*
Serialization	*(Verb)* A process of converting a data structure into a sequence of bits that can be stored or transferred. *(Noun)* A standard for the output of serialization; for example, XML and JSON.
Structures namespace	A namespace that provides base types and attributes for the XSD representation of NIEM models. *(see §3.6)*
Subset namespace	A subset of the components in a reference or extension namespace.*(see §3.6)*
Subset rule	Any data that is valid for a subset namespace must also be valid for its reference namespace or extension namespace, and must have the same meaning.*(see §8.4)*
Subset schema document	A schema document for a subset namespace. *(see §9.10)*

Terms imported from *Extensible Markup Language (XML) 1.0 (Fourth Edition)* [XML]:

Term	Definition
Document element	An element, no part of which appears in the content of another element; preferred synonym for *root element*.
XML document	A data object is an XML document if it is well-formed, as defined in this specification. (Section 2, Documents)

Terms imported from *XML Information Set (Second Edition)* [XML Infoset]:

Term	Definition
Attribute	An *attribute information item*, as defined by Section 2.3: *Attribute Information Items*.
Element	An *element information item*, as defined by Section 2.2, *Element Information Items*.

Terms imported from [XML Schema Structures]:

Term	Definition
Attribute declaration	As defined by *Section 2.2.2.3, Attribute Declaration*.
Base type definition	A type definition used as the basis for an extension or restriction.*(see Section 2.2.1.1, Type Definition Hierarchy)*
Complex type definition	As defined by *Section 2.2.1.3, Complex Type Definition**.
Element declaration	As defined by *Section 2.2.2.1, Element Declaration*.
Schema component	The generic term for the building blocks that comprise the abstract data model of the schema*(see Section 2.2, XML Schema Abstract Data Model)*
Schema document	As defined by *Section 3.1.2, XML Representations of Components*, which states, “A document in this form (i.e. a element information item) is a schema document.”
Simple type definition	As defined by *Section 2.2.1.2, Simple Type Definition*.
Valid	As defined by *Section 2.1, Overview of XML Schema*, which states, “The word valid and its derivatives are used to refer to clause 1 above, the determination of local schema-validity.”
XML Schema	A set of schema components. *(see Section 2.2, XML Schema Abstract Data Model)*
XML Schema definition language (XSD)	As defined by *Abstract*, which states, “XML Schema: Structures specifies the XML Schema definition language, which offers facilities for describing the structure and constraining the contents of XML 1.0 documents, including those which exploit the XML Namespace facility.”

Terms imported from NIEM Conformance Targets Attribute Specification [CTAS-v3.0]:

Term	Definition
Conformance target	A class of artifact, such as an interface, protocol, document, platform, process or service, that is the subject of conformance clauses and normative statements. *(see §6.1)*
Conformance target identifier	An internationalized resource identifier (IRI) that uniquely identifies a conformance target.
Effective conformance targets attribute	The first occurrence of the attribute {https://docs.oasis-open.org/niemopen/ns/specification/conformanceTargets/6.0/}conformanceTargets , in document order.
Effective conformance target identifier	An internationalized resource identifier reference that occurs in the document's effective conformance targets attribute.

1.1.2 Acronyms and abbreviations

Term	Literal
APPINFO	Application Information
CCC	Complex type with Complex Content
CMF	Common Model Format
CSC	Complex type with Simple Content
CSV	Comma Separated Values
CTAS	Conformance Targets Attribute Specification
ID	Identifier
IEP	Information Exchange Package
IEPD	Information Exchange Package Documentation
ISO	International Organization for Standardization
JSON	JavaScript Object Notation
JSON-LD	JavaScript Object Notation Linked Data
NBAC	NIEMOpen Business Architecture Committee
NS	Namespace
NTAC	NIEMOpen Technical Architecture Committee
OED	Oxford English Dictionary
OP	Open Project
OWL	Web Ontology Language
PGB	Project Governing Board

Term	Literal
QName	Qualified Name
RDF	Resource Description Framework
RDFS	Resource Description Framework Schema
RFC	Request For Comments
UML	Unified Modeling Language
URI	Uniform Resource Identifier
URL	Uniform Resource Locator
URN	Uniform Resource Name
XML	Extensible Markup Language
XSD	XML Schema Definition

2. How To Read This Document

This document provides normative specifications for NIEM-conforming data models. It also describes the goals and principles behind those specifications. It includes examples and explanations to help users of NIEM understand the goals, principles, and specifications.

This document is not intended as a user guide. Training materials for message designers and developers will be available at www.niemopen.org.

The relevant sections of this document will depend on the role of the user.Figure 2-1 illustrates the relationships between these roles and NIEM activities.

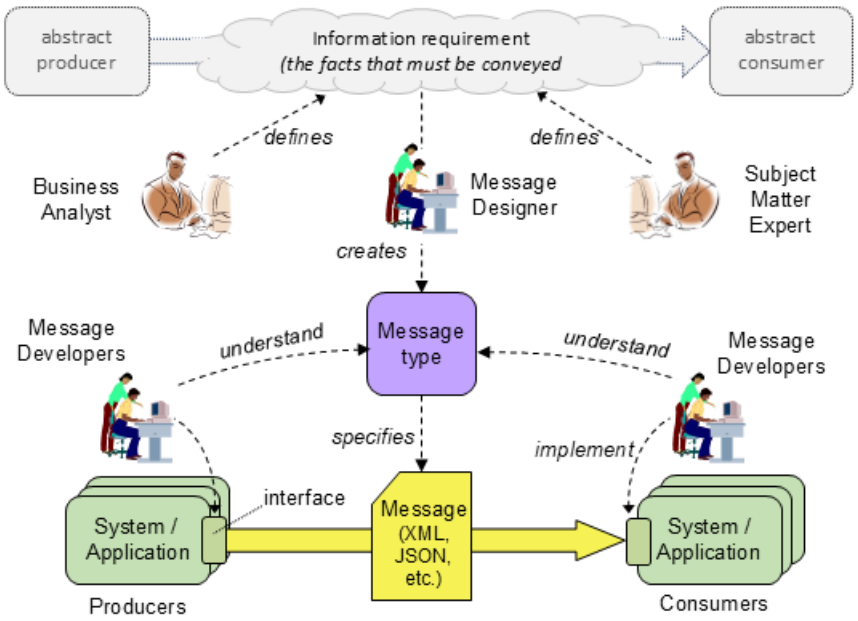


Figure 2-1: User roles and activities

The user roles in the above figure are:

- *Business analysts* and *subject matter experts*, who provide the requirements for information transfer. These requirements might describe an information resource available to all comers. They could describe an information exchange as part of a business process. They need not be tied to known producers and consumers.
- *Message designers*, who express those requirements as a message type, which specifies the syntax and semantics of the data that will convey the required information at runtime.
- *Message developers*, who write software to construct messages that contain the required information and follows the defined syntax, and who write software to parse and process such messages.

The remaining sections of this document most relevant to each of these roles are shown in the following table:

Section	Manager	Business Analyst	Message Designer	Message Developer
3. Overview of NIEM technical architecture	x	x	x	x
4. Data models in NIEM			x	
5. Data modeling patterns			x	
6. Conformance		x	x	x
7. Rules for model components		x	x	
8. Rules for namespaces		x	x	
9. Rules for schema documents			x	
10. Rules for models			x	
11. Rules for message types and message formats			x	x
12. Rules for XML messages			x	x
13. Rules for JSON messages			x	x
14. RDF interpretation of NIEM models and messages			x	

Table 2-2: Relevant document sections by user role

2.1 Document references

This document relies on references to many outside documents. Such references are noted by bold, bracketed inline terms. For example, a reference to RFC 3986 is shown as [RFC 3986]. All reference documents are recorded in Appendix A, References, below.

2.2 Clark notation and qualified names

This document uses both Clark notation and QName notation to represent qualified names.

QName notation is defined by XML Namespaces Section 4, Qualified Names. A QName for the XML Schema string datatype is xs:string. Namespace prefixes used within this specification are listed in Section 2.3, Use of namespaces and namespace prefixes, below.

This document sometimes uses Clark notation to represent qualified names in normative text. Clark notation is

described by ClarkNS, and provides the information in a QName without the need to first define a namespace prefix, and then to reference that namespace prefix. A Clark notation representation for the qualified name for the XML Schema string datatype is {http://www.w3.org/2001/XMLSchema}string

```
```

.

Each Clark notation value usually consists of a namespace URI surrounded by curly braces, concatenated with a local name. The exception to this is when Clark notation is used to represent the qualified name for an attribute with no namespace, which is ambiguous when represented using QName notation. For example, the element targetNamespace, which has no [namespace name] property, is represented in Clark notation as

```
{}targetNamespace
```

.

2.3 Use of namespaces and namespace prefixes

The following namespace prefixes are used consistently within this specification. These prefixes are not normative; this document issues no requirement that these prefixes be used in any conformant artifact. Although there is no requirement for a schema or XML document to use a particular namespace prefix, the meaning of the following namespace prefixes have fixed meaning in this document.

```
xs
```

: The namespace for the XML Schema definition language as defined byXML Schema Structures and XML Schema Datatypes, http://www.w3.org/2001/XMLSchema.

```
xsi
```

: The XML Schema instance namespace, defined by XML Schema Structures Section 2.6, Schema-Related Markup in Documents Being Validated, for use in XML documents, http://www.w3.org/2001/XMLSchema-instance.

```
ct
```

: The namespace defined by CTAS for the conformanceTargets attribute, https://docs.oasis-open.org/niemopen/ns/specification/conformanceTargets/6.0/.

```
appinfo
```

: The namespace for the appinfo namespace, https://docs.oasis-open.org/niemopen/ns/model/appinfo/6.0/.

```
structures
```

: The namespace for the structures namespace, https://docs.oasis-open.org/niemopen/ns/model/structures/6.0/.

```
cmf
```

: The namespace for the CMF model representation, https://docs.oasis-open.org/niemopen/ns/specification/cmf/1.0/.

3. Overview of the NIEM Technical Architecture

This overview describes NIEM's design goals and principles, and introduces key features of the architecture. The major design goals are:

- *Shared understanding of data.* NIEM helps developers working on different systems to understand the data their systems share with each other.
- *Reuse of community-agreed data definitions.* NIEM reduces the cost of data interoperability by promoting shared data definitions — without requiring a single data model of everything for everyone.
- *Open standards with free-and-open-source developer tools.* NIEM does not depend on proprietary standards or the use of expensive developer tools.

The key architecture features mentioned in this section:

- *The NIEM metamodel* — an abstract, technology-neutral data model for NIEM data models
- *Two equivalent model representations* — One is a profile of XML Schema (XSD) that has been used in every version of NIEM. The other is itself a NIEM-based data specification, suitable for XML and many other data technologies.
- *Model namespaces* — for model configuration management by multiple authors working independently.

3.1 Machine-to-machine data specifications

NIEM is a framework for developer-level specifications of data. A NIEM-based data specification — which is built *using* NIEM and in *conformance* to NIEM, but is not itself a *part* of NIEM — describes data to the developers of producing and consuming systems. This data may be shared via:

- a message passed between applications
- an information resource published on the web
- an API for a system or service

NIEM is potentially useful for any data sharing mechanism that transfers data across a system or organization boundary. (Within a system, NIEM may be useful when data passes between system components belonging to different developer teams.)

The primary purpose of a NIEM-based data specification is to establish a common understanding among developers, so that they can write software that correctly handles the shared data, hence "machine-to-machine". (NIEM-conforming data may also be directly presented to human consumers, and NIEM can help these consumers understand what they see, but that is not the primary purpose of NIEM.)

Data sharing in NIEM is implemented in terms of messages, message formats, and message types. These are illustrated in figure 3-1.

- message — a package of data shared at runtime; an instance of a message format and of a message type
- message format — a definition of a syntax for the messages of a message type
- message type — a definition of the information content in equivalent message formats

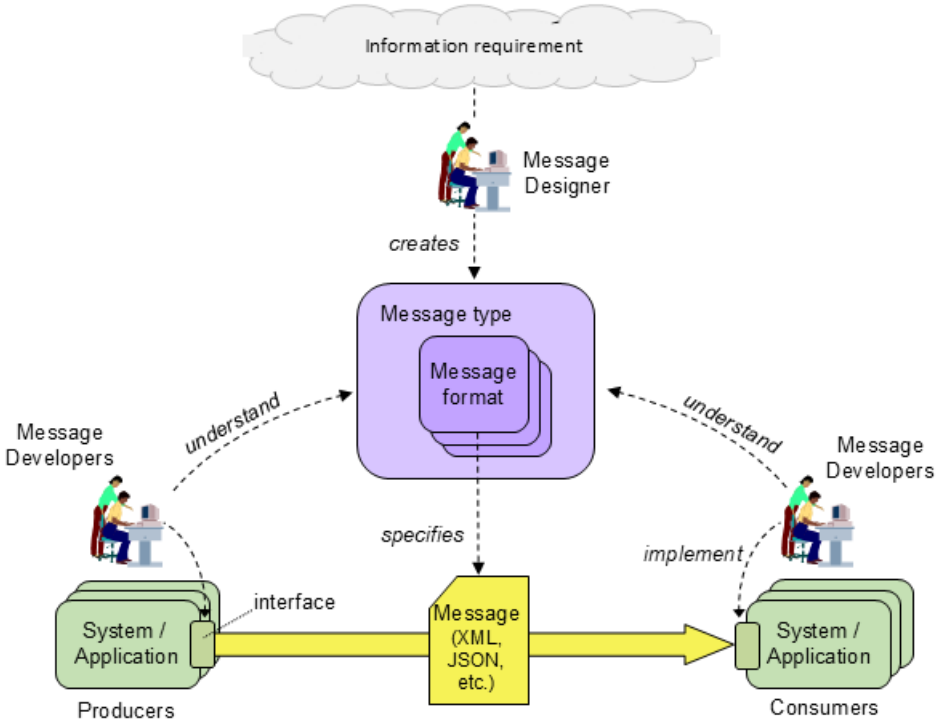


Figure 3-1: Message types, message formats, and messages

A message designer turns information requirements into a message type, then turns a message type into one or more message formats. Message developers then use the message type and message format to understand how to implement software that produces or consumes conforming messages.

3.1.1 Messages

In NIEM terms, the package of data shared at runtime is a message. This data is arranged according to a supported serialization. The result is a sequence of bits that represents the information content of the message. Example 3-2 shows two messages representing the same information, one serialized in XML, the other in JSON. Each message in this example is a request for a quantity of some item. (In all examples, closing tags and brackets may be omitted, long lines may be truncated, and some portions omitted and/or replaced with ellipses (…).)

```
<msg:Request                                                    | {
 xmlns:nc="https://docs.oasis-open.org/niemopen/ns/model/niem | "@context": {
 xmlns:msg="http://example.com/ReqRes/1.0/">                  |   "nc": "https://docs.oasis-open.org/n
  <msg:RequestID>RQ001</msg:RequestID>                        |   "msg": "http://example.com/ReqRes/1.
  <msg:RequestedItem>                                         | },
    <nc:ItemName>Wrench</nc:ItemName>                         | "msg:Request": {
    <nc:ItemQuantity>10</nc:ItemQuantity>                     |   "msg:RequestID" : "RQ001",
  </msg:RequestedItem>                                        |   "msg:RequestedItem": {
</msg:Request>                                                |     "nc:ItemName": Wrench",
                                                              |     "nc:ItemQuantity": 10
                                                              |   }
                                                              | }
                                                              |
```

Example 3-2: Example of messages in XML and JSON syntax

The data structure of a NIEM message appears to be a tree with a root node. It is actually a directed graph with an initial node called the message object. For example, the me

node. It is actually a directed graph with an initial node called the message object. For example, the m
object in example 3-2 is the

```
msg:Request
```

element in the XML message. In the JSON message
it is the value for the

```
msg:Request
```

key.

Every NIEM serialization has a mechanism for references; that is, a
way for one object in the serialized graph to point to an object
elsewhere in the graph. This mechanism supports cycles and avoids
duplication in the graph data structure. (See section
5.2.)

Every message is an instance of a message format. A conforming message must satisfy the
rules in section 12 and section 13. In particular, it
must be valid according to the schema of its message format.

> A NIEM message was originally known as an *information exchange
> package (IEP)*, a term that found its way into the U.S. Federal
> Enterprise Architecture (2005). A message specification was originally
> known as an *information exchange package documentation (IEPD).*
> These terms are in widespread use within the NIEM community today, and
> will not go away soon (if ever).

3.1.2 Message format

A message format specifies the syntax of valid
messages. This provides message developers with an exact description of
the messages to be generated or processed by their software.

A message format includes a schema that can be used to assess the validity of a message. This schema is
XML Schema (XSD) for XML message formats, and JSON Schema for JSON
message formats. Example 3-3 shows a portion of the
schemas for the two example messages in example
3-2.

```
<xs:complexType name="RequestType">                    | {
  <xs:sequence>                                        |   "msg:RequestType": {
    <xs:element ref="msg:RequestID"/>                  |     "type": "object",
    <xs:element ref="msg:RequestedItem"/>              |     "properties": {
  </xs:sequence>                                       |       "msg:RequestID": {"$ref": "#/prope
```

```
</xs:complexType>                                          |       "msg:RequestedItem": {"$ref": "#/p
<xs:element name="Request" type="msg:RequestType"/>        |     },
                                                           |     "required": [
                                                           |       "msg:RequestID",
                                                           |       "msg:RequestedItem"
                                                           |     ]
                                                           |   },
                                                           |   "msg:Request": {
                                                           |     "$ref": "#/definitions/msg:RequestTy
                                                           |   }
                                                           | }
```

Example 3-3: Example message format schemas

Producing and consuming systems may use the message format schema to validate the syntax of messages at runtime, but are not obligated to do so. Message developers may also use the schema during development for software testing. The schemas may also be used by developers for data binding; for example, Java Architecture for XML Binding (JAXB).

A message format belongs to exactly one message type. A conforming message format must satisfy the rules in section 11; in particular, it must be constructed so that every message that is valid according to the format also satisfies the information content constraints of its message type.

3.1.3 Message type

One important feature of NIEM is that every message has an equivalent message in every other supported serialization. These equivalent messages have a different message format, but have the same message type. For example, the XML message and the JSON message in example 3-2 above are equivalent. They represent the same information content, and can be converted one to the other without loss of information.

A message type specifies the information content of its messages without prescribing their syntax. A message type includes a message model, which is the means through which the message designer precisely defines the mandatory and optional content of conforming messages and the meaning of that content. This model is expressed in either of NIEM's two model representations, which are described in section 3.4 and section 3.5, and fully defined in section 4. Example 3-4 shows a portion of the message model for the two message formats in example 3-3.

```
<xs:complexType name="ItemType" appinfo:referenceCode="NONE"> | <Class structures:id="nc.ItemType
  <xs:annotation>                                             |   <Name>ItemType</Name>
    <xs:documentation>A data type for an article or thing.    |   <Namespace structures:ref="nc" 
  </xs:annotation>                                            |   <DocumentationText>A data type 
  <xs:complexContent>                                         |   <ReferenceCode>NONE</ReferenceC
```

```
    <xs:extension base="structures:ObjectType">
      <xs:sequence>
        <xs:element ref="nc:ItemName"/>
        <xs:element ref="nc:ItemQuantity"/>
      </xs:sequence>
    </xs:extension>
  </xs:complexContent>
</xs:complexType>
<xs:element name="ItemName" type="nc:TextType">
  <xs:annotation>
    <xs:documentation>A name of an item.</xs:documentation>
  </xs:annotation>
</xs:element>
<xs:element name="RequestedItem" type="nc:ItemType">
  <xs:annotation>
    <xs:documentation>A specification of an item request.</xs
  </xs:annotation>
</xs:element>
```

```
  <ChildPropertyAssociation>
    <DataProperty structures:ref=
    <MinOccursQuantity>1</MinOccu
    <MaxOccursQuantity>1</MaxOccu
  </ChildPropertyAssociation>
  <ChildPropertyAssociation>
    <DataProperty structures:ref=
    <MinOccursQuantity>1</MinOccu
    <MaxOccursQuantity>1</MaxOccu
  </ChildPropertyAssociation>
</Class>
<DataProperty structures:id="nc.I
  <Name>ItemName</Name>
  <Namespace structures:ref="nc" :
  <DocumentationText>A name of an
  <Datatype structures:ref="nc.Te
</DataProperty>
<ObjectProperty structures:id="ms
  <Name>RequestedItem</Name>
  <Namespace structures:ref="msg"
  <DocumentationText>A specificat
  <Class structures:ref="nc.ItemT
  <ReferenceCode>NONE</ReferenceC
</ObjectProperty>
```

Example 3-4: Example message model in XSD and CMF

In addition to the message model, a message type also declares the initial property of conforming messages. In a conforming message, the message object is always the value of the initial property. For example, the message type for the message in example 3-2 declares that the initial property is

```
msg:Request
```

.

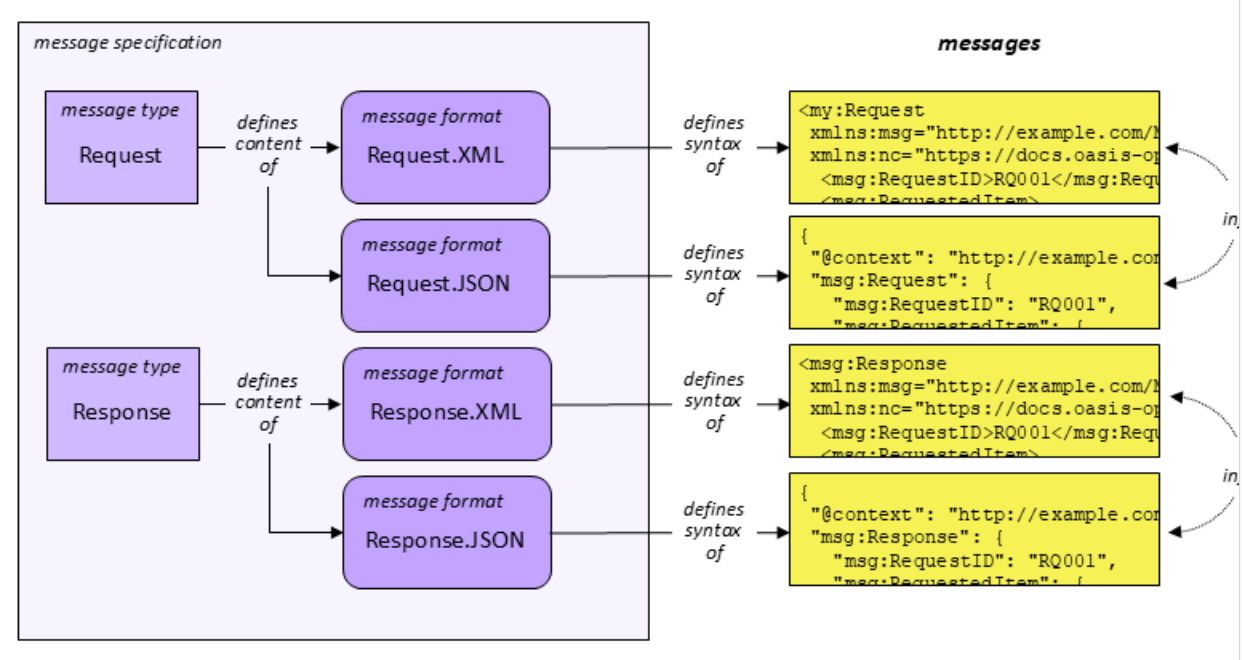
A message type provides all of the information needed to generate the schema for each message format it specifies. NIEMOpen provides free and open-source software tools to generate these schemas from the message model. (Message designers may also compose these schemas by hand, if desired.)

A conforming message type must satisfy all of the rules in section 11.

3.1.4 Message specification

A message specification is a collection of related message types. For instance, a Request message type might be paired with a Response message type as part of a

might be paired with a Response message type as part of a request/response protocol. Those two message types could be collected into a message specification for the protocol, as illustrated below in example 3-5.



Example 3-5: Message specifications, types, and formats

Summary:

- A message specification defines one or more message types; a message type belongs to one message specification
- A message type defines one or more message formats; a message format belongs to one message type
- A message format defines the syntax of valid messages
- A message type defines the semantics of valid messages, plus their mandatory and optional content
- A message is an instance of a message format and of that format's message type

3.2 Reuse of community-agreed data models

NIEM is also a framework allowing communities to create reuse models for concepts that are useful in mult
data specifications. These community models are typically not *complete* for any particular specification. Instead, they reflect the community's judgement on which definitions are *worth the trouble of agreement*. The NIEM core model contains definitions found useful by the NIEM community as a whole. NIEM domain models reuse the core, extending it with definitions found useful by the domain community. The core model plus the domain models comprise the "NIEM model". Figure 3-6 below illustrates the relationships between domain communities and community models.

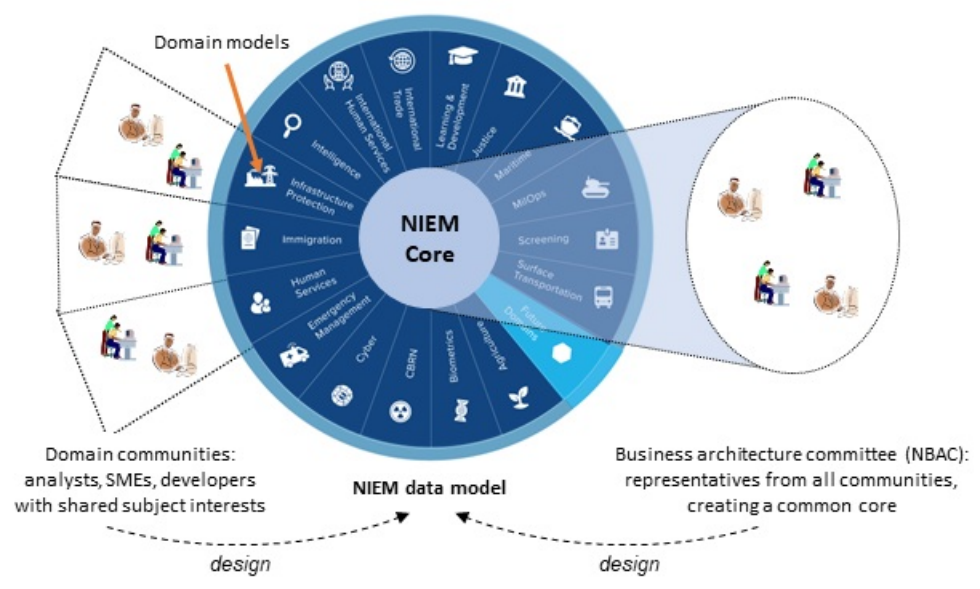


Figure 3-6: NIEM communities and data models

Message designers reuse definitions from the NIEM model, selecting a (usually small) subset of definitions that express a part of their information requirement. Message designers then create model extensions, adding components that do not yet exist in the NIEM model. These local extensions could be useful to others in the community beyond the scope of the original message, and may be submitted for potential adoption into the NIEM model (see https://github.com/niemopen/niem-model/issues).

NIEM's policy of easy model extension supports easy reuse of community data models. Because a community model does not need to be complete for the union of all needs, each community may focus its effort on its common needs, where the effort of agreement has the highest value. Data definitions that are not common, that are needed only for a particular message appear only as extensions in that message type, and need be learned only by the message developers who implement it. Model extensions are further described in section 3.7.

Data model reuse is especially useful in a large enterprise. Its value grows with the number of developer teams, and with the degree of commonality in the shared data. NIEM was originally designed for data sharing among federal, state, and local governments — where commonality and number of developer teams is large indeed.

3.3 Reuse of open standards

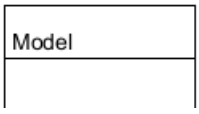
NIEM is built on a foundation of open standards, primarily:

- XML and XSD — message serialization and validation; also a modeling formalism
- JSON and JSON-LD — message serialization and linked data
- JSON Schema — message validation
- RDF, RDFS, and OWL — formal semantics
- ISO 11179 — conventions for data element names and documentation

One of NIEM's principles is to reuse well-known information technology standards when these are supported by free and open-source software. NIEM avoids reuse of standards that effectively depend on proprietary software. When the NIEMOpen project defines a standard of its own, it also provides free and open-source software to support it.

3.4 The NIEM metamodel

A data model in NIEM is either a message model, defining the information content of a message type, or a reuse model, making the agreed definitions of a community available for reuse. The information required for those purposes can itself be modeled. The model of that information is the *NIEM metamodel* – an abstract model for NIEM data models. The metamodel is expressed in UML, and is described in detail in section 4. At a high level, the major components of the metamodel are properties, classes, datatypes, namespaces, and models. Figure 3-7 provides an illustration.



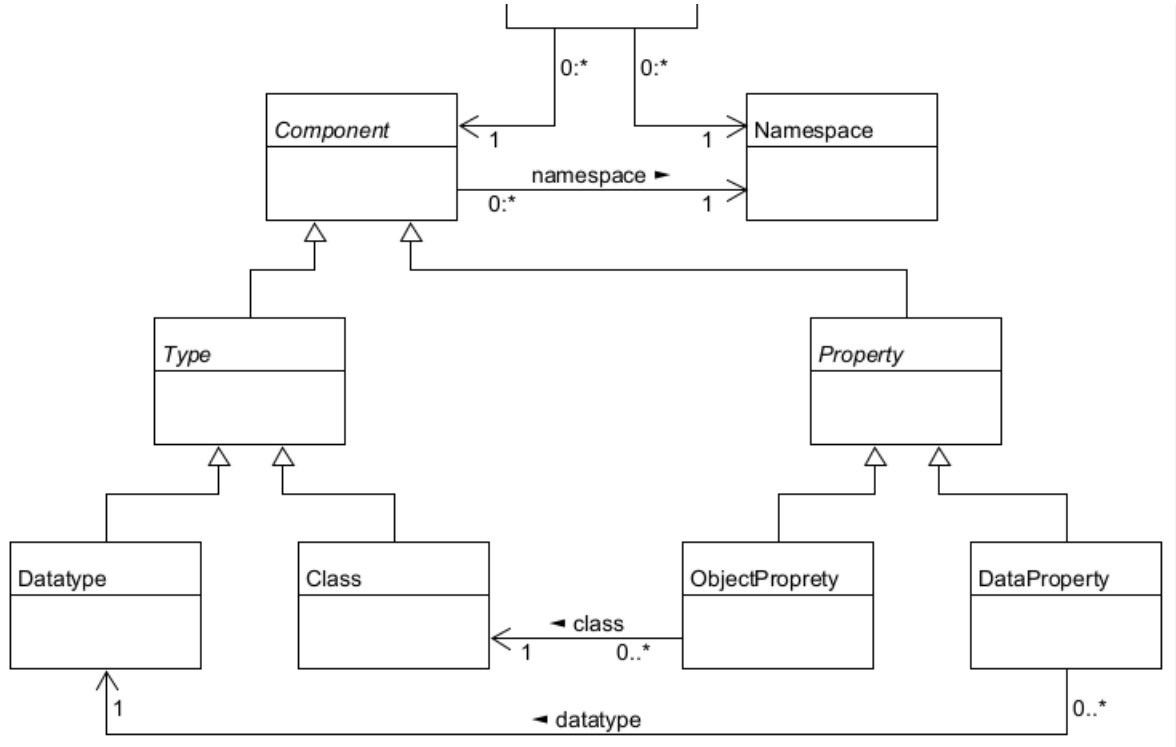


Figure 3-7: High-level view of the NIEM metamodel

- A *property* is a concept, idea, or thing. It defines a field that may appear in a message and can contain subfields (for objects / object properties) or a value (for literals / data properties). For example, in example 3-4,

```
req:RequestedItem
```

and

```
nc:ItemName
```

are names of properties.

```
req:RequestedItem
```

is an object property for the requested item;

```
nc:ItemName
```

is a data property for the name of the item. The meaning of these properties is captured in the documentation text.

- A *class* defines the properties that may appear in the content of a corresponding *object* in a message. A class has one or more *properties*. An *object property* in a class defines a subject-property-value relationship between two objects. A *data property* defines a relationship between an object and a literal value. In example 3-4,

  ```
  nc:ItemType
  ```

  is the name of a class.

- A *datatype* defines the allowed values of a corresponding *literal value* in a message. In example 3-4,

  ```
  nc:TextType
  ```

  is the name of a datatype.

- Classes and datatypes are the two kinds of *type* in the metamodel. For historical reasons, the name of every class and datatype in the NIEM model ends in “Type”. This is why the high-level view of the metamodel includes the abstract Type UML class.

- Classes, datatypes, and properties are the three kinds of metamodel *component*. (All of the common properties of classes and datatypes are defined in the Component class, which is why the abstract Type class is not needed in the detailed metamodel diagram in section 4.)

- A *namespace* is a collection of uniquely-named components defined by an authority. (See section 3.6)

- A *model* is a collection of components (organized into namespaces) and their relationships.

Figure 3-8 below illustrates the relationships among metamodel components, NIEM model components, and the corresponding message objects and values.

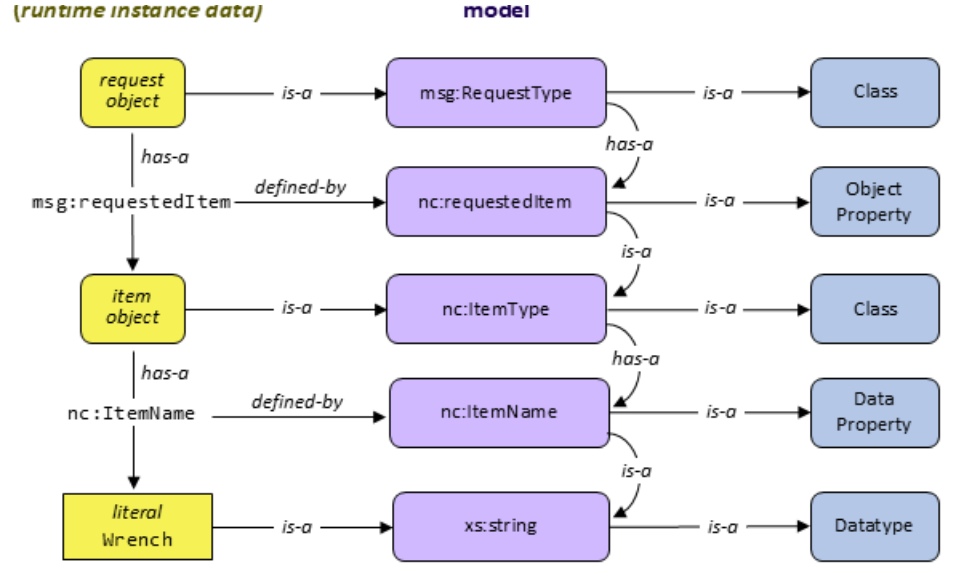


Figure 3-8: Message, message model, and metamodel relationships

A NIEM message contains properties which are based on objects or literal values. These are specified by the class, property, and datatype objects in a NIEM message model, which defines the content of a conforming message and also defines the meaning of that content. For example, in figure 3-8, the *item object* is defined by the

```
nc:ItemType
```

Class object; the *literal value* (

```
Wrench
```

) is defined by the

```
xs:string
```

Datatype object, and the property relationship between the two is defined by the

```
nc:ItemName
```

DataProperty object.

3.5 NIEM model representations: XSD and CMF

The abstract metamodel has two concrete representations: NIEM XSD and NIEM CMF. These are equivalent representations and may be converted from one to the other without loss. (NIEMOpen provides free and open-source software tools that perform the conversion; see software tools.)

Every version of NIEM uses a profile of XML Schema (XSD) as a NIEM model representation. In XSD, a NIEM model is represented as a schema assembled from a collection of schema documents. Every aspect of the metamodel is represented in some way by a schema component.

XSD as a model representation directly supports conformance testing of NIEM XML messages through schema validation. However, JSON developers (and developers working with other formats) cannot use XSD to validate their messages. Nor do they want to read XSD specifications of message content. For this reason, NIEM 6 introduces the Common Model Format (CMF), which is a NIEM model representation intended to support all developers.

CMF is the result of applying the NIEM framework to the information requirements in the metamodel. That result is a NIEM-based message type, which is part of a message specification, which is published in CMF. In CMF, a model is represented as an instance of that message type; that is, a CMF message, also known as a model file.

CMF is a technology-neutral model representation, because:

- A CMF model can be transformed into XSD for validation of XML messages, and into JSON Schema for validation of JSON messages.
- A CMF model can itself be represented in XML or JSON, according to developer preference. That is, like any other NIEM message, the CMF representation of a model can be serialized in either XML or JSON. For example, example 3-9 shows a portion of the message model from example 3-4 in both XML and JSON syntax.

```
<Class structures:id="nc.ItemType">                                  | {
  <Name>ItemType</Name>                                              |   "cmf:Class": {
  <Namespace structures:ref="nc" xsi:nil="true"/>                    |     "cmf:Name": "ItemType",
  <DocumentationText>A data type for an article or thing.</Docum     |     "cmf:Namespace": { "@id":
  <ReferenceCode>NONE</ReferenceCode>                                |     "cmf:DocumentationText": "A
  <ChildPropertyAssociation>                                         |     "cmf:ReferenceCode": "NONE
    <DataProperty structures:ref="nc.ItemName" xsi:nil="true"/>      |     "cmf:PropertyAssociation":
    <MinOccursQuantity>1</MinOccursQuantity>                         |       "cmf:DataProperty": { "@
    <MaxOccursQuantity>1</MaxOccursQuantity>                         |       "cmf:MinOccursQuantity":
```

```
  </ChildPropertyAssociation>                                          |       "cmf:MaxOccursQuantity":
  <ChildPropertyAssociation>                                           |     },
    <DataProperty structures:ref="nc.ItemQuantity" xsi:nil="true       |     "cmf:PropertyAssociation":
    <MinOccursQuantity>1</MinOccursQuantity>                           |       "cmf:DataProperty": { "@
    <MaxOccursQuantity>1</MaxOccursQuantity>                           |       "cmf:MinOccursQuantity":
  </ChildPropertyAssociation>                                          |       "cmf:MaxOccursQuantity":
</Class>                                                               |     }
                                                                       |   }
                                                                       | }
```

Example 3-9: CMF model in XML and JSON syntax

Section 4 defines the mappings
between the metamodel, NIEM XSD, and CMF.

> While NIEM uses JSON Schema to validate JSON messages, there is no
> JSON Schema representation of the metamodel, because JSON Schema does
> not have all of the necessary features to represent NIEM models.

3.6 Namespaces

The components of a NIEM model are partitioned into
namespaces. This prevents name clashes among communities or
domains that have different business perspectives, even when they choose
identical data names to represent different data concepts.

Each namespace has an author, a person or organization that is the
authoritative source for the namespace definitions. A namespace is the
collection of model components for concepts of interest to the namespace
author. Namespace cohesion is important: a namespace should be designed
so that its components are consistent, may be used together, and may be
updated at the same time.

Each namespace must be uniquely identified by a URI. The namespace
author must also be the URI's owner, as defined by [webarch]. Both URNs and URLs are allowed. It is
helpful, but not required, for the namespace URI to be accessible,
returning the definition of the namespace content in a supported model
format.

NIEM defines two categories of authoritative namespace: reference namespace and extension
namespace.

- *Reference namespace:* The NIEM model is a reuse model comprised entirely of reference namespaces. Th
  are intended for the widest possible reuse. They provide names and
  definitions for concepts, and relations among them. These namespaces are
  characterized by “optionality and over-inclusiveness”. That is, they
  define more concepts than needed for any particular data exchange
  specification, without cardinality constraints, so it is easy to select
  the concepts that are needed and omit the rest. They also omit
  unnecessary range or length constraints on property datatypes.

  A reference namespace is intended to capture the
  meaning of its components. It is not intended for a complete definition
  of any particular message type. Message designers are
  expected to subset, profile, and extend the components in reference namespaces as needed to match tl
  information exchange requirements.

- *Extension namespace:* The components in an extension namespace are intended for reuse within a more
  narrow scope than those defined in a reference
  namespace. These components express the additional vocabulary
  required for an information exchange, above and beyond the vocabulary
  available from the NIEM model. The intended scope is often a particular
  message specification. Sometimes a community or
  organization will define an extension namespace for
  components to be reused in several related message specifications. In
  this case, the namespace components may also omit cardinality and
  datatype constraints, and may be incomplete for any particular message type.

  Message designers are encouraged to subset, profile, and extend the
  components in extension namespaces created by another
  author when these satisfy their modeling needs, rather than create new
  components.

Namespaces are the units of model configuration management. Once
published, the components in a reference namespace or
extension namespace may not be removed or changed in
meaning. A change of that nature may only be made in a new namespace
with a different URI.

As a result of this rule, once a specific version of a namespace is
published, it can no longer be modified. Updates must go into a new
version of the namespace. All published versions of a namespace continue
to be valid in support of older exchanges.

In addition, note that a message specification contains its own copy
of the schemas that they depend upon. Therefore new versions of a model
or a namespace do not affect existing exchanges. Exchange partners may
decide to upgrade to a new version of NIEM if they decide it suits their
needs, but only if they choose to do so, and only on their own timeline.
The NIEM release schedule does not force adopters to keep in sync.

Message designers almost never require *all* the components in the NIEM model, and so NIEM defines a third namespace category:

- *Subset namespace:* Technically, this is a "namespace subset", which contains only some of the components of a reference namespace or extension namespace. It provides components for reuse, while enabling message designers and developers to:
  - Omit optional components in a reference namespace or extension namespace that they do not need.
  - Provide cardinality and datatype constraints that precisely define the content of one or more message types.

  All message content that is valid for a subset namespace must also be valid for the reference namespace or extension namespace with the same URI. Widening the value space of a component is not allowed. Adding components is not allowed. Changing the documentation of a component is not allowed.

NIEM has a fourth namespace category, for namespaces containing components from standards or specifications that are based on XML but not based on NIEM.

- *External namespace:* Any namespace defined by a schema document that is not:
  - a reference namespace
  - an extension namespace
  - a subset namespace
  - the structures namespace, https://docs.oasis-open.org/niemopen/ns/model/structures/6.0/
  - the XML namespace, http://www.w3.org/XML/1998/namespace

  .

XML attributes defined in an external namespace may be part of a NIEM model. XML elements defined in an external namespace are not part of a NIEM model, but may be used as properties of an adapter type *(see §9.4)*.

Three special namespaces do not fit into any of the four categories:

- The structures namespace is not part of any NIEM model. It provides base types and attributes that are used in the XSD representation of NIEM models.
- The XML namespace is not considered to be an external namespace. It defines the

  ```
  xml:lang
  ```

  attribute, which may be a component in a NIEM model.
- The XSD namespace (http://www.w3.org/2001/XMLSchema

  ```

  ```

) defines the primitive datatypes (

  ```
  xs:string
  ```

  , etc.) This namespace appears explicitly in CMF model representations, and is implicitly part of every XSD representation.

3.7 Model extensions

Reuse of a community data model typically supplies some but not all of the necessary data definitions. Model extension allows a model designer to supply the missing definitions. NIEM has two forms of model extension: subclassing and augmentation.

In a *subclass*, a namespace designer creates a new class in his own namespace to represent a special kind of thing. The new class shares all of the properties of its parent class, and adds properties belonging only to the new class. For example, in the NIEM model,

belonging only to the new class. For example, in the NIEM model,

```
nc:Vehicle
```

is a subclass of

```
nc:Conveyance
```

.
Like any Conveyance, a Vehicle may have the

```
nc:ConveyanceEngineQuantity
```

property, but only Vehicles
have the

```
nc:VehicleSeatingQuantity
```

property; other
Conveyances do not.

In an *augmentation*, a namespace designer creates additional
properties for a class that is defined in a different namespace. Here
the designer is not creating a new class for a new kind of thing.
Instead, he is providing properties which could have been defined by the
original class designer, but in fact were not. For example, the
designers of the NIEM Justice domain have augmented

```
nc:PersonType
```

with the

```
j:PersonSightedIndicator
```

property, because for the members
of the Justice domain it is useful to record whether a person is able to
see, even though to the NIEM community as a whole, adding this property
to NIEM Core is not worth the trouble.

In general, augmentations are preferred over subclassing. At present
the NIEM metamodel does not support multiple inheritance. If several
domains were to create a subclass of

```
nc:PersonType
```

, there
would be no way for a message designer to combine in his message model
the properties of a person from NIEM Justice, NIEM Immigration, etc.
That combination is easily done with augmentations.

---

4. Data models in NIEM

The NIEM metamodel is an abstract model that specifies the content of a NIEM data model. It is described by the UML diagram in figure 4-1 below.

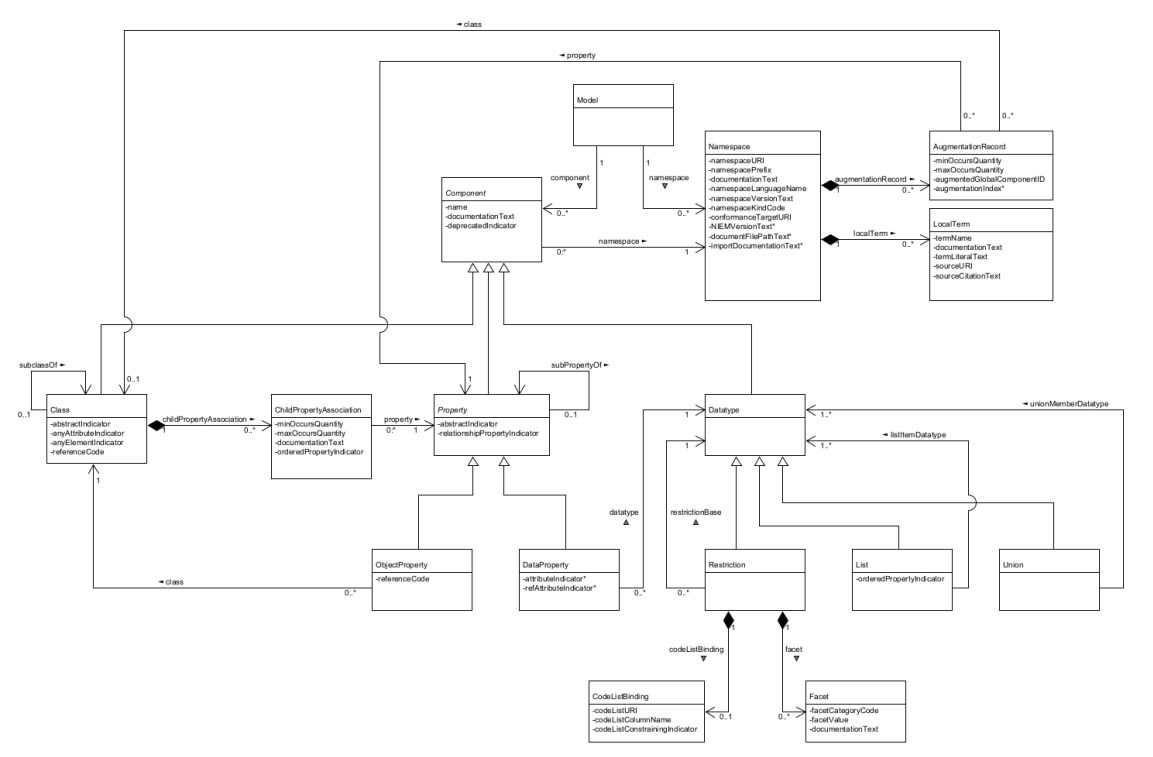


Figure 4-1:The NIEM metamodel

This section specifies:

- the meaning of the classes, attributes, and relationships in the metamodel
- the meaning of the classes, datatypes, and properties in CMF, which implements the metamodel
- the XSD constructs that correspond to CMF classes, datatypes, and properties, and which also implement the metamodel

In addition to the UML diagram, this section contains several tables that document the classes, attributes, and relationships in the metamodel. These tables have the following columns:

Column	Definition
Name	the name of the class, attribute, or relationship
Definition	the definition of the object or property
Card	the number of times this property may/must appear in an object
Ord	true when the order of the instances of a repeatable property in an object is significant
Range	the class or datatype of a property

Table 4-2: Definition of columns in metamodel property tables

Classes, attributes, and relationships have the same names in the metamodel and in CMF. (Attributes and relationship names have lower camel case in the diagram and tables, following the UML convention. The tables and the CMF specification use the same names in upper camel case, following the NIEM convention.)

The definitions in these tables follow NIEM rules for documentation (which are described in section 7.2). As a result, the definition of each metamodel class begins with “A data type for…” instead of “A class for…”. (For historical reasons, the name of every class and datatype in the NIEM model ends in “Type”, and this is reflected in the conventions for documentation; see section 3.4.)

Names from CMF and the metamodel do not appear in the XSD representation of a model. Instead, NIEM defines special interpretations of XML Schema components, making the elements and attributes in an XSD schema document equivalent to CMF model components. The mapping between CMF components and XSD schema components is provided by a table in each section below, with these columns:

Column	Definition
CMF	CMF component name
XSD	XSD equivalent

Table 4-3: Definition of columns in CMF-XSD mapping tables

4.1 Model

A Model object represents a NIEM model.

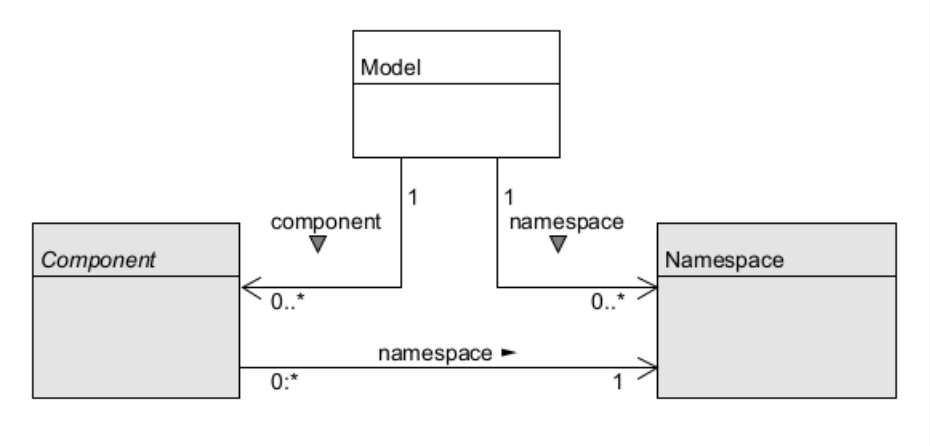


Figure 4-4: Model class diagram

Name	Definition	Card	Ord	Range
Model	A data type for a NIEM data model.			
Component	A data concept for a component of a NIEM data model.	0..*	-	Component
Namespace	A namespace of a data model component	0..*	-	Namespace

Table 4-5: Properties of the Model object class

In XSD, an instance of the Model class is represented by a schema document set.

4.2 Namespace

A Namespace object represents a namespace in a model. For example,
the namespace with the URI
https://docs.oasis-open.org/niemopen/ns/model/niem-core/6.0/

is a namespace in the NIEM 6.0 model.

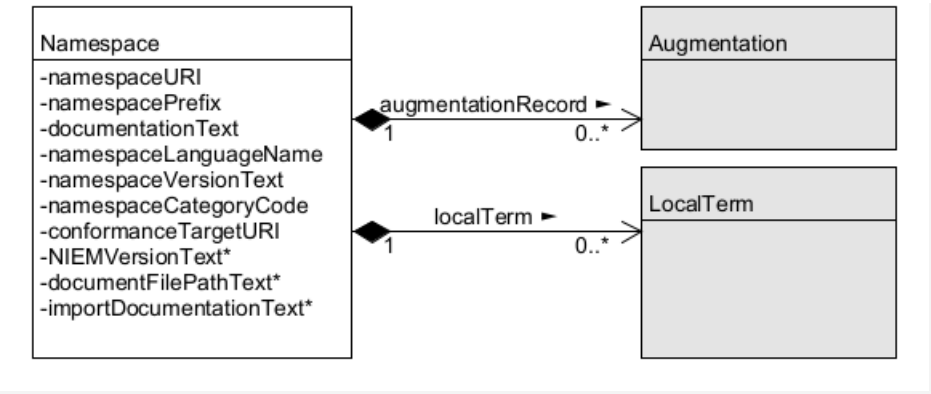


Figure 4-6: Namespace class diagram

Name	Definition
Namespace	A data type for a namespace.
NamespaceURI	A URI for a namespace.
NamespacePrefixText	A namespace prefix name for a namespace.
DocumentationText	A human-readable text documentation of a namespace.
NamespaceLanguageName	A name of a default language of the terms and documentation a namespace.
NamespaceVersionText	A version of a namespace; for example, used to distinguish namespace subset, bug fix, documentation change, etc.
NamespaceCategoryCode	A kind of namespace in a NIEM model (external, core, domain etc.).
ConformanceTargetURI	A conformance target identifier.
NIEMVersionText	A NIEM version number of the builtin schema components used namespace; e.g. “5” or “6”.
DocumentFilePathText	A relative file path from the top schema directory to a sch document for this namespace.
ImportDocumentationText	Human-readable documentation from the first `xs:import` element importing this namespace.
AugmentationRecord	An augmentation of a class with a property by a namespace.
LocalTerm	A data type for the meaning of a term that may appear withi

Name	Definition
	name of a model component.

Table 4-7: Properties of the Namespace object class

In XSD, an instance of the Namespace class is represented by the

```
<xs:schema>
```

element in a schema document. Example 4-8 shows the representation of a Namespace object in CMF and in the corresponding XSD.

```
<Namespace>
  <NamespaceURI>https://docs.oasis-open.org/niemopen/ns/model/niem-core/6.0/</NamespaceURI>
  <NamespacePrefixText>nc</NamespacePrefixText>
  <DocumentationText>NIEM Core.</DocumentationText>
  <ConformanceTargetURI>
    https://docs.oasis-open.org/niemopen/ns/specification/NDR/6.0/#ReferenceSchemaDocument
  </ConformanceTargetURI>
  <NamespaceVersionText>ps02</NamespaceVersionText>
  <NamespaceLanguageName>en-US</NamespaceLanguageName>
</Namespace>
---------------
<xs:schema
  targetNamespace="https://docs.oasis-open.org/niemopen/ns/model/niem-core/6.0/"
  xmlns:ct="https://docs.oasis-open.org/niemopen/ns/specification/conformanceTargets/6.0/"
  xmlns:nc="https://docs.oasis-open.org/niemopen/ns/model/niem-core/6.0/"
  xmlns:xs="http://www.w3.org/2001/XMLSchema"
  ct:conformanceTargets="https://docs.oasis-open.org/niemopen/ns/specification/NDR/6.0/#ReferenceSche
  version="ps02"
  xml:lang="en-US">
  <xs:annotation>
    <xs:documentation>NIEM Core.</xs:documentation>
  </xs:annotation>
</xs:schema>
```

Example 4-8: Namespace object in CMF and XSD

The following table shows the mapping between Namespace object representations in CMF and XSD.

CMF	XSD
NamespaceURI	`xs:schema/@targetNamespace`
NamespacePrefixText	The prefix in the first namespace declaration of the target namespace

CMF	XSD
DocumentationText	xs:schema/xs:annotation/xs:documentation
ConformanceTargetURI	Each of the URIs in the list attribute xs:schema/@ct:conformanceTargets
NamespaceVersionText	xs:schema/@version
NamespaceLanguageName	xs:schema/@xml:lang

Table 4-9: Namespace object properties in CMF and XSD

4.3 Component

A Component is either a Class object, a Property object, or a Datatype object in a NIEM model. This abstract class defines the common properties of those three concrete subclasses.

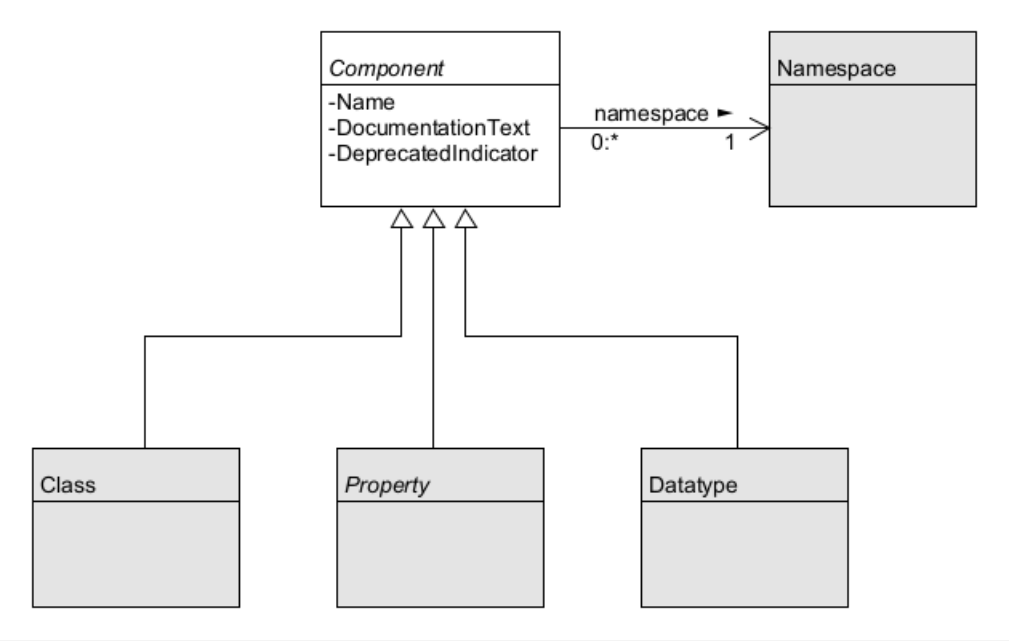


Figure 4-10: Component class diagram

Figure 4-10: Component class diagram

Name	Definition
Component	A data type for common properties of a data model component in NIEM.
Name	The name of a data model component.
DocumentationText	A human-readable text definition of a data model component.
DeprecatedIndicator	True for a deprecated schema component; that is, a component tha provided, but the use of which is not recommended.
Namespace	The namespace of a data model component.

Table 4-11: Properties of the Component abstract class

In XSD, the common properties of a Component object are represented by a complex type definition or an element or attribute declaration. Example 4-12 shows the representatio properties in CMF and XSD.

```
<DataProperty>
  <Name>ActivityCompletedIndicator</Name>
  <Namespace structures:ref="nc"/>
  <DocumentationText>True if an activity has ended; false otherwise.</DocumentationText>
  <DeprecatedIndicator>false</DeprecatedIndicator>
---------------
<xs:element name="ActivityCompletedIndicator" type="niem-xs:boolean" appinfo:deprecated="false">
  <xs:annotation>
    <xs:documentation>True if an activity has ended; false otherwise.</xs:documentation>
  </xs:annotation>
</xs:element>
```

Example 4-12: Component object (abstract) in CMF and XSD

The following table shows the mapping between Component object properties in CMF and XSD.

CMF	XSD
Name	`@name`

CMF	XSD
NamespaceURI	`@targetNamespace` of schema document
DocumentationText	`xs:annotation/xs:documentation` of element or attribute declaration
DeprecatedIndicator	’@appinfo:deprecated` of element or attribute declaration

Table 4-13: Component object properties in CMF and XSD

4.4 Class

A Class object represents a class of message objects defined by a NIEM model. For example,

```
nc:ItemType
```

is a Class object in the NIEM Core model.

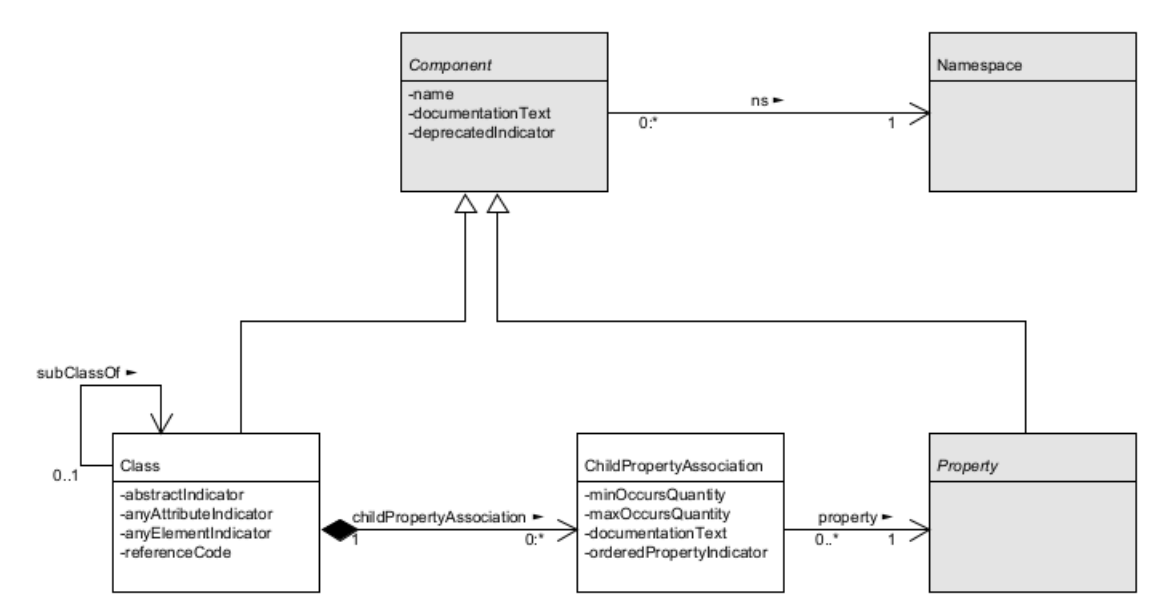


Figure 4-14: Class and ChildPropertyAssociation class diagram

Name	Definition
Class	A data type for a class.
AbstractIndicator	True if a class is a base for extension, and must be speci be used directly; false if a class may be used directly.
AnyAttributeIndicator	True when instances of a class may have arbitrary attribut ChildPropertyAssociation.
AnyElementIndicator	True when instances of a class may have arbitrary element ChildPropertyAssociation.
ReferenceCode	A code describing how a property may be referenced (or mus inline).
SubClassOf	A base class of a subclass.
ChildPropertyAssociation	An association between a class and a child property of tha class.

Table 4-15: Properties of the Class object class

The range of the

`ReferenceCode`

property is a code list with the following codes and meanings:

Code	Definition
REF	A code for a property that may be referenced by an IDREF (in XML) or NCName (in JSON).
URI	A code for a property that may be referenced by a URI.
ANY	A code for a property that may be reference by IDREF/NCName or URI.
NONE	A code for a property that my not be referenced and must appear inline.

Table 4-16: ReferenceCode code list

Class objects may be categorized into four groups, as follows:

- An object class contains one or more properties from a conforming namespace. An object class has a name ending in “Type”. Most class objects fall into this category.
- An adapter class contains only properties from a single external namespace. It acts as a conformance wrapper around data components defined in standards that are not NIEM conforming. An adapter class has a name ending in “AdapterType”. (See section 9.4.)
- An association class represents a specific relationship between objects. Associations are used when a simple NIEM property is insufficient to model the relationship clearly, or to model properties of the relationship itself. An association class has a name ending in “AssociationType”.
- A literal class contains no object properties, at least one attribute property, and exactly one element property. A literal class has a name ending in “Type”.

The instances of most classes (including adapter and association classes) are represented in XML as an element with complex content; that is, with child elements, and sometimes with attributes. For example, example 4-17 shows an XML element wi content, and also the equivalent in a JSON message.

```
<ex:ItemWeightMeasure>                                          | {
  <ex:MassUnitCode>KGM</unece:MassUnitCode>                     |   "ex:ItemWeightMeasure": {
  <ex:MeasureDecimalValue>22.5</ex:MeasureDecimalValue>         |     "ex:MassUnitCode": "KGM",
</ex:ItemWeightMeasure>                                         |     "ex:MeasureDecimalValue": 22.5
                                                                |   }
                                                                | }
```

Example 4-17: Instance of a class in XML and JSON

These classes are represented in XSD as a complex type with complex content (“CCC type”); that is, a type with child elements. Example 4-18 below shows a ordinary Class obje defining the class of the

```
ItemWeightMeasure
```

```
 itemWeightMeasure
```

property in the
example above, represented first in CMF, and then in XSD as a complex
type with child elements.

```
<Class structures:id="ex.WeightMeasureType">
  <Name>WeightMeasureType</Name>
  <Namespace structures:ref="ex" xsi:nil="true"/>
  <ChildPropertyAssociation>
    <DataProperty structures:ref="ex.MassUnitCode" xsi:nil="true"/>
    <MinOccursQuantity>1</MinOccursQuantity>
    <MaxOccursQuantity>1</MaxOccursQuantity>
  </PropertyAssociation}>
  <ChildPropertyAssociation>
    <DataProperty structures:ref="ex.MeasureDecimalValue" xsi:nil="true"/>
    <MinOccursQuantity>1</MinOccursQuantity>
    <MaxOccursQuantity>1</MaxOccursQuantity>
  </PropertyAssociation>
</Class>
---------------
<xs:complexType name="WeightMeasureType">
  <xs:complexContent>
    <xs:extension base="structures:ObjectType">
      <xs:sequence>
        <xs:element ref="ex:MassUnitCode"/>
        <xs:element ref="ex:MeasureDecimalValue"/>
      </xs:sequence>
    </xs:extension>
  </xs:complexContent>
</xs:complexType>
```

Example 4-18: A Class object in CMF and XSD (CCC
type)

The following table shows the mapping between Class object
representations in CMF and XSD.

CMF	XSD
AbstractIndicator	`xs:complexType/@abstract`
AnyAttributeIndicator	`xs:anyAttribute`
AnyElementIndicator	`xs:any`

CMF	XSD
ReferenceCode	xs:complexType/@appinfo:referenceCode
SubClassOf	xs:complexType/xs:complexContent/xs:extension/@base
ChildPropertyAssociation	xs:complexType/xs:complexContent/xs:extension/xs:sequence/xs:element or xs:complexType/xs:complexContent/xs:extension/xs:attribute

Table 4-19: Class object object properties in CMF and XSD

Instances of a literal class are represented as an element with simple content and attributes in XML. Example 4-20 below shows an XML and JSON instance of a literal class.

```
<ex:ItemWeightMeasure ex:massUnitCode="KGM">
  22.5
</ex:ItemWeightMeasure>
```

```
{
  "ex:ItemWeightMeasure": {
    "ex:massUnitCode": "KGM",
    "ex:WeightMeasureLiteral": 22.5
  }
}
```

Example 4-20: Instance of a literal class in XML and JSON

A literal class is represented in XSD as a complex type with simple content (“CSC type”) and attributes. This is illustrated in example 4-21 below, which shows a literal cla

```
ItemWeightMeasure
```

property in example 4-20 above.

```
<Class structures:id="ex.WeightMeasureType">
  <Name>WeightMeasureType</Name>
  <Namespace structures:ref="ex" xsi:nil="true"/>
  <ChildPropertyAssociation>
    <DataProperty structures:ref="ex.massUnitCode" xsi:nil="true"/>
```

```
      <MinOccursQuantity>1</MinOccursQuantity>
      <MaxOccursQuantity>1</MaxOccursQuantity>
    </ChildPropertyAssociation>
    <ChildPropertyAssociation>
      <DataProperty structures:ref="ex.WeightMeasureLiteral" xsi:nil="true"/>
      <MinOccursQuantity>1</MinOccursQuantity>
      <MaxOccursQuantity>1</MaxOccursQuantity>
    </ChildPropertyAssociation>
  </Class>
---------------
<xs:complexType name="WeightMeasureType">
  <xs:simpleContent>
    <xs:extension base="xs:decimal">
      <xs:attribute ref="ex:massUnitCode" use="required"/>
      <xs:attributeGroup ref="structures:SimpleObjectAttributeGroup"/>
    </xs:extension>
  </xs:simpleContent>
</xs:complexType>
```

Example 4-21: A literal class object in CMF and XSD (CSC type)

A literal class always has one DataProperty that is not an attribute property. This property is named after the class, with “Type” replaced by “Literal” It does not appear in the XSD representation of the literal class, or as a separate element in the XML message.

A literal class always has at least one attribute property. In XSD, a complex type with simple content and no attributes represents a Datatype, not a Class.

4.5 ChildPropertyAssociation

An instance of the ChildPropertyAssociation class represents an association between a class and a child property of that class. For example,

```
nc:PersonMiddleName
```

property and

```
nc:personNameCommentText
```

are two child properties of the ’nc:PersonType` class.

Name	Definition
ChildPropertyAssociation	A data type for an occurrence of a property as content of a class.

Name	Definition
MinOccursQuantity	The minimum number of times a property may occur within an a class.
MaxOccursQuantity	The maximum number of times a property may occur within an a class.
DocumentationText	A human-readable documentation of the association between and a child property content of that class.
OrderedPropertyIndicator	True if the order of a repeated property within an object significant.
Property	The property that occurs in the class.

Table 4-22: Properties of the ChildPropertyAssociation object class

A ChildPropertyAssociation object is represented in XSD as an element or attribute reference within a complex type definition. Example 4-23 shows the representation of two PropertyAssociation objects, first in CMF, and then in XSD.

```
<ChildPropertyAssociation>
  <ObjectProperty structures:ref="nc.PersonMiddleName" xsi:nil="true"/>
  <MinOccursQuantity>0</MinOccursQuantity>
  <MaxOccursQuantity>unbounded</MaxOccursQuantity>
  <DocumentationText>
    Documentation here is unusual; it refers to the association between the object and this prope
  </DocumentationText>
  <OrderedPropertyIndicator>true</OrderedPropertyIndicator>
</ChildPropertyAssociation>
<ChildPropertyAssociation>
  <DataProperty structures:ref="nc:personNameCommentText" xsi:nil="true"/>
  <MinOccursQuantity>0</MinOccursQuantity>
  <MaxOccursQuantity>1</MaxOccursQuantity>
</ChildPropertyAssociation>
---------------
<xs:sequence>
  <xs:element ref="nc:PersonMiddleName"
    minOccurs="0" maxOccurs="unbounded" appinfo:orderedPropertyIndicator="true">
    <xs:annotation>
      <xs:documentation>
        Documentation here is unusual; it refers to the relationship between the object and this
      </xs:documentation>
    </xs:annotation>
  </xs:element>
</xs:sequence>
<xs:attribute ref="nc:personNameCommentText" use="optional"/>
```

Example 4-23: PropertyAssociation object in CMF and XSD

XSD

The following table shows the mapping between PropertyAssociation representations in CMF and XSD.

CMF	XSD

Property	The property object for
	`xs:element/@ref`
	or
	`xs:attribute/@ref`
	.

MinOccursQuantity	`xs:element/@minOccurs`
	or
	`xs:attribute/@use`

MaxOccursQuantity	`xs:element/@maxOccurs`

DocumentationText	`xs:element/xs:annotation/xs:documentation`
	or
	`xs:attribute/xs:annotation/xs:documentation`

OrderedPropertyIndicator	`xs:element/@appinfo:orderedPropertyIndicator`

AugmentingNamespace	`xs:element/@appinfo:augmentingNamespace`
	or
	`xs:attribute/@appinfo:augmentingNamespace`

Table 4-24: ChildPropertyAssociation object properties in CMF and XSD

4.6 Property

4.6 Property

A Property object is either an ObjectProperty or a DataProperty in a NIEM model. This abstract class defines the common properties of those two concrete subclasses.

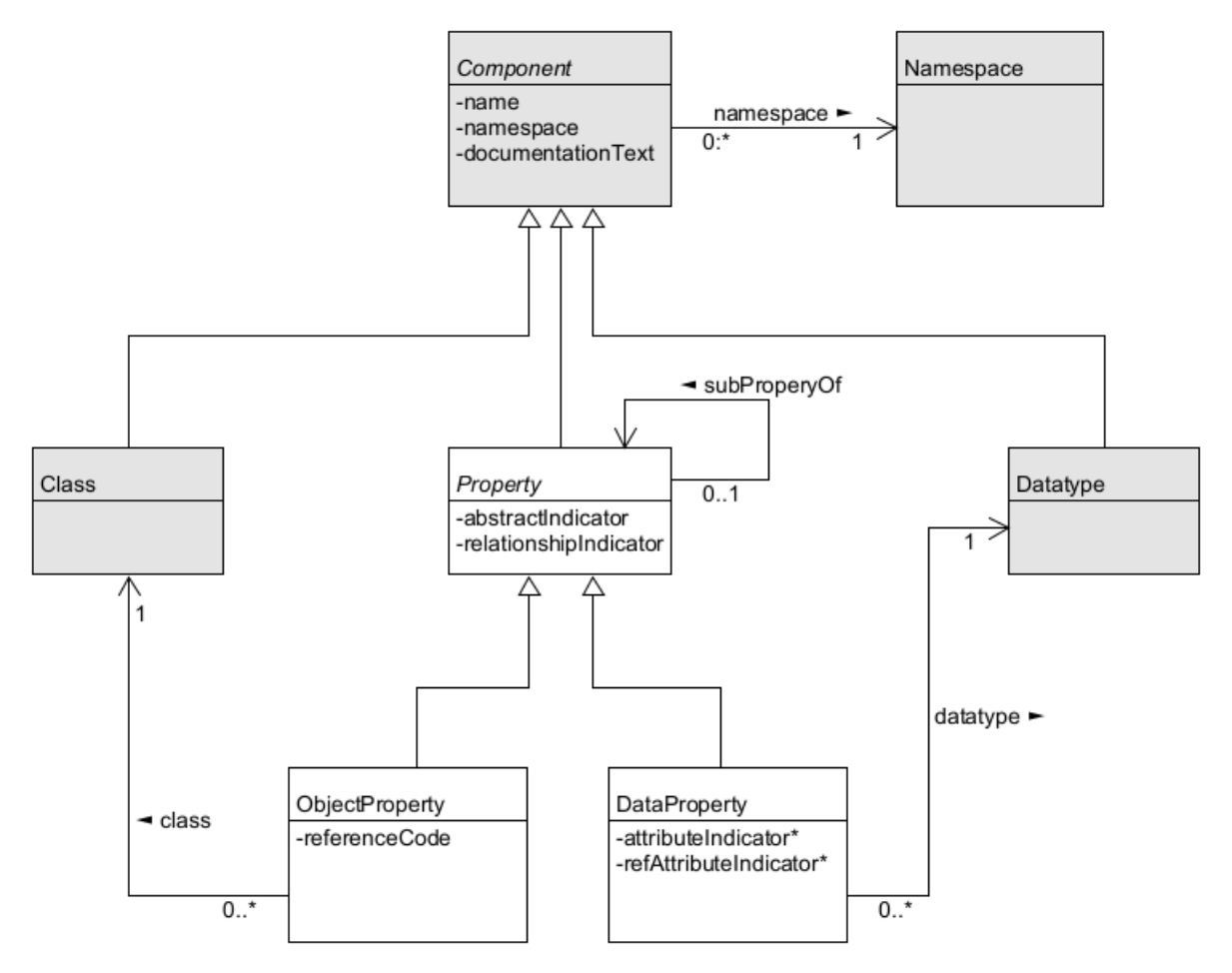


Figure 4-25: Property class diagram

Name	Definition
Property	A data type for a property.
AbstractIndicator	True if a property must be specialized; false if a property ma used directly.
RelationshipIndicator	True for a relationship property, a property that applies to the relationship between its parent and grandparen objects.

Name	Definition
SubPropertyOf	A property of which a property is a subproperty.

Table 4-26: Properties of the Property abstract class

Apart from the message object, every object in a message is a child property of another object, and typically provides information about that object. A relationship property instead provides information about the relationship between its parent and grandparent objects. Section 5.5 provides an example.

The examples of a Property object in CMF and XSD, and the table showing the mapping between the CMF and XSD representations, are shown below in the definitions of the concrete subclasses, ObjectProperty and DataProperty.

4.7 ObjectProperty

An instance of the ObjectProperty class represents a property in a NIEM model with a range that is a class. For example, the

```
nc:PersonMiddleName
```

object in the NIEM core model is an object property with a range of the

```
nc:PersonNameTextType
```

class.

Name	Definition
ObjectProperty	A data type for an object property.
ReferenceCode	A code describing how a property may be referenced (or must appear inline).
Class	The class of this object property.

Table 4-27: Properties of the ObjectProperty object class

An ObjectProperty object is represented in XSD as an element declaration with a type that is a Class object. Example 4-28 shows an ObjectProperty object, represented first in CMF, and then in XSD.

```
<ObjectProperty structures:id="ex.ExampleObjectProperty">
  <Name>ExampleObjectProperty</Name>
  <Namespace structures:ref="ex" xsi:nil="true"/>
  <DocumentationText>Documentation text for ExampleObjectProperty.</DocumentationText>
  <DeprecatedIndicator>false</DeprecatedIndicator>
  <AbstractIndicator>true</AbstractIndicator>
  <ReferenceCode>URI</ReferenceCode>
  <Class structures:ref="ex.ExType" xsi:nil="true"/>
</ObjectProperty>
---------------
<xs:element name="ExampleObjectProperty" type="ex:ExType" abstract="true" appinfo:referenceCode="U
  <xs:annotation>
    <xs:documentation>Documentation text for ExampleObjectProperty.</xs:documentation>
  </xs:annotation>
</xs:element>
```

Example 4-28: ObjectProperty object in CMF and XSD

The following table shows the mapping between ObjectProperty object representations in CMF and XSD.

CMF	XSD
Namespace	The namespace object for the containing schema docume
Name	`xs:complexType/@name`
DocumentationText	`xs:complexType/xs:annotation/xs:documentation`
DeprecatedIndicator	`xs:complexType/@appinfo:deprecated`
AbstractIndicator	`xs:complexType/@abstract`
SubPropertyOf	The property object for `xs:element/@substitutionGroup`
RelationshipPropertyIndicator	`xs:element/@appinfo:relationshipPropertyIndicator`
Class	The class object for

CMF	XSD
	xs:element/@type
ReferenceCode	xs:complexType/@appinfo:referenceCode

Table 4-29: ObjectProperty object properties in CMF and XSD

4.8 DataProperty

An instance of the DataProperty class represents a property in a NIEM model with a range that is a datatype. For example, the

```
nc:personNameCommentText
```

property in the NIEM core model is a data property with a range of the

```
xs:string
```

datatype.

Name	Definition
DataProperty	A data type for a data property.
AttributeIndicator	True for a property that is represented as attributes in XML.
RefAttributeIndicator	True for a property that is an reference attribute property.
Datatype	The datatype of this data property.

Table 4-30: Properties of the DataProperty object class

An attribute property is a data property in which

```
AttributeIndicator
```

is true. These are represented in XSD as an attribute declaration.

A reference attribute property is an attribute property that contains one or more identifiers for message objects of a known class. It is interpreted as an [object reference] to each object thus identified. Object references and

identifIers are described in section 5.3,
and reference attribute properties in section 5.3.6.

A DataProperty object is represented in XSD as an attribute declaration, or as an element declaration with a type that is a Datatype object. Example 4-31 shows the representations of two DataProperty objects, first in CMF, and then in the corresponding XSD.

```
<DataProperty structures:id="ex.ExampleDataProperty">
  <Name>ExampleDataProperty</Name>
  <Namespace structures:ref="ex" xsi:nil="true"/>
  <DocumentationText>Documentation text for ExampleDataProperty.</DocumentationText>
  <DeprecatedIndicator>true</DeprecatedIndicator>
  <AbstractIndicator>true</AbstractIndicator>
  <SubPropertyOf structures:ref="ex.PropertyAbstract" xsi:nil="true"/>
  <Datatype structures:ref="ex.ExType" xsi:nil="true"/>
</DataProperty>
<DataProperty structures:id="ex.exampleAttributeProperty">
  <Name>exampleAttributeProperty</Name>
  <Namespace structures:ref="ex" xsi:nil="true"/>
  <DocumentationText>Documentation text for AttributeProperty.</DocumentationText>
  <DeprecatedIndicator>true</DeprecatedIndicator>
  <Datatype structures:ref="xs.string" xsi:nil="true"/>
  <AttributeIndicator>true</AttributeIndicator>
  <RefAttributeIndicator>true</RefAttributeIndicator>
</DataProperty>
---------------
<xs:element name="ExampleDataProperty" type="ex:ExType" substitutionGroup="ex:PropertyAbstract" a
  <xs:annotation>
    <xs:documentation>Documentation text for ExampleDataProperty.</xs:documentation>
  </xs:annotation>
</xs:element>
<xs:attribute name="exampleAttributeProperty" type="xs:string" appinfo:referenceAttributeIndicato
  <xs:annotation>
    <xs:documentation>Documentation text for ExampleDataProperty.</xs:documentation>
  </xs:annotation>
</xs:attribute>
```

Example 4-31: DataProperty object in CMF and XSD

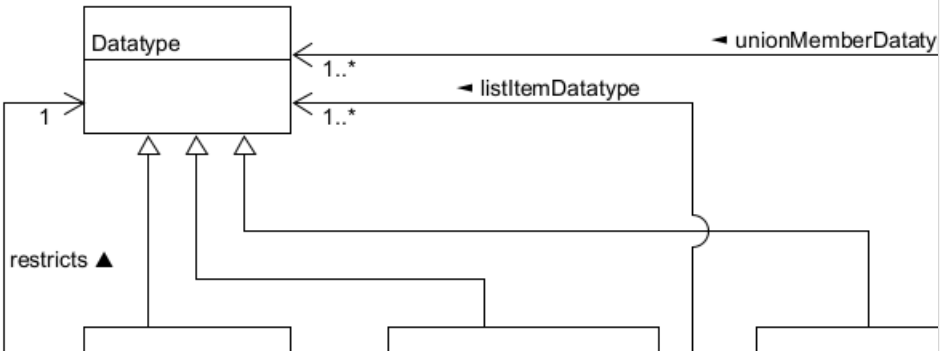
The following table shows the mapping between DataProperty representations in CMF and XSD.

CMF	XSD
Namespace	The namespace object for the containing schema docume
Name	xs:complexType/@name

CMF	XSD
DocumentationText	xs:complexType/xs:annotation/xs:documentation
DeprecatedIndicator	xs:complexType/@appinfo:deprecated
AbstractIndicator	xs:complexType/@abstract
SubPropertyOf	The property object for xs:element/@substitutionGroup
RelationshipPropertyIndicator	xs:element/@appinfo:relationshipPropertyIndicator
Datatype	The datatype object for xs:element/@type
AttributeIndicator	True for an attribute declaration.
RefAttributeIndicator	xs:attribute/@appinfo:referenceAttributeIndicator

Table 4-32: DataProperty object properties in CMF and XSD

4.9 Datatype



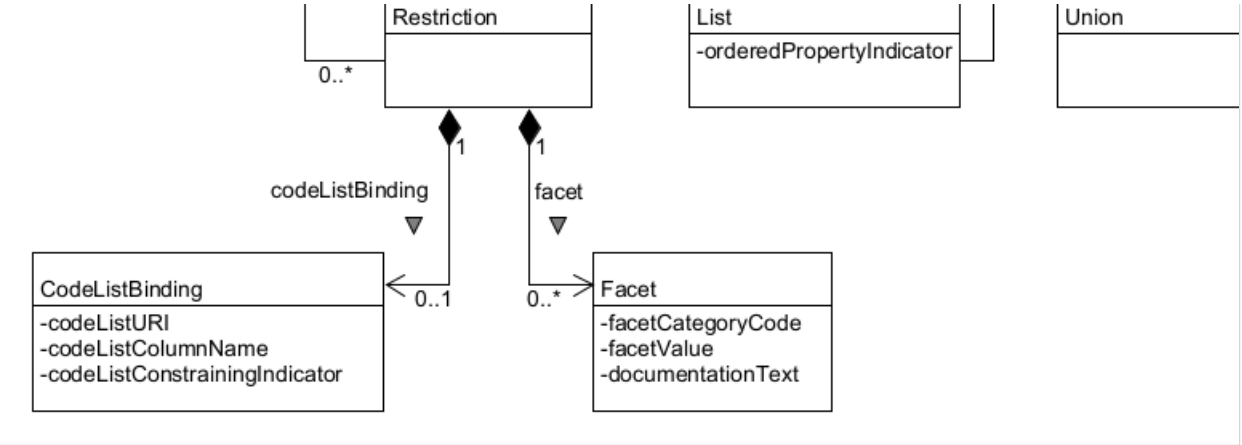


Figure 4-33: Datatype classes

An instance of the Datatype class defines the allowed values of a data property in a message. Objects for primitive data types, corresponding to the XSD data types, have only the *name*, *namespace*, and *documentation* properties inherited from the Component class. For example, example 4-34 shows the CMF representation of the

```
xs:string
```

primitive data type. All other datatypes are represented by either a Restriction, List, or Union object.

```
<Datatype>
  <Name>string</Name>
  <Namespace structures:ref="xs" xsi:nil="true"/>
</Datatype>
```

Example 4-34: Plain CMF datatype object for

```
xs:string
```

4.10 List

An instance of the List class represents a NIEM model datatype with values that are a whitespace-separated list of literal values.

Name	Definition

Name	Definition
List	A data type for a NIEM model datatype that is a whitespace list of literal values.
OrderedPropertyIndicator	True if the order of a repeated property within an object is significant.
ListItemDatatype	The datatype of the literal values in a list.

Table 4-35: Properties of the List object class

A List object is represented in XSD as a complex type definition that extends a simple type definition that has an

```
xs:list
```

element. Example 4-36 shows the CMF and XSD representation of a List object.

```
<List structures:id="ex.ExListType">
  <Name>ExListType</Name>
  <Namespace structures:ref="ex" xsi:nil="true"/>
  <DocumentationText>A data type for a list of integers.</DocumentationText>
  <ListItemDatatype structures:ref="xs.integer" xsi:nil="true"/>
  <OrderedPropertyIndicator>true</OrderedPropertyIndicator>
</List>
---------------
<xs:simpleType name="ExListSimpleType">
  <xs:list itemType="xs:integer"/>
</xs:simpleType>
<xs:complexType name="ExListType" appinfo:orderedPropertyIndicator="true">
  <xs:annotation>
    <xs:documentation>A data type for a list of integers.</xs:documentation>
  </xs:annotation>
  <xs:simpleContent>
    <xs:extension base="ex:ExListSimpleType">
      <xs:attributeGroup ref="structures:SimpleObjectAttributeGroup"/>
    </xs:extension>
  </xs:simpleContent>
</xs:complexType>
```

Example 4-36: List object in CMF and XSD

The following table shows the mapping between List object representations in CMF and XSD.

CMF	XSD

CMF	XSD
Namespace	The namespace object for the containing schema document.
Name	xs:complexType/@name
DocumentationText	xs:complexType/xs:annotation/xs:documentation
DeprecatedIndicator	xs:complexType/@appinfo:deprecated
ListItemDatatype	xs:simpleType/xs:list/@itemType
OrderedPropertyIndicator	xs:complexType/@appinfo:orderedPropertyIndicator

Table 4-37: List object properties in CMF and XSD

4.11 Union

An instance of the Union class represents a NIEM model datatype that is the union of one or more datatypes.

Name	Definition	Ca
Union	A data type for a NIEM model datatype that is a union of datatypes.	
UnionMemberDatatype	A NIEM model datatype that is a member of a union datatype.	1.

Table 4-38: Properties of the Union object class

A Union object is represented in XSD as a complex type definition that extends a simple type definition that has an

```
xs:union
```

element. Example 4-39 shows the XSD and CMF representations of a Union object.

```
<Union structures:id="ex.UnionType">
  <Name>UnionType</Name>
```

```
  <Name>UnionType</Name>
  <Namespace structures:ref="test" xsi:nil="true"/>
  <DocumentationText>A data type for a union of integer and float datatypes.</DocumentationText>
  <UnionMemberDatatype structures:ref="xs.integer" xsi:nil="true"/>
  <UnionMemberDatatype structures:ref="xs.float" xsi:nil="true"/>
</Union>
---------------
<xs:simpleType name="UnionSimpleType">
  <xs:union memberTypes="xs:integer xs:float"/>
</xs:simpleType>
<xs:complexType name="UnionType">
  <xs:annotation>
    <xs:documentation>A data type for a union of integer and float datatypes.</xs:documentation>
  </xs:annotation>  <xs:simpleContent>
    <xs:extension base="ex:UnionSimpleType">
      <xs:attributeGroup ref="structures:SimpleObjectAttributeGroup"/>
    </xs:extension>
  </xs:simpleContent>
</xs:complexType>
```

Example 4-39: Union object in CMF and XSD

The following table shows the mapping between UnionDatatype object representations in CMF and XSD.

CMF	XSD
Namespace	The namespace object for the containing schema document.
Name	`xs:complexType/@name`
DocumentationText	`xs:complexType/xs:annotation/xs:documentation`
DeprecatedIndicator	`xs:complexType/@appinfo:deprecated`
UnionMemberDatatype	`xs:simpleType/xs:union/@memberTypes`

Table 4-40: Union object properties in CMF and XSD

4.12 Restriction

An instance of the Restriction class represents a NIEM model datatype

as a base datatype plus zero or more constraining facets.

Name	Definition
Restriction	A data type for a restriction of a data type.
RestrictionBase	The NIEM model datatype that is restricted by this datatype.
Facet	A constraint on an aspect of a data type.
CodeListBinding	A property for connecting literal values defined by a data type to a column of a code list.

Table 4-41: Properties of the Restriction object class

A Restriction object is represented in XSD as a complex type with simple content that contains an

```
xs:restriction
```

element. Example 4-42 shows the CMF and XSD representations of a Restriction object.

```
<Restriction structures:id="test.RestrictionType">
  <Name>RestrictionType</Name>
  <Namespace structures:ref="test" xsi:nil="true"/>
  <DocumentationText>Exercise code list binding</DocumentationText>
  <RestrictionBase structures:ref="xs.token" xsi:nil="true"/>
  <Facet>
    <FacetCategoryCode>enumeration</FacetCategoryCode>
    <FacetValue>GB</StringValue>
  </Facet>
  <Facet>
    <FacetCategoryCode>enumeration</FacetCategoryCode>
    <FacetValue>US</StringValue>
  </Facet>
  <CodeListBinding>
    <CodeListURI>http://api.nsgreg.nga.mil/geo-political/GENC/2/3-11</CodeListURI>
    <CodeListColumnName>foo</CodeListColumnName>
    <CodeListConstrainingIndicator>true</CodeListConstrainingIndicator>
  </CodeListBinding>
</Restriction>
---------------
<xs:complexType name="RestrictionType">
  <xs:annotation>
    <xs:appinfo>
      <clsa:SimpleCodeListBinding codeListURI="http://api.nsgreg.nga.mil/geo-political/GENC/2/3-11"
        columnName="foo" constrainingIndicator="true"/>
    </xs:appinfo>
  </xs:annotation>
  <xs:simpleContent>
    <xs:restriction base="niem-xs:token">
      <xs:enumeration value="GB"/>
```

```
      <xs:enumeration value="US"/>
    </xs:restriction>
  </xs:simpleContent>
</xs:complexType>
```

Example 4-42: Restriction object in CMF and XSD

The following table shows the mapping between Restriction object representations in CMF and XSD.

CMF	XSD
Namespace	The namespace object for the containing schema document.
Name	`xs:complexType/@name`
DocumentationText	`xs:complexType/xs:annotation/xs:documentation`
DeprecatedIndicator	`xs:complexType/@appinfo:deprecated`
RestrictionBase	The datatype object for `xs:complexType/xs:simpleContent/xs:restriction/@base`
Facet	`xs:complexType/xs:simpleContent/xs:restriction/` *facet-element*
CodeListBinding	`xs:complexType/xs:annotation/xs:appinfo/clsa:SimpleCodeListBinding`

Table 4-43: Restriction object properties in CMF and XSD

A code list is a set of string values, each having a known meaning beyond its value, each representing a distinct conceptual entity. These code values may be meaningful text or may be a string of alphanumeric identifiers that represent abbreviations for literals.

A code list datatype is a Restriction in which each value that is valid for the datatype corresponds to a code value in a code list.

Many code list datatypes have an XSD representation composed of

```
xs:enumeration
```

values. Code list datatypes may also be constructed using the *NIEM Code Lists Specification* [Code Lists], which supports code lists defined using a variety of methods, including CSV spreadsheets; these are represented by a CodeListBinding object, described below.

4.13 Facet

An instance of the Facet class specifies a constraint on the base datatype of a Restriction object.

Name	Definition
Facet	A data type for a constraint on an aspect of a data type.
FacetCategoryCode	A kind of constraint on a restriction datatype.
FacetValue	A value of a constraint on a restriction datatype.
DocumentationText	A human-readable documentation of a constraint on a restriction datatype.

Table 4-44: Properties of the Facet object class

The range of the

```
FacetCategoryCode
```

property is a code list. The twelve codes correspond to the twelve constraining facets in XML Schema Structures; that is, the code

```
length
```

corresponds to the

```
xs:length
```

constraining facet in XSD, and constrains the valid values of the base datatype in the same way as the XSD facet.

A Facet object is represented in XSD as a constraining facet on a simple type. Example 4-45 shows the representation of two Facet objects, first in CMF, then in XSD:

```
<Facet>
  <FacetCategoryCode>minInclusive</FacetCategoryCode>
  <FacetValue>0</FacetValue>
</Facet>
<Facet>
  <FacetCategoryCode>maxExclusive</FacetCategoryCode>
  <FacetValue>360</FacetValue>
</Facet>
---------------
<xs:restriction base="niem-xs:decimal">
  <xs:minInclusive value="0"/>
  <xs:maxExclusive value="360"/>
</xs:restriction>
```

Example 4-45: Facet object in CMF and XSD

The following table shows the mapping between Facet representations in CMF and XSD:

CMF	XSD
FacetCategoryCode	*the local name of the facet element; e.g.* `minInclusive`
FacetValue	`@value`
DocumentationText	`xs:annotation/xs:documentation`

Table 4-46: Facet object properties in CMF and XSD

4.14 CodeListBinding

An instance of the CodeListBinding class establishes a relationship between a Restriction object and a code list specification. The detailed meaning of the object properties is provided in [Code Lists]

in [Code Lists].

Name	Definition
CodeListBinding	A data type for connecting simple content defined by a component to a a column of a code list.
CodeListURI	A universal identifier for a code list.
CodeListColumnName	A local name for a code list column within a code list
CodeListConstrainingIndicator	True when a code list binding constrains the validity value, false otherwise.

Table 4-47: Properties of the CodeListBinding object class

A CodeListBinding object is represented in XSD as a

```
clsa:SimpleCodeListBinding
```

element in an

```
xs:appinfo
```

element. Example 4-48 shows the representation of a CodeListBinding object, first in CMF, then in XSD.

```
<CodeListBinding>
  <CodeListURI>http://api.nsgreg.nga.mil/geo-political/GENC/2/3-11</CodeListURI>
  <CodeListConstrainingIndicator>false</CodeListConstrainingIndicator>
</CodeListBinding>
---------------
<xs:simpleType name="CountryAlpha2CodeSimpleType">
  <xs:annotation>
    <xs:documentation>A data type for country codes.</xs:documentation>
    <xs:appinfo>
      <clsa:SimpleCodeListBinding codeListURI="http://api.nsgreg.nga.mil/geo-political/GENC/2/3-11"co
    </xs:appinfo>
```

Example 4-48: CodeListBinding object in CMF and XSD

The following table shows the mapping between CodeListBinding representations in CMF and XSD.

CMF	XSD

CMF CMF	XSD XSD
CodeListURI	clsa:SimpleCodeListBinding/@codeListURI
CodeListColumnName	clsa:SimpleCodeListBinding/@columnName
CodeListConstrainingIndicator	clsa:SimpleCodeListBinding/@constrainingIndicator

Table 4-49: CodeListBinding object properties in CMF and XSD

4.15 Augmentation class

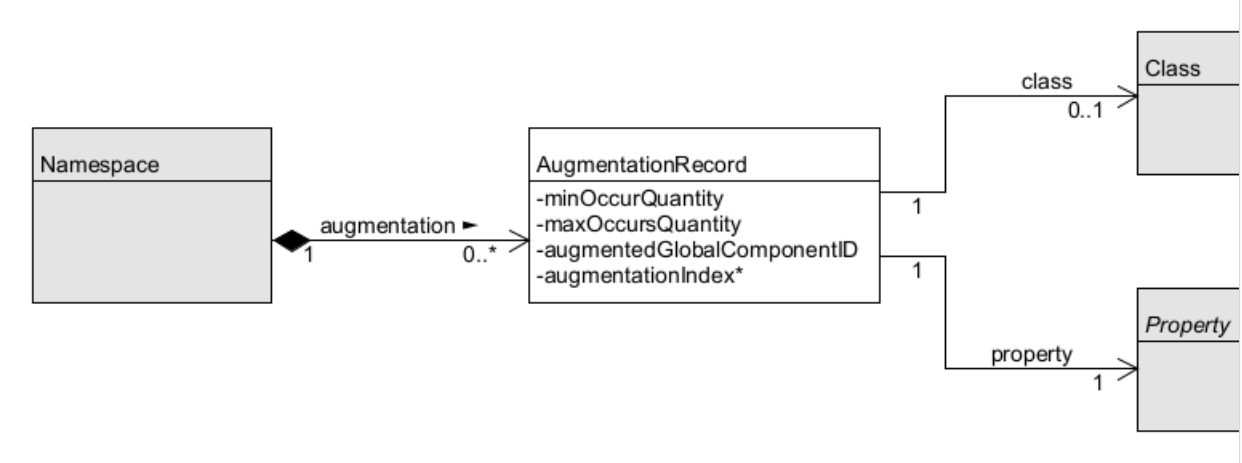


Figure 4-50: Augmentation class diagram

Augmentation is the NIEM mechanism allowing the author of one namespace (the *augmenting namespace*) to add a property to a class in another namespace (the *augmented namespace*) — without making any change to the augmented namespace. For example, the model designers for the NIEM Justice domain have augmented the

```
nc:PersonType
```

class with the

```
j:PersonSightedIndicator
```

property. Then:

- https://docs.oasis-open.org/niemopen/ns/model/domains/justice/6.0/

  is the augmenting namespace

- https://docs.oasis-open.org/niemopen/ns/model/niem-core/6.0/

  is the augmented namespace

```
j:PersonSightedIndicator
```

is an *augmentation property*

```
nc:PersonType
```

is an *augmented class*

The XSD representation of an augmentation is complex and is explained below. In CMF, an augmentation is represented as an AugmentationRecord object belonging to the augmenting namespace. In this way, each namespace object contains a complete list of all the augmentations it makes.

Name	Definition
AugmentationRecord	A data type for a class that is augmented with a property by a namespace.
MinOccursQuantity	The minimum number of times a property may occur within an objec a class.
MaxOccursQuantity	The maximum number of times a property may occur within an objec a class.
AugmentationIndex	The ordinal position of an augmentation property that is part of an augmentation type.
GlobalClassCode	A code for a kind of class (object, association, or literal), su that every class in a model of that kind is augmented with a property
Class	An augmented class.
Property	An augmentation property

Property Name	An augmentation property ... Definition

Table 4-51: Properties of the Augmentation object class

For example, augmentation of

```
nc:PersonType
```

with

```
j:PersonAdultIndicator
```

and

```
j:PersonSightedIndicator
```

by the justice namespace results in the following CMF for the augmenting namespace.

```
<Namespace>
  <NamespaceURI>https://docs.oasis-open.org/niemopen/ns/model/domains/justice/6.0/</NamespaceURI>
  <NamespacePrefix>j</NamespacePrefix>
  <AugmentationRecord>
    <Class structures:ref="nc.PersonType" xsi:nil="true"/>
    <Property structures:ref="j.PersonAdultIndicator" xsi:nil="true"/>
    <MinOccursQuantity>0</MinOccursQuantity>
    <MaxOccursQuantity>unbounded</MaxOccursQuantity>
    <AugmentationIndex>0</AugmentationIndex>
  </AugmentationRecord>
  <AugmentationRecord>
    <Class structures:ref="nc.PersonType" xsi:nil="true"/>
    <Property structures:ref="j.PersonSightedIndicator" xsi:nil="true"/>
    <MinOccursQuantity>0</MinOccursQuantity>
    <MaxOccursQuantity>unbounded</MaxOccursQuantity>
    <AugmentationIndex>1</AugmentationIndex>
  </AugmentationRecord>
</Namespace>
```

Example 4-52: Augmentation object in CMF

A *global augmentation* adds a property to every class of a specified kind in the model. In CMF, a global augmentation is represented by an AugmentationRecord object with a GlobalClassCode property and no Class property. For example, a global augmentation adding

```
my:PrivacyCode
```

to every every object class results in the following CMF for the augmenting namespace.

```
<Namespace>
  <NamespaceURI>http://example.com/MyNamespace/</NamespaceURI>
  <NamespacePrefix>my</NamespacePrefix>
  <AugmentationRecord>
    <Property structures:ref="my.PrivacyCode"/>
    <MinOccursQuantity>1</MinOccursQuantity>
    <MaxOccursQuantity>1</MaxOccursQuantity>
    <AugmentationIndex>0</AugmentationIndex>
    <GlobalClassCode>OBJECT</GlobalClassCode>
  </AugmentationRecord>
</Namespace>
```

Example 4-53: Global augmentation in CMF

A global AugmentationRecord object has no Class property (because it applies to every class). The range of the

```
GlobalClassCode
```

property is a code list with the following codes and meanings:

Code	Definition
OBJECT	A code for an augmentation property that applies to all object classes.
ASSOCIATION	A code for an augmentation property that applies to all association classes in the model.
LITERAL	A code for an augmentation property that applies to all datatypes and literal classes in the model. *(see §4.15.5)*

Table 4-54: GlobalClassCode code list

4.15.1 Augmentations in NIEM XSD

The XSD representation of an augmentation is complex, and varies based on two factors:

1. Whether the augmentation property is an attribute property or an element property

2. Whether the model is a message model In a message model, attribute augmentations appear in the schema documents for both the augmenting namespace and the augmented namespace. (See section 4.15.4: *Attribute augmentations in message models*)

4.15.2 Augmenting a class with an element property in XSD

In XSD, a class with element properties is represented by a complex type definition with complex content (a “CCC type”). For example,

```
nc:PersonType
```

is represented as the following CCC type definition (some properties are omitted for simplicity):

```
<xs:complexType name="PersonType">
  <xs:annotation>
    <xs:documentation>A data type for a human being.</xs:documentation>
  </xs:annotation>
  <xs:complexContent>
    <xs:extension base="structures:ObjectType">
      <xs:sequence>
        <xs:element ref="nc:PersonBirthDate" minOccurs="0" maxOccurs="unbounded"/>
        <xs:element ref="nc:PersonName" minOccurs="0" maxOccurs="unbounded"/>
        <xs:element ref="nc:PersonAugmentationPoint" minOccurs="0" maxOccurs="unbounded"/>
      </xs:sequence>
    </xs:extension>
  </xs:complexContent>
</xs:complexType>
```

Example 4-55: Example complex type definition with complex content (CCC type)

Every CCC type contains an augmentation point element. This is an abstract element declaration in the same namespace, having the same name as the type which contains it, with the final “Type” replaced with “AugmentationPoint”. Because it is abstract, an augmentation point element cannot appear in a message; it is only a placeholder for element substitution. For example,

```
nc:PersonAugmentationPoint
```

is the augmentation point element for

```
nc:PersonType
```

.

```
<xs:element name="PersonAugmentationPoint" abstract="true">
  <xs:annotation>
    <xs:documentation>An augmentation point for PersonType</xs:documentation>
  </xs:annotation>
</xs:element>
```

Example 4-56: Example augmentation point element declaration

In the XSD representation of a model, a namespace augments a CCC type with an element property by defining an augmentation type and an augmentation element. Together these define a container element for the desired augmentation properties that is substitutable for the augmentation point element. For example, example 4-56 shows the XSD for the NIEM Justice namespace augmenting

```
nc:PersonType
```

with two properties, and example 4-57 shows an XML message with that augmentation. (The CMF corresponding to the XSD is shown in example 4-52.)

```
<xs:complexType name="PersonAugmentationType">
  <xs:complexContent>
    <xs:extension base="structures:AugmentationType">
      <xs:sequence>
        <xs:element ref="j:PersonAdultIndicator" minOccurs="0"/>
        <xs:element ref="j:PersonSightedIndicator" minOccurs="0"/>
      </xs:sequence>
    </xs:extension>
  </xs:complexContent>
</xs:complexType>
<xs:element name="PersonAugmentation" type="j:ExampleAugmentationType" substitutionGroup="nc:Pers
```

Example 4-57: Augmenting a class with an augmentation type and element in XSD

```
<nc:Person>
  <nc:PersonBirthDate>
    <nc:Date>2021-09-11</nc:Date>
  </nc:PersonBirthDate>
  <nc:PersonName>
```

```
    <nc:PersonFullName>John Doe</nc:PersonFullName>
  </nc:PersonName>
  <j:PersonAugmentation>
    <j:PersonAdultIndicator>true</j:PersonAdultIndicator>
    <j:PersonSightedIndicator>true</j:PersonSightedIndicator>
  </j:PersonAugmentation>
</nc:Person>
```

Example 4-58: Example message with an augmentation element

All of the augmentations in the XSD representation of the NIEM model use the above approach. There is an alternative approach, in which a namespace augments a CCC type without defining an augmentation type. This is done by making an element pr
http://example.com/Characters

```

```

could augment

```
nc:PersonType
```

with a

```
PersonFictionalCharacterIndicator
```

property via the XSD in example 4-59.

```
<xs:element name="PersonFictionalCharacterIndicator" type="niem-xs:boolean"
    substitutionGroup="nc:PersonAugmentationPoint">
  <xs:annotation>
    <xs:documentation>True if a person is a character in a work of fiction.</xs:documentation>
  </xs:annotation>
</xs:element>
```

Example 4-59: Augmenting a class with an element property in XSD

```
<nc:Person>
  <nc:PersonBirthDate>
    <nc:Date>2021-09-11</nc:Date>
  </nc:PersonBirthDate>
  <nc:PersonName>
    <nc:PersonFullName>John Doe</nc:PersonFullName>
  </nc:PersonName>
  <chars:PersonFictionalCharacterIndicator>true</nc:PersonFictionalCharacterIndicator>
</nc:Person>
```


Example 4-60: Example message showing augmentation with an element property

The CMF corresponding to the XSD in example 4-59 is shown below. Since there is no augmentation type in the XSD, the AugmentationRecord object does not have an AugmentationIndex property to show the position of the augmentation property within that type.

```
<Namespace>
  <NamespaceURI>http://example.com/Characters/1.0</NamespaceURI>
  <NamespacePrefix>chars/NamespacePrefix>
  <DocumentationText>Example namespace for NDR6.</DocumentationText>
  <AugmentationRecord>
    <Class structures:ref="nc.PersonType" xsi:nil="true"/>
    <DataProperty structures:ref="chars.PersonFictionalCharacterIndicator" xsi:nil="true"/>
    <MinOccursQuantity>0</MinOccursQuantity>
    <MaxOccursQuantity>1</MaxOccursQuantity>
  </AugmentationRecord>
</Namespace>
```

Example 4-61: CMF for an element property augmentation

4.15.3 Augmenting a literal class or datatype with an element property in XSD

In the XSD representation of a model, a complex type definition with simple content (“CSC type”) can represent either a literal class or a datatype. It is not possible to directly augment either kind of CSC type with an element property, because element properties are only possible within a CCC type. The desired effect is instead accomplished by augmenting the literal class or datatype with a reference attribute property. These are c augmenting a datatype with an attribute necessarily converts it into a literal class; see section 5.1.)

4.15.4 Augmenting a class with an attribute property in XSD

In the XSD representation of a model, a namespace augments a class with an attribute property by writing application information into the namespace schema document. For example, example 4-62 shows the XSD for the *Characters* namespace augmenting

```
nc:PersonType
```

with
the attribute property

```
chars:genre
```

, and
example 4-63 shows an XML message with that
augmentation.

```
<xs:schema
  targetNamespace="http://example.com/Characters/1.0/"
  xmlns:myChars="http://example.com/Characters/1.0/"
  xmlns:nc="https://docs.oasis-open.org/niemopen/ns/model/niem-core/6.0/"
  xmlns:xs="http://www.w3.org/2001/XMLSchema"
  ct:conformanceTargets="https://docs.oasis-open.org/niemopen/ns/specification/NDR/6.0/#ExtensionSche
  version="1.0"
  xml:lang="en-US">
  <xs:annotation>
    <xs:documentation>Example Characters namespace for NDR6.</xs:documentation>
    <xs:appinfo>
      <appinfo:Augmentation class="nc:PersonType" property="myChars:genre"/>
    </xs:appinfo>
  </xs:annotation>
  <xs:attribute name="genre" type="xs:token">
    <xs:annotation>
      <xs:documentation>A name of a genre of fiction applicable to a fictional character.</xs:documen
    </xs:annotation>
  </xs:attribute>
</xs:schema>
```

Example 4-62: Augmenting a class with an attribute
property in XSD

```
<nc:Person myChars:genre="mystery">
  <nc:PersonBirthDate>
    <nc:Date>1890-10-15</nc:Date>
  </nc:PersonBirthDate>
  <nc:PersonName>
    <nc:PersonFullName>Peter Death Bredon Wimsey</nc:PersonFullName>
  </nc:PersonName>
  <chars:PersonFictionalCharacterIndicator>true</nc:PersonFictionalCharacterIndicator>
</nc:Person>
```

Example 4-63: Example message showing an attribute
property augmentation

4.15.5 Global augmentations in XSD

Global augmentation with an element property is represented in XSD by creating an *augmentation element* substitutable for

```
structures:ObjectAugmentationPoint
```

or

```
structures:AssociationAugmentationPoint
```

. For example, example 4-64 shows the XSD for the *Privacy* namespace augmenting all object classes with the

```
priv:Restriction
```

element property; example 4-65 shows part of an XML message with that augmentation.

```
<xs:complexType name="ObjectAugmentationType">
  <xs:annotation>
    <xs:documentation>A data type for additional information about an object.</xs:documentation>
  </xs:annotation>
  <xs:complexContent>
    <xs:extension base="structures:AugmentationType">
      <xs:sequence>
        <xs:element ref="priv:Restriction"/>
      </xs:sequence>
    </xs:extension>
  </xs:complexContent>
</xs:complexType>
<xs:element name="ObjectAugmentation" type="priv:ObjectAugmentationType substitutionGroup="struct
  <xs:annotation>
    <xs:documentation>Additional information about an object.</xs:documentation>
  </xs:annotation>
</xs:element>
```

Example 4-64: Global augmentation with an element property in XSD

```
<nc:Person>
  <priv:ObjectAugmentation>
    <priv:Restriction>PII</priv:Restriction>
  </priv:ObjectAugmentation>
  <nc:PersonName>
    <nc:PersonFullName>John Doe</nc:PersonFullName>
```

```
    </nc:PersonName>
  </nc:Person>
```

Example 4-65: Global augmentation with an element property in XSD

Global augmentation with an attribute property is represented in XSD by writing application information into the augmenting namespace schema document. Instead of specifying the augmented class, this appinfo provides a code from

```
GlobalAugmentationCodeType
```

. For example, example 4-66 shows the XSD for the *Privacy* namespace augmenting all object classes with the

```
priv:classification
```

attribute property.

```
<xs:schema
  targetNamespace="http://example.com/Privacy/1.0/"
  xmlns:priv="http://example.com/Privacy/1.0/"
  xmlns:nc="https://docs.oasis-open.org/niemopen/ns/model/niem-core/6.0/"
  xmlns:xs="http://www.w3.org/2001/XMLSchema"
  ct:conformanceTargets="https://docs.oasis-open.org/niemopen/ns/specification/NDR/6.0/#ExtensionSche
  version="1.0"
  xml:lang="en-US">
  <xs:annotation>
    <xs:documentation>Example Privacy namespace for NDR6.</xs:documentation>
    <xs:appinfo>
      <appinfo:Augmentation property="priv:classification" globalClassCode="OBJECT"/>
    </xs:appinfo>
  </xs:annotation>
</xs:schema>
```

Example 4-66: Global augmentation with an attribute property in XSD

4.15.6 Attribute augmentations in message models

The XSD representation of a message model must successfully validate all conforming messages. This means the augmented type definition has to include the augmenting attribute property. For example, the highlighted line in example 4-67

shows how the type definition of

```
nc:PersonType
```

would
include the augmentation property

```
chars:genre
```

.

```
<xs:complexType name="PersonType"></code>
  <xs:annotation>
    <xs:documentation>A data type for a human being.</xs:documentation>
  </xs:annotation>
  <xs:complexContent>
    <xs:extension base="structures:ObjectType">
      <xs:sequence>
        <xs:element ref="nc:PersonBirthDate" minOccurs="0" maxOccurs="unbounded"/>
        <xs:element ref="nc:PersonName" minOccurs="0" maxOccurs="unbounded"/>
        <xs:element ref="nc:PersonAugmentationPoint" minOccurs="0" maxOccurs="unbounded"/>
      </xs:sequence>
      <xs:attribute ref="myChars:genre" appinfo:augmentingNamespace="chars"/>
    </xs:extension>
  </xs:complexContent>
</xs:complexType>
```

Example 4-67: Example complex type definition with
complex content (CCC type)

The

```
appinfo:augmentingNamespace
```

attribute is required;
it declares that this attribute reference is an augmentation. The value
of the attribute may be either the namespace prefix or URI.

4.16 LocalTerm

A local term is a word, phrase, acronym, or other
string of characters that is used in the name of a namespace component,
but that is not defined in OED, or that has a non-OED
definition in this namespace, or has a word sense that is in some way
unclear. An instance of the LocalTerm class captures the namespace
author’s definition of such a local term. For example, the Justice
domain namespace in the NIEM model has a LocalTerm object defining the
name “CLP” with documentation “Commercial Learners Permit”.

Name	Definition
LocalTerm	A data type for the meaning of a term that may appear within the name of a model component.
TermName	The name of the local term.
DocumentationText	A human-readable text definition of a data model component or te or the documentation of a namespace.
TermLiteralText	A meaning of a local term provided as a full, plain-text form.
SourceURI	A URI that is an identifier or locator for an originating or authoritative document defining a local term.
SourceCitationText	A plain text citation of, reference to, or bibliographic entry f an originating or authoritative document defining a local term.

Table 4-68: Properties of the LocalTerm object class

A LocalTerm object is represented in XSD by a

```
appinfo:LocalTerm
```

element within

```
xs:appinfo
```

element in the

```
xs:schema
```

element. Example 4-69 shows the representation of a LocalTerm object in CMF and XSD.

```
<LocalTerm>
  <TermName>2D</TermName>
  <TermLiteralText>Two-dimensional</TermLiteralText>
</LocalTerm>
<LocalTerm>
  <TermName>3D</TermName>
  <DocumentationText>Three-dimensional</DocumentationText>
</LocalTerm>
<LocalTerm>
  <TermName>Test</TermName>
  <DocumentationText>only for test purposes</DocumentationText>
  <SourceURI>http://example.com/1 http://example.com/2</SourceURI>
  <SourceCitationText>citation #1</SourceCitationText>
  <SourceCitationText>citation #2</SourceCitationText>
</LocalTerm>
---------------
```

```
<xs:appinfo>
  <appinfo:LocalTerm term="2D" literal="Two-dimensional"/>
  <appinfo:LocalTerm term="3D" definition="Three-dimensional"/>
  <appinfo:LocalTerm term="Test" definition="only for test purposes" sourceURIs="http://example.com/1
    <appinfo:SourceText>citation #1</appinfo:SourceText>
    <appinfo:SourceText>citation #2</appinfo:SourceText>
  </appinfo:LocalTerm>
</xs:appinfo>
```

Example 4-69: Example LocalTerm objects in CMF and XSD

The following table shows the mapping between LocalTerm object representations in CMF and XSD.

CMF	XSD
TermName	`appinfo:LocalTerm/@term`
DocumentationText	`appinfo:LocalTerm/@definition`
TermLiteralText	`appinfo:LocalTerm/@literal`
SourceURI	Each URI in the `appinfo:LocalTerm/@sourceURIs` list
SourceCitationText	`appinfo:LocalTerm/appinfo:SourceText`

Table 4-70: LocalTerm object properties in CMF and XSD

4.17 TextType

An instance of the TextType class combines a string property with a language property.

Name	Definition	Card	Ord	Ra
TextType	A data type for a character string with a language code.			
TextLiteral	A literal value that is a character string.	1	-	xs
lang	A name of the language of a character string.	0..1	-	xs

Table 4-71: Properties of the TextType object class

---

5. Data modeling patterns

This section is informative. It explains common patterns in NIEM models and messages.

5.1 Datatypes and literal classes

A model component can be a datatype in one message model and a class in another. This occurs when a message designer creates a subset of a reused literal class, or augments a reused datatype.

Removing attribute properties from a reused literal class can turn it into a datatype. For example,

```
nc:NumericType
```

is a literal class in the NIEM model, but in a subset can become a datatype in a message model. In the NIEM model,

```
nc:NumericType
```

has one element property and one attribute property. Example 5-1 shows the class representation in CMF and XSD; example 5-2 shows an object of the class in an XML and JSON message.

```
<Class structures:id="nc.NumericType">                          | <xs:complexType name="NumericType":
  <Name>NumericType</Name>                                      |   <xs:simpleContent>
  <Namespace structures:ref="nc"                                |     <xs:extension base="niem-xs:de
  <ChildPropertyAssociation>                                    |       <xs:attribute ref="nc:tolera
    <DataProperty structures:ref="nc.NumericLiteral"/>          |     </xs:extension>
    <MinOccursQuantity>1</MinOccursQuantity>                    |   </xs:simpleContent>
    <MaxOccursQuantity>1</MaxOccursQuantity>                    | </xs:complexType>
```

```
  </ChildPropertyAssociation>                                  |
  <ChildPropertyAssociation>                                   |
    <DataProperty structures:ref="nc.toleranceNumeric"/>       |
    <MinOccursQuantity>0</MinOccursQuantity>                   |
    <MaxOccursQuantity>1</MaxOccursQuantity>                   |
  </ChildPropertyAssociation>                                  |
</Class>                                                       |
```

Example 5-1: A literal class in CMF and XSD

```
<my:Message>                                                                | "my:Message": {
  <my:MaximumNumber nc:toleranceNumeric="2">7<my:MaximumNumber>             |   "my:MaximumNumber": {
</my:Message>                                                               |     "nc:NumericLiteral": "7
                                                                            |     "nc:toleranceNumeric":
                                                                            |   }
                                                                            | }
```

Example 5-2: Objects of a literal class in an XML and
JSON message

If a message designer decides to reuse

```
nc:NumericType
```

,
and to remove

```
nc:toleranceNumeric
```

 from the class in his
model subset, then

```
nc:NumericType
```

 becomes a datatype in the
subset. Example 5-3 shows the CMF and XSD
representations of that subset; example 5-4 shows
the resulting data property in an XML and JSON message.

```
<Restriction structures:id="nc.NumericType">         | <xs:complexType name="NumericType">
  <Name>NumericType</Name>                           |   <xs:simpleContent>
  <Namespace structures:ref="nc"                     |     <xs:extension base="niem-xs:decimal"/>
  <RestrictionBase structures:ref="xs:decimal"/>     |   </xs:simpleContent>
</Restriction>                                       | </xs:complexType>
```


Example 5-3: A restriction datatype in a CMF and XSD model subset

```
<my:Message>                                          | "my:Message": {
  <my:MaximumNumber>7<my:MaximumNumber>               |   "my:MaximumNumber": "7"
</my:Message>                                         | }
```

Example 5-4: A data property in an XML and JSON message

Going the other way, augmenting a reused datatype turns it into a literal class. For example,

```
nc:PersonUnionCategoryCodeType
```

is a datatype in the NIEM model, and

```
nc:PersonUnionCategoryCode
```

is a data property with that datatype. Example 5-5 shows the datatype representation in CMF and XSD; example 5-6 shows the data property in an XML and JSON message.

```
<Restriction structures:id="nc.PersonUnionCategoryCodeType">      | <xs:complexType name="PersonU
  <Name>PersonUnionCategoryCodeType</Name>                        |   <xs:simpleContent>
  <Namespace structures:ref="nc" xsi:nil="true"/>                 |     <xs:restriction base="niem
  <RestrictionBase structures:ref="xs.token" xsi:nil="true"/>     |       <xs:enumeration value="
  <Enumeration>                                                   |       <xs:enumeration value="
    <StringValue>civil union</StringValue>                        |       <xs:enumeration value="
  </Enumeration>                                                  |       <xs:enumeration value="
  <Enumeration>                                                   |       <xs:enumeration value="
    <StringValue>common law</StringValue>                         |     </xs:restriction>
  </Enumeration>                                                  |   </xs:simpleContent>
  <Enumeration>                                                   | </xs:complexType>
    <StringValue>domestic partnership</StringValue>               |
  </Enumeration>                                                  |
  <Enumeration>                                                   |
    <StringValue>married</StringValue>                            |
  </Enumeration>                                                  |
  <Enumeration>                                                   |
    <StringValue>unknown</StringValue>                            |
  </Enumeration>                                                  |
</Restriction>                                                    |
```

Example 5-5: A datatype in CMF and XSD

```
<nc:Person>                                                          | "nc:Person": {
  <nc:PersonUnionCategoryCode>married</nc:PersonUnionCategoryCode>   |   "nc:PersonUnionCategory
</nc:Person>                                                         | }
```

Example 5-6: A data property in an XML and JSON message

A message designer might decide to augment

```
nc:PersonUnionCategoryCodeType
```

with metadata to indicate this information is sometimes privileged. Doing so turns it into a literal class in his model subset. Example 5-7 shows the CMF and XSD representations of that subset; example 5-8 shows the resulting object in an XML and JSON message.

```
<Restriction structures:id="nc.PersonUnionCategoryCodeSimple | <xs:simpleType name="PersonUnionCa
  <Name>PersonUnionCategoryCodeSimpleType</Name>             |   <xs:restriction base="xs:token">
  <Namespace structures:ref="nc"/>                           |     <xs:enumeration value="civil u
  <RestrictionBase structures:ref="xs.token" xsi:nil="true"/ |     <xs:enumeration value="common
  <Enumeration>                                              |     <xs:enumeration value="domesti
    <StringValue>civil union</StringValue>                   |     <xs:enumeration value="married
  </Enumeration>                                             |     <xs:enumeration value="unknown
  <Enumeration>                                              |   </xs:restriction>
    <StringValue>common law</StringValue>                    | </xs:simpleType>
  </Enumeration>                                             | <xs:complexType name="PersonUnionC
  <Enumeration>                                              |   <xs:simpleContent>
    <StringValue>domestic partnership</StringValue>          |     <xs:extension base="nc:PersonU
  </Enumeration>                                             |       <xs:attribute ref="my:privil
  <Enumeration>                                              |           appinfo:augmentingNamesp
    <StringValue>married</StringValue>                       |       <xs:attributeGroup ref="stru
  </Enumeration>                                             |     </xs:extension>
  <Enumeration>                                              |   </xs:simpleContent>
    <StringValue>unknown</StringValue>                       | </xs:complexType>
  </Enumeration>                                             |
</Restriction>                                               |
<DataProperty structures:id="nc.PersonCategoryCodeLiteral">  |
  <Name>PersonUnionCategoryCodeLiteral</Name>                |
  <Namespace structures:ref="nc"/>                           |
  <Datatype structures:ref="nc.PersonUnionCategoryCodeSimple |
</DataProperty>                                              |
<Class>                                                      |
  <Name>PersonUnionCategoryCodeType</Name>                   |
  <Namespace structures:ref="nc"/>                           |
  <ChildPropertyAssociation>                                 |
    <DataProperty structures:ref="nc.PersonCategoryCodeLiter |
```



```
    <DataProperty structures:ref="nc.PersonCategoryCodeLiter |
    <MinOccursQuantity>1</MinOccursQuantity>                 |
    <MaxOccursQuantity>1</MaxOccursQuantity>                 |
  </ChildPropertyAssociation>                                |
  <ChildPropertyAssociation>                                 |
    <DataProperty structures:ref="my.privileged"/>           |
    <MinOccursQuantity>0</MinOccursQuantity>                 |
    <MaxOccursQuantity>1</MaxOccursQuantity>                 |
    <AugmentingNamespace>my</AugmentingNamespace>            |
  </ChildPropertyAssociation>                                |
</Class>                                                     |
```

Example 5-7: A literal class in a CMF and XSD model subset

```
<nc:Person>                                                          | "nc:Person": {
  <nc:PersonUnionCategoryCode                                        |   "nc:PersonUnionCategoryCo
      my:privileged="true">married</nc:PersonUnionCategoryCode>      |     "nc:PersonUnionCategory(
</nc:Person>                                                         |     "my:privileged": "true"
                                                                     |   }
                                                                     | }
                                                                     |
```

Example 5-8: An object property with a code list class in an XML and JSON message

The representation of a literal class is complex when compared to the datatype. The JSON message is likewise complicated. Best practice is therefore to avoid augmenting a datatype whenever possible.

5.2 Meaning of NIEM data

The meaning of NIEM data is partly expressed through the hierarchy of nested objects in a message, and partly through the message model's definition of those objects. For example, the meaning of the two equivalent messages in example 3-2 (reproduced below) is described in table 5-9.

```
<msg:Request                                                         | {
 xmlns:nc="https://docs.oasis-open.org/niemopen/ns/model/niem |   "@context": {
 xmlns:msg="http://example.com/ReqRes/1.0/">                 |     "nc": "https://docs.oasis-open.or
  <msg:RequestID>RQ001</msg:RequestID>                       |     "msg": "http://example.com/ReqRes
  <msg:RequestedItem>                                        |   },
    <nc:ItemName>Wrench</nc:ItemName>                        |   "msg:Request": {
    <nc:ItemQuantity>10</nc:ItemQuantity>                    |     "msg:RequestID" : "RQ001",
  </msg:RequestedItem>                                       |     "msg:RequestedItem": {
```

```
  </msg:RequestedItem>
</msg:Request>
```

```
|       msg:RequestedItem" : {
|         "nc:ItemName": Wrench",
|         "nc:ItemQuantity": 10
|       }
|    }
| }
```

Message data	Description	Mea

`<msg:Request>`
 	
or
 	
`"msg:Request":{...}`
	The initial property is
	
	`msg:Request`
	
	. The message model defines the range of this property as the
	
	`msg:RequestType`
	
	class.
		The nam

`<msg:RequestID>`
 	
*or
 	
`"msg:RequestID":...`
	The next property is
	
	`msg:RequestID`
	
	. The message model defines the range of this data property as the
	
	`xs:token`
	
	datatype.
		The
		ms
		an
		RQ
		.

`<msg:RequestedItem>`
 	
or
 	
`"msg:RequestedItem":{...}`
	The next property is
	
	`msg:RequestedItem`
	
	. The message model defines the range of this object property as the
	
	`nc:ItemType`
	
	class.
		The
		ms
		an
		nc
		.

`<nc:ItemName>`
 	
or
 	
`"nc:ItemName":...`
	The next property is
	
	`nc:ItemName`
	
	. The message model defines the range of this data property as the
		The
		nc
		an
		Wr

Message data	Description	Mea
	datatype.	

`<nc:ItemQuantity>`
 	
or
 	
`nc:ItemQuantity":...`
	The next property is `nc:ItemQuantity`. The message model defines the range of this data property as the `nc:QuantityType` datatype.	The `nc` an `10` .

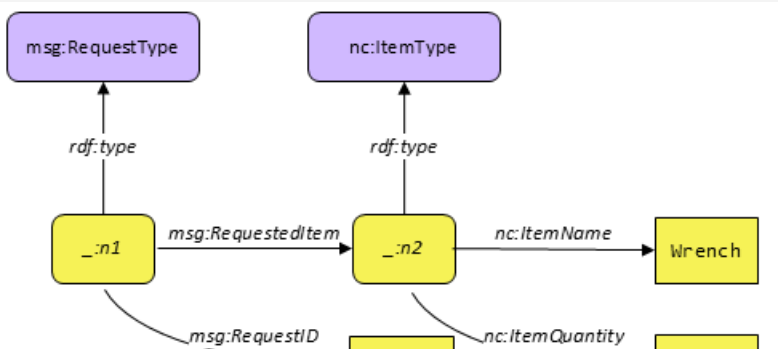
Table 5-9: Meaning of NIEM data

NIEM is designed so that NIEM data is a form of RDF data. For example, the message data above corresponds to the RDF shown in example 5-10

```
@prefix nc: <https://docs.oasis-open.org/niemopen/ns/model/adapters/niem-xs/6.0/> .
@prefix msg: <http://example.com/ReqRes/1.0/> .
_:n1 a msg:RequestType .
_:n1 msg:RequestID "RQ001".
_:n1 msg:RequestedItem _:n2 .
_:n2 a nc:ItemType .
_:n2 nc:ItemName "Wrench" .
_:n2 nc:ItemQuantity "10" .
```

Example 5-10: RDF interpretation of NIEM data (Turtle syntax)

That RDF data expresses a graph, illustrated by the diagram in figure 5-11.



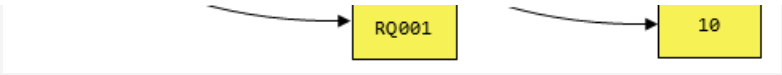


Figure 5-11: Diagram showing meaning of NIEM data

In a NIEM message, that which is not stated is not implied. If data says a person's name is John, it is not implicitly saying that he does not have other names, or that John is his legal name, or that he is different from a person known as Bob. The only assertion being made is that one of the names by which this person is known is John.

Likewise, nothing may be inferred from data that is not present in a NIEM message. It may be absent due to lack of availability, lack of knowledge, or deliberate withholding of information. These cases should be modeled explicitly, if they are required.

5.3 Identifiers and references in NIEM messages

A hierarchy of nested objects (illustrated above) is sufficient to represent simple data that takes the form of a tree. However, this simple representation has limitations, and is not capable of expressing all relationships among objects. Situations that cause problems include:

- Cycles: some object has a relationship that, when followed, eventually circles back to itself. For example, suppose that Bob has a sister relationship to Sue, who has a brother relationship back to Bob. These relationships do not form a tree, and require a data structure that is a graph, rather than a simple hierarchy of objects.

- Reuse: multiple objects have a relationship to a common object. For example, suppose Bob and Sue both have a mother relationship to Sally. Expressed via nested objects, this would result in a duplicate representation of Sally.

NIEM solves these problems through object identifiers and object references. Any object may have an identifier. An object reference can take the place of any object in a message, and is interpreted as if the object with the same identifier actually appeared in that place. The resulting data structure is a graph, not a tree.

For example, in example 5-12 below, there is
only one Person object in the message; it has the identifier

only one Person object in the message; it has the identifier

```
JD
```

, and is a child property of

```
nc:PersonLocationAssociation
```

. The

```
nc:Person
```

property of the

```
nc:PersonOrganizationAssociation
```

 object is
an object reference. The interpretation is that the person located at
the Pentagon is also the person associated with the US Army.

```
<nc:PersonLocationAssociation>                                  | "nc:PersonLocationAssociation": {
  <nc:Person structures:id="JD">                                |   "nc:Person": {
    <nc:PersonName>                                             |     "@id": "#JD",
      <nc:PersonFullName>4R</nc:PersonFullName>                 |     "nc:PersonName": {
    </nc:PersonName>                                            |       "nc:PersonFullName": "John Doe
  </nc:Person>                                                  |     }
  <nc:Location>                                                 |   },
    <nc:LocationName>Pentagon</nc:LocationName>                 |   "nc:Location": {
  </nc:Location>                                                |     "nc:LocationName": "Pentagon"
</nc:PersonLocationAssociation>                                 |   }
<nc:PersonOrganizationAssociation>                              | },
  <nc:Person structures:ref="JD" xsi:nil="true"/>               | "nc:PersonOrganizationAssociation":
  <nc:Organization>                                             |   "nc:Person": {
    <nc:OrganizationName>US Army</nc:OrganizationName>          |     "@id": "#JD"
  </nc:Organization>                                            |   },
</nc:PersonOrganizationAssociation>                             |   "nc:Organization": {
                                                                |     "nc:OrganizationName": "US Army"
                                                                |   }
                                                                | }
```

Example 5-12: Example of object references in NIEM XML
and JSON

5.3.1 Object references in NIEM XML using structures:id and structures:ref

[XML] defines ID and IDREF attributes; these act
as references in XML data. NIEM XML uses ID and IDREF as one way to
reference data across data objects

reference data across data objects.

structures:id

is an ID attribute. Its value is an identifier for the object in which it appears. For example, in example 5-12 the value

JD

is an identifier for the

nc:Person

object. According to the rules of XML, an ID value must be unique within the XML document.

An ID attribute is a *fragment identifier* within the XML document. For example, if the message as a whole has the URI http://example.com/MSG/

, then the object identifier

JD

is equivalent to http://example.com/MSG/#JD

.

structures:ref

is an IDREF attribute. An object with this attribute is a reference to the object with that identifier. For example, in example 5-12, the element

<nc:Person structures:ref="JD" xsi:nil="true"/>

is a reference to the

<nc:Person>

object that has the identifier

JD

.

The

```
structures:ref
```

attribute has type

```
xs:IDREF
```

, so according to the rules of XML the message must contain an ID attribute with the same value. This means a

```
structures:ref
```

reference can only link to an object within the same message.

Object references using

```
structures:ref
```

must not have content. If the object type has mandatory content, then

```
xsi:nil="true"
```

is required.

5.3.2 Object references in NIEM XML using structures:uri

NIEM introduced support for linked data through the use of uniform resource identifiers (URIs), expressed in NIEM XML through the attribute

```
structures:uri
```

. In linked data, anything modeled or addressed by an information system may be called a *resource*: people, vehicles, reports, documents, relationships, ideas: anything that is talked about and modeled in an information system is a resource. In NIEM, the objects in a message are the resources; an object identifier is a resource identifier.

The

```
structures:uri
```

attribute assigns an object identifier to the element in which it appears. All of the elements having the same identifier refer to a single object, and all of those elements provide property values for that one object. For example, in example 5-13 below, there is only

in the message. The person located at the Pentagon is also the person associated with the US Army; that person is named “John Doe” and also has red hair.

```
<nc:PersonLocationAssociation>                                  | "nc:PersonLocationAssociation": {
  <nc:Person structures:uri="#JD">                              |   "nc:Person": {
    <nc:PersonName>                                             |     "@id": "#JD",
      <nc:PersonFullName>John Doe</nc:PersonFullName>           |     "nc:PersonName": {
    </nc:PersonName>                                            |       "nc:PersonFullName": "John D
  </nc:Person>                                                  |     }
  <nc:Location>                                                 |   },
    <nc:LocationName>Pentagon</nc:LocationName>                 |   "nc:Location": {
  </nc:Location>                                                |     "nc:LocationName": "Pentagon"
</nc:PersonLocationAssociation>                                 |   }
<nc:PersonOrganizationAssociation>                              | },
  <nc:Person structures:uri="#JD">                              | "nc:PersonOrganizationAssociation"
    <nc:PersonHairColorText>Red</nc:PersonHairColorText>        |   "nc:Person": {
  </nc:Person>                                                  |     "@id": "#JD",
  <nc:Organization>                                             |     "nc:PersonHairColorText": "Red
    <nc:OrganizationName>US Army</nc:OrganizationName>          |   },
  </nc:Organization>                                            |   "nc:Organization": {
</nc:PersonOrganizationAssociation>                             |     "nc:OrganizationName": "US Arm
                                                                |   }
                                                                | }
```

Example 5-13: Example of URI object references in NIEM XML and JSON

The

```
structures:uri
```

attribute has the type

```
xs:anyURI
```

. Values can be either a *URI-reference* or a *relative-ref*, as defined by [RFC 3986]. A URI-reference can be a URN or URL; for example:

```
  <nc:Person structures:uri="urn:uuid:f81d4fae-7dec-11d0-a765-00a0c91e6bf6"/>
  <nc:Person structures:uri="http://example.com/PersonID/B263-1655-2187"/>
```

If the message as a whole has a URI, then a relative reference is interpreted according to the rules for reference resolution in [RFC 3986]. For example, if the message UR
http://example.com/MSG/

, then the relative reference

JD

resolves to http://example.com/MSG/#JD

.

A relative resource in

structures:uri

is the same thing
as a fragment identifier in

structures:id

, but with a
leading

#

character. For example,

structures:uri="#JD"

and

structures:id="JD"

denote the same resource identifier.

5.3.3 Comparison of object references in NIEM XML

structures:ref

and

structures:id

must
appear within the same message.

structures:ref

requires and provides type safety, in that the type of an object pointed to by structures:ref must be consistent with the referencing element’s type declaration.

- The value of `structures:id` must be unique for IDs within the XML document.
- The value of `structures:ref` must appear within the document as the value of an attribute `structures:id`.
- A `structures:uri` can reference any `structures:id` in the same message, or in another message.
- Any `structures:uri` may reference any other `structures:uri`, in the same message, or in another message.

5.3.4 Object references in NIEM JSON using @id

Object references in NIEM JSON use JSON-LD’s

```
@id
```

keyword. This is equivalent to

```
structures:uri
```

 in NIEM XML.
For example, the following NIEM XML and JSON references mean the same thing and are interpreted in the same way. (There is no JSON equivalent to XML’s ID/IDREF attributes.)

```
<nc:Person structures:uri="#JD">
"nc:Person": { "@id": "#JD" }
```

The two JSON objects in example 5-13 that are values of a

```
nc:Person
```

 key have the same

```
#JD
```

value for

```
@id
```

. That means the two JSON objects contain properties of a single NIEM message object, representing a person named “John Doe” who has red hair.

5.3.5 Meaning of inline objects and object references

An important aspect of all of the object reference mechanisms (

```
structures:ref
```

,

```
structures:uri
```

, and

```
@id
```


) is that they all have the same meaning. There is also
no difference in meaning between an object that appears inline and an
object that appears through a reference.

Any claim that inline objects represent composition, while object
references represent aggregation is incorrect. No life cycle dependency
is implied by either method. Similarly, any claim that inline objects
are intrinsic (i.e., a property inherent to an object), while object
references are extrinsic (i.e., a property derived from a relationship
to other things), is false. A property represented as an inline object
has the exact same meaning as that property represented by a
reference.

5.3.6 Reference attribute properties

A reference attribute property contains a list of
object identifiers, and is interpreted as an object reference to each of
the objects thus identified, each a child property of the object
containing the reference attribute property. For
example, the two XML messages in example 5-14 have
the same meaning.

```
<my:Thing nc:metadataRef="m6 m7">                          | <my:Thing>
  <my:ThingName>The Snark</my:ThingName>                   |   <my:ThingName>The Snark</my:ThingNam
  <my:ThingLocation>Dismal Valley</my:ThingLocation>       |   <my:ThingLocation>Dismal Valley</my:
</my:Thing>                                                |   <nc:Metadata>
<nc:Metadata structures:id="m6">                           |     <nc:ConfidencePercent>75</nc:Confi
  <nc:ConfidencePercent>75</nc:ConfidencePercent>          |   </nc:Metadata>
</nc:Metadata>                                             |   <nc:Metadata>
<nc:Metadata structures:id="m7">                           |     <nc:SourceIDText>Bingo-7</nc:Sourc
  <nc:SourceIDText>Bingo-7</nc:SourceIDText>               |   </nc:Metadata>
</nc:Metadata>                                             | </my:Thing>
```

Example 5-14: Reference attribute property and
equivalent message in XML

Example 5-15 shows the equivalent JSON
message.

```
"my:Thing": {
  "my:ThingName": "The Snark",
  "my:ThingLocation": "Dismal Valley",
  "nc:metadataRef": [
    { "@id": "#m6"},
    { "@id": "#m7"}
```

```
    ]
  },
  "nc:Metadata": [
    {
      "nc:ConfidencePercent": "75",
      "@id": "#m6"
    },
    {
      "nc:SourceIDText": "Bingo-7",
      "@id": "#m7"
    }
  ]
```

Example 5-15: Reference attribute property in JSON message

The class of these objects is determined by the name of the reference attribute property. For example, an object reference belonging to

```
nc:metadataRef
```

must have the class

```
nc:MetadataType
```

, or a derived class. *(see rule 12-11.)*

5.4 Metadata and augmentation

Metadata is data about data. The distinction is created by intended use. To the person editing an image, the creation timestamp is metadata, something he does not need. To the person writing software to sort photos into creation order, the timestamp is the data for his code. One man's metadata is another man's data.

The NIEM model contains a number of classes and properties that are suitable for metadata representations, and any model designer is free to invent new components for this purpose, as needed. A message designer may use these components in his message model, in the same way as any other component. For example, a message designer might, within the components he creates, use

```
nc:Metadata
```

to represent a source of information and the level of confidence in that information. Figure 5-16 shows an example of a message in which the designer chose to use

```
nc:Metadata
```

as a property within

as a property within
his own

```
my:ThingType
```

class.

```
<my:Thing>
  <my:ThingName>The Snark</my:ThingName>
  <my:ThingLocation>Dismal Valley</my:ThingLocation>
  <nc:Metadata>
    <nc:ConfidencePercent>75</nc:ConfidencePercent>
    <nc:SourceIDText>Bingo-7</nc:SourceIDText>
```

Example 5-16: Metadata properties used in a designer's own class

A message designer might also want to record source and confidence in a class reused from another namespace. This is done through augmentation, following one of two patterns. The first is to augment the class with an object property. Example 5-17 shows a message example in which

```
nc:PersonType
```

is augmented with

```
nc:Metadata
```

.

```
<nc:Person>                                          | "nc:Person": {
  <nc:PersonBirthDate>                               |   "nc:PersonBirthDate": {
    <nc:Date>2021-09-11</nc:Date>                    |     "nc:Date": "2021-09-11"
  </nc:PersonBirthDate>                              |   },
  <nc:PersonName>                                    |   "nc:PersonName": {
    <nc:PersonFullName>John Doe</nc:PersonFullName>  |     "nc:PersonFullName": "John Doe"
  </nc:PersonName>                                   |   },
  <my:PersonAugmentation>                            |   "nc:Metadata": {
    <nc:Metadata">                                   |     "nc:SourceIDText": "Tango-7"
      <nc:SourceIDText>Tango-7</nc:SourceIDText>     |   }
    </nc:Metadata>                                   | }
  </my:PersonAugmentation>                           |
</nc:Person>                                         |
```

Example 5-17: Metadata object property augmenting a reused class

The above augmentation pattern only works for a class with element properties. To add metadata properties to a literal class, the message designer must augment the class with a reference attribute property. Example 5-18 shows a message example in which

```
nc:PersonNameTextType
```

is augmented with

```
nc:metadataRef
```

.

```
<nc:Person>                                                                  | "nc:Person": {
  <nc:PersonBirthDate>                                                       |   "nc:PersonBirthDa
    <nc:Date>2021-09-11</nc:Date>                                            |     "nc:Date": "202
  </nc:PersonBirthDate>                                                      |   },
  <nc:PersonName>                                                            |   "nc:PersonName":
    <nc:PersonFullName nc:metadataRef="m2">John Doe</nc:PersonFullName>      |     "nc:PersonFullN
  </nc:PersonName>                                                           |     "nc:metadataRef
</nc:Person>                                                                 |   },
<nc:Metadata structures:id="m2">                                             |   "nc:Metadata": {
  <nc:ConfidencePercent>75</nc:ConfidencePercent>                            |     "@id": "#m2",
</nc:Metadata>                                                               |     "nc:ConfidenceP
                                                                             |   }
                                                                             | }
```

Example 5-18: Metadata reference attribute augmenting a reused class

5.5 Relationship properties

The value of a property usually provides information about its parent object. For example, the value of

```
nc:personNameCommentText
```

in example 5-19 tells us something about the parent object; namely, that this name is a silly name.

```
<nc:Person>                                                                  | "nc:Person": {
  <nc:PersonName nc:personNameCommentText="This is a silly name">            |   "nc:PersonName": {
    <nc:PersonFullName>Bozo the Clown</nc:PersonFullName>                    |     "nc:personNameCommentT
  </nc:PersonName>                                                           |     "nc:PersonFullName": "
</nc:Person>                                                                 |   }
                                                                             | }
```

Example 5-19: Example of an ordinary property

Sometimes that is not what is needed. For example, in example 5-20, the relationship property

```
my:isSecret
```

is not telling us the name “Superman” is a secret. Everybody knows that name! Instead,

```
my:isSecret
```

is telling us something about the *relationship* between the name “Superman” and the person object with the other name “Clark Kent”. That relationship is the thing to be kept secret.

```
<nc:Person>                                                  | "nc:Person": {
  <nc:PersonName my:isSecret="true">                         |   "nc:PersonName": [
    <nc:PersonFullName>Superman</nc:PersonFullName>          |     {
  </nc:PersonName>                                           |       "nc:PersonFullName": "Superman"
  <nc:PersonName>                                            |       "@annotation": { "my:isSecret":
    <nc:PersonFullName>Clark Kent</nc:PersonFullName>        |     },
  </nc:PersonName>                                           |     {
</nc:Person>                                                 |       "nc:PersonFullName": "Clark Ken
                                                             |     }
                                                             |   }
                                                             | }
```

Example 5-20: Example of a relationship property

NIEM uses RDF-star to represent relationship properties. Example 5-21 shows the RDF equivalent for the me in example 5-20. Figure 5-22 provides a diagram of that RDF graph.

```
_:n1 nc:PersonName _:n2 .
_:n1 nc:PersonName _:n2 {| "my:isSecret": "true" |} .
_:n2 nc:PersonFullName "Superman" .
_:n3 nc:PersonFullName "Clark Kent" .
```

Example 5-21: RDF-star equivalent for a relationship property

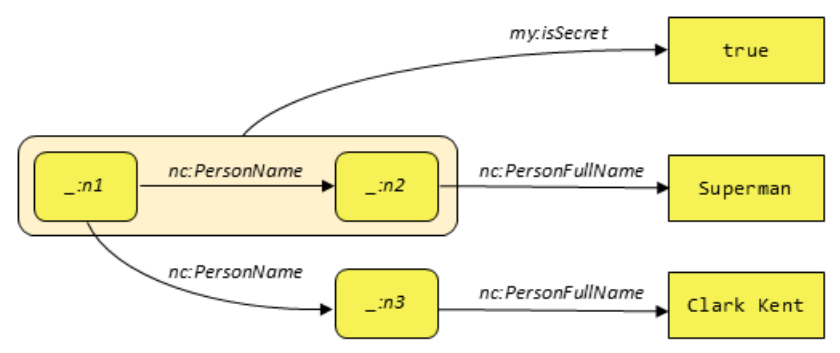


Figure 5-22: RDF-star graph diagram for a relationship property

```
## 5.6 Roles

> These use `structures:uri` in NIEM 6. Need explanation and example TODO

## 5.6 Representation pattern

> Stuff from NDR 5 section 10.7 TODO

## 5.7 Container objects

> NDR 5 section 10.6 TODO

---

# 6. Conformance

This document defines conformance for namespaces, schema documents, models, and messages. These are t

NIEM does not define conformance for applications, systems, databases, or tools. It is therefore impo

NIEM defines _conformance_ with the rules in this document, but it does not define _compliance_. The

The rules in this document are designed to be used with or without the component definitions in the N

## 6.1 Conformance targets

The conformance targets specified in this document are listed below. The rules for each conformance t

- _Namespace:_ A [conforming namespace](#def) is a namespace that satisfies all of the applicable rul

  [_Section 7.1: Rules for component names_](#71-rules-for-component-names)\
  [_Section 7.2: Rules for component documentation_](#72-rules-for-component-documentation)\
  [_Section 8: Rules for namespaces_](#8-rules-for-namespaces)

  - _Reference namespace:_ Additional rules for the [reference namespace](#def) conformance target ar
```

```
  - _Extension namespace:_ Additional rules for the [extension namespace](#def) conformance target ar

  - _Subset namespace:_ Additional rules for the [subset namespace](#def) conformance target are in [

- _Schema document_: A [conforming schema document](#def) is a [schema document](#def) that satisfies

  [_Section 9.1: Rules for the NIEM profile of XSD_](#91-rules-for-the-niem-profile-of-xsd)\
  [_Section 9.2: Rules for type definitions_](#92-rules-for-type-definitions)\
  [_Section 9.3: Rules for attribute and element declarations_](#93-rules-for-attribute-and-element-d
  [_Section 9.4: Rules for adapters and external components_](#94-rules-for-adapters-and-external-com
  [_Section 9.5: Rules for proxy types_](#95-rules-for-proxy-types)\
  [_Section 9.6: Rules for augmentations_](#96-rules-for-augmentations)\
  [_Section 9.7: Rules for machine-readable annotations_](#97-rules-for-machine-readable-annotations)

  - _Reference schema document:_ Additional rules for the [reference schema document](#def) conforman

  - _Extension schema document:_ Additional rules for the [extension schema document](#def) conforman

  - _Subset schema document:_ Additional rules for the [subset schema document](#def) conformance tar

- _Model_: A conforming model fulfils all of the rules in [section 10](#10-rules-for-models). There a

  - _Model file:_ A [model file](#def) is a [message](#def) that conforms to the CMF [message type](#

  - _Schema document set_: A [conforming schema document set](#def) is a [schema document set](#def)

- _Message type and message format_: Rules for these conformance targets are in [section 11](#11-rule

- _XML message_: Rules applying to a message in XML format are in [section 12](#12-rules-for-xml-mess

- _JSON message:_ Rules applying to a message in JSON format are in [section 13](#13-rules-for-json-m

## 6.2 Conformance target assertions

It is often helpful for an artifact to contain an assertion of the kind of thing it is supposed to be

For XSD, NIEMOpen makes use of [[CTAS-v3.0]](#ref) to indicate whether a [schema document](#def) is i
```

```
<figcaption><a name="ex6-1">Example 6-1: Conformance target assertion in XSD</a></figcaption>

In CMF, the `ConformanceTargetURI` property indicates whether a Namespace object represents a ref
```

https://docs.oasis-open.org/niemopen/ns/model/niem-core/6.0/

nc

NIEM Core

NIEM Core.

https://docs.oasis-open.org/niemopen/ns/specification/NDR/6.0/#ReferenceSchemaDocument

6

1

en-US

```
<figcaption><a name="ex6-2">Example 6-2: Conformance target assertion in CMF</a></figcaption>

## 6.3 Conformance testing

Automated testing of most rules is possible. Some rules require human evaluation.

- Many rules for schema documents may be tested by the Schematron rules provided in TODO.

- Messages must be valid when assessed against the schema of their [message format](#def). Many of th

- The rules in this document that require human evaluation are marked with TODO.

---

# 7. Rules for model components

These rules apply to model components in both the CMF and XSD representations of [conforming namespac

- Rules for names of components appear in [section 7.1](#71-rules-for-component-names)
- Rules for documentation of components appear in [section 7.2](#72-rules-for-component-documentation
- Rules for namespaces appear in [section 8](#8-rules-for-namespaces)

## 7.1 Rules for component names

Data component names must be understood easily both by humans and by machine processes. These rules i

These rules apply to all namespaces. In a CMF representation, they apply to the Name property of a Co

**Rule 7-1:** Attribute and element do not have same uncased name || A namespace MUST NOT include two

For example, a namespace may not include both the attribute `commentText` and the element `CommentTex

### 7.1.1 Rules based on kind of component

**Rule 7-2:** Name of Class, Datatype, and Property components || Class and Datatype components MUST

This rule immediately distinguishes Property components from Class and Datatype components. In an XSD

**Rule 7-3:** Augmentation names are reserved || A component MUST NOT have a name ending in "Augmenta

XSD components with these names appear only in the XSD representation of a model. These XSD component

#### 7.1.1.1 Rules for names of Class components

**Rule 7-4:** Name of adapter classes || An [adapter class](#def) MUST have a name ending in "Adapter
```

```
**Rule 7-5:** Name of association classes || An [association class](#def) MUST have a name ending in

**Rule 7-6:** Name of code list literal classes || A [literal class](#def) with a [literal property](

These rules immediately distinguish special Class components from ordinary. [Rule 7-5](#rule7-5) hand

#### 7.1.1.2 Rules for names of Datatype components

**Rule 7-7:** Names ending in "SimpleType" || A component with a name ending in "SimpleType" MUST be

A Datatype with a name ending in "SimpleType" is sometimes needed for a [literal property](#def), or

**Rule 7-8:** Names ending in "CodeSimpleType" || A Datatype object with a name that ends in "CodeSim

**Rule 7-9:** Name of code list datatypes || A [code list datatype](#def) MUST have a name ending in

The component representing a [code list](#def) is usually a Datatype object. However, when the XSD re

#### 7.1.1.3 Rules for names of Property components

**Rule 7-10:** Name of abstract properties || A Property object having an AbstractIndicator property

A property name ending in "Abstract" reminds message designers that it cannot be used directly but mu

**Rule 7-11:** Name of association properties || A Property with an [association class](#def) MUST ha

**Rule 7-12:** Name of code properties || A Property with a Class or Datatype that represents a [code

**Rule 7-13:** Name of literal properties in CMF || The [literal property](#def) of a [literal class]

Component names ending in "Literal" only occur in the CMF representation of a [literal class](#def).

**Rule 7-14:** Name of representation attributes || A Property that is a [reference attribute propert

### 7.1.2 Rules for composition of component names

**Rule 7-15:** Component name composed of English words || Except as otherwise provided in this docum

The English language has many spelling variations for the same word. For example, American English pr

NIEM supports internationalization in several ways. NIEM allows (but does not encourage) component na

**Rule 7-16:** Component names have only specific characters || The name of a model component MUST be

- Upper-case letters (A-Z)
- Lower-case letters (a-z)
- Digits (0-9)
- Underscore (\_)
- Hyphen (-)
- Period (.)

Other characters, such as unicode characters outside the ASCII character set, are explicitly prohibit

**Rule 7-17:** Component names use camel case || The name of a model component MUST use the camel cas

Camel case is the convention of writing compound words or phrases with no spaces and an initial lower

**Rule 7-18:** Name of attribute properties begin with lower case letter || The name of an [attribute

**Rule 7-19:** Name of components other than attribute properties begin with upper case letter || The
```



```
**Rule 7-20:** Punctuation in component name is a separator || The characters hyphen (-), underscore

Names of standards and specifications, in particular, tend to consist of series of discrete numbers.

### 7.1.3 General component naming rules from ISO 11179-5

Names are a simple but incomplete means of providing semantics to data components. Data definitions,

**Rule 7-21:** Singular form is preferred in name || A noun used as a term in the name of an XML Sche

**Rule 7-22:** Present tense is preferred in name || A verb used as a term in the name of an XML Sche

**Rule 7-23:** Name does not have nonessential words || Articles, conjunctions, and prepositions MUST

Articles (e.g., a, an, the), conjunctions (e.g., and, or, but), and prepositions (e.g., at, by, for,

### 7.1.4 Property naming rules from ISO 11179-5

The set of NIEM data components is a collection of data representations for real-world objects and co

**Rule 7-24:** Property name follows ISO 11179-5 pattern || Except as specified elsewhere in this doc

For example, the NIEM component name `AircraftFuselageColorCode` is composed of the following:

- Object class term = Aircraft
- Qualifier term = Fuselage
- Property term = Color
- Representation term = Code

#### 7.1.4.1 Object-class term

**Rule 7-25:** Object-class term identifies concrete category || The object-class term of a NIEM comp

NIEM adopts an object-oriented approach to representation of data. Object classes represent what [ISO

The object-class term indicates the object category that this data component describes or represents.

#### 7.1.4.2 Property term

**Rule 7-26:** Property term describes characteristic or subpart || A property term MUST describe or

Objects or concepts are usually described in terms of their characteristic properties, data attribute

#### 7.1.4.3 Qualifier terms

**Rule 7-27:** Name may have multiple qualifier terms || Multiple qualifier terms MAY be used within

**Rule 7-28:** Name avoids unnecessary qualifier terms || The number of qualifier terms SHOULD be lim

**Rule 7-29:** Order of qualifiers is not significant || The order of qualifiers MUST NOT be used to

Very large vocabularies may have many similar and closely related properties and concepts. The use of

#### 7.1.4.4 Representation term

The representation terms for a property name serve several purposes in NIEM:

1. It can indicate the style of component. For example, types are clearly labeled with the representa

2. It helps prevent name conflicts and confusion. For example, elements and types may not be given th
```

```
3. It indicates the nature of the value carried by element. Labeling elements and attributes with a n

The valid value set of a data element or value domain is described by the representation term. NIEM u

| Primary</br>Representation</br>Term | Secondary</br>Representation</br>Term | Definition
| ---------------------------------- | ------------------------------------ | ----------------------
| Amount                             | -                                    | A number of monetary
| BinaryObject                       | -                                    | A set of finite-lengt
|                                    | Graphic                              | A diagram, graph, mat
|                                    | Picture                              | A visual representati
|                                    | Sound                                | A representation for
|                                    | Video                                | A motion picture repr
| Code                               |                                      | A character string (i
| DateTime                           |                                      | A particular point in
|                                    | Date                                 | A continuous or recur
|                                    | Time                                 | A particular point in
|                                    | Duration                             | An amount of time; th
| ID                                 |                                      | A character string to
|                                    | URI                                  | A string of character
| Indicator                          |                                      | A list of two mutuall
| Measure                            |                                      | A numeric value deter
| Numeric                            |                                      | Numeric information t
|                                    | Value                                | A result of a calcula
|                                    | Rate                                 | A relative speed of c
|                                    | Percent                              | A representation of a
| Quantity                           |                                      | A counted number of n
| Text                               | -                                    | A character string (i
|                                    | Name                                 | A word or phrase that
| List                               |                                      | A sequence of values.
| Abstract                           |                                      | An element that may r
| Representation                     |                                      | An element that acts

<figcaption><a name="tab7-1">Table 7-1: Property representation terms</a></figcaption>

**Rule 7-30:** Redundant term in name is omitted || If any word in the representation term is redunda

This rule, carried over from 11179, is designed to prevent repeating terms unnecessarily within compo

**Rule 7-31:** Data property uses representation term || The name of a data property SHOULD use an ap

**Rule 7-32:** Object property uses representation term when appropriate || The name of an object pro

**Rule 7-33:** Object property uses representation term only when appropriate || The name of an objec

### 7.1.5 Acronyms, abbreviations, and jargon

**Rule 7-34:** Names use common abbreviations || A component name SHOULD use the abbreviations shown

| Abbreviation | Full Meaning               |
| ------------ | -------------------------- |
| ID           | Identifier                 |
| URI          | Uniform Resource Identifier |

**Rule 7-35:** Local terms usable within their namespace || A [local term](#def) MAY be used in the n

A [local term](#def) is a word, phrase, acronym, or other string of characters that is defined within

**Rule 7-36:** Local term has literal or definition || In CMF, a LocalTerm object MUST have a Documen

## 7.2 Rules for component documentation

NIEM models are composed of data components for the purpose of information exchange. A major part of
```

```
NIEM models are composed of data components for the purpose of information exchange. A major part of

[Reference namespaces](#def) and [extension namespaces](#def) provide the authoritative definition of

1. The structural definition of each component, expressed as CMF objects or XSD schema components. Wh

2. A text definition of each component, describing what the component means. The term used in this sp

A [data definition](#def) is the DocumentText property of a CMF object, or the content of the first o

A [documented component](#def) is a CMF object or XSD schema component that has an associated data de

### 7.2.1 Rules for documented components

**Rule 7-37:** Namespace has data definition || In CMF, a Namespace object MUST be a documented compo

**Rule 7-38:** Model component has data definition || In CMF, a Component object MUST be a documented

**Rule 7-39:** Enumeration facet has data definition || In CMF, a Facet object with a FacetCategoryCo

**Rule 7-40:** Pattern facet has data definition || In CMF, a Facet object with a FacetCategoryCode o

**Rule 7-41:** Documentation is provided in US English || In CMF, the language name for the first ins

A model file or schema document always contains data definitions in US English. It may contain equiva

### 7.2.2 Rules for data definitions

**Rule 7-42:** Data definition does not introduce ambiguity || Words or synonyms for the words within

**Rule 7-43:** Object class has only one meaning || An object class MUST have one and only one associ

**Rule 7-44:** Data definition of a part does not redefine the whole || An object class MUST NOT be r

Data definitions should be concise, precise, and unambiguous without embedding additional definitions

**Rule 7-45:** Do not leak representation into data definition || A data definition SHOULD NOT contai

A component definition is intended to describe semantic meaning only, not representation or structure

### 7.2.3 Data definition rules from ISO 11179-4

These rules are adopted from [[ISO 11179-4]](#ref), _Information technology — Metadata
registries: Formulation of data definitions_

**Rule 7-46:** Data definition follows 11179-4 requirements || Each data definition MUST conform to t

- be stated in the singular
- state what the concept is, not only what it is not
- be stated as a descriptive phrase or sentence(s)
- contain only commonly understood abbreviations
- be expressed without embedding definitions of other data or underlying concepts

**Rule 7-47:** Data definition follows 11179-4 recommendations || Each data definition SHOULD conform

- state the essential meaning of the concept
- be precise and unambiguous
- be concise
- be able to stand alone
- be expressed without embedding rationale, functional usage, or procedural information
- avoid circular reasoning
- use the same terminology and consistent logical structure for related definitions
```



```
- be appropriate for the type of metadata item being defined

### 7.2.4 Data definition opening phrases

In order to provide a more consistent voice across NIEM, a model built from requirements from many di

#### 7.2.4.1 Opening phrases for properties

These rules apply to Property objects in CMF, and to element and attribute declarations in XSD.

**Rule 7-48:** Standard opening phrase for abstract property data definition || The data definition f

**Rule 7-49:** Standard opening phrase for association property data definition || The data definitio

**Rule 7-50:** Standard opening phrase for date property data definition || The data definition for a

**Rule 7-51:** Standard opening phrase for quantity property data definition || The data definition f

**Rule 7-52:** Standard opening phrase for picture property data definition || The data definition fo

**Rule 7-53:** Standard opening phrase for indicator property data definition || The data definition

**Rule 7-54:** Standard opening phrase for identification property data definition || The data defini

**Rule 7-55:** Standard opening phrase for name property data definition || The data definition for a

**Rule 7-56:** Standard opening phrase for property data definition || The data definition for a prop

#### 7.2.4.2 Opening phrases for classes

These rules apply to Class objects in CMF, and to complex type definitions in XSD.

**Rule 7-57:** Standard opening phrase for association class data definition || The data definition f

**Rule 7-58:** Standard opening phrase for class data definition || The data definition for a class S

## 7.3 Rules for specifications of components

**Rule 7-59:** Enumerations are unique || A Restriction object MUST NOT contain two Facet objects wit

# 8. Rules for namespaces

## 8.1 Rules for properties of namespaces

**Rule 8-1:** Namespace identifier is absolute URI || The namespace MUST have an identifier, which MU

**Rule 8-2:** Namespace URI is owned by namespace authority || The namespace identifier must be a URI

For example, namespace authors must not choose a namespace URI beginning with `https://docs.oasis-ope

**Rule 8-3:** Namespaces use slash URIs || The namespace SHOULD have an identifier ending in the slas

**Rule 8-4:** Namespace URI includes version || The namespace SHOULD have an identifier ending in the

Examples:
```

https://docs.oasis-open.org/niemopen/ns/model/niem-core/6.0/

https://docs.oasis-open.org/niemopen/ns/model/niem-core/6.0/

http://example.com/myNS/1.0.1/

http://example.com/yourNS/1.1.1-alpha.7/

```
**Rule 8-5:** Namespace URI uses semantic versioning || The version identifier in a namespace identif
In semantic versioning, version numbers and the way they change convey meaning about the underlying c
**Rule 8-6:** Namespace has a prefix || The namespace MUST have a defined prefix, which MUST match th
In CMF, the prefix is the value of the NamespacePrefix property in a Namespace object. In XSD, the pr
**Rule 8-7:** Namespace has version || The namespace MUST have a version, which MUST NOT be empty. In
**Rule 8-8:** Namespace has language || The namespace MUST have a default language, which MUST be a w
## 8.2 Rules for reference namespaces
**Rule 8-9:** Reference namespace asserts conformance || A [reference namespace](#def) MUST assert th
The conformance target identifier ends in "ReferenceSchemaDocument" instead of "ReferenceNamespace" f
**Rule 8-10:** Reference namespace does not have wildcard || In CMF, a Class object with a Namespace
Wildcards are permitted in [extension namespaces](#def), but not in [reference namespaces](#def) or i
**Rule 8-11:** Object properties in reference namespace are referenceable || In CMF, a Class object o
To promote reuse, object properties defined in [reference namespaces](#def) and [extension namespaces
**Rule 8-12:** Reference namespace uses reference namespace components || A component that is used in
## 8.3 Rules for extension namespaces
**Rule 8-13:** Extension namespace asserts conformance || An [extension namespace](#def) MUST assert
**Rule 8-14:** Object properties in extension namespace are referenceable || In CMF, a Class object o
## 8.4 Rules for subset namespaces
**Rule 8-15:** Subset namespace asserts conformance || A [subset namespace](#def) must assert the con
**Rule 8-16:** Subset has corresponding reference or extension namespace || A representation of a [re
It is helpful when a [message specification](#def) includes the representation of the [reference name
**Rule 8-17:** Subset does not extend component range || A subset namespace MUST NOT extend the valid
**Rule 8-18:** Subset does not add components || With the exception of an [augmentation property](#de
**Rule 8-19:** Subset does not alter data definition || The data definition of a component in a [subs
The previous three rules together make up the [subset rule](#def): Any data that is valid for a [subs
---
# 9. Rules for schema documents
```



```
This section contains rules that apply only to the XSD representation of NIEM models; that is, to [re

**Rule 9-1:** Schema is CTAS-conformant || The schema document MUST be a conformant document as defin

**Rule 9-2:** Document element has attribute `ct:conformanceTargets` || The [document element](#def)

## 9.1 Rules for the NIEM profile of XSD

The W3C XML Schema Language provides many features that allow a developer to represent a data model m

Note that [external schema documents](#def) do not need to obey the rules set forth in this section.

**Rule 9-3:** Document is a valid schema document || The XSD representation of a namespace MUST be a

**Rule 9-4:** Document element is `xs:schema` || The [document element](#def) of the XSD representati

**Rule 9-5:** Prohibited schema components || A schema document MUST NOT contain any of the following

- `xs:notation`
- `xs:all`
- `xs:unique`
- `xs:key`
- `xs:keyref`
- `xs:group`
- `xs:attributeGroup`
- `xs:redefine`
- `xs:include`

**Rule 9-6:** Prohibited base types || A schema component MUST NOT have an attribute `{}base` with a

- `xs:ID`
- `xs:IDREF`
- `xs:IDREFS`
- `xs:anyType`
- `xs:anySimpleType`
- `xs:NOTATION`
- `xs:ENTITY`
- `xs:ENTITIES`
- any type in the XML namespace `http://www.w3.org/XML/1998/namespace`

**Rule 9-7:** Prohibited list item types || A schema component MUST NOT have an attribute `{}itemType

- `xs:ID`
- `xs:IDREF`
- `xs:anySimpleType`
- `xs:ENTITY`

**Rule 9-8:** Prohibited union item types || A schema component MUST NOT have an attribute `{}memberT

- `xs:ID`
- `xs:IDREF`
- `xs:IDREFS`
- `xs:anySimpleType`
- `xs:ENTITY`
- `xs:ENTITIES`

**Rule 9-9:** Prohibited attribute and element types || A schema component MUST NOT have an attribute

- `xs:ID`
- `xs:IDREF`
- `xs:anySimpleType`
- `xs:ENTITY`
```



```
- `xs:ENTITY`
- `xs:ENTITIES`

[Rule 9-88](#rule9-88) also forbids the type `xs:IDREFS` for all schema components other than [refere

**Rule 9-10:** No mixed content on complex type or complex content || A complex type definition MUST

Mixed content allows the mixing of data tags with text. Languages such as XHTML use this syntax for m

**Rule 9-11:** Complex type content is explicitly simple or complex || A complex type definition MUST

XML Schema provides shorthand to defining complex content of a complex type, which is to define the c

**Rule 9-12:** Base type of complex type with complex content must have complex content || The base t

This rule addresses a peculiarity of the XML Schema definition language, which allows a complex type

**Rule 9-13:** Untyped element is abstract || An untyped element or an element of type `xs:anySimpleT

Untyped element declarations act as wildcards that may carry arbitrary data. By declaring such types

**Rule 9-14:** Element type not in the XML or XML Schema namespace || An element type MUST NOT be in

**Rule 9-15:** Element type is not simple type || An element type that is not `xs:anySimpleType` MUST

**Rule 9-16:** Attribute declaration has type || An attribute declaration MUST have a type. (N5R 9-50

**Rule 9-17:** No default or fixed value || An element declaration MUST NOT have an attribute `{}defa

**Rule 9-18:** Sequence has minimum and maximum cardinality 1 || An element `xs:sequence` MUST have a

**Rule 9-19:** `xs:choice` must be child of `xs:sequence` || An element `xs:choice` MUST be a child o

**Rule 9-20:** Choice has minimum and maximum cardinality 1 || An element `xs:choice` MUST have a `mi

**Rule 9-21:** Comment is not recommended || An XML comment SHOULD NOT appear in the schema. (N5R 9-7

Since XML comments are not associated with any specific XML Schema construct, there is no standard wa

**Rule 9-22:** Documentation element has no element children || A child of element `xs:documentation`

**Rule 9-23:** Import has namespace || An element `xs:import` MUST have an attribute `{}namespace`. (

An import that does not specify a namespace is enabling references to components without namespaces.

**Rule 9-24:** Import specifies local resource || An element `xs:import` MUST specify a schema docume

The schema document may be specified by a {}schemaLocation attribute in the xs:import element, or by

## 9.2 Rules for XSD types

This section provides rules for _type definitions_ in the XSD representation of a model. A type defin

**Rule 9-25:** Name of type definitions || A type definition that does not define a [_proxy type_](#d

Use of the representation term Type immediately identifies XML types in a NIEM-conformant schema and

**Rule 9-26:** Name of simple type definitions || A simple type definition MUST have a name ending in

Specific uses of type definitions have similar syntax but very different effects on data definitions.

**Rule 9-27:** Name of complex type definition || A complex type definition MUST be a Class component
```



```
**Rule 9-28:** `xs:sequence` must be child of `xs:extension` || An element `xs:sequence` MUST be a ch

**Rule 9-29:** `xs:sequence` must be child of `xs:extension` or `xs:restriction` || An element `xs:se

Restriction is allowed in an extension schema document, but not in reference schema document.

**Rule 9-30:** Type definition is top-level || A type definition MUST be top-level. (N5R 9-10,9-25)

All XML Schema top-level types (children of the document element) are required by XML Schema to be na

**Rule 9-31:** Complex type has a category || A complex type definition MUST be an object type, an as

The rules in this document use the name of a type as the key indicator of the type's category. This m

- Name ends with AdapterType → type represents an [adapter class](#def). (see [Rule 7-3](#rule7-3))
- Name ends with AssociationType → type represents an [association class](#def). (see [Rule 7-4](#rul
- Name ends with AugmentationType → type is an [augmentation type](#def).
- Otherwise → type is the XSD representation of an [object class](#def).

**Rule 9-32:** Object type with complex content is derived from `structures:ObjectType` || A type wit

**Rule 9-33:** Adapter type derived from `structures:AdapterType` || A type definition that represent

**Rule 9-34:** Association type derived from `structures:AssociationType` || A type definition that r

**Rule 9-35:** Augmentation type derived from `structures:AugmentationType` || A type definition that

**Rule 9-36:** Complex type with simple content has `structures:SimpleObjectAttributeGroup` || A comp

**Rule 9-37:** Base type definition defined by conformant schema || The base type definition of a typ

**Rule 9-38:** Component reference defined by conformant schema || An attribute or element reference

**Rule 9-39:** Schema uses only known attribute groups || An attribute group reference MUST be `struc

The use of attribute groups is restricted in a [conforming schema document](#def). The only attribute

**Rule 9-40:** Augmentation elements are not used directly || A complex type definition MUST NOT have

[Augmentation elements](#def) do not correspond to a model component, and must not be used as a prope

**Rule 9-41:** List item type defined by conformant schemas || The item type of a list simple type de

**Rule 9-42:** Union member types defined by conformant schemas || Every member type of a union simpl

**Rule 9-43:** No complex wildcards || A complex type definition MUST not contain the element `xs:any

Restrictions on attribute and element wildcards, if desired, must be enforced through some mechanism

## 9.3 Rules for attribute and element declarations

**Rule 9-44:** No literal properties in XSD || The name of an element declaration or attribute declar

Literal properties appear only in the CMF representation of a [literal class](#def).

**Rule 9-45:** Declarations are top-level || An attribute declaration or element declaration MUST be

**Rule 9-46:** Element type is not simple type || An element declaration MUST NOT have a simple type.

**Rule 9-47:** Attribute and element type is from conformant namespace || The type definition of an a
```



```
**Rule 9-48:** Element substitution group defined by conformant schema || An element substitution gro

**Rule 9-49:** Attribute and element type not from structures namespace || An attribute declaration o

**Rule 9-50:** Only reference attributes have type `xs:IDREFS` || The attribute declaration of a [ref

[Reference attribute properties](#def) are a special form of object reference; see [§5.3.6](#536-refe

## 9.4 Rules for adapters and external components

**Rule 9-51:** Import of external schema document is labeled || An `xs:import` element importing an [

An [external schema document](#def) is any schema document that is not

- a [reference schema document](#def), or
- an [extension schema document](#def), or
- a [subset schema document](#def), or
- a schema document that has the [structures namespace](#def) as its target namespace, or
- a schema document that has the XML namespace as its target namespace.

There are a variety of commonly used standards that are represented in XML Schema. Such schemas are g

A schema component defined by an external schema document may be called an external component. A NIEM

- An [adapter class](#def) may be constructed from externally-defined elements and attributes. A goal

- A type that is not an [adapter type](#def), and which is defined by an [extension schema document](

**Rule 9-52:** Import of external namespace has data definition || An `xs:import` element importing a

A NIEM-conformant schema has well-known documentation points. Therefore, a schema that imports a NIEM

**Rule 9-53:** Name of adapter type || An [adapter type](#def) MUST have a name ending in "AdapterTyp

An [adapter type](#def) is a NIEM-conformant type that adapts [external components](#def) for use wit

An [adapter type](#def) should contain the information from an external standard to express a complet

In the case of an external expression that is in the form of model groups, attribute groups, or types

In normal (conformant) type definitions, a reference to an attribute or element is a reference to a d

**Rule 9-54:** Structure of external adapter type definition follows pattern || An [adapter type](#de

**Rule 9-55:** Element use from external adapter type defined by external schema documents || An elem

**Rule 9-56:** External adapter type not a base type || An [adapter type](#def) definition MUST NOT b

**Rule 9-57:** External attribute use has data definition || An external attribute use MUST be a docu

**Rule 9-58:** External attribute use not an ID || An attribute use schema component MUST NOT have an

NIEM schemas use `structures:id` to enable references between components. Each NIEM-defined complex t

The term "attribute use schema component" is defined by [[XML Schema Structures]](#ref) Section 3.5.1

**Rule 9-59:** External element use has data definition || An external attribute use MUST be a docume

## 9.5 Rules for proxy types

**Rule 9-60:** Proxy types || The XSD declaration of a [proxy type](#def) MUST have the same name as
```

```
A [proxy type](#def) is an XSD complex type definition with simple content that extends one of the si
```

```
A [proxy type](#def) is not a model component. It is a convenience complex type definition wrapper fo

**Rule 9-61:** Proxy type has designated structure || A proxy type MUST have the designated structure

## 9.6 Rules for augmentations

**Rule 9-62:** Name of augmentation types || The XSD definition of an [augmentation type](#def) MUST

**Rule 9-63:** Name of augmentation elements || The XSD declaration of an [augmentation element](#def

**Rule 9-64:** Name of augmentation point elements || The XSD declaration of an [augmentation point e

**Rule 9-65:** Standard opening phrase for augmentation point element data definition || The data def

**Rule 9-66:** Standard opening phrase for augmentation element data definition || The data definitio

**Rule 9-67:** Standard opening phrase for augmentation type data definition || The data definition f

**Rule 9-68:** Augmentation point element corresponds to its base type || A schema document containin

For example, a schema document with an element declaration for `FooAugmentationPoint` must also conta

**Rule 9-69:** An augmentation point element has no type || An [augmentation point element](#def) MUS

**Rule 9-70:** An augmentation point element has no substitution group || An [augmentation point elem

**Rule 9-71:** Augmentation point element is only referenced by its base type || An [augmentation poi

For example, the `FooAugmentationPoint` element must not be included in any type other than `FooType`

**Rule 9-72:** Augmentation point element use is optional and unbounded || An [augmentation point ele

**Rule 9-73:** Augmentation point element use must be last element in its base type || An [augmentati

## 9.7 Rules for machine-readable annotations

NIEM defines a single namespace that holds components for use in NIEM-conformant schema application i

**Rule 9-74:** Appinfo attribute annotates schema component || An attribute in the [appinfo namespace
```


Rule 9-74: Appinfo attribute annotates schema component || An attribute in the [appinfo namespace

Rule 9-75: `xs:appinfo` children are comments, elements, or whitespace || A child of element `xs:

Rule 9-76: Appinfo child elements have namespaces || An element that is a child of `xs:appinfo` M

Rule 9-77: Appinfo descendants are not XML Schema elements || An element that is a descendent of

Rule 9-78: Component marked as deprecated is deprecated component || A schema component that has

Rule 9-79: LocalTerm appinfo applies to schema || When the element `appinfo:LocalTerm` appears in

9.8 Rules for reference schema documents

Rule 9-80: No simple type disallowed derivation || A [reference schema document](#def) MUST NOT h

Rule 9-81: No use of "fixed" on simple type facets || A simple type constraining facet in a [refe

Rule 9-82: No disallowed substitutions || A [reference schema document](#def) MUST NOT contain th

Rule 9-83: No disallowed derivation || A [reference schema document](#def) MUST NOT contain the a

Rule 9-84: Element declaration is nillable || An element declaration in a [reference schema docum

Properties in a reference or extension namespace are always referenceable, in order to maximize reuse

Rule 9-85: No `xs:choice` || A [reference schema document](#def) MUST NOT contain the element `xs

Rule 9-86: External attribute use only in adapter type || An [external attribute](#def) use withi

9.9 Rules for extension schema documents

Rule 9-87: Element declaration is nillable || An element declaration in an [extension schema docu

9.10 Rules for subset schema documents

Rule 9-88: Attribute augmentations are documented || Within a [message model](#def), an attribute

Augmented XSD type definitions in a message model must include attribute augmentations so that the sc

---

10. Rules for models

These rules apply to both the CMF and XSD representations of a model.

Rule 10-1: Namespaces are conforming or external || Every namespace in a model MUST be one of the

- a [conforming namespace](#def); that is, a [reference namespace](#def), [extension namespace](#def)
- an [external namespace](#def)
- the [structures namespace](#def)
- the XML namespace, `http://www.w3.org/XML/1998/namespace`
- the XSD namespace, `http://www.w3.org/2001/XMLSchema`.

The [appinfo namespace](#def) is not part of a NIEM model. It provides schema components for use in t

Rule 10-2: Unique namespace prefixes || A model MUST NOT contain two namespaces with the same pre

In a NIEM model there is always a one-to-one match between namespace prefix and namespace URI.

10.1 Rules for model files

```
**Rule 10-3:** Unique namespace identifiers || A model MUST NOT contain two namespaces with the same

This is impossible in an XSD representation of a model.

## 10.2 Rules for schema document sets

A [schema document set](#def) is a collection of [schema documents](#def) that together are capable o

**Rule 10-4:** Composition of schema document set || The [schema documents](#def) in a [schema docume

- Beginning with the empty set
- Add one or more specified initial [schema documents](#def)
- As each [schema document](#def) is added, find each `<xs:import>` element contained therein, and ad

Schema assembly is underspecified in [XML Schema](#ref). But a specification that defines message con

Most schema document sets are established by a single extension schema document, with all other neede

**Rule 10-5:** Consistent import schema document || The members of a [schema document set](#def) MUST

XML Schema permits conflicting imports, but the result is underspecified, and often causes errors tha

**Rule 10-6:** Consistent import labels || The members of a [schema document set](#def) MUST NOT cont

**Rule 10-7:** Consistent import documentation || The members of a [schema document set](#def) MUST N

An [external schema document](#def) is usually imported once in a [schema document set](#def), and im

**Rule 10-8:** Namespace prefix is unique || There MUST be a one-to-one match between namespace prefi

XML Schema permits a schema document set to contain

- schema document A containing `xmlns:foo="http://example.com/MyFoo/"`
- schema document B containing `xmlns:bar="http://example.com/MyFoo/"`
- schema document C containing `xmlns:foo="http://example.com/MyBar/"`

This is not allowed in NIEM XSD. There is always a one-to-one match between namespace prefix and URI

**Rule 10-9:** Schema document set must be complete || A [schema document set](#def) MUST be complete

A [schema document set](#def) defines an XML Schema that may be used to validate an XML document. Thi

**Rule 10-10:** Use structures namespace consistent with specification || A [schema document set](#de

This rule further enforces uniform and consistent use of the NIEM structures namespace, without addit

---

# 11. Rules for message types and message formats

**Rule 11-1:** Message type declares initial property || A [message type](#def) MUST declare the init

This document does not specify any particular syntax for the declaration.

**Rule 11-2:** Message format schema matches message type || The [schema](#def) for a [message format

This is the only conformance rule for the XML Schema in an XML message format, or the JSON Schema in

---

# 12. Rules for XML messages
```



```
**Rule 12-1:** Message begins with initial property || An XML [message](#def) MUST be an XML document

The element for the initial property is often the document element, but this is not necessarily so. A

**Rule 12-2:** Message is schema-valid || An XML [message](#def) MUST be schema-valid as assessed aga

This rule should not be construed to mean that XML validation must be performed on all XML instances

**Rule 12-3:** No attributes from wildcards in structures || Every attribute in an XML message MUST b

The [schema document](#def) for the [structures namespace](#def) contains `xs:anyAttribute` elements

**Rule 12-4:** No forbidden references || An element in an XML message MUST NOT have the attribute `s

**Rule 12-5:** No forbidden references || An element in an XML message MUST NOT have the attribute `s

**Rule 12-6:** No forbidden references || An element in an XML message MUST NOT have the attribute `s

**Rule 12-7:** Element has only one resource identifying attribute || An element in an XML message MU

Model designers may use `appinfo:referenceCode` in the XSD representation of a model to constrain the
```

```
declares that objects of that class may not be the target of an object reference, and must instead ap

**Rule 12-8:** Attribute `structures:ref` must reference `structures:id` || The value of an attribute

Although many attributes with ID and IDREF semantics are defined by many vocabularies, for consistenc

**Rule 12-9:** Linked elements have same validation root || Every element that has an attribute `stru

The term "validation root" is defined by [[XML Schema Structures]](#ref) _Section 5.2, Assessing Sche

NIEM supports type-safe references; that is, references using `structures:ref` and `structures:id` mu

**Rule 12-10:** Attribute `structures:ref` references element of correct type || An element that is t

The term _validly derived_ is as established by [[XML Schema Structures]](#ref), subsection _Schema C

This rule requires that the type of the element pointed to by a structures:ref attribute must be of (

**Rule 12-11:** Reference attribute property refers to correct class || An element that is the target

For example, an element that is the target of `nc:metadataRef` must have the type `nc:MetadataType`,

**Rule 12-12:** `xs:anyURI` value must be valid URI || The value of an attribute with or derived from

XML Schema validation does not always check the validity of URI values. Examples of valid and invalid

<pre><code>structures:uri="http://example.com/Person/223/" <span class="codeComment"><-- valid</span>
structures:uri="#boogala"                        <span class="codeComment"><-- valid</span>
structures:uri="boogala"                         <span class="codeComment"><-- invalid</span>
</code></pre>

**Rule 12-13:** No duplicate augmentation elements || An element MUST NOT contain two instances of th
```

For example, a message must not contain

…

…

```
even though this is schema-valid. Instead, all augmentation properties should be consolidated into a

**Rule 12-14:** Nilled element must be an object reference || An element with `xsi:nil="true"` MUST h

The attribute `xsi:nil` can only be used to create an object reference. It cannot be used to omit man

# 13. Rules for JSON messages

**Rule 13-1:** Message is a JSON object || A JSON message MUST be valid according to the grammar synt

According to the JSON specification, a valid JSON text can be an object, array, number, string, or li

**Rule 13-2:** Message is a JSON-LD document || A JSON message MUST conform to the JSON-LD specificat

**Rule 13-3:** Message conforms to message format || A JSON message MUST be valid when assessed again

The schema for a JSON [message format](#def) is expressed in JSON Schema, and validates exactly those

**Rule 13-4:** Message has context map for model namespaces || A JSON message MUST have an embedded c

Embedded context, remote context, and context via HTTP header are defined in [[JSON-LD]](#ref) [§3.1:

For example, the JSON message in [example 3-2](#ex3-2) has a context that maps the prefixes `nc` and

**Rule 13-5:** Object keys are defined || The name in a name-value mapping within a JSON object MUST

For example:

<pre><code>&quot;@context&quot;: {
  &quot;nc&quot;: &quot;https://docs.oasis-open.org/niemopen/ns/model/niem-core/6.0/&quot;,
  &quot;pname&quot;: &quot;nc:PersonName&quot;},
&quot;nc:Person&quot;: {   <span class="codeComment"><i>valid, expands to https://docs.oasis-open.org
  &quot;@id&quot;: &quot;#JD&quot;,  <span class="codeComment"><i>valid, JSON-LD keyword</i></span>
  &quot;pname&quot;: {     <span class="codeComment"><i>valid, expands to https://docs.oasis-open.org
    &quot;foo:FullName&quot;: &quot;John Doe&quot;    <span class="codeComment"><i>invalid, no mappin
  }
}
</code></pre>

**Rule 13-6:** @id keyword is object reference || Two JSON objects with the same value for the `@id`

**Rule 13-7:** No forbidden references || A JSON object representing the value of a model Property ob

**Rule 13-8:** Linked objects have compatible class || Two JSON objects with the same value for the `
```

```
For example, the following NIEM JSON is valid, because `nc:Item` and `nc:Equipment` have the same cla
```

```
“nc:Item”: {
“@id”: “#ITEM7”,
“nc:ItemQuantity”: 7
},
“nc:Equipment”: {
“@id”: “#ITEM7”,
“nc:EquipmentName”: “Pump”
}
```

```
---
# 14. RDF interpretation of NIEM models and messages
TODO
# Appendix A. References
This appendix contains the normative and informative references that are used in this document. Any n
While any hyperlinks included in this appendix were valid at the time of publication, OASIS cannot gu
## A.1 Normative References
The following documents are referenced in such a way that some or all of their content constitutes re
###### [ClarkNS]
Clark, J. "XML Namespaces", 4 February 1999. Available from http://www.jclark.com/xml/xmlns.htm.
###### [CMF]
Common Model Format Specification, NIEM Technical Architecture Committee. Available from https://gith
###### [Code Lists]
Roberts, W. "NIEM Code Lists Specification". NIEM Technical Architecture Committee (NTAC), November 7
###### [CTAS-v3.0]
Conformance Targets Attribute Specification (CTAS) Version 3.0. Edited by Tom Carlson. 22 February 20
###### [ISO 11179-4]
"ISO/IEC 11179-4 Information Technology — Metadata Registries (MDR) — Part 4: Formulation of Data Def
```

```
###### [ISO 11179-5]

"ISO/IEC 11179-5:2005, Information technology — Metadata registries (MDR) — Part 5: Naming and identi

###### [JSON-LD]

Sporny, M., et al. "JSON-LD 1.1: A JSON-based Serialization for Linked Data". W3C Recommendation, 16

###### [OED]

Oxford English Dictionary, Third Edition, Oxford University Press, November 2010. http://dictionary.o

###### [RFC 2119]

Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", BCP 14, RFC 2119, DOI 10.174

###### [RFC 3986]

Berners-Lee, T., et al., "Uniform Resource Identifier (URI): Generic Syntax", Request for Comments 39

###### [RFC 8174]

Leiba, B., "Ambiguity of Uppercase vs Lowercase in RFC 2119 Key Words", BCP 14, RFC 8174, DOI 10.1748

###### [RFC 8259]

Bray, T. "The JavaScript Object Notation (JSON) Data Interchange Format", Request for Comments 8259,

###### [SemVer]

"Semantic Versioning 2.0.0". https://semver.org/.

###### [XML]

"Extensible Markup Language (XML) 1.0 (Fourth Edition)", W3C Recommendation, 16 August 2006. Availabl

###### [XML Infoset]

Cowan, John, and Richard Tobin. "XML Information Set (Second Edition)", 4 February 2004. http://www.w

###### [XML Namespaces]

"Namespaces in XML 1.0 (Third Edition)", W3C Recommendation, 8 December 2009. Available from http://w

###### [XML Schema Structures]

"XML Schema Part 1: Structures Second Edition", W3C Recommendation, 28 October 2004. Available from h

###### [webarch]

Jacobs, I. "Architecture of the World Wide Web, Volume One". W3C Recommendation 15 December 2004. htt

## A.2 Informative References

---

# Appendix B. Structures namespace
```

```
The structures namespace provides base types and other
components for definition of NIEM-conformant XML
schemas.

A data type for a type that contains a single
non-conformant property from an external standard for use in
NIEM.

A data type for a relationship between two or more
objects, including any properties of that
relationship.
```



```
A data type for a set of properties to be applied to a
base type.
```

```
A data type for a thing with its own lifespan that has
some existence.
```



```
An augmentation point for type
structures:AssociationType.




An augmentation point for type
structures:ObjectType.




True if this element is a property of its parent;
false if it appears only to support
referencing.




A document-relative identifier for an XML
element.




A document-relative reference to an XML
element.




An internationalized resource identifier or uniform
resource identifier for a node or object.
```



```

```

Appendix C. Index of rules

- Rule 7-19: Name of components other than attribute properties begin with upper case letter.
- Rule 7-20: Punctuation in component name is a separator.
- Rule 7-21: Singular form is preferred in name.
- Rule 7-22: Present tense is preferred in name.
- Rule 7-23: Name does not have nonessential words.
- Rule 7-24: Property name follows ISO 11179-5 pattern.
- Rule 7-25: Object-class term identifies concrete category.
- Rule 7-26: Property term describes characteristic or subpart.
- Rule 7-27: Name may have multiple qualifier terms.
- Rule 7-28: Name avoids unnecessary qualifier terms.
- Rule 7-29: Order of qualifiers is not significant.
- Rule 7-30: Redundant term in name is omitted.
- Rule 7-31: Data property uses representation term.
- Rule 7-32: Object property uses representation term when appropriate.
- Rule 7-33: Object property uses representation term only when appropriate.
- Rule 7-34: Names use common abbreviations.
- Rule 7-35: Local terms usable within their namespace.
- Rule 7-36: Local term has literal or definition.
- Rule 7-37: Namespace has data definition.
- Rule 7-38: Model component has data definition.
- Rule 7-39: Enumeration facet has data definition

definition.

- Rule 7-40: Pattern facet has data definition.
- Rule 7-41: Documentation is provided in US English.
- Rule 7-42: Data definition does not introduce ambiguity.
- Rule 7-43: Object class has only one meaning.
- Rule 7-44: Data definition of a part does not redefine the whole.
- Rule 7-45: Do not leak representation into data definition.
- Rule 7-46: Data definition follows 11179-4 requirements.
- Rule 7-47: Data definition follows 11179-4 recommendations.
- Rule 7-48: Standard opening phrase for abstract property data definition.
- Rule 7-49: Standard opening phrase for association property data definition.
- Rule 7-50: Standard opening phrase for date property data definition.
- Rule 7-51: Standard opening phrase for quantity property data definition.
- Rule 7-52: Standard opening phrase for picture property data definition.
- Rule 7-53: Standard opening phrase for indicator property data definition.
- Rule 7-54: Standard opening phrase for identification property data definition.
- Rule 7-55: Standard opening phrase for name property data definition.
- Rule 7-56: Standard opening phrase for property data definition.
- Rule 7-57: Standard opening phrase for association class data definition.
- Rule 7-58: Standard opening phrase for class data definition.
- Rule 7-59: Enumerations are unique.
- Rule 8-1: Namespace identifier is absolute

URI.

- Rule 8-2: Namespace URI is owned by namespace authority.
- Rule 8-3: Namespaces use slash URIs.
- Rule 8-4: Namespace URI includes version.
- Rule 8-5: Namespace URI uses semantic versioning.
- Rule 8-6: Namespace has a prefix.
- Rule 8-7: Namespace has version.
- Rule 8-8: Namespace has language.
- Rule 8-9: Reference namespace asserts conformance.
- Rule 8-10: Reference namespace does not have wildcard.
- Rule 8-11: Object properties in reference namespace are referenceable.
- Rule 8-12: Reference namespace uses reference namespace components.
- Rule 8-13: Extension namespace asserts conformance.
- Rule 8-14: Object properties in extension namespace are referenceable.
- Rule 8-15: Subset namespace asserts conformance.
- Rule 8-16: Subset has corresponding reference or extension namespace.
- Rule 8-17: Subset does not extend component range.
- Rule 8-18: Subset does not add components.
- Rule 8-19: Subset does not alter data definition.
- Rule 9-1: Schema is CTAS-conformant.
- Rule 9-2: Document element has attribute

  ```
  ct:conformanceTargets
  ```

  .

- Rule 9-3: Document is a valid schema

document.

- Rule 9-4: Document element is

  ```
  xs:schema
  ```

  .

- Rule 9-5: Prohibited schema components.

- Rule 9-6: Prohibited base types.

- Rule 9-7: Prohibited list item types.

- Rule 9-8: Prohibited union item types.

- Rule 9-9: Prohibited attribute and element types.

- Rule 9-10: No mixed content on complex type or complex content.

- Rule 9-11: Complex type content is explicitly simple or complex.

- Rule 9-12: Base type of complex type with complex content must have complex content.

- Rule 9-13: Untyped element is abstract.

- Rule 9-14: Element type not in the XML or XML Schema namespace.

- Rule 9-15: Element type is not simple type.

- Rule 9-16: Attribute declaration has type.

- Rule 9-17: No default or fixed value.

- Rule 9-18: Sequence has minimum and maximum cardinality 1.

- Rule 9-19:

  ```
  xs:choice
  ```

  must be child of

  ```
  xs:sequence
  ```

  .

- Rule 9-20: Choice has minimum and maximum cardinality 1.

- Rule 9-21: Comment is not recommended.

- Rule 9-22: Documentation element has no element

children.

- Rule 9-23: Import has namespace.
- Rule 9-24: Import specifies local resource.
- Rule 9-25: Name of type definitions.
- Rule 9-26: Name of simple type definitions.
- Rule 9-27: Name of complex type definition.
- Rule 9-28:

  ```
  xs:sequence
  ```

  must be child of

  ```
  xs:extension
  ```

  .
- Rule 9-29:

  ```
  xs:sequence
  ```

  must be child of

  ```
  xs:extension
  ```

  or

  ```
  xs:restriction
  ```

  .
- Rule 9-30: Type definition is top-level.
- Rule 9-31: Complex type has a category.
- Rule 9-32: Object type with complex content is derived from

  ```
  structures:ObjectType
  ```

  .
- Rule 9-33: Adapter type derived from

  ```
  structures:AdapterType
  ```

  .

- Rule 9-34: Association type derived from

  ```
  structures:AssociationType
  ```

  .

- Rule 9-35: Augmentation type derived from

  ```
  structures:AugmentationType
  ```

  .

- Rule 9-36: Complex type with simple content has

  ```
  structures:SimpleObjectAttributeGroup
  ```

  .

- Rule 9-37: Base type definition defined by conformant schema.

- Rule 9-38: Component reference defined by conformant schema.

- Rule 9-39: Schema uses only known attribute groups.

- Rule 9-40: Augmentation elements are not used directly.

- Rule 9-41: List item type defined by conformant schemas.

- Rule 9-42: Union member types defined by conformant schemas.

- Rule 9-43: No complex wildcards.

- Rule 9-44: No literal properties in XSD.

- Rule 9-45: Declarations are top-level.

- Rule 9-46: Element type is not simple type.

- Rule 9-47: Attribute and element type is from conformant namespace.

- Rule 9-48: Element substitution group defined by conformant schema.

- Rule 9-49: Attribute and element type not from structures namespace.

- Rule 9-50: Only reference attributes have type

  ```
  xs:IDREFS
  ```

  .

- Rule 9-51: Import of external schema document is labeled.
- Rule 9-52: Import of external namespace has data definition.
- Rule 9-53: Name of adapter type.
- Rule 9-54: Structure of external adapter type definition follows pattern.
- Rule 9-55: Element use from external adapter type defined by external schema documents.
- Rule 9-56: External adapter type not a base type.
- Rule 9-57: External attribute use has data definition.
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- Rule 9-59: External element use has data definition.
- Rule 9-60: Proxy types.
- Rule 9-61: Proxy type has designated structure.
- Rule 9-62: Name of augmentation types.
- Rule 9-63: Name of augmentation elements.
- Rule 9-64: Name of augmentation point elements.
- Rule 9-65: Standard opening phrase for augmentation point element data definition.
- Rule 9-66: Standard opening phrase for augmentation element data definition.
- Rule 9-67: Standard opening phrase for augmentation type data definition.
- Rule 9-68: Augmentation point element corresponds to its base type.
- Rule 9-69: An augmentation point element has no type.
- Rule 9-70: An augmentation point element has no substitution group.
- Rule 9-71: Augmentation point element is only referenced by its base type.
- Rule 9-72: Augmentation point element use is

- Rule 9-72: Augmentation point element use is optional and unbounded.
- Rule 9-73: Augmentation point element use must be last element in its base type.
- Rule 9-74: Appinfo attribute annotates schema component.
- Rule 9-75:

  ```
  xs:appinfo
  ```

  children are comments, elements, or whitespace.
- Rule 9-76: Appinfo child elements have namespaces.
- Rule 9-77: Appinfo descendants are not XML Schema elements.
- Rule 9-78: Component marked as deprecated is deprecated component.
- Rule 9-79: LocalTerm appinfo applies to schema.
- Rule 9-80: No simple type disallowed derivation.
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- Rule 9-82: No disallowed substitutions.
- Rule 9-83: No disallowed derivation.
- Rule 9-84: Element declaration is nillable.
- Rule 9-85: No

  ```
  xs:choice
  ```

  .
- Rule 9-86: External attribute use only in adapter type.
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- Rule 9-88: Attribute augmentations are documented.
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- Rule 10-3: Unique namespace

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- Rule 10-4: Composition of schema document set.
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- Rule 11-1: Message type declares initial property.
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- Rule 12-3: No attributes from wildcards in structures.
- Rule 12-4: No forbidden references.
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- Rule 12-6: No forbidden references.
- Rule 12-7: Element has only one resource identifying attribute.
- Rule 12-8: Attribute

  ```
  structures:ref
  ```

  must reference

  ```
  structures:id
  ```

  .
- Rule 12-9: Linked elements have same validation root.
- Rule 12-10: Attribute

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references element of correct type.

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- Rule 12-13: No duplicate augmentation elements.
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- Rule 13-1: Message is a JSON object.
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- Rule 13-4: Message has context map for model namespaces.
- Rule 13-5: Object keys are defined.
- Rule 13-6: @id keyword is object reference.
- Rule 13-7: No forbidden references.
- Rule 13-8: Linked objects have compatible class.

Appendix D. Mapping NIEM 5 rules to NIEM 6

NIEM 5 Rule	NIEM 6 Rul
Rule 4-1, Schema marked as reference schema document must conform	rule8-9
Rule 4-2, Schema marked as extension schema document must conform	rule8-13
Rule 4-3, Schema is CTAS-conformant	rule9-1

NIEM 5 Rule	NIEM 6 Rul
Rule 4-3, Schema is CTAS conformant	rule9-2
Rule 4-4, Document element has attribute ct:conformanceTargets	
Rule 4-5, Schema claims reference schema conformance target	rule8-9, r
Rule 4-6, Schema claims extension conformance target	rule8-13
Rule 5-1, structures:uri denotes resource identifier	*no matchin*
Rule 7-1, Document is an XML document	rule9-3
Rule 7-2, Document uses XML namespaces properly	rule9-3
Rule 7-3, Document is a schema document	rule9-3
Rule 7-4, Document element is xs:schema	rule9-4
Rule 7-5, Component name follows ISO 11179 Part 5 Annex A	rule7-24
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Appendix H. Acknowledgments

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